



**LANDSCAPE INTERFACE DEVELOPMENT  
REPORT**

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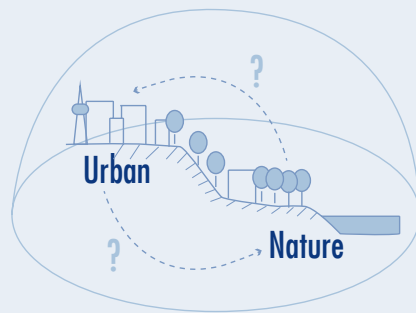
1. Reflection thinking

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1. Reflection thinking

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# **PART ONE**

## **INTRODUCTION**





# PART ONE: INTRODUCTION

## 1.Fascination



*Fig.1 The Garden Of Earthly Delights (1503-1515) - Hieronymus Bosch*

Last summer I went to the Prado Museum in Spain and was attracted by one big panel. The Early Netherlandish master Hieronymus Bosch's painting, "The Garden of Earthly Delights" address these three different images of the combination of culture and nature. (Figure 1) In the first panel it showed a paradise. In the middle panel, there are more cultural influence on the nature, some people are dying in the landscape. In the last panel, it shows the twisted scenery that people suffer and die on the burning landscape. It's exactly a nightmare of a lot of people, we are worried that our landscape will be degraded and destroyed by human interventions in the end, turned from the paradise to the hell. What is the right balance between culture and nature. How can city integrates in nature in an effective way and create harmony.





*Fig.2 Cheonggyecheon before development, South Korea*

The space in-between urban environment and natural figures are always in hybrid form just like the image showed. Here Urban and landscape fragments contrast, blend and mix with each other. Some people describe the in-between conglomerate as “a ravishing cacophony of built and not-built spaces. But the behind story of this image is removing the highway structures above the river and return the nature back to the place. Nowadays people are still searching for the interrelationship between culture and nature, like in this image, between the city and the river landscape.



*Fig.3 Cheonggyecheon after development, South Korea*

Exactly the same place after development, this is what we get now. Now the in-between space was transformed into an urban recreation space where people can go across the city center by the sunken space near the river. At the same time, the table river was reactivated into flowing waters, bringing ecological benefit to city center.

This is the exact complementary space what we want between culture and nature.

## 2. Problem Fields



*Climate changes*



*Extreme weather*



*Sea level rises*

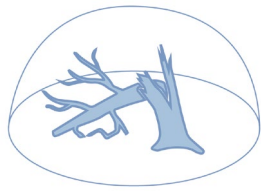


*Woodland wildfire*

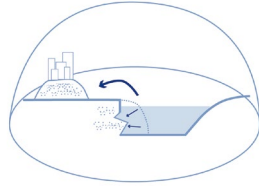
### 2.1 The interactions between nature and urban

Nature is the undoubtedly uncertain factor for urban environment. Especially in recent years, more and more extreme situations happened like woodland wildfires and delta cities flooding, which threat the living environment around the nature.

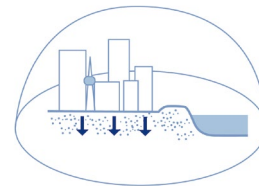
For example, cities are more vulnerable because of water challenge. A large part of the world's population lives in low-lying urbanised coastal zones or river deltas (UN Habitat, 2013). These urbanised low elevation coastal areas are vulnerable to flooding due to a combination of natural high tides, storm surges and high river discharges, and human induced stresses such as subsidence and urbanization. (Hallegatte et al., 2013; IPCC, 2007; Nicholls et al., 2007). Flooding is primarily driven by weather events which can be hard to predict. Many cities are facing a higher risk of flooding in the future due to changing climate conditions, rising sea level and caused by which the unpredictable extreme situations. For example, extreme weather events across the globe have become commonplace news. And the extreme weather will definitely have severe influence on the water system. A rise in sea level will raise the likelihood of coastal erosion and flooding. And an increase in peak discharges because of extreme weather will raise the likelihood of flooding from the inland rivers.



*Ecosystem damage*



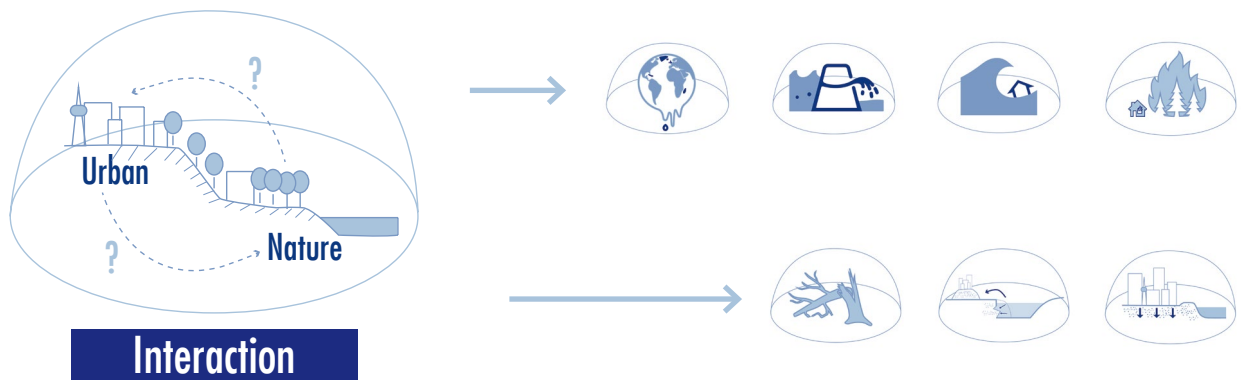
*River bank erosion*



*Land subsidence*

At the same time, human interventions are the vulnerable factors for natural environments. For example, growing population force people to search for new living space, natural environment was captured by urban settlements, which causing several severe problems like the damage of ecosystem, the land subsidence, and the river bank erosion, etc.

There is a growing awareness that the increasing vulnerability of urbanized deltas and coastal cities to flood risk is related to processes of urbanisation and changing socio-economic conditions. (Peter Christiaan van Veelen, 2016). Population will continue to grow especially in coastal and delta urban areas. There will be more migrations to cities due to the growth of population, the process of urbanization, and the economic policies (eg. China government). There will be bigger conflict between demanding for more living space and demanding for conserving nature. Secondly, urbanization may lead to worse conditions for nature. For examples, low-land countries like Netherlands are suffering from land subsidence because of drainage of marshlands. Dredging river depositions from up-stream may solve the flood problem and provide more space for constructions temporarily, it can actually increase flood damage by increasing the susceptibility to erosion.

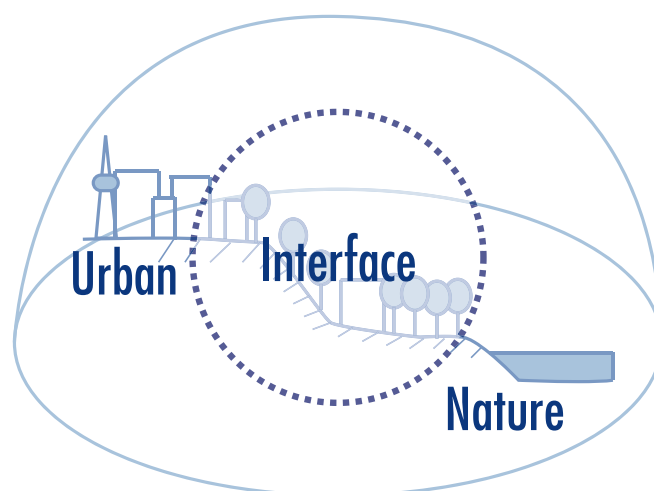


## 2.2 Interface between urban and nature

In general, natural environment and urban environment influence on each other, while the interaction between human induced factors and nature environment add more vulnerability of the whole landscape. The concept of interface is very powerful in studying these interactions.

For this project, interface refers to the zone of transition between unoccupied land and human development. It is the confrontation of urban and natural environment. There are no clear boundary between nature and urban on it. It is the place where urban environment and natural environment are porous into each other and interact and conflict with each other most frequently.

Interface is a complementary approach to study the interaction of urban and nature.



### 2.3 Adaptive interface

As a transitional zone between urban area and nature area, the "interface" is the confrontation of urban systems and natural systems. It consists of many subsystems which interact and show high interdependencies within. In this view, "interface" is understood as a complex adaptive system.

"Complex systems constantly change through self-organization and learning, and through transformation of their components."(Waldrop, M M, 1992) Natural and social processes constantly change the landscape components in between, making the dynamics of the transformation a key issue in research and design. While regarding "interface" in the design terms, it is important to regard the interface as a changing structure which conveys urban dynamism and natural process. It is seldom possible to undertake all restoration measures at a single point in time, due to practical, financial or resourcing constraints. Thus the design shouldn't be a fixed site plan on the paper, instead, an open-ended plan aiming at guiding developments.

In this case, on top of the idea of "interface", how to add adaptivity is the most important issue for the volatile forms of interface. Thus I am going to research not only "interface" but also "adaptive interface" in my project, considering it as a whole system, which has influence in different scales, and will be verified through time scope.



*Fig.5 Nijmegen, NL  
New urban land*



*Fig.6 Cheonggyecheon, South Korea  
Riverfront Promenade*



*Fig.7 Mill Race Park, US  
Recreation Park*

## 2.4 Problem Statement

The land between the urban and the nature is important. Conceiving landscape as infrastructure can be characterized as a goal-oriented approach, where landscape is treated as an operative field that defines and sustains the urban development and ecological and economic processes are employed as formative design tools.

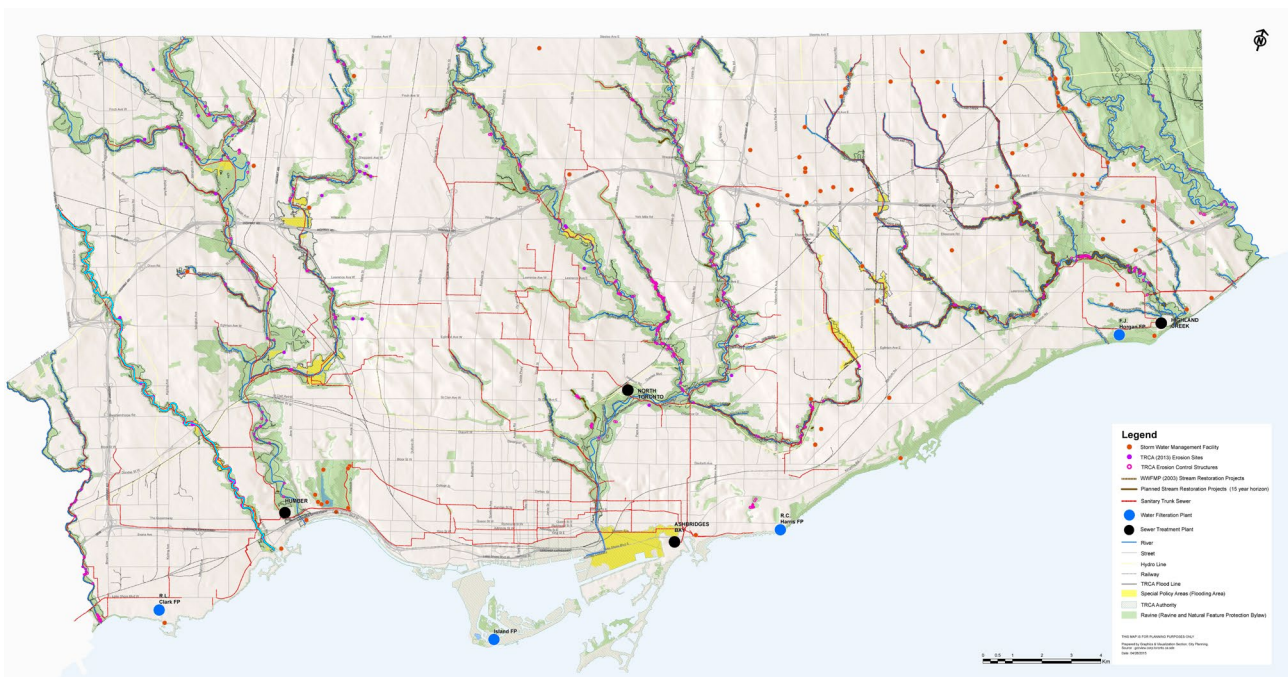
How do we develop an approach to design and planning which can create conditions in adapt to uncertain natural factors in the future and at the same time provide opportunities for urban development?

As a landscape architecture student, in dealing with the space on interface, how should I position myself in making design decision on interface. There are large amount of existing projects developed on the transition zone between unoccupied land and human development. How do we develop an approach to design and planning on interface which can create a changing place which can adapt to urban-nature interactions?

### 3. Design Objective and Location

So my main research question of this: How do we develop an approach to design and planning which can create conditions in adapt to uncertain natural factors in the future and at the same time provide opportunities for extra benefits other such as urban development? In which role landscape design can play while designing for water infrastructures, and also taking into consideration of urban dynamism.

In order to test the concept of interface and the adaptivity of it, I need to find a place to test it. Over 250 miles of deep ravines like dramatic scars running into in cityscape of Toronto. The nature figures are quite clearly in the urban context. And as one of the most important city in the world, the City's Urban Development Services Department predicts that by 2020 the GTA's population will have ballooned to 6.9 million, and that Toronto itself will have grown to approximately 2.9 million, which leads to further urbanization into the city (Stephen Michalowicz 2009). That's why I want to do the case study on the Toronto interface.



*Fig.8 Ravine Strategy Draft Flooding & Stream Restoration*

**PART TWO**  
**METHODOLOGY FRAMEWORK**



## 1. Theory Background

### 1.1 A Complex Adaptive system

As a transitional zone between urban area and nature area, the 'landscape interface' is the confrontation of urban systems and natural systems. It consists of many subsystems which interact and show high interdependencies within. In this view, 'landscape interface' is understood as a complex adaptive system.

“Complex systems constantly change through self-organization and learning, and through transformation of their components.”(Waldrop, M M, 1992) Natural and social processes constantly change the landscape components in between, making the dynamics of the transformation a key issue in research and design. While regarding "landscape interface" in the design terms, it is important to regard the interface as a changing structure which conveys urban dynamism and natural process. It is seldom possible to undertake all restoration measures at a single point in time, due to practical, financial or resourcing constraints. Thus the design shouldn't be a fixed site plan on the paper, instead, an open-ended plan aiming at guiding developments.

“An important feature of a complex adaptive system is that the behavior of the system emerges from the interactions between the systems' higher and lower level components.” (Manson, SM, 2001) An intervention on landscape interface will have impacts on not only the site itself, but also on different levels of scales. For examples, some water management interventions may need to be implemented across scales and work with urban planning. In this case, working through scales is the premise, for example for systematic elaboration of planning strategies (e.g. regional planning and design) and design interventions (e.g. project-based realization).

Searching for the design strategies for Toronto ravine system thus should consider the landscape interface into the broader context at multiple scales and within different time frames. In other words, the research method should consider the landscape interface as a whole system, an adaptive structure which has influence in different scales, and will be verified through time scope.

## 1.2.Landscape Approach for adaptive complex system

Understanding the complexity and dynamism of the 'landscape interface', the question is how to develop design strategy which creates adaptability of the interface.

As a landscape architecture, I will take the role of composer rather than performer, be a catalyst instead of a finisher. Which means, landscape approach will be used in designing the adaptive interface, as it considers the design as designing, as an adaptive act over time through monitoring and management.

As Professor Jusuck Koh mentioned in his report, while applying landscape approach in urban context, "Interfaces between the urban and the rural become porous - the boundary line delineating city from countryside is in reality a zone in the landscape. Periphery and parameters rather than the center assume new importance as cellular membrane: a porous, integrating and multifunctional entity of complexity and creative chaos."(Jusuck Koh, 2013) Which means, this approach breaks down the wall between urban and nature landscape, and focus on the intermediate space itself.

In short, "research-by-design" is the landscape approach which frames my project. "Research-by-design is about study through design using knowledge acquired by design research." (Nijhuis, S., Bobbink,I. 2012) There will be two main steps in my project: 1. experimental design, 2. design study.

## 1.3 Applying Layer Approach

"Managing complex systems is not easy given the dynamics, unexpected coevolution and self organizing character of systems. Adaptive management is adapting to the evolution of systems and using the possibilities that the dynamics create (Koppejan & Klijn, 2011).

Adaptive governance in this "landscape interface" requires a thorough understanding of the urban system and nature system and more importantly the interaction within them. I will refer to the Dutch Layers Approach here to understand the complex system. The important clues from this famous planning and design Model is that it distinguishes three layers in the spatial organization -substratum, networks and the layer of the occupation pattern. (De Hoog et al., 1998b)

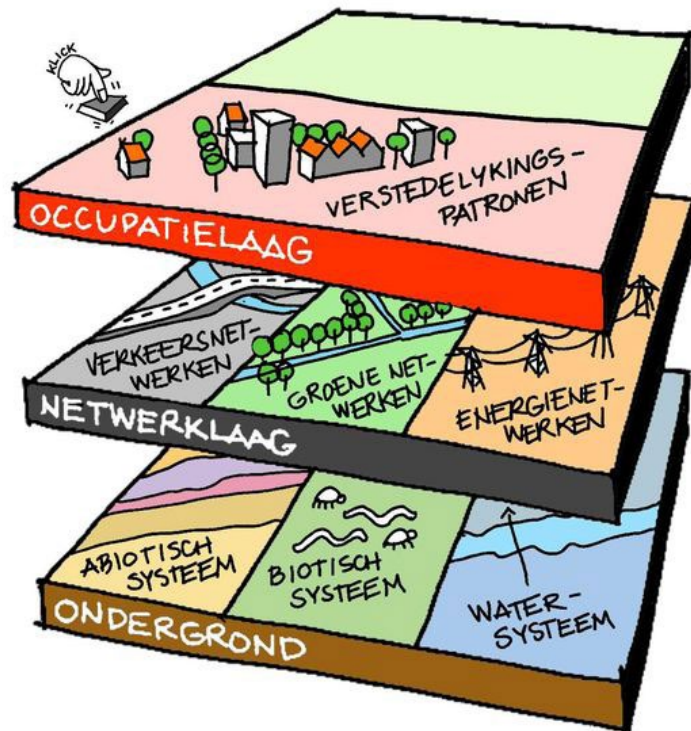


Figure 1. Dutch Layer Approach Model

Urban-nature Interface			
Three Layer	<b>Occupation Layer</b>	<b>Infrastructure Layer</b>	<b>Nature Landscape Layer</b>
	5-50 years	50-100 years	>100 years

## 1.4 Interface Layer - New Layer Approach

Being in the city's hinterland, 'landscape interface' has its typical ecological, spatial, functional and social role in the sustenance of both the urban and nature zones.

In this case, in relation to "landscape interface", the original layer model is a good starting point, but not refined properly and specifically for the interaction on the interface. The original model focuses more on the hierarchy of the layers, and is good for policy planning; But when it comes to study relations, a more descriptive and analytical model is needed.

The Layer Approach should be expanded here in terms of different interaction on the interface. According to these quality of 'landscape interface', these following layers are of my interest: Natural landscape, as it is the lowest dynamic layer which provides natural conditions. Infrastructure networks for transportation, but its transformation and development on interface goes faster than the natural conditions. Land use and urban settlement, as it determines how people use the interface in a short time. And to understand and analyze the different layers of the complex systems, the spatial relationships which are related to those roles should be explored via research and mapping. "Map dissection is a useful tool for discovering spatial patterns by selection and reduction, and serves as the basis for spatial association analysis, which explores the relation between different patterns using a layer approach." (Nijhuis and Pouderoijen 2014)<sup>ix</sup> But to develop an adaptive 'landscape interface', it is important to specify these general layers into detailed dimensions according to different design contexts. In the next section, I will use Toronto ravine as a case study, and show using mapping as a tool to research and analyze the different dimensions of 'landscape interface'.

