Architecture in a
Northern Flood Plain

by

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AUTHOR'S DECLARATION FOR ELECTRONIC SUBMISSION OF A THESIS

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

The thesis is an exploration of strategies that could be utilised in creating sustainable urbanism, one in which the inhabitants retain a relationship with the environmental and geographic conditions of their place. Promoting awareness of the natural context of urban activities is necessary in an increasingly complex world that is more able to disregard the natural systems that we depend on. Sustainability is seen as crucial in terms of the economic viability of cities as well as the sustainability of the environment in which dense urban centres are situated. In the case of a city located on a flood plain, the viability of the physical and social condition of the urban centre as well as its impact on that of the surrounding region comes to the forefront each time there is a flood. The city of Winnipeg on the Red River flood plain in the central lowlands of the eastern prairie of Canada is chosen as the site for this exploration where the difficulties of freezing temperatures make the problem of building on a flood plain a greater challenge. Several methods are explored in this urban design, demonstrating that urban sustainability and environmental sustainability are not exclusive of one another. The technique of densifying and unifying elements of the urban fabric, including parks and landscaping, residential inhabitation, as well as industrial and commercial activities, can be effective for both environmental and urban sustainability. Techniques explore the incorporation of vertically integrated multi-use buildings, the movement of public areas above street level, and construction on engineered hills, stilts or with the use of floatation devices, resulting in a site specific response to urban inhabitation. The trend toward a generic non-location specific urban lifestyle is superceded in this proposal for a mode of urban dwelling reconnected with surrounding context, marked by experience of seasonal and cyclical conditions of environment inscribed by an awareness of place.

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Chapter 1
Urban Design

1.1 Introduction

This thesis explores the problem of reclaiming an urban centre on a flood plain in a method attuned to the physical realities of the Winnipeg region. The site of Winnipeg is an extreme example of a city with unusual site characteristics. It is situated on the Red River flood plain in the central lowlands of the eastern prairie of Canada, on a north-flowing river. Every spring thaw brings potential ice damming. While the mouth of the river is still frozen, water from the south accumulates and overflows the banks over much of the surrounding prairie surface. Although the ground plane is flat and in some ways, ideal for building on, it is also frequently submerged, deeply frozen for many months of the year and composed of clay which makes it highly unstable for supporting large buildings. These unique conditions make it more difficult to transplant design solutions from cities in other regions successfully. As a result, a lot of money and effort must be spent to sustain the constructions of habitation typical of more benign environments. There is presently little of the city's architecture that makes significant adjustments to the unique conditions of this region.

The current broad interest in sustainability has implications for an architecture that is responsive to its geographic situation. This thesis evaluates the specific conditions of a site within Winnipeg known, as Point Douglas, by exploring its historical origins, geographic make up and evolution as a part of the city. In addition, this thesis examines relevant precedents in other cities: the adaptive re-use of an industrial building in Montreal, Canada; a garbage powered generating station within the city of Perham, USA; the mixed use urban streets of Camden Lock in London, UK; and the dense integration of commercial and residential buildings of downtown Toronto, Canada. Precedents examined also include reference to mega structures such as the visioning projects of Sant'Elia and built examples such as the Barbican in London, U.K. All contribute to sustainable urban centres. Successful sustainable urban centres tend to enable a multitude of uses with mutually beneficial relationships and cost effective sharing of infrastructure.

Following the establishment of programs for a sustainable city within this proposal, the environmental sustainability of the urban centre of a flood plain is addressed. The intent of this design solution is to merge the physical site with architectural strategies in an urban topography, where the realities of the site conditions inform the function of the built environment, enabling the essential elements of a city to coexist with flooding in a concentrated centre.

Figure 1.1 Map of Canada showing Winnipeg's location

The intent of the thesis is to design a way of living with the natural environment and maintain a constant awareness of the nature of an inhabited flood plain, rather than to design new technology that would allow people to side-step the consequences of flooding. The premise is that by accepting the less consequential interruptions triggered by flooding, communities can remain in place where the phenomenon can be experienced without the catastrophic disruptions of city-wide disaster mitigation. A landscape infrastructure that permits the variety of building types and inhabitation that are intrinsic to city life is concentrated and arranged as the framework for this alternative inhabitation. Buildings within a dense urban fabric are close enough to be connected via the urban topography formed by bridges and roof tops. By building up instead of out, there is less surface area to be protected from flooding and less displacement of flood water via the current techniques of diverting and diking. By reducing reliance on these techniques, the outlying regions surrounding the city of Winnipeg may be spared from greater disasters that arise from the need to accommodate the displaced flood-water from within the city boundaries of Winnipeg. It is possible for flood architecture to replace the defensive techniques inherent in diversions and diking and permit the city to re-focus on growth instead of planning for flood probabilities.

Following the format of this new urban design Winnipeg will continue to monitor the water level on the Red River in order to estimate probable water levels and anticipate potential floods. As spring arrives and temperatures rise, the ice breaks up, and water levels rise and carry the ice downstream, scouring the river banks. In anticipation of serious flooding topping the shoreline, many riverside communities prepare for the worst. In the proposed community of Point Douglas a different scenario emerges as residents who choose not to be involved with boating to the stores during the flood season begin to put by provisions. Some enterprising individuals commence seasonal delivery services that sell door-to-door by boat. Stores stock up to reduce the need to transfer goods, normally supplied by truck. People arrange to move their cars inland or into parking elevators. Since roads will be under water, transportation adapts to boats and barges. Meanwhile, the factories pack goods and equipment onto upper levels or indoor rafts. The labour and resources formerly devoted to sand-bagging are now absent from this community. Instead, preparations are made for one month of amphibious life on the flood-plain. As with other water infused and flood prone cities such as Venice, the cyclical rise and fall of water levels becomes both a factor to live with and marks it as a place of unique character and experience.

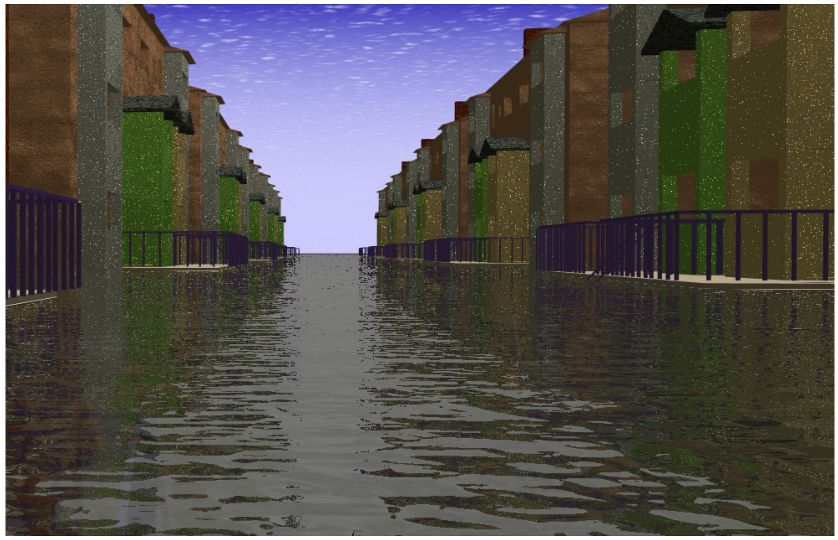


Figure 1.2 Back yards in flood

Figure 1.3 A unique life in Point Douglas

Toys and equipment are removed from lawns and placed in skiffs, which are tied to homes to prevent them floating away. When the water level rises in the new community, the first effects are experienced by people floating in the marina. Town houses in the river rise up alongside houses in the streets. As the flood water moves inland, the rising level is observed creeping up the landscape, marked by the trees in the riverside park. The roads are awash and the indoor rafts begin to float. Soon, any cars left within the parking garages are submerged, and the terraced slopes of the city blocks appear to shrink. Finally, all the town houses appear to rest on the surface of the water. They remain linked together by strips of walkways, with boats tied up at the ends. People launch themselves in the little boats towards the city blocks nearby. For one month people lead an amphibious life in which they float to the office, to Church, and to the shops. Factories take a flood break while they wait for the water to subside. Lease payments are suspended by the city for the duration until real estate becomes solid ground, relieving industry of some of the burden that co-operating with a flood city entails.

As the water slowly subsides, the rafts regain their footings and boats are beached. A layer of mud settles on the surface of the city, marking the high water level. Street plows push mud back to the shoreline. Parks emerge from the mud with a coating on every fixture. Figures that were once wire frames are now solid forms from the flood-level down. The mud covered walkways eventually dissolve as pedestrians stamp mud chips through the perforations. As with some ancient civilisations such as in Egypt where the agricultural base was periodically renewed with nutrient rich deposits in the flood prone Nile Valley,[2] the mud deposits in the streets of Point Douglas are harvested to enrich the parks and gardens in the area.

As the residents of Point Douglas demonstrate that coexistence with flooding can be achieved successfully and with relative calm, they provide an example to the region for the sustainable inhabitation of a very unique environment. The inducement for people to inhabit a region must consist of more than a desire to exploit regional resources if inhabitation is to persist. People who have an engaged relationship with the environment in which they live have a stronger resolve to preserve it. This active engagement with the environment reinforces the uniqueness of place and helps to preserve the notion that the arrangement is beneficial for inhabitants in the short term as well as the environment they depend on in the long term.

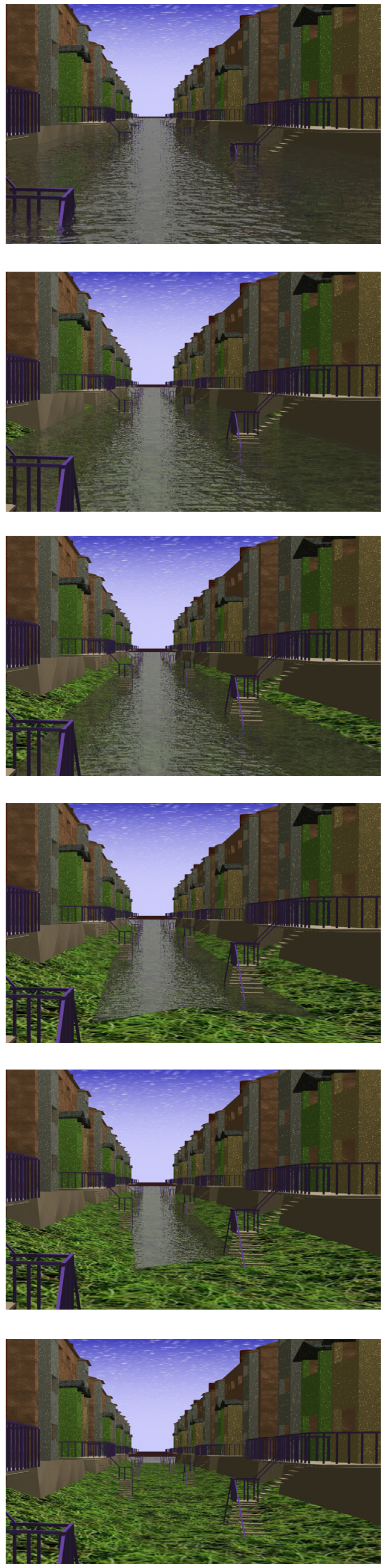


Figure 1.4 *Flood receding*

1.2 Urban Form

Figure 1.5 Office in Chicago , USA

Figure 1.6 Hotel in Hamburg Germany

Regional forms are those which most closely meet the actual conditions of life and which most fully succeed in making people feel at home in their environment. Lewis Mumford. (*The South in Architecture.* 30.)[3]

Point Douglas is defined by the Red River. The extreme nature of this site creates an opportunity to stress the idea that designing within context is important, not just for economic or environmental reasons but also for the sake of cultural identity. Modern technology provides us with the tools to develop techniques for adapting to the extreme environment of a flood plain so that we can inhabit the region uniquely and responsibly.

This thesis sets out a proposal for Point Douglas with an architectural design that speaks about this place and, in doing so, an architecture that speaks about the people who live there.

Once the program of the urban centre is established, the unique environment in which it is located should become apparent in the form the city takes. Modern urban centres often appear to adopt similar forms despite the diversity of their respective environments. Two cities may have similar appearances despite being in different continents with vastly different climatic and geographic context (Fig. 1.7 & 1.8). Urban streets may appear similar in two cities despite their diverse environmental situations (Fig. 1.9 & 1.10). Two buildings can look alike although they are built in different countries (Fig. 1.5 & 1.6), and similar types of decorative motifs can be found in buildings constructed thousands of years and continents apart (Fig. 1.11 & 1.12).

As a result of these similarities, places lose the intrinsic expression of a relation to context, program, material and structural approach. Cities can achieve distinction by employing properties derived from their surroundings such as familiar materials or local culture, or by developing designs informed by local climates and geographic conditions. Aside from the greater efficiency of creating buildings that are tailored to regional conditions, responsive buildings have the ability to express a unique sense of their place and the particular cultural traditions that characterise it. When these buildings are identifiable with their location, they give people a greater sense of ownership and more inclination to preserve them. While designing with this goal in mind, the importation of generic building types, building techniques or alien symbolism is counter intuitive.

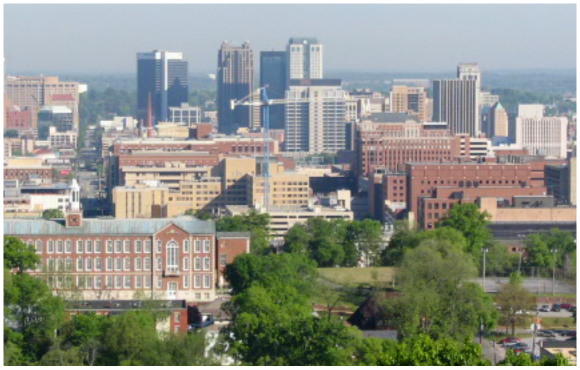


Figure 1.7 Birmingham, USA

Figure 1.8 Birmingham, UK

Figure 1.9 Yonge Street, Toronto

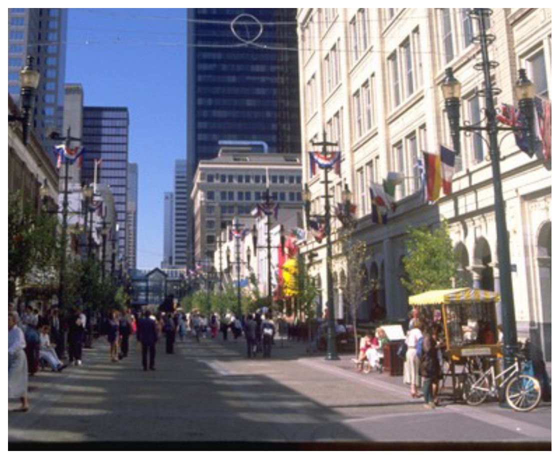


Figure 1.10 Steven Avenue, Calgary

Figure 1.11 Caryatids of Ancient Athens

Figure 1.12 Caryatids in Winnipeg

1.3 Urban Context

For the purpose of establishing an urban program, land uses within a city can be broken down into major categories of residential, industrial, commercial and park space. The design proposes to establish a sufficient proportion of these land uses on Point Douglas to approximate the needs of an urban centre. These categories of use are interdependent, so bringing them into close proximity can increase the efficiency of the urban infrastructure. Services that presently bridge various land uses can be cross-utilised within the same area, when demand for them occurs at different times.

By cross-utilising infrastructure, each of these components is better able to reinforce links with other components. Manufacturing and service businesses typical of industrial parks supply jobs and provide goods and services to people who live in the city. They also depend on commercial banks, typically located in the core, to finance them; these in turn are dependent on a widespread population from which to draw capital and labour.

Other links are apparent in the residential sector, which supplies industry and commerce with labourers as well as investment capital and markets. The industrial sector is reaching an awareness that long term commitments to sustaining the environmental sector is necessary for supporting the neighbourhood communities on which they depend. Healthy, natural environments improve the quality of life for inhabitants as well as supplying raw materials for industry. The manufacturing sector has often exploited the environment for raw materials and waste storage, and has often not employed an attitude of stewardship to the environment. The ability of the neighbourhood residents to monitor the industrial environment can play a vital role in sustaining that environment. Without opportunities to monitor the environmental impact of industry, cities can find themselves burdened with industrial brown-field sites that result from years of neglect.

A common feature of cities in industrialised nations is the isolation of the various land use types within exclusive areas of the city. This isolation becomes apparent in downtown areas, composed primarily of office towers, or in the industrial parks and residential subdivisions, located on the periphery of urban centres. These primary components of the contemporary city will be reorganised in this proposal in order to increase efficiency and reduce the duplication of infrastructure and services.

In forming a city on a flood plain, the stratification of urban programs can make industrial and parking structures more versatile, as these become the foundations for elevated commercial and residential units, which are less adaptable to flood waters.

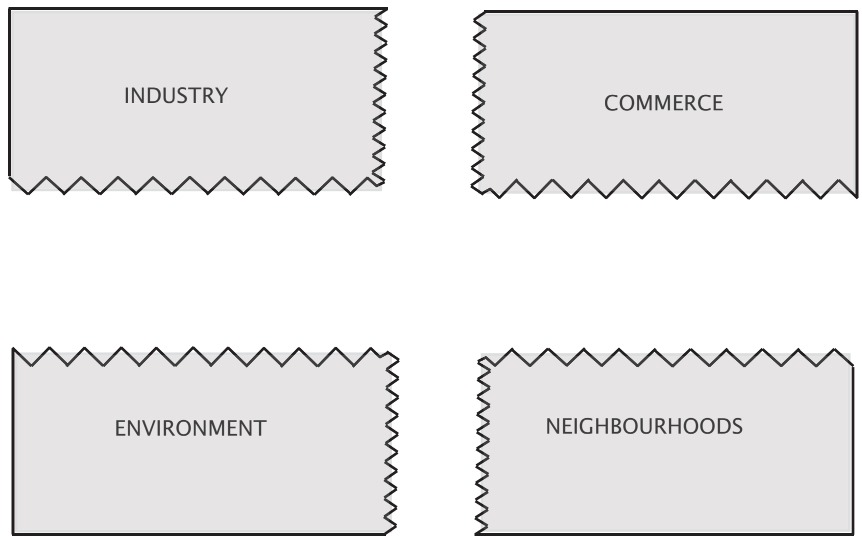


Figure 1.13 Conceptual Division of Urban Components in the decentralised city

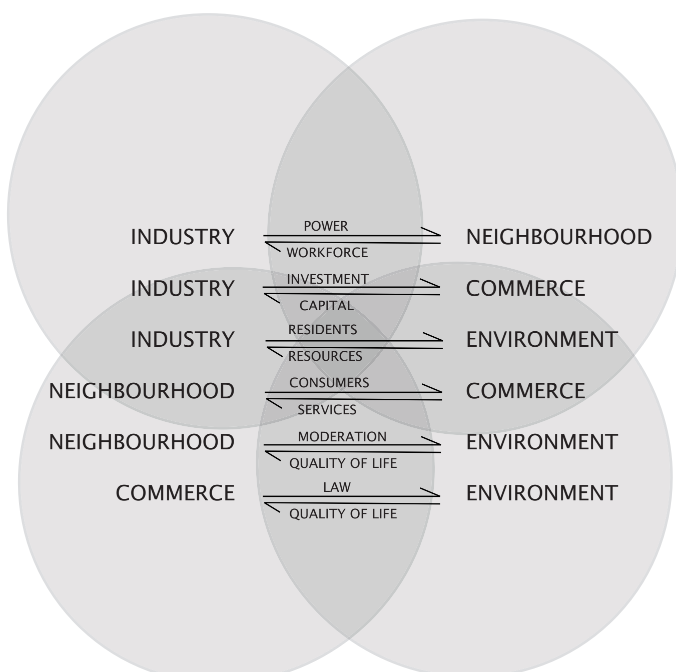


Figure 1.14 Inter-relationship of Urban Components in the integrated city

End Notes

1. Frank A. Randall. *History of the Development of Building Construction in Chicago*. (University of Illinois Press, 1949), 300.

2. Ronald Wright. *A Short History of Progress*. (Carroll and Graf Publishers, 2004), 103.

3. Lewis Mumford. *The South in Architecture*. (New York: Harcourt, Brace and Company, 1941), 30.

Chapter 2
The Urban Site

2.1 Winnipeg

The site of this thesis, Point Douglas, is contained in a bend of the Red River (Fig. 2.3), located close to the downtown core of Winnipeg. The name, Point Douglas, comes from the Earl of Selkirk, Thomas Douglas, the chief shareholder of the Hudson's Bay Company during the early 19th century.[1] His appointed officer, Miles Macdonell, chose this particular location, despite the reputation of the site as flood prone, to settle a colony of Scottish crofters, displaced during the late 18th century by the Highland Clearances.[2] Until the settlers arrived in 1812, the city of Winnipeg was no more than a native trading post at the confluence of the Assiniboine and Red Rivers.[3] The trader, Sieur de La Vérendrye, from the competing North West Company established Fort Rouge at this junction in 1738,[4] with the intention of intercepting furs before they could reach the rival Hudson's Bay Company, which operated trading posts downstream.[5] The North West Company operated forts in this area seasonally until 1822. During this period, the Hudson's Bay Company encountered difficulties controlling its inland trade from the distant York Factory far to the north on Hudson's Bay. Although the Hudson's Bay Company had title to the area,[6] it had no practical means of protecting these distant fur trading interests without an inland settlement to support it,[7] and, due to the regular flooding of the region, permanent settlement of the area had never been a consideration. This situation, along with reports of fertile farmland in the area, inspired Lord Selkirk to strike a deal with the Hudson's Bay Company to grant him land on which to settle his Scottish crofters. Immediately, a strong resistance to settlement became apparent as the North West Company perceived that free passage of its goods via the river, would be interrupted if a permanent Hudson's Bay Company settlement were to reinforce ownership of the area.[8] Once the settlers arrived, they were subjected to property damage and violence in addition to conditions of extreme weather, storms of locusts, serious floods and food shortages.[9] Conflicts between the two companies continued to disrupt the settlement until 1822, when the Hudson's Bay Company and the North West Company amalgamated, establishing a new fort known as Upper Fort Garry at the forks of the Assiniboine and the Red river.[10] The ensuing success of the established settlement induced waves of immigration prompted by expectations of plentiful crops and economic opportunity. The location offered natural grassland in proximity to an abundant source of water as well as a small supply of wood along the river banks.

Figure 2.1 Manitoba 1:4,500,000

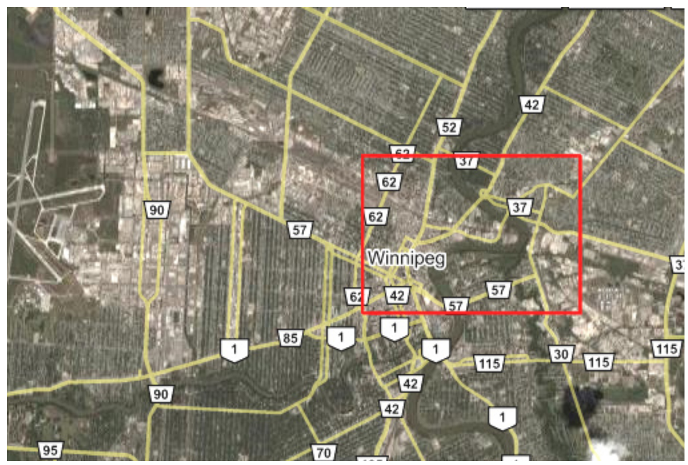


Figure 2.2 Winnipeg 1:250,000

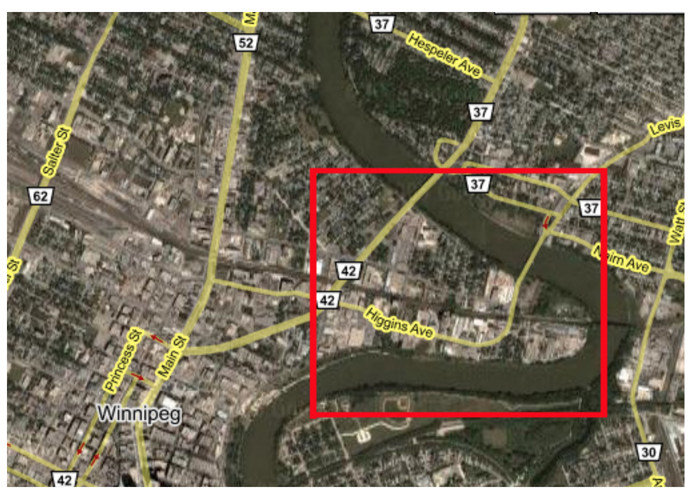


Figure 2.3 Point Douglas area in Winnipeg 1:15,000

2.2 Point Douglas

The Point Douglas site is a 75 hectare industrial area located about .8 kilometres north-east of the core of Winnipeg (Fig. 2.5). The point contains many derelict buildings, both industrial and residential, which are scattered mainly over its south side. On the north side is a low density residential enclave and an important electrical power station. One storey, industrial buildings housing auto-body, scrap-metal and welding shops are prominent over a large portion of the site. A paper and industrial-waste recycler occupies the tip of Point Douglas where flooding is the worst. The north-east corner of the point has been perpetually uninhabited.

There is a raised embankment constructed above the flood level to accommodate two CPR railway tracks running through the length of the site, dividing the point into roughly equal areas to the north and south.

Two major streets parallel the CPR line through Point Douglas, Sutherland Avenue on the north and Higgins Avenue to the south. These connect the downtown core, as well as factories along the railway line, to the north end of the St. Boniface district on the east side of the river.

There are about 460 residents currently living within this area of Point Douglas east of the Disraeli Freeway, distributed in approximately 190 dwellings.[11] This very low density occupation of approximately
2.5 units per hectare (6.3 units per acre), is less than many suburban locations.

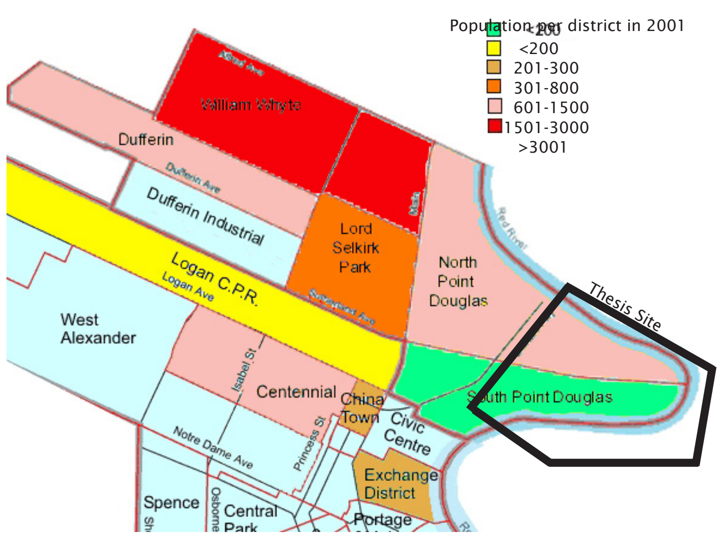


Figure 2.4 Population Density at the core of Winnipeg

Figure 2.5 Point Douglas site 1:7,500

The small community of modest houses dating from the 1900's to 1990's, on the north side of the point, such as those on Angus Street (Fig. 2.10), along with the hydro station, are marginally protected by the dike system. On the south side, a smaller number of nineteenth century homes, such as those in Figures 2.6 and 2.7, are found, along with many small-scale, commercial businesses.

