

**RECONNECTING WITH THE RED: RESTORING THE CITY OF WINNIPEG'S
RELATIONSHIP WITH ITS RIVERS**

by

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ABSTRACT

The thesis addresses the current disconnection between the city of Winnipeg and its rivers. Despite their historic significance to the city and their current potential to increase the public's quality of life, the city's rivers, for the most part, are no longer valued. Winnipeg has turned its back to its rivers.

The thesis uses a spatial language based on Lynch, Norberg-Schulz, and others to describe the components of the new river network. A 'sectional toolkit' design strategy is used to apply this network to the city, and could be used incrementally in order to re-orient the city, and to re-establish a sense of value along the length of the rivers. The seasonal cycles of the river and seasonal programming are considered in order to establish a sense of value year-round.

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Lastly, thank you to my parents and my sister for their love and support. I would not have been able to finish this program without them.

CHAPTER 1: INTRODUCTION

Thesis Question

How can architecture reorient the city of Winnipeg toward its rivers and re-establish them as an element of the city that is valued year-round?

Introduction

The city of Winnipeg exists because of its rivers. The name of the city reflects this, derived from a Cree word meaning 'muddy waters' (Turner 2017). When the city first developed, the rivers were the most valued and significant feature of the city, providing Indigenous peoples and fur traders with nearly continuous trade routes across the continent. The earliest Indigenous peoples in the area gathered at the meeting of the two rivers, the Red and the Assiniboine, a location known today as 'The Forks' (Turner 2017).

Despite their historic significance, the city of Winnipeg has turned its back to its rivers. There has been very little development along the rivers (largely due to the fluctuating water levels in the spring) and few opportunities for public interaction with them. As a result, the rivers have lost their significance and value to the public, and are known to many as 'the city's dumping ground' (Turner 2017). The rivers are underused and undervalued, even though environmental experts agree that the water in the rivers is not dangerous to human health (Cheung 2016).

Winnipeg's rivers, as acknowledged by the City

of Winnipeg's 20 year vision (refer to Appendix A) have the potential to offer the public unique and valuable experiences within the city. To reach this potential, a sense of physical continuity must be perceived from the city toward the river (and from the river toward the city), and a sense of value or 'centre' must be developed at key locations along the river. The rivers' seasonal changes and seasonal programmatic opportunities must be a key consideration of any development along the rivers, as well as the city's extreme climate.

The thesis uses a spatial language derived from *The Image of the City* by Kevin Lynch, *Existence, Space, and Architecture* by Christian Norberg-Schulz, and *Experiential Landscape* by Kevin Thwaites and Ian Simkins in order to describe a new design strategy that will re-orient the city and re-establish a sense of year-round value along the rivers. A key case study for the work is the Antwerp Quays project by PROAP, which uses a more incremental design method for the city's waterfront, applied in sectional pieces over time.



Figure 1. A view of Winnipeg that most of the public have not yet experienced.

CHAPTER 2: PLACE AND CONTEXT

Winnipeg's History: How the Rivers were Disconnected and Devalued

While there is little written evidence of the interaction with Winnipeg's rivers by Indigenous peoples, there is a lot of archeological evidence as well as many stories passed down through oral traditions that make clear the value of the rivers as a vital method of transportation and as an important food source. Many artifacts dug up at the forks attest to the widespread Indigenous trade routes that converged at the Forks (Turner 2017).

The first European explorers and fur traders also understood the value of the rivers to their methods of transportation and trade. La Verendrye, a French explorer and fur trader from Trois Rivieres, was the first fur trader to travel to Winnipeg using the Red River, and established a permanent structure at the Forks in 1738, known as Fort Rouge (Turner 2017). This was followed by the construction of Fort Gibraltar near the forks in 1809, by the Montreal-based North West Company, and later by the settlement initiated by Thomas Douglas (also known as Lord Selkirk), who worked for the Hudson's Bay Company. The value of the rivers to the traders meant that each of their new structures and settlements were established in close proximity to the rivers. This is also evidenced by the Red River Settlement's use of the 'river lot' system along the banks of the Red. Their settlement grew along the river as the fur trade expanded. (Manitoba 125 Vol. 1, 159, 228-229).

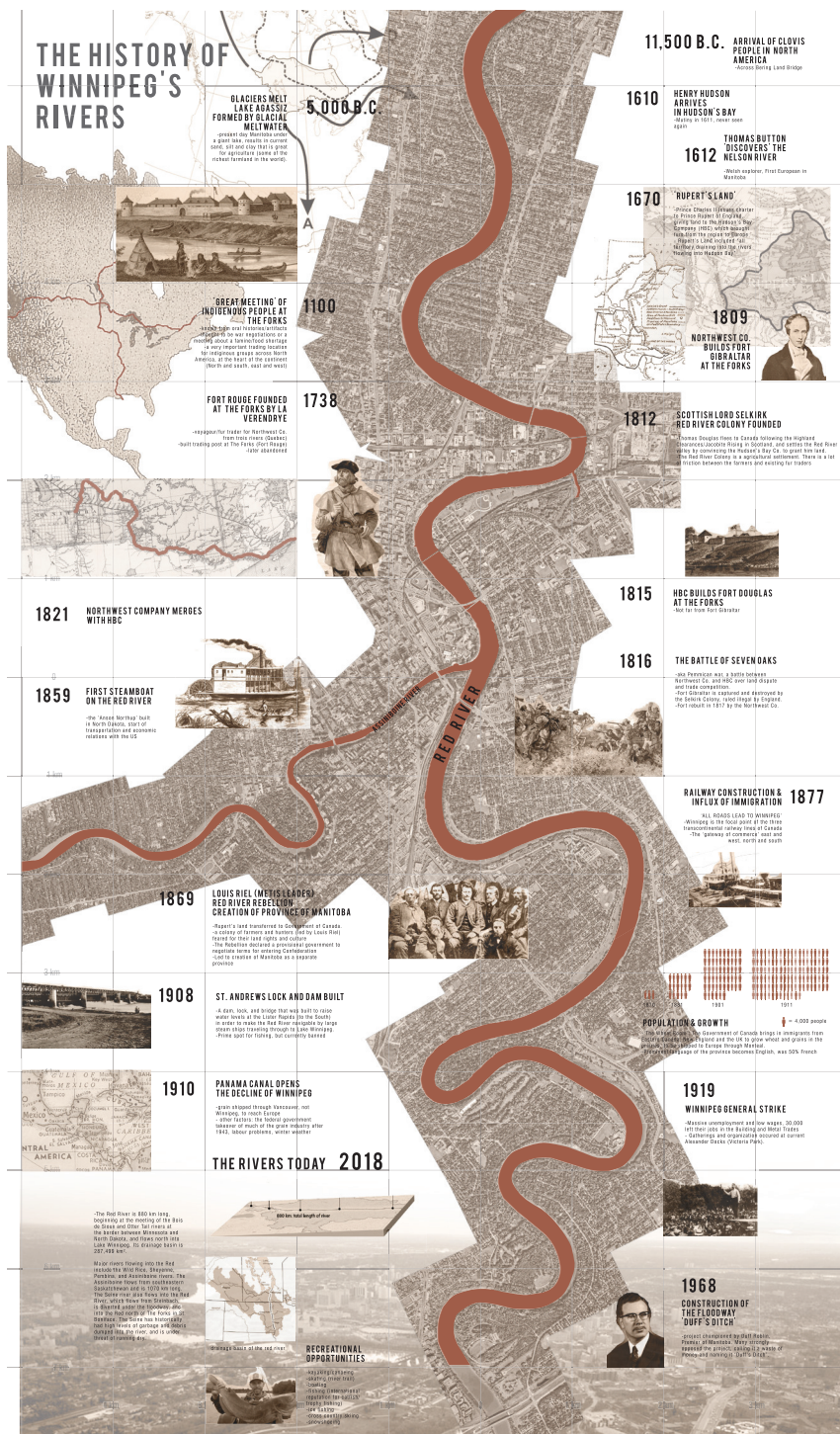


Figure 2. Historic Timeline of Winnipeg's Rivers. See following pages for more detailed images. (base map from Google Earth)

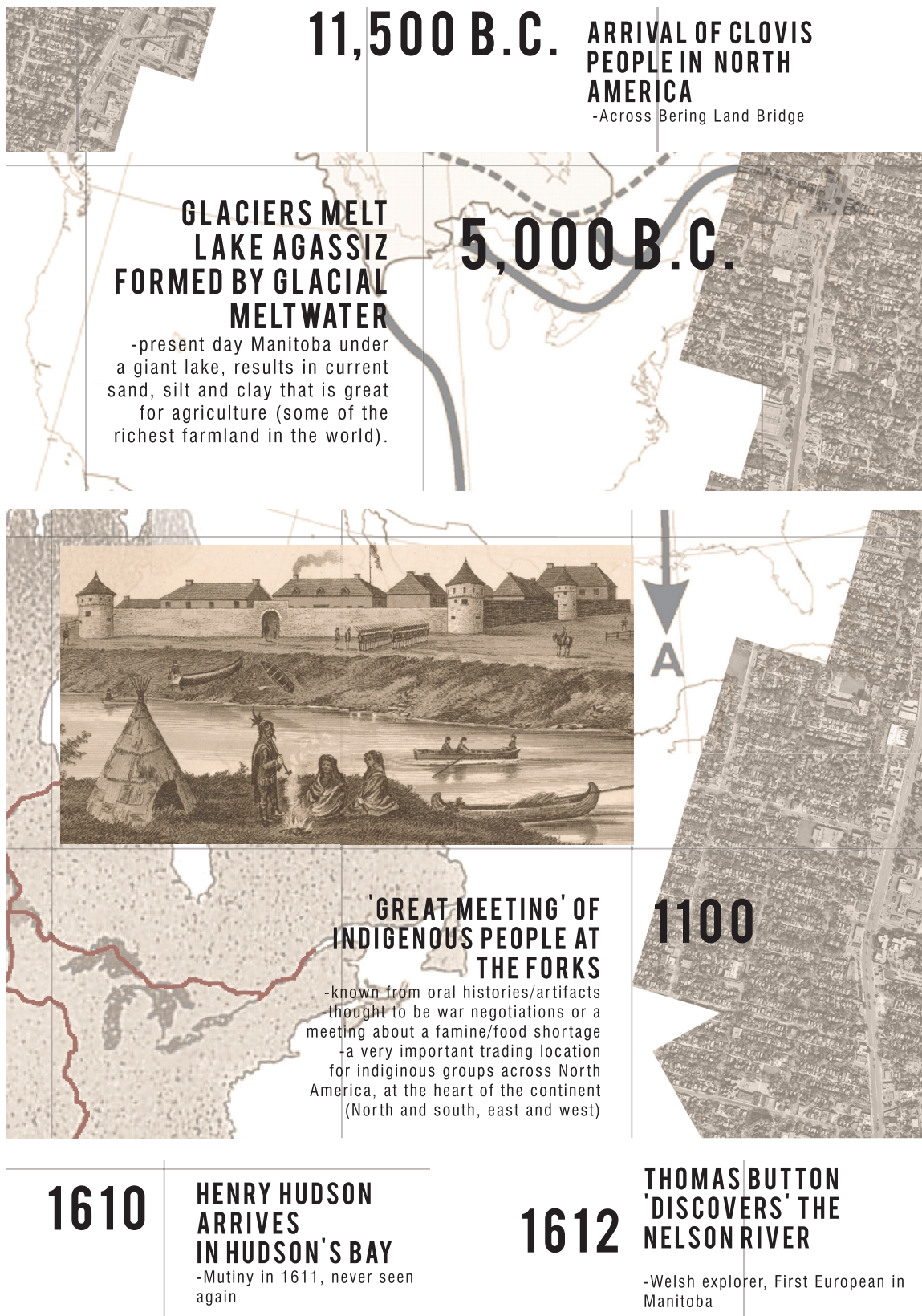


Figure 3. More detailed images from the historic timeline of Winnipeg's rivers. (Glaser 1889, Hilderman Witty Crosby & Associates 1993).



Figure 4. More detailed images from the historic timeline of Winnipeg's rivers. (Boutal La Vérendrye, *Thomas Douglas* 1771–1820 Archives of Manitoba)



1812

SCOTTISH LORD SELKIRK RED RIVER COLONY FOUNDED

-Thomas Douglas flees to Canada following the Highland Clearances/Jacobite Rising in Scotland, and settles the Red River valley by convincing the Hudson's Bay Co. to grant him land.
-The Red River Colony is a agricultural settlement. There is a lot of friction between the farmers and existing fur traders



1815

HBC BUILDS FORT DOUGLAS AT THE FORKS

-Not far from Fort Gibraltar



1816

THE BATTLE OF SEVEN OAKS

-aka Pemmican war, a battle between Northwest Co. and HBC over land dispute and trade competition.
-Fort Gibraltar is captured and destroyed by the Selkirk Colony, ruled illegal by England.
-Fort rebuilt in 1817 by the Northwest Co.

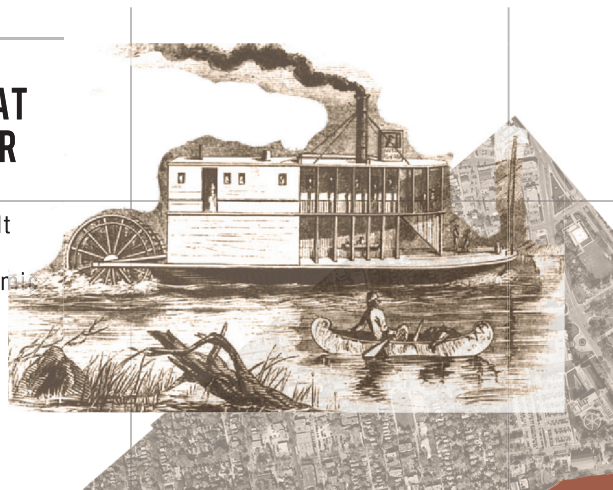
1821

NORTHWEST COMPANY MERGES WITH HBC

Figure 5. More detailed images from the historic timeline of Winnipeg's rivers.
(Jeffereys 1816, Lord Selkirk 1817).

0
1859**FIRST STEAMBOAT
ON THE RED RIVER**

-the 'Anson Northup' built in North Dakota, start of transportation and economic relations with the US

**1869****LOUIS RIEL (METIS LEADER)
RED RIVER REBELLION
CREATION OF PROVINCE OF MANITOBA**

-Rupert's land transferred to Government of Canada.
-a colony of farmers and hunters (led by Louis Riel) feared for their land rights and culture
-The Rebellion declared a provisional government to negotiate terms for entering Confederation
-Led to creation of Manitoba as a separate province

**RAILWAY CONSTRUCTION &
INFLUX OF IMMIGRATION**

'ALL ROADS LEAD TO WINNIPEG'
-Winnipeg is the focal point of the three transcontinental railway lines of Canada
-The 'gateway of commerce' east and west, north and south

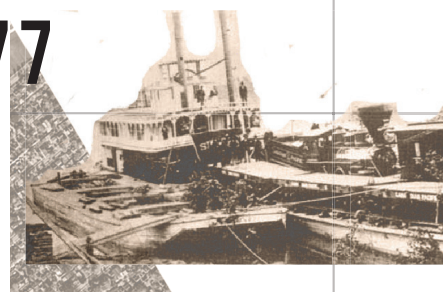
1877

Figure 6. More detailed images from the historic timeline of Winnipeg's rivers.
(*The Anson Northup Archives of Manitoba, Louis Riel Archives of Manitoba, Canadian Pacific Railway 1877*)

From 1859 to 1912, steamboats (rather than canoes) became the most common method of transportation along the city's shallow rivers. The steamboats carried goods and were also the transportation method many immigrants used to travel to Manitoba until the construction of the railway (Manitoba 125 Vol. 2, 18 & 46). City streets continued to the river's edge, so one could almost step off of a boat and into the city.



Figure 7. Map showing a strong sense of perpendicular direction, when Winnipeg's city streets continued to the river's edge. (Macoun 1882)



Figure 8. Drawing showing a strong sense of perpendicular direction, when St. Boniface's streets continued to the river's edge. (Fowler 1880)



Figure 9. Drawing showing a strong sense of perpendicular direction, before the railway cut off the ends of city streets. (Fonseca 1884)

Richard White, author of *The Organic Machine*, argues that humans are tied to nature through labour, and that the development of machines (beginning with the steamboat) initiated the failed relationship of man and nature. The fur traders and Indigenous peoples, traveling in their canoes, had to directly expend their own energy to match the energy of the river. Once the steamboat was introduced, that direct connection was lost. He writes: “humans no longer rowed, towed, and hauled their way upriver; sweat and aching muscles remained, but they vanished below decks with the boiler crew” (White 1995, 30).

In 1870, following the rebellion led by Metis leader Louis Riel, Manitoba was brought under the control of the Canadian government. The government planned to use the region to grow wheat that would be shipped to Europe through Montreal. In order for this to work, a trans-continental railway needed to be built. The railway was completed in 1885 (The Manitoba Library Consortium, 2005). By this time, the commercial monopoly previously held by the Hudson’s Bay Company (a fur trading company) was destroyed. The rivers no longer had value as a transportation system or as an economic necessity for trade. As Richard White argues, the railway also further disconnected the public from their previous bodily connection and direct engagement with the river (White 1995, 36-37). In some cases, the railway actually cut the ends of city streets from the river’s edge. As more and more immigrants flooded into the city from the railways, land prices skyrocketed, leading to urban sprawl. This new pattern of city growth was independent of the rivers,



Figure 10. Map showing the current strong sense of parallel direction between the city and the river. (Google Earth)



Figure 11. Aerial photo showing the lack of perpendicular direction between the city and the river. (Google Earth)

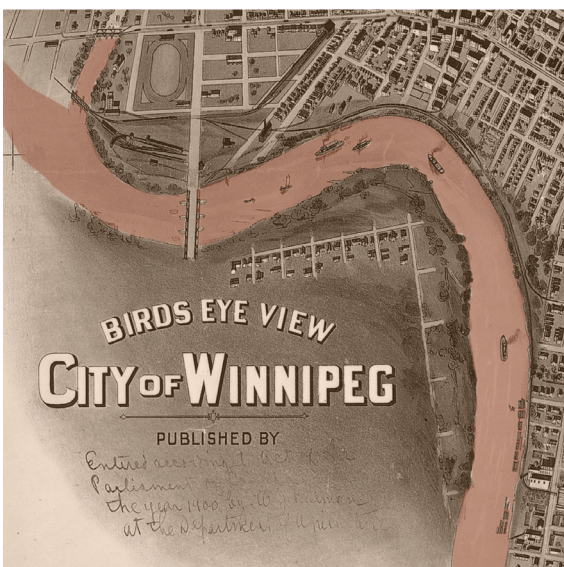


Figure 12. Map showing how the city turned its back to the river once the railway was introduced. At this location, the railway physically cut off city streets from the river's edge. (Bulman 1900)

especially when compared to the previously used 'river lots'. (Lyon and Fenton 1984, 10-14). By this period, the rivers had lost all value to the city, functioning only as the city's 'dumping ground' (Turner 2017).

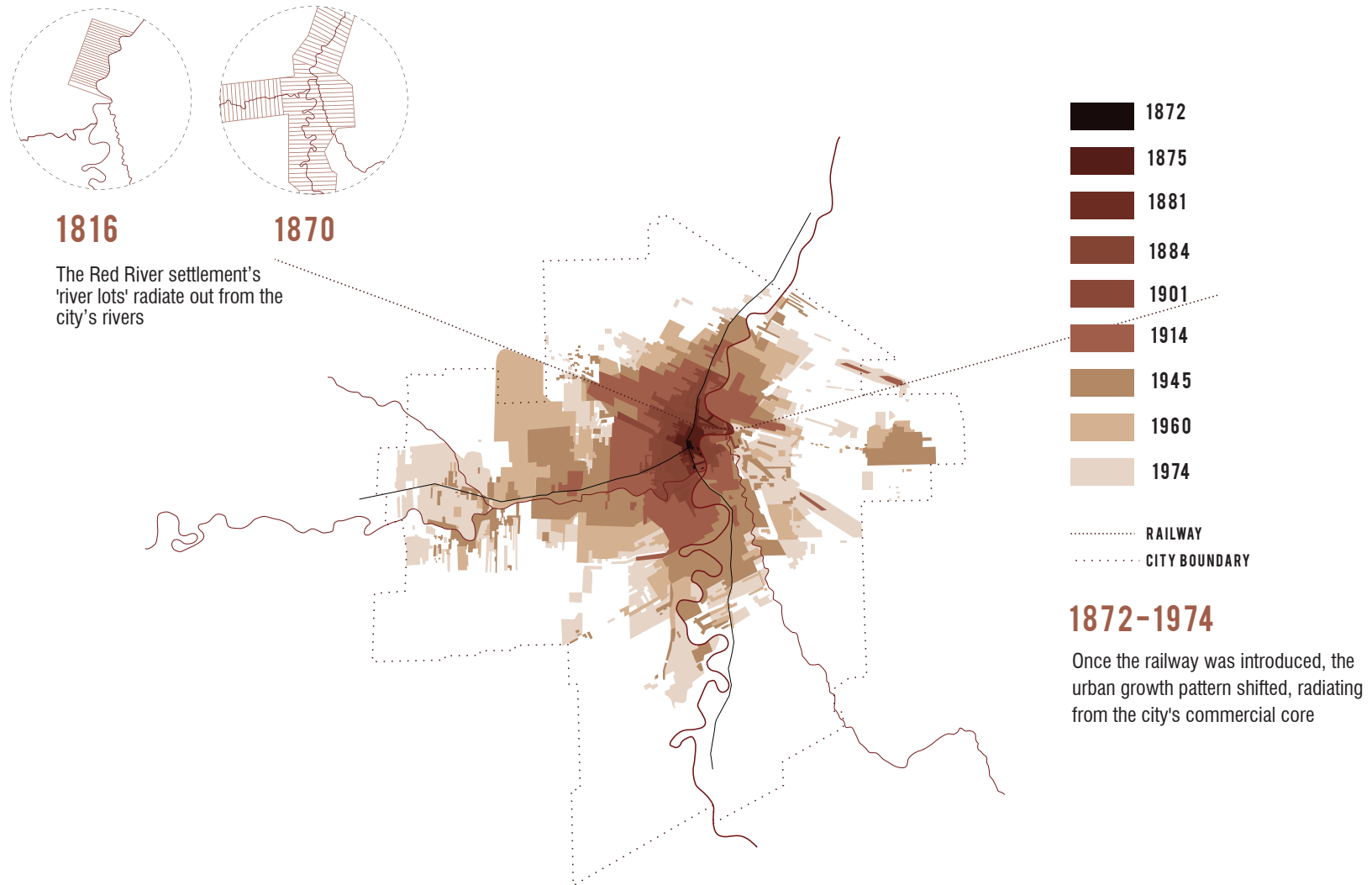


Figure 13. Winnipeg becomes disconnected from its rivers.
 (Drawings adapted from Arrowsmith 1820, Grant & Simmers Real Estate Agents. 1900, Winnipeg Planning Division 1966)



Figure 14. The 'river lot' system.
(Grant & Simmers 1900)



Figure 15. The rivers are used for transportation and fur trade. The city is developed along its valued rivers. (Weir 1960)

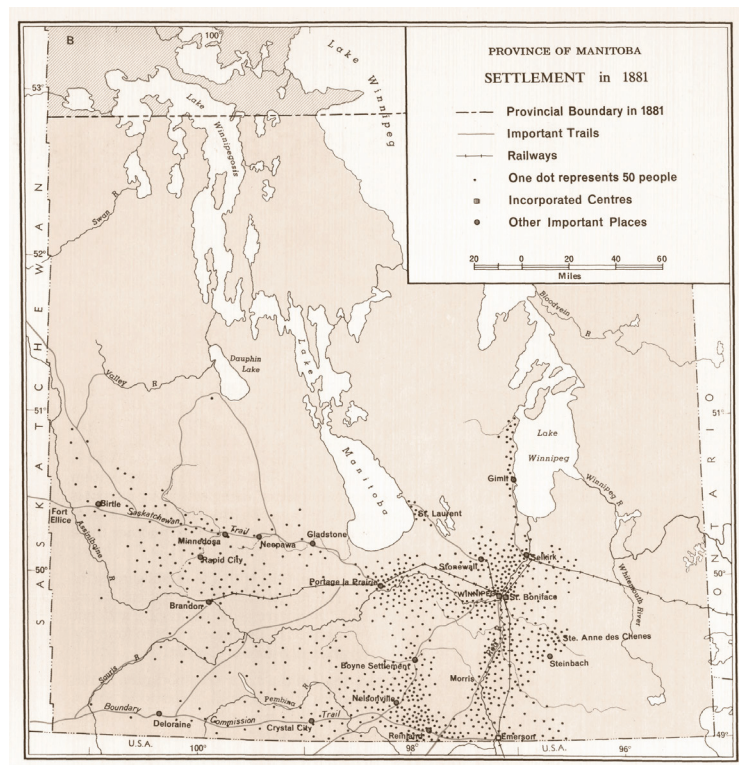


Figure 16. The railway becomes the primary transportation method for an agricultural economy, and the city develops independent of its rivers. (Weir 1960)

Loss of Direct Engagement: Flooding

The Red and Assiniboine rivers are very slow-moving due to their small incline, which is about three inches per mile in the case of the Red (International Joint Commission 1968). Their slowness means that they are shallow rivers that have not cut deep channels. When large quantities of water flow into them, the water is not contained and floods occur. There is also very little topographic change in the region to stop the flood waters. Flooding is only exacerbated by spring snow and ice melt and the frequent ice jams along its meandering length. For these reasons, floods have historically occurred frequently in Winnipeg (Bumsted 1997, 8-9). The water levels continue to fluctuate today, but are mechanically controlled.