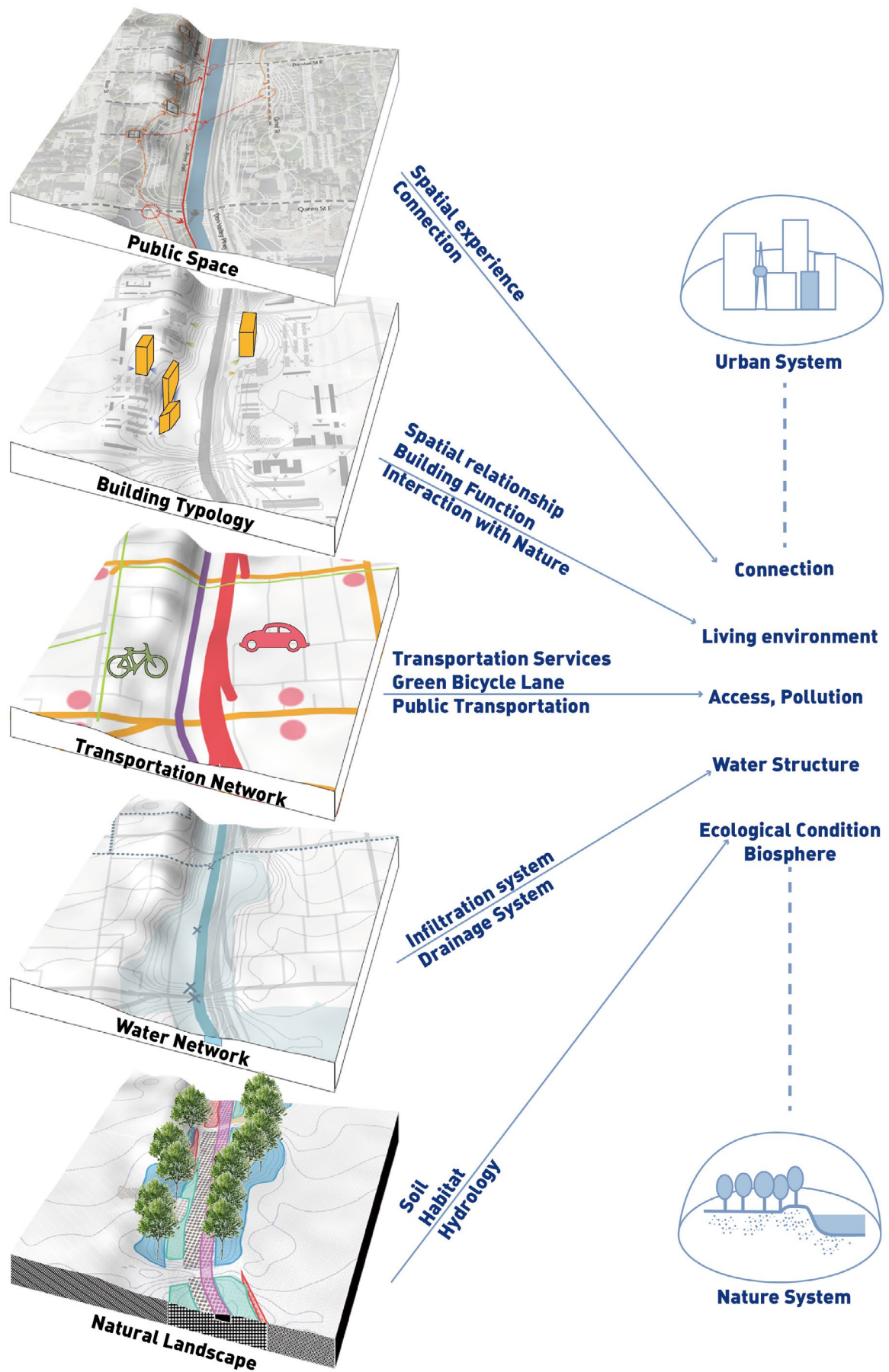


Figure 2. Interface Layer

## 2 Methodology Framework

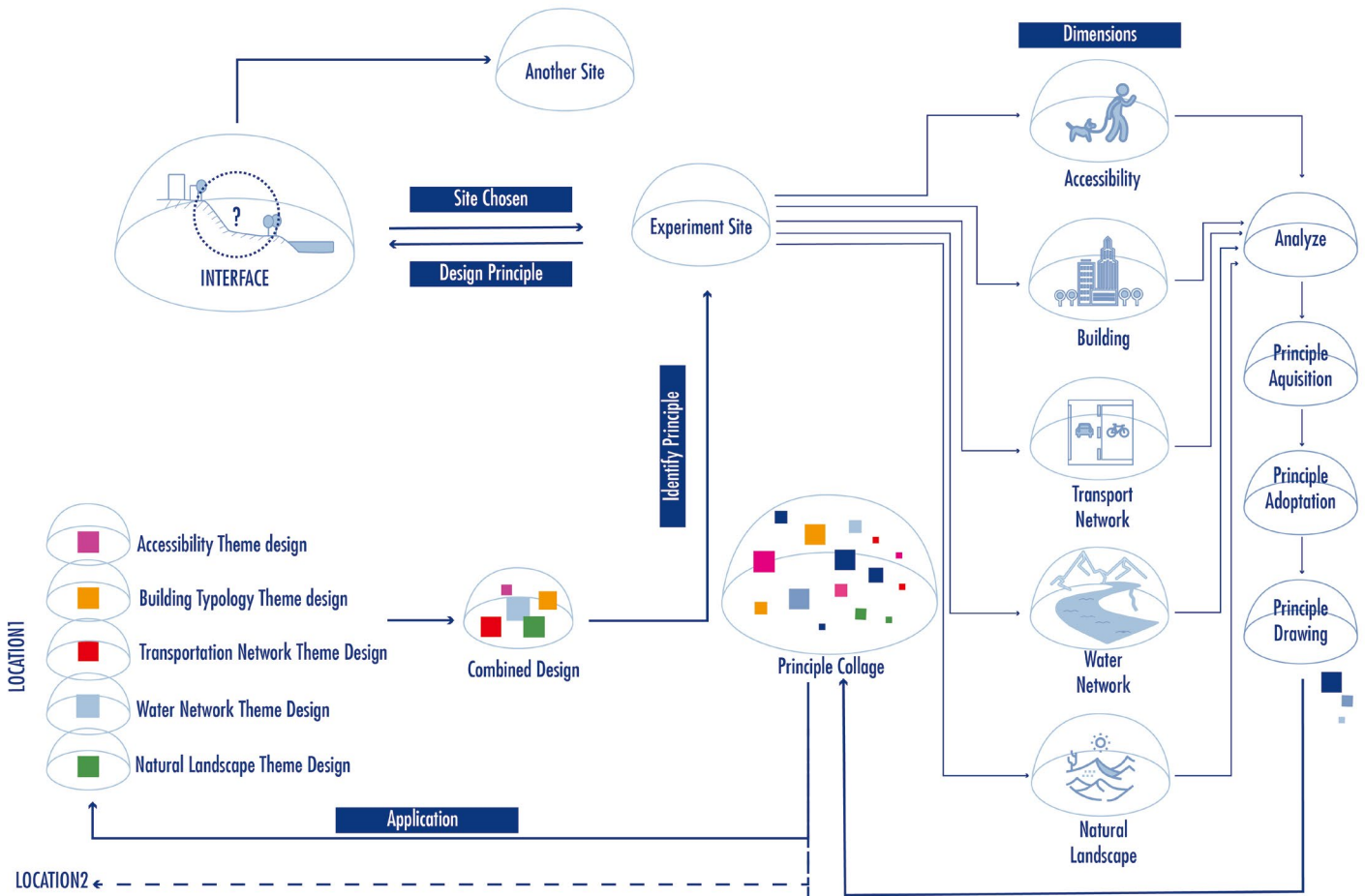
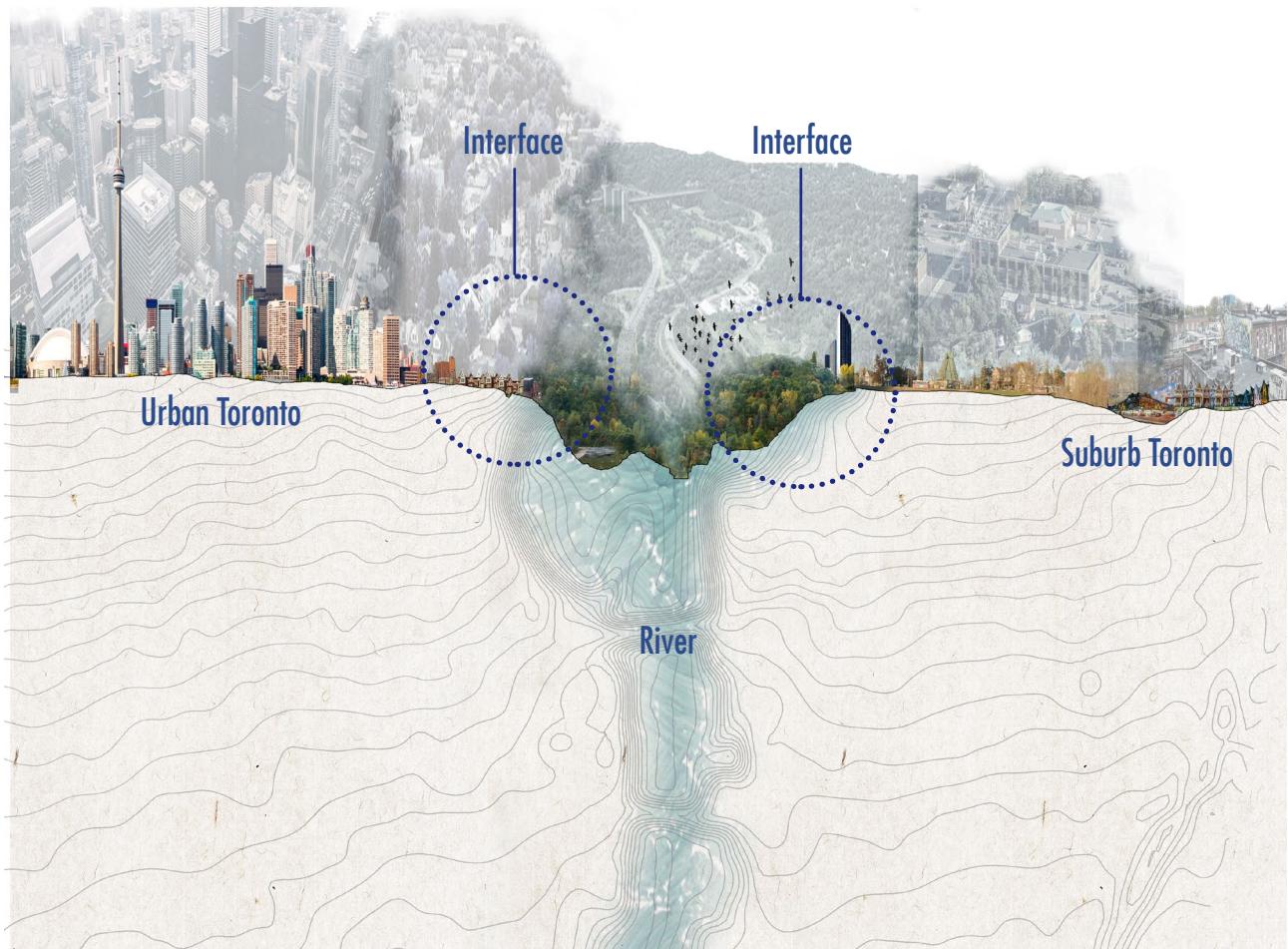


Figure 3. Methodology Framework

To develop the adaptive interface, I am going to first define one experimental interface in Toronto region I want to work on. Then, according to different elements on interface I am going to analyze them in five dimensions, and use the theoretical papers and examples to develop several principles which I am going to test. And by testing the principles through theme design and combined design I will identify the design principles. These identified principles can be the tools or strategies to develop the interface in an adaptive way.

**PART THREE**  
**UNDERSTANDING SITE**



## 1. Toronto Interface

When I think about the Toronto interface, there are five dimensions more of my most interests. And I am going to show the research and design on Toronto interface through these five strong lenses.

As it mentioned in methodology background, these dimensions are developed from layer approach. Interface as a changing structure and a complex system, the interrelation between subsystems stabilizes over time. From slow development to fast development, there are three main layers consisting the interface:

1. Substratum, as it is the lowest dynamic layer which provides natural conditions on interface.

2. Infrastructure networks, its transformation and development goes faster than the natural conditions.

3. Land use and urban settlement enjoys the highest dynamism, and it determines how people use the interface in a short time.

Slow Development

Fast Development



**Substratum**, as it is the lowest dynamic layer which provides natural conditions on interface.



**Natural landscape** create soil, hydrology conditions for the land and in a fundamental way determine the habitats on the interface.

**Infrastructure networks**, its transformation and development goes faster than the natural conditions.



**Water network** implies the water structures to convey water flow, which include both infiltration networks and drainage networks. The composing elements of the networks are water channels, underground water tube, infiltration zones, rivers, floodplains, wetlands and lakes, etc.



**Traffic network** here implies the transportation services which carries the flow of people.

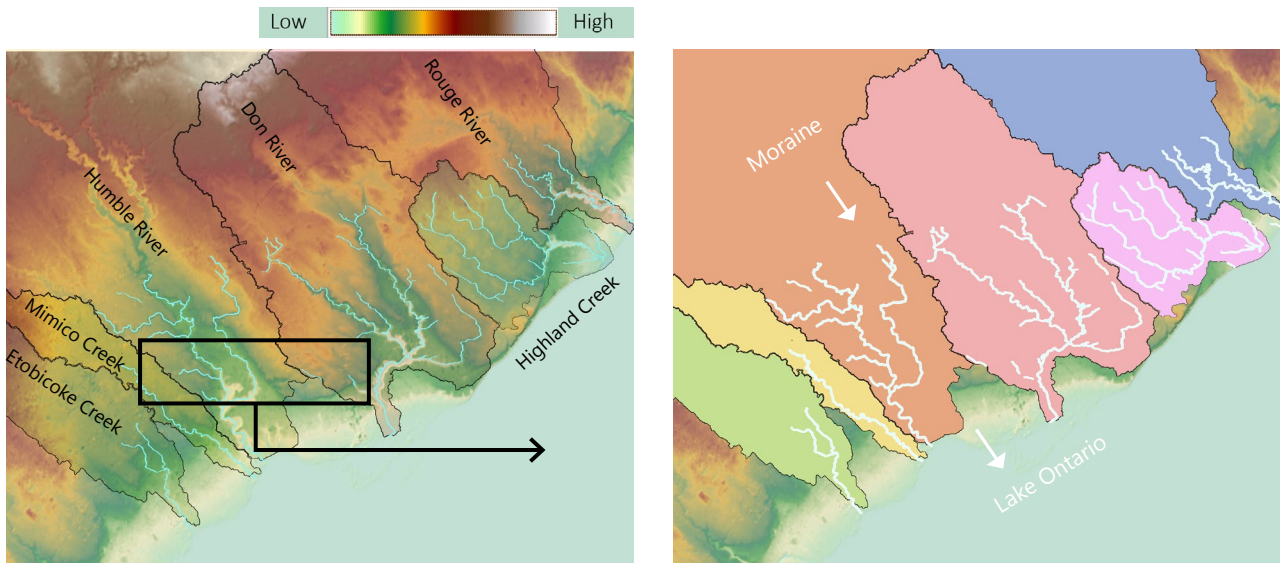
**Land use and urban settlement** enjoys the highest dynamism, and it determines how people use the interface in a short time.



While **building typology** dimension here emphasizes on the spatial relationship between building blocks and natural environment on interface.



**Accessibility** here specifically points at how people reaching the nature environment from urban environment through public space, and focus on the continuous and discontinuous of the spatial experience on the interface.



*Catchment/ Watershed Scale: It is implicitly understood that rivers must be viewed in their landscape and catchment (watershed) context. The catchment boundary defines the separation of surface flow from one hydrologic system to another. So when I regard the rivers as system, I will consider its boundary – catchment (watershed)*

## 2 Toronto Watershed

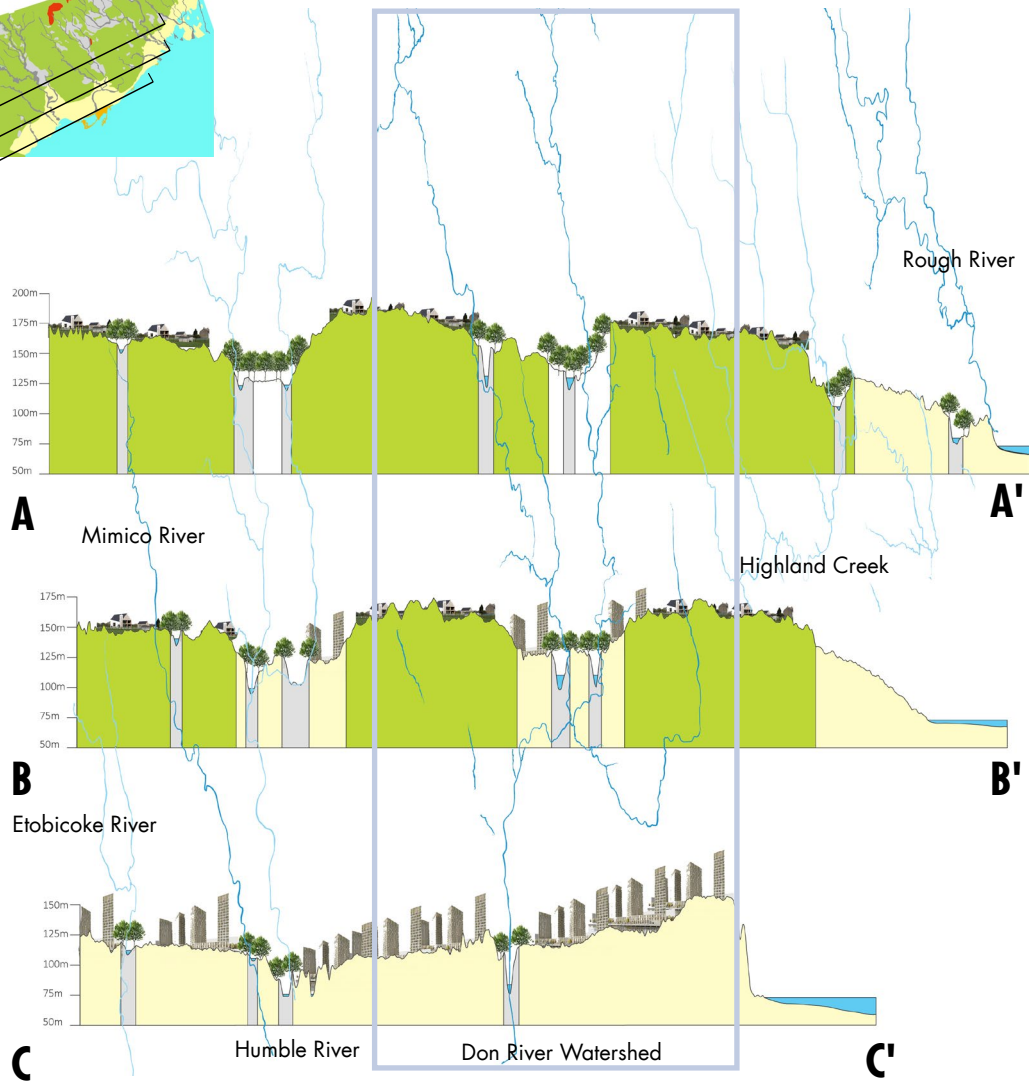
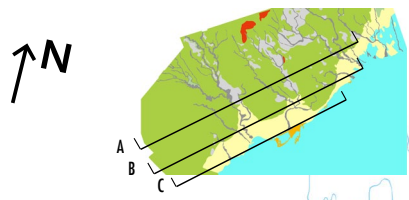
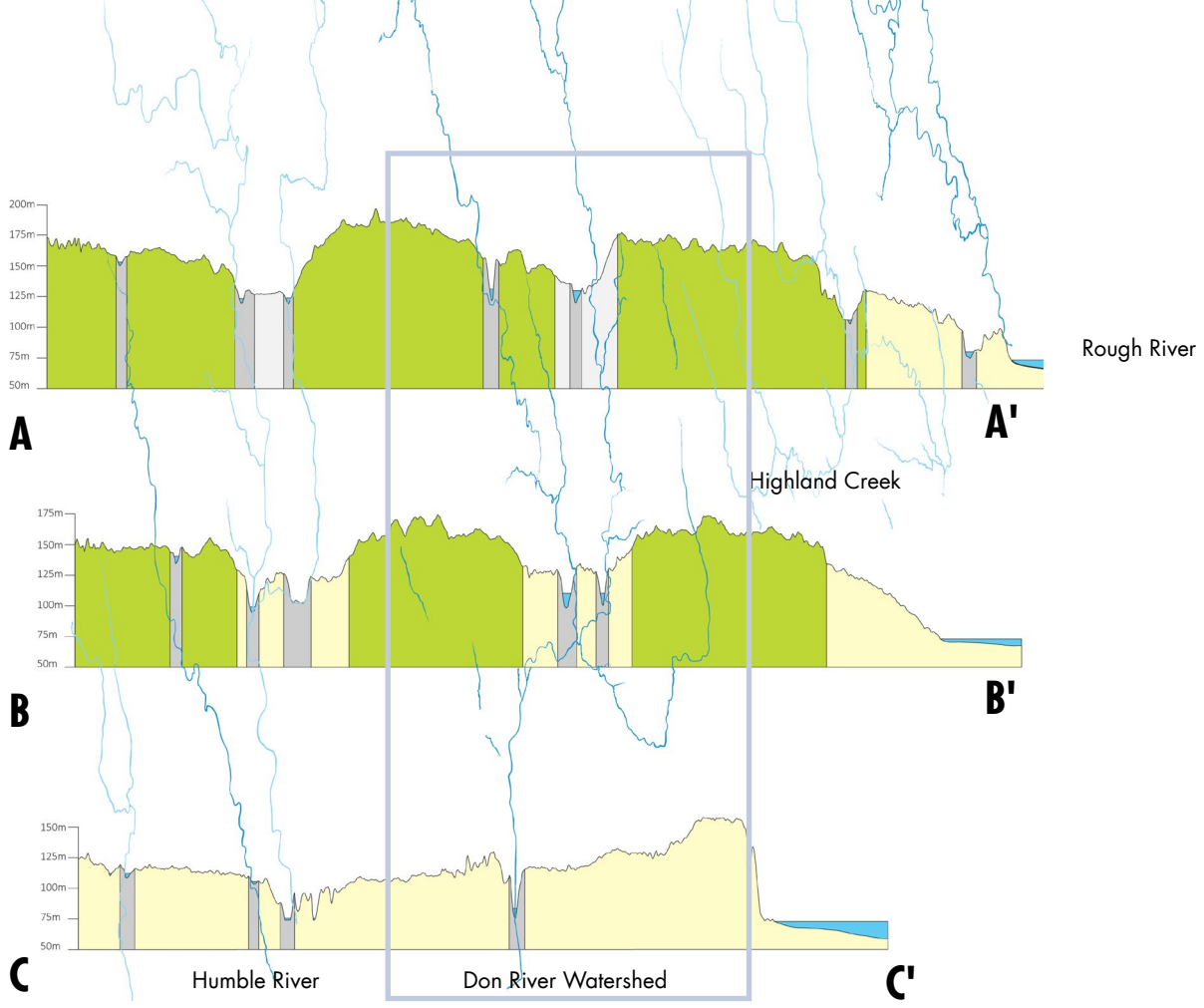
Water system is a crucial figure while working on the urban-nature interface of Toronto. Ravine is related to water. Therefore I need to look into the watershed (catchment), which is the boundary of the water system.