A large part of Point Douglas is still prone to flooding despite the construction of the Winnipeg Flood-way that diverts water to the city perimeter, as well as the dike system within the point. The dike, which follows and protects the north shore, doubles as Rover Avenue. Even with these protective measures in place, a significant portion of Point Douglas, as indicated in Figure 2.8, remains outside the dike.

Figure 2.9 indicates how the surface of Point Douglas would be affected in the event of a 10-year flood, eight metres above normal river level, without the dike system or Flood-way in place. Such an event would cover the entire point with the exception of the CPR tracks, the bridges and the Disraeli Freeway.

Figure 2.6 Ellis House 1883

Figure 2.7 Richard Laird House 1894

Figure 2.8 Protected portion of Point Douglas

Figure 2.9 Point Douglas without flood protection

Figure 2.10 Late 20th Century housing on Angus Street, north of the CPR tracks

2.3 Analysis of Point Douglas

Despite its ragged edges, there are features of Point Douglas that make it viable as the base for a sustainable city on a flood plain, rather than a site unsuitable for contemporary urban life. First, it is very close to downtown Winnipeg, an important source of employment and commercial activity. Furthermore, it has a solid residential history persisting from the time of its original settlement, alongside manufacturing businesses that supply employment in the area. A particular appeal of Point Douglas is the fact that many of the people who live there also work within its boundaries. People walk or bicycle to work in this neighbourhood more than the average of the city, as indicated in Figure 2.11 below. Also of interest is that much of the industry in Point Douglas is already adapted to flood situations. Items that are impervious to flood damage are staples of businesses that use the surface for scrap yards, re-cycling and industrial storage. Other businesses, such as the auto body shops and welding and metal fabricating shops, deal with products that are relatively mobile and water resistant. The area also contains a large quantity of undeveloped land that would be suitable for recreational use. Being near the core of a major urban centre, this site has the potential to promote the benefits of using a sustainable approach to inhabiting the sensitive environmental situation of the Red River flood plain.

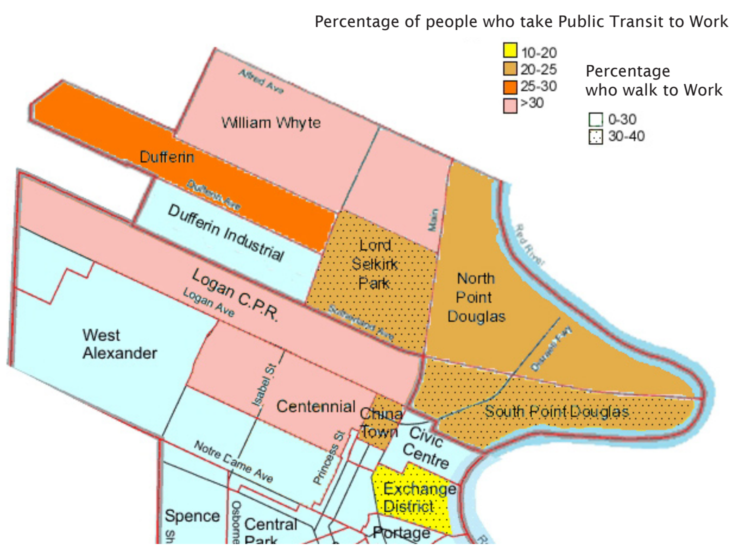


Figure 2.11 Public transit

Figure 2.12 The Louise bridge, formerly a railway crossing, connects Point Douglas to the east side of the Red River.

Figure 2.13 There is a public boat launch, referred to as the Yacht club, on the north side of the point.

Figure 2.14 Industrial and residential uses occupy much of the site in close proximity.

2.4 Urban Renewal Proposal

The re-establishment of Point Douglas as an urban centre, outlined in this proposal includes retaining a few of its most prominent features.

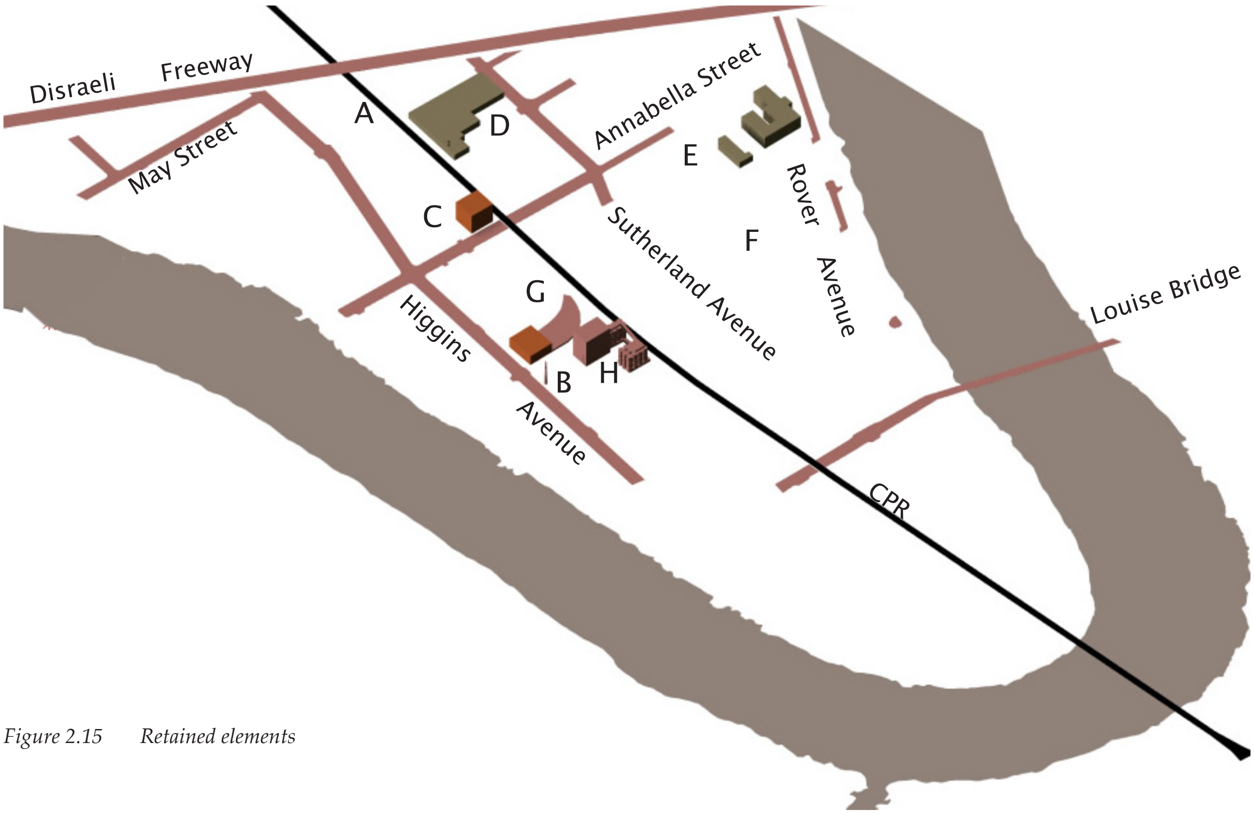


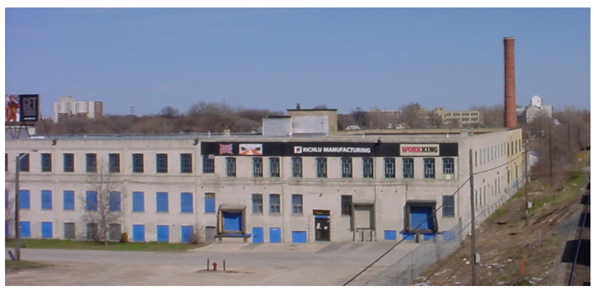
Figure 2.15 Retained elements

1. Portions of Sutherland and Higgins Avenues are retained, as are the general orientation of minor streets, following the form of the original settlement.
2. The Canadian Pacific Railway (A), is not only prominent in the landscape; it is also responsible for Winnipeg's success and contributed to the evolution of Point Douglas to its current status.
3. The prominent smoke-stack on Higgins Avenue (B) is to be adapted to become a central feature in the civic area as an urban folly.
4. A tall, red brick commercial building (C) retains continuity with the past; since it provides suitable density, it is retained in a commercial capacity.
5. An industrial building complex (D) is suitable for incubator industries or for adaptive re-use as a multi-use conversion. The industrial component is a major part of the new scheme.
6. The Hydro building infrastructure(E) on the north shore, is preserved as a flag-ship for the site, since losing it to a flood in the past was the ultimate signal for the city's evacuation.
7. The residential area on the north side (F) is preserved for residential use.
8. The shipping portion of the Ogilvie Mill (G) has already been converted to commercial use as a grocery that conforms with plans for adaptive re-use. An adjacent building retains the shape of a former railway spur and will be preserved up to flood level as a raised civic square for public gatherings.
9. The Ogilvie Mill (H) holds a historic position in the centre of the site where the first mill was erected in the city. The structure is the tallest building on Point Douglas and served as a temporary refuge for residents displaced during historic flooding events.

A

B

C



D

E

F

G

H

End Notes

1. Daniel Francis, *Battle for the West*. (Hurtig Publishers, 1982), 116.
2. Gregg Shillday, *Manitoba 125: A History Volume 1, Rupert's Land to Riel.* (Great Plains Publications,1993), 96.
3. Gregg Shillday, 1993, 99.
4. Gregg Shillday, 1993, 74.
5. Daniel Francis, 1982, 28.
6. *Ibid.*, 23.
7. *Ibid.*, 117.
8. Gregg Shillday, 1993, 84.
9. Halkett, John, *Statement Respecting the Earl* etc. (John Murray, 1817). Appendix D-T
10. Gregg Shillday, 1993, 115.
11. derived from City of Winnipeg. "Census 2001" <http://www.winnipeg.ca/census/2001/> (1 November 2005)

Chapter 3
Origins

3.1 Flood Plain Geology

Within Canada, the Red River flood plain consists of 40 to 50 feet of clay over a limestone base, the former bottom of glacial Lake Agassiz. The Red River basin reaches from the Manitoba Escarpment in the west to the Canadian Shield in the east and indicates the extent of Lake Agassiz. As the Figures 3.2 and 3.3 indicate, it would be an enormous challenge to control the surface water of such a vast region as the Red River flood plain. The geography of the region is composed of a relatively flat surface of clay, with quarries of limestone and granite found in outcroppings to the north and east of Winnipeg, particularly in the area of Selkirk. From its source in North Dakota to the mouth at Lake Winnipeg, the channel length of the Red River is 880 kilometres.[1] The topographical conditions of the river valley provide an optimal situation for flooding. The river descends an average of 9.5 centimetres per kilometre, with a 100 to 180 metre width and a depth of 6 to 15 metres. The average slope of the flood plain towards the river is only about 62 cm. per km.[1] Once the river tops its banks, the wide flat surface is entirely open to flooding. Winnipeg is in a particularly vulnerable position, where a 28 year flood level is above the nearby prairie as indicated in Figure 3.1 below. Along the course of the Red River, the junction at the Assiniboine River marks the approximate centre of Winnipeg, on the slope of the river banks in the immediate path of flooding.

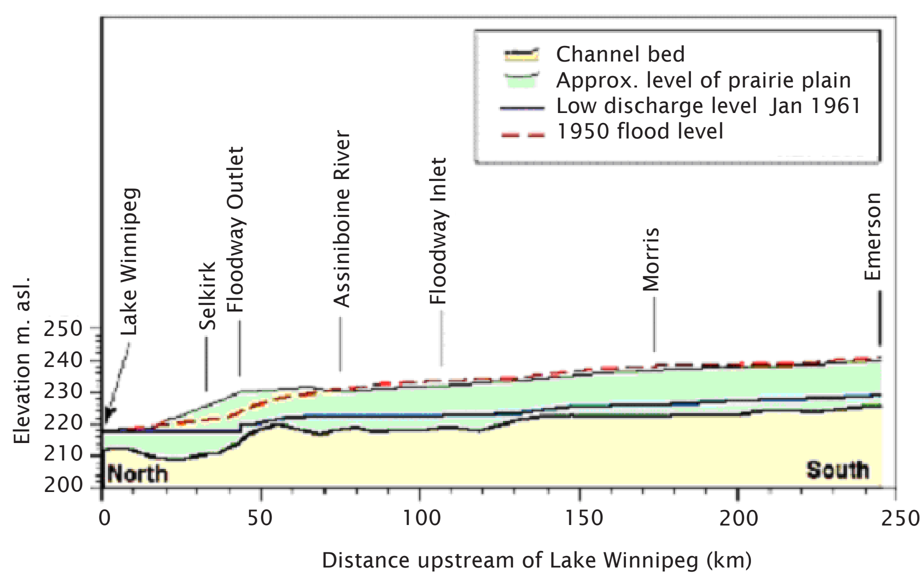


Figure 3.1 Section along Red River basin through Winnipeg

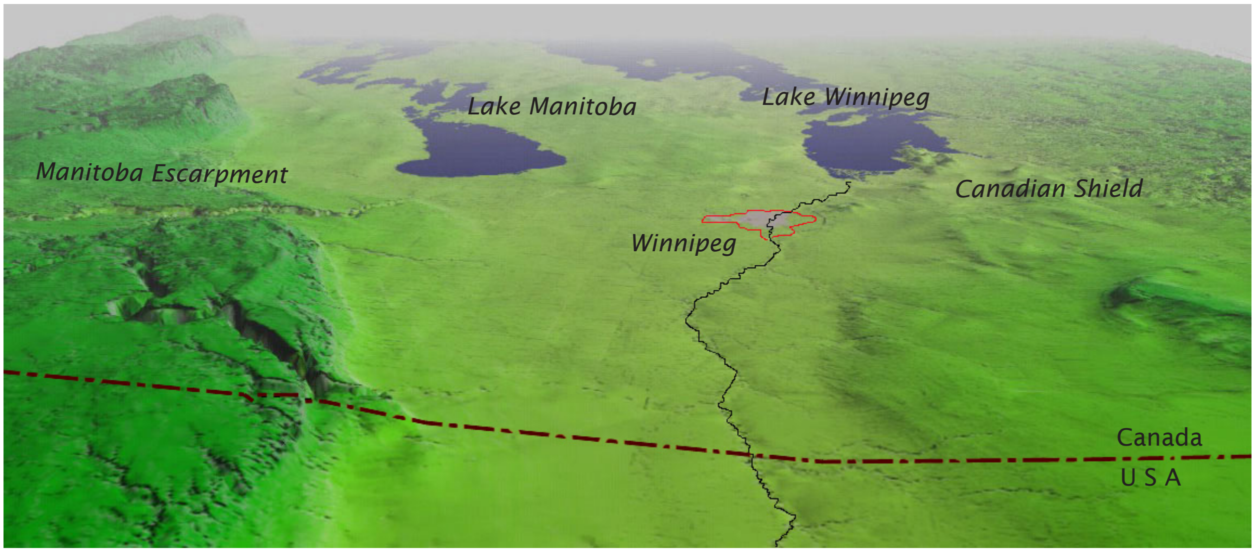


Figure 3.2 Flood plain of the Red River formed from Glacial Lake Agassiz, covering 290,000 km² over the USA and Canada

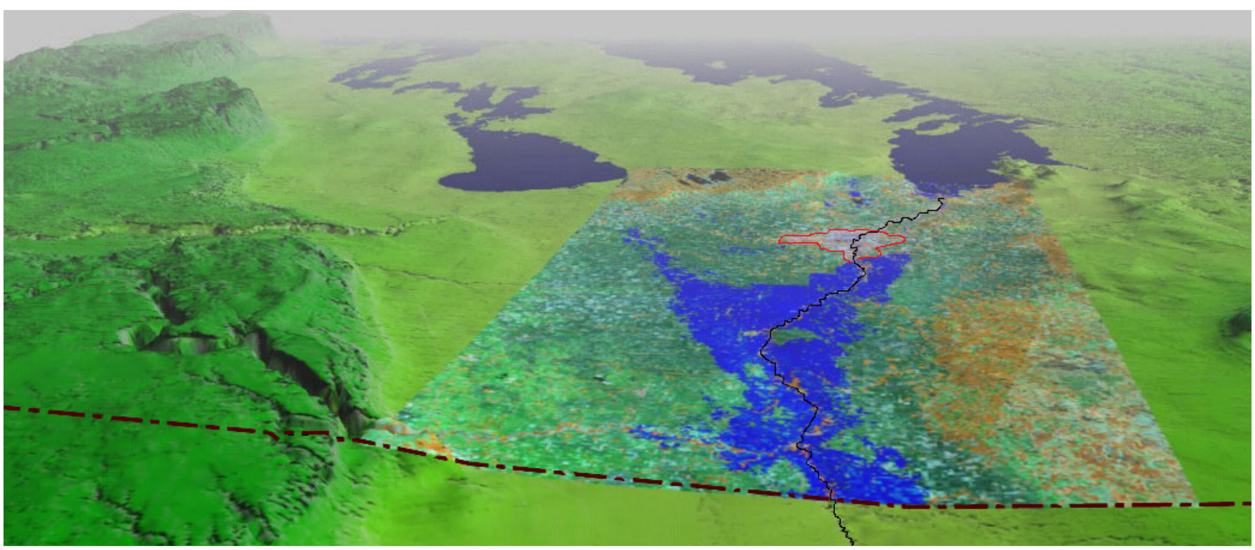


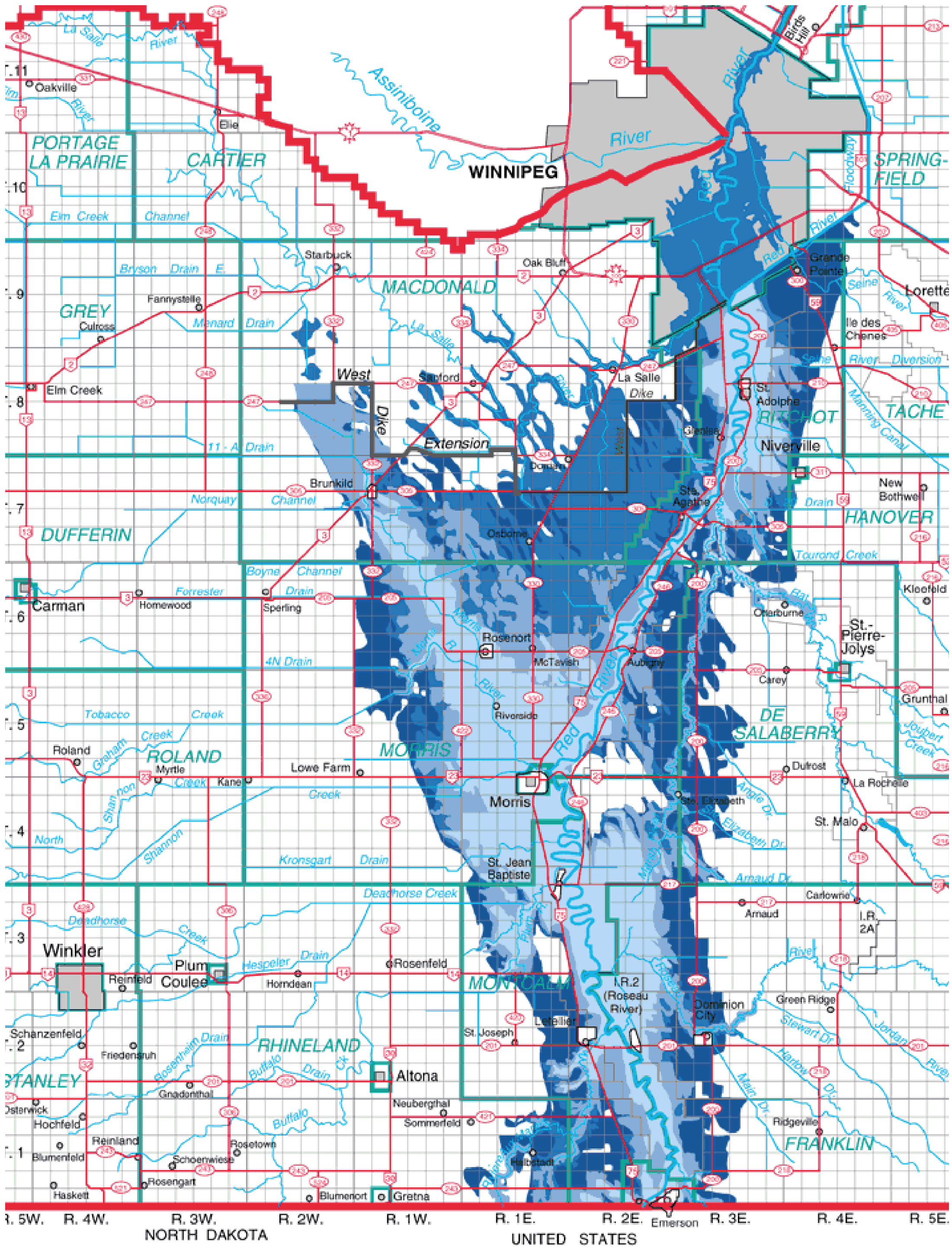
Figure 3.3 Extent of recorded river overflow, north of the 49th parallel

3.2 Red River

The frequent flooding of the Red River flood plain is a result of two factors, the direction of river flow from south to north, and the extremely flat ground through which it flows. When spring arrives and the mouth is still frozen, water from the spring thaw to the south has nowhere to go but over the banks into the prairie, transforming the landscape into an enormous lake with lines of trees marking the former river. The image of Figure 3.4 shows the result of the Red River flooding at the southern edge of Winnipeg in 1997. The city of Winnipeg constantly monitors the river level in order to determine the appropriate degree of flood defence that might be required. The following list provides an overview of water levels compared to the James Street Datum, a river level monitoring point within the core of the city of Winnipeg. The water levels listed below have significance for designing inhabitation within the flood zone.

James Avenue Datum	= 0 metres
Normal river level	= 2.13 m.
Residential area	= 7.44 m. (approximate within design site)
1997 flood level	= 7.47 m.
Ideal dike height	= 8.02 m.[1]
CPR tracks	= 10.24 m.[2]

Figure 3.4 Red River in flood, 1997



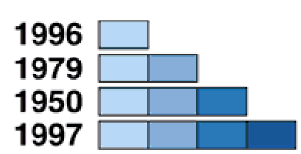


Figure 3.5 Areas Flooded by the Red River in Canada

3.3 Floods

In the flood-prone areas of warmer countries, the most common response to flooding is to build on stilts. Where high winds and wave action are involved, it is good practice to keep areas in the flood-path clear, often relegating the ground level to parking. Yet construction on stilts does not work well in colder climates, such as that experienced in Winnipeg, because of the difficulty in protecting building services from freezing. The increasing quantity of property being constructed on the surface in any case has resulted in an increase of damage due to flooding. This damage is catastrophic in many cases. The hazards that are most pertinent in Winnipeg are summarised as drowning, floating debris, contamination, service interruption and fire, all made worse by inadequate insurance to cover losses.

The most immediate flood hazard of drowning is usually avoided by anticipating flood conditions and avoiding contact. In Winnipeg, floods can be extensive but not very deep or forceful. Data from Emergency Preparedness Canada reveals only four fatalities, since 1900 in Winnipeg, were attributed to flooding.[3]

During the initial spring thaw, ice flow damage can occasionally be a factor. This occurs close to the river edge; most flood water in Winnipeg is too shallow to allow large objects to move quickly. High winds associated with certain types of flooding and subsequent collisions with debris are not significant factors at Winnipeg. Large objects, such as buildings, do not normally float away but can be undermined by flood water, leaving them on unstable ground and liable to collapse. Sharp objects carried by flood water can become a problem when buried in silt and debris deposited after the water subsides.

Sewage is the most pressing problem and is responsible for a large share of the property damage. When sewage systems infiltrate the river system during a flood, any absorbent material that comes in contact will be contaminated. Any material that cannot be properly washed will continue to harbour harmful bacteria. This includes drywall, insulation, upholstery, clothing, soft furnishings, and soil. Spontaneous combustion can also occur in cases where large amounts of cellulose-based materials are left damp. Moulds, specifically *stachybotrys chartarum*, that cause serious respiratory illness can build up in materials left damp after a flood.[4]

Figure 3.6 Spring break-up on the Red River with potential ice damming

Figure 3.7 Houses along the Red River, 1950

The final surrender to flooding occurs when essential electrical, water or sewage services have to be shut down. This situation renders buildings uninhabitable and requires the complete evacuation of all areas affected. Winnipeg is somewhat unique in that drinking water is provided by aqueducts from 100 miles away, so potable water is easily protected from the effects of flooding. Sewage pumping capacity during any flood is limited by the amount of flood water the system can accommodate and this is only slightly relieved by mass evacuation. Overflow from sewage systems enters directly into the flooded area, affecting everyone down-stream from the flood zone. Sewer systems cannot safely contain sewage unless they collect, store and treat it entirely above the flood level or within a closed system protected from the infiltration of river water. Outlying areas, without community sewage services, operate with individual septic systems from which material will enter flood water, so all flood water is considered contaminated.[5]

Electrical services, fixtures and products have internal parts that are often impossible to clean up without risking residual damage or electrical hazards. Electrical shorts can occur in individual items not allowed to dry as well as in general electrical systems in contact with water, resulting in electrocution. Some mechanical or electronic items can remain clogged by sewage debris or silt, leading to failure. Also, pilot lights on gas equipment may be extinguished by high water, resulting in gas leakage or potential gas build-up and combustion.[6] The difficulty in providing for fire trucks to access burning property through high flood water is the most serious situation, leading to catastrophic loss.[7] The city of Fargo, (Fig. 3.8), is a dramatic example of this where buildings surrounded by water are consumed by fire for lack of fire fighting equipment.

Catastrophic loss is the greatest problem encountered as a result of flooding on a flood plain. In Canada, flood insurance for property damage is not available in either private or public form. Disaster relief, in the form of Disaster Financial Assistance Arrangements (DFAA) or Public Safety and Emergency Preparedness Canada (PSEPC), is the only option.[8] In the case of flooding in a flood plain, the focus of these programs is primarily on supporting and protecting public safety and infrastructure,[9] not damage relief.

Figure 3.8   City of Fargo, North Dakota during the flood of 1997.

3.4 Flood Control

Since flooding is a common occurrence in the region around Winnipeg, various methods of flood control have been applied with varying results.

A common method for protecting existing buildings is to wait for a flood to approach and sandbag as the water rises (Fig. 3.10). This temporary levee-making is a labour intensive technique that requires intense vigilance, yet often fails. There is a practical limit to how high one can sandbag, because the base needs to be greater than the height for stability. The higher the bags are piled, the wider the wall must be at the bottom. The success of this method is also affected by the availability of sand and labour, as supplies dwindle and access is closed by flooding.

A common method to protect individual buildings from flooding in rural locations is to construct them on engineered hills. Besides requiring a large surrounding land area and quarry material to make the initial mound, costs escalate if roads and infrastructure are also treated this way. The hill does serve to protect the water and sewer lines from freezing during the winter, and placement of a garage under a portion of the building will reduce the amount of fill required. A few examples are shown in Figures 3.11 and 3.12.

There are riverside neighbourhoods within Winnipeg, such as Kingston Row, that rely on permanent levees (Fig. 3.9) for protection from flooding. This method is most effective for minor fluctuations in river levels; but for higher flood levels, other methods are required. However, this intermediate system of levees reduces the need for sandbagging that would otherwise be needed.