The Indigenous peoples' use of the area was seasonal, and intimately tied to the rivers. Frequent flooding was part of their understanding of the river, leading to the logical conclusion that settlements along the river should not be permanent. Their ingenious invention of the birchbark canoe and teepee, light and easily transportable, were effective methods of shelter and transportation (Turner 2017). The flood of 1776, known through stories rather than through written evidence, was not a tragic one due to the methods of relocation and adaptation used by Indigenous peoples (Bumsted 1997, 15).

Once permanent structures were constructed by the Red River Settlement (who initially had little understanding of the river's flooding cycles), the attitude to flooding shifted. Rather than adapting and

**FLOOD OF 1776
RELOCATION & ADAPTAION**



Figure 17. Indigenous peoples used the rivers seasonally, and would move away from the rivers during floods (Glaser 1889).

**FLOOD OF 1826
ENDURING & REBUILDING**

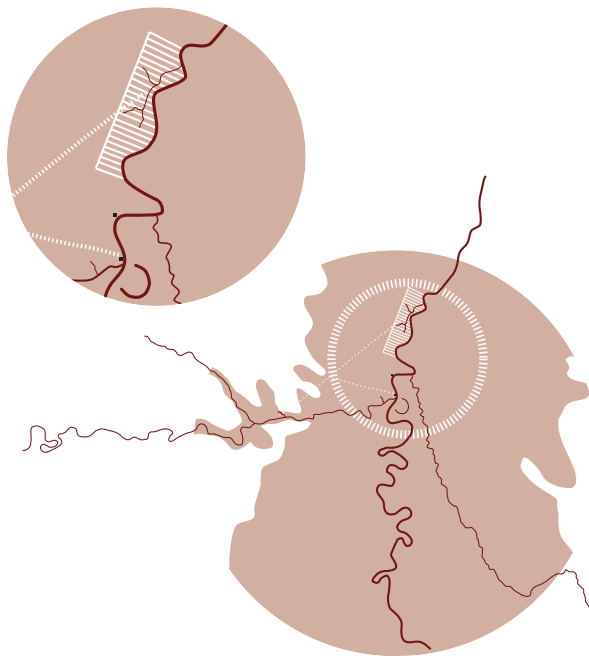


Figure 18. Initial settlements were destroyed and rebuilt after the 1826 flood (Adapted from Arrowsmith 1820 and Baker 1979)

**FLOOD OF 1852, 1861
ENDURING & REBUILDING**

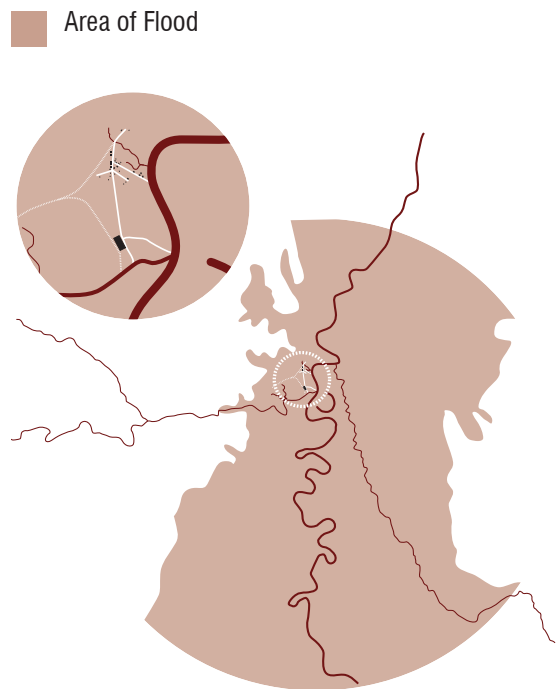


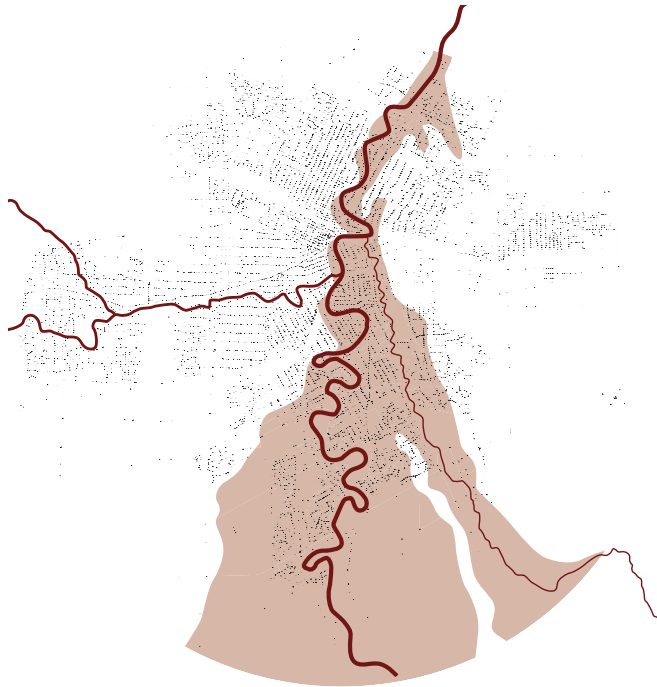
Figure 19. Initial settlements were destroyed and rebuilt after the flood of 1852 and 1861 (Adapted from Weir 1978 and Baker 1979)

relocating as the Indigenous peoples did, the settlers endured the floods and rebuilt their structures in the exact same way they built before the flood occurred. The first flood experienced by the settlement occurred in 1826, and it was a flood of great proportions. The waters rose almost 40 feet above ice levels, livestock were killed, and most houses were washed off their foundations. The settlers seemed unaffected by the floods, rebuilding their homes as they stood before the flood, occupying low-lying lands and developing no methods for flood protection (Bumsted 1997, 18-19).

The settlement continued to experience devastating floods in 1852 and in 1861 (Bumsted 1997, 20-23). Turner writes of the perseverance of the settlers despite the frequency of the floods: "It often appears Winnipeggers have only been emboldened by the uprisings of the Red and Assiniboine. No sooner had the flood of 1861 receded, for example, than the first house was erected on Winnipeg's Main Street" (Turner 2017).

By 1950, the city had grown and sprawled dramatically, which greatly increased the potential for property damage during a major flood. After over a century without a major flood, Winnipeggers were reminded of the destructive power of their rivers. They used sandbags, dikes, and drainage ditches to try to protect their city from damage. It was the most devastating flood in the city's history (Bumsted 1997, 45).

After much controversy and debate in the



FLOOD OF 1950 REBUILDING & PROTECTING

Figure 20. Once the city had developed further, more damage could be done by flooding and dikes and sandbags were used to try to protect the city. (Government of Manitoba, *Manitoba Land Initiative* and Baker 1979)

■ Area of Flood



Figure 21. Flood of 1950, the Forks. (Government of Manitoba 1950)

city, the construction of the Winnipeg Floodway (also known as 'Duff's Ditch') was completed in 1968, and is still used today. The city no longer needs to protect itself from flooding, because spring water levels are mechanically controlled. The Winnipeg Floodway combines a dam and a diversion to lower water levels during periods of flooding. The dam, when its gates are raised, holds back the river's waters filling a reservoir south of the city. The water from the reservoir flows into a large diversion (or ditch) which was dug around the city of Winnipeg.

The construction of the floodway was responsible for perhaps the greatest shift in the city's attitudes toward flooding, and toward their rivers. The loss of the threat of flooding, which acted as a continual reminder of the rivers, meant that the rivers fell out of the public consciousness. Richard White describes this transition, or the 'failed relation with nature', in the context of the Columbia River. He notes that "The machine, a product of their minds and hands, was their surrogate in what seemed a simple opposition of the mechanical and the natural. Machines could exert far greater force than human bodies alone could muster. Machines replaced bodies. Machines overcame nature" (White, 1995, 30). Today, a machine (rather than human bodies) deals with the threat of flooding in Winnipeg, and so a failed relationship with the river has resulted. White writes:

Today, except when disaster strikes, when a hurricane hits, or earthquakes topple our creations, or when a river unexpectedly rises and sweeps away the results of our efforts and labour, we forget the awesome power - the energy - of nature. There is little in our day-to-day life

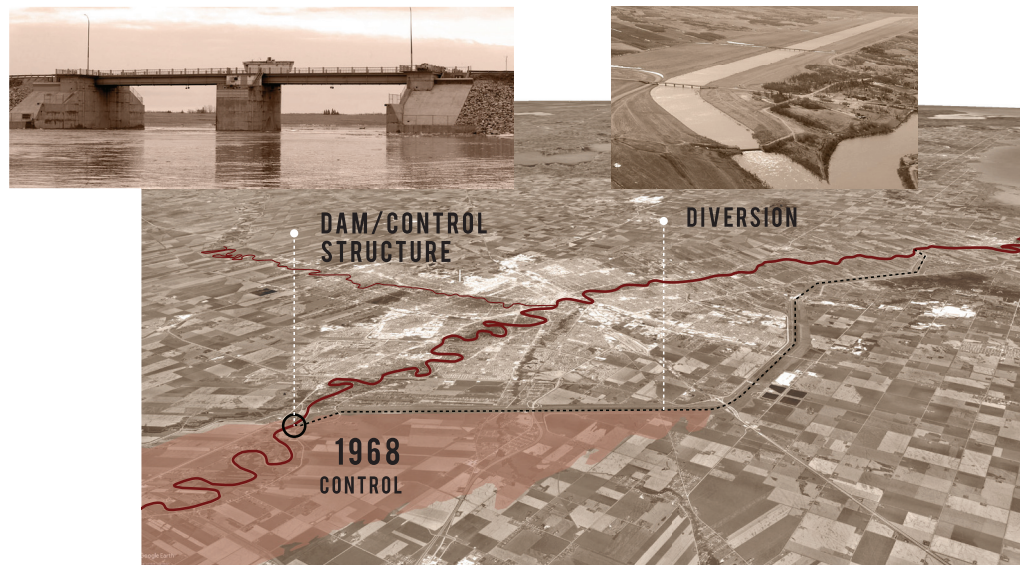


Figure 22. City-scale diagram of the Winnipeg dam and diversion.
 (Red River North Heritage 2017, Glowaki 2017, base map Google Earth)

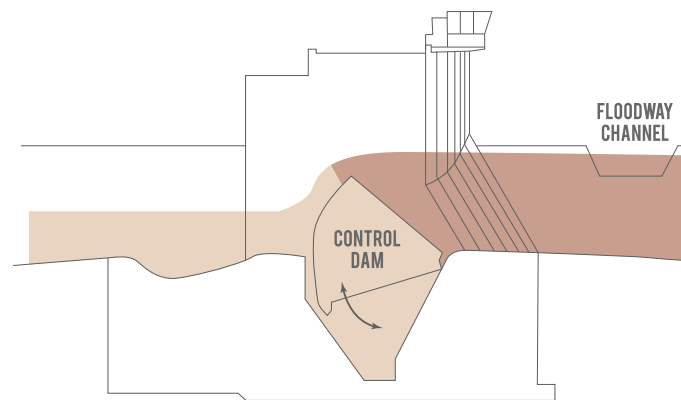


Figure 23. Diagram of the Winnipeg floodway control structure. The gates of the control dam are lifted, slowing the flow of water and creating a large reservoir south of the city (shown in red). The excess water is diverted into the floodway channel, moving around the city of Winnipeg in a large ditch.
 (Adapted from Government of Manitoba, *Floodway gates*).

to preserve the connection...The link between our work and nature's work has weakened...Once the energy of the Columbia River was felt in human bones and sinews; human beings knew the river through the work the river demanded of them (White 1995, 4).

As White describes, machines have led to both the physical and psychological detachment of the public and their environment. In Winnipeg's case, the floodway has disconnected the public from the most defining element of their own city.

To bring back the public's psychological awareness and direct bodily engagement with the city's rivers, their changing levels should be embraced by all new developments along the river. The changing height of the water should be viewed as a design tool that is a key aspect of the proposal, rather than an obstacle to be avoided or controlled further.

It is also important to note that the use of the floodway has many political implications. Whenever the floodway is used, occupied lands south of the city are flooded. The city effectively chooses to protect itself at the expense of others residing further south. There are many regulations in place that determine when exactly the floodway can and cannot be used (Government of Manitoba 2015). It has been determined by the city that the floodway should only be used when necessary, in order to protect the city from flooding (and should not be used to ease the feasibility or affordability of future developments along the river's edges).

Winnipeg's Climate

The city of Winnipeg has a very extreme climate, with temperatures often reaching +40 degrees Celsius in the summer and -40 degrees Celsius in the winter. The primary wind direction is from the south, and secondary winds are from the northwest direction (Vickers et al. 2001, 145). In the winter, the winds contribute to extreme windchill temperatures (reaching -53 degrees Celsius in 2013, which was colder than the surface of Mars that day).

CHAPTER 3: SPATIAL LANGUAGE OF THE RIVER NETWORK

Environmental Psychology

The field of environmental psychology examines the complex relationship of a person to their environment. As argued by many theorists in the field, the person-environment relationship should be understood as a holistic relationship comprised of both the *physical* form and organization of the environment, as well as the *psychological* understanding, or the interpreted meaning of the environment (Thwaites and Simkins 2007, 35).

In his book *The Image of the City*, Kevin Lynch examines how people perceive and navigate in urban environments, focusing on the physical form and organization of the city, or what he calls its 'identity and structure'. He argues that the psychological, interpreted meanings are far too complex and individual to be properly explored or generated by architects and planners (Lynch 1960, 8). Conversely, in his concept of 'existential space', Norberg-Schulz argues that both the physical and psychological (the concrete and the abstract) must be considered in tandem by architects. He proposes that our individual worlds and interpretations must have common structures and values in order to enable us to become part of a society, which leads to the creation of the 'public world', or the public existential space of society. This abstract, public existential space is what architecture should aim to make concrete (Norberg-Schulz 1971, 38-39).

Kevin Thwaites and Ian Simkins draw directly on the ideas of 'existential space' proposed by Norberg-Schulz and Lynch's *Image of the City* to create their *Experiential Landscape Method*, arguing (like Norberg-Schulz) that a more holistic relationship of human experience and space must be considered in the design of places, integrating "human behavioural and psychological functioning with the spatial and material world" (Thwaites and Simkins 2007, 35). They aim to make practical place-making recommendations to designers, founded on more abstract theories proposed by environmental psychologists.

Their concept, which expands on the concepts proposed by Norberg-Schulz and Lynch, argues that humans perceive their environments as a set of four components: *centre*, *direction*, *transition*, and *area* (this is similar to Lynch's purely physical elements of node, path, landmark, edge, and district). These are not perceived independently, but one component is often emphasized or perceived more strongly than another. They arise out of "a deep psychological human need to "bring meaning and order into a world of events and actions" (Norberg-Schulz 1971, 9), or the "fundamental human impulse to know where we are and what this means to us in relation to our wider surroundings" (Thwaites and Simkins 2007, 36). Once a sense of orientation is developed, feelings of well-being and place attachment can be fostered.

Analyzing the Experiential Landscape of Winnipeg's Rivers

The overall site along the city's rivers was analyzed using the *experiential landscape method* as previously described. It was concluded that:

- i. There is a very strong sense of direction parallel to the rivers.
- ii. There is very little sense of perpendicular direction from the city to the rivers (and from the rivers to the city). This is at its worst where the railway blocks off the existing river path from the adjacent neighborhoods.
- iii. There is very little sense of centre at the river. There are a few exceptions: there are many centres at The Forks and also at the St. Boniface Cathedral, but most do not reach the water's edge.
- iv. Much of the current infrastructure is built at a low level, and so it is not functional when the river's water levels are high.

Legend:

- Centre
- Direction
- ≡ Transition
- ▨ Area



Figure 24.
Analysis of the existing
experiential landscape along
Winnipeg's rivers
(adapted from Google Earth)

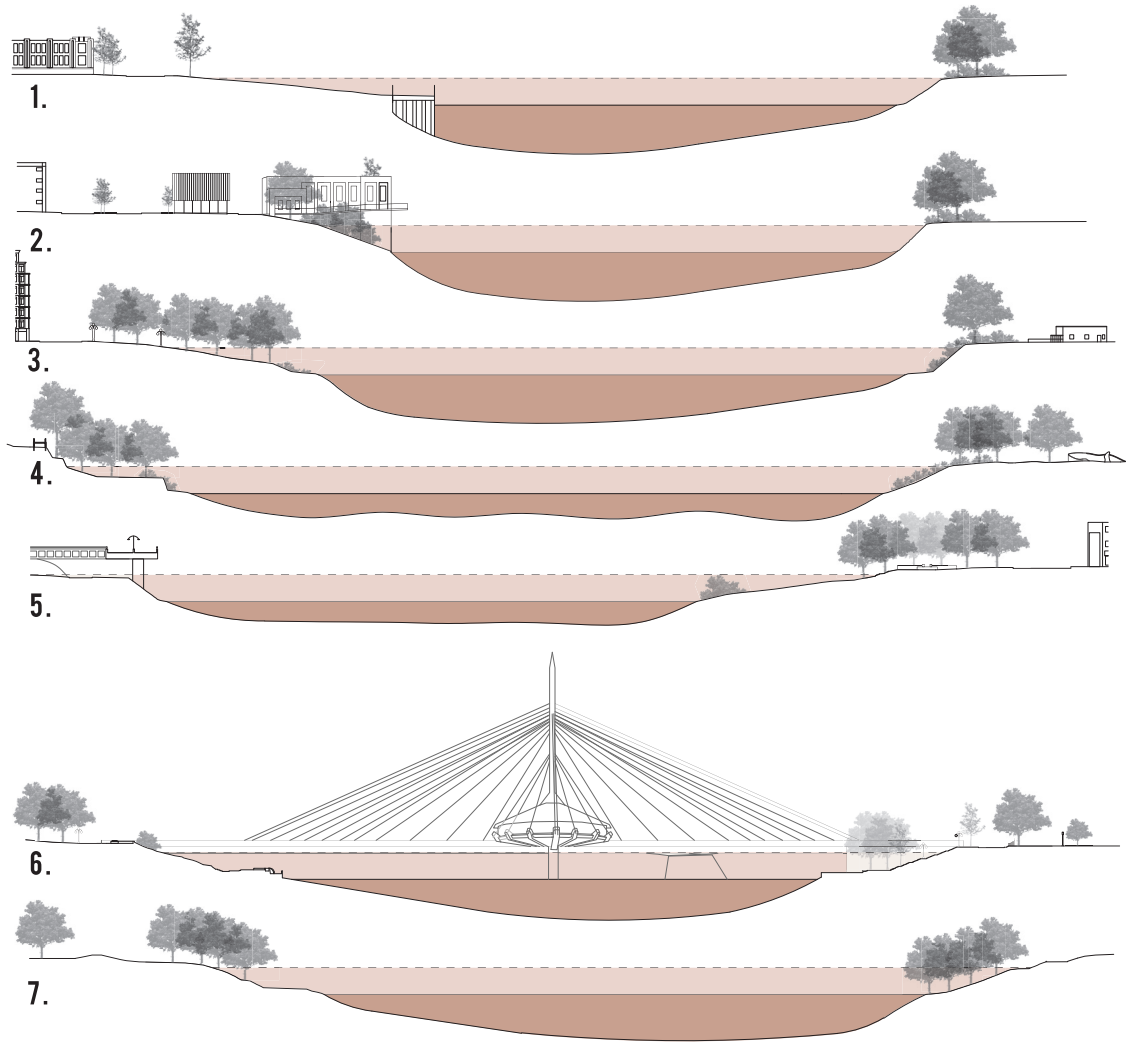


Figure 25.
Sectional studies along the river



Figure 26. Key plan of sectional studies

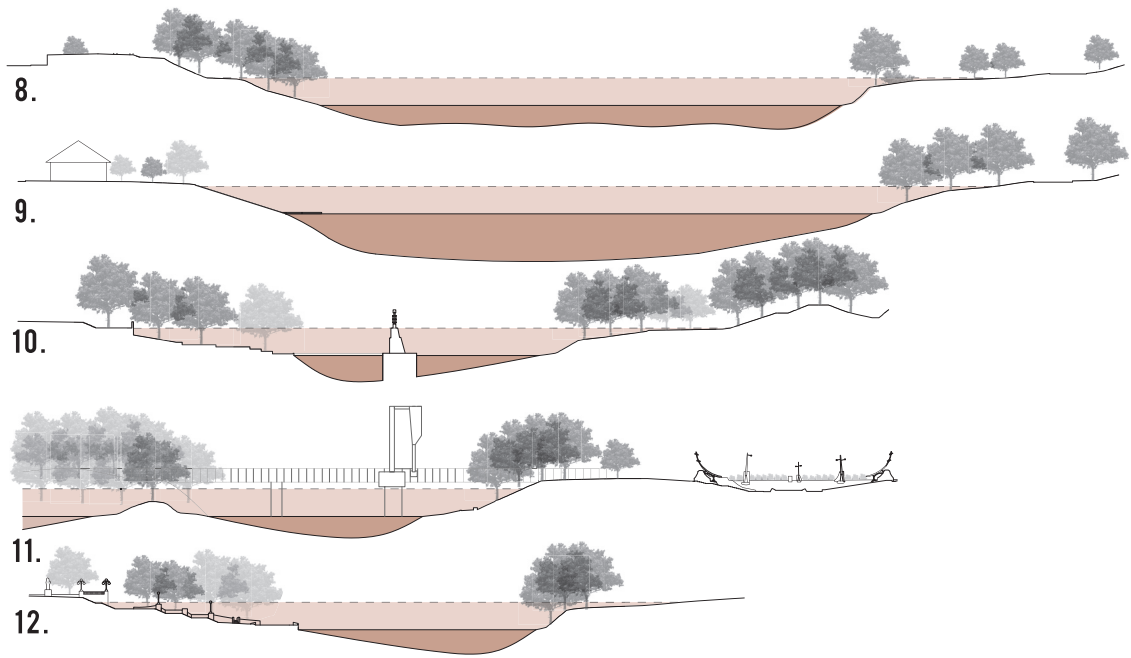


Figure 27.
Sectional studies along the river



Figure 26. Key plan of sectional studies

The Spatial Language of Winnipeg's New River Network

The spatial language of Winnipeg's new river network uses three of the concepts proposed by Thwaites and Simkins, Lynch, and Norberg-Schulz in order to address these issues. The first is the idea of the centre (from Norberg-Schulz and Thwaites and Simkins), the second is the path (from Kevin Lynch) and the third is the transition (Thwaites and Simkins).