The largest ravines are home to the rivers running south from the Moraine to Lake Ontario. These rivers and creeks flow through high land (North) to waterfront area (South). And the river basin formed the lowland in city area.

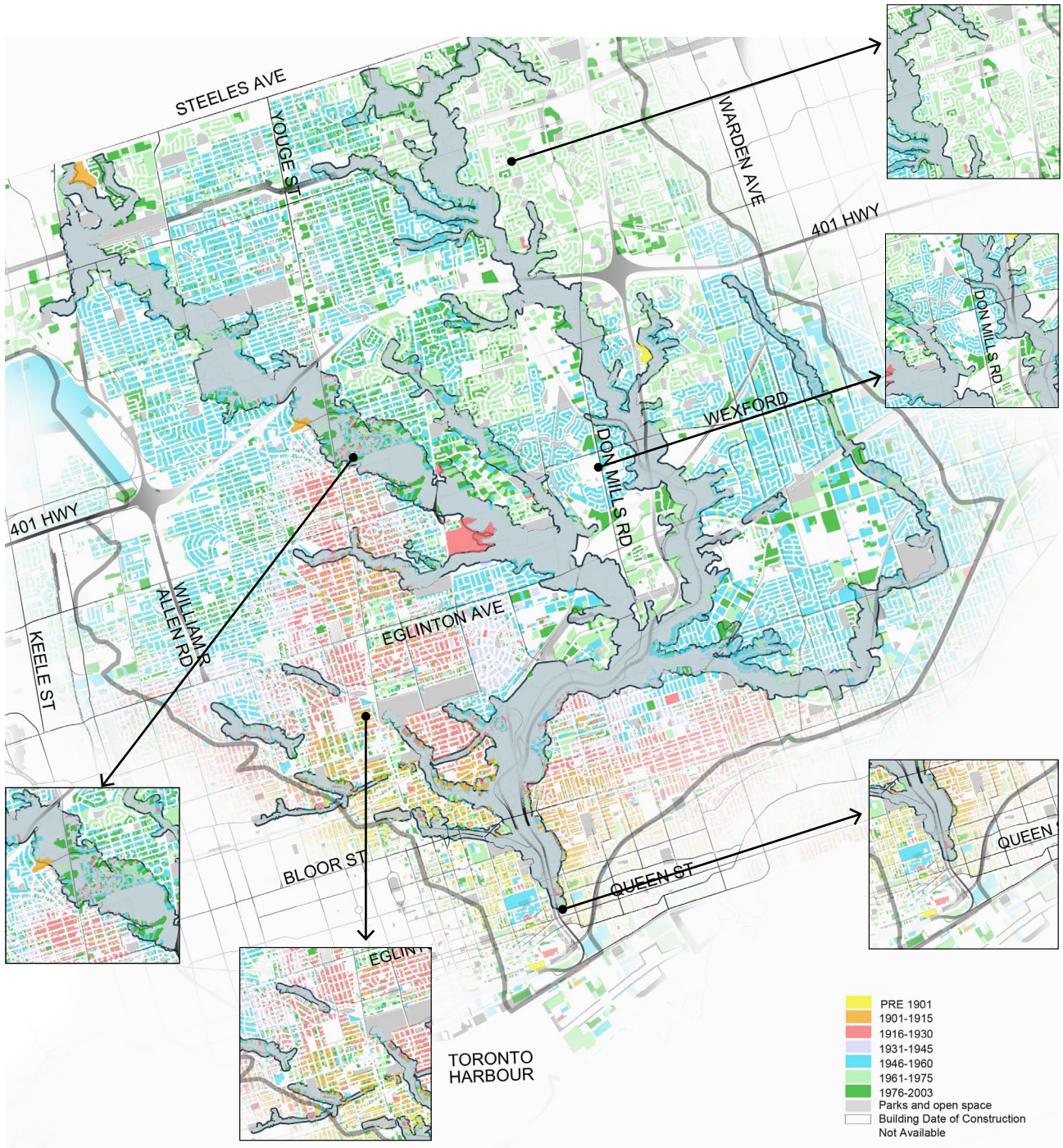
Toronto's ravine systems, with its river, dramatic geography and forest defines urban and natural landscape.

The sections in next page show the geomorphological impression of the watersheds in Toronto. Floodplain is the lowest spot in watershed while urban buildings were built mostly on the high spots on the watershed.

In the following research, I am going to zoom in into Don River Watershed, which includes downtown Toronto with a natural ravine inserting the city.



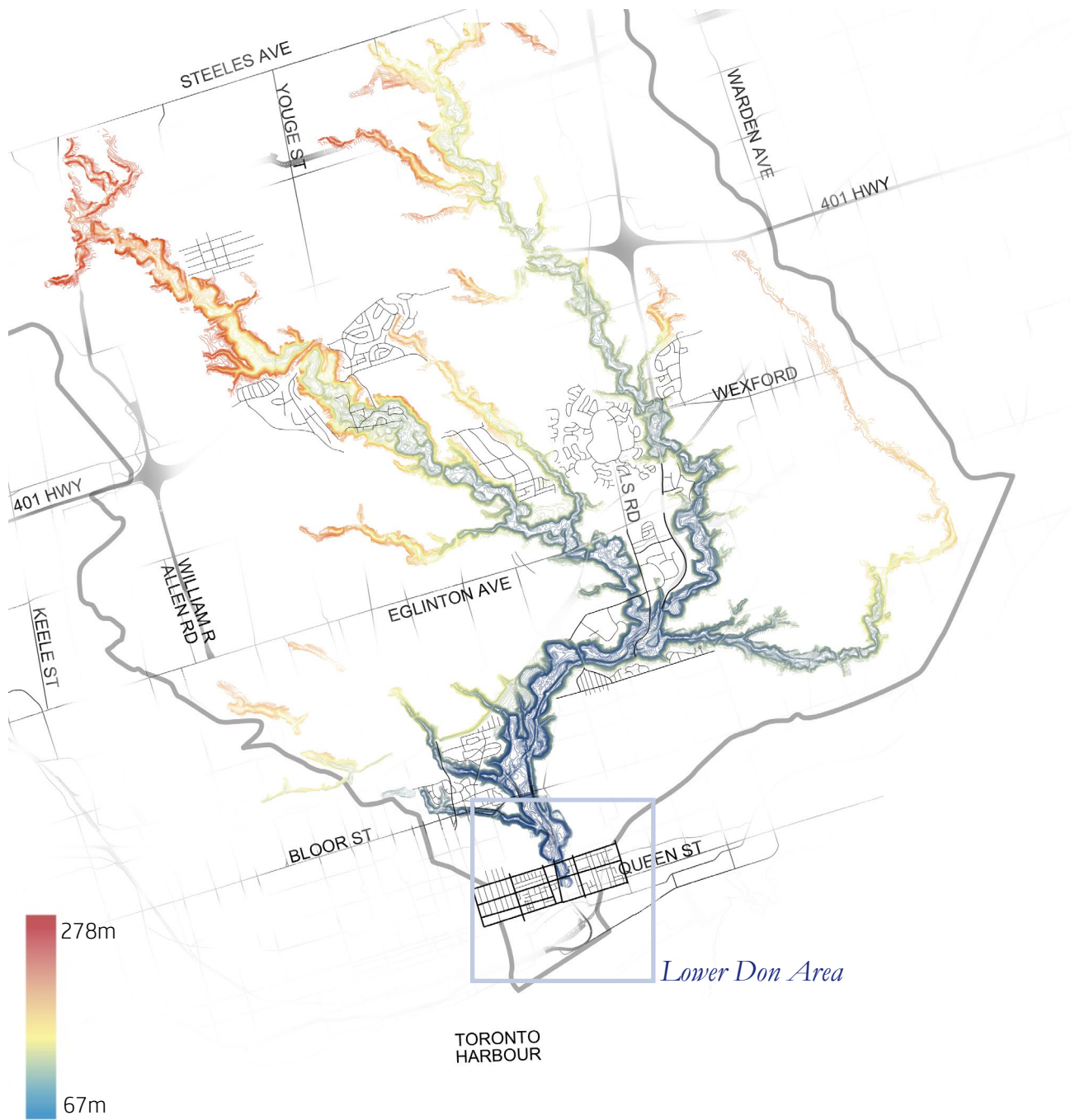
### 3. Historical Development of Don Watershed



While combining the historical development of city Toronto with Ravine nature protected areas, I found there are two major growing models of urban tissues:

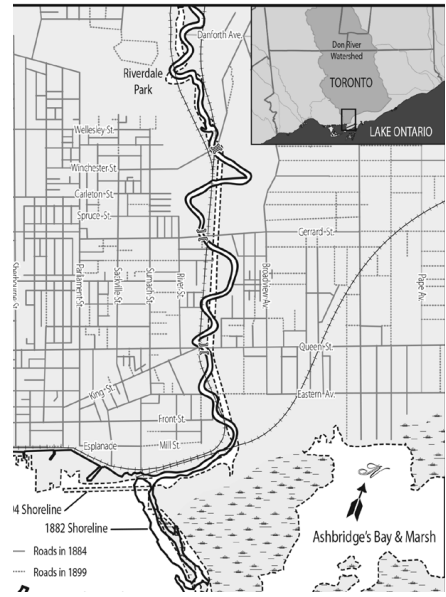
1. Mostly urban patterns grow independently but some old developed areas might have problems of aged water facility which cannot hold extreme discharge.
2. Here are several dependent patterns near ravine, pattern of one area even grows into ravine area.

These five main spots are the place where urban tissues interweave with nature figures.

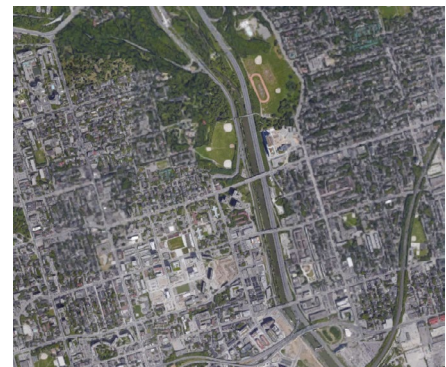


Here is the conclusion map for those dependent patterns around ravine valley areas. There are the places where interactions happened between urban environment and natural landscape, which are the interface I want to work on.

#### 4. Experimental Site - Lower Don Area



*The Lower Don River before and after straightening, 1882 and 1894*



South of Winchester Street, the natural meander river lost its gentle meanders and soft edges to form a wide, straight channel in nineteenth century and the narrative began afterwards.

Geomorphological condition was reshaped by human since then, soils and habitat was changing accordingly. Industrial buildings and infrastructures began to grow into the valley, turning the interface into a left-over space in city in last century. However, pollution continued unabated. Chronic problems with flooding, ice jams, and siltation also persisted and are becoming worse in recent years. The ravine protected area stopped at Gerrard Street and the south part was innovated into mainly urban environment.

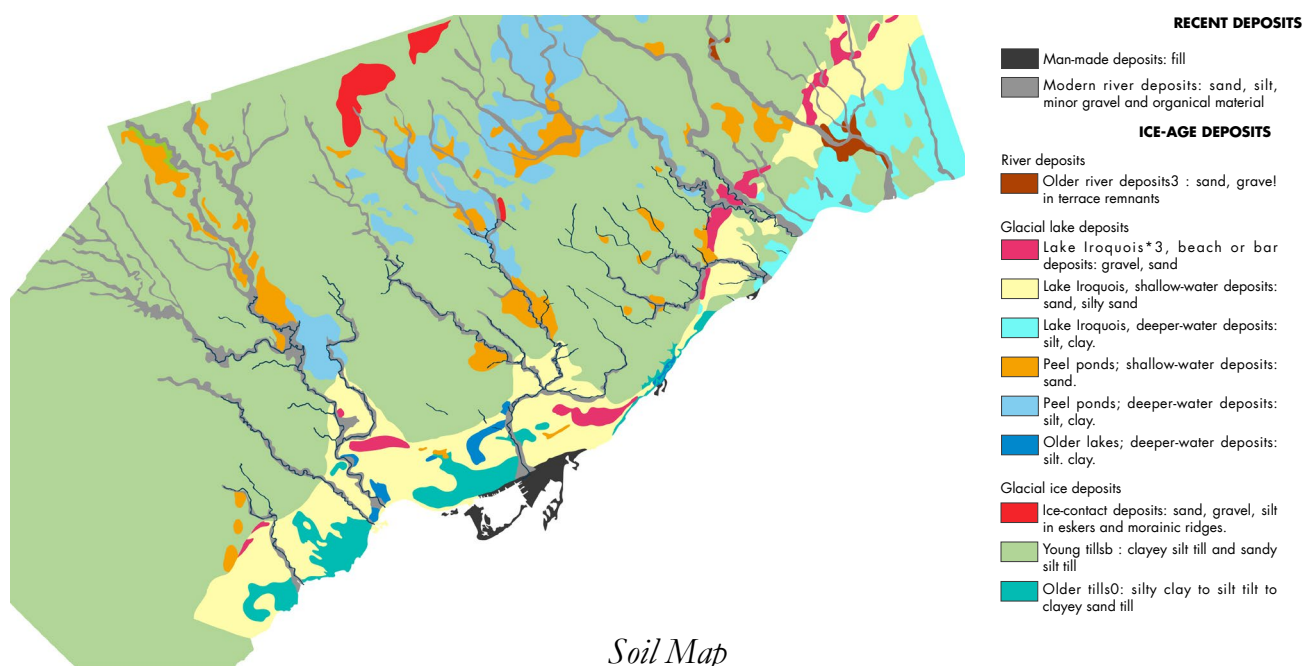
**PART FOUR**  
**FINDING PRINCIPLES**

## 1. Design with Natural Landscape Dimension

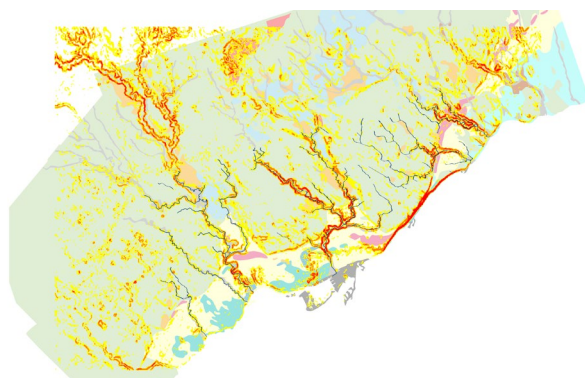




## 1.1 Analysis



*Soil Map*



*Geomorphology Structure*



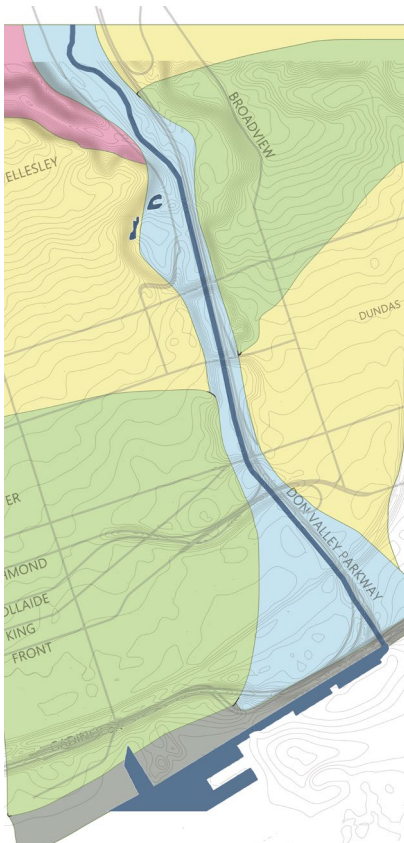
*Extreme Slope*



*Geomorphology Model*

In order to understand the natural layer of landscape, I have to look into the geomorphology of the region.

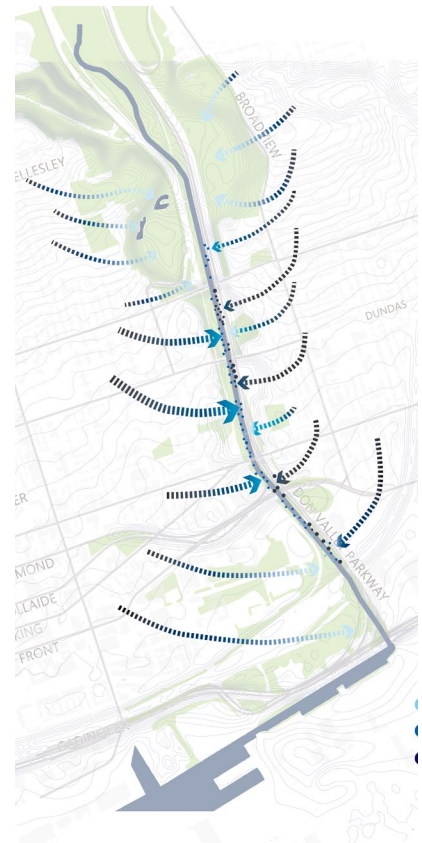
Large river ravine landscape is dissecting these two sloping plains - north of the Iroquois bluff in undulating till plain, south of the Iroquois bluff has more dynamic height difference.