Figure 3.9 River bank levee in the Kingston Row neighbourhood of Winnipeg

Figure 3.10 Sandbagged House

Figure 3.11 House on engineered hill, south of Winnipeg

Figure 3.12 House on hill, with garage partially displacing fill

Many small communities in the region of Winnipeg build levees around their towns, allowing them to be closed off in times of flood. The towns of St. Agathe and Morris (Fig. 3.14) are examples of entire communities surrounded by levees (St. Agathe's failed in 1997). This is an expensive method because of the vigilance involved in keeping the levees maintained. Emergency systems still have to be engaged during flooding, and the growth of these communities can be limited by the difficulty involved in adding more property to the closed system. This system is also prone to failure when flood waters persist and weaken the levees.

The most ambitious method of avoiding flood disasters has been to bypass the entire community with a diversion canal (Fig. 3.13) and reintroduce water downstream, where flooding is considered less of a problem. This is the primary means of protecting Winnipeg. The Winnipeg Flood-way is 47 kilometres long and 135 metres wide at its base, designed as a diversion canal to accommodate 160-year flood returns.[10] The cost of this infrastructure is shared by the whole city, making it reasonably affordable; but bypassing the community in this way also limits growth and aggravates problems in outlying areas as evidenced in St. Agathe, which had not previously been a flood prone district before the diversion canal was created.

These are examples of a response to flood-proofing through engineering designs that resist floods. Most of them are impractical for flood-proofing the dense urban centre of a city, and the cost of implementing them becomes more apparent when consolidated as a city service. Those defensive methods that displace water may contribute to greater flooding in surrounding regions when water must be accommodated elsewhere. When water is diverted from an area the size of Winnipeg, it has a significant effect on water levels in adjacent areas. Beyond issues of sustainability, there are ethical issues to be considered when displacing flood water to neighbouring locales. Elsewhere is always somewhere for somebody, making diversion solutions less tenable as regions become more populated.

Figure 3.13 Winnipeg's diversion canal inlet south of the city in 1997

Figure 3.14 Town of Morris view of perimeter dike 1997

End Notes

1. Information derived from City of Winnipeg, "What does James Avenue Datum Mean?" <http://www.winnipeg.ca/Services/CityLife/HistoryOfWinnipeg/flood/james_ave_datum.stm> (1August 2004)

2. City of Winnipeg, Digital Contour Maps. Winnipeg, 2004.

3. Natural Resources Canada. *Significant flood disasters in Manitoba during the 20th century*. <http://gsc.nrcan.gc.ca/floods/redriver/table2_e.php> (1 December 2005)

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5. International Joint Commission. International Red River Basin Task Force. *The Next Flood: Getting Prepared* April 2000.

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7. National Institute for Occupational Safety and Health. *NIOSH Publication No. 94-123:* March 1997.

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9. Public Safety and Emergency Preparedness Canada <http://www.psepc-sppcc.gc.ca/prg/em/fdai/fdai-inventory-en.asp#phy>(1 December 2005)

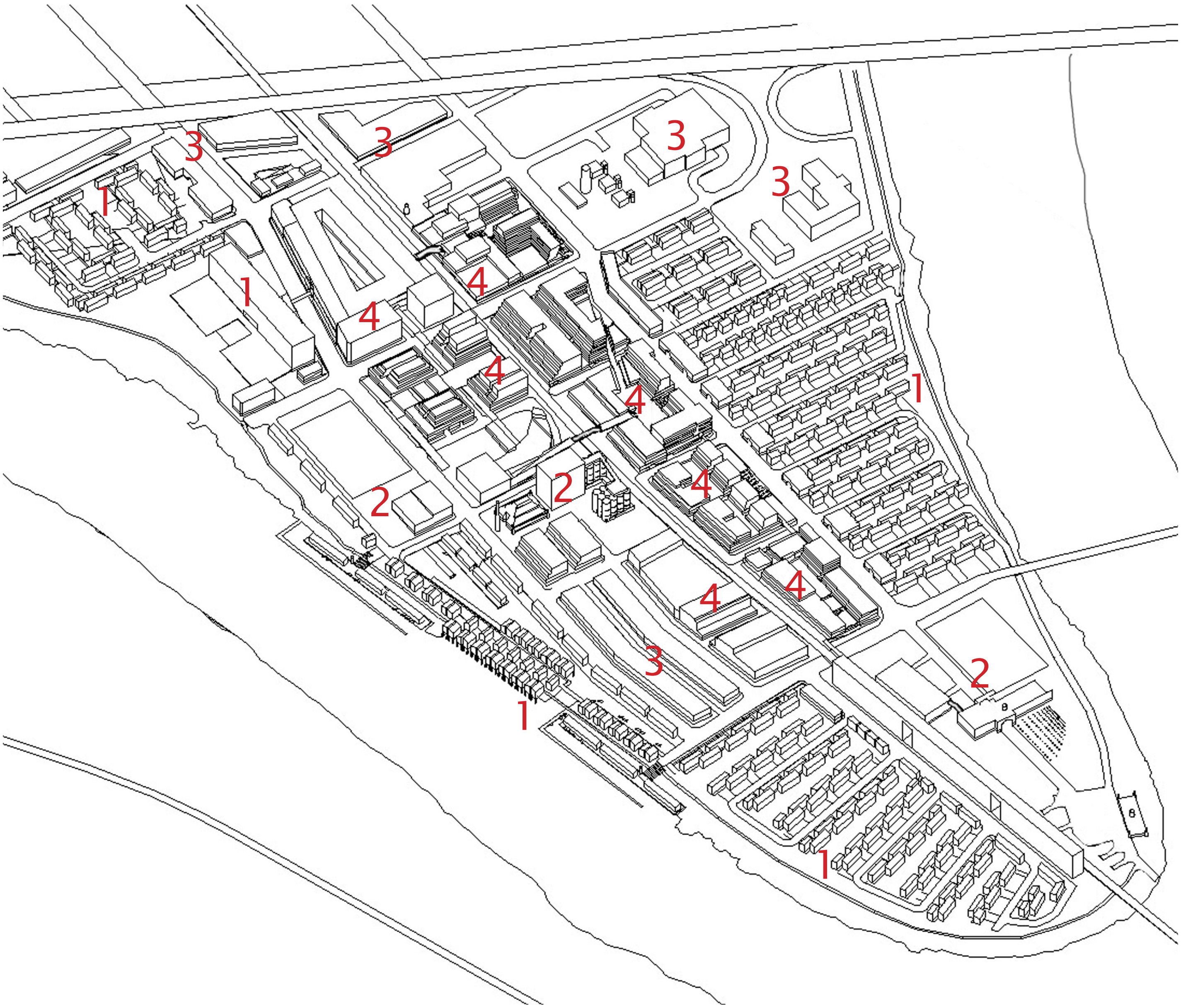
10. Public Safety and Emergency Preparedness Canada. <http://www.ocipep.gc.ca/ep/ep_digest/js_97_fea_e.asp> (1 November 2005)

Chapter 4
New Point Douglas Proposal

4.1 Overview

The general layout of new Point Douglas incorporates a large number of multi-use buildings to be located along either side of the railway. These buildings include retail, commercial offices, residential, and small scale industrial uses, as well as parking areas. Larger industrial businesses dominate the western edge of the site next to the Disraeli Freeway, and a multi-unit industrial block is located near the centre of the site. Also centrally located are institutional and recreational public use buildings which connect the public with the south shoreline of Point Douglas. A waterfront walkway along the shoreline links the public's recreational parks. This waterfront walkway runs continuously around the perimeter of the site, providing full public access to the river. At the tip of the point, institutional and recreational buildings are also arranged, where they connect the waterfront with residential zones nearby. The residential zones employ a variety of techniques for occupying a flood plain and these zones are placed at intervals along the waterfront, between the public walkway and the high density core. One strategy is to build vertically as seen in two twelve storey apartment buildings located, one at the point and the other just south of a shopping mall near the central core area of the site. Another strategy is apparent in a community constructed on hills which are located along the northern shore of the point. A similarly sized community has been placed on the south-east tip of the point, which is elevated on piles or stilts. Immediately to the west of this area is a marina which incorporates floating townhomes and is overlooked by homes on stilts. On the western entrance to the site, adjacent to the downtown core of Winnipeg, another area of townhomes utilises a mix of responses to flood plain occupation including hills, stilts and floating floor structures. The strategy utilising floating structures is incorporated in residential, commercial, industrial and institutional uses interspersed throughout the whole of the new Point Douglas.

Over-all Axonometric of New Scheme



1 Residential
2 Institutional/Recreational
3 Industrial
4 Mixed use

Figure 4.1 Site Plan Axonometric

4.2 Zero Level

Within Point Douglas, the most critical area to address for flooding is the area between average ground level and the top of the railway embankment. The railway is the reference datum in this proposal, as it is above the level of most flooding. The ground surface below the railway datum, which will be referred to as zero level, activities that are not adaptable to displacement or to some level of disruption during flooding are not suitable. Inhabitation within the zero level must meet particular health and safety criteria in order to be free from flood disaster relief activity. For example, permanent structures need to be washable and impermeable to bacteria laden flood-water. Also, any materials, equipment or machinery that cannot withstand immersion in flood-water need to be mobile in order to be moved before the arrival of flood water.

The most flood-adaptable component of the city is the parkland because it is uninhabited during flood events. The greatest impact to parklands comes from the thick layers of mud that accumulate over immersed surfaces and need to be cleared afterwards. Otherwise, parks can be left to the natural fertilising benefits of flooding.

The next most adaptable use is parking. It is a large part of the urban core and is suited to the zero level because vehicles can be removed easily, off site or to upper levels, and can be partially concealed under structures.

Finally, many industrial buildings can safely occupy the zero level. Industrial uses conducive to the concept of adaptable use include those with stand-alone equipment (without extensive, rigid interconnections), those with large storage requirements with or without open space required for assembly purposes, those with office and assembly space combinations, and those with portable, mobile equipment (steel fabricating, welding and assembly, storage and distribution, unit construction or assembly, and repair shops).

The recurrent phenomenon of flooding is to be normalised across the site as a natural process, to be experienced in adaptable habitation without the hazards that require disaster mitigation.

Figure 4.2 Site Plan

Conditions of Inhabitation at the Zero Level

LEGEND

Floating Structures

Urbographic Connections

Industrial Flood Condition

Inhabited Flood Condition

Urbographic Contours

Hydro
MSW
City of Winnipeg
Hill Community
Public Park
CPR
Public Park
Marina Community
Stilt Community
Red River
N
0 25 50 100 150 250 metre

4.3 Topographical Intervention

In preparation for the design intervention that normalises the flooding of Point Douglas, there are some changes involving the topography. First of all, the dike system along Rover Avenue is to be dismantled. In general, Point Douglas will not be protected by dikes. The existing hydro plant is the only exception and is to be protected by a dike, indicated at point V (Fig. 4.3). Only a few components of Point Douglas are to be protected from floods by being elevated with fill to the determined safe level, eight metres above the river level. An engineered hill at U will be created for a Municipal Solid Waste (MSW) plant, located near the existing hydro building, in order to share existing equipment. This MSW plant is kept out of the flood zone so that it can maintain continuous operations during flooding events. It has a vital function to process Winnipeg's garbage and generate power to the community. However, as a way of addressing the ethical issue of displacement of river overflow to outlying areas, any displacement of flood water resulting from this strategy will be balanced by earth removal somewhere else on the site.

Displaced flood water will be accommodated in the area at Y. This is to be excavated enough to create a four metre clearance under a stilt-supported residential area. The area marked X is also to be excavated for storm water management before being built over. Area Z is to be the largest excavation; it is to be converted to a residential marina.

Engineered hills in the region of W are to be offset by the excavation of valleys between them to support a residential area with a corrugated topography. These hills support interconnected walkways and enclose services to the town houses. The earthwork of the hills and the single dike are counterbalanced by valleys between.

The railway embankment is currently penetrated by streets at only two locations, Annabella Street and Higgins Avenue, marked as T. In the new plan, there are three pedestrian tunnels added at the locations marked S.

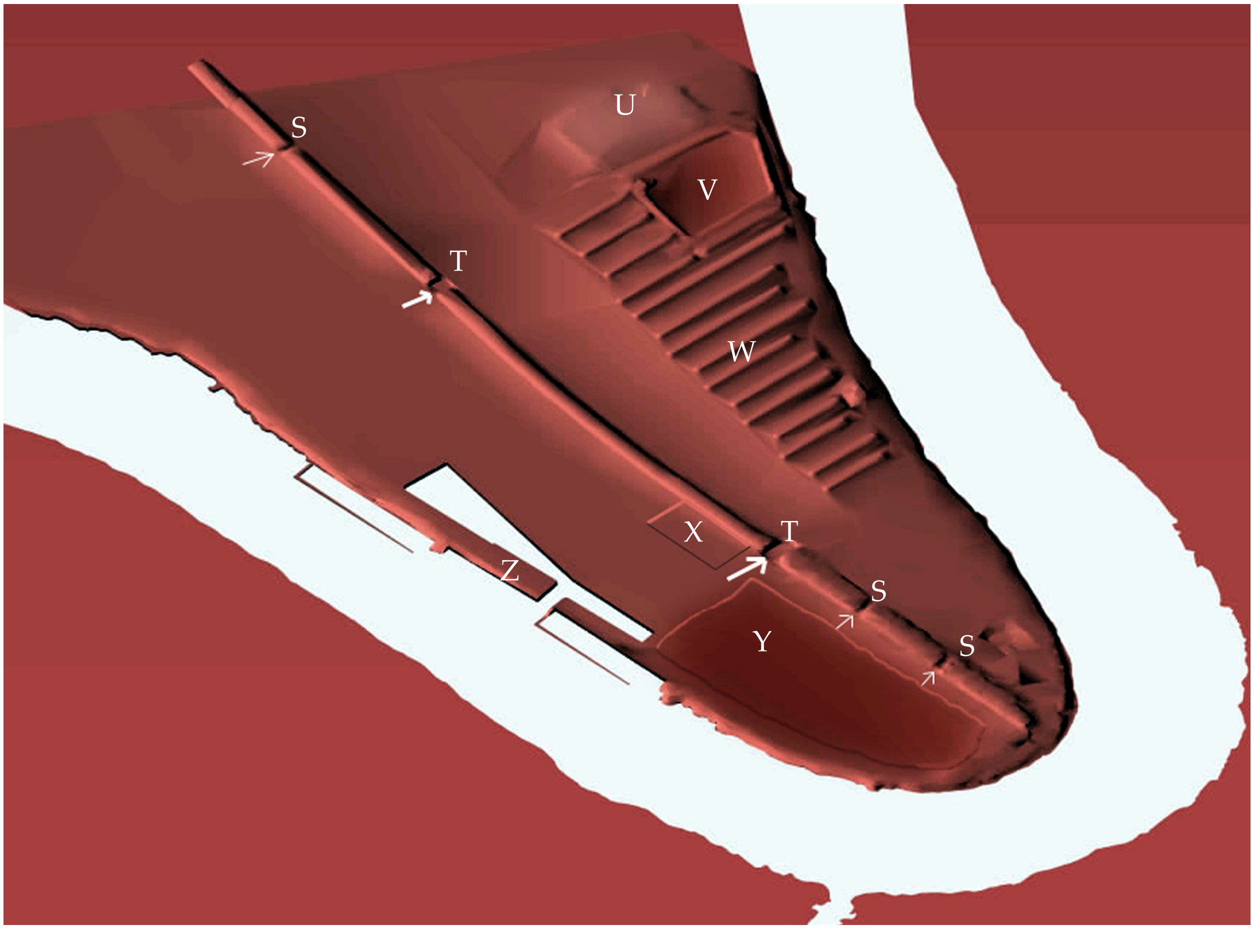


Figure 4.3 Topographic intervention

S	Pedestrian tunnel
T	Vehicular underpass
U	Engineered Industrial Hill
V	Hydro Building Dike
W	Residential Hills
X	Storm-water Lagoon
Y	Excavated Residential area
Z	Excavated Marina

4.4 Transportation

The railway line is a powerful presence on Point Douglas. It was the catalyst for the transformation of an agricultural settlement into a city and turned the marsh of Point Douglas into an industrial landscape. For that reason it is retained in this proposition as the main organising piece of infrastructure on the site. During the period when railway locomotives were powered by coal fired engines, the resulting pollution led to the partial abandonment of the site by residents; but now the offending coal fired engines are obsolete. There are also no stops, assembly yards or level crossings at Point Douglas that make railways unpleasant to live near. There is only the rhythmic sound of slowly passing freights, which serves as a counterpoint to the natural power of the Red River. The transportation network in the proposal is designed to unify the essential components of an urban centre without compromising safety or efficiency.

Two major streets that parallel the railway will be preserved to collect industrial traffic and serve parking lots within the high density core. They need slight alterations, such as straightening and shifting, to improve the spacing of city blocks. These wider streets serve as collectors for the narrower side streets and as transition space between surface occupation on the outskirts and the urban topography at the core.

Vehicular underpasses that cut the railway embankment at two locations along the length of Point Douglas are also preserved. The two wide streets, that run perpendicular to the railway, complete a vehicular circuit between Higgins and Sutherland Avenues. At Sutherland Avenue near the hydro station, an off-ramp is required to connect to the Disraeli Freeway in order to minimise the infiltration of heavy truck traffic into the neighbourhood.

Street level side-walks are confined to the lower-density sides of Higgins and Sutherland Avenues in order to separate pedestrians on the outskirts from commercial traffic emanating from the core. Pedestrian crossings from the outskirts are placed at mid-block where access points to upper levels of the core exist (Fig. 4.4). Side streets on the outskirts are looped to facilitate regular city services and maximise movement between the public space on the periphery and the public space at the core.

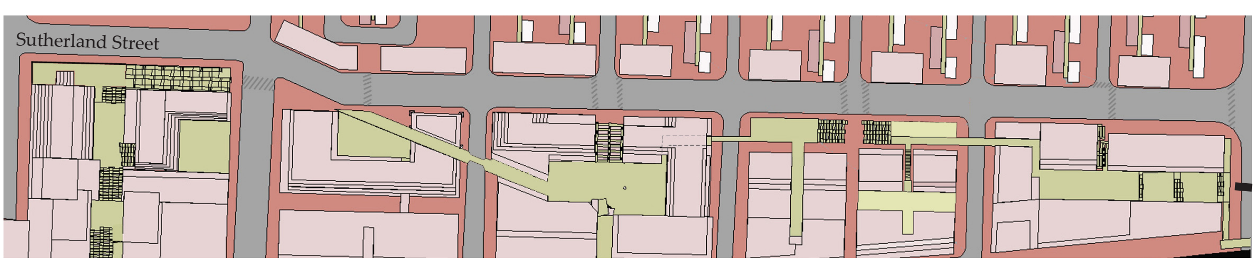


Figure 4.4 Access points to upper levels of block

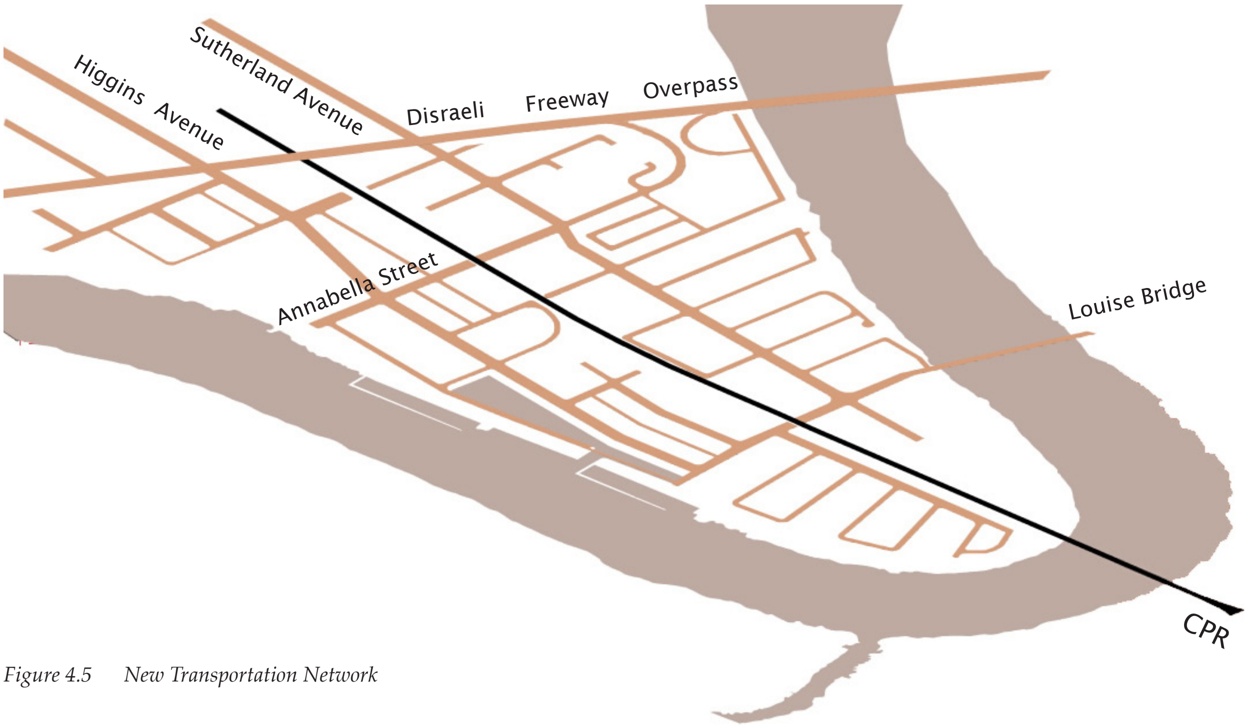


Figure 4.5 New Transportation Network

Figure 4.6

If the datum of this image is accepted as the sunken railway then the landscape becomes the projected form. The continuity of the landscape is broken by the railway. An isolated construction can be used to bridge it.

Figure 4.7

In this image, the surrounding structures lack the density to create much form on a flat surface. The buildings are distinct forms in the landscape. If the railway is elevated, the structures become even further disconnected.

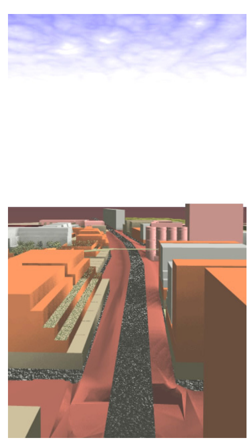


Figure 4.8

This image shows a constructed landscape of buildings along an elevated railway. Increasing density permits bridging between structures and lowers the railway within the urban landscape.

4.5 Civic Program

A community such as Point Douglas is strengthened by the inclusion of central, community facilities that provide inclusive venues for staging public events and integrating residential, recreational and educational land uses within the community. This is achieved by making highly visible, accessible places for public education programs, organised events and games as well as by providing for the more specialised programs of libraries and spiritual centres.

The Point Douglas proposal includes civic facilities in two locations and includes a Civic Centre, a spiritual and interment centre, a library, a school, a boat launch facility (yacht club) and an open public square. These facilities are linked together at ground level by the park system that flows around the perimeter of the site and maintain linkages during harsh weather by means of an elevated network of pathways within the urban topography.

The primary public facility is the Civic Centre, a new building centrally located on the south side of Higgins Avenue beside a playing field. It provides indoor programs and multi-purpose classrooms as well as linking organised public programs with the riverside park system. The Civic Centre is situated across the street from a complex of industrial buildings that are to be adapted for public programs. These buildings are the remnants of the Ogilvie Mill and are prominent as the tallest structures on the site. They provide continuity with the industrial history of the site, and should be available for public enjoyment. The curved, shipping portion of the mill is to become the open public square for the community. It is situated above the flood level and linked to commercial space on the opposite side of the tracks via an overhead bridge. Nearby, a new, floating Church is sited on Higgins Avenue behind the decommissioned smoke stack. Behind the Church, the old silos are adapted for use as a mausoleum, in place of a graveyard.

The second location, which accommodates a library, a school and the boat launch, is at the point of the peripheral park system, the most flood-prone area of Point Douglas. The library and school are linked by a bridge above the flood level, facilitating the consolidation of services. Linking tunnels below the railway connect these buildings with the south side. The school is easily adapted to flooding due to the large area of water-resistant flooring that can be used as a gymnasium. The boat launch, commonly referred to as the Yacht Club, achieves a greater status as spectacle in view of the school, and it is accessed by a road that penetrates the school through an underpass.

These public programs encourage participation in the flood-active site with a wide variety of flood adaptive techniques that promote active reflection on the difference the community can make to life on a flood plain.

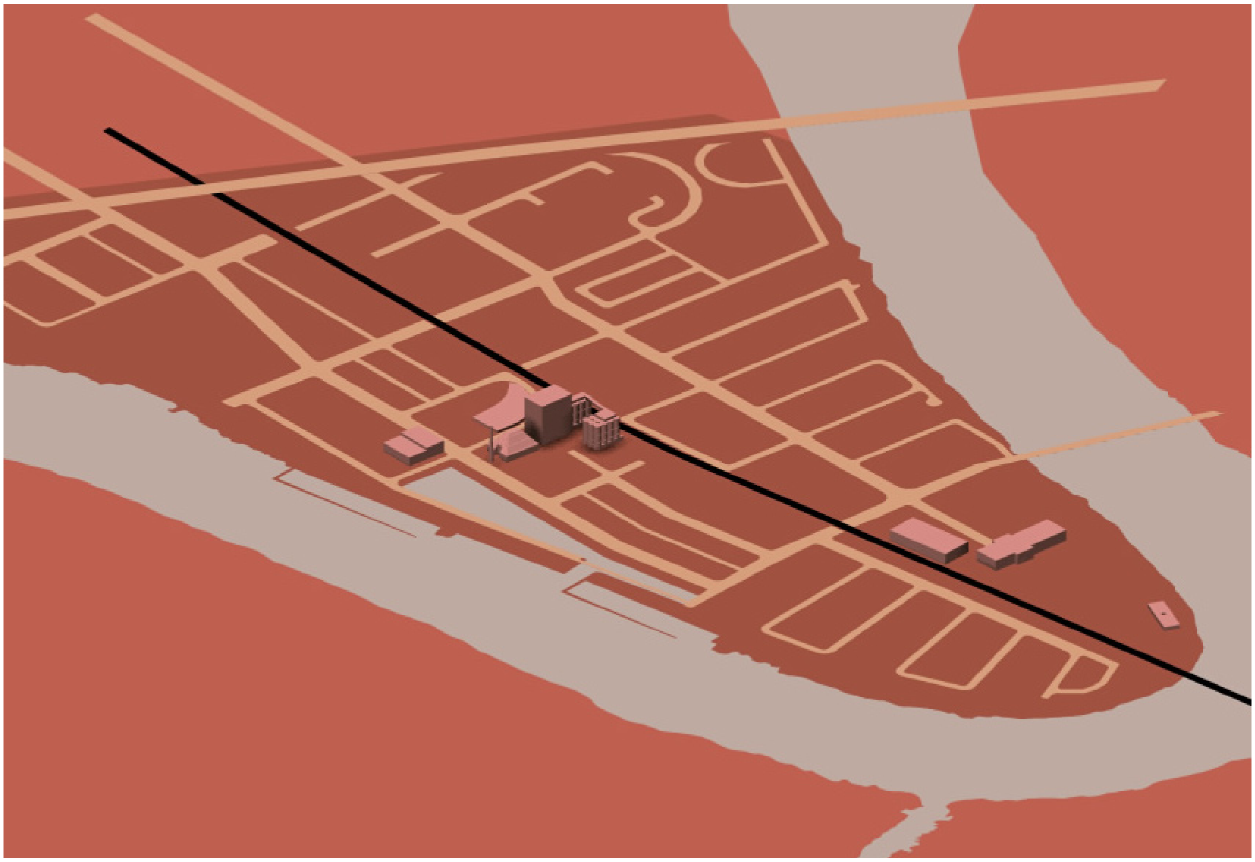
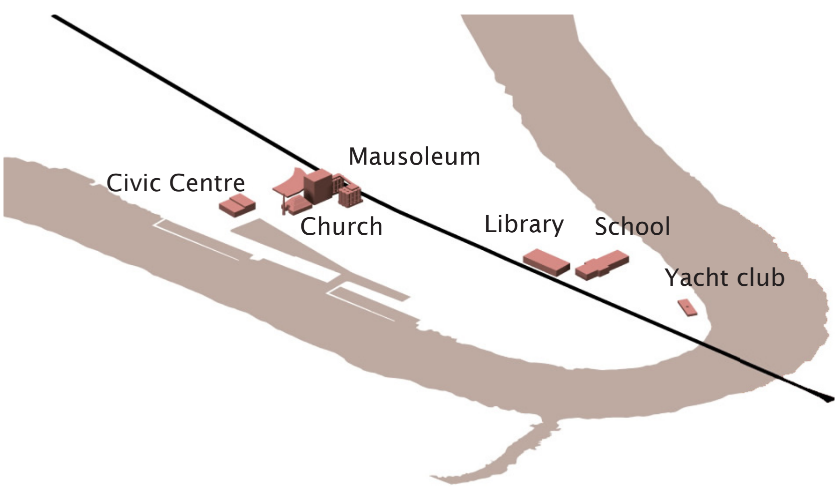


Figure 4.9 Public Buildings in context



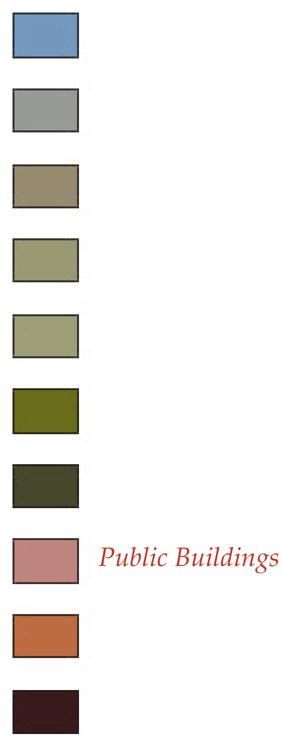


Figure 4.10 Public Buildings indicator

4.6 Parks

Figure 4.11

A good precedent for park facilities is the toboggan chute across the river.