Symbol:
The Centre

The Centre

Thwaites builds from Norberg-Schulz's idea of 'centre', which combines Lynch's purely physical concept of 'node' with the psychological aspects of spatial interpretation. Norberg-Schulz proposes that all humans perceive 'centres' as known locations, or reference points that help them avoid getting lost in their environment. This begins during childhood with the home, and as one develops, new centres become places of action. Centres are where particular activities are carried out, where social interaction occurs, and where meaningful events take place. Centres become locations where one takes of possession of the environment, the locations of place attachment. (Norberg-Schulz 1971, 18-20). Thwaites has expanded on this idea of centre, creating three new categories of centre that include more contemporary ideas relating to social place attachment. These categories are: *social imageability*, *social interaction*, and *restorative benefit*.

Social imageability refers to the memorability of the location based on social or physical characteristics,

such as: pronounced physical features (natural or man-made) or associated social meanings (a location used for ceremony, work or play) (Thwaites and Simkins 2007, 60).

Social interaction is based upon Jane Jacob's notion (in her novel *The Death and Life of Great American Cities*) that successful urban places attract and encourage spontaneous interaction between people (Thwaites and Simkins 2007, 61). This idea differs from social imageability in that these locations are not often visually notable, but have great importance in the routine social life of individuals. Characteristics for creating social interaction include: the significant convergence of routes, the presence of features for waiting, seating in social groupings, the presence of features encouraging comment and observation, revealingness (as opposed to privacy), and places of arrival and departure. There must be places to move through the 'centre' as well as places for staying, waiting, and people-watching (Thwaites and Simkins 2007, 60-61).

The last category is *restorative benefit*, which refers to a centre that may offer physical and psychological benefits to human health by: being a spiritually uplifting location offering feelings of revival, renewal or relaxation; being a contemplative location with material elements and spatial configurations that allow the mind to wander; reducing distractions; or fostering feelings of comfort, safety, shelter and security. Restorative centres often include nature (trees, water, and natural materials) (Thwaites and Simkins

2007, 63-66).

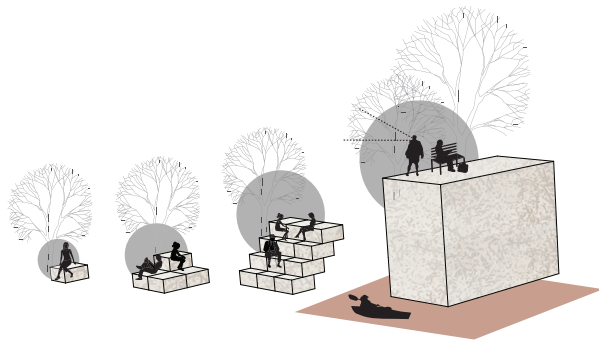
There are 4 types of centres along the new river network. They range in scale and program, addressing all categories proposed by Thwaites and Simkins.

1) The outdoor gathering. These are informal gathering spaces to rest, talk, eat, to look out to views of the river and the city, and to relax. They can occur in a variety of scales, from the individual, to small groups, or to larger crowds.

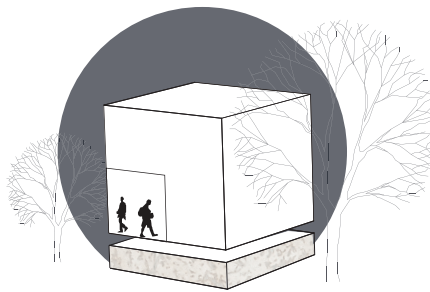
2) The pavilion. Small-scale buildings to house small programming such as: small retail spaces, coffee shops, exhibition spaces, and artist workshops. Refer to the design chapter for more details.

3) The tower. Towers act as visual reference points in the landscape, visible from the city and from the river (see figures 67 and 68). They also re-establish the river as an active transportation network, reintroducing daily, direct engagement with the rivers. The towers mark spots where equipment can be rented along the new river transportation network (see figures 61-66). Refer to the design chapter for more details.

4) The public anchor. The public anchor is a larger-scale building with programming that attracts the public to the river either for everyday use, or for special events. Parts of these buildings may also be connected to the new river transportation network, with space for equipment rentals. Refer to the Alexander Docks portion of the design chapter for more details.



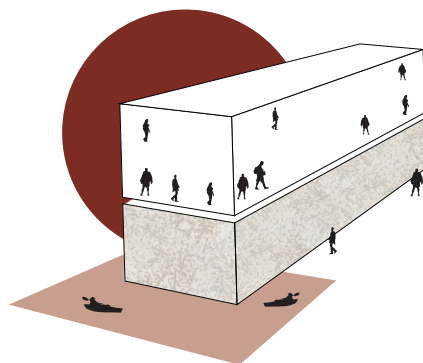
A centre a: the outdoor gathering



B centre b: the pavilion

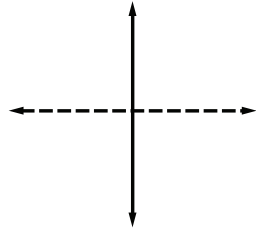


C centre c: the tower



D centre d: the public anchor

Figure 29. Diagrams of four types of centres along the proposed river network in Winnipeg.



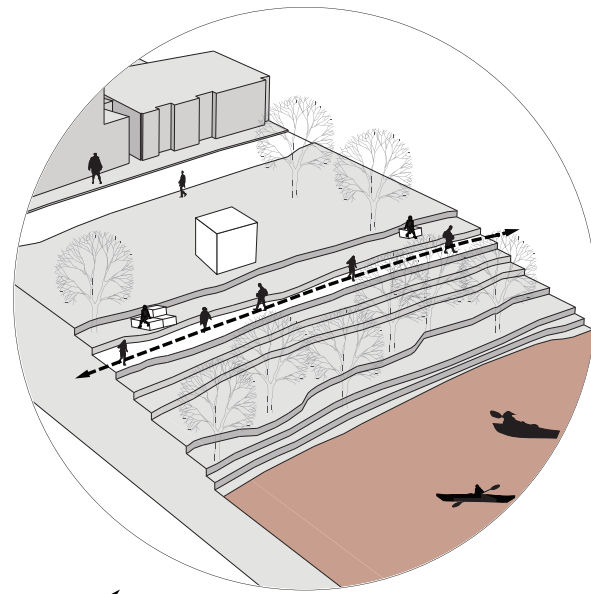
Symbol:
The Path

The Path

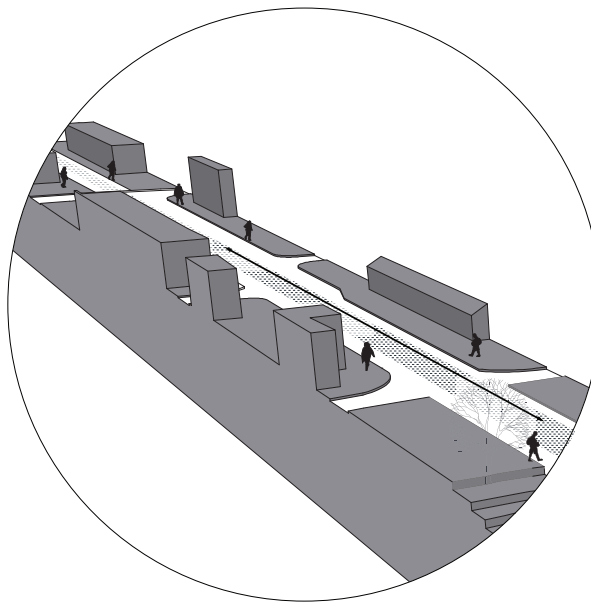
Norberg-Schulz's concept of 'direction' argues that every centre must have a psychologically associated direction, just as every inside must have an outside. The direction represents the unknown, it leads to another destination, 'centre', or goal, and it can act as an organizing axis for future elements (Norberg-Schulz 1971, 20-22). This idea is similar to Lynch's physical element of the 'path'. Architecturally, Norberg-Schulz proposes that direction is created using the Gestalt principle of *continuity*. Continuity in depth is created by articulating 'guiding elements' using the floor, walls, or ceiling (Norberg-Schulz 1971, 49-56). Thwaites also argues that too much emphasis of direction without centre or transition reduces the quality of experience and creates a monotonous feeling.

There are 2 types of paths along the proposed river network:

- 1) the parallel path (existing condition) running beside the river.
- 2) the perpendicular path, leading from the city to the river.



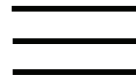
Path A: The parallel path (existing condition)



Path B: The perpendicular path

Figure 30. Diagrams of two types of paths along the proposed river network in Winnipeg.

The Transition

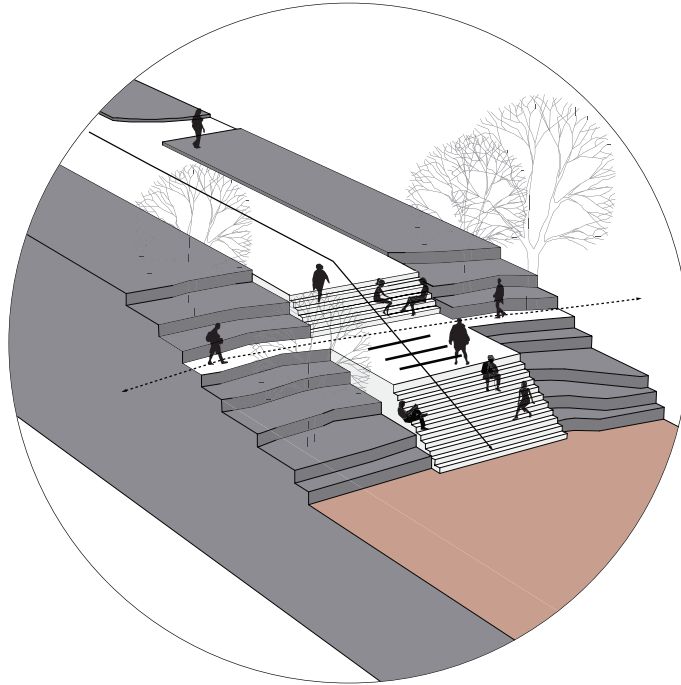



Symbol:
The Transition

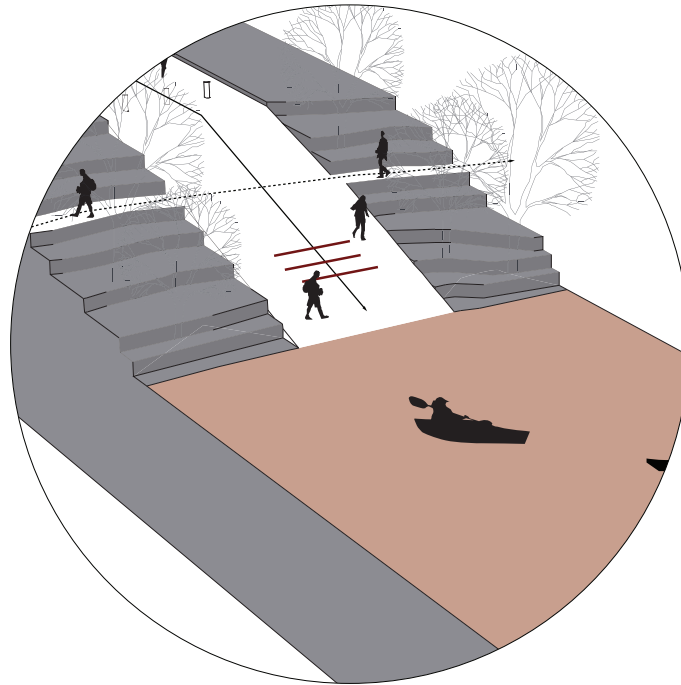
Norberg-Schulz does not include a separate category of transition, but he does note that there is an area of tension at the edge of each centre, creating an area of transition (Norberg-Schulz 1971, 25). This is similar to Lynch's notion of the edge, or a break in continuity (Lynch 1960, 47-48). Thwaites argues that transitions should not be accidental occurrences that are found when two centres meet. He argues that there is great importance in the intentionally created transition, as it contributes to a more holistic spatial language (Thwaites and Simkins 2007, 47).

Thwaites' additional category of transition refers to the locations of change, where one notices the differences between adjacent places. It is the punctuation of spatial language, "creating intervals to provide rhythm and structure to the whole. They may be abrupt and dramatic...or softer and more subtle" (Thwaites and Simkins 2007, 76).

Along the new river network, the transition refers to the movement from river to city and city to river. They reintroduce the connection of the city grid to the river's edge, and help to create a less monotonous experience along paths (with new views and more directional options). This can be achieved in a variety of ways, including a stair, a ramp, a floating dock, or a daylighted stream, depending on the location.



 Transition A: Stair (used on the more steep, inner curves of the river)




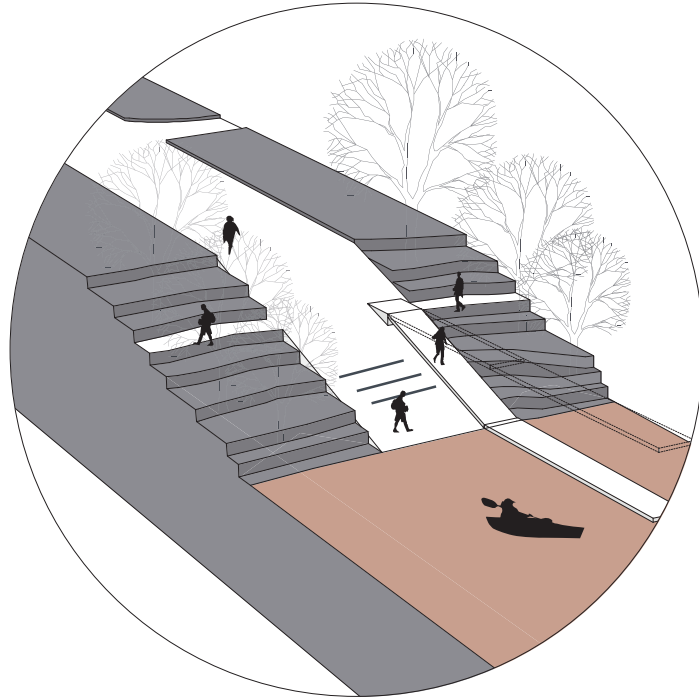
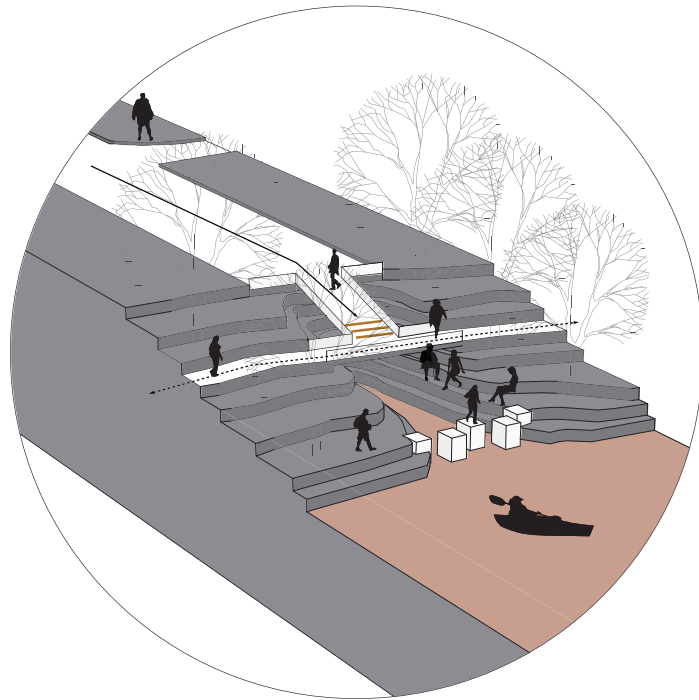
 Transition B: Ramp (used on the more gradual, outer curves of the river)

Figure 31. Diagrams of transitions along the proposed river network in Winnipeg.



Transition C: Floating dock (at a stair or ramp)



Transition D: Daylighted stream

Figure 32. Diagrams of transitions along the proposed river network in Winnipeg.

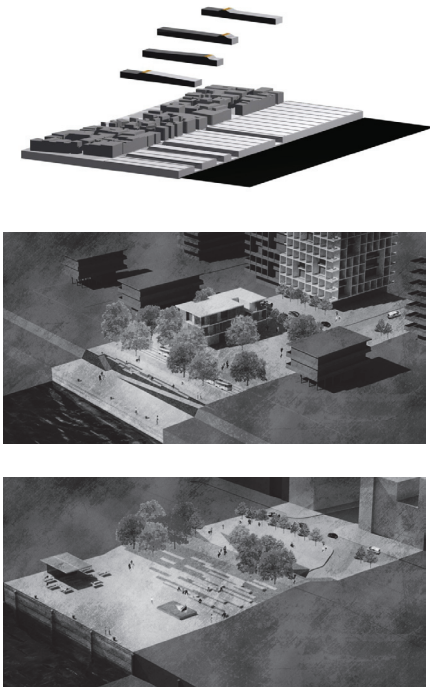


Figure 33. Sectional 'toolkit' for the Antwerp Quays Project (PROAP 2006)

The Sectional Method: Antwerp Quays by PROAP

The Antwerp Quays waterfront project by PROAP created a sectional toolkit to reconnect the city with its waterfront. Rather than creating a complex master plan for the city, the firm developed a design process that could change with the various conditions of the city and landscape. Each sectional piece of their process has a different edge condition of the city and water, “one section, resting on pontoons, rises and falls with the tides; another slopes down gradually from a protective berm; a third cantilevers out over the water. All suitably answer the demands of the flood protection plan while retaining access—visual and physical—to the river” (João Nunes in Lamster 2007).

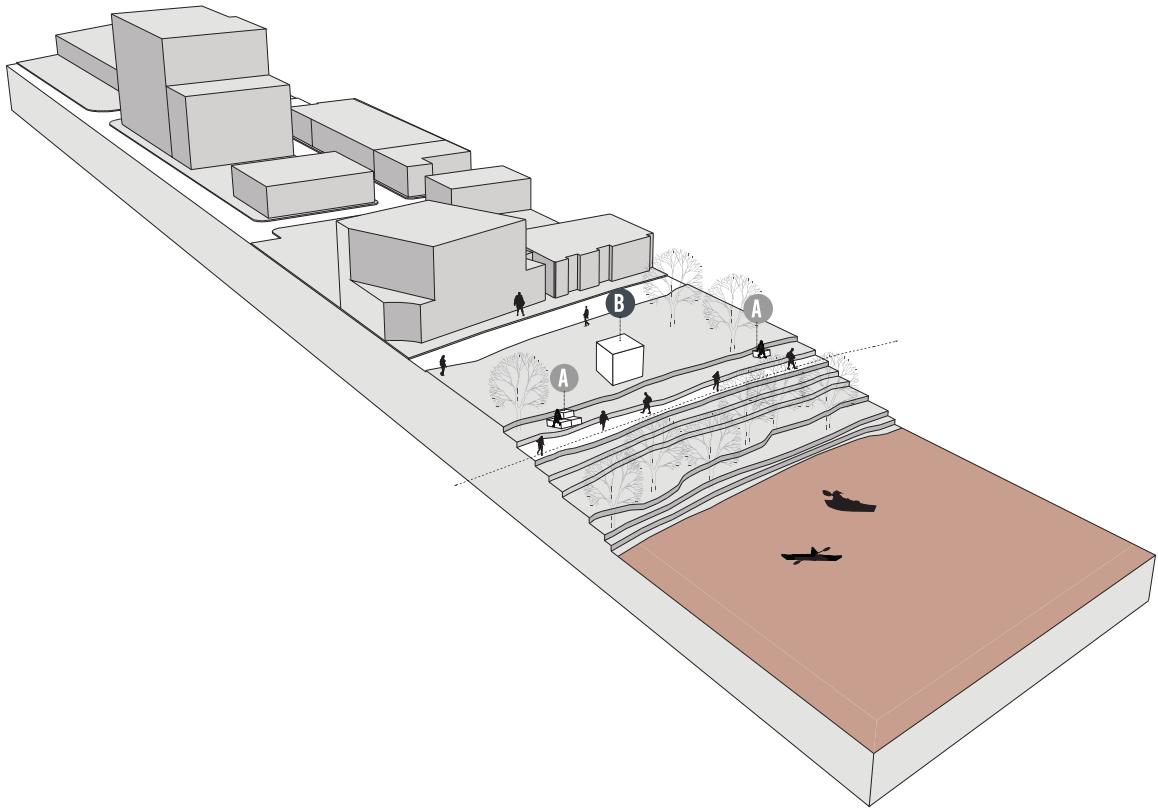
A similar sectional method is used to address the various zones, programmatic uses, and edge conditions along the Red River in Winnipeg. They each include components of the spatial language as established earlier in the chapter. The six sectional tools are:

- 1) The parallel path and existing park remains. In this section, The existing path and park remains, with new outdoor gathering centres added to it. See figure 34.
- 2) Adding transitions to the river by reintroducing perpendicular paths. See figure 35.
- 3) The path terminates at a 'lookout' to key views of the city and river, used where views are especially desirable. See figure 36.

4) Where the towers will be located. The tower is located at key city streets. They must be able to be seen from the city and from the river. They are generally located so that the next tower can be seen from the previous one when traveling along the river. See figure 37.

5) The city is brought to the water with pavilions and public anchor centres. These may be very concentrated, creating a 'hub', or they may be more spread out, depending on the density of the city along the river. Some of these centres may also act as spots to rent equipment, filling in for the 'tower' sectional tool along the curves of the river. Outdoor gathering centres of various scales may also be included in these sections. See figure 38.

6) The bridge physically connects both sides of the river at key points along the path that are currently dead ends. This may be a new structure, or existing bridges may be altered to provide new pedestrian access. See figure 39.

**TYPE 1**

The parallel path and the existing park remains with new centres (outdoor gatherings and pavilions).

Figure 34.