*Soil Distribution*



*Habitat Distribution*

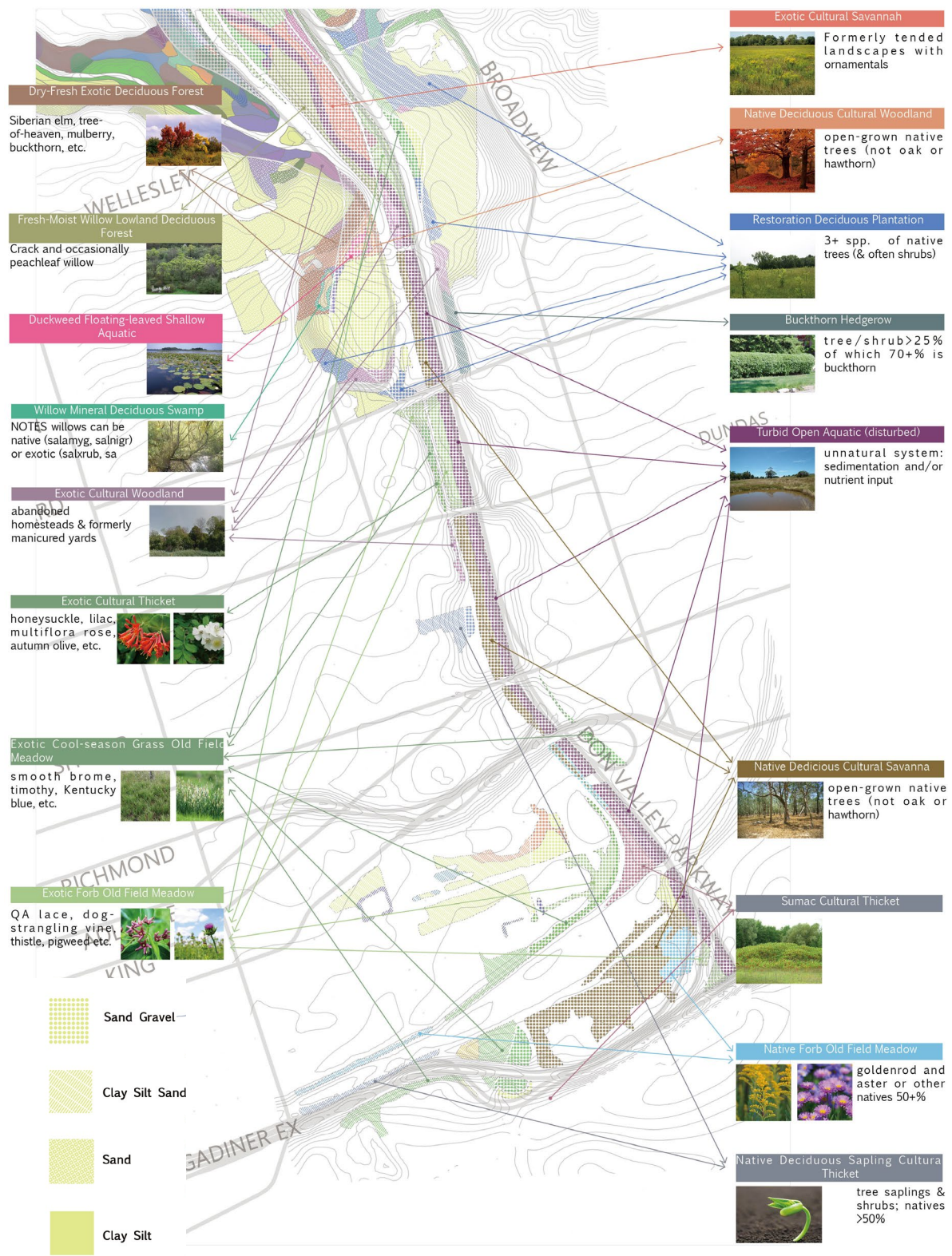


*Rainwater Runoff*

Most people have an emotional connection to trees. In cities, they represent one of our remaining links to the natural world. In this case, besides its ecological value, the vegetation on the interface between the urban area and ravine area is also the emotional connection between people and nearby nature.

By analysing the species, I will look into the general habitats and the underneath soil conditions and the land geomorphology which are related intimately with the above habitats.

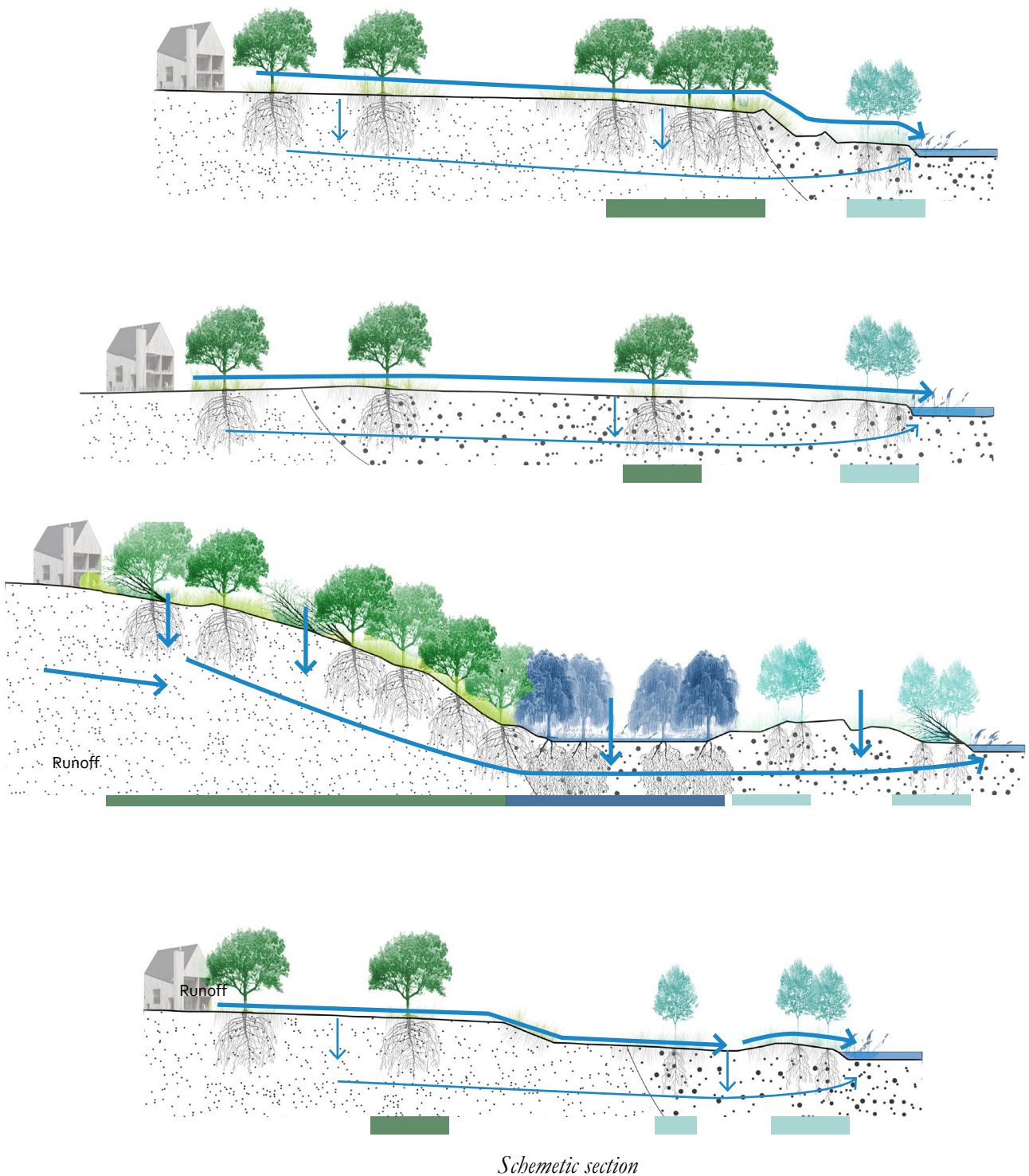
To rebuild the ecological diversity of valley interface, present habitats and the appropriate species needed to be researched. Research the species if they are native species, invasive species or adapted exotic plants according to the document from Toronto government.



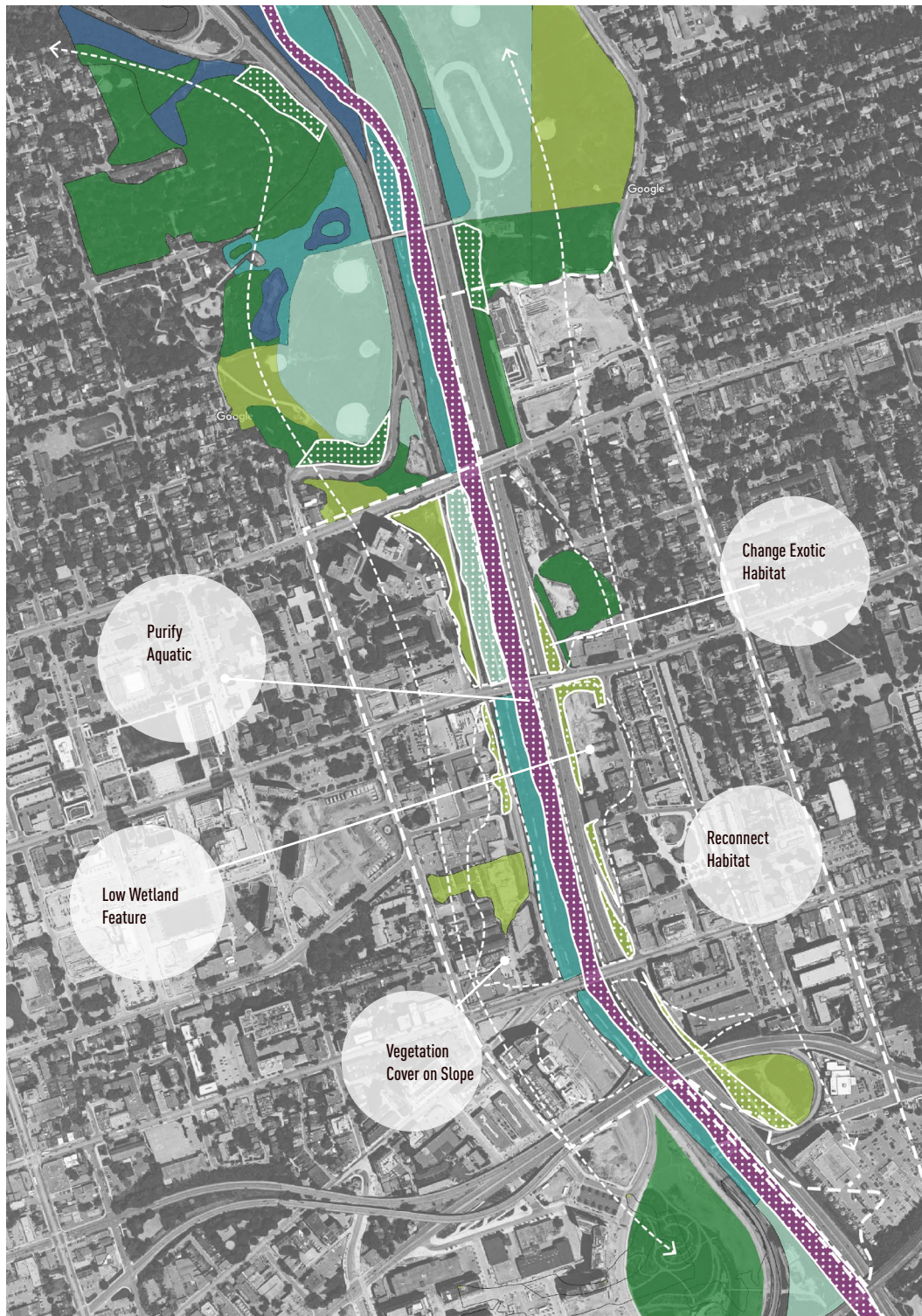
*Soil-Habitat Analysis*

By matching plants to their intended environment, soil types needed to be researched to ensure that the plants will be healthy, grow well, and need a minimum of care on the right place. Soil texture and of its relation to the movement of soil water and air, always determines the basic living conditions for vegetation and building construction. By mapping soil types and vegetation habitats, I can apply different ecological habitats on different landscape by carefully changing the land condition in the design.

## 2.2 Problem Statement



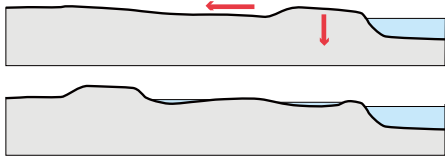
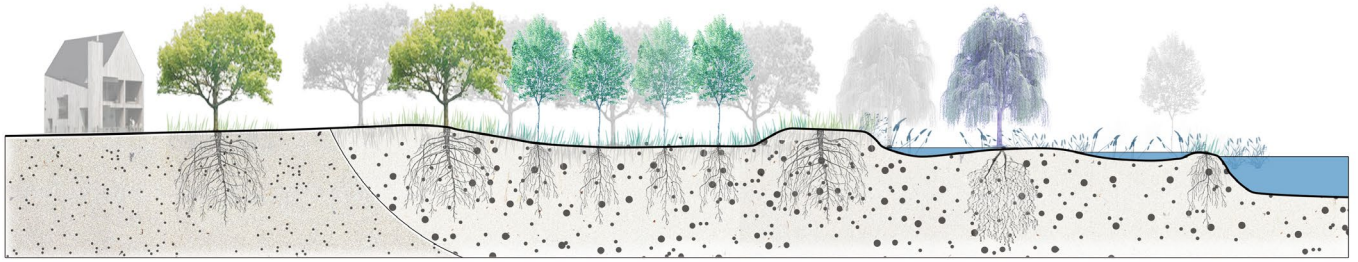
The above four sections show the soil conditions on site and the species on top of the ground. Then it shows clear that there are low biodiversity on the interface, and wetland features are missing while there are some parts of sand gravel soil underneath to provide wetland condition.



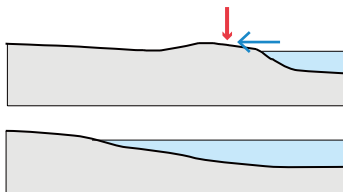
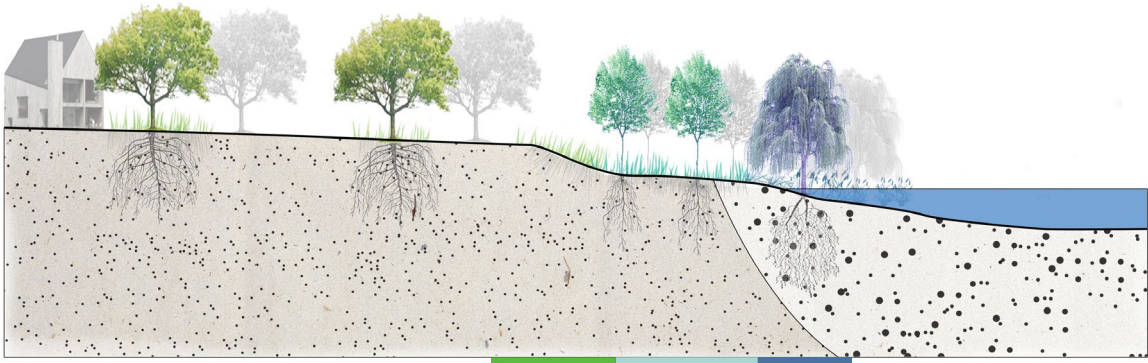
In respond to the analysis above, I proposed here to rebuild the ecological zone on interface, to connect the north ravine habitats and the lower corktown common habitats. Several potential were sited on this map according to that.

## 2.3 Adapt Principle

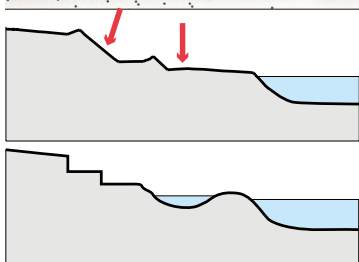
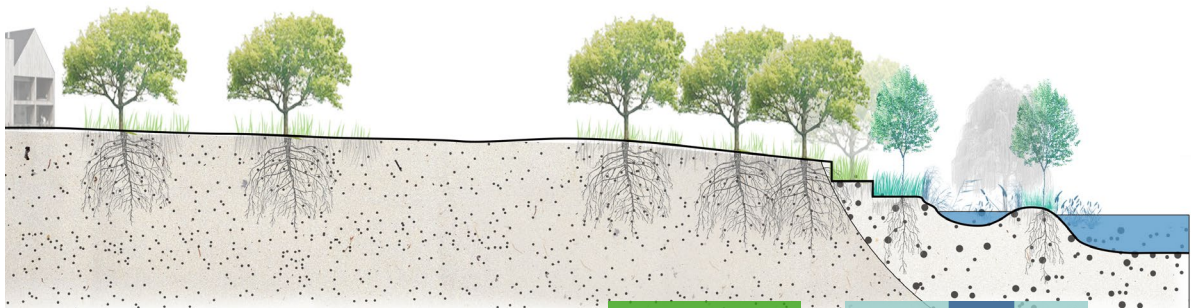
0 10 20 50 100



**Levee Setback:**  
Set back the levee to create wetland conditions to waterfront space



**Space for River:**  
To widen the river to create more space for aquatic vegetation



**Vegetation Terrace:**  
Change steep slope to vegetation steps to have more space for growing vegetation and delay the urban runoff.

## 2. Design with Water Infrastructure

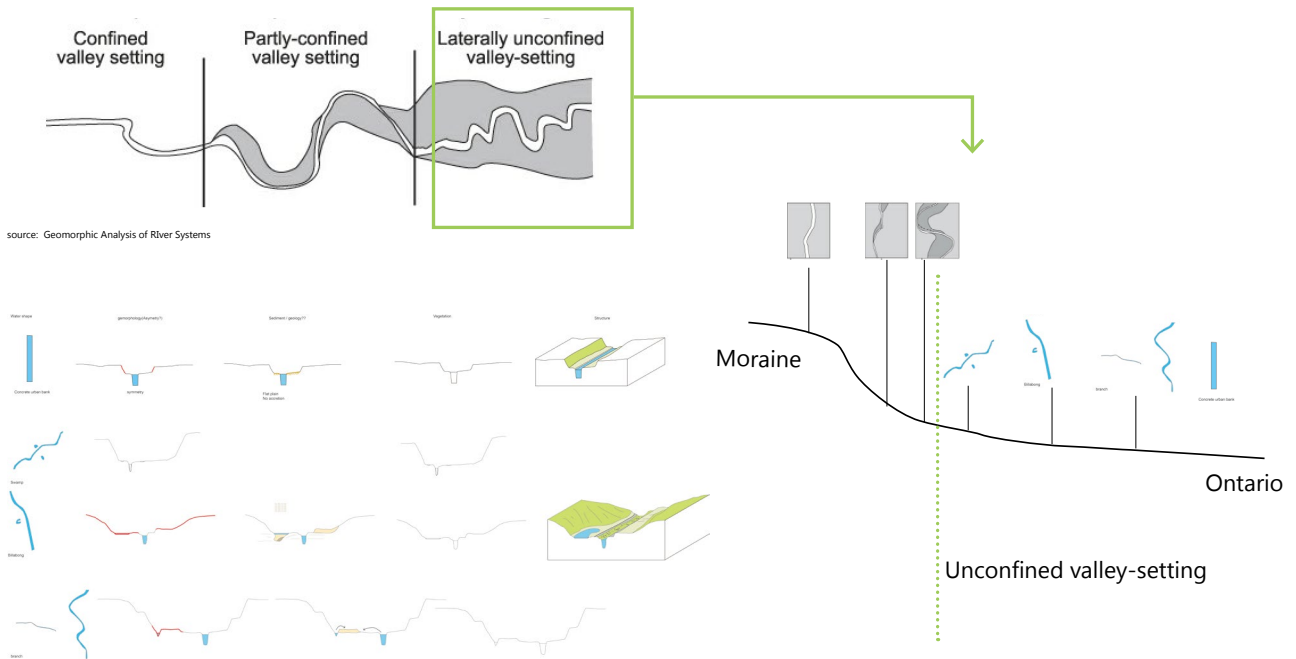


Midway Combined Sewer

Source: <http://www.vanishingpoint.ca/midway-combined-sewer>

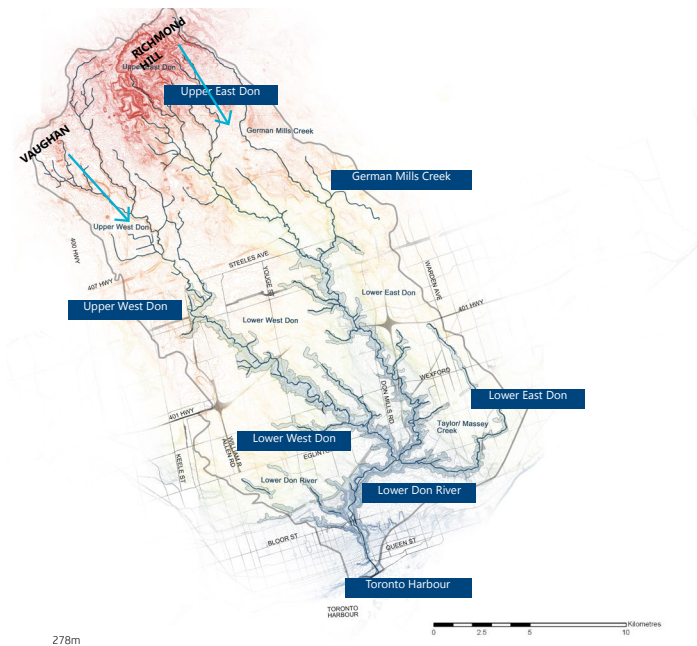
## 2.1 Watershed Analysis

To analyze the water problems on experiment site, I need to zoom out to watershed level to understand.