Figure 4.12

An Ice-wall is popular for adventurers and easily constructed during winter.

Figure 4.13

Sculptures such as those of Michael Morgan are suitably informal for this park

Public parks can showcase the unique characteristics of a city to advantage, encouraging people to become actively involved in the community. Lush growing conditions (often artificially maintained) are a feature of many public parks, evoked by elaborate flower gardens and water features. Outdoor sporting facilities and picnic grounds contribute to healthy, active communities. In the search for unique attractions to engage people in the city, natural features intrinsic to the particular character of local geography may be overlooked. This is occurring in many cities that are rediscovering the attraction of water. Formerly, industrial cities made extensive use of waterways for transportation, water supply and waste disposal. This utilitarian view, which valued functional exploitation of resources over appreciation for the value of natural systems and environments, led to the degradation of these natural features, particularly as alternative means of supplying water and transporting goods reduced reliance on bodies of water and the need to preserve them. The result was a disconnection between people and their surrounding environment. Nowadays, many cities like Chicago, Toronto and Winnipeg are reclaiming their waterfronts as prime features of public park systems.

In this proposal, the public parks are to play an important role in the public program of Point Douglas. They will provide space for recreational activities and connect the community with others nearby through a continuous pedestrian circuit along the waterfront, extending from Waterfront Drive to the downtown urban centre. The changeable nature of the Red River is to be featured for pedestrians travelling along the waterfront, as they pass the winter toboggan runs (Fig. 4.11) and ice-wall (Fig. 4.12), a soccer field, a marina (Fig. 4.16) and the stilt village (Fig. 4.95), rounding the point (Fig. 4.17) under the railway overpass to arrive at the boat launch. At this point, the sculptural quality of the Red River is utilised, as all objects subjected to flood water accumulate layers of mud after flooding. These objects can be deliberately designed to accommodate this phenomenon so that the layers of mud they acquire wears off through the season due to surface contact or are washed away by rain. The experiences encountered through the park circuit along the river are the primary means of keeping residents in touch with their unique environment.

Figure 4.14 Parks in context

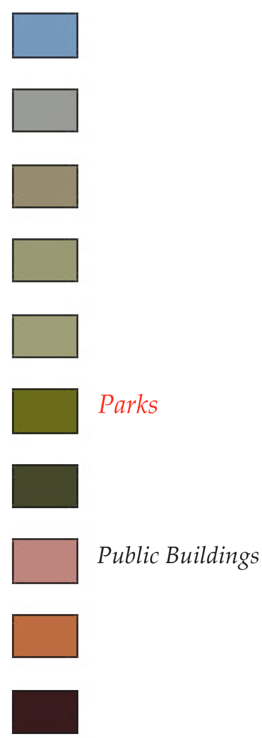


Figure 4.15 Parks indicator

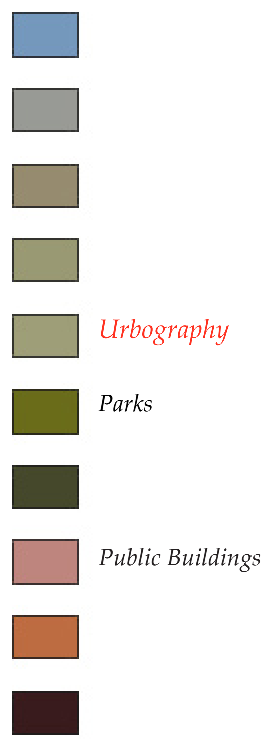
4.7 Urbography

Buildings and the landscapes in which they are situated are often designed separately, at different times, or by different people. As the natural world becomes more precious in the built-up urban environment, it becomes more important as an urban counterpoint. In order to maintain the connection between urban life and the environment, the proposal for Point Douglas merges landscape and structure, utilising landscape as building enclosure and buildings as structures for landscape. The main purpose of this is to address the need to remove urban activities out of the flood zone without disconnecting them from the local environment. The primary strategy within the zero level is to create building enclosures with landscape by constructing walls in the form of landscaped terraces. These forms convey vital services to the upper levels as well as providing enclosures for industrial businesses, parking facilities, and public operations. The surfaces of buildings extending through the flood zone are designed to fill the role of public open space. These constructed surface areas are called the *urbography*. This urbography is an interconnected, artificial, urban topography that links pedestrians at the natural ground level with the urban program within and above the zero level. The upper levels of urbography open up to squares which have the same function as esplanades, with shop-fronts overlooking public areas of seating, vegetation, signage, and textured paving. Access to this upper level is facilitated by the merging of the structures in the zero level with landscaping forms to create an artificial terrain resembling terraced hillsides. This landscape improves the experience of the street level, which would otherwise have the appearance of a mass of parking garages and factory walls. The urbography also conveys the idea that the upper region is a public place. The urbography in the upper levels enables connections between commercial and residential programs, eliminating the isolation that would occur if flood water were to surround individual buildings on the true ground level. The urbography is most effective in the high-density, central blocks where the infrastructure functions most efficiently.

Figure 4.16 Path through Urban Marina

Figure 4.17 The perforated walk-way

Figure 4.18 Urbography in context



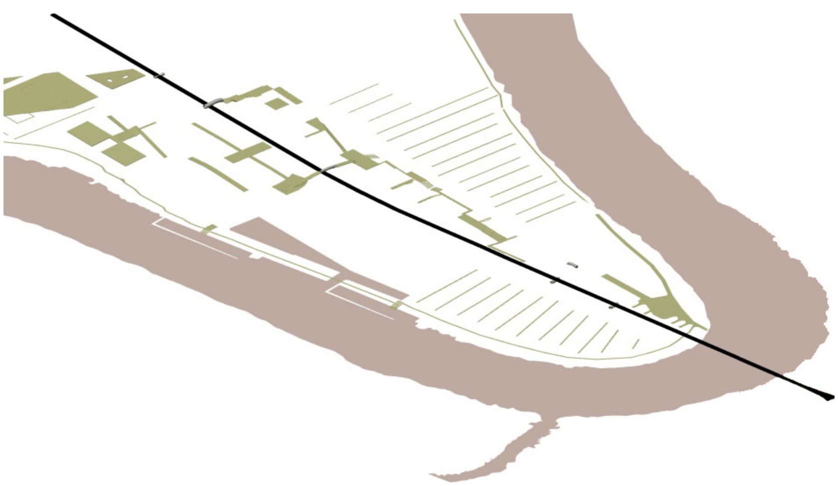


Figure 4.19 Urbography indicator

Figure 4.20 Futurist, Sant'Elia's Megastructure, 1913

Figure 4.21 Artist Robert McCall's Megastructure of the 21st Century

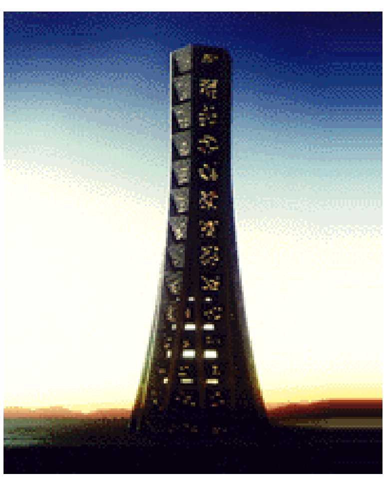


Figure 4.22 Sky City planned for Tokyo 1,000 metres tall

4.7.1 Collective Form

The urbography of Point Douglas is primarily designed to link large, multi-use urban block forms that share a few characteristics with megastructures such as Sant'Elia's fictional structures (Fig. 4.20) or the Barbican in London, England (Fig. 4.23). A megastructure is a framework designed to support a large concentration of diverse functions in relative proximity to each other. It was defined by Ralf Wilcoxon in 1968 [1] as being a structure consisting of modular units, capable of extension, having a framework onto which other units might be attached, and having a useful life beyond that of the individual units supported by it. The McMaster Health Sciences Centre in Hamilton (Fig. 4.24) is an example of a single-use building that has achieved the massiveness equivalent to that of a megastructure. The modern megastructures have an imposing presence at a human level, which can potentially alienate activities surrounding them from programs within. The city blocks in the Point Douglas proposal share the idea of the communal infrastructure of a megastructure, but are conceived on a smaller scale, sustaining surface connections with the surrounding area. A predecessor of the megastructure and early example of inhabited infrastructure is the Ponte Vecchio in Florence (Fig. 4.25). In this case, the human scale of the structure and a relationship to the surface is retained. The urban blocks in the Point Douglas proposal are multi-use buildings with strong connections to the ground plane and access to the riverside, which distinguishes them from many examples of the modern megastructure.

The Cahokia Village of Illinois (Fig. 4.26) is an example of the landscaping equivalent of a megastructure. This site provides an interesting variant to many modern megastructures in that a continuity is maintained between the various levels, from the lower ground plane to the higher level hill tops. In the proposal for Point Douglas, the megastructure-landscape proposition is apparent in the linked series of landscaped structures. However, the designs in Point Douglas make more efficient use of the landscaping. The landscaping form of construction permits the urban structures to withstand erosion during floods while retaining some useful functions at the surface level by being inhabitable. The resulting form of Point Douglas is an interconnected, inhabited landscape where the connections between the upper level and zero level ground plane are maintained, but can, during times of flooding, operate independently.

Figure 4.23 The Barbican in London, England

Figure 4.24 McMaster University Medical Centre

Figure 4.25 Ponte Vecchio in Florence, an early megastructure

Figure 4.26 Painting by L.K. Townsend depicting the earth works of Cahokia, AD 1100, a landscape/building hybrid.

4.7.2 Urban Blocks

In the Point Douglas proposal, the interconnected blocks of landscape, which concentrate the central core of the site along the railway line, are bounded by Sutherland and Higgins Avenues. A stratified program of industrial, commercial, and residential uses increases density and permits infrastructure to be utilised throughout the entire day. The urbography is used to knit these programs together and connect the blocks with the street level.

Industrial and parking activities, which rely less on natural light, are easily accommodated within the large footprint at the landscaped base level. The terraced building faces function as pedestrian routes to the upper commercial levels at various locations along the street. The urbography has an important role in drawing people from the traffic level in order to attract business from outside the community as well as service the local population. Terraced landscaping creates a form for the urbography that links the interstitial spaces above. The commercial and public activities dominate the central stratum, close to shipping and accessible to customers, while multi-residential units occupy the upper regions where light and views are best. The residential component at the top maintains control of the urban squares of the urbography through visual links from terraced balconies.

Figure 4.27 Urbographical connection from street level to urban square

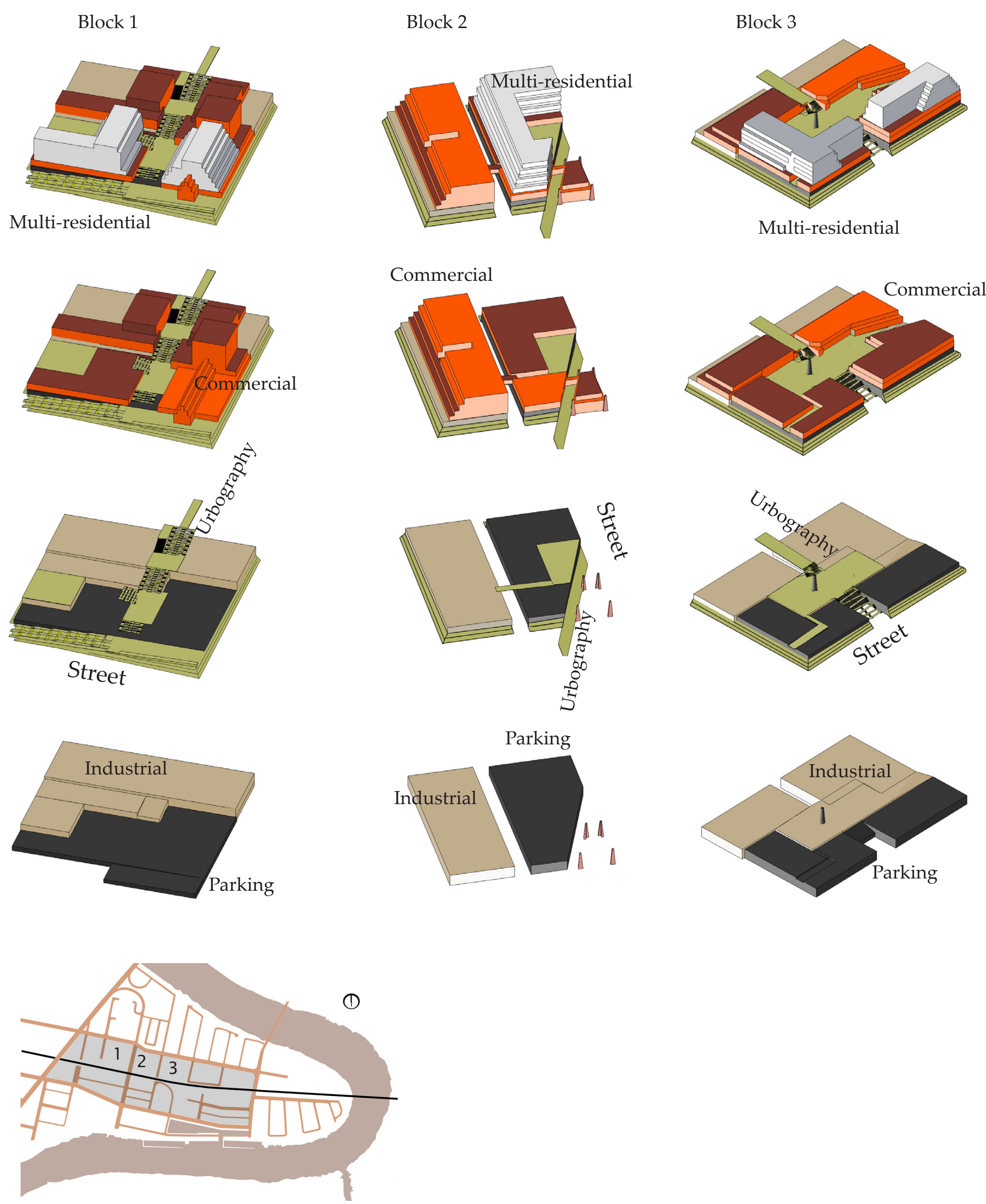


Figure 4.28 Vertically Integrated Central Urban Blocks

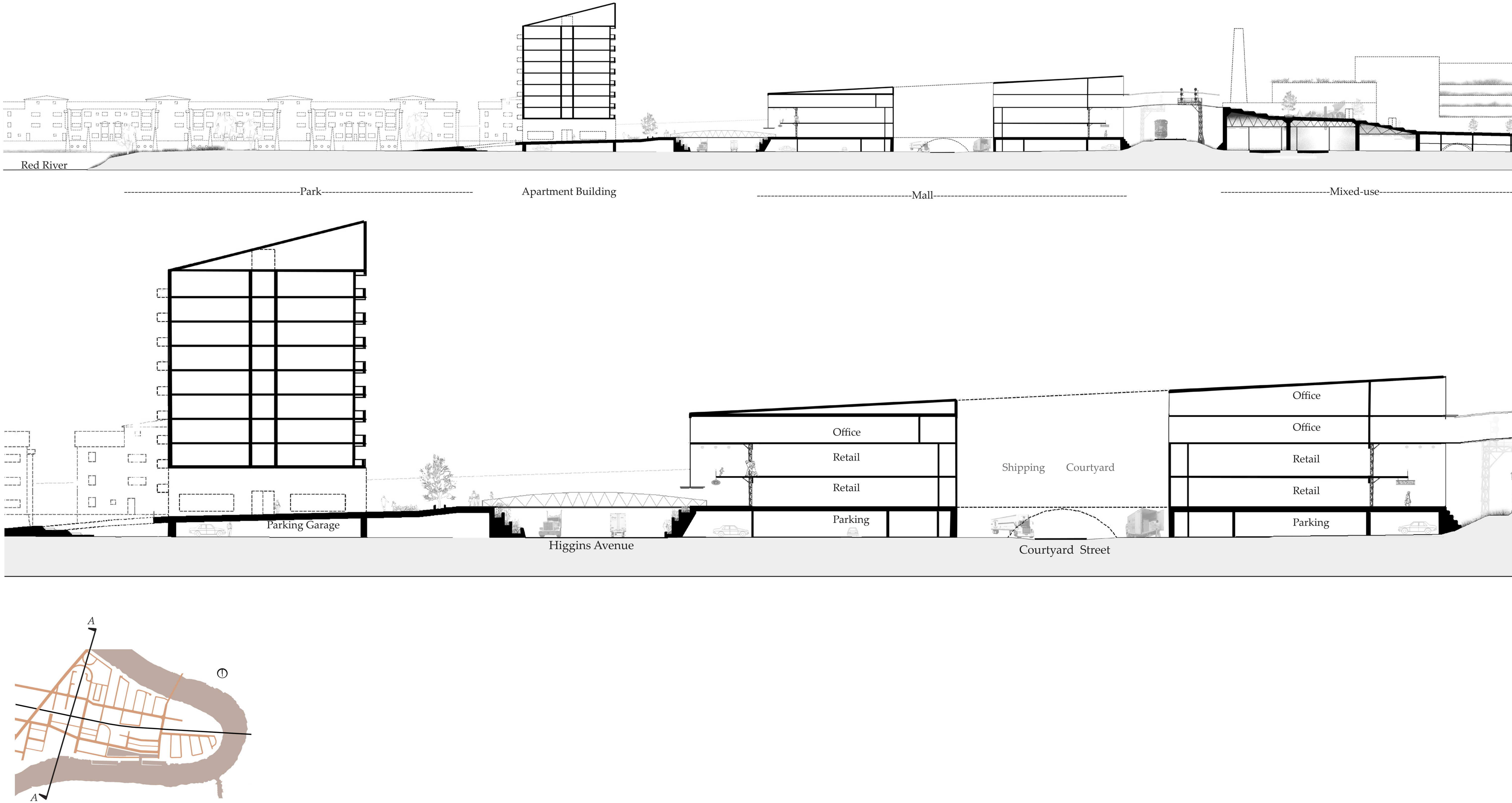
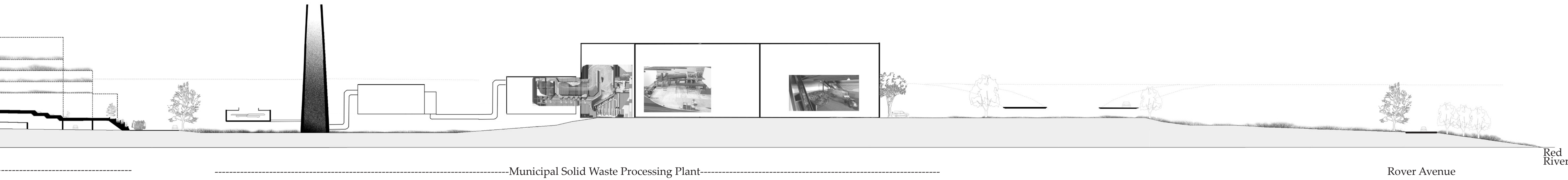
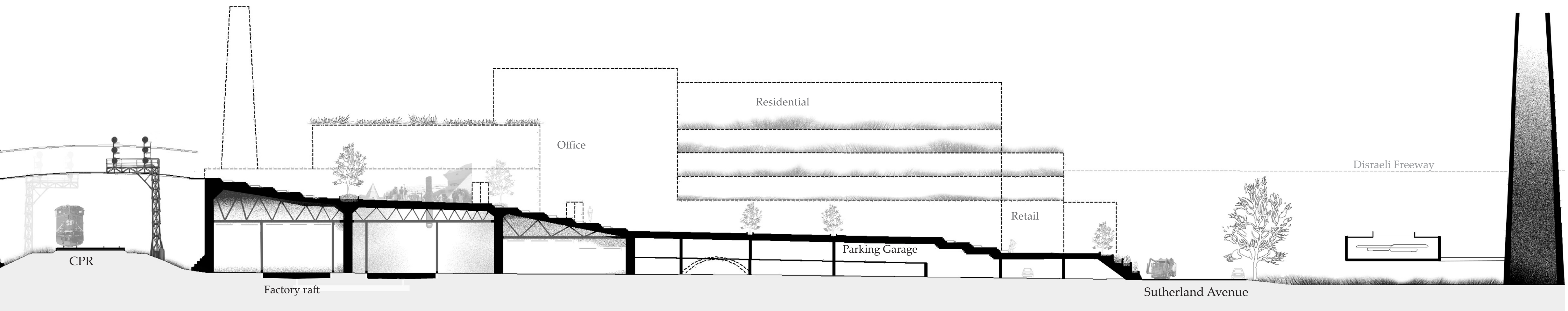


Figure 4.29 *Site Section AA through core*



Red
River
Municipal Solid Waste Processing Plant
Rover Avenue



Residential
Office
Disraeli Freeway
Retail
Parking Garage
CPR
Factory raft
Sutherland Avenue

Figure 4.30 Courtyard of Camden Lock

4.7.3 Public Squares

At the core, various city blocks are linked by an urban landscape that includes pedestrian bridges originating from the public squares on the roofs of the factories and parking structures. The urbography at this upper level, which links the commercial and multi-unit residential components, is recognisable as a vehicle-free, public street, operating in a fashion similar to the Camden Lock or Clerkenwell communities of London, England, where residential units closely overlook public areas. These public spaces serve the residential and office users above the flood level as well as being accessible from parking lots hidden in the zero levels. The dense structure within each block allows for some sheltering between buildings, to accommodate the harsh winters of Winnipeg.

Figure 4.31 Sheltered winter-plaza

Figure 4.32 Landscaped street of Clerkenwell

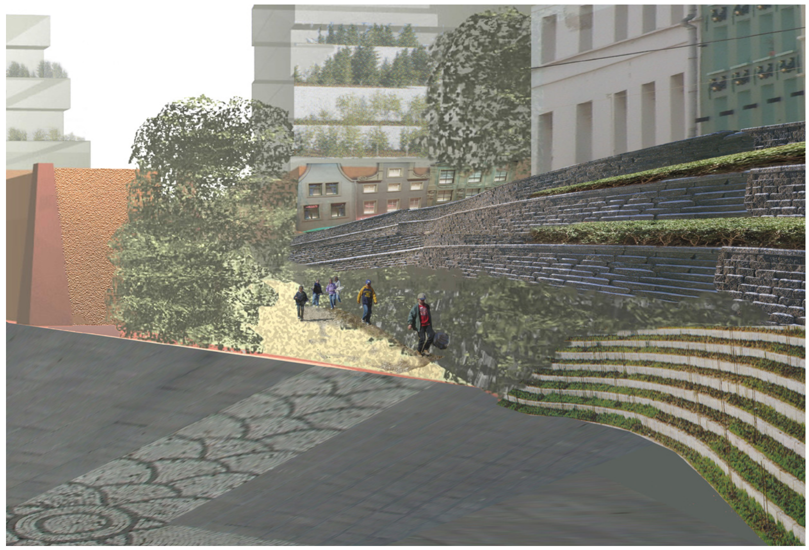


Figure 4.33 Access to the urban block(#2) from street level is achieved via urbography, the constructed landscape in the flood zone.

Figure 4.34 This 16 m wide street separates the urban core from the primarily residential perimeter. It is accessed at centre block, leaving the intersections to vehicular traffic. Side walks are restricted to the residential side of the street.

4.8 Industrial

The new design for Point Douglas incorporates a large component of industrial activity. The industrial sector is extremely important in Point Douglas, supplying a significant amount of employment to local residents.

Past problems of the incompatible nature of industrial activity in the proximity of residential areas has been greatly mitigated by technological advances that have improved the means of handling the hazardous by-products of manufacturing. A Municipal Solid Waste (MSW) processing plant (appendix A) is a good example of turning a noxious industrial process to advantage while reducing the environmental impact of urbanisation. The tonnes of garbage a large city must contend with can be turned into heat and energy for local consumption while reducing the volume of material that ends up as land-fill. A university in Perham, Minnesota USA has one of these facilities operating within the community; it is largely unnoticed due to the high quality of their pollution reduction techniques. An MSW processing plant is to be incorporated into the Point Douglas plan to supply jobs, strengthen the connection to greater Winnipeg and reduce the city's environmental impact on the region.