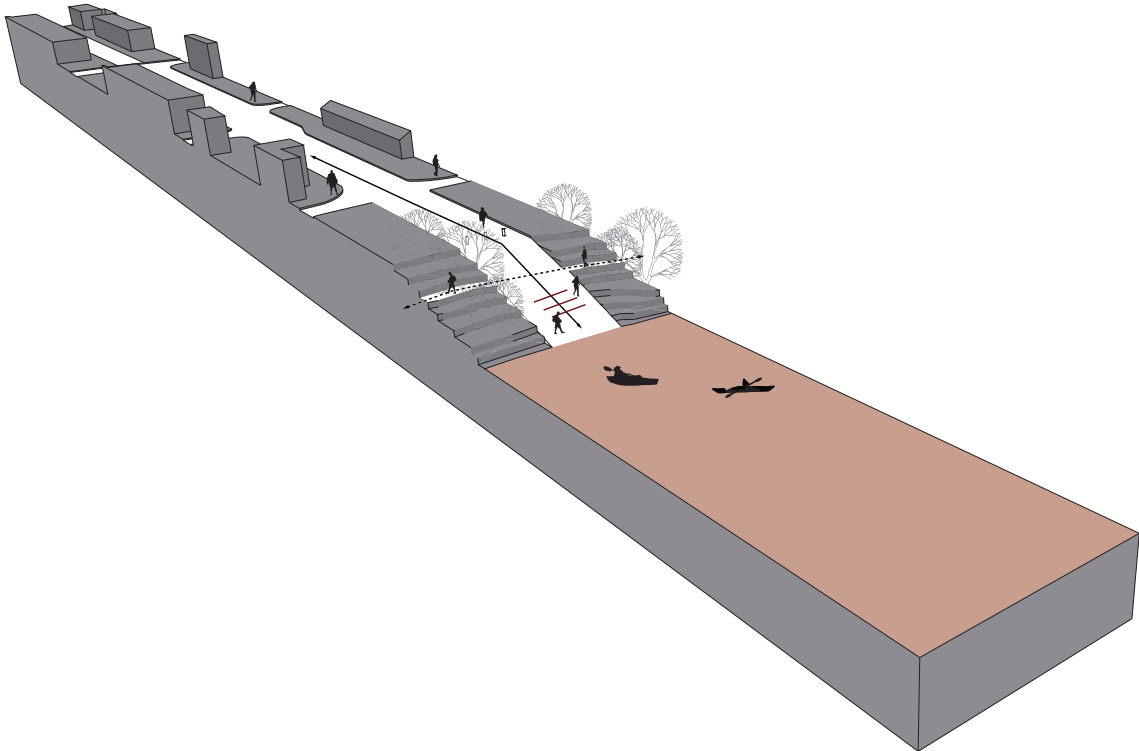
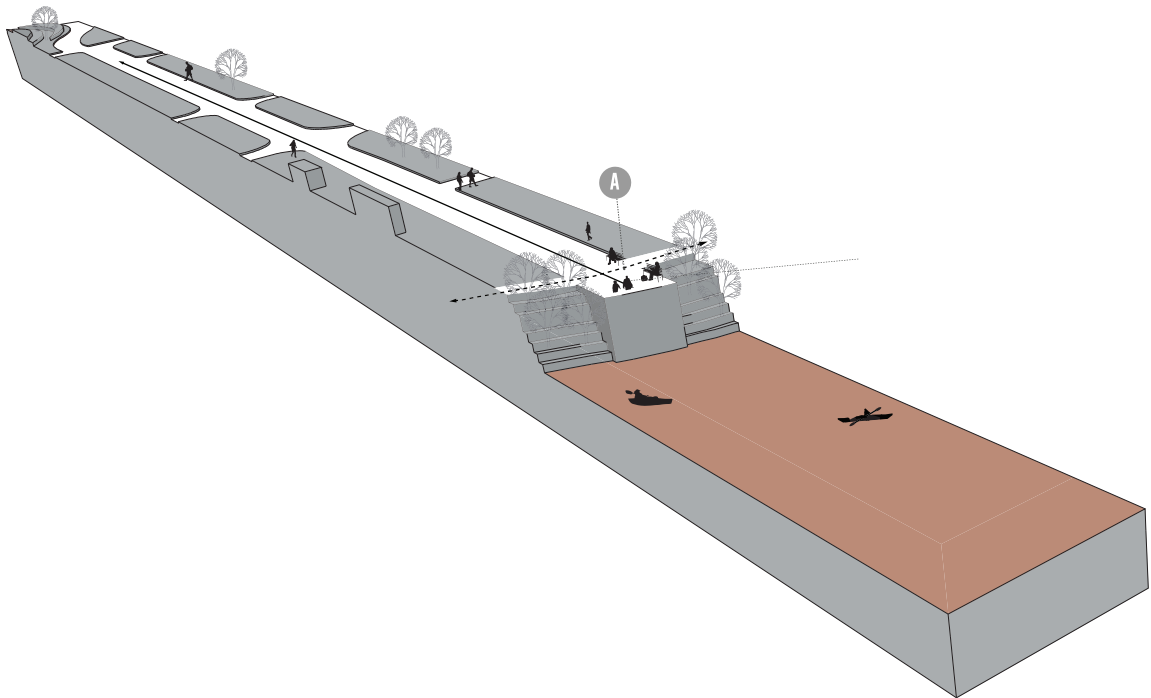
**TYPE 2**

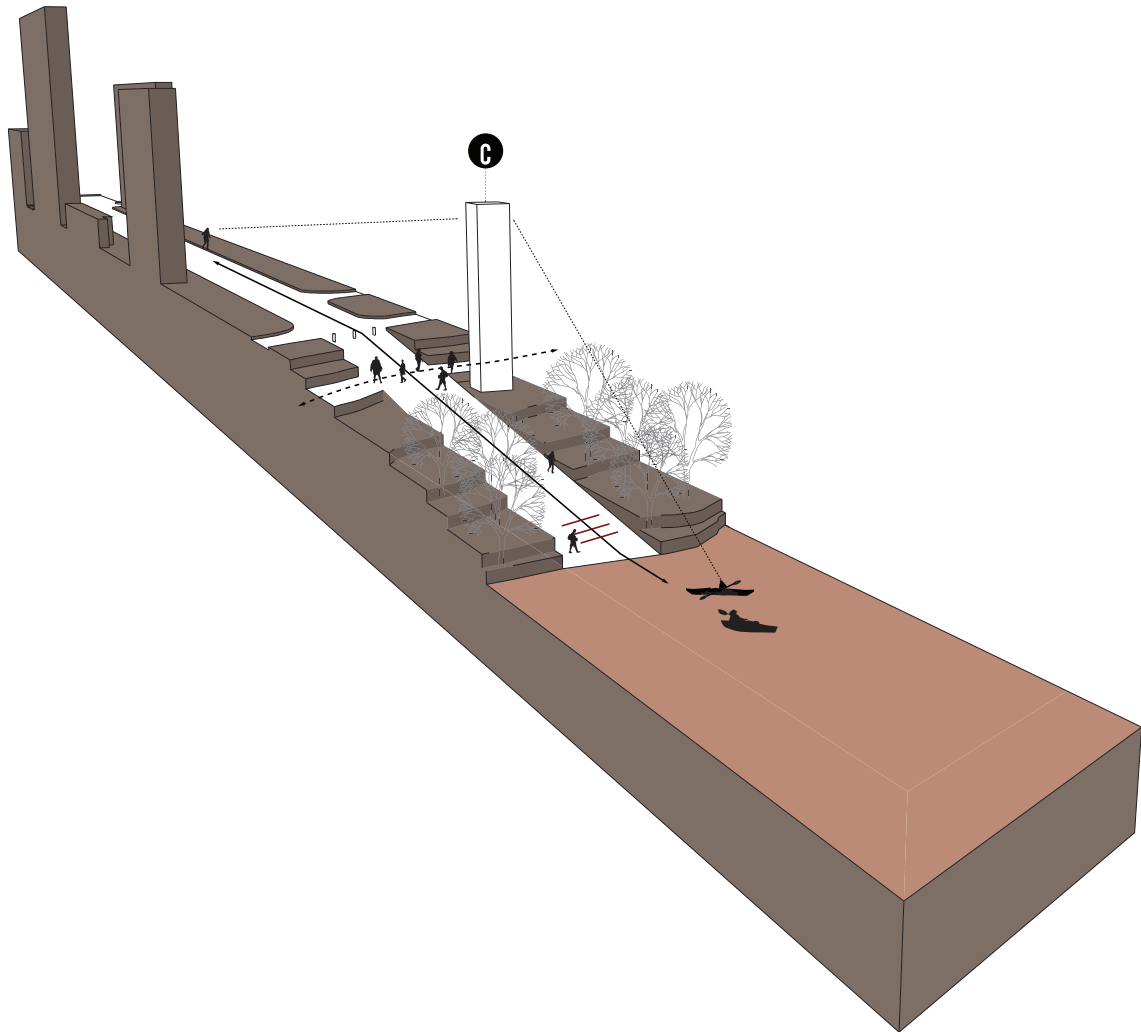
Figure 35.

Reintroducing perpendicular paths, adding transitions from the city to the river, and providing accessibility to the river's edge.

**TYPE 3**

The perpendicular path terminates at a 'lookout' to key views of the city and the river.

Figure 36.

**TYPE 4**

'The tower' acts as a visual reference point from the city and the river, and re-establishes the river as a transportation network.

Figure 37.

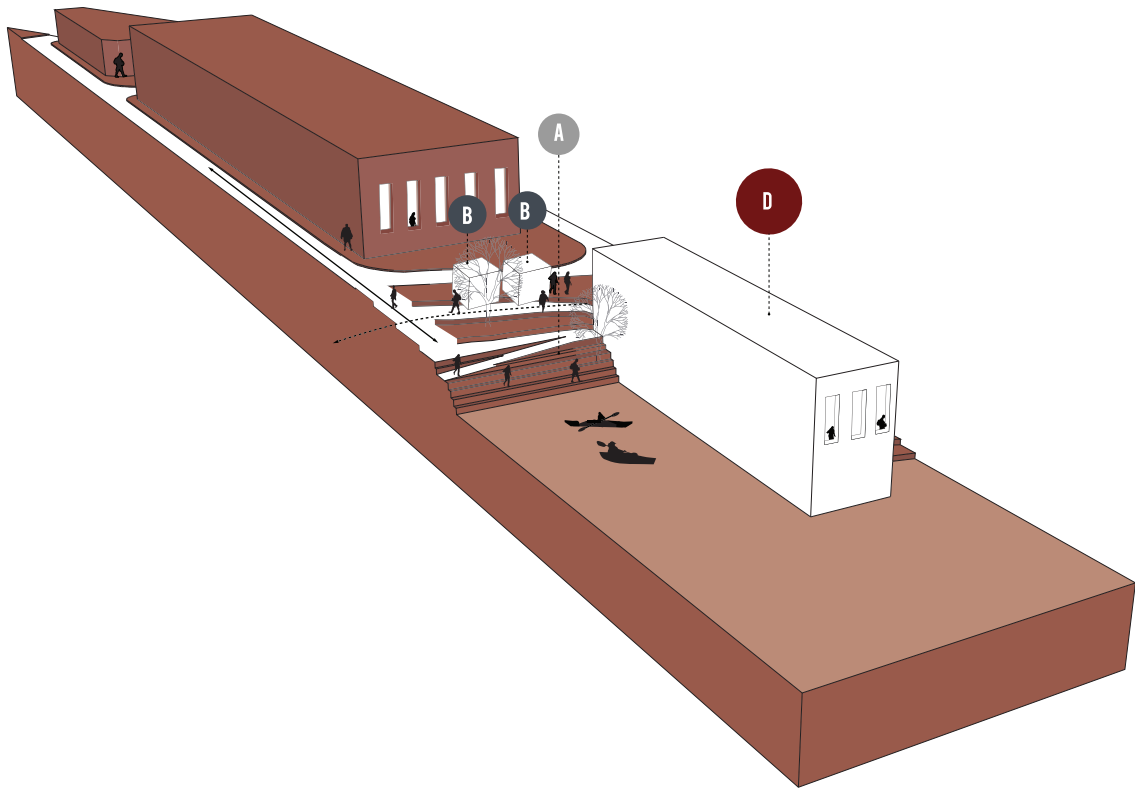
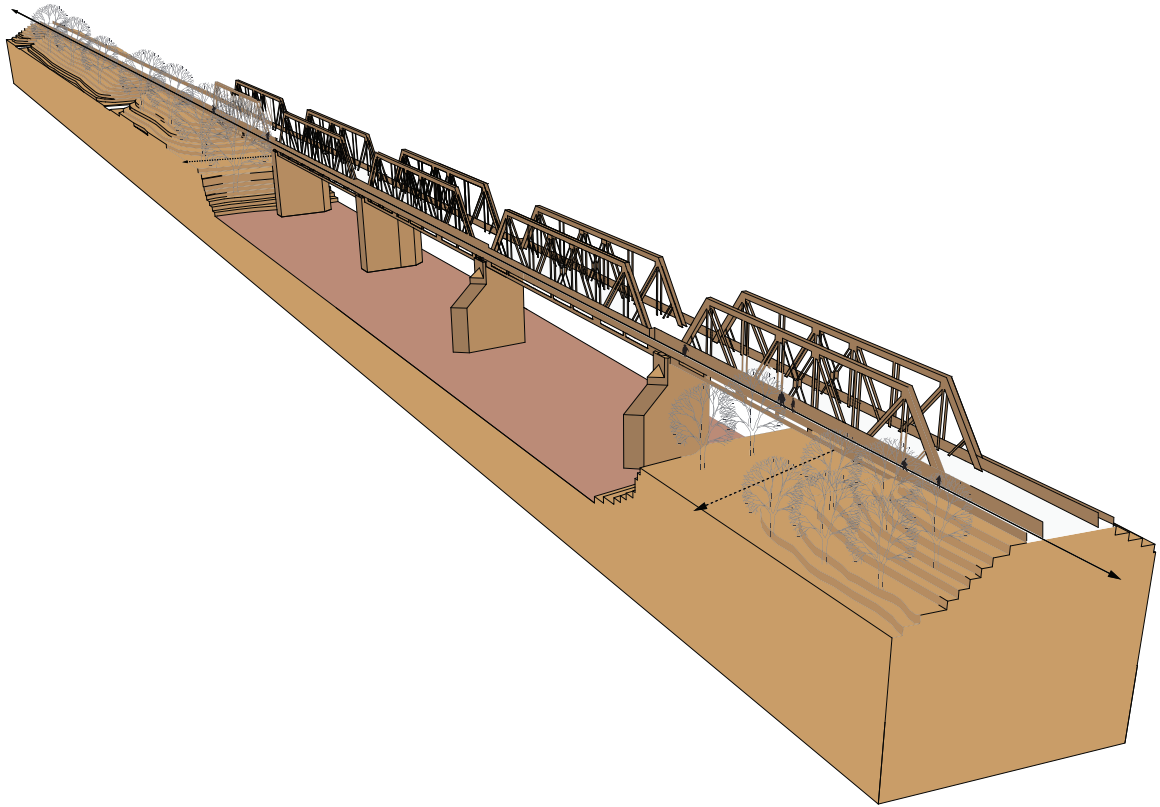
**TYPE 5**

Figure 38.

The city is brought to the river, and a 'hub' of centres is created to draw the public to the river. These can also be locations to rent transportation equipment.

**TYPE 6**

The bridge connects both sides of the river and eliminates dead ends along the path.

Figure 39.

CHAPTER 4: THE SECTIONAL TOOLKIT APPLIED TO THE CITY

Application at the City Scale

The sectional tools are applied at the city scale by redividing the city using the historic river lot lines, represented by the city's streets today. The sectional tools adapt to different areas of the city, and when applied incrementally, imply how the rivers may develop over time (see figure 40).

Sectional tool type one is used for the majority of land beside the river, maintaining the existing continuous parallel pathway and park with new pavilions along it (see figures 41-44). Sectional tool type two is used to reconnect perpendicular streets to the water wherever possible. Sectional tool type three is used where views are most impressive, to the downtown skyline and to the Provencher bridge and the Human Rights Museum. Sectional tool type four is used to re-establish the river as a transportation network, where one tower can be seen from the first. Sectional tool type five is used to bring the city to the water at The Forks, the legislative building, the Alexander Docks, Osborne Village, and at the St. Boniface cathedral. These may be more dense or more spread out developments, depending on the conditions of the adjacent neighbourhood or city district. Sectional tool six is shown where existing bridges connect both sides of the river, where new bridges may be added, or where rail bridges have pedestrian access added to them.

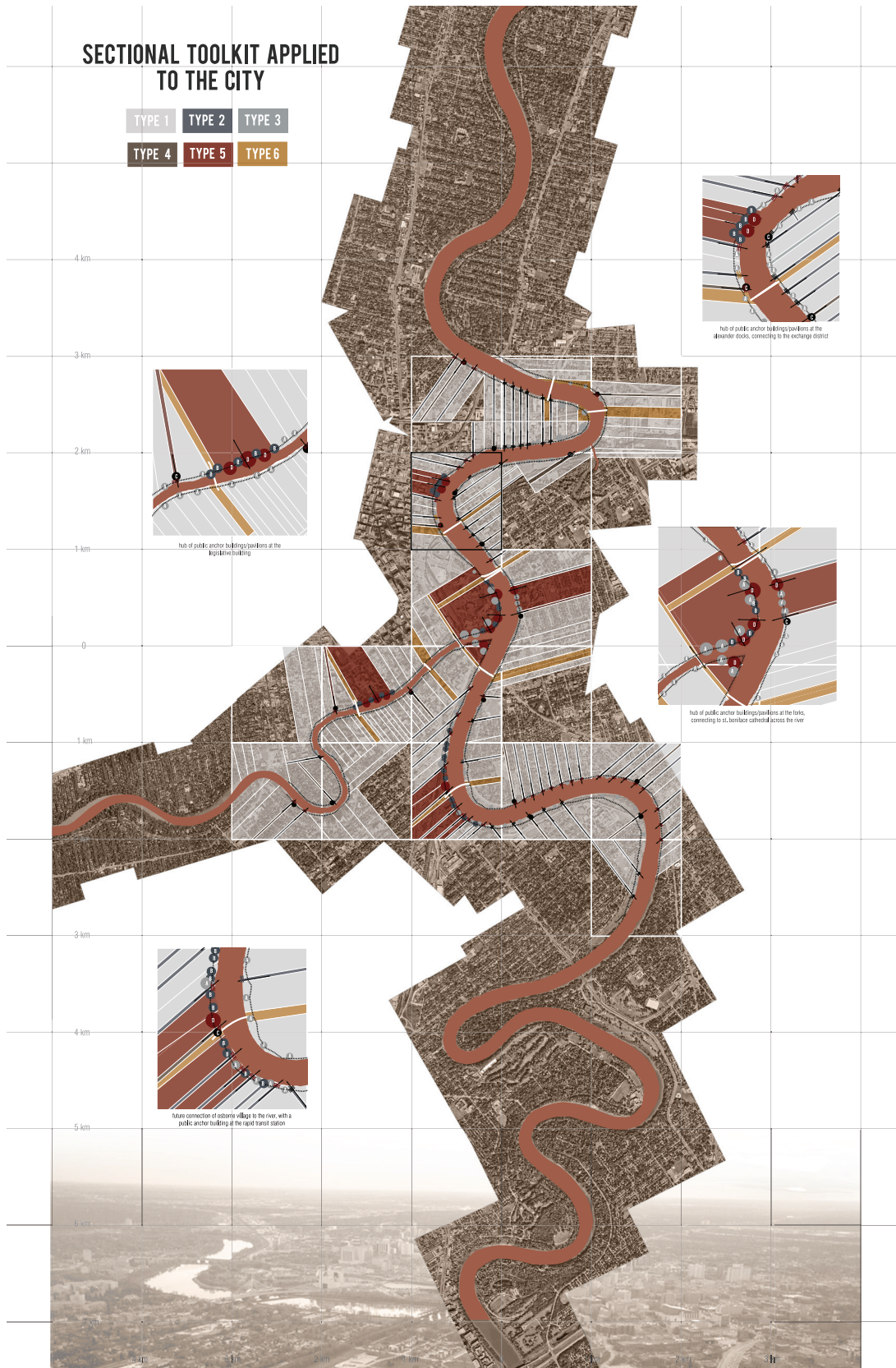


Figure 40. How the sectional toolkit is applied to the city.