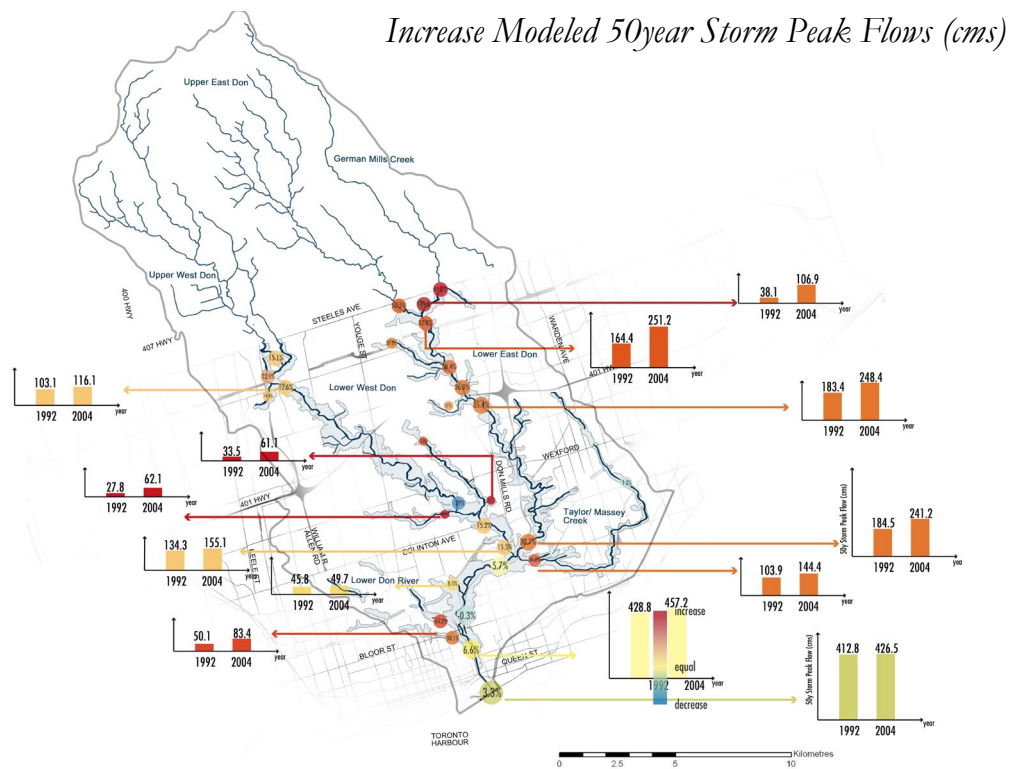
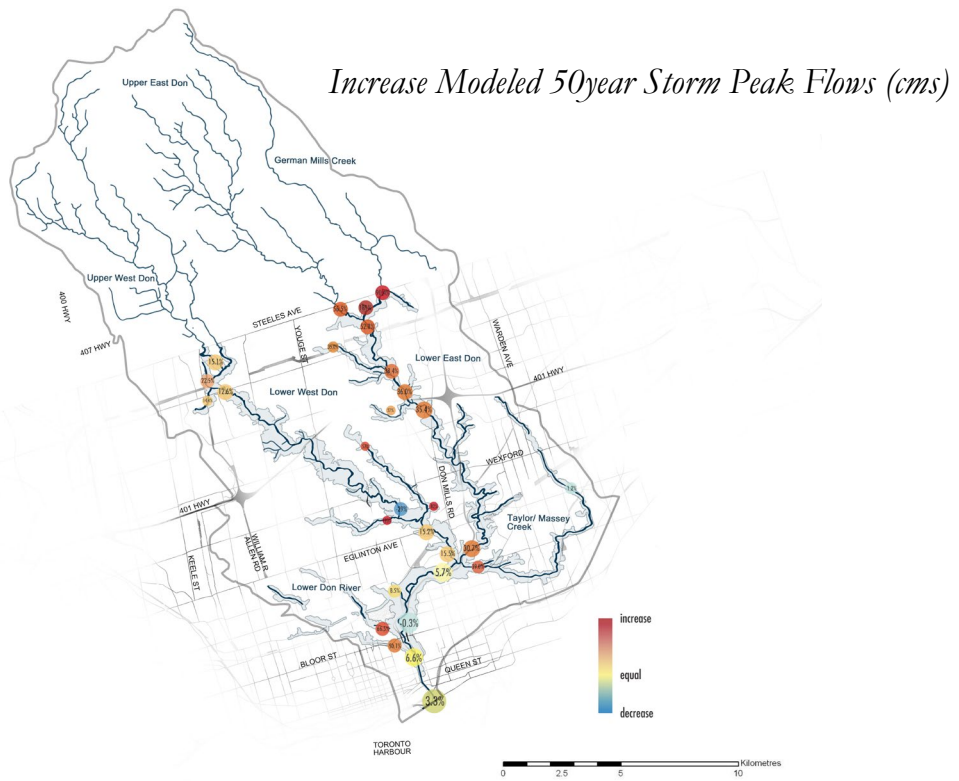


### *River geomorphology*

The Don river in Toronto region part is the unconfined valley-setting, with floodplain alongside the river. Several water features are existing on this part, like swamp, billabong, and branches.







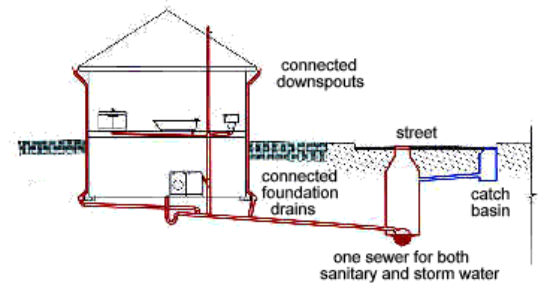
New urban developments implement stormwater management practices in an attempt to mitigate their impacts by maintaining pre-development peak flows. However, the impacts associated with the timing of peak flows and volume of stormwater runoff remains a challenge for the surface water resource management within the Don River.

The new hydrology model, the 2004 peak flows show a minor increase over the peak flows simulated during the previous 1992.

## 2.2 Site Analysis



*Flood plain on lower Don*

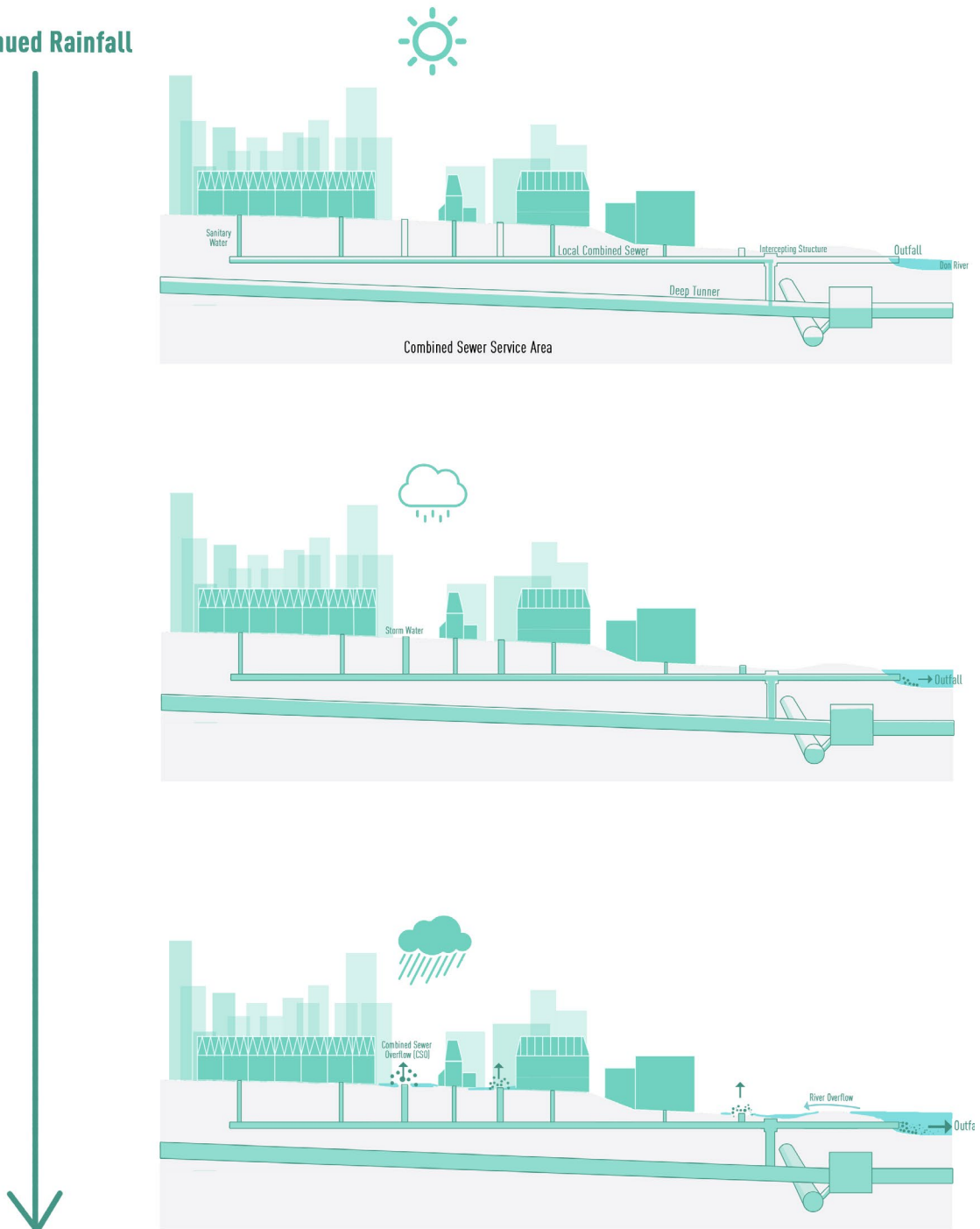


Source: <http://www.citynews.ca/2013/08/22/torontos-storm-sewer-system-needs-upgrades-report/>

There are flood plain on lower Don which Combined sewers, carry both waste water from the community and water from the streets. In dry weather and light rains, all the water goes to the pollution control facility, but when the amount of rain plus sanitary water reaches the capacity of the sewer, it overflows into the lake or a stream. Such an event and the outflow pipe are called Combined Sewer Overflows, frequently abbreviated to CSO.

## Present situation

Continued Rainfall



In rainy season, the overflow will cause serious overflow in the city. And the combined sewer will overflow into the Don river which polluted the water quality



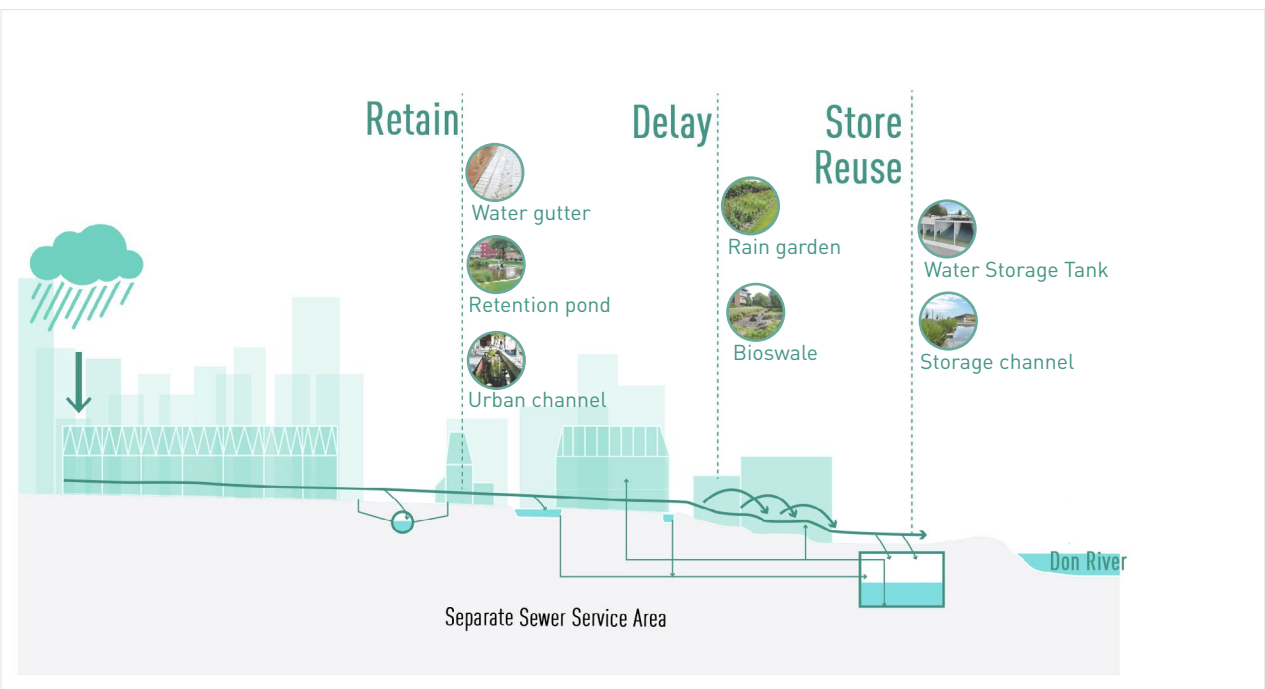
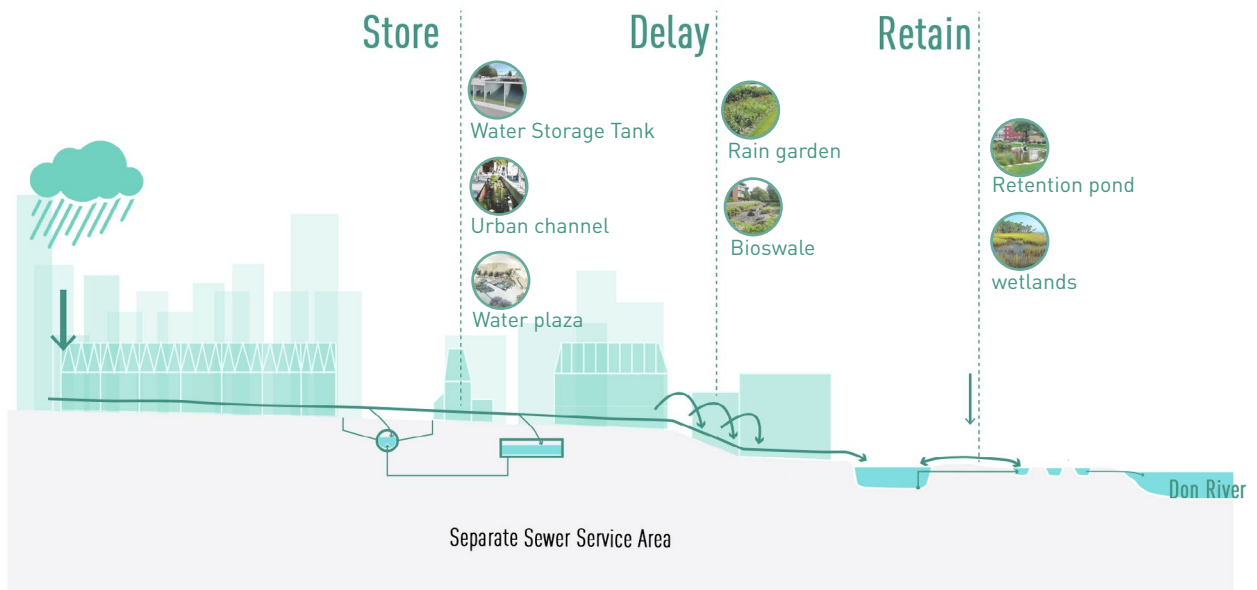
Delay

Retain

Store

Reuse

Drain



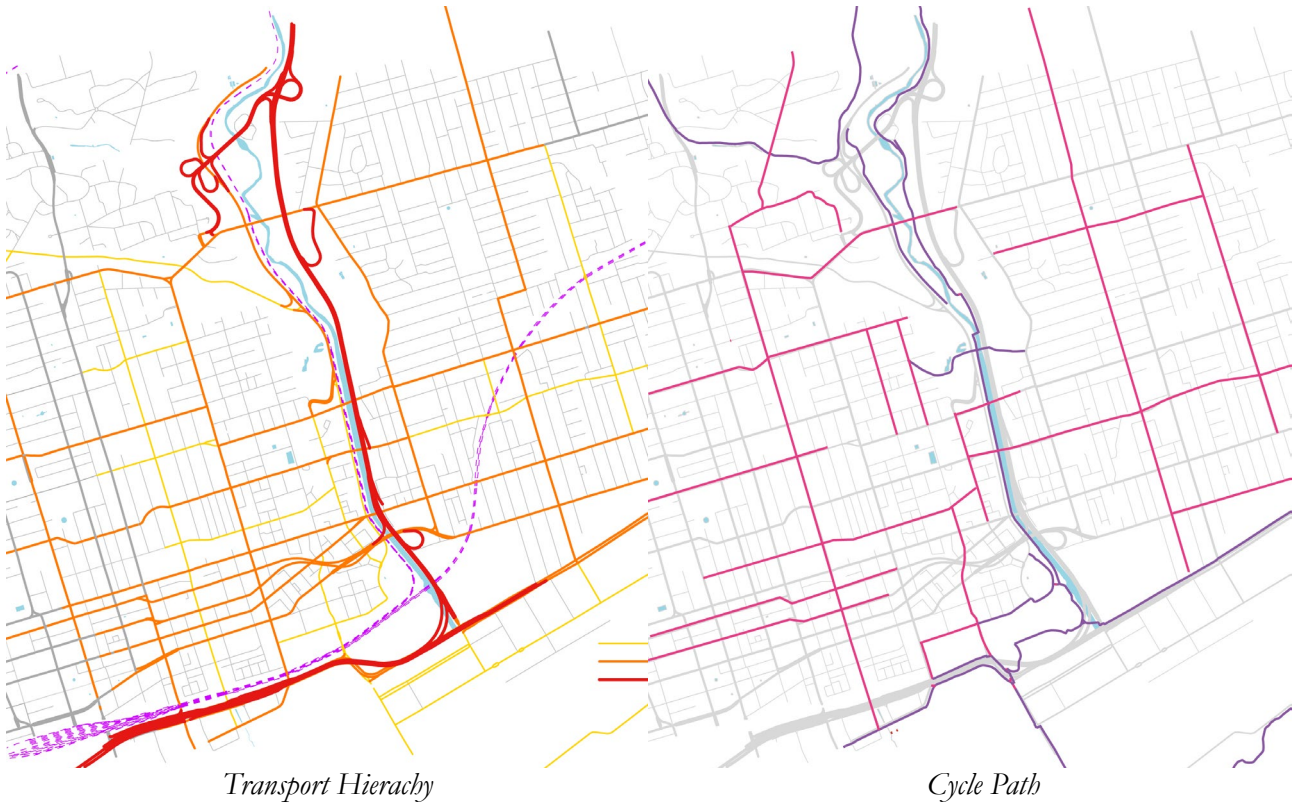
In order to solve the problem of wet-weather flow and polluted water quality, I will use these two models to increase the infiltration on land, delay the water conveyance, and store or retain the water.