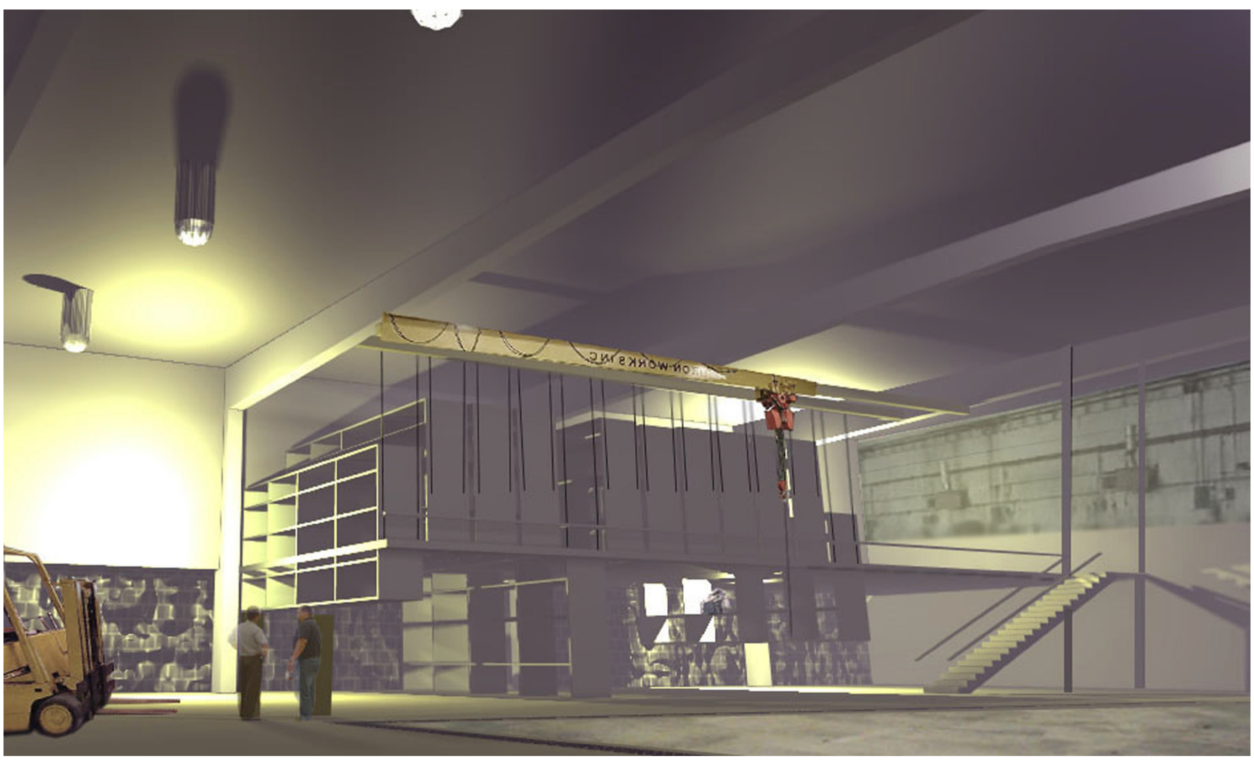
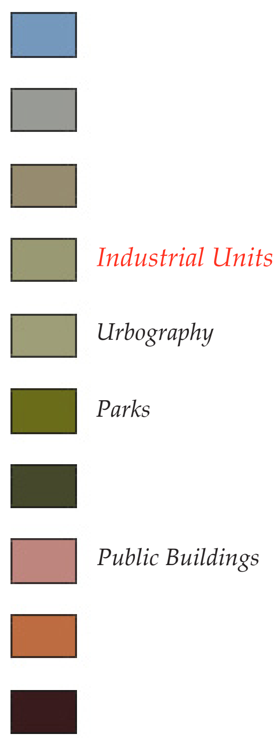


Figure 4.35 Factory with vertically mobile storage units, accessible from mezzanine as well as floor level

Figure 4.36 Industrial units in context



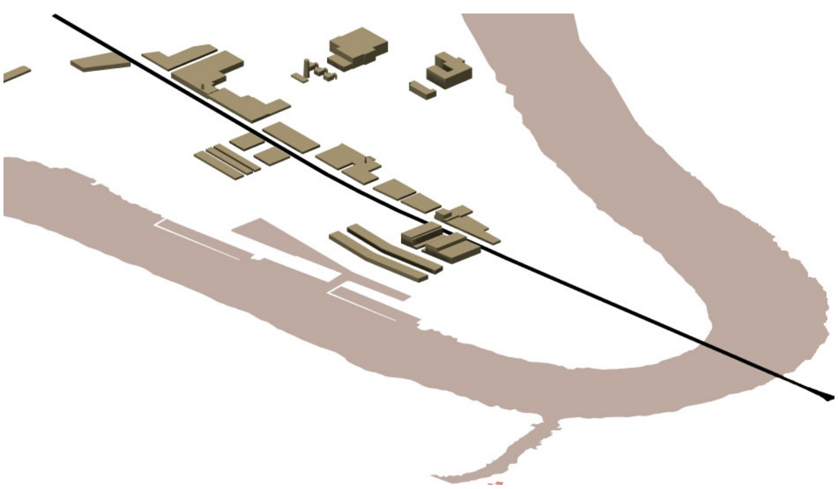


Figure 4.37 Industrial indicator

While some types of industry benefit from large tracts of cheaper land available in sparsely serviced, peripheral areas, other types are compatible with urban situations. Light industrial uses can operate in facilities accommodating units ranging in size from 330 to 500 square metres, arranged in clusters or groups. The Angus Locoshop located in Montreal provides an example of a large industrial site that has been adapted to accommodate small scale users, referred to as an incubator industrial facility. It provides space for industrial businesses in the early stages of development that do not have large space requirements. Many of these types, such as auto service, welding and fabricating shops, would benefit from proximity to walk-in trade, available within more populated areas.

The tendency toward small industry in Point Douglas can be used to advantage by accommodating it within the zero level, where the landscaped foundation of the city blocks can be occupied. Some aspects of the industrial sector have a greater tolerance for the effects of flooding than the residential or retail sectors due to the nature of their products and the greater resilience of their enclosures. Despite this greater tolerance for floods, there are several modifications that can be made to increase the flood resistance of industrial businesses.

City guidelines requiring that services shut-offs be located above flood levels suggests that offices, computer equipment or other delicate equipment should be located there as well. Keeping the lower floor areas clear and supplying electrical services from above are a common practice in factories that need adaptable floor space. Instead of constructing office enclosures on the ground level and leaving open mezzanines, this must be reversed to adapt to flooding.

Another method to accommodate storage in this design is to make adaptable shelves. Rows of shelving units can be packed tightly together and accessed one or two at a time by sliding a selection out. In this case, the sliding is vertical, aided by the mechanics of the chain hoist. This can create a working space below the units or a mezzanine on top of them, depending on the positioning of the units, as shown in Figure 4.35.

The next method is to modify a portion of the floor to float, thereby protecting equipment that may be too cumbersome to move in the event of flooding. A further explanation of the details can be read on page 90.

Figure 4.38

Angus Locoshop adapts inner city industrial building for use by Incubator industrial tenants

Figure 4.39

The interior of this industrial business shows hydro service from above along with remote controlled chain hoist and flexible connections. The gutter panels prevent debris and feet from falling in.

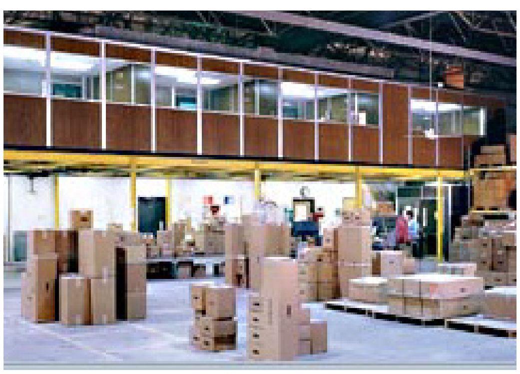


Figure 4.40

This industrial unit has commonly seen office/mezzanine configuration. Usually, the offices are located on the ground level but the configuration in this case is the best one for a flood prone site.

Figure 4.41

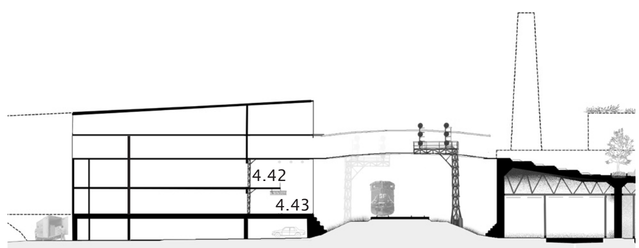
This another example of a mezzanine, common for storage space. This also displays the open floor area required in shipping and assembly areas.

4.9 Commercial

The commercial component of the design includes retail outlets and office spaces and is the main inducement for people to inhabit the flood protected level at the core. Within the urban blocks, commercial uses are contained in the layer between the industrial zone, and the high density residential zone.

Retail commercial areas are featured prominently along streets, surrounding squares, or bordering dense residential areas. Commercial office spaces, with smaller floor areas, are located above retail areas or above the factories concentrated near the railway.

A retail mall is designed on Higgins Avenue, inside-out, with corridors of full height windows to be easily viewed by traffic on Higgins Avenue. This increases the exposure of retail business to customers passing through from outside the area. The windowed perimeter hallway continues to the north face, where the railway is adopted as a central feature within the mall (Fig. 4.43). The shops hug the interior walls around a courtyard street that allows for service vehicles to access the shops from behind. The upper levels of the mall house offices that are oriented to take advantage of sunlight from the south side. Public access to the mall is achieved from pedestrian bridges on the north, south and east sides as well as from the ground level on Higgins Avenue. Individual commercial units are also located on the residential side of Sutherland Avenue, anchoring the ends of the residential streets. Additional retail-commercial space, for seasonal use, is to be located in small buildings near the park on the south shore.



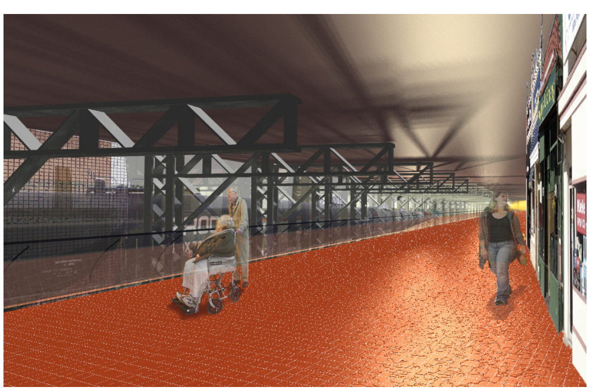


Figure 4.42 Upper tier view of inside-out mall

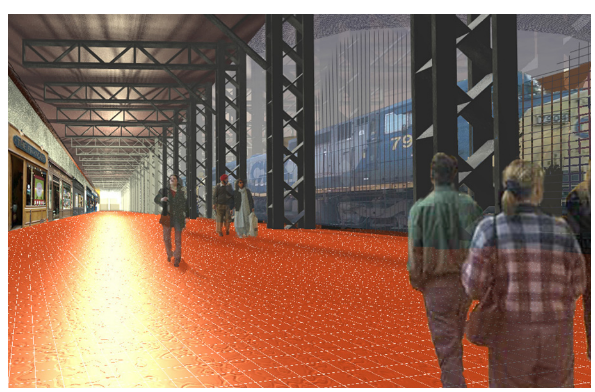
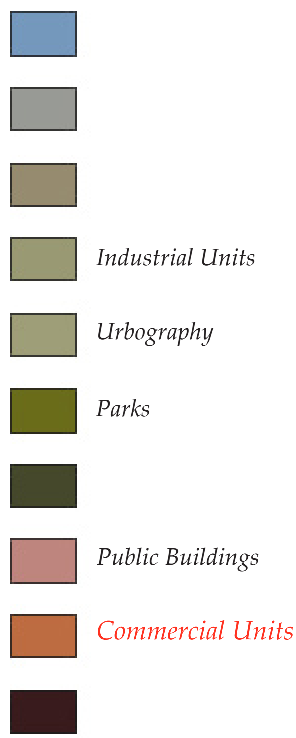


Figure 4.43 Lower tier view of inside-out mall

Figure 4.44 Commercial units in context

Figure 4.45 Commercial indicator



4.10 Multi-Residential

Multi-unit residential apartments are planned for several locations to increase the overall density of the area. This improves the customer base for the retailers in the area and increases the number of single-level residential units, which are not plentiful in the multi-level residential areas designated along the shoreline.

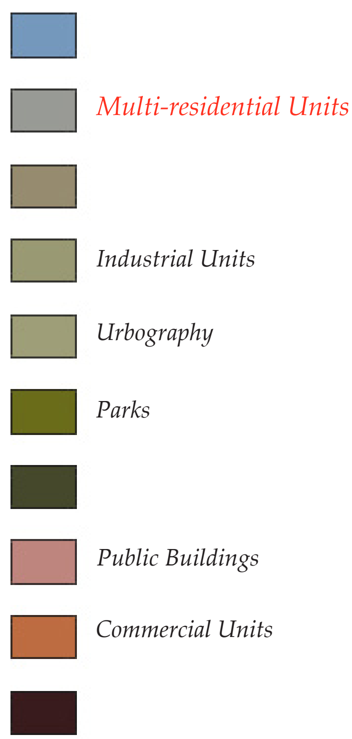
Within the urban blocks at the core, multi-unit apartment complexes occupy the levels above commercial spaces, with views to the courtyards and public areas below. These buildings are terraced to provide exterior gardens for each unit (Fig. 4.46). Atria are created between buildings at the courtyard levels to permit the continuous use of communal areas through the winter months or to function as indoor malls. The intent is to increase access to green space within the highly built up core.

Multi-unit residential apartments north of the railway, components of the urban blocks, face towards Sutherland Avenue and the courtyards within the blocks. On the south side of the railway, connecting to the mall via a pedestrian bridge, there is a single-use, multi-unit residential building, designed with a visual connection to the riverside park and seasonal Ice-wall.

A long, south-facing apartment complex is located on the tip of the point, facing south to maximise heat gain through the southern exposure, providing sunlight for two atria that break the building into three, and facilitating views of the trains and activity on the point from communal sun-rooms. This building also houses two pedestrian tunnels at the base of each atrium. These connect residents on the south shore directly to the school and library located on the north side of the tracks. The height of the apartment building is eleven stories above the flood level, the second tallest building on the site.

Figure 4.46 Landscaping effect, planned by stepping the apartments on the south, west and east sides.

Figure 4.47 Multi-residential units in context



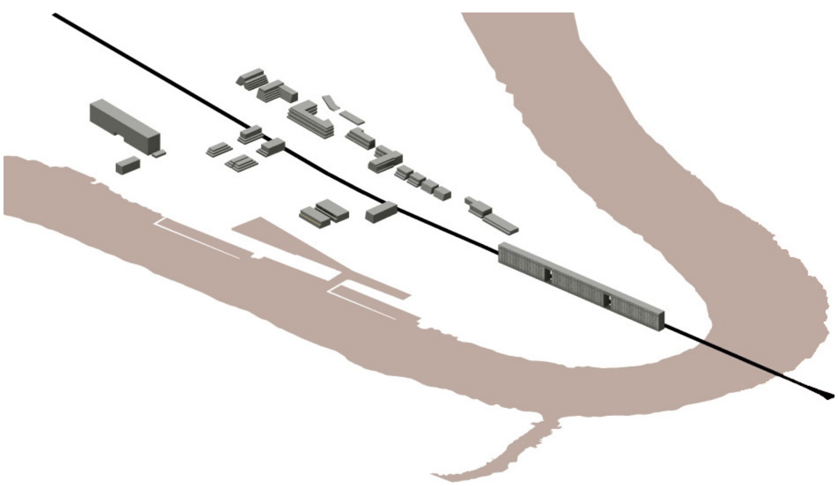


Figure 4.48 Multi-residential unit indicator

4.11 Residential Design

Within Point Douglas, several flood protection techniques are to be employed in areas comprising town house type buildings. This basic type is to be adapted for the flood plain using techniques of elevating on stilts or hills or by floating them completely or in part. The resulting communities offer the greatest opportunity for people to experience a sustainable lifestyle on a flood plain without the trauma of typical flooding events. The lower density housing in these residential areas is in direct contact with ground level and, unlike many of the industrial buildings, is designed to be inhabited during flood events. The objective is to achieve a balance between a tolerable inconvenience from transportation interruptions and work stoppage and the more catastrophic impact of flooding in conventional residential situations. Other aspects of flooding are left to be experienced during this time. When these buildings are left in the path of flooding, there are several options employed to deal with the consequences. The design proposal offers several methods of permanently or temporarily elevating living units to sustain the urban population during a flood.

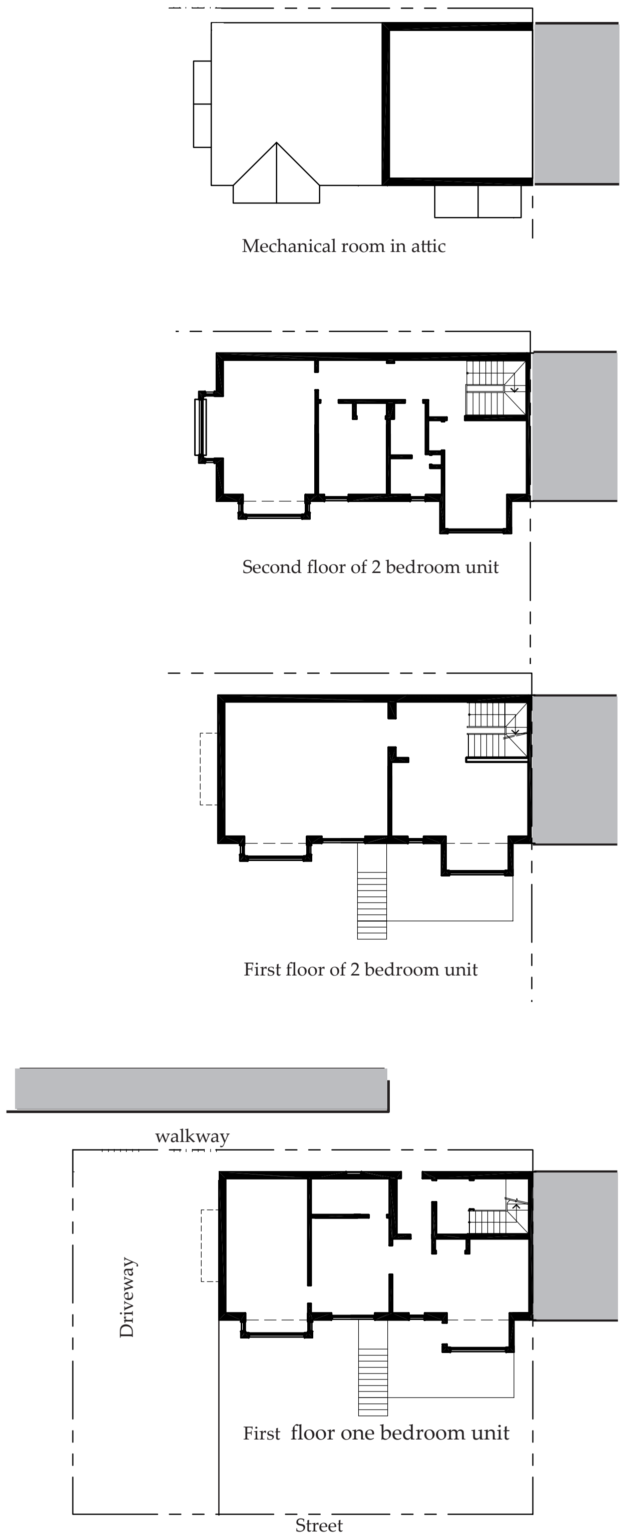


Figure 4.49 Typical floor plan of stacked town house

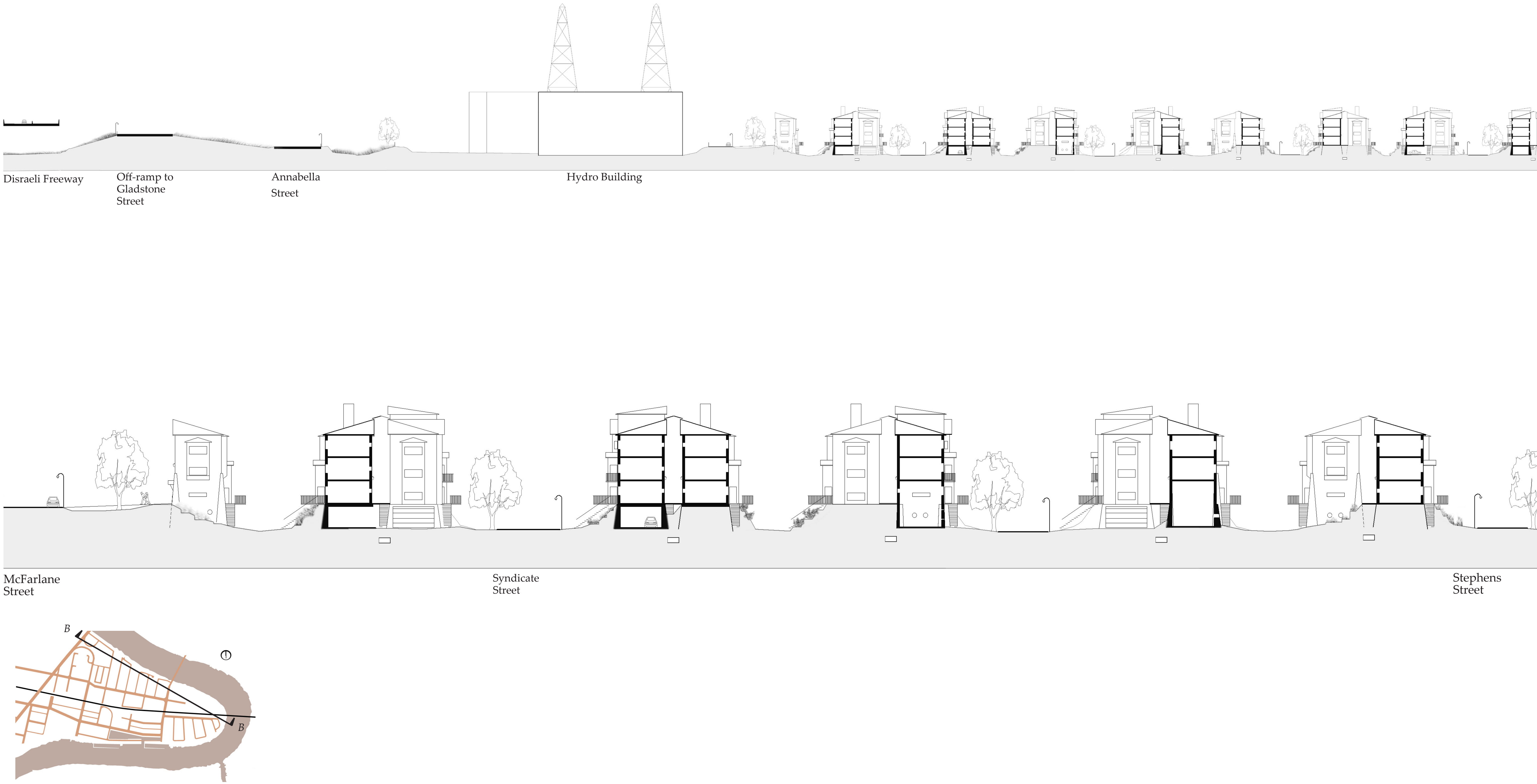
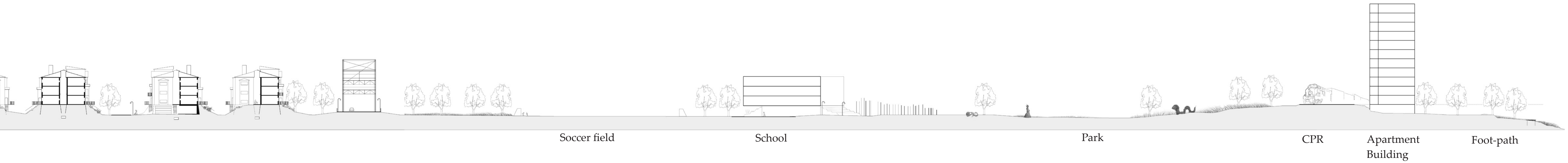
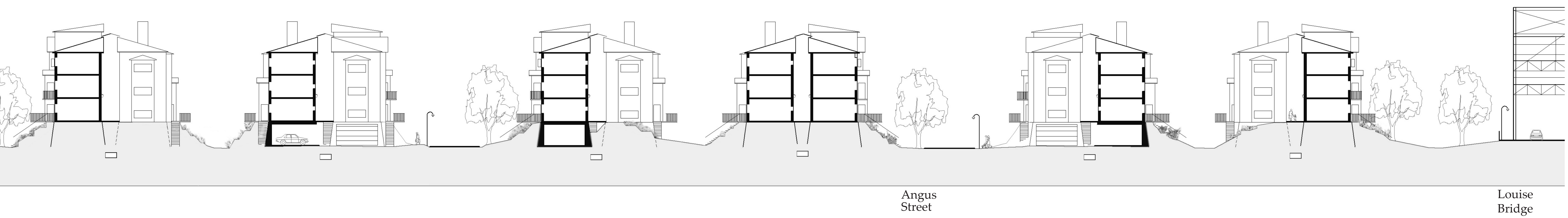


Figure 4.50 Site Section BB through North Shore


Soccer field
School
Park
CPR
Apartment Building
Foot-path


Angus Street
Louise Bridge

4.12 Density

In order to facilitate the design solutions for living with flood events, it is essential to increase the density of the residential population. On the perimeter of the Point Douglas site, residential occupation is to be encouraged via stacked town housing, a model that makes efficient use of land and improves the base for shared infrastructure.

The town houses designed for this proposal are modelled after the East-York-Semi (Fig. 4.51), a housing type common in the East York borough of Toronto and characterised as a deep and narrow, two storey, semi-detached house with a staircase along the party wall. These houses are oriented to light the interior, primarily through the front and rear of the narrow ends, with outdoor spaces reserved to the front and back yards. In the proposal, stacked town houses are linked on their short end, whereas the East York Semis are linked on their long side. The East-York-Semi model is used in the marina area of the proposal, fronting the street and overlooking the shoreline.