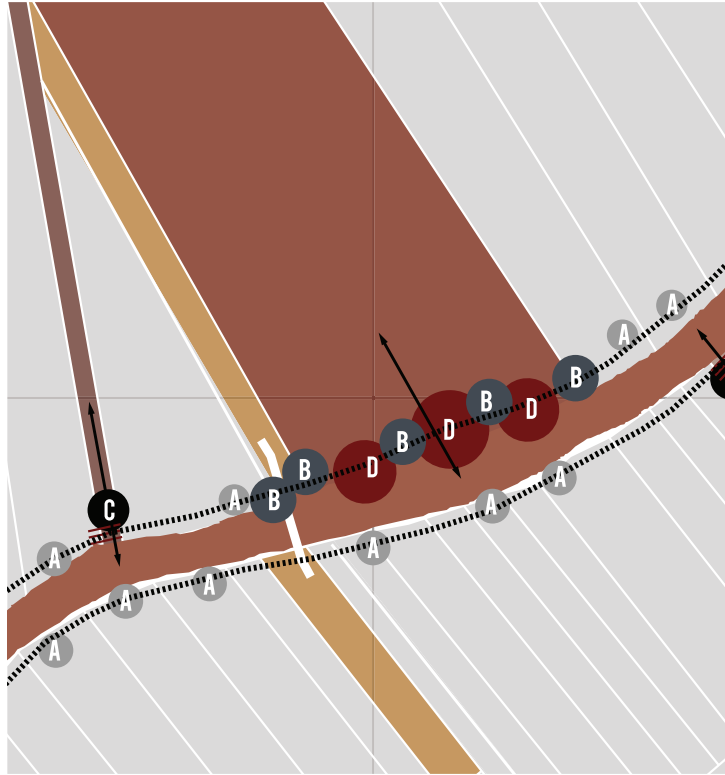


Figure 41. A hub of public anchor buildings/pavilions at the legislative building

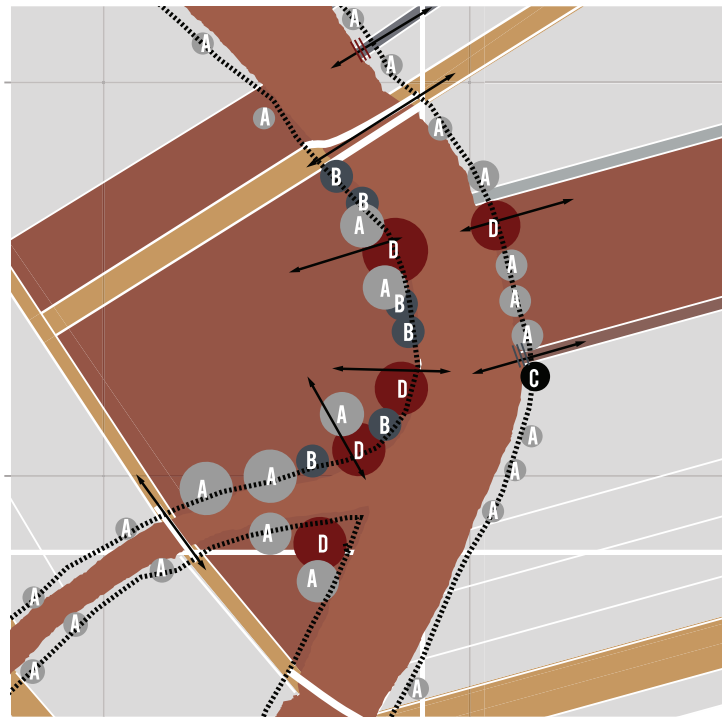


Figure 42. A hub of public anchor buildings/pavilions at The Forks, connecting to the St. Boniface cathedral across the river

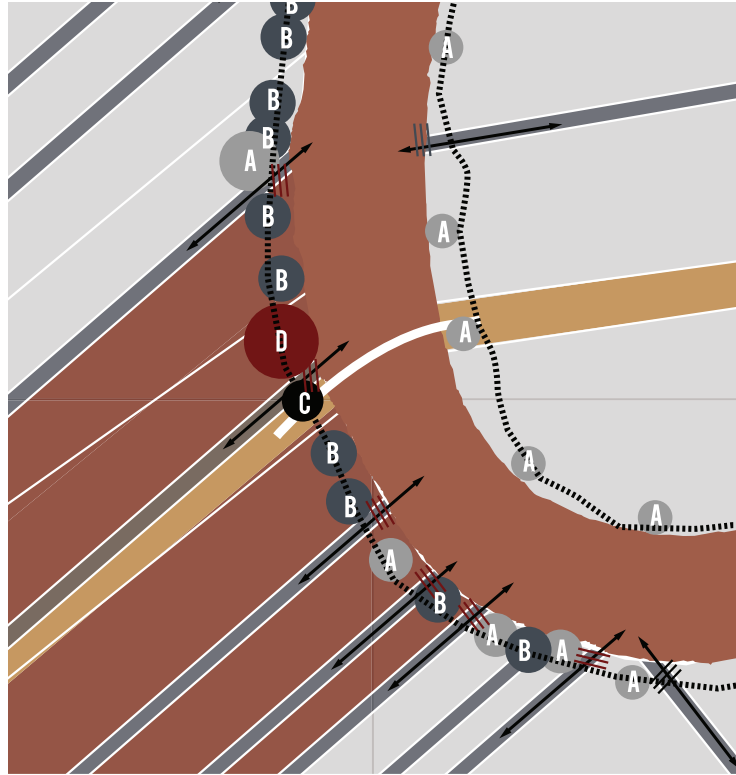


Figure 43. The future connection of Osborne Village to the river, with a public anchor building at the rapid transit station

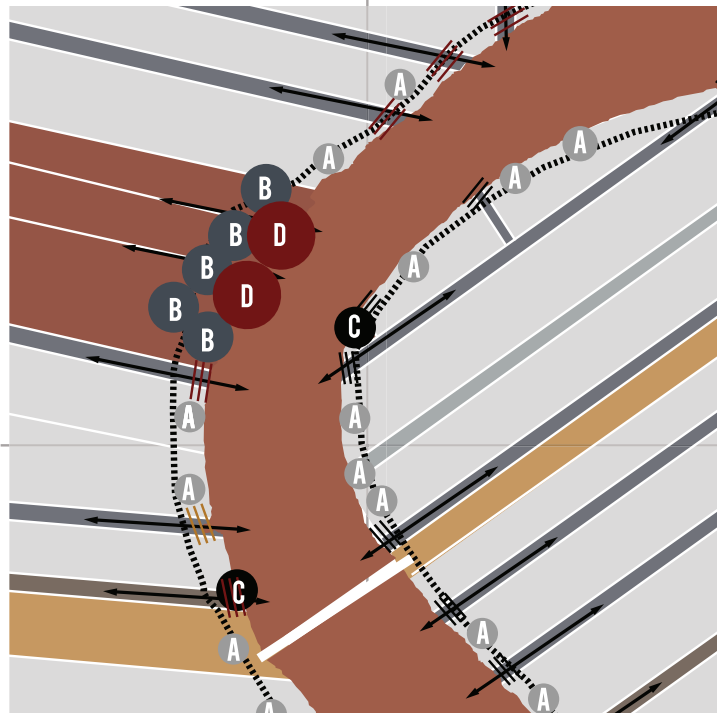


Figure 44. A hub of public anchor buildings/pavilions at the Alexander Docks, connecting to the Exchange District

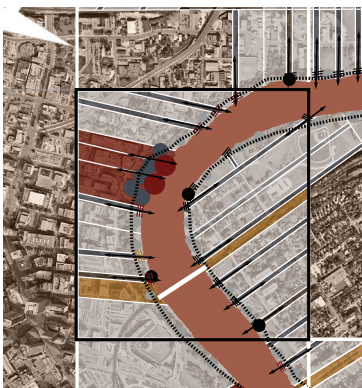


Figure 45: (shown for reference)
The sectional toolkit at the selected site (see Figure 40)

- Character/Historic
- Manufacturing
- Community
- Residential
- Park
- Educational/Institutional

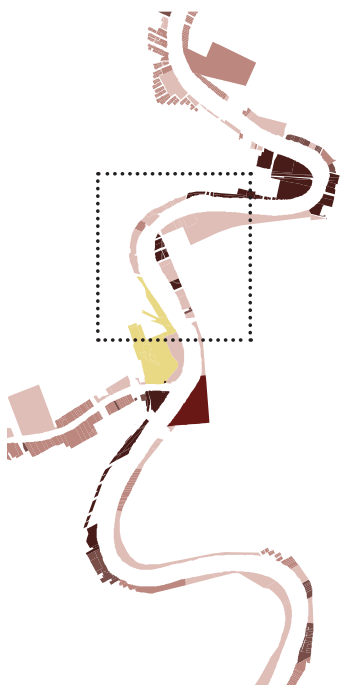


Figure 46. Map of zoning adjacent to the city's Rivers, showing the selected site in context. (Adapted from The City of Winnipeg 2017)

Application at the Selected Site

A site was selected to show how all of these sectional tools can work together (see figure 48). The chosen site contains a large variety of zones found along the river (commercial, residential and industrial zones, both urban and suburban, see figure 46). The site's location is also next to the city's historic Exchange District or warehouse district. The Exchange District is the commercial core and the heart of downtown. There are a lot of historic brick and tyndall stone warehouse buildings in this area.

The site also includes the city's former Alexander Docks, which was built in 1929 for the steamboats bringing goods to the nearby industrial area of the city (Manitoba Historical Society 2017). Today the docks have fallen apart, are structurally unsafe and abandoned. A new hotel and restaurant next to the docks are some of the only buildings in the city built near the rivers, but they both avoid interaction with the water (see figure 47). Adjacent to the site are historic warehouses, warehouses that have been converted into apartments, and new apartment buildings.



Figure 47. The existing site (image from Google Earth)
Legend: #1 - restaurant, #2 - hotel, #3 - existing docks
#4 - warehouse, #5 - apartment

The urban axo drawing (figures 48-54) shows how the sectional tools are used at the site. The existing parallel path and park remain in many sections, with new centres for small outdoor gatherings and pavilions. Tower sections are located at Mcdermot Avenue and Tache Avenue, feeding key streets from adjacent neighbourhoods and districts into the new river transportation network. When traveling down the river, the next tower can be seen from the first. A lookout from St. Boniface faces a view of the downtown skyline. Pedestrian access is added to the existing rail bridge to connect both sides of the river. The city is brought to the water and a public 'hub' is created at the Alexander Docks using a concentration of many small pavilions and two larger public anchor buildings.

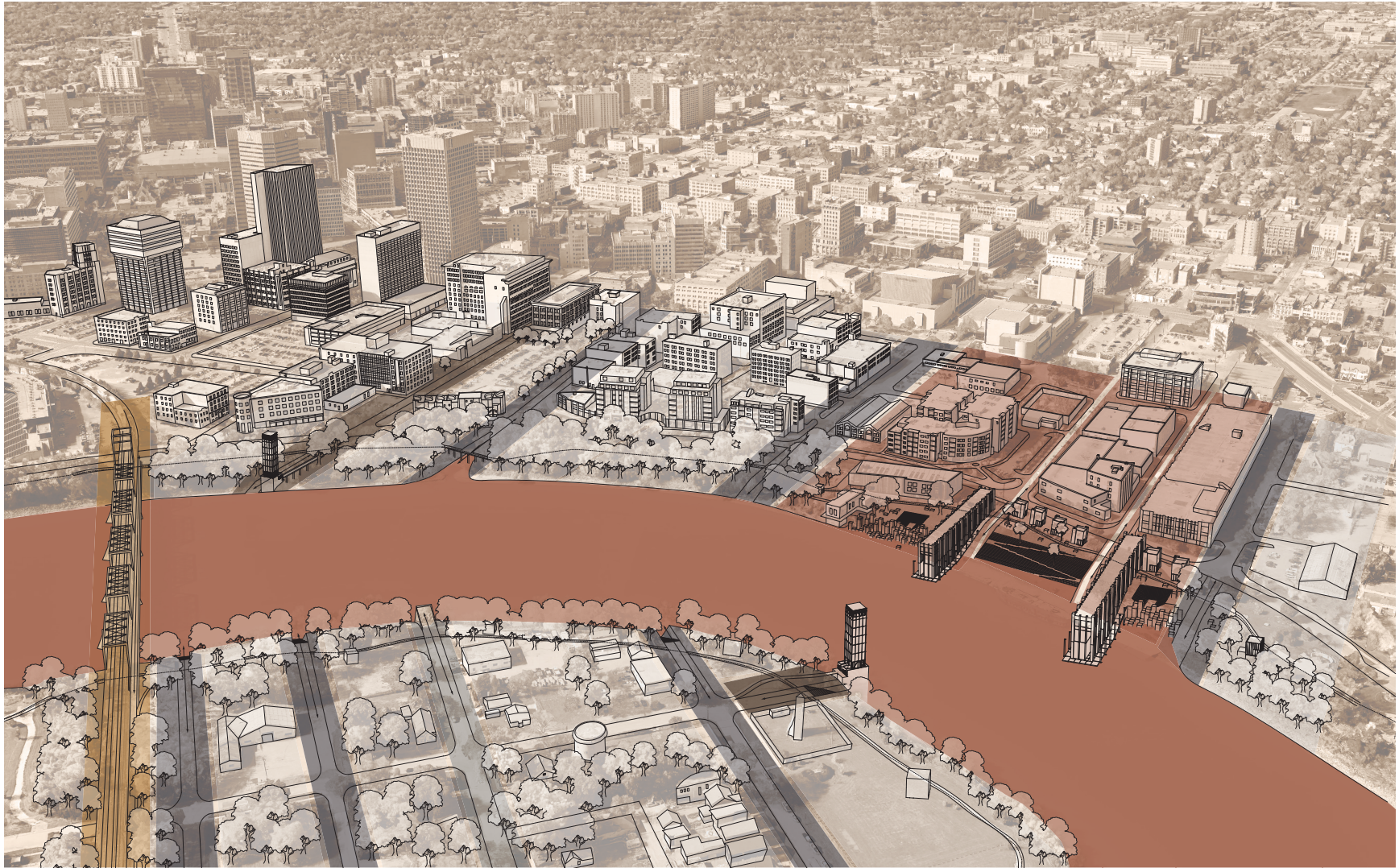


Figure 48. An urban axonometric drawing showing the sectional toolkit applied to the selected site.
(see following pages for details)



Figure 49. Type 1 at the site, with new pavilion along the existing parallel path.



Figure 50. Type 2, James Avenue is continued to the water, with a ramp down to the river's edge.

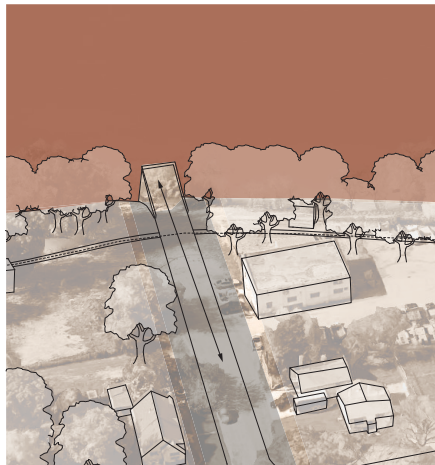


Figure 51. Type 3, a lookout facing the downtown skyline.

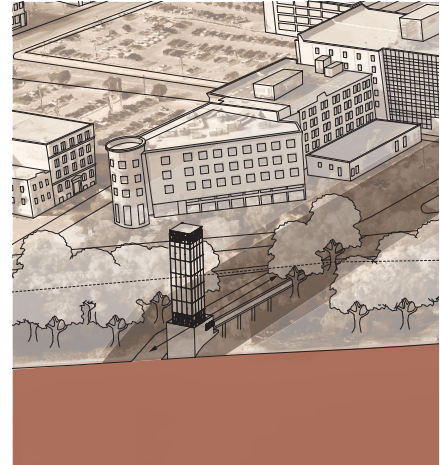


Figure 52. Type 4, the tower is shown at Mcdermot Avenue, a key street reaching across Main Street to the heart of the Exchange District.

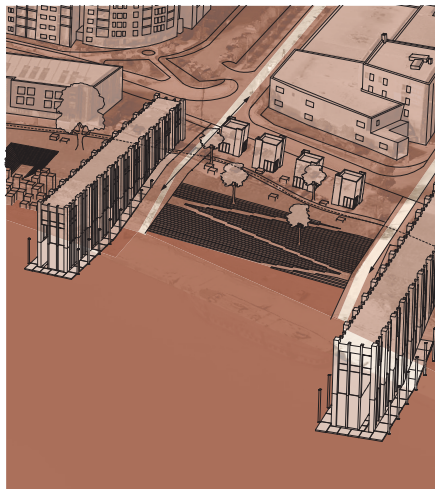


Figure 53. Type 5, the city is brought to the water at the Alexander Docks.



Figure 54. Type 6, pedestrian access is added to the existing rail bridge.

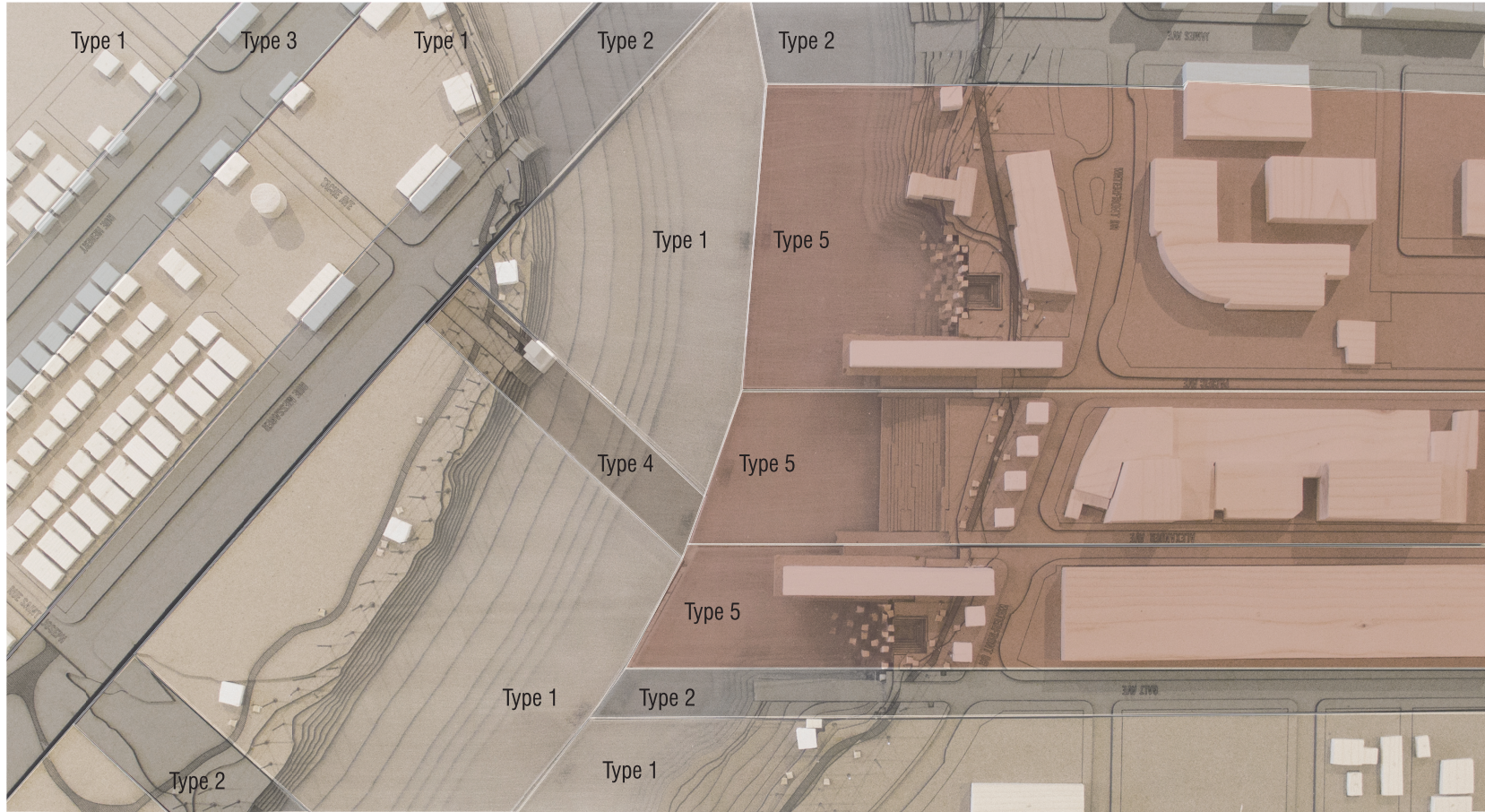


Figure 55. Site model showing application of sectional toolkit.

CHAPTER 5: DESIGN

Precedent Study: Grant's Old Mill

The construction of all of the 'centres' at this site would look industrial, constructed with metal, brick and tyndall stone, which creates a sense of physical continuity to the historically industrial warehouse district of the city. The way that these buildings meet the river draws from a historic and local precedent, known as Grant's Old Mill. Grant's Old Mill was constructed in 1829 along Sturgeon Creek, which runs into the Assiniboine River (Manitoba Historical Society 2014). The mill's stereotomic base, built from the city's tyndall stone, protects it from the large, moving pieces of ice in the spring (see figures 56-58). The tectonic, wood structure sits safely above the spring ice level. The towers, pavilions, and public anchor buildings at this portion of the river are all constructed in this manner.



Figure 56. Grant's Old Mill, high river level. (Fraser 2011)



Figure 57. Grant's Old Mill, low river level. (Hainstock 1980)



Figure 58. Spring ice conditions on the Red River. (Hughes 2011)



(figure 49 shown again for reference)

Sectional Tool 1 at the Site: The Parallel Path and the Pavilion

Pavilions are added along the existing parallel path at the site. They are small-scale buildings to house programming such as: retail spaces, coffee shops, exhibition spaces, or artist workshops. At this site, these programs would help to provide the everyday amenities that are currently inadequate in this area of the city to residents living in the apartments nearby, and to the artist community located in Point Douglas (the neighbourhood adjacent to the site).

The pavilions at this site are designed using Grant's Old Mill as a precedent, with a solid tyndall stone base that raises the tectonic structure above higher than the level of spring ice. The metal facade relates to the industrial history of the site and to the adjacent historic warehouses and rail bridges.

The pavilion is set off of the parallel path in order to have more interaction with the river, especially during the spring (see figures 60 and 61). The pavilion is surrounded by water during this period (see figure 59).



Figure 59. The pavilion - view from the parallel path (spring river level shown)

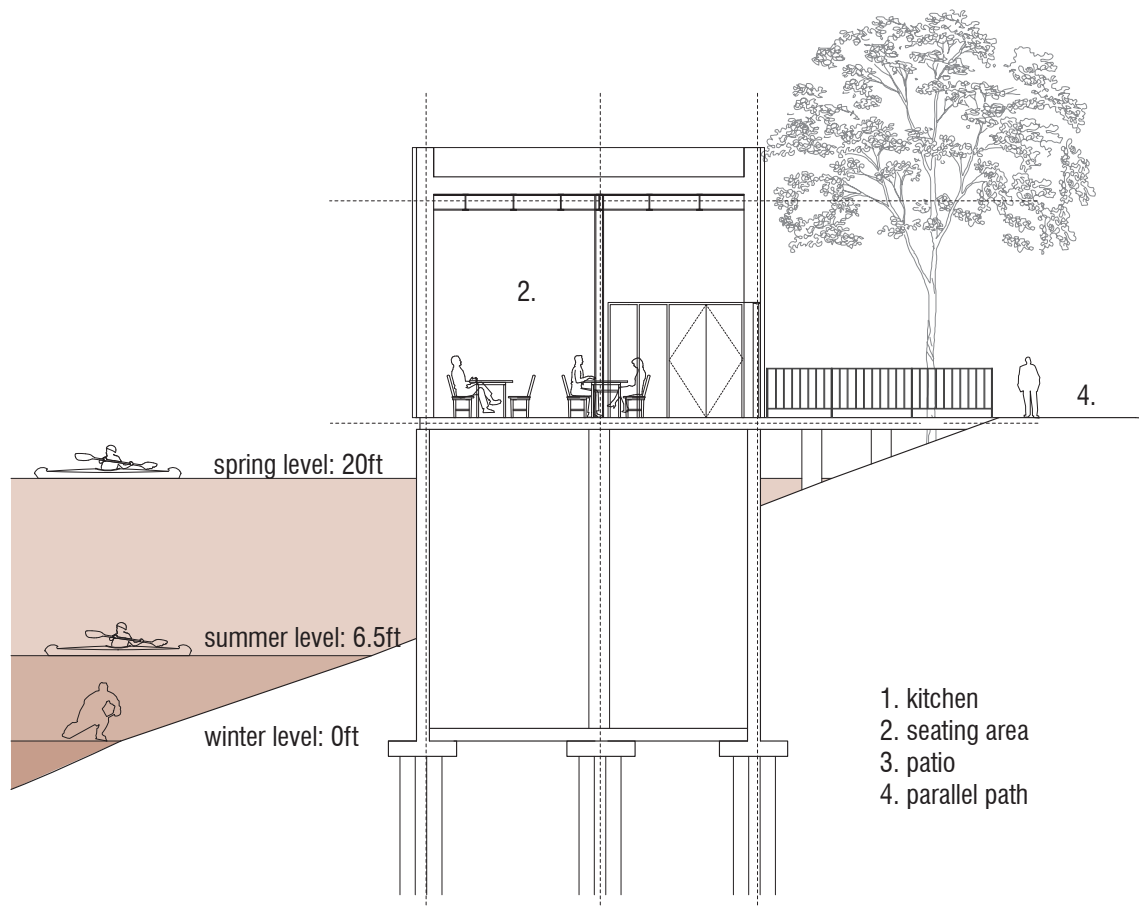


Figure 60. Section of the pavilion, showing all seasonal river levels and connection to the parallel path.