### 3. Design with Infrastructure Network



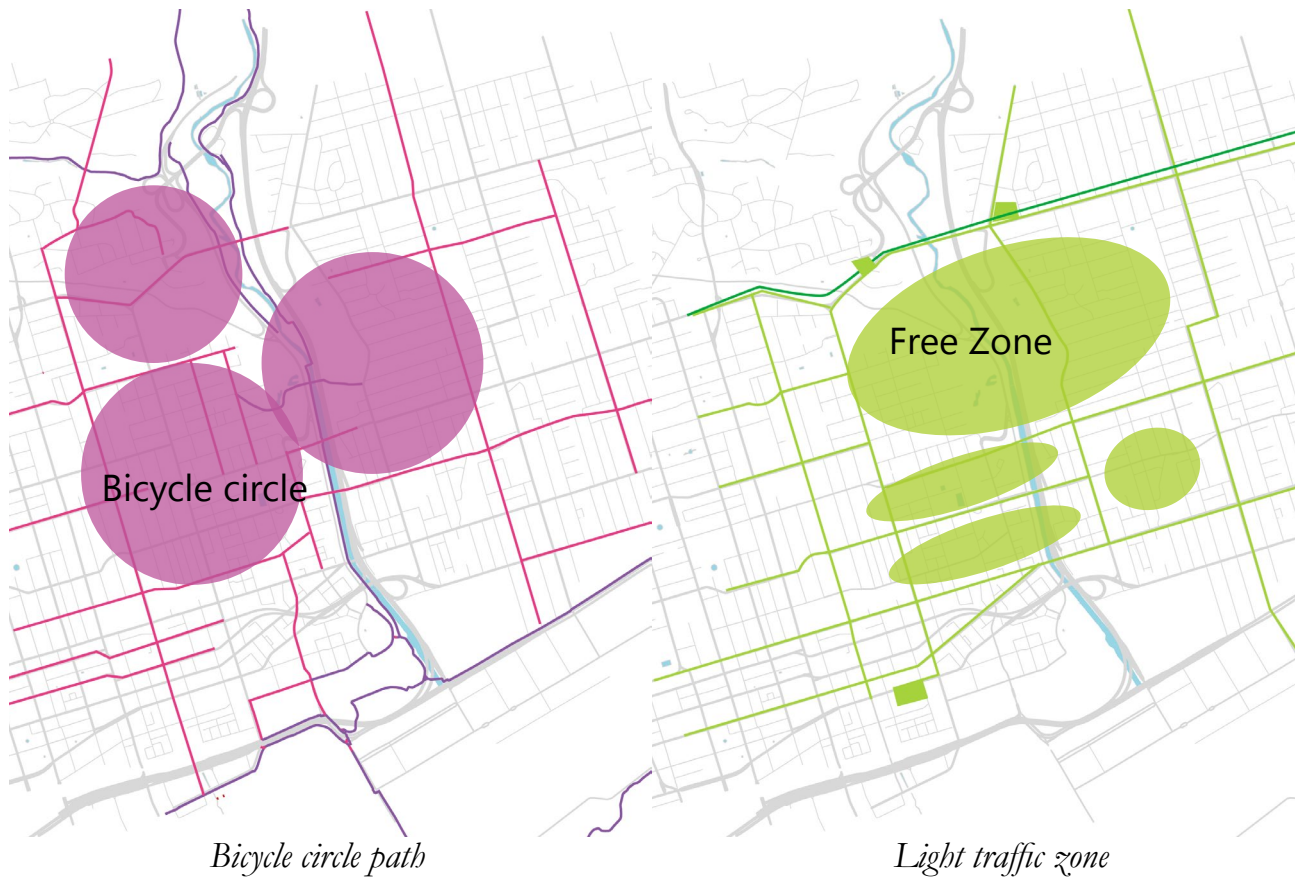
Don River Parkway  
Source: by Author

### 3.1 Analyze



To analyze the transport networks, there are three dimensions I am interested in. 1: Transport service Hierachy. 2. Existing cycle path. 3. Public tranportation and stops

### 3.2 Problem Statement



After analysing, I realize the highway and railway cannot be removed in short time, so I proposed to create lighter traffic zone in between major roads, and create cycle circular routine to increase secondary transportation.

### 3.3 Adapt Principle



*Transportation Corridor 1*



*Transportation Corridor 2*



*Green Bicycle infrastructure*

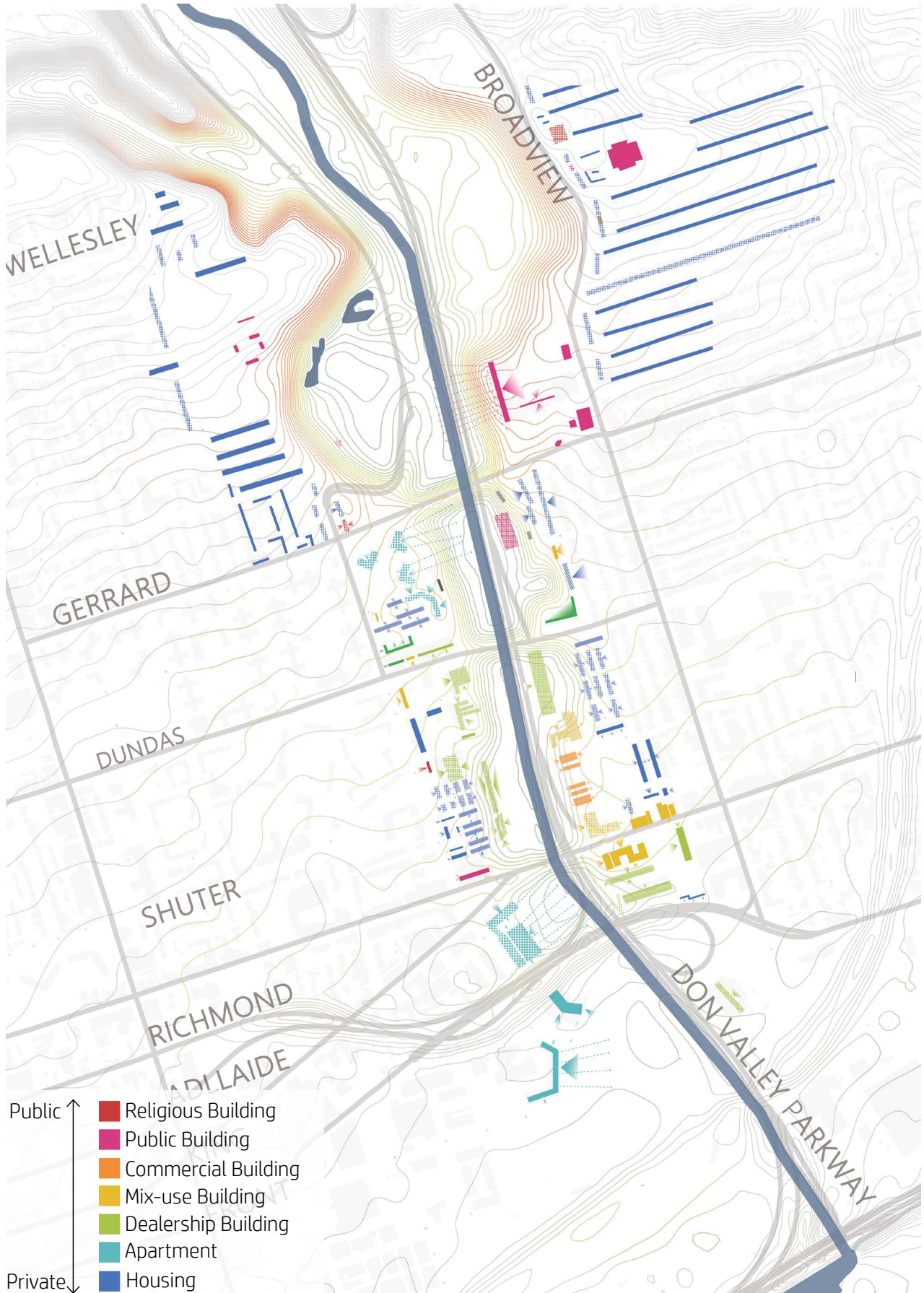
There are my three initial strategies according to above analysis.

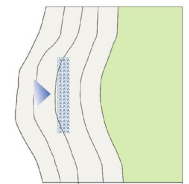
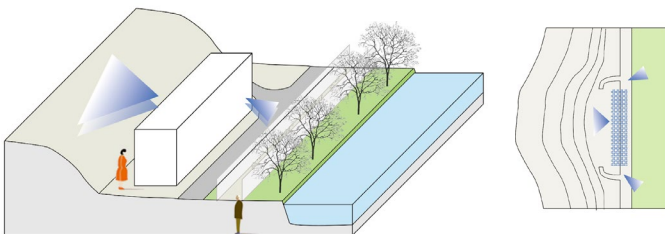
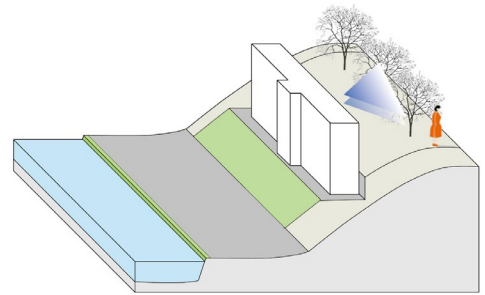
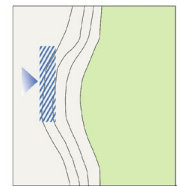
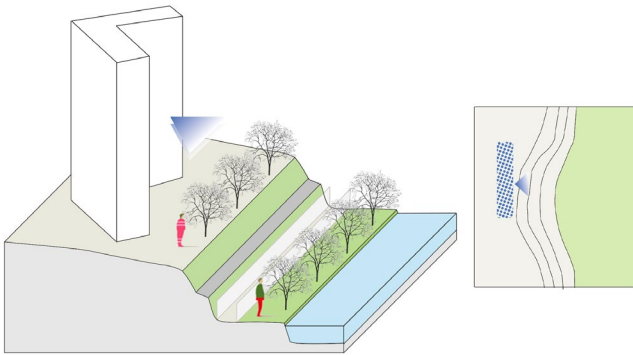
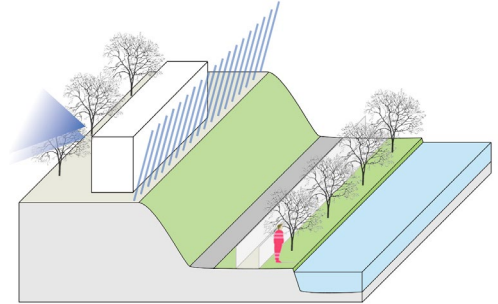
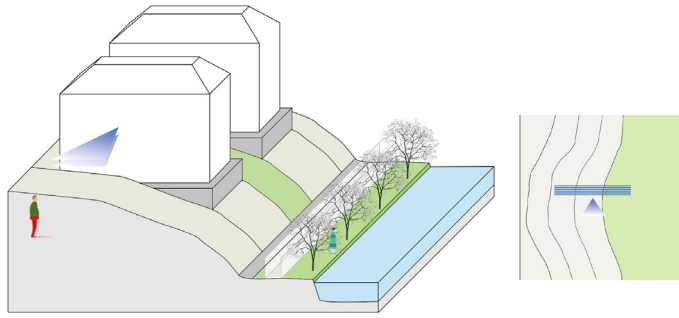


#### 4. Design with Building Typology



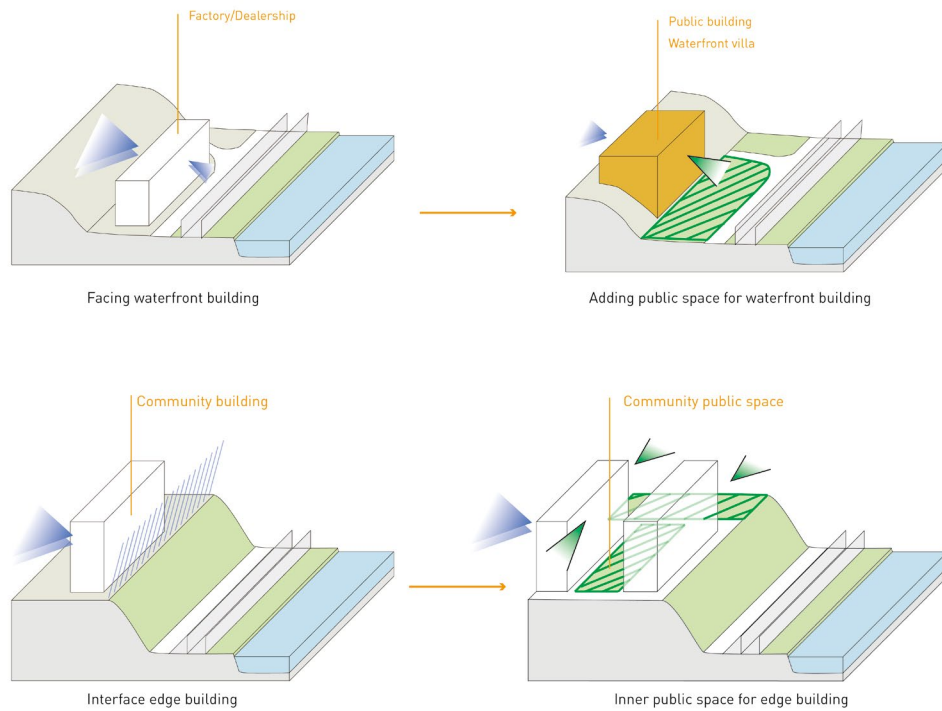
## 4.1 Analysis





Because of the straightening the Don River in the Nineteenth Century, industrial factories, residents buildings began to grow alongside the riverbank. There are a lot of buildings grow on the interface. Some have good spatial relationship between valley, some don't have. Here I analyze the viewing connection, the building orientation and the connection between local community gardens or family gardens and the ravine natural features.

## 4.2 Adapt Principles



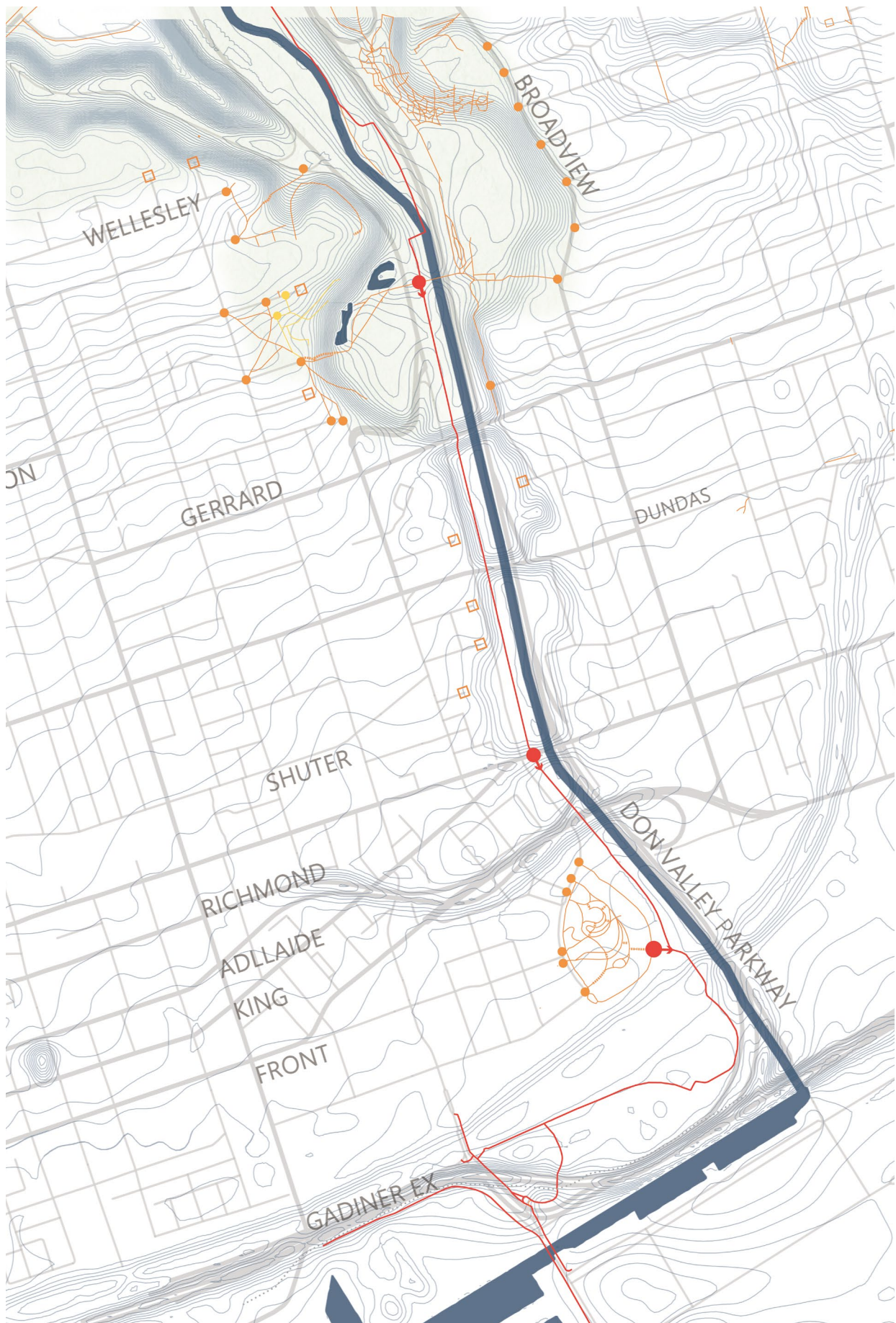
The principles for building dimension mainly focus on opening up the spatial connection between urban blocks and ravine nature features. The initial idea is removing the industrial factories and auto dealerships alongside the waterfront, to transform into public buildings or low-rise building to open the view. The other idea is to build the connection between neighborhood gardens/parks to ravine nature features.