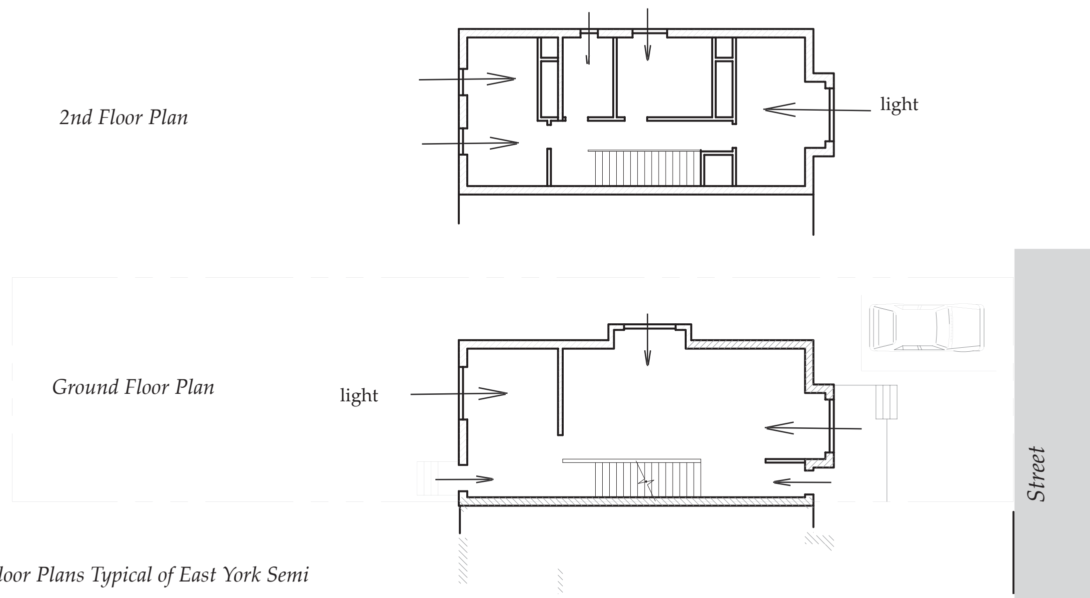


Figure 4.51 Floor Plans Typical of East York Semi

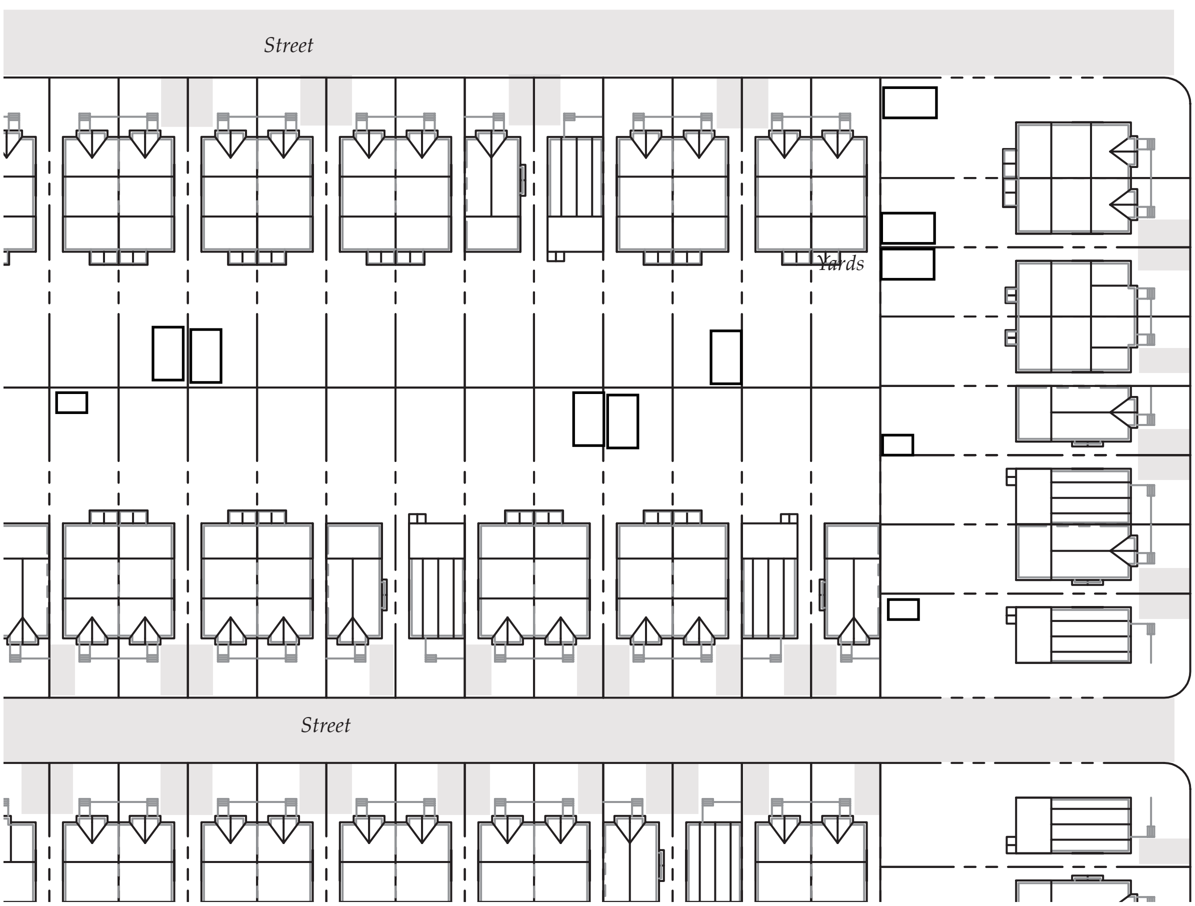


Figure 4.52 Neighbourhood of East York Semi type units.

A primary strategy utilised in the proposal involves linking and stacking units, then turning them ninety degrees, to introduce more light through the long sides; the plan also staggers the buildings (Fig. 4.55) to reduce the effect of a doubled building depth on the site. In this way, a communal walkway above the flood level can be shared and linked to centralised service lines more efficiently. The arrangement is somewhat like the Daal en Berg Duplex houses (Fig. 4.53) designed by Jan Wils in Den Haag, Netherlands, with an improvement in light penetration due to the reduced street front depth of individual units.

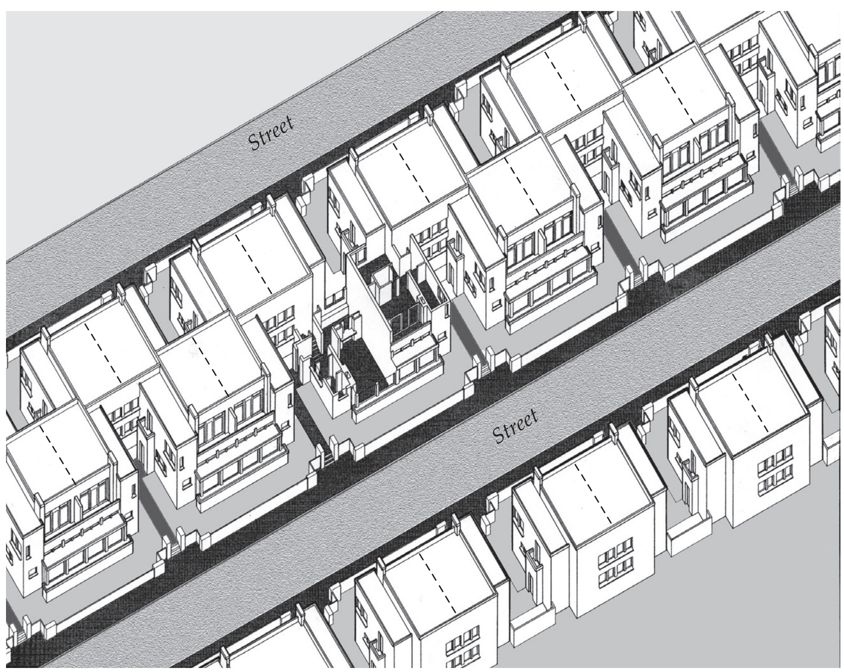


Figure 4.53 Daal en Berg Duplex Houses 1920 by Jan Wils

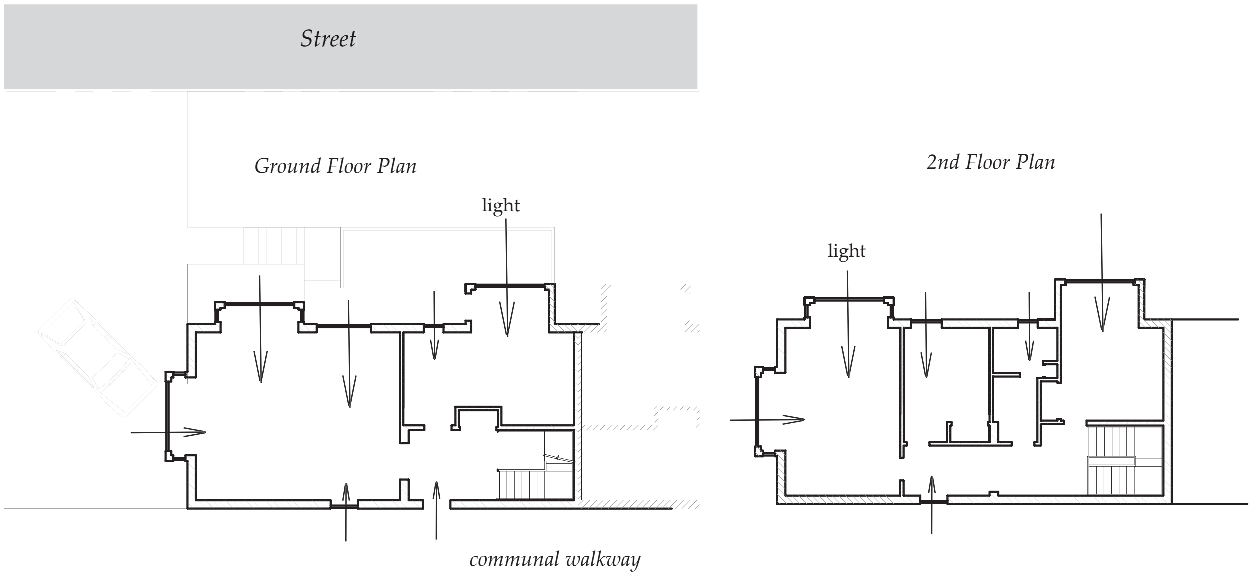


Figure 4.54 Floor Plans of Town house

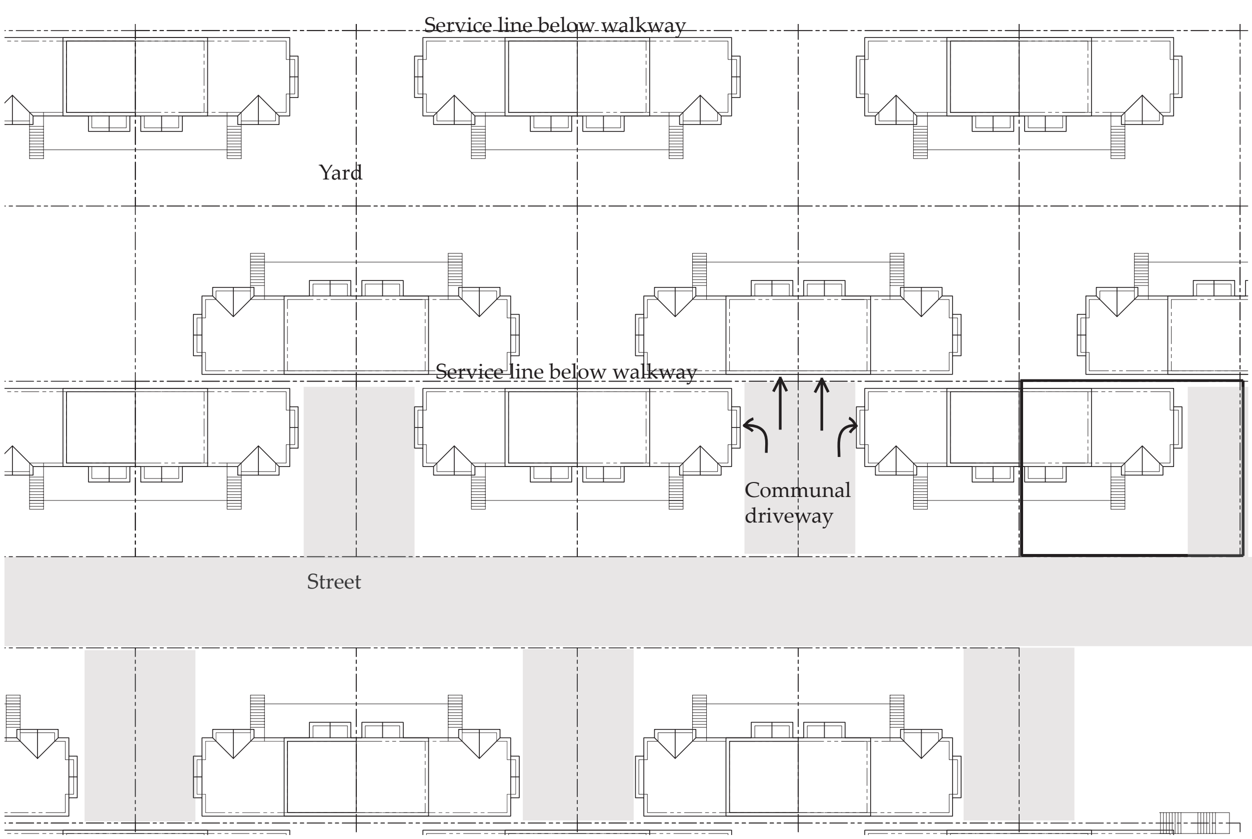


Figure 4.55 Town houses in context where density is maximized to consolidate infrastructure

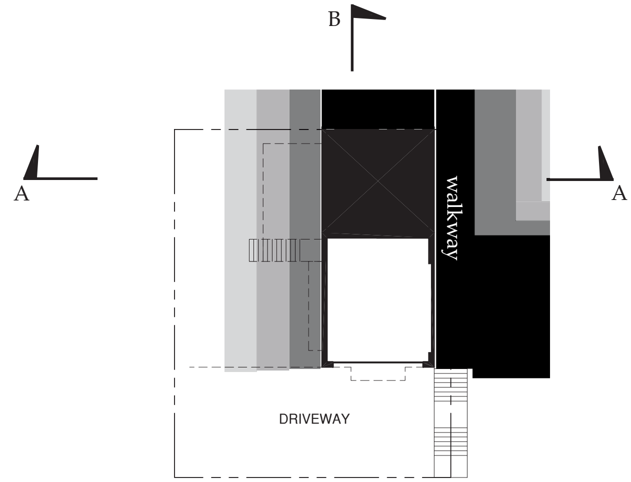


Figure 4.56 Plan view of town house on hill Below flood level

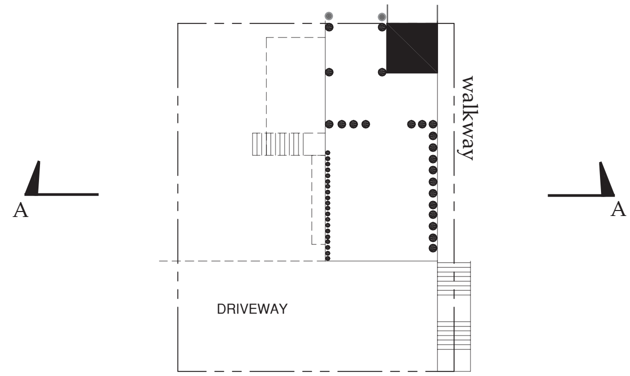


Figure 4.57 Plan view of town house on stilts Below flood level

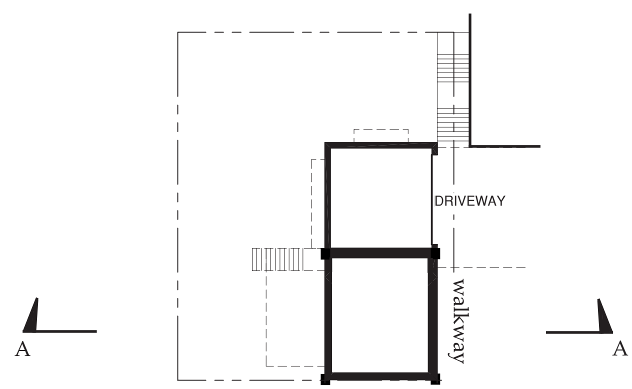


Figure 4.58 Plan view of a floating-floor town house Below flood level

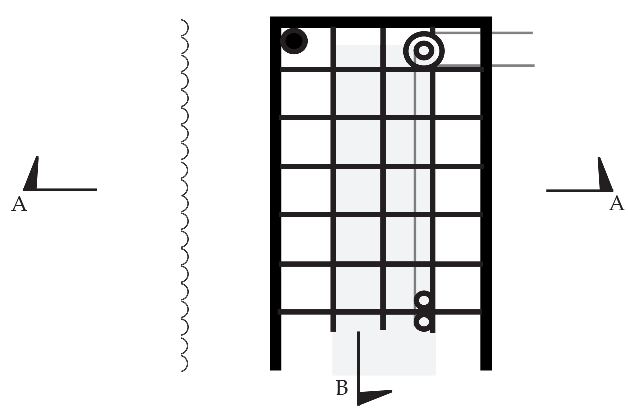
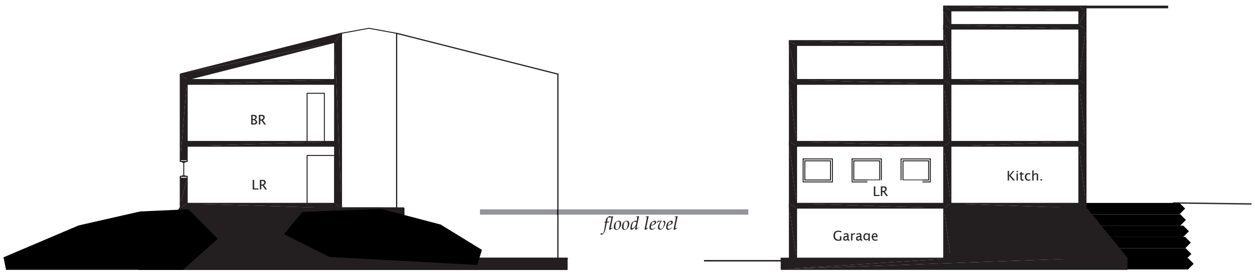
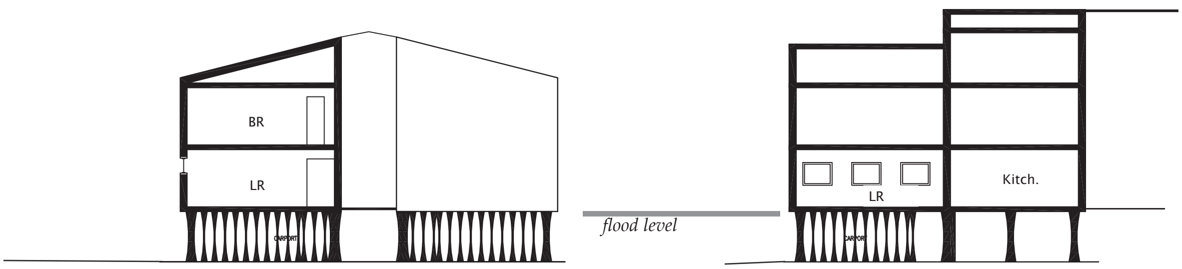


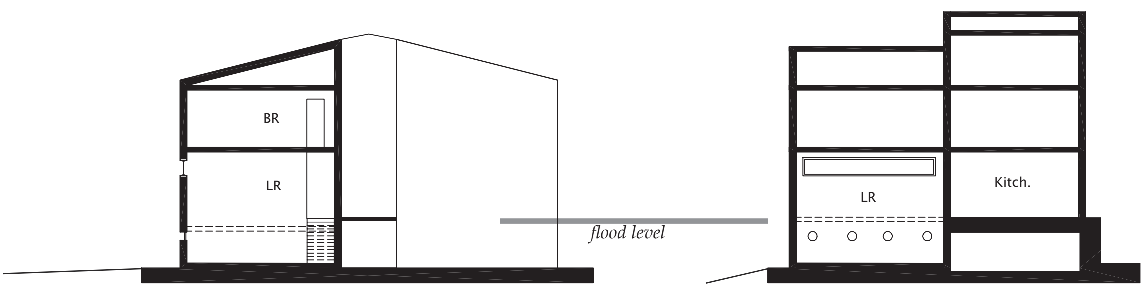
Figure 4.59 Plan view of a floating pier Below water level Building above shown shaded



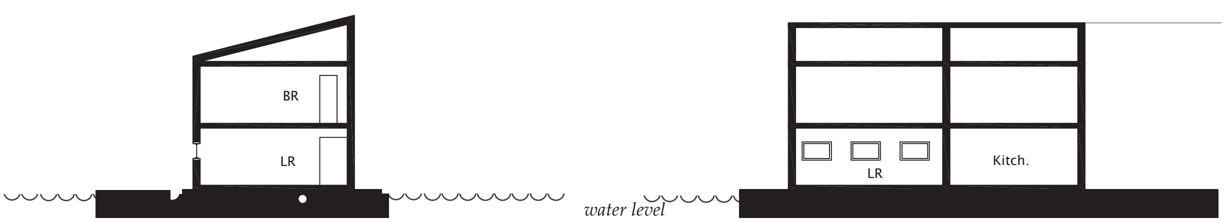
Hill House



Stilt House



Floating -floor House



Floating House

Short sections AA of Various unit types

Long sections BB of Various unit types

Figure 4.60 Various Town House Sections

4.13 Floating Structures

Using the building design to address the problem of flooding is the most direct approach to the hazard and is most often the choice of individuals for long term relief. One of the most recent developments is the floating house (Fig. 4.64). This type of inhabitation is different from a houseboat because, to be considered a permanent structure, it must have fixed service connections. Maasbommel in Holland has a recently designed community, by Factor Architecten, shown in Figure 4.66. These houses are built with hollow, concrete foundations that float with the water level. The method utilises flexible service connections that allow electrical and plumbing services to continue uninterrupted while the buildings rise with the water level. This technique could be utilized in the Winnipeg community with the provision of heated service connections to prevent freezing during the winter.

The thesis proposal adopts this approach in the marina created on the south shore. In this case the housing density is increased to conform to a more urban situation by consolidating houses on floating piers. These share services that connect the multi-unit structure at a single point to city services from the shoreline.

The concept of using floating structures to accommodate flooding enables land beyond the infrastructural framework of the core to be inhabited without incurring the catastrophe that would strike conventional homes. Additional benefits of this technique include increasing the utility of urban land, sharing the cost of infrastructure, as well as allowing members of the population to remain in touch with the surface and the unique experience of living in the flood plain environment. With the experience accepted as a more normal occurrence there will be less need to alter the environment in the way that has been done in the area of Winnipeg. The following is an account by a resident of a floating home in Maasbommel.

Anna van der Molen, 45, who lives with her husband and child in one of the houses, said “not only do we live on water, but we also live with water.” The houses sit on concrete pontoons that rest on footings projected slightly above the river bottom at low water periods, but ride up during floods along a pair of 15-foot poles. Their low centre of gravity, created by the weight of the pontoons, makes them very stable. Still, Ms. van der Molen said, “Sometimes it is scary, very scary, when the water is coming up.” [2]

Figure 4.61 Marina canal

Figure 4.62 Floating structures in context

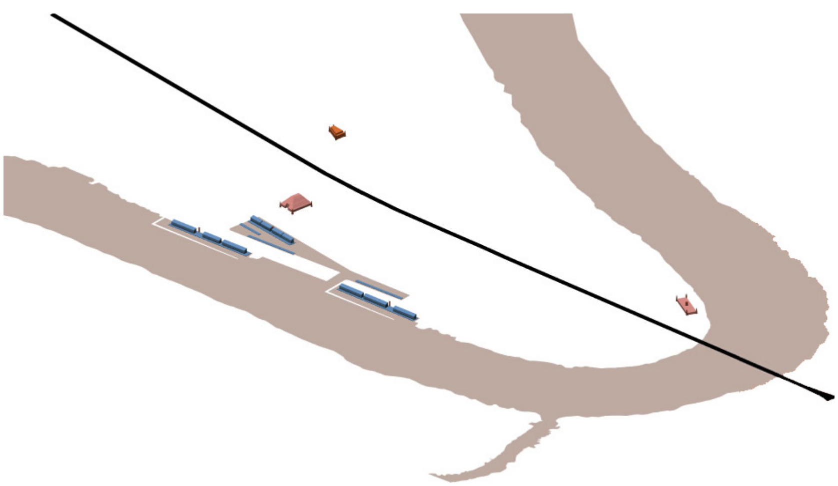
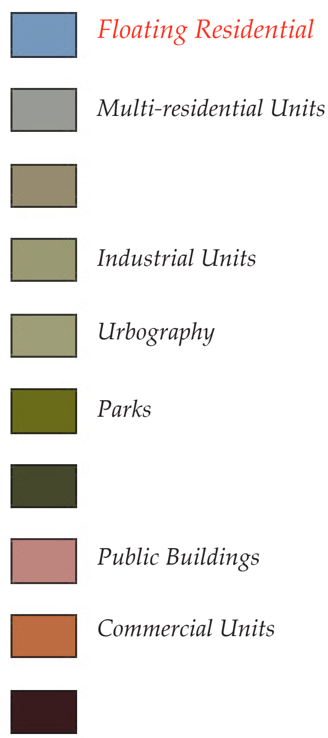


Figure 4.63 Floating structures indicator



The technology required to support a floating structure is derived from the Phoenix caissons of WW II. These concrete structures (Fig. 4.65) were submersible shipping piers the Allies placed in the Atlantic Ocean off the coast of Arromanche, France, which was occupied by the Germans at the time. They temporarily supported the heavy truck traffic required to off-load supplies and troops from ships to the shore.

The Dutch used similar technology on a smaller scale in designing the floating community at Maasbommel (Fig. 4.66). In order to make this technique feasible, they also developed flexible service connections to meet the building code for permanent structures.

The piers of town houses (Fig. 4.69 and 4.70) in the Point Douglas marina are a combination of both techniques. In this case the entire pier is loaded with housing, guided during water level changes by piles in the riverbed, and protected from ice-flow damage by a break-wall upstream. People can thereby coexist with flood conditions with minimal disruptions to their livelihood or to the environment.

Figure 4.64 Floating house designed by Gene Morris

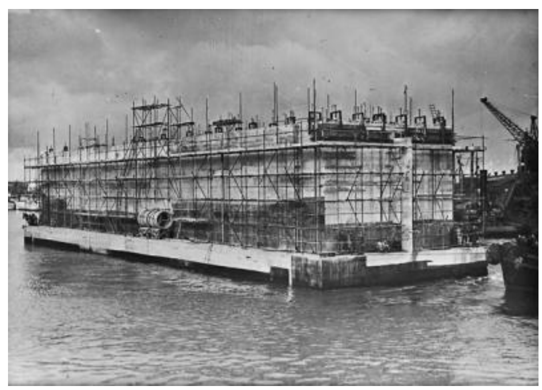


Figure 4.65 Phoenix Caisson, WW II Atlantic Ocean floating, concrete pier under construction

Figure 4.66 Floating houses of Maasbommel

Figure 4.67 Ijburg Theatre, Amsterdam A floating building

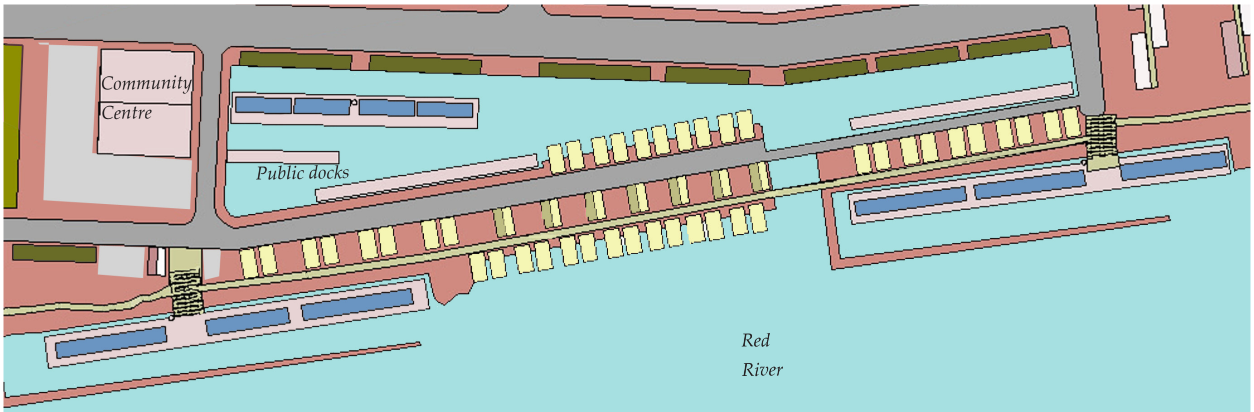


Figure 4.68 Site plan of Marina area where East York Semi designs are high lighted in yellow along the shoreline

Floating piers of housing *East York Semi design* *Stilt town houses*

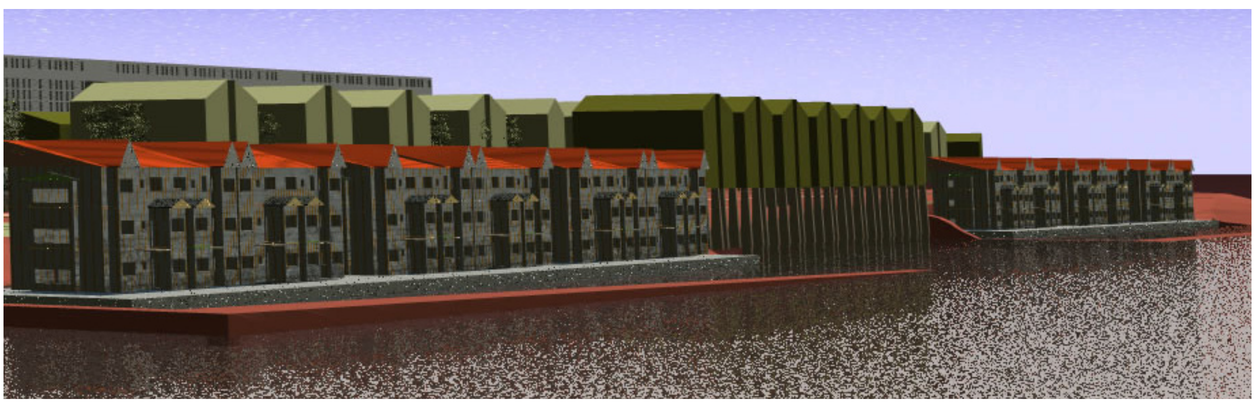


Figure 4.69 Floating piers of Town houses

Figure 4.70 Floating piers in flood

4.14 Floating Floors

The floating method of coping with flood conditions could be used on a smaller scale as well by isolating the technique to a single floor area, making the idea even more economical and less energy intensive than floating the whole building. A space left open at ground level for flood proofing invites inhabitation in some form. Rather than leaving these spaces empty, where they are likely to accumulate debris, they can be inhabited by incorporating a floating floor. Interior rooms that do not require extensive water and sewage connections are the most appropriate for this type of construction, resulting in an interior space with a cathedral ceiling. This partial floatation strategy allows undisrupted inhabitation during flooding events while retaining a connection with the environment via the experience of rising water levels. With a only a portion of the structure floating, most of the expense required to supply flexible services in a floating building is eliminated. Protective measures are confined to the area that needs it rather than to the whole structure. The strategy can be adapted to larger buildings with bigger floor areas such as retail and commercial spaces. The floating, concrete raft is strong enough to support machinery and equipment needed for industrial occupations. Maintaining a sense of balanced floor loads is the main concession inhabitants would need to live in this flood environment.