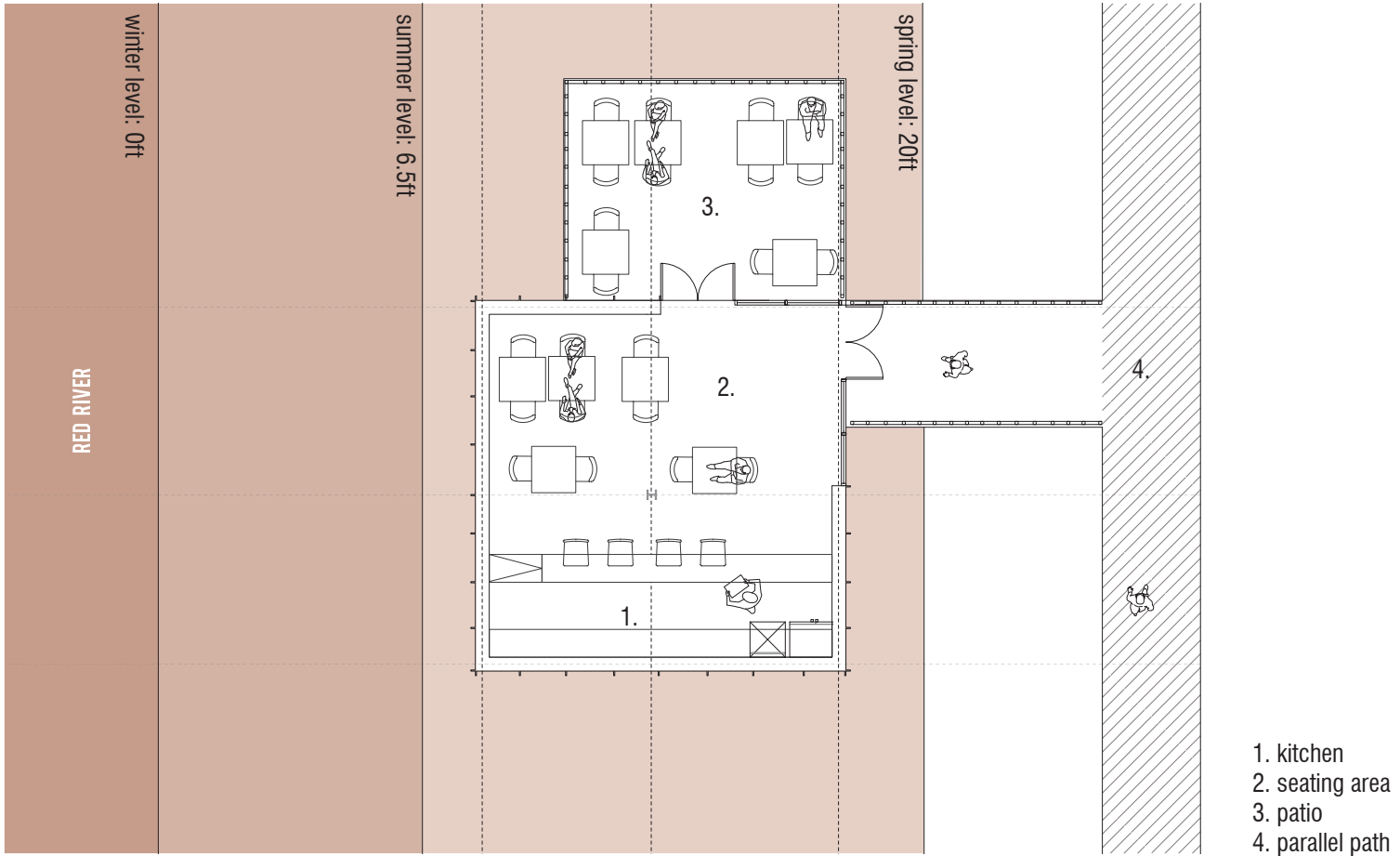


Figure 61. Floor plan of the pavilion, showing all seasonal river levels and connection to the parallel path.



(figure 52 shown again for reference)

Sectional Tool 4 at the Site: The Tower

The towers act as a visual reference point in the landscape, visible from both the city and from the river (see figures 66 and 67). They mark spots where equipment can be rented along the new river transportation network.

In the spring and summer, kayaks and canoes are stored in the base of the tower (see figures 62 and 63). The adjacent transition to the river next to the tower allows for people to access the river's edge, as a place to get in the kayak or canoe from the city, or as a place to pull the kayak or canoe out of the water and tow them back to the tower.

In the winter, the towers act as heated spaces of refuge to rest and to warm up when traveling along the city's river trail (see figures 64 and 65). This gives a sense of safety in extreme weather conditions, since one tower can be seen from the next (see figure 68). Equipment like skates and skis are stored inside the heated portion of the building, with a small bench to rest and put on skates.

On the outside of the insulated portion of the tower, a steel staircase leads to a lookout on the top floor, which would be lit so it could be seen at night (see figure 68).

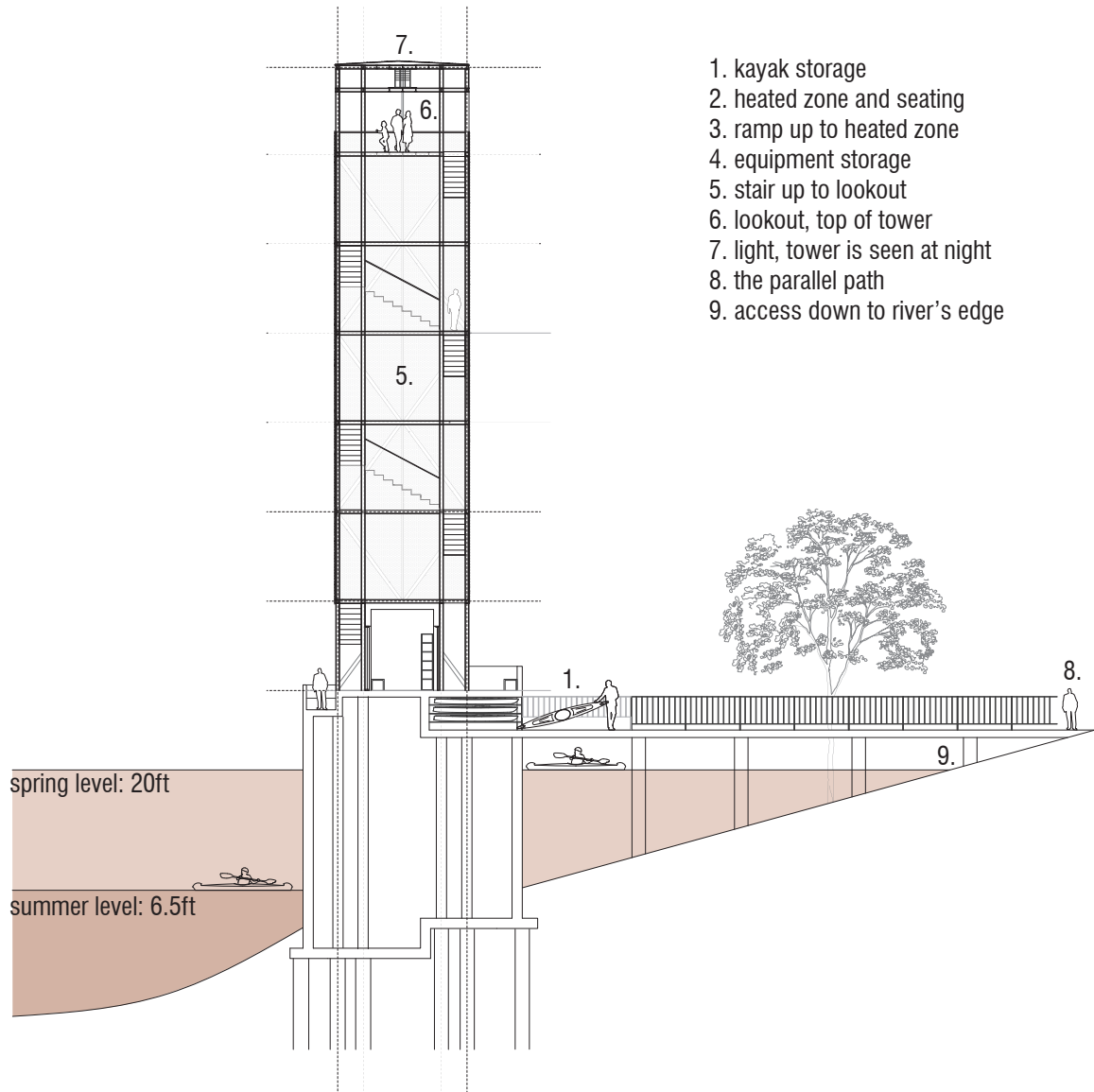


Figure 62. The tower - section showing spring and summer condition

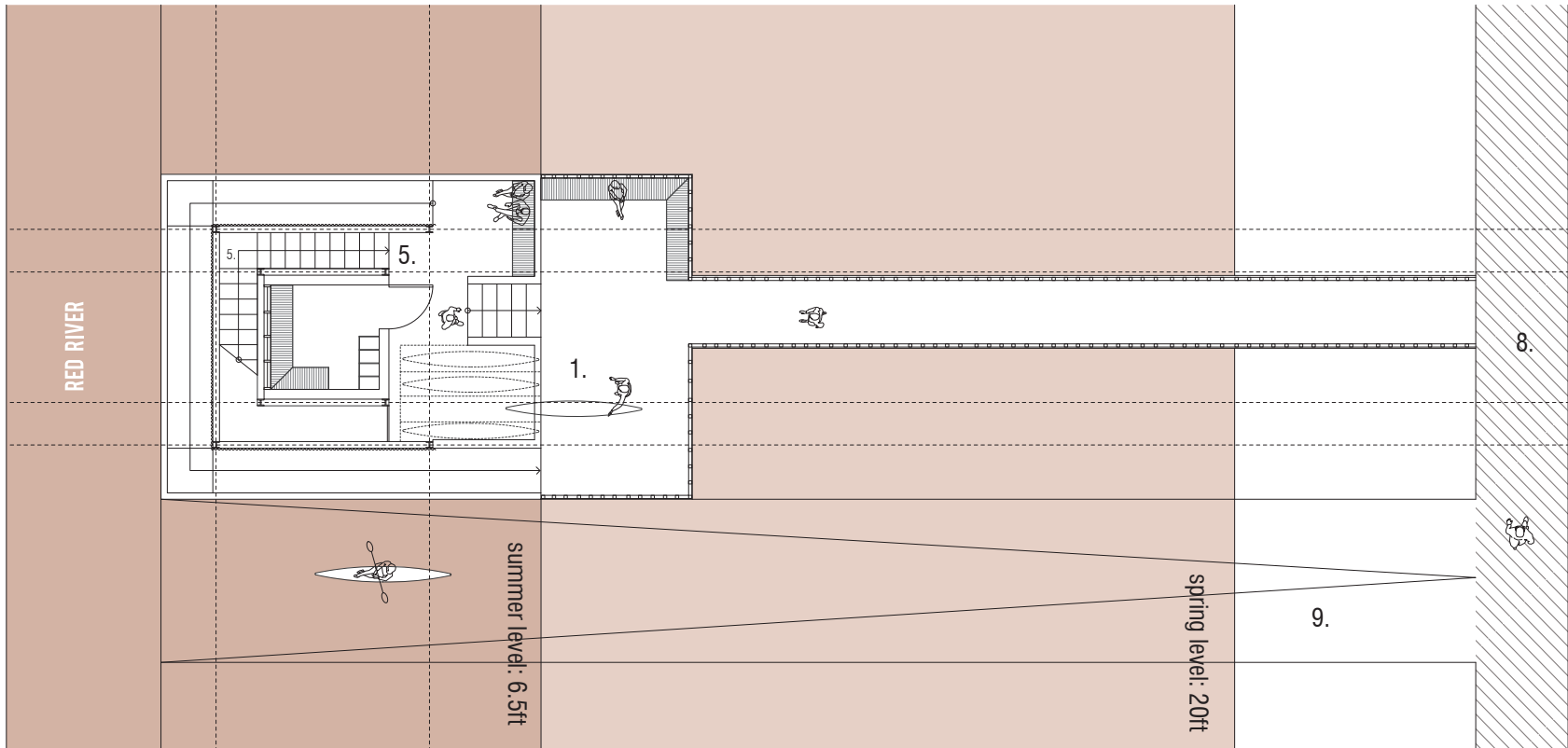


Figure 63. The tower - floor plan showing spring and summer condition.

1. kayak storage
2. heated zone and seating
3. ramp up to heated zone
4. equipment storage
5. stair up to lookout
6. lookout, top of tower
7. light, tower is seen at night
8. the parallel path
9. access down to river's edge

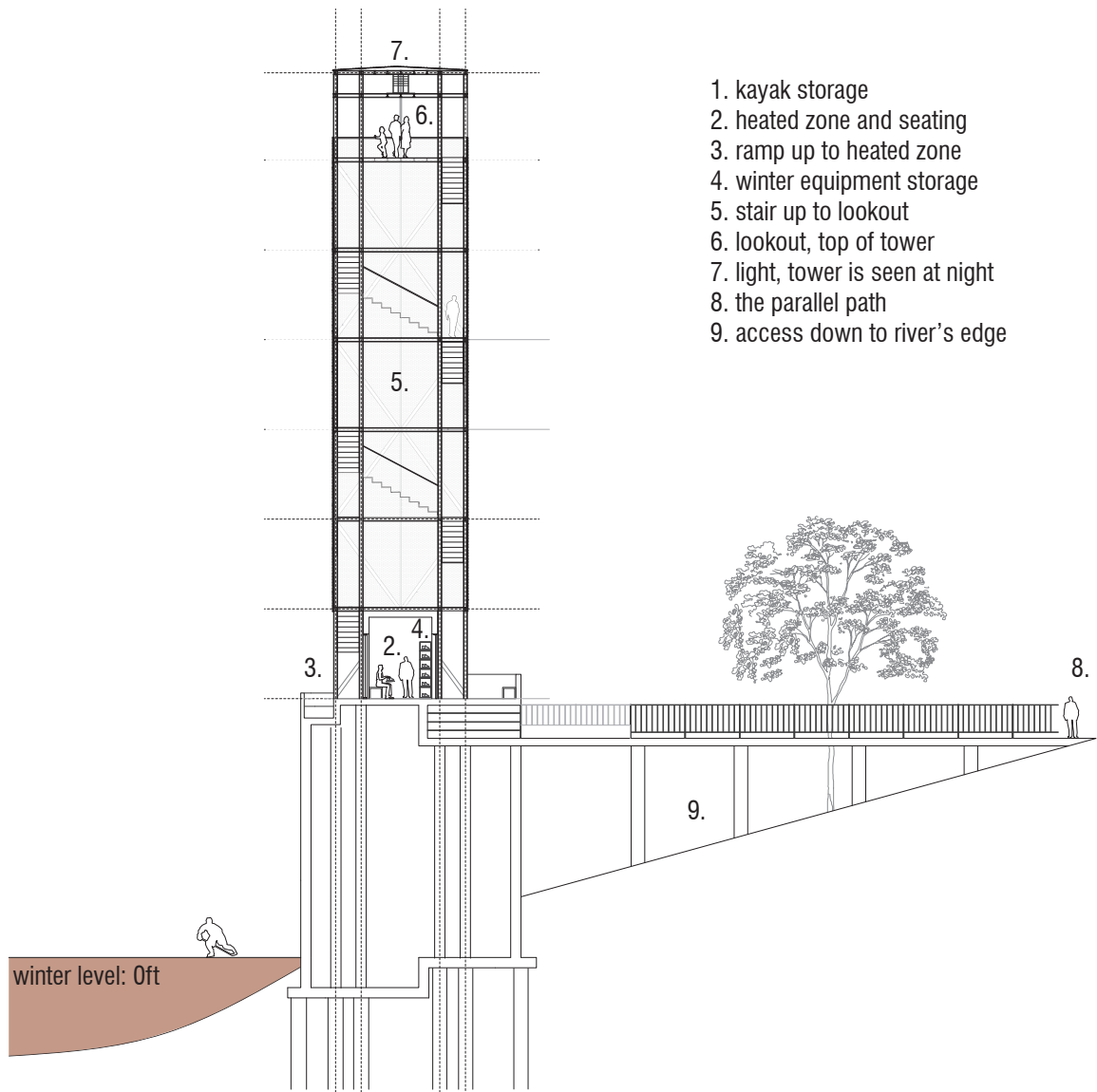


Figure 64. The tower - section showing winter condition

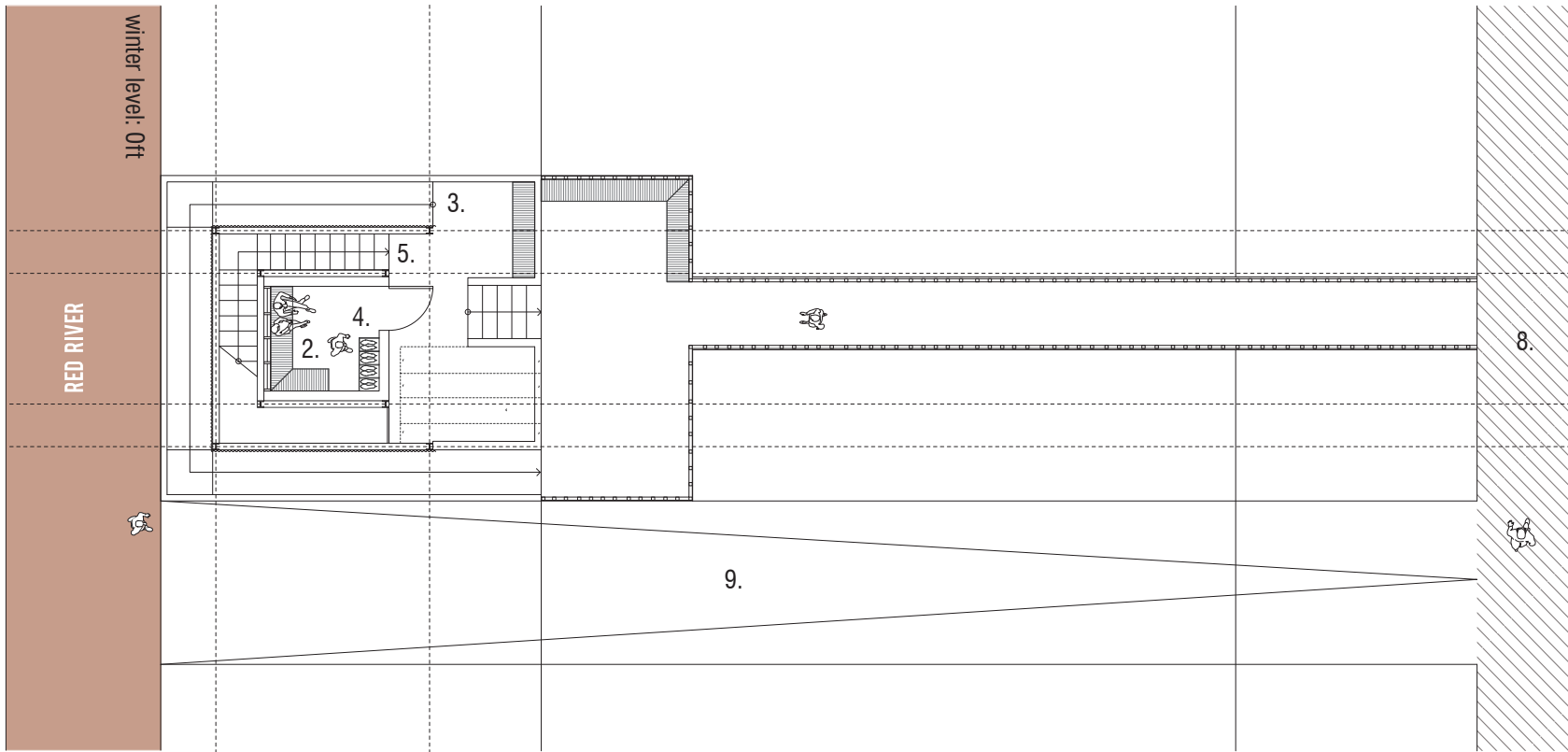


Figure 65. The tower - floor plan showing winter condition.

1. kayak storage
2. heated zone and seating
3. ramp up to heated zone
4. winter equipment storage
5. stair up to lookout
6. lookout, top of tower
7. light, tower is seen at night
8. the parallel path
9. access down to river's edge



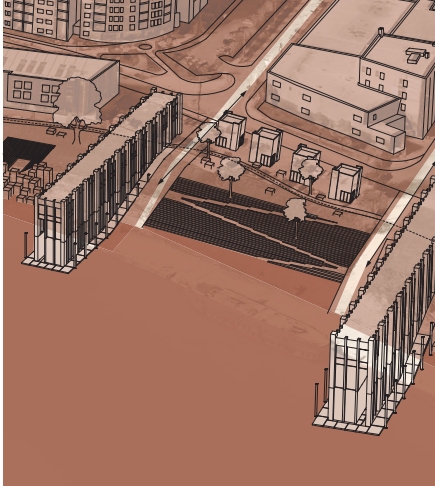
Figure 66. The tower, the perpendicular path, and the transition - view from the city



Figure 67. The tower and the transition to the river's edge - view from the river, summer river level. Note that the next tower can be seen from the first, providing a sense of safety when traveling along the river trail in the winter time in extreme weather conditions.



Figure 68. The tower and the transition to the river's edge - view from the river, winter condition. Note that the next tower can be seen from the first, providing a sense of safety when traveling along the river trail in the winter time in extreme weather conditions.



(figure 53 shown again for reference)

Sectional Tool 5 at the Site: The City is Brought to the Water (The Alexander Docks)

In order to bring the city to the water at the Alexander Docks site, two new public anchor buildings and six pavilions are added. They match the height of the adjacent warehouse buildings to create a more urban condition at Waterfront Drive (see figure 73). Between these buildings, protected courtyards with stairs and steps provide access and interaction with the water (see figure 70). Stepped flooding squares and tyndall stone blocks play with the river's water levels, as some blocks disappear and reappear depending on the season (see figures 74 and 75). The main courtyard has a combination of a stair and ramp that also works with different levels, and provides a place to watch boats come and go in the spring and summer, or to watch a hockey game in the winter (see figures 74 and 75). Alexander, Pacific and Galt Avenues are continued to the water, and can be used to launch boats in the spring and summer (see figure 71 and 75).

While the public anchor buildings do have a stereotomic base, like Grant's Old Mill, details in their construction allow for more interaction with the river. The buildings can be accessed from the city at street level, but also from the river at every seasonal level using a combination of a staircase and a floating dock, or the staircase can be accessed directly from the ice level during the winter (see figures 81 and 82). Small floating transportation equipment lockers fit into some of the solid vertical walls in the base of the market, rising with the floating docks when the river levels are high. In the spring, summer, and fall, they would be

kayak and canoe lockers for public use. They would sit on the ice in the winter, as a place to lock up your skates, cross country skis, or snow shoes.

The main portion of the public anchor buildings act as markets, with a large open space in the middle for temporary vendors to sell food (see figure 80). Downtown Winnipeg does not currently have a grocery store and the markets could fill this need. There are permanent retail spaces on the second floor, and a small coffee shop or restaurant faces Waterfront Drive on the ground level, with garage doors that open to a street level patio in the spring and summer (see figure 78). The parallel river path runs through a covered opening in the building at ground level between the coffee shop and main market space (see figures 72, 78 and 79).