## 5. Design with Accessibility



Lower Don Tunnel Entrance  
Source: by Author

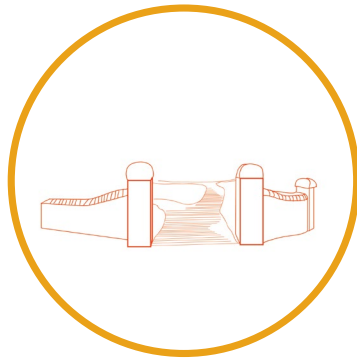
## 5.1 Analyze



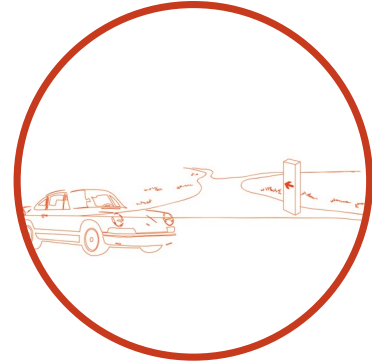
## Access Points



*1 Private Gate*



*2 Open Gate*



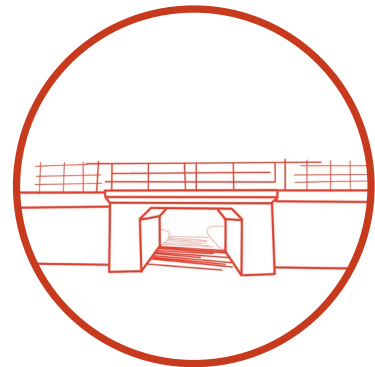
*3 Road Entrance*



*4 Nature Edges*

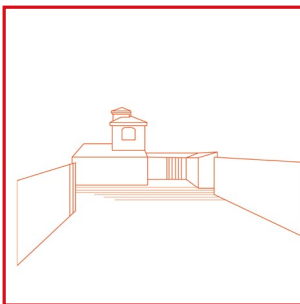


*5 Stairs*

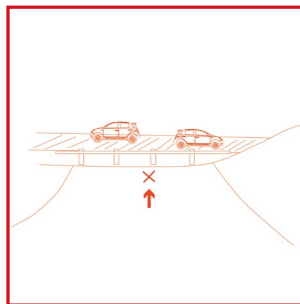


*6 Tunnel*

## Blocking Points



*Building*



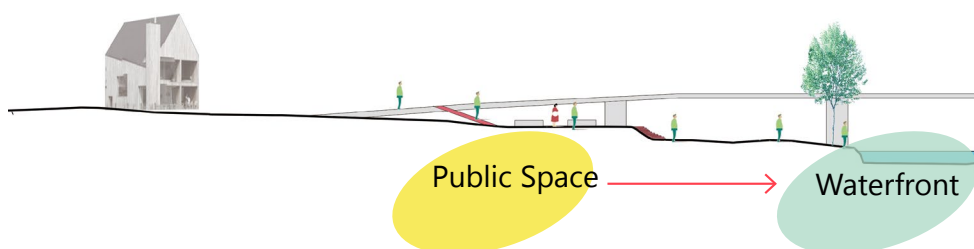
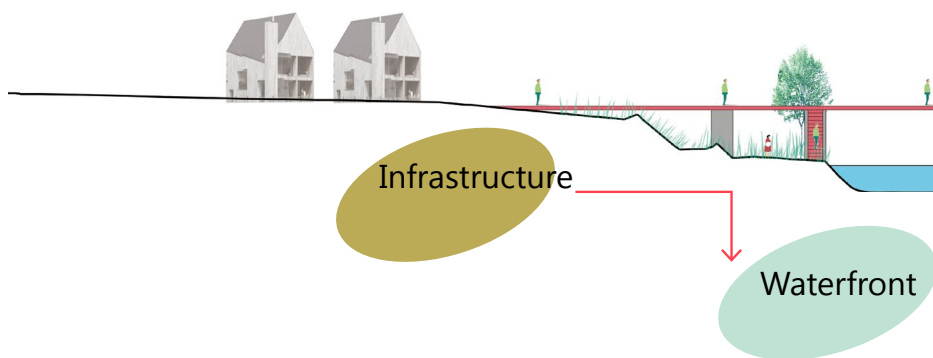
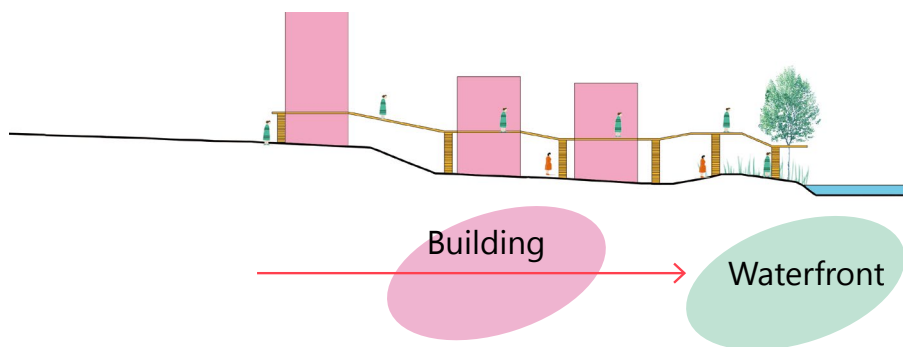
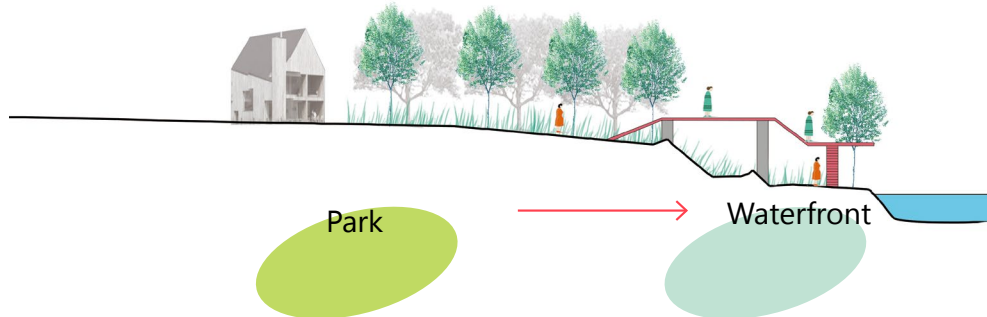
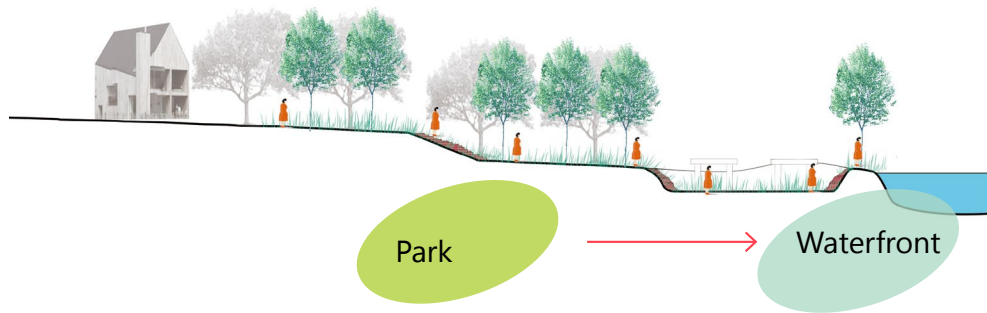
*Infrastructure*

Don valley is the most readily available go-to natural experience for downtown residents, it's a perfect setting for environmental and historic interpretation, public art, and recreation.

The intensification and development of new communities in the lower Don Valley neighbourhoods will bring increasing demand for accessing the nearby nature. There should be more possibilities for people to go into the nature.

Thus, I looked into the interface between city and Don Valley to find out the existing access points and blocking points, and classified them into few typologies

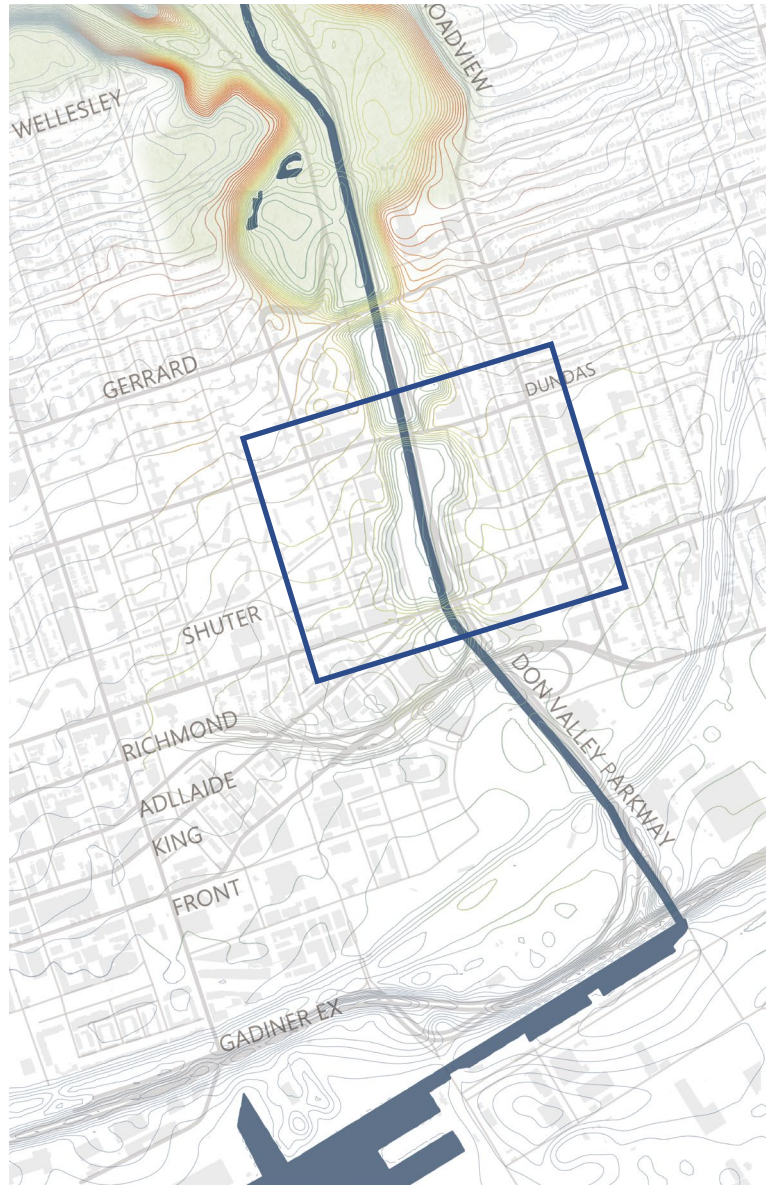
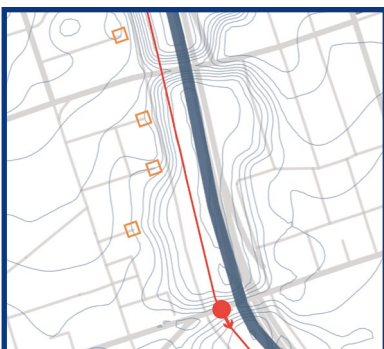
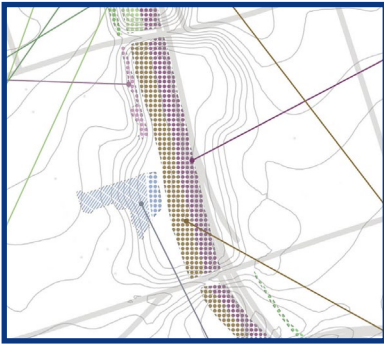
### 5.3 Adapt Principle





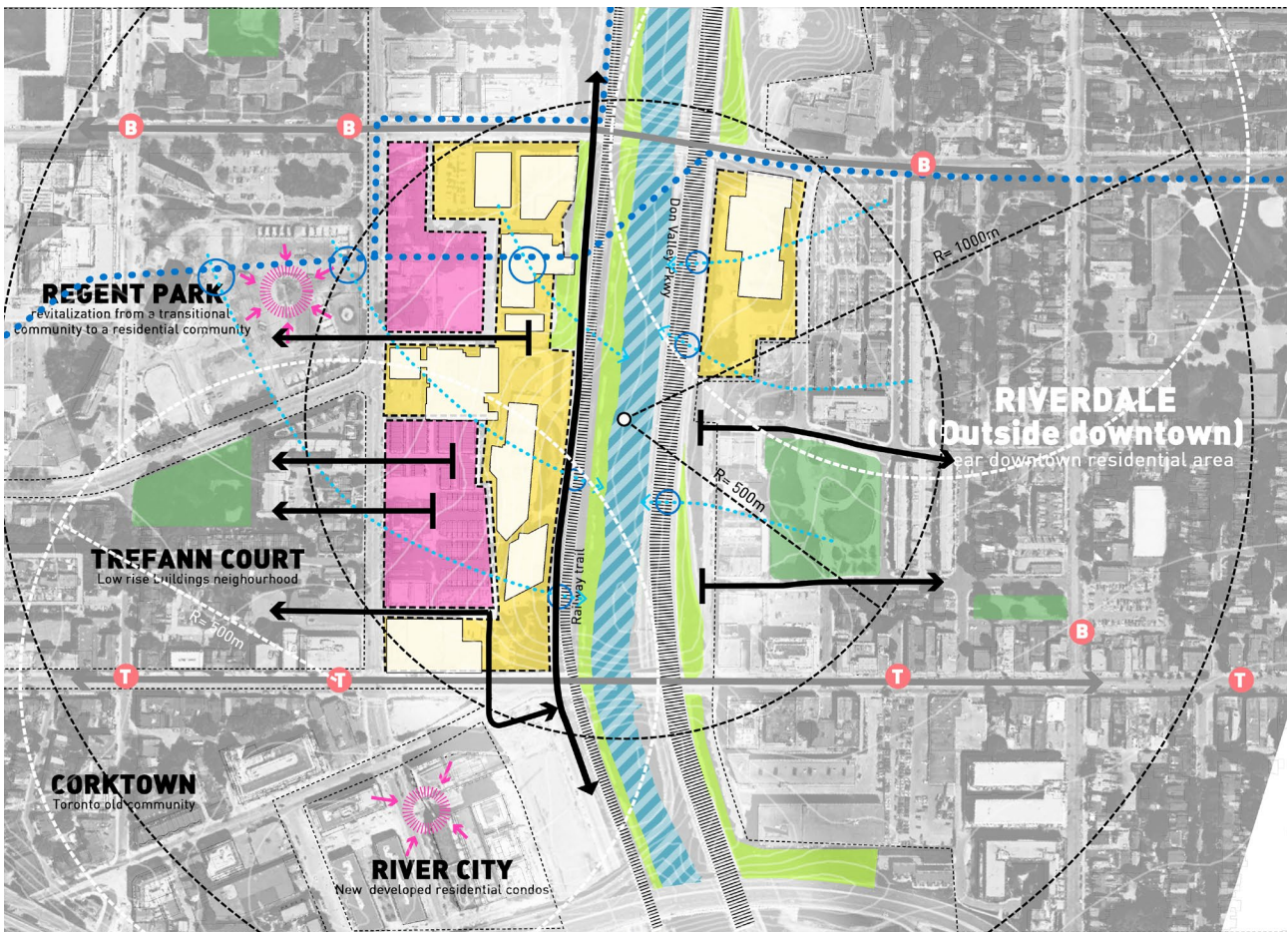
**PART FIVE**  
**DESIGN APPLICATION**

## 1 Design Location



After the last chapter's analysis, I had the principles for five dimensions. In corresponding to them, and due to the time issue, I am going to test them on one site on lower Don interface, where all the dimensions were involved in.

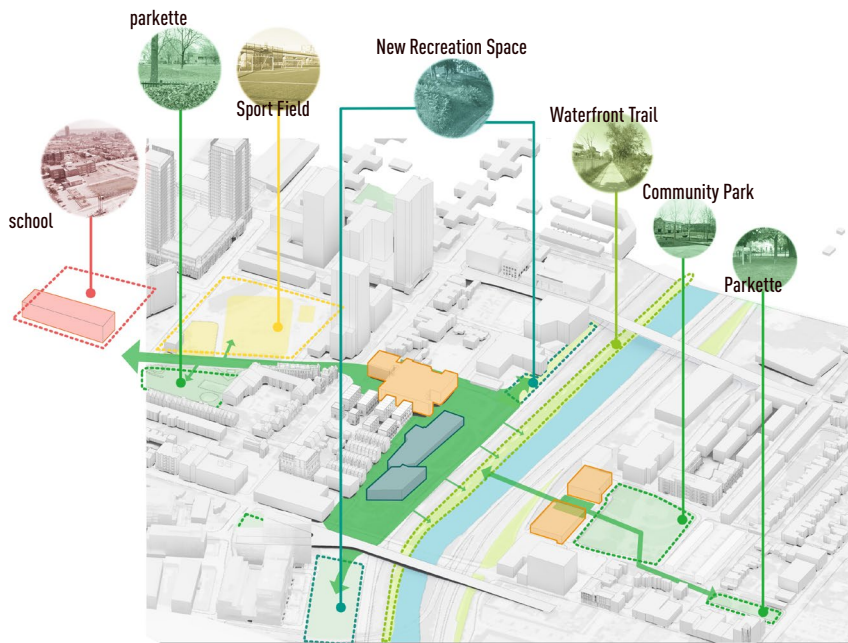
The Site I chose sits in the middle of the Lower Don River. It is about 50 hectares.



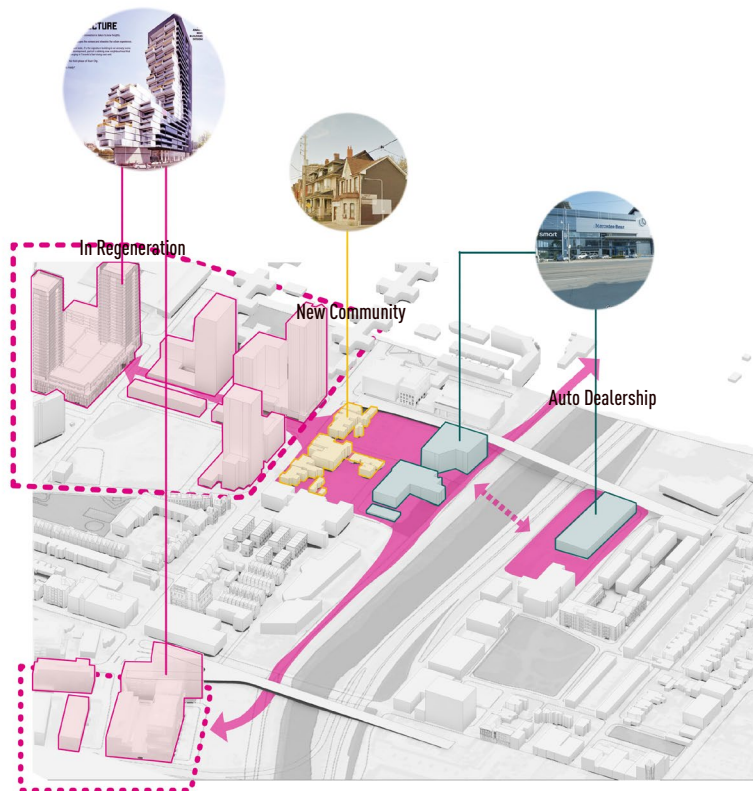
### 1.1 Analysis of the site

According to the analysis of the 5 dimensions above, and the specifically problems on site, here is the conclusion I draw for this site. Here natural don ravine was taken up by urban blocks, the natural habitat was almost gone but only a little shrubs and trees were growing on few spots. There are few outputs in this area, city's main water trunk is running under the site. But the area still uses combined sewer systems which causes overflows and polluted water in rainy season. Train trail and high way are cutting through the interface, auto dealerships are taking over the space on the bottom of the interface. While the surrounding neighborhood (Regent Park and River City) is going through community regeneration, the interface was left over with old community and post industrial functions.