Figure 4.71 Living room viewed from upper level

Figure 4.72 Living room afloat during full flood

Figure 4.73 Floating floor structures in context

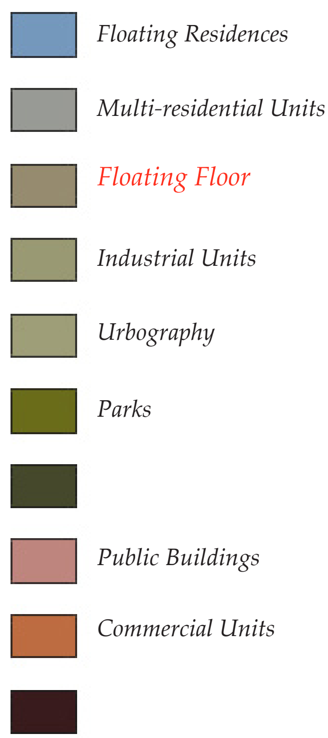


Figure 4.74 Floating floor residence indicator

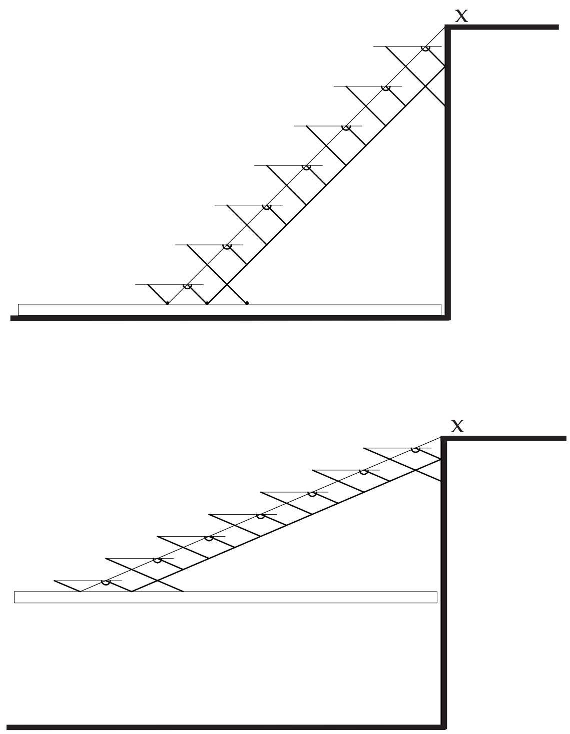


Figure 4.75 Alternate stair design

In this stair configuration, the staircase could be connected at the upper floor level at x.
The foot of the stair would require room to extend during flooding.
Each one metre rise in the flood-level would require a .95 m. horizontal extension of the stair foot.
Railings must be constructed to allow slippage.

Figure 4.76 Adjustable Stair

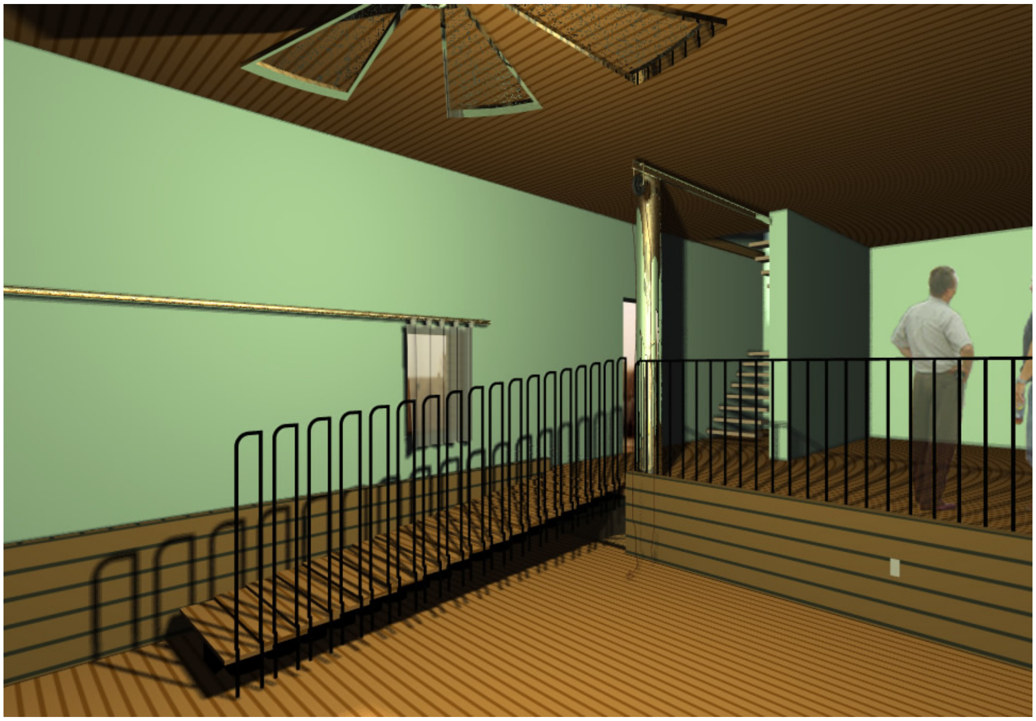


Figure 4.77 Modified Stair during flood

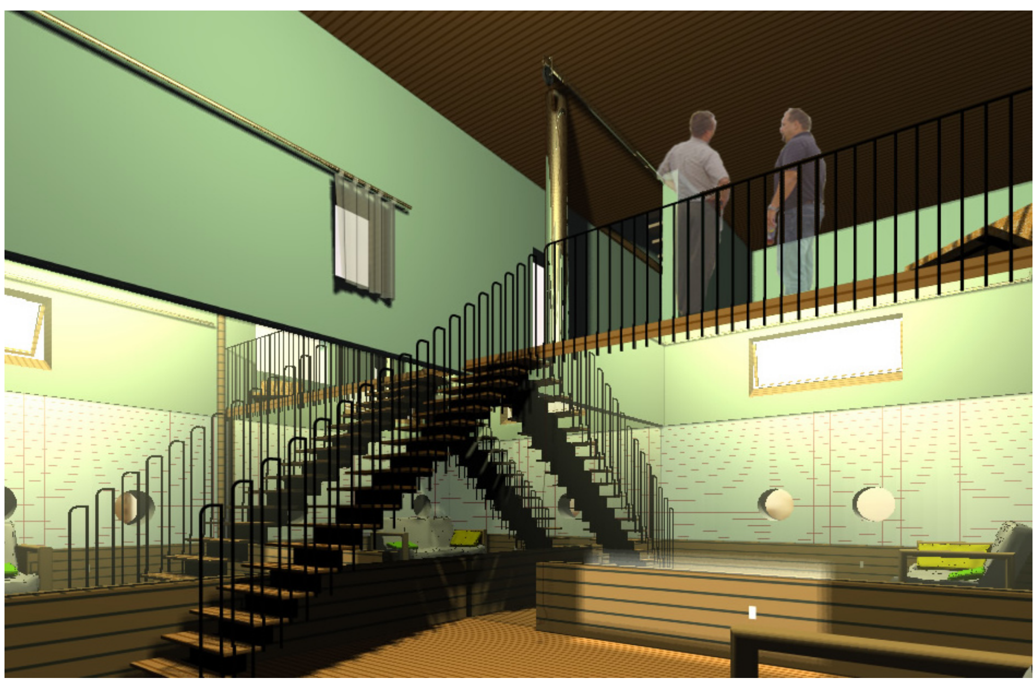


Figure 4.78 View from living room at ground level

4.14.1 Raft Construction

The raft construction for residential and commercial inhabitation requires a filtered water inlet at the base of the wall on one side and a clean-out on the lower side (Fig. 4.81) for reducing mud infiltration. Water drainage across the sloping sub-floor can be enhanced with pressure washing from the upper side if necessary. Floor drains are not feasible under residential rafts because of the difficulty in keeping p-traps full. The residential raft can incorporate electrical service at conventional floor level outlets by supplying knee-walls on the perimeter with flexible attachment points. These knee-walls are supplied with removable caps to fill the void between wall and knee-wall in order to prevent the accumulation of debris in the gap and binding during movement. Due to the increased height required to accommodate a rising floor level plus furnishings, the amphibious level below is kept open to the level above (cathedral ceiling style). In order to make the raft constantly habitable, access is gained from the upper level via stairs. These must be adjustable to a full range of flood levels (Fig. 4.77 and 4.78). All wall openings within the flood level are designed to operate outward.

live load = 50 psf.
=2.4 kPa
=2.44 N/m^2
=240 kg/m^3

2400 kg/m^3

600 Kg/m^2 concrete structure
240 Kg/m^2 live load
840 Kg/m^2 total

Water = 1000 Kg/m^2
require 840 mm air under slab for support

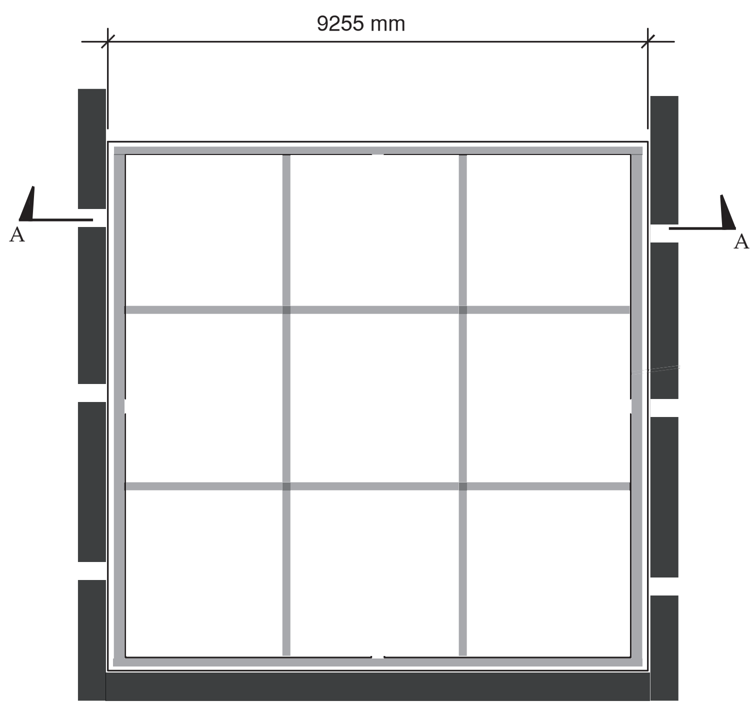


Figure 4.79 Residential Raft Plan Construction

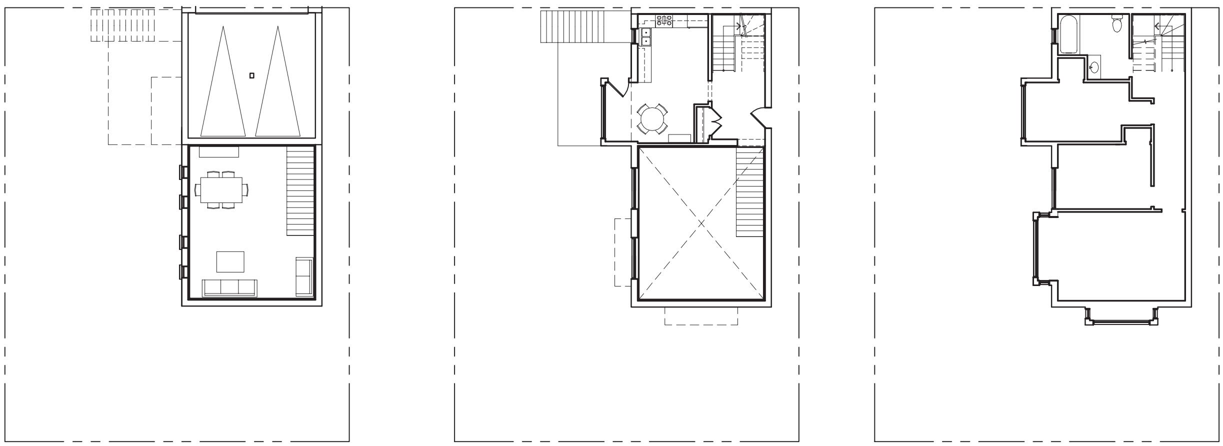


Figure 4.80 Typical floor plans of a 3 bedroom floating floor unit.

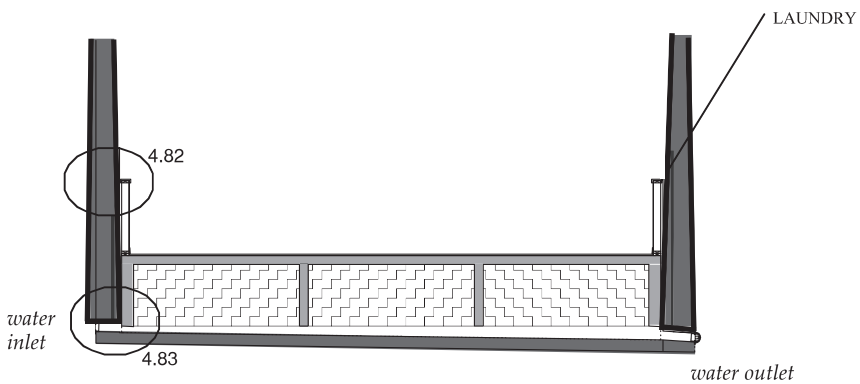


Figure 4.81 Section AA

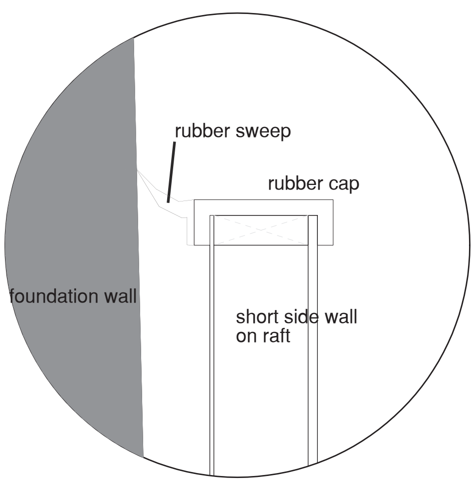


Figure 4.82 Baseboard detail

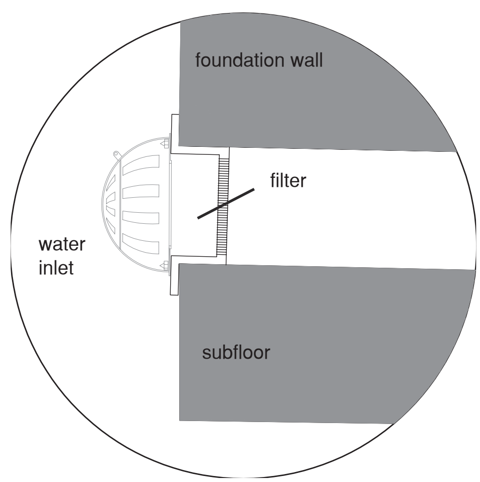
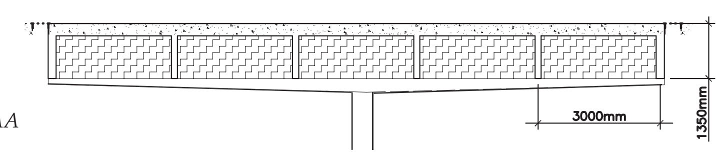


Figure 4.83 Drain detail

The industrial use raft construction differs from that of the residential raft in several ways, because is it does not occupy the whole floor area and is not intended for use during floods. The objective is to protect materials, machinery and tools from flooding until flood waters subside. Electrical services are delivered from above, as is the convention in many industrial situations, and incorporate shut-offs from above flood levels in compliance with building code regulations. Access to the raft is gained from the ground level, and mezzanine stairs are fixed in place, never connected to the raft. Stairs do not need to be used during a flood, although this is achievable using either method diagrammed on page 88. The raft is only required to cover an area large enough to contain the materials or machinery in question. The raft is guided by columns at the corners, while open spaces around the edges are to be capped by removable, metal floor plates (Fig. 4.39). These floor openings aid in clean-out after a flood event with the use of power hosing. The sub-floor is sloped under the industrial raft with drainage into central catch basins, which collect water and mud like storm sewers in the streets.

Raft Section AA



Raft Section BB

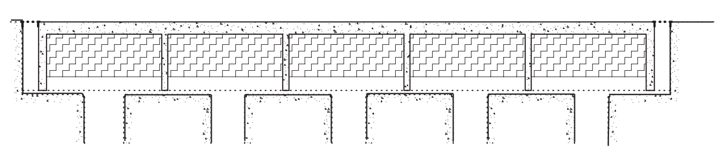
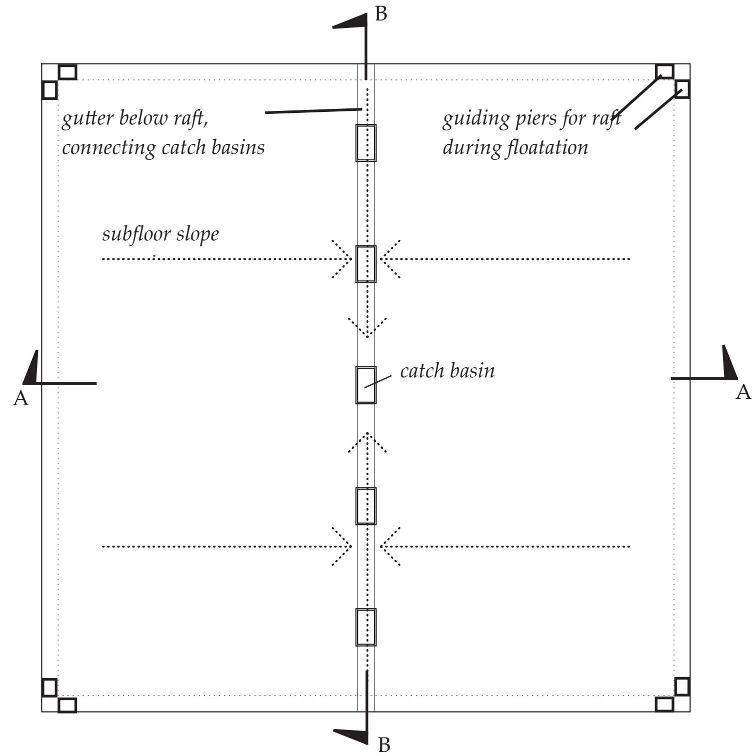
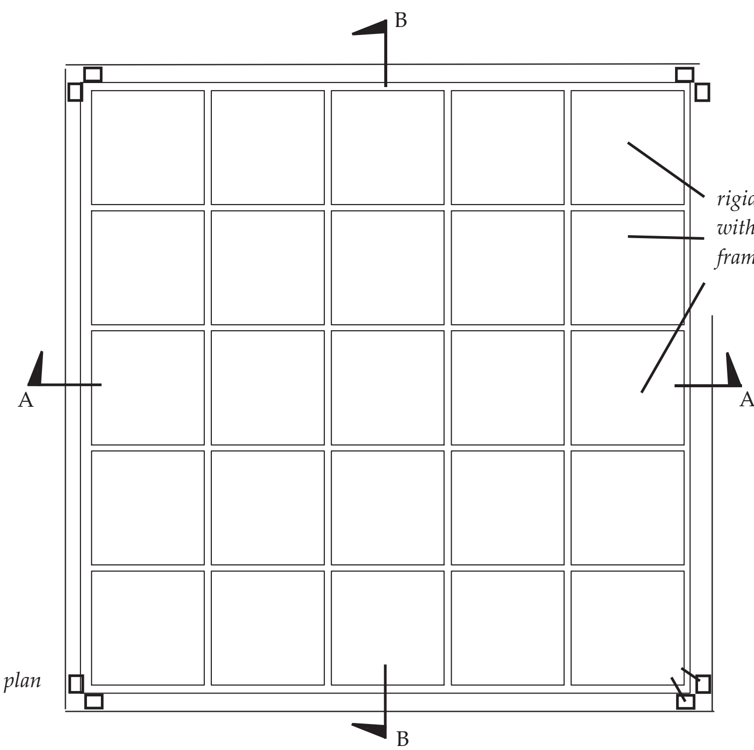


Figure 4.84 Industrial Raft Construction Sections



Subfloor plan



Floating floor framework plan

Figure 4.85 Industrial Raft Construction Plans

4.15 Hill Community

In the flood plains of Manitoba it is common to elevate houses on hills where at least a portion of the building remains connected at ground level to protect and supply services during intense freeze conditions. This approach can be modified to work in an urban design scheme but with a reduction in the amount of fill required per unit by leaving part of the underlying area open to flooding. By increasing the residential density, the volume of fill can be further reduced through sharing the services. Constructing the base of the houses in the same way as terraced landscaping can reduce the amount of fill even more because the foundation walls have taken that role.

The proposal for Point Douglas includes a hill community, which occupies an area of linear mounds on the north shore of the site. This creates a corrugated effect on the topography, minus portions taken out for garages, and forms the service base for this housing type. Within this base, electrical, water and sewage services are supplied, connecting double rows of town houses on each side of every street. Along the surface of each hill, the residences on each side of the street are connected by walkways above the flood level. These walkways reach a terminus at Sutherland Avenue where commercial units and the urbography negotiate the grade change to street level. Each residential unit in the hill community is designed to access either a back yard or a front yard, with garages in between. The community is oriented to provide connections to services and amenities in the core and to the river. When floods arrive, the river-lot street pattern provides an efficient transportation connection between the river and the city core, easily adapted to the amphibious lifestyle.

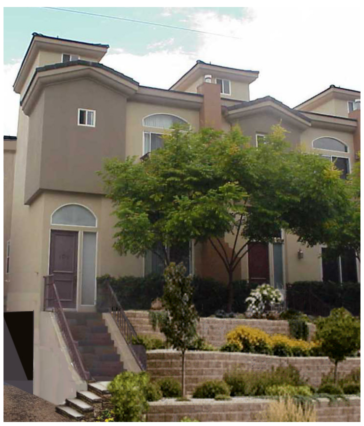


Figure 4.86 Hill houses

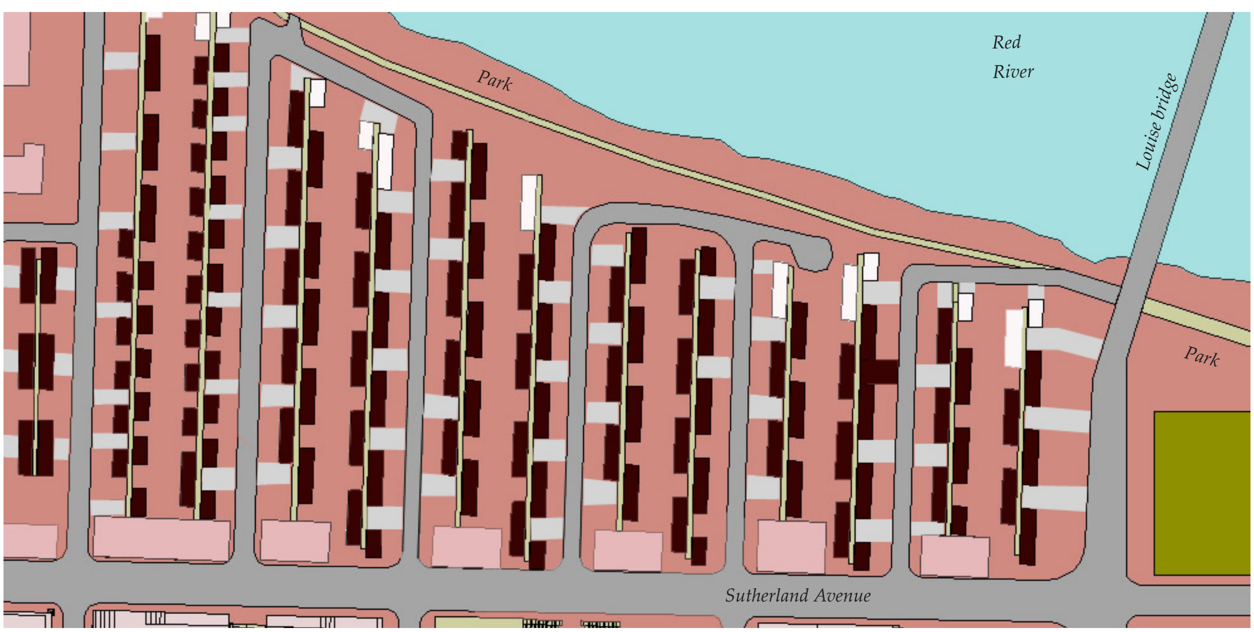


Figure 4.87 Hill community site plan

Figure 4.88 Hill Residences in context

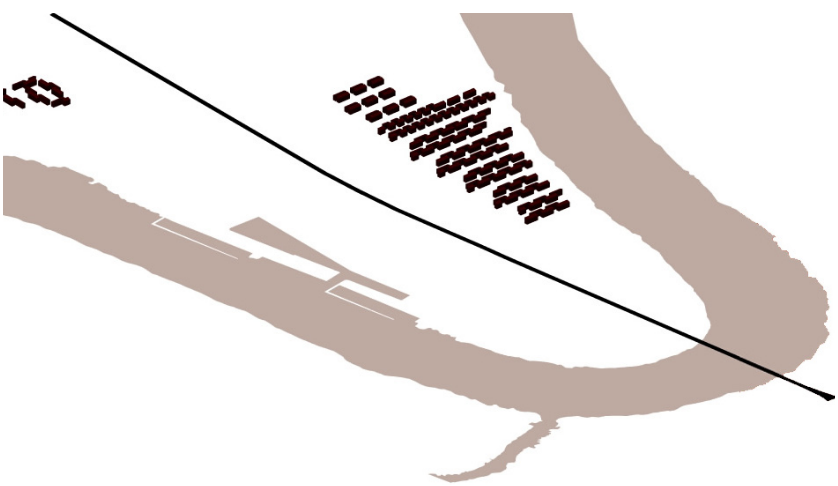
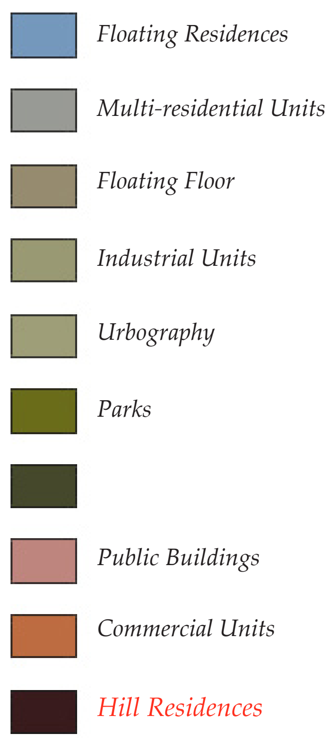


Figure 4.89 Hill residence indicator



4.16 Stilt Community

The main method of construction used to deal with flood conditions in warmer countries involves elevating buildings above flood levels on piles. Houston, Texas (Fig. 4.93), and houses in Florida's Everglades are examples of this method. Garages are often incorporated into the empty spaces underneath, and cars can be moved to safety when flooding becomes an issue.