Diagrams showing key site moves at the Alexander Docks

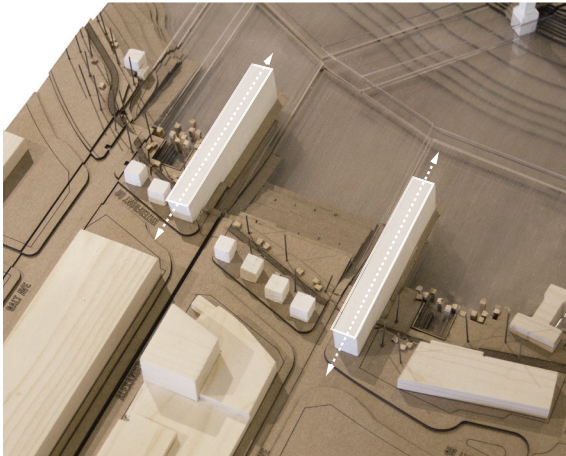


Figure 69. Public anchor buildings provide pedestrian access through the site, from city to river.

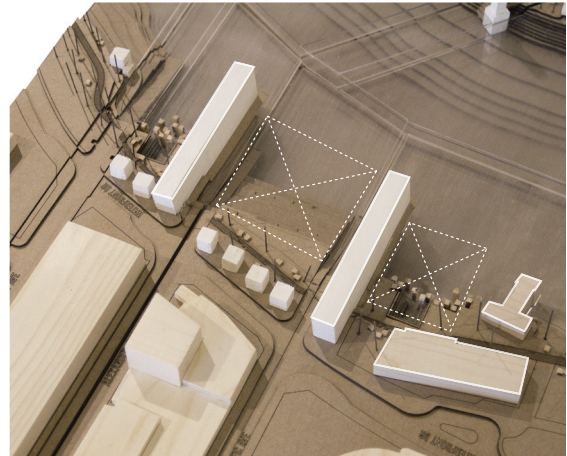


Figure 70. Public anchor buildings create protected courtyards between them and with the adjacent restaurant and hotel.

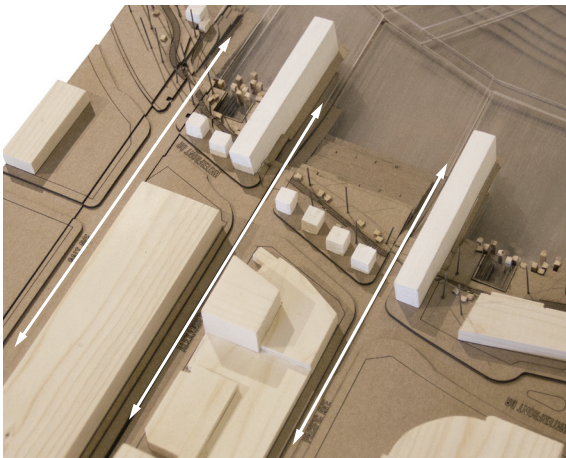


Figure 71. Galt Avenue, Alexander Avenue, and Pacific Avenue are continued to the Red River.

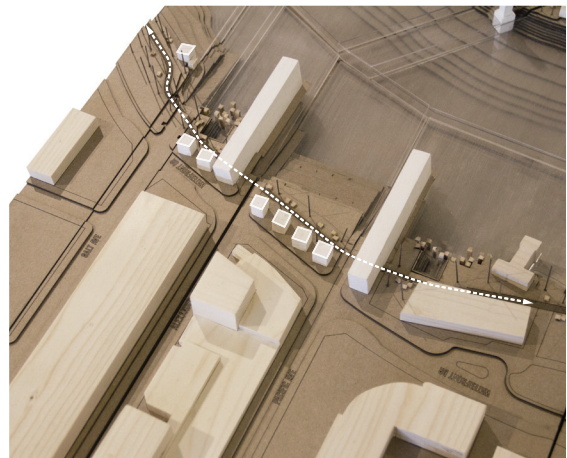


Figure 72. The parallel path is continued through the site and through the public anchor buildings, with new pavilions along it.

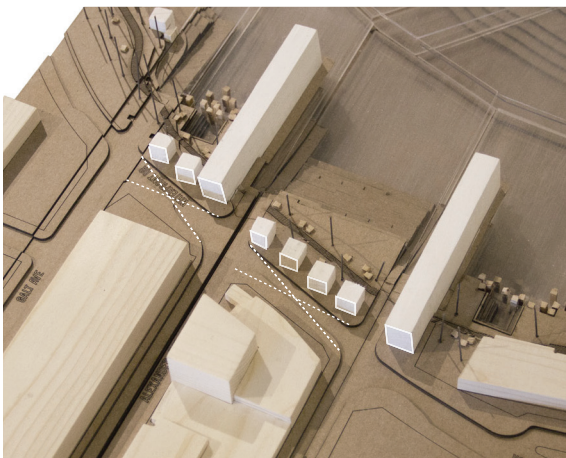


Figure 73. Pavilions and anchor buildings match the height of adjacent warehouse buildings, creating a more urban condition along waterfront drive.

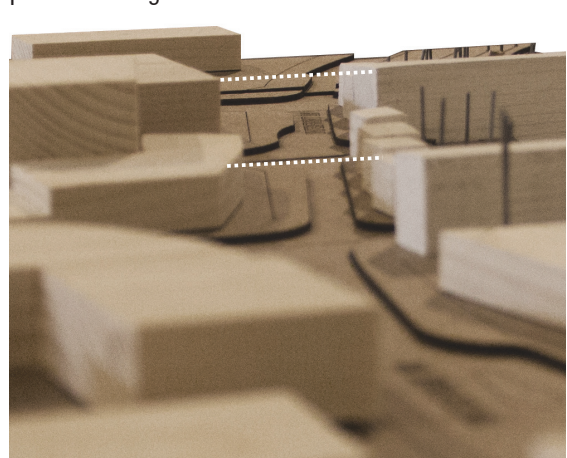




Figure 74. Site axonometric drawing of the Alexander Docks, winter condition.

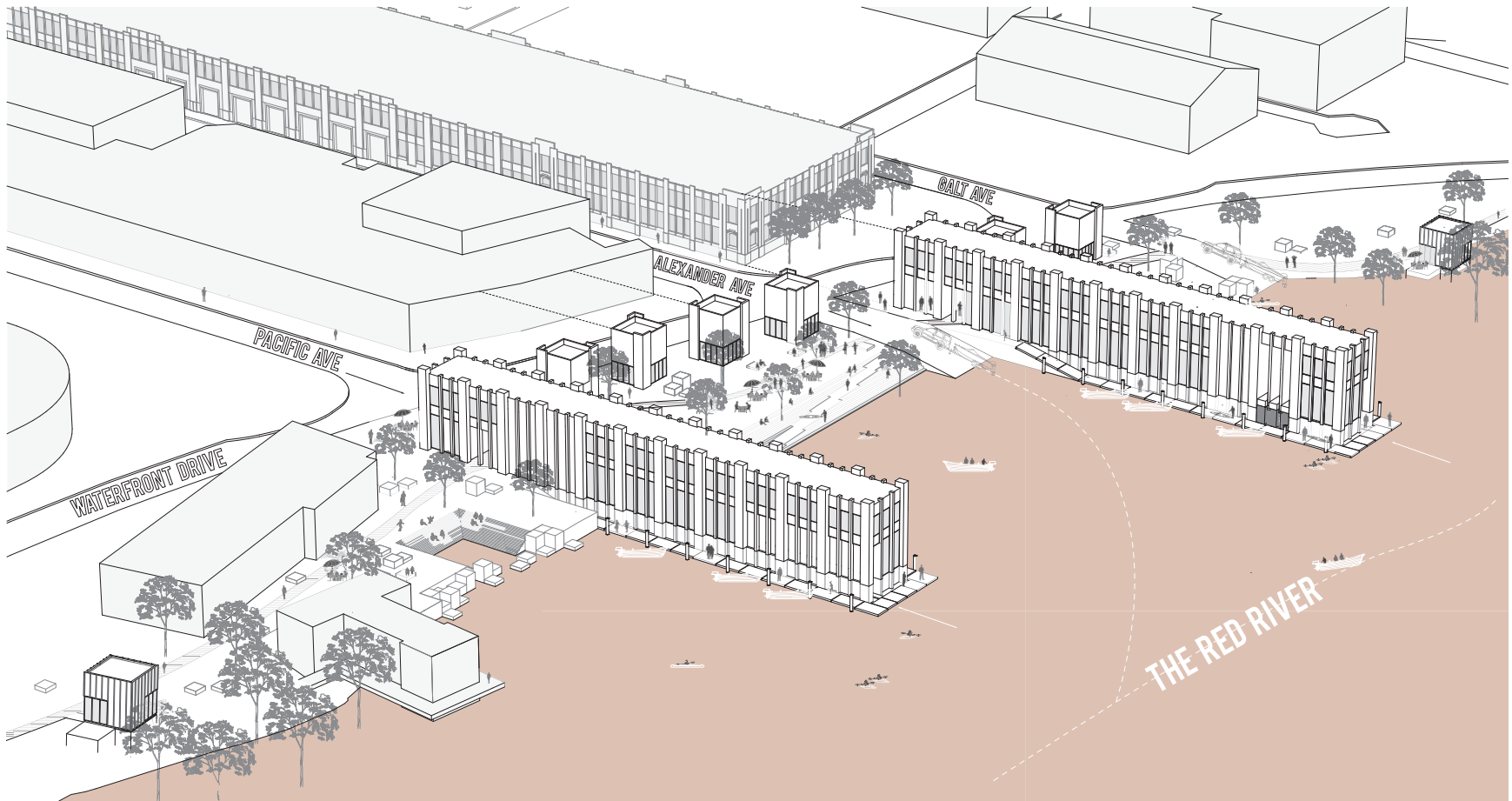


Figure 75. Site axonometric drawing of the Alexander Docks, spring condition.

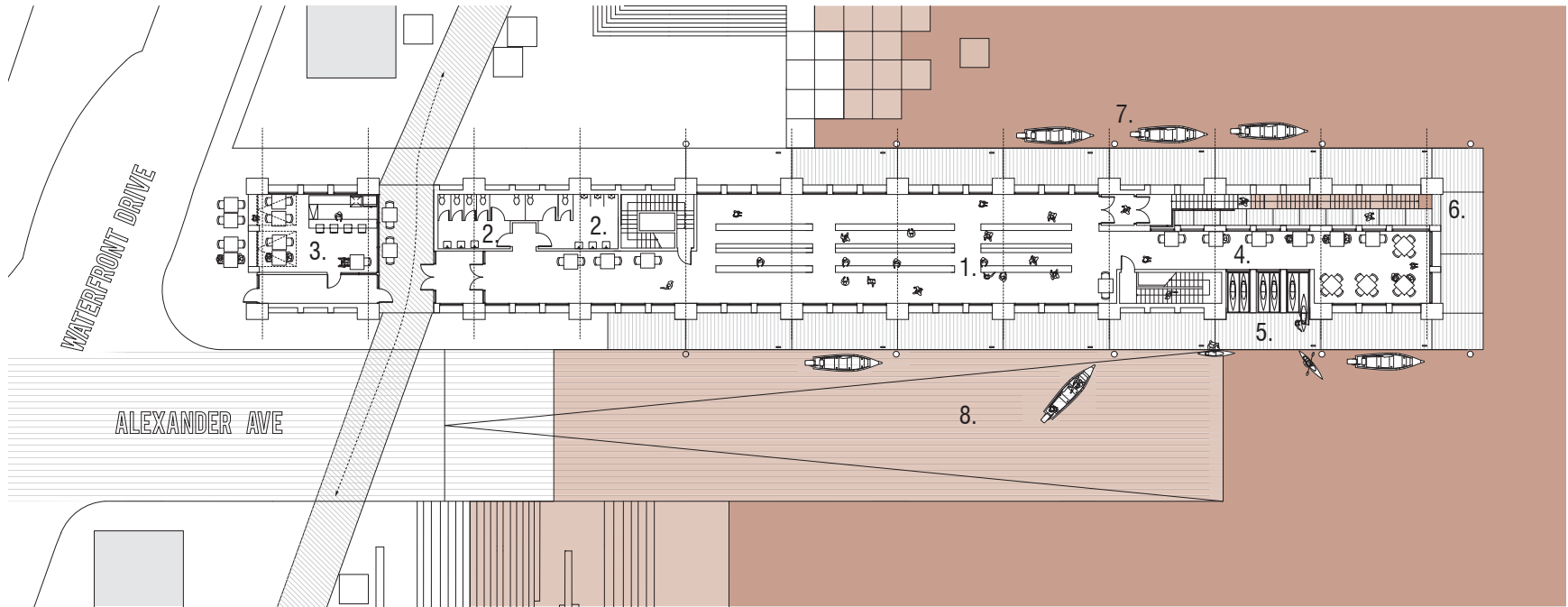


Figure 77. First floor plan drawing of the public anchor building at the Alexander Docks, all river levels shown. There is an open vendor space in the middle of the market, and a small restaurant or coffee shop faces the street. The parallel path runs through the building between the coffee shop and the market.

1. open market area for temporary vendors
2. washrooms
3. small coffee shop or retail space facing street
4. open dining areas
5. floating equipment rentals
6. stair down to floating dock
7. boat parking
8. boat launch
9. permanent retail spaces

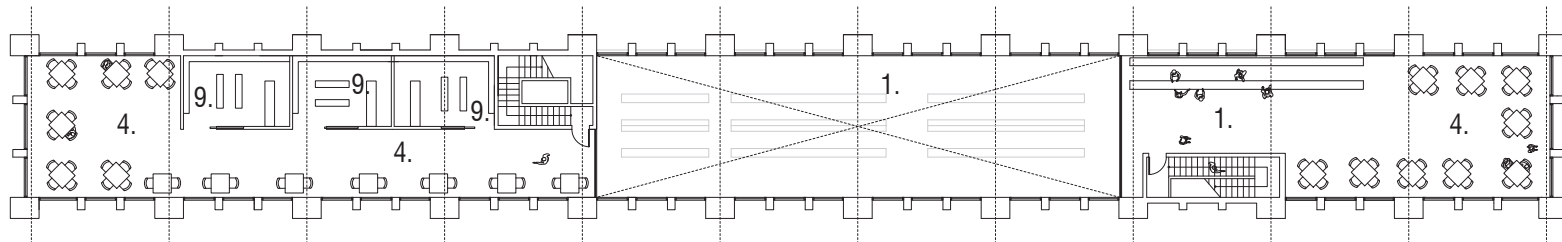


Figure 76. Second floor plan drawing of the public anchor building at the Alexander Docks.

- 1. open market area for temporary vendors
- 2. washrooms
- 3. small coffee shop or retail space facing street
- 4. open dining areas
- 5. floating equipment rentals
- 6. stair down to floating dock
- 7. boat parking
- 8. boat launch
- 9. permanent retail spaces

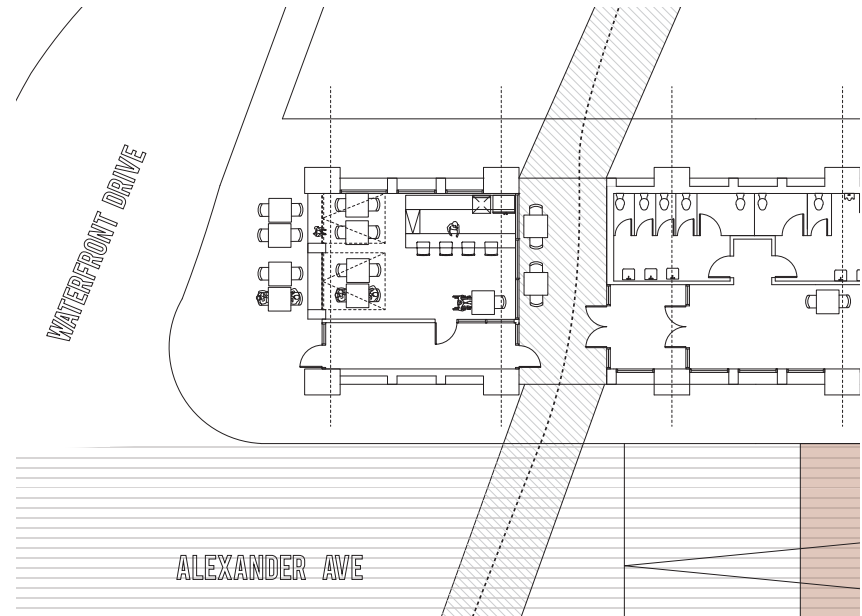
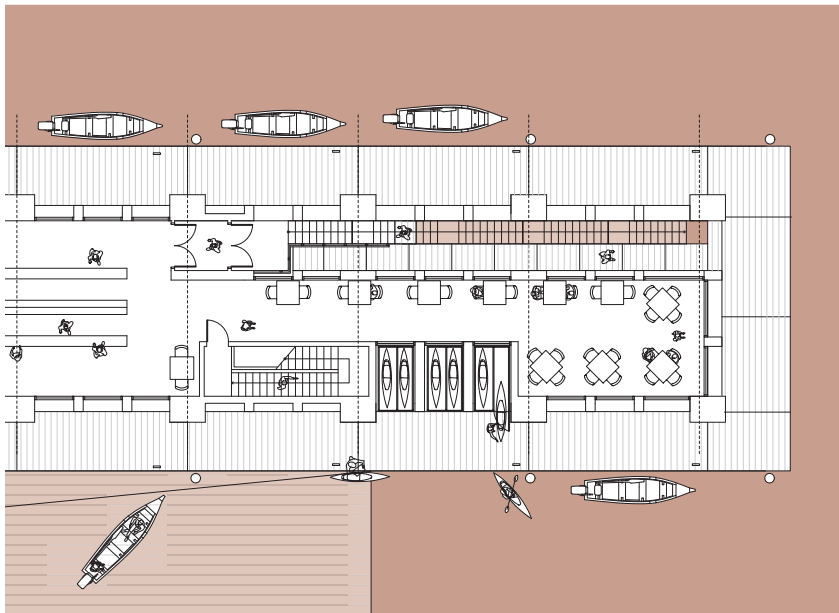


Figure 78. Plan details of the public anchor buildings at the Alexander Docks, spring and summer conditions shown. There is a floating dock all the way around the building, kayak rentals that float at the same level as the dock, places to launch and park boats around the docks, and an all season entry from the river (left). Garage doors open to the Waterfront Drive side (or city side) of the building to allow for a patio facing the street (right).

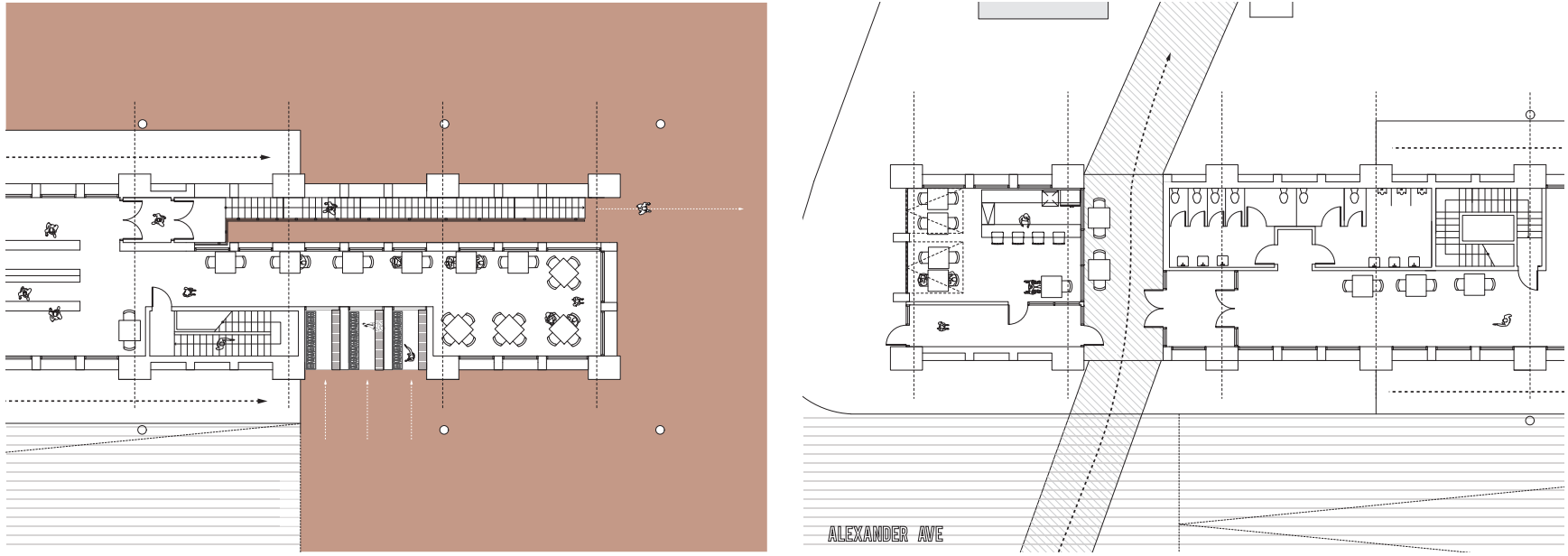


Figure 79. Plan details of the public anchor building, winter condition shown. The floating docks are removed all the way around the building, skate and ski rentals sit on the ice, and the building is accessible by skating into the all-season entry from the river (left). The patio is closed during the winter (right).

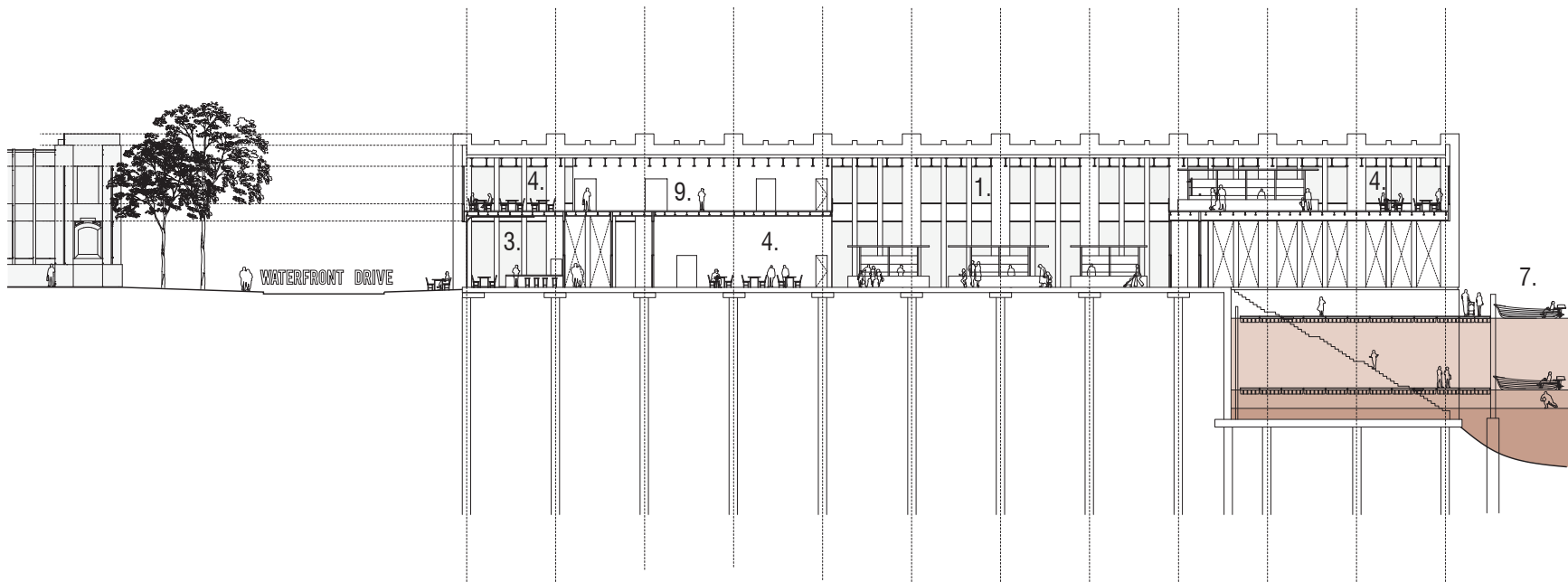


Figure 80. Longitudinal section drawing of the public anchor buildings at Alexander Docks, all river levels shown.