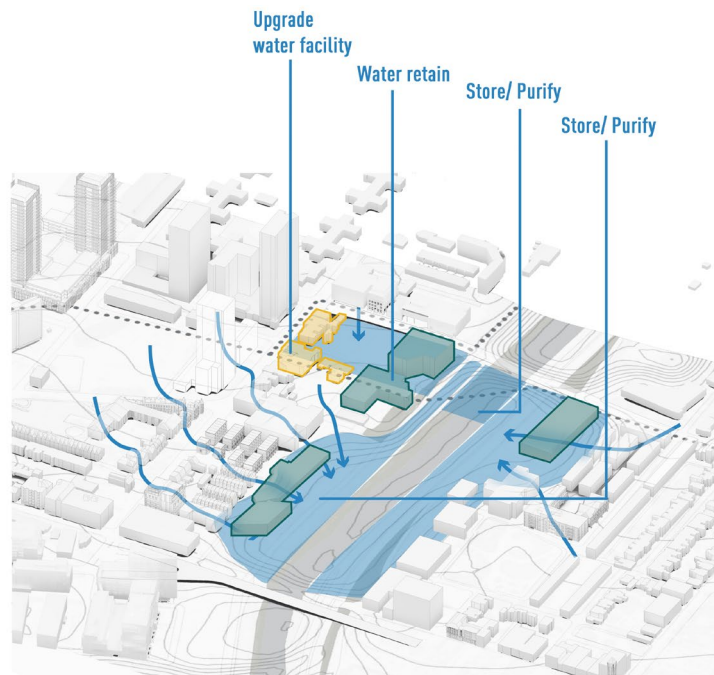
## 1.2 Potentials of the site



### 1. Recreation Hub



### 2. Regeneration Extension

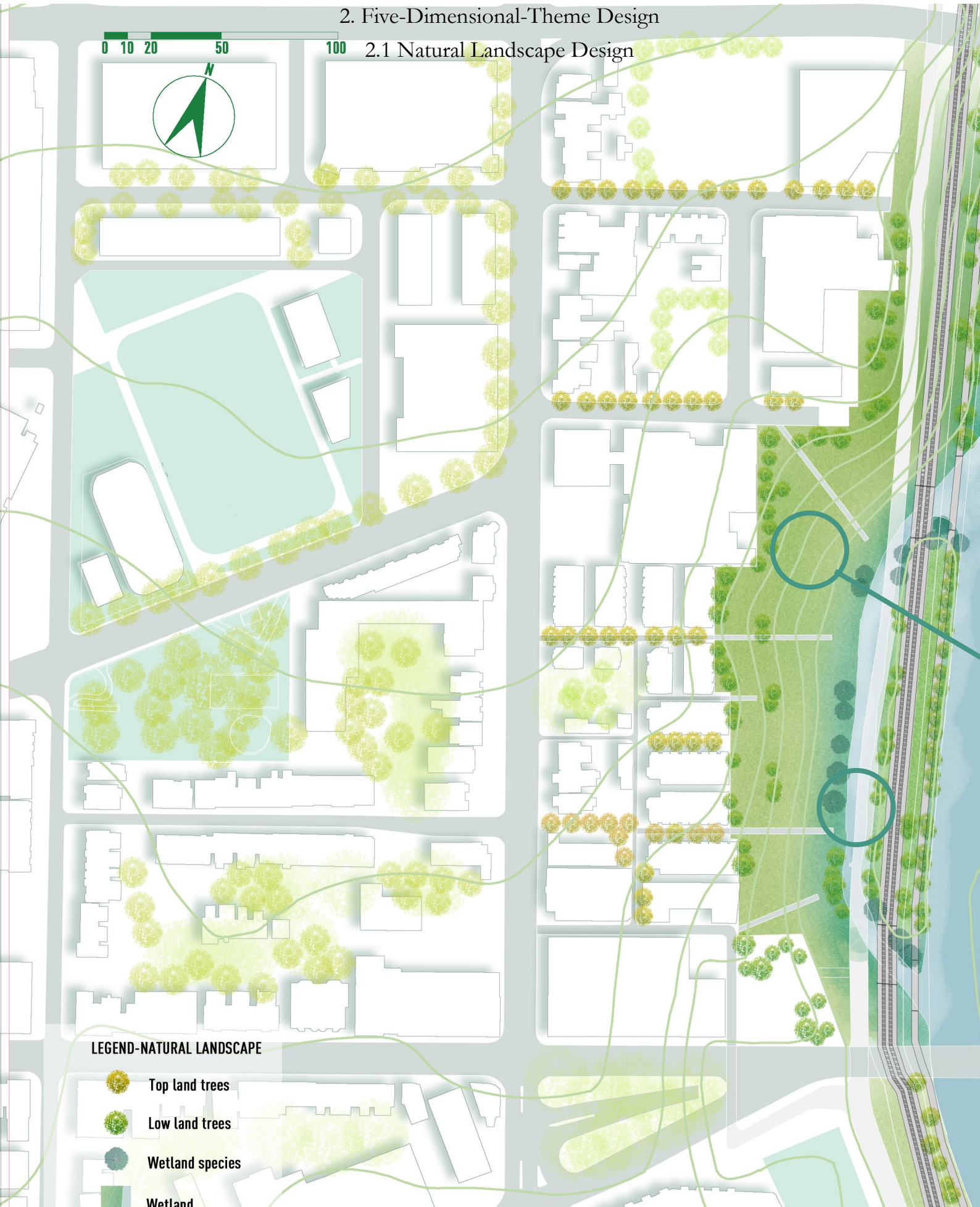


### *3. Water resilient community*




There are three main potentials I proposed for the area. 1. To create more green spaces to connect parks and other recreation spots in city to create a recreational section through the interface. 2. To redevelop the community on interface in respond to the urban regeneration nearby, and to take it as an opportunity to renew the old facilities. 3. To make use of the geomorphological advantages, upgrades the old water facilities in order to build a water resilient community. Principles will be experimented through design based on these potentials.

## 2. Five-Dimensional-Theme Design

### 2.1 Natural Landscape Design



#### LEGEND-NATURAL LANDSCAPE

-  Top land trees
-  Low land trees
-  Wetland species
-  Wetland

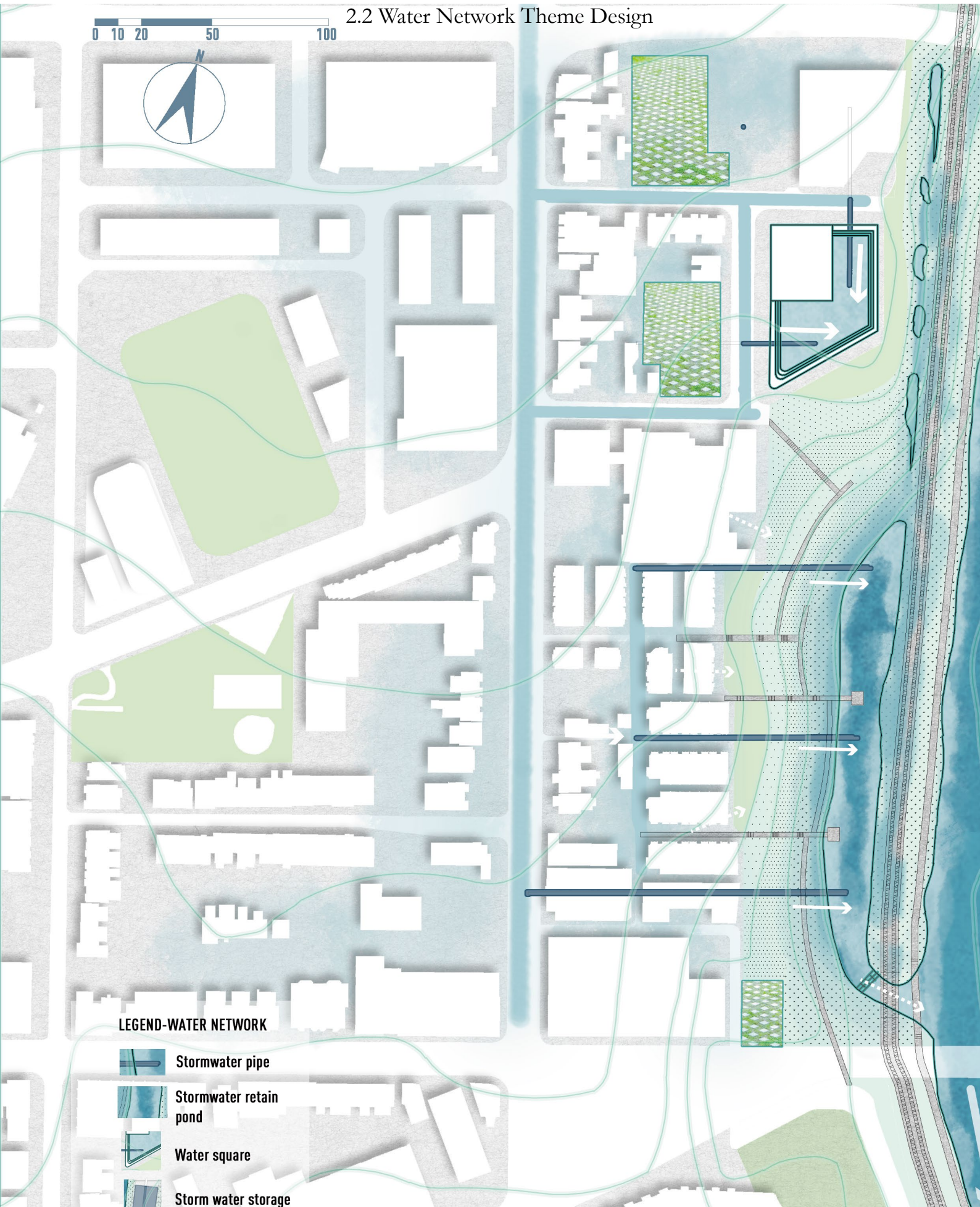


**Levee Setback:**  
Set back the levee to create wetland conditions to waterfront space





**Space for River:**  
To widen the river to create more space for aquatic vegetation

**Vegetation Terrace:**  
Change steep slope to vegetation steps to have more space for growing vegetation and delay the urban runoff.

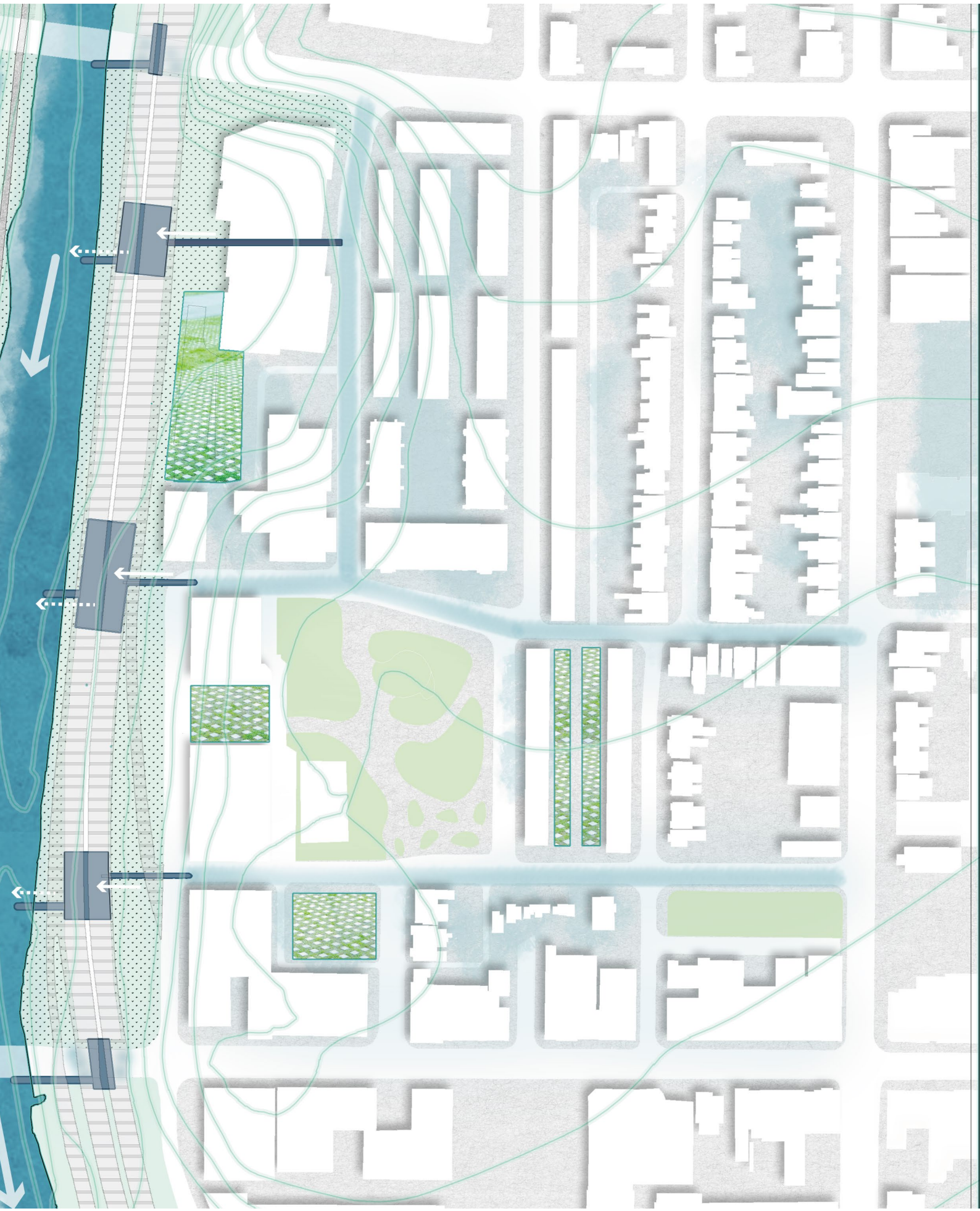
## 2.2 Water Network Theme Design



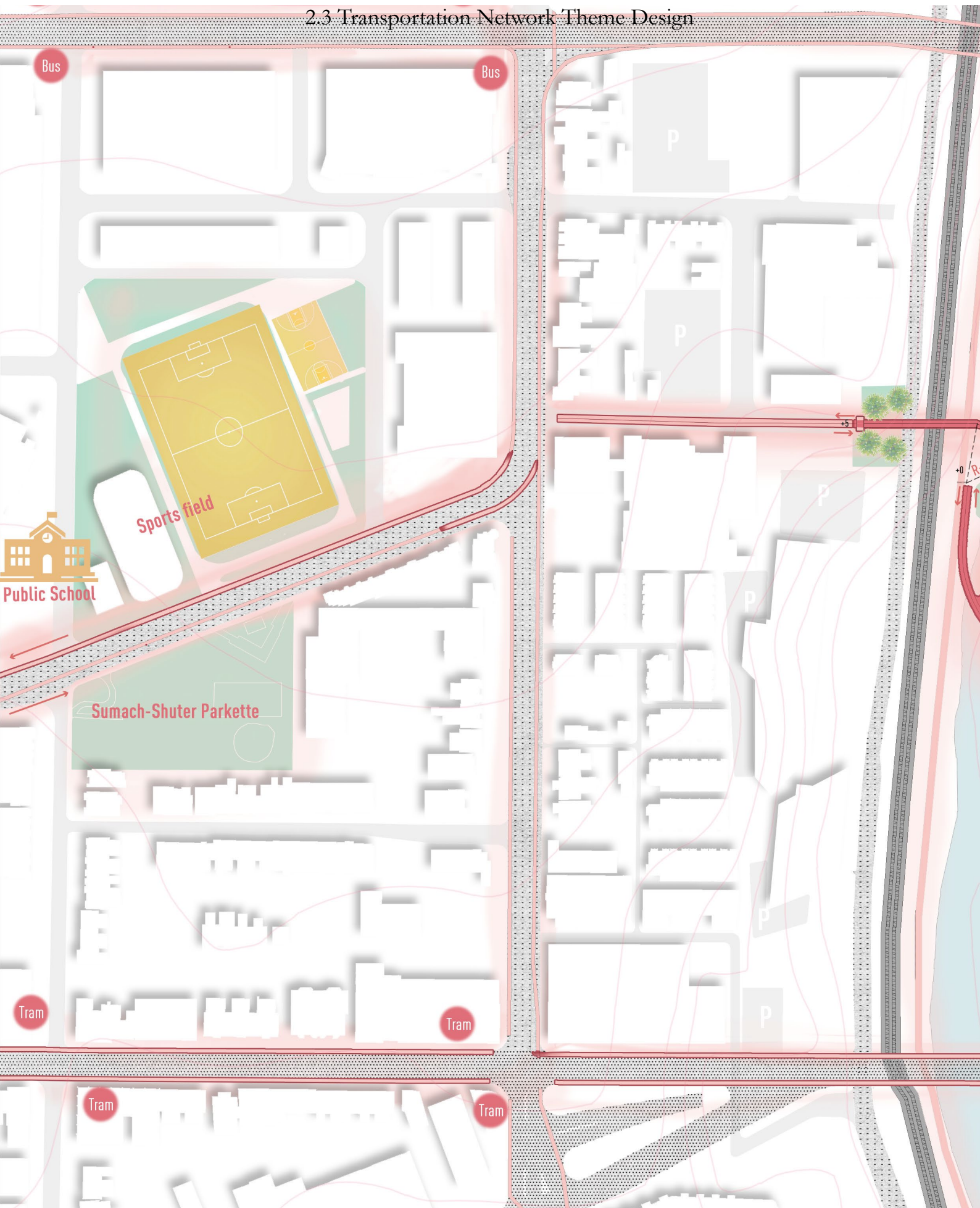
### LEGEND-WATER NETWORK

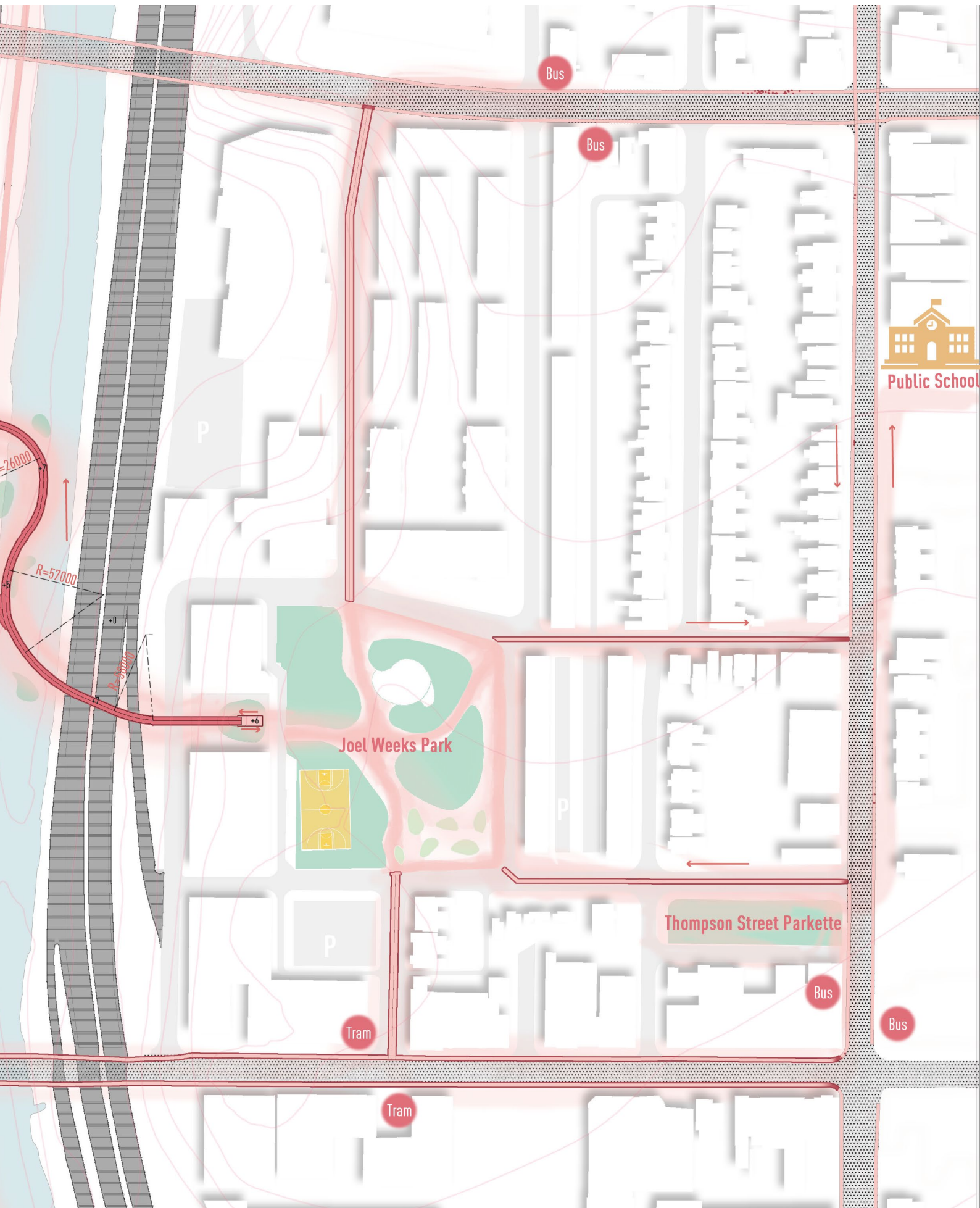
-  Stormwater pipe
-  Stormwater retain pond
-  Water square
-  Storm water storage