The proposal for Point Douglas includes a community of homes on stilts, occupying the south side of the Point Douglas tip, where many nineteenth century homes are presently located. The stilt community is built in the form of town houses similar to the ones in the hill community, raised on stilts to the flood protection level, eight metres above the river. In this case, foundation piles are exposed from four metres below the houses to maximise light penetration at the ground plane and maintain versatility in the spaces below the buildings. This arrangement creates a forest of piles with variable diameters. Some are broader to support structure and accommodate services and stairwells, while others are merely designed to screen car ports. The streets here are also arranged to maximize the connection with the river, which is visible from every street or yard (Fig. 4.96).

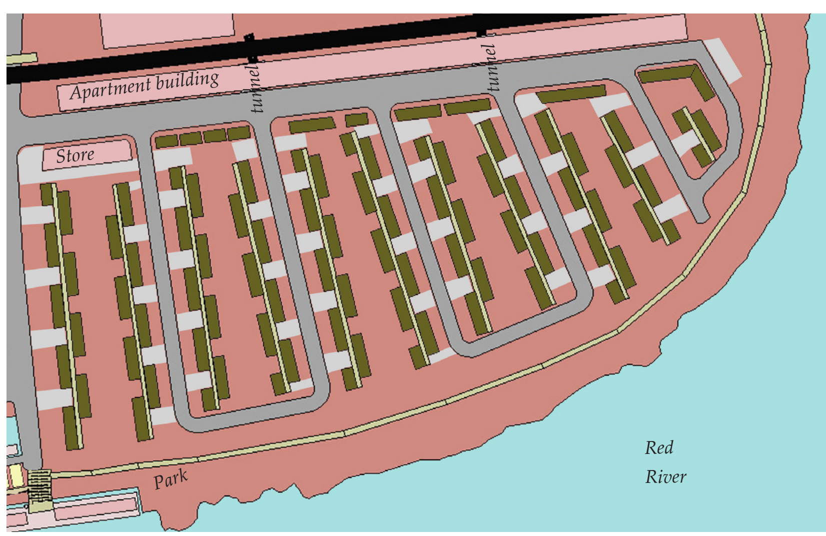


Figure 4.90 Stilt community site plan

Figure 4.91 Stilt Residences in context

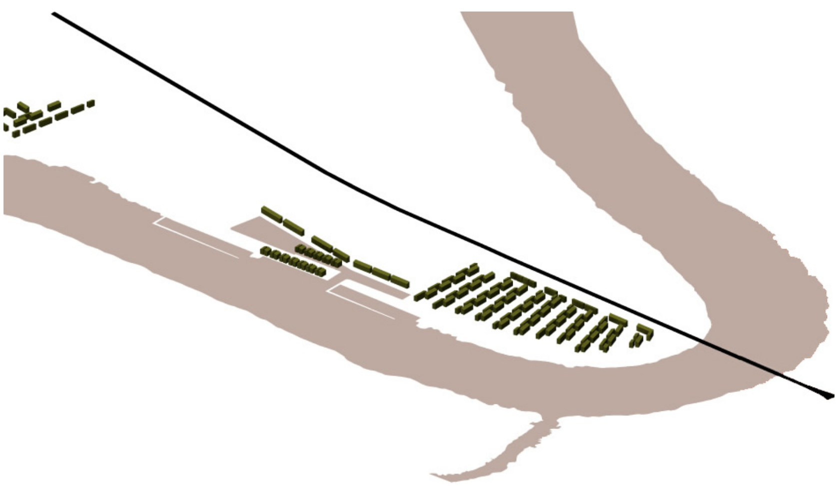


Figure 4.92 Stilt residence indicator

Figure 4.93 Houses on stilts on the outskirts of Houston, Texas, built for hurricane force floods

Figure 4.94 House in France

Figure 4.95 Stilt community with train apartments behind, viewed from riverside park.

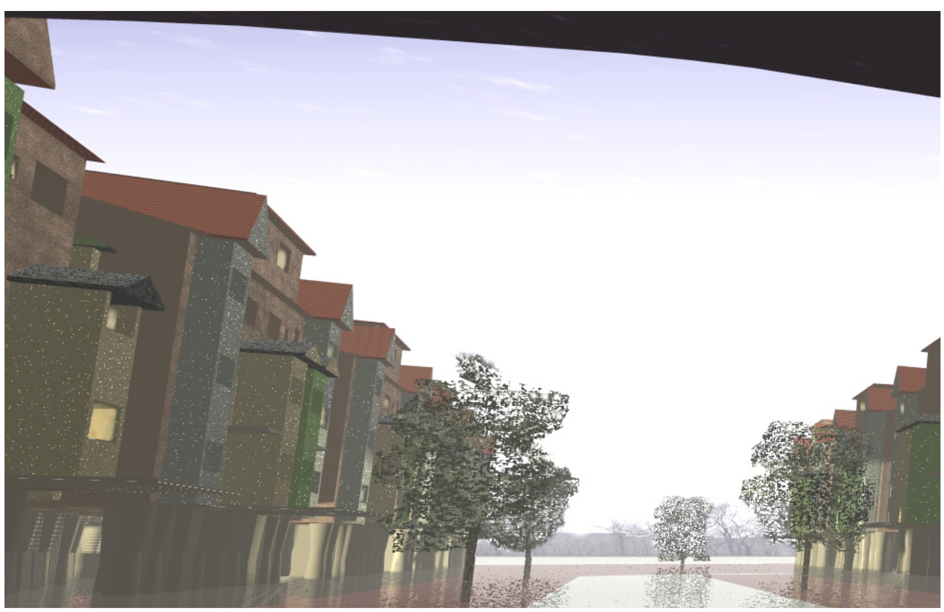


Figure 4.96 Stilt community and river viewed from under apartment building during flood

End Notes

1. Reyner Banham. *Megastructure: Urban Futures of the Recent Past*. (Thames and Hudson Ltd. 1976), 8.

2. Peter Edidin, "Afloat in the Flood Zone," *New York Times*, 2005.<http://www.mezomorf.com/garden/news-9825.html>(1 November 2005)

Chapter 5
Conclusion

5.1 The Flood Myth

When considering the inhabitation of a flood plain, the inevitable question of why people would do so cannot be avoided. Ultimately, there are no clear answers after more than one hundred years other than habit, tradition and, of course, the investment of human capital in a particular location.

After surviving a flood, many people who are asked why they stay reply that it has always been their home. In the mobile society of today, it would seem easy enough to move elsewhere. When the Red River region was first opened for settlement, the choice to move into the flood zone must surely have been more difficult financially than choosing to move out of it. The motivation may be more than financial.

For the original settlement, the first apparent inducement to inhabit the flood plain was good farm land with ready access to water. River lots along the Red River met these criteria, though extensive portions of this farm land south of Selkirk had a known history of serious flooding. The settlers were informed of this as soon as they arrived; yet they still chose a site near the Forks, sixteen kilometres (ten miles) up river from high ground, as Fig. 5.1 shows.[1]

Perhaps the preexistence of the Fort and a desire to be closer to other people influenced their decision. In fact, the area was inhabited only seasonally[2], and the settlers were brought in with the expectation that they would support the Fort, not the other way around[3]. The traders in the area were actually hostile to the settlement to the point of looting and burning it on several occasions[4]. The attraction of the site persisted, even after a railway line was pushed through the centre of it in 1881.

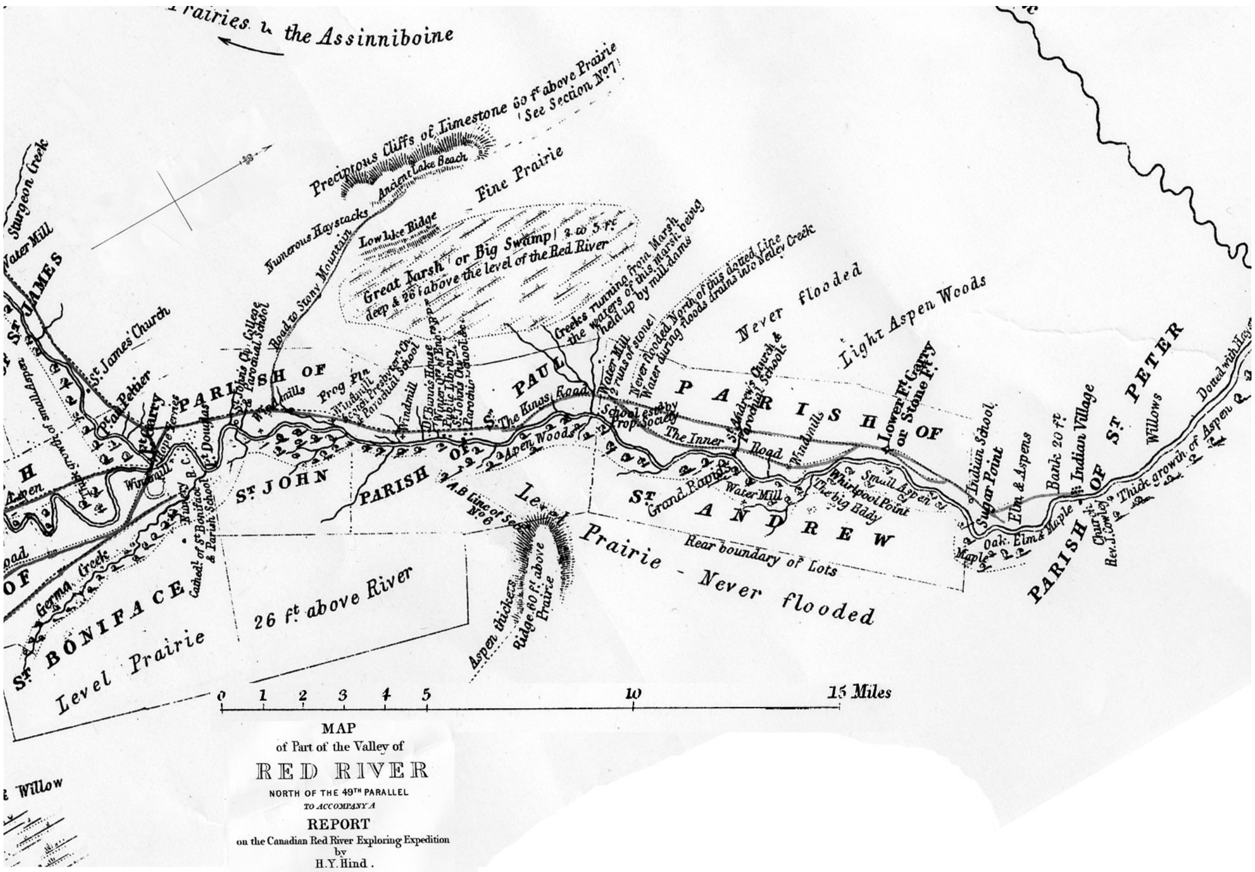


Figure 5.1 1858 Survey of Red River Settlement by H. Y. Hind

In 1905 Point Douglas remained the most densely populated, and wealthiest part of Winnipeg[5] despite the experience of numerous floods and extensive property loss. Later, once flooding became an established fact of life, the first house constructed away from the prime location of the river side was built at Portage and Main, notorious as the muddiest site within the community[6]. It seems that there is some reason, beyond practical considerations, for siting on a flood plain.

Aspects of the originating settlement are reminiscent of a flood myth. In many myths, as well as in the Red River settlement, a select group of people are left in an uninhabited world to recreate a better one after a flood has wiped out the wicked people. Perhaps the settlers may have been attuned unconsciously to re-creating a familiar scenario from the recurrent renewal myth of the flood, seen in many cultures.

There are countless stories from most parts of the world of mythic floods such as those recounted in The Epic of Gilgamesh, Noah's Ark and Atlantis which commonly contain themes of cleansing the earth, particularly of destroying mankind for uncivilised behaviour. Additionally, since the intent in each myth is to destroy the evils of humanity, allowing the physical world to return to normal, it suggests that the catastrophe leaves no trace except on the human mind. A paradigm shift in the way one conceives of the world could be imagined to leave such a strong impression on the mind that the mind uses the tangible nature of flooding as its best metaphor for the enlightenment. The point at which humans become aware of themselves as separate from animals, or when they became aware of their own mortality, could be strong enough to induce such a strong and universal metaphor. In the case of cultures with strong flood myths, there is the possibility that in experiencing the sensation, such as the survival of a flood, the rest of the story is unconsciously implied. The unconscious implication is that one has been spared to rebuild a better world.

While this may give insights into part of the reason a community would initially tolerate the destruction inherent in knowingly occupying a flood zone, an explanation is required for the opposite behaviour in later years as the community chooses to carry on with an intense resistance to flooding.

Figure 5.2 Glass sculpture, The process of transformation

The transformation that comes with change can be difficult, so it is logical to look for ways to circumvent such difficulty, particularly if, while focused on the struggle, one loses perspective of the positive aspects of the transforming part of the experience. In the modern condition, we see a city living in denial of the river. The fertile qualities are no longer important in an industrial society where the river's transformative powers are viewed as a destructive nuisance. The river has been harnessed and re-directed around the perimeter of the city during the transformation into an industrial centre. While technology supplies the means to overcome difficulties the river presents, it inadvertently removes the resolve for change and renewal associated with these difficulties. The site of the original colony at Point Douglas is literally split down the middle with a railway, symbolic of the industrialization that transformed the area from an agrarian one focused on nature to an industrial one focused on commerce. This railway is a negation of community on that site, where the value of commerce is placed above that of amenity. While this brought trade and technology from eastern Canada, it also eliminated the jobs in river transport and reduced the reliance on local trade[7]. It also removed resolve to adapt to local environmental conditions. Within a few years following the introduction of the Canadian Pacific Railway, the region's unique, multi-cultural community was swamped with a largely Protestant, British culture emigrating from Ontario[8]. The new culture focused on recreating a foreign environment, resisting changes the original settlement had come to accept. The river fell in status as the railway took over as the primary mode of transport, and the effects of flooding were less tolerated as the city relied more on industrial activity. The subsequent neglect at Point Douglas is representative of the attempt to ignore or escape the idiosyncrasies of natural forces. The construction of the Flood-way is the ultimate move to deny the force of the river. In the modern ideal, the river would never overflow its banks and people would not be compelled to experience the river at all.

All experiences have some element of transformation about them, and there is no need to accept all the negative aspects. Rather than attempting to eliminate natural forces, we can mediate the effects to the degree that financial costs are balanced with social and environmental benefits.

Figure 5.3 Transforming sculptures

Today humanity, as never before, is split into two apparently irreconcilable halves. The psychological rule says that when an inner situation is not made conscious, it happens outside as fate. This is to say, when the individual remains undivided and does not become conscious of his inner contradictions, the world must perforce act out the conflict and be torn into opposite halves.
Carl Jung (*CW* 9ii: par.126)

In the case of inhabiting the flood plain, it may be that by denying the power of the river or imagining it under control, the risk of greater destruction increases, as the flood of 1997 demonstrated. There was a mere 600 mm. difference between the top of the Floodway and the peak flood-level that year. Meanwhile, the outlying areas are facing uncharacteristic flooding, and the city, if successful at barricading itself from the forces of flood water, effectively inscribes the limit of its growth. The slow growth the city has encountered may be made evident in the physical barrier they have created.

Instead, the population remains static[9] while slowly dispersing to the outskirts of the enclosure (see Fig. 5.4). By stopping the river, they unconsciously stop time, stop change and circumvent fears. While the desire for growth and renewal within the collective unconscious is denied, the city freezes in time. Growth stops and change is superficial. Industrial areas wear out and nothing takes their place. Without the life affirming nature of the river, there is nothing left to hold the population together; so it disperses, leaving a hollow at the centre of the city.

The multitude of flood myths that exist throughout history are the basis for the idea that an unconscious association of renewal and growth with flooding is archetypal in all humanity. For this reason the actual experience of a flood is not necessary to induce an acceptance of the flood and all its implications because the association can already be present in the mind.

The wishes of the inhabitants must be in balance with the natural features of the site in order to sustain a modern community operating on commercial principles. Within this balance, it is possible to preserve the things we love while the transformative powers of nature are experienced safely.

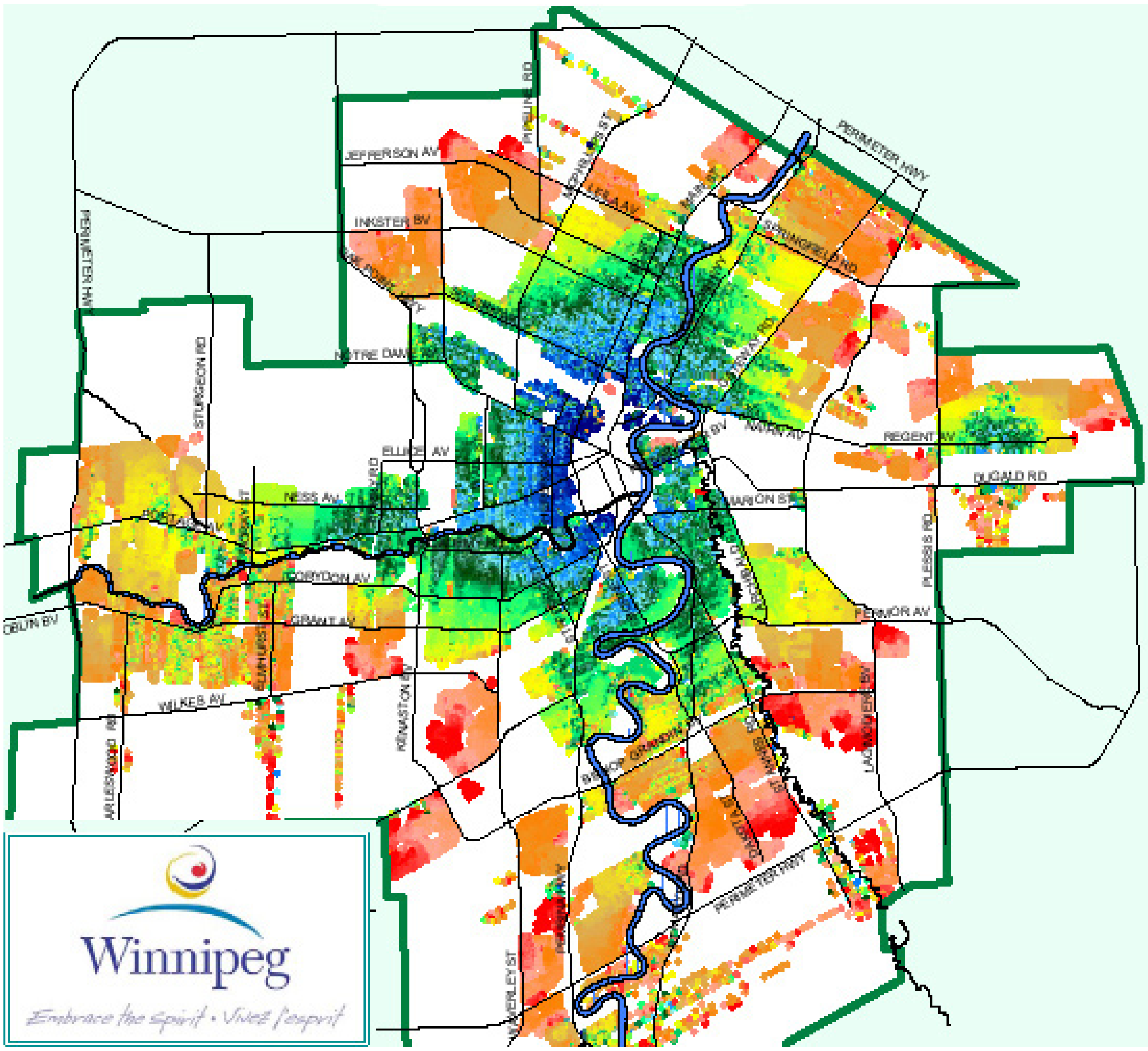


Figure 5.4 Residential Construction Age (some properties excluded)

- 1900
- 1910
- 1920
- 1930
- 1940
- 1950
- 1960
- 1970
- 1980
- 1990
- 2000

Conclusion

End Notes

1. H.Y. Hind, *1858 Survey of Selkirk Settlement*. 1858.
2. Parks Canada, The Forks National Historic Site of Canada, *Land Use in the Precontact Period* <http://www.pc.gc.ca/lhn-nhs/mb/forks/natcul/vocation-landuse_e.asp>(1 November 2005)
3. Parks Canada, The Forks National Historic Site of Canada, *The Competitive Fur Trade Period: 1760-1821* <http://www.pc.gc.ca/lhn-nhs/mb/forks/natcul/period_e.asp)> (1 November 2005).
4. Halkett, John, *Statement Respecting the Earl* etc. (John Murray, 1817). Appendix D-T
5. Anne Matheson Henderson, *From Fort Douglas to the Forks.* Manitoba Historical Society. Transactions Series 3, Number 23, 1966-67 season <http://www.mhs.mb.ca/docs/transactions/3/fortdouglasforks.shtml> (1 November 2005).
6. Anne Matheson Henderson, ibid.
7. Frits Pannekoek. *A Snug Little Flock*. (Watson & Dwyer Publishing Ltd. 1991). 192
8. educationcanada.com. *Manitoba History and People.* <http://educationcanada.com/facts/index.phtml?sid=mb&a=3&lang=eng> (1 March 2006)
9. Winnipeg population growth rate since 1991 is 1% according to Government of Canada, *Annual Labour Market Perspectives 2003.*

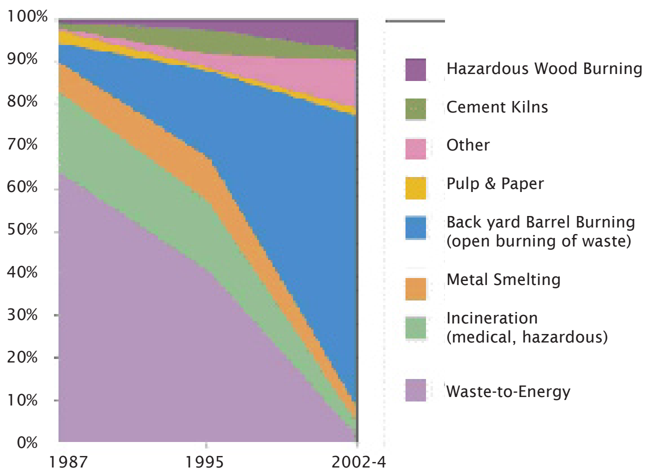
Appendix A

Waste to Energy (WTE) Plants

Modern technology has evolved to the point that Waste to Energy facilities can be located within communities without hazards to the inhabitants. There is a facility existing on an American college campus, where most people do not even know it is there. Negative pressure within the plant ensures that odours do not escape into the community. The ash waste from the facility is cleaned and shipped to a municipal waste site where it takes a fraction of the space of regular garbage. Emissions are constantly monitored and regulated to ensure that the cleaning devices are maintained.

The energy that is produced by these WTE facilities is often in the form of electrical power that can be used or sold. However, where electrical supplies are plentiful and there is a sufficient density of buildings nearby, the heat generated by the process can be tapped directly for local heating and cooling purposes.

The Point Douglas site would be ideal for a WTE facility. It is close to a steady fuel supply; and the existing transportation network, which is sufficient for the factory, would result in minimal impact on local residents. Local residents could benefit from employment at the plant and from the heat it generates.



Distribution of Dioxin sources in USA.[1,2]

WTE facility in Brescia, Italy [3]

The US EPA recently affirmed that WTE plants in the US ‘produce 2800 MW of electricity with less environmental impact that almost any other source of electricity’ [4]

1. US EPA, *Docket A-90-45*, VIII. B.II Office of Air Quality Planning and Standards, 2002
2. Derziotis, P., M. S. Thesis, Columbia University and N. J. *Themelsis, Substance and Perceptions of Environmental Impacts of Dioxin Emissions*, Proceedings of the 11th North American Waste-to-Energy Conference, ASME International, Tampa FL April 2003.
3. ASM Brescia
4. Letter to M. Zannes of Integrated Waste Services Association from EPA Assistant Administrators Marianne Horinko and Jeffrey Holmstead 14 February 2003

Appendix B

Greatest Floods on the Red River at Winnipeg [1]

Date of Maximum	Flow Rate(m^3/s)	Return period(yrs)
Before Flood-way was operational:		
1826-05-21	6371	667
1852-05-21	4672	150
1861-05-08	3540	45
1950-05-19	3060	28
1966-04-14	2497	14
1916-04-24	2427	13
1882-05-03	2421	13
1904-04-24	2209	9
1948-05-01	2124	8
1956-04-27	1974	7
1960-04-18	1965	7
1892-04-19	1974	7
1897-04-27	1954	7
After Flood-way was operational:		
1997-05-03	4615*	110
1996-04-29	3058*	25
1979-05-10	3030*	27
1974-04-25	2718*	19
1987-04-09	2350*	12
1970-04-30	2251*	10
1999-04-20	2183*	9
1969-05-02	2143*	8

* Computed natural flows without existing flood control works.

1. A.A. Warkentin, *Greatest Floods on the Red River at Winnipeg*. Environment Canada <http://www.ec.gc.ca/water/en/manage/floodgen/e_prair.htm#red> (1 December 2005).

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