1. open market area for temporary vendors
2. washrooms
3. small coffee shop or retail space facing street
4. open dining areas
5. floating equipment rentals
6. stair down to floating dock
7. boat parking
8. boat launch
9. permanent retail spaces

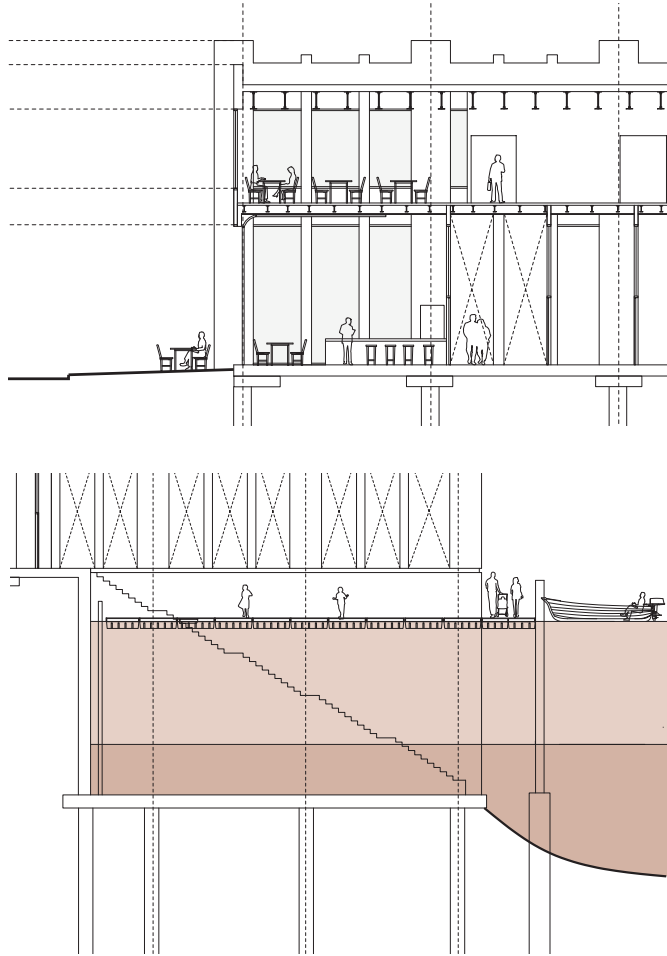


Figure 81. Section details of the public anchor buildings at the Alexander Docks, spring and summer conditions shown. There is an all-season entry from the river (bottom). Garage doors open to the Waterfront Drive side (or city side) of the building to allow for a patio facing the street (top).

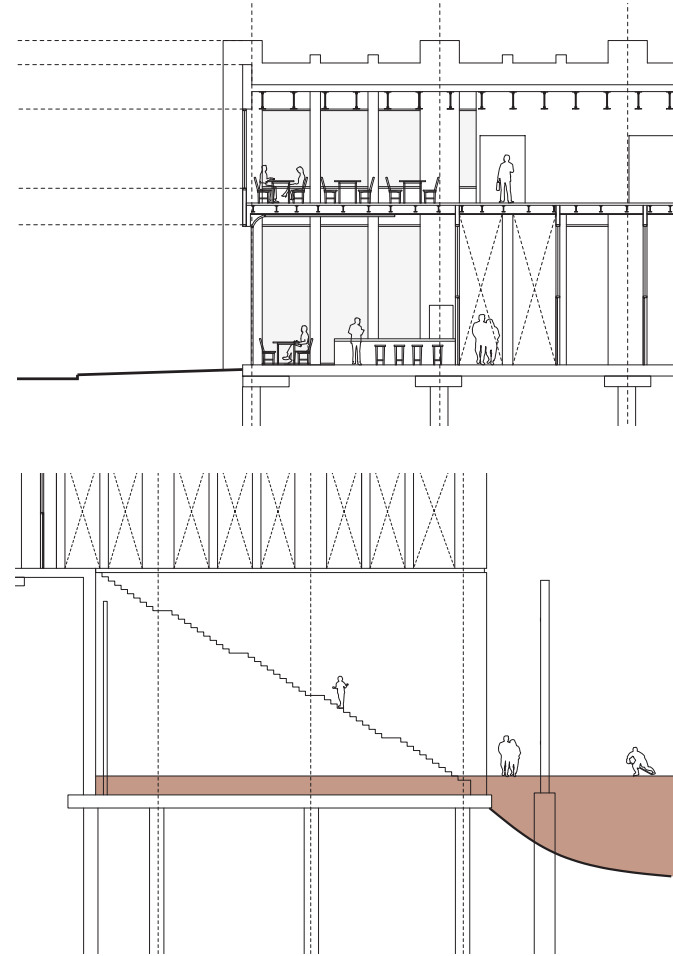


Figure 82. Section details of the public anchor building, winter condition shown. The floating docks are removed all the way around the building. The building is accessible by skating into the all-season entry from the river (bottom). The patio is closed during the winter (top).

- 4. open dining areas
- 5. floating equipment rentals
- 6. stair down to floating dock

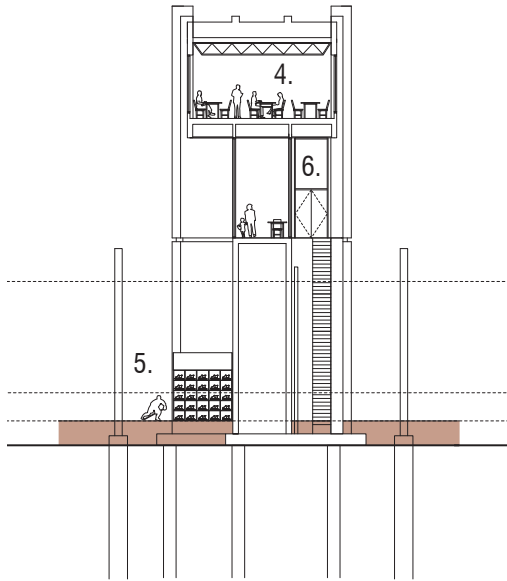


Figure 83. Cross section of the all-season entry from the river and the floating equipment rentals, winter condition shown.

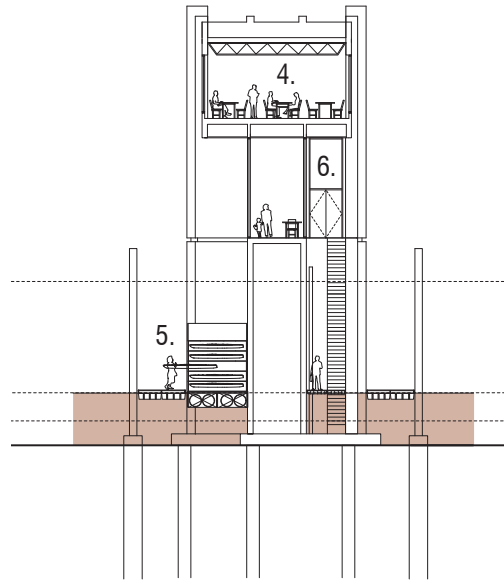


Figure 84. Cross section of the all-season entry from the river and the floating equipment rentals, summer condition shown.

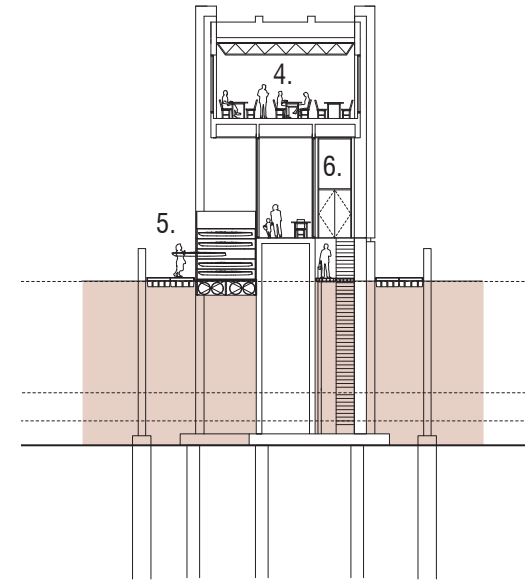


Figure 85. Cross section of the all-season entry from the river and the floating equipment rentals, spring condition shown.

CHAPTER 6: CONCLUSION

The sectional toolkit method provides common principles to solve many of the current issues that keep the city of Winnipeg disconnected from its rivers. Wherever the method is applied, it would:

- 1) Make the current parallel river walk experience much less monotonous (using sectional tool type one, the pavilion).
- 2) Create more connections to both sides of the river, and provide visual connections from the city to the river and from the river to the city (using sectional tool type four, the tower; type six, the bridge; and type two, transitions to the river).
- 3) Re-establish the river as a transportation network (using sectional tool type four, the tower).
- 4) Re-establish the city's perpendicular connections to the river that were lost to the railway (using sectional tool type two, transitions to the river).

However, since the sectional method is incremental in nature, there could still be a lot of variation in how the river is developed over time, creating a much more exciting experience as one travels along it. While the towers, the pavilions, and the public anchor buildings at the selected site are shown to be built using a more solid, industrial construction that speaks to the character of the adjacent buildings at that point along the river, other sites may be constructed in a very different manner.

The centres at The Forks (figure 42) may relate more to the Indigenous history of the site, drawing from the more adaptive and temporary methods of construction that were used there historically. The centres at the legislative building (figure 41) may be more monumental or monolithic tyndall stone structures, like many of the buildings in that area of the city. The centres at Osborne Village (figure 43) may relate to its more human-scale neighbourhood, with many dense pavilions and less large public anchor buildings. All of the future centres would consider seasonal programming and changing river conditions.

APPENDICES

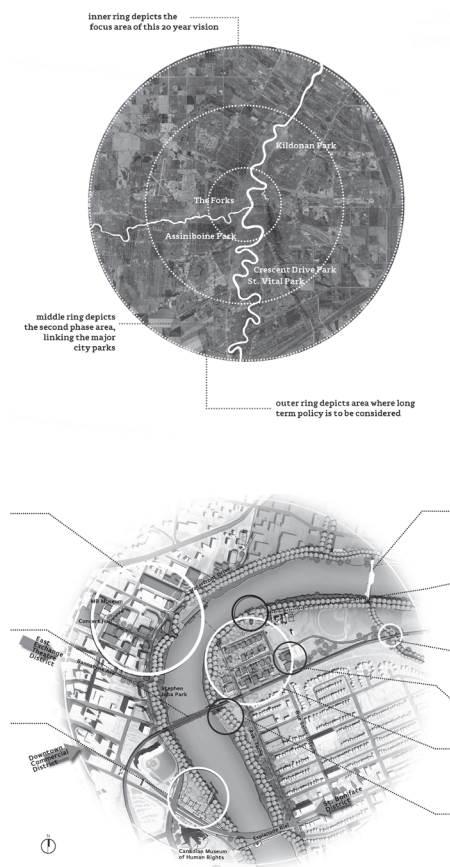
Appendix A: Winnipeg's 20 Year Vision

In 2014, the City of Winnipeg and The Forks published a 20-year vision for the city's rivers, titled *Go... to the Waterfront*. Their development plan for the river includes public input. Their objectives are: to celebrate Winnipeg as a river city, to provide connectivity along the riverfront, to inspire new riverfront development, to guide new development by type and quality, and to protect the riverfront.

The plan focuses on the city's downtown first (working outward over time), eventually connecting all the major parks in the city. The downtown plan is divided into six major neighbourhoods and programmatic 'centres' are proposed for each, including river access at each neighbourhood.

A major component of the city's plan is to build from what already exists along the rivers, or "completing existing communities by building on existing assets". They also propose new public spaces that will become catalysts for future business developments.

The proposal does not address flooding, instead it notes that all development within the flood zone is subject to 'improvements in flood management'.



Images from the City of Winnipeg's 20 Year Vision. (The City of Winnipeg, 2014).

REFERENCES

- Archives of Manitoba. 1870. "Louis Riel (seated, centre) and members of his Provisional Government". *Manitoba Historical Society*. http://www.mhs.mb.ca/docs/mb_history/29/redriverresistance.shtml.
- Archives of Manitoba. "The Anson Northup". *Manitoba Historical Society*. Last modified July 4, 2014. <http://www.mhs.mb.ca/docs/sites/ansonnorthup.shtml>.
- Arrowsmith, A. 1820. "Plan of the Settlement on Red River as it was June 1816". In *Report of Trials in the Courts of Canada, Relative to the Destruction of the Earl of Selkirk's Settlement on the Red River With Observations* by Andrew Amos. London: J. Murray. <https://www.flickr.com/photos/manitobamaps/3010231147/>.
- Baker, Ralph C. 1979. "Historic Flood Profile - City of Winnipeg." *Manitoba Pageant* 24, no. 4. <http://www.mhs.mb.ca/docs/pageant/24/historicfloods.shtml>.
- Boutal, Pauline. "La Vérendrye, CUSB". Encyclopedia of French Cultural Heritage in North America. Last modified 2007. http://www.ameriquefrancaise.org/en/article-375/La_Vérendrye:_Archetypal_Ideal_of_the_Voyageur.html.
- Bulman, W. J. 1900. "Birds Eye View City of Winnipeg". <https://www.flickr.com/photos/manitobamaps/2195562204/in/album-72157603459135495/>.
- Bumsted, J.M. 1997. *Floods of the Centuries: A History of Flood Disasters in the Red River Valley 1776-1997*. Winnipeg: Great Plains Publications.
- The Burland Lithographic Co. 1882. "Map Showing the City of Winnipeg and Parts of the Parishes of St. Boniface and St. John". In *Manitoba and the Great North-West : the Field for Investment; the Home of the Emigrant, Being a Full and Complete History of the Country* by John Macoun. <https://www.flickr.com/photos/manitobamaps/2339777134/>.
- Canadian Pacific Railway. 1877. "The Arrival of the Countess of Dufferin". *Manitoba Historical Society*. <http://www.mhs.mb.ca/docs/pageant/04/ladyoftherails.shtml>.
- Cheung, Adrian. 2016. "Ripple effect: The Red River, what's in the water and how safe is it?" *Global News* (Winnipeg). October 4. <https://globalnews.ca/news/2978322/the-red-river-whats-in-the-water-and-how-safe-is-it/>.
- The City of Winnipeg. 2014. "Go to the Waterfront". Accessed April 5, 2018. http://www.theforks.com/uploads/ck/files/Publications/GoWaterfront_2014.pdf.
- The City of Winnipeg. 2017. "Map of Assessment Parcels". *City of Winnipeg Open Data*. <https://data.winnipeg.ca/Assessment-Taxation-Corporate/Map-of-Assessment-Parcels/rt7t-3m4m>.
- Fonseca, W. G. 1884. "Winnipeg Bird's-Eye View". Ottawa: *Mortimer & Co. Lith*. <https://www.flickr.com/photos/manitobamaps/2182110970/in/album-72157603970368975/>.
- Fowler, Thaddeus Mortimer. 1880. "Bird's Eye View of Saint Boniface, Manitoba".

- Wisconsin: J.J. Stoner, Madison, Wis. Beck & Pauli Lith. <https://www.flickr.com/photos/manitobamaps/2229269685/in/album-72157603970368975/>.
- Fraser, William J. 2011. "Grant's Old Mill (2011)". <http://www.mhs.mb.ca/docs/sites/grantsoldmill.shtml>.
- Gillis Quarries. 2017. *Technical and Commercial Brochure*. <http://tyndallstone.com/technical/brochures>.
- Glaser, Louis. 1889. "Souvenir of Winnipeg Manitoba: Fort Garry in 1871". Toronto: Toronto News Co. <https://www.flickr.com/photos/manitobamaps/3720185173/>.
- Glowaki, Wayne. 2017. *The floodway gates at the Red River Floodway control structure south of the city*. <https://www.winnipegfreepress.com/local/todays-opening-of-floodway-unusually-early-417776973.html>.
- Government of Manitoba. 1950. "An aerial photo showing flooding in the former CNR rail yards at The Forks in downtown Winnipeg". https://www.gov.mb.ca/mit/wms/rrf/historical_1950.html.
- Government of Manitoba. 2015. *Provincial Flood Control Infrastructure Review of Operating Guidelines: A Report to the Minister of Manitoba Infrastructure and Transportation*. https://www.gov.mb.ca/mit/wms/wm/pdf/review_operating_guidelines.pdf.
- Government of Manitoba. *Floodway gates raised during Guideline 2 operation*. Accessed April 5, 2018. <https://www.gov.mb.ca/mit/wms/rrf/index.html>.
- Government of Manitoba. Manitoba Land Initiative. "Winnipeg Capital Region - (roads, streets, and highways)". Accessed October 15, 2017. http://mli2.gov.mb.ca/roads_hwys/index.html.
- Grant & Simmers Real Estate Agents. 1900. "Map of Winnipeg District". Scale 1:253,440. Winnipeg: Rolph and Clarke Ltd. <https://www.flickr.com/photos/manitobamaps/2363697713/>.
- Hainstock, Bob. 1980. "Grant's Old Mill (1980s)". <http://www.mhs.mb.ca/docs/sites/grantsoldmill.shtml>.
- Hilderman Witty Crosby & Associates. 1993. "The Forks Commemorative Plaza is situated at the heart of North America and the junction of key water routes". In *The Forks Commemorative Plaza* by Hilderman Witty Crosby & Associates. <http://www.theforks.com/about/history/heritage-research/bibliography/display,bibliography/293/the-forks-commemorative-plaza>.
- Hughes, Ivan. 2011. "Red River Flood Watch - Winnipeg, Manitoba". Uploaded on April 5, 2011. Image from Youtube Video, 1:05 min. <https://youtu.be/4fkazqNoYpQ>.
- International Joint Commission. 1968. *Pollution of the Red River*. <http://www.ijc.org/files/publications/ID335.pdf>.
- Jefferys, Charles William. 1816. *The Fight at Seven Oaks*. Ottawa: Library and Archives Canada. <http://www.bac-lac.gc.ca/eng/portrait-portal/Pages/arprofile.aspx?ArchivalRecordKey=2814396>.
- Lamster, Mark. 2007. "The City and the Stream." *Metropolis Magazine*, September 1. <http://www>.

- metropolismag.com/uncategorized/the-city-and-the-stream/.
- Lord Selkirk. 1817. "Fort Douglas". In George Bryce, *Lord Selkirk's Colonists, The Romantic Settlement of the Pioneers of Manitoba*, 112. *Manitoba Historic Society*. <http://www.mhs.mb.ca/docs/pageant/13/selkirksettlement2.shtml>.
- Lynch, Kevin. 1960. *The Image of the City*. Cambridge: Harvard University Press.
- Lyon, Deborah, and Robert Fenton. 1984. "The Development of Downtown Winnipeg: Historical Perspectives on Decline and Revitalization". Winnipeg: University of Winnipeg Institute of Urban Studies. <http://winnspace.uwinnipeg.ca/bitstream/handle/10680/888/1984-LyonFenton-DowntownWinnipegDeclineRevitalization-WEB.pdf?sequence=1>.
- Macoun, John. 1882. "Map Showing the City of Winnipeg and Parts of the Parishes of St. Boniface and St. John". Guelph: World Pub. Co. <https://www.flickr.com/photos/manitobamaps/2339777134/in/album-72157603459135495/>.
- Manitoba 125: A History*. Vol. 1: Rupert's Land to Riel. 1993. Winnipeg: Great Plains Publications Ltd.
- Manitoba 125: A History*. Vol. 2: Gateway to the West. 1993. Winnipeg: Great Plains Publications Ltd.
- Manitoba 125: A History*. Vol. 3: Decades of Diversity. 1993. Winnipeg: Great Plains Publications Ltd.
- Manitoba Historical Society. 2017. "Historic Sites of Manitoba: Winnipeg Public Docks / Alexander Docks (70 Alexander Avenue, Winnipeg)". <http://www.mhs.mb.ca/docs/sites/alexanderdocks.shtml>.
- Manitoba Historical Society. 2014. "Historic Sites of Manitoba: Grant's Old Mill (2777 Portage Avenue, Winnipeg)". <http://www.mhs.mb.ca/docs/sites/grantsoldmill.shtml>.
- The Manitoba Library Consortium. 2005. "Immigration and Settlement: 1870-1919." *Manitobia: Digital Resources on Manitoba History*. <http://manitobia.ca/content/en/themes/ias/1>.
- Norberg-Schulz, Christian. 1971. *Existence, Space and Architecture*. New York: Praeger.
- PROAP. 2006. "Antwerp Quays Waterfront." <http://www.proap.pt/project/antwerp-quays-waterfront-1/>.
- Red River North Heritage. 2017. *2004 Outlet Structure*. <https://redrivernorthheritage.com/aerial-photos-photo-gallery/>.
- Thomas Douglas, the 5th Earl of Selkirk*. 1771–1820. Ottawa: Library and Archives Canada. http://collectionscanada.gc.ca/pam_archives/index.php?fuseaction=genitem.displayItem&lang=eng&rec_nbr=3526168.
- Thwaites, Kevin and Ian Simkins. 2007. *Experiential Landscape: An Approach to People, Place and Space*. New York: Routledge.
- Turner, Randy. 2017. "The Rivers: The Power and Potential of Winnipeg's Waterways." *Winnipeg Free Press*. Accessed April 5, 2018. <https://www.winnipegfreepress.com/the-rivers/The-Rivers---Part->

- 1-Sacred-Ground-Troubled-Water-332713141.html.
- Vickers, Glenn, Sandra Buzza, Dave Schmidt, and John Mullock. 2001. *The Weather of the Canadian Prairies*. Ottawa: NAV Canada. <http://www.navcanada.ca/EN/media/pages/publications-operational-weather-manuals.aspx>.
- Weir, Thomas R. 1960. "Settlement 1870-1921". In *Economic Atlas of Manitoba* by Thomas R. Weir. Winnipeg: Manitoba Dept. of Industry and Commerce. <https://www.flickr.com/photos/manitobamaps/2129548738>.
- Weir, Thomas R. 1978. "Winnipeg Early Growth 1869 to 1881". In *Atlas of Winnipeg* by Thomas R. Weir. Toronto: University of Toronto Press. <https://www.flickr.com/photos/manitobamaps/2242508805/>.
- White, Richard. 1995. *The Organic Machine: The Remaking of the Columbia River*. New York: Hill and Wang.
- Winnipeg Planning Division. 1966. "Winnipeg Historical Growth Pattern". In Winnipeg Planning Division, *The Metropolitan Development Plan*, Plate 4. Winnipeg: The Metropolitan Corporation of Greater Winnipeg. <https://www.flickr.com/photos/manitobamaps/2175798383/>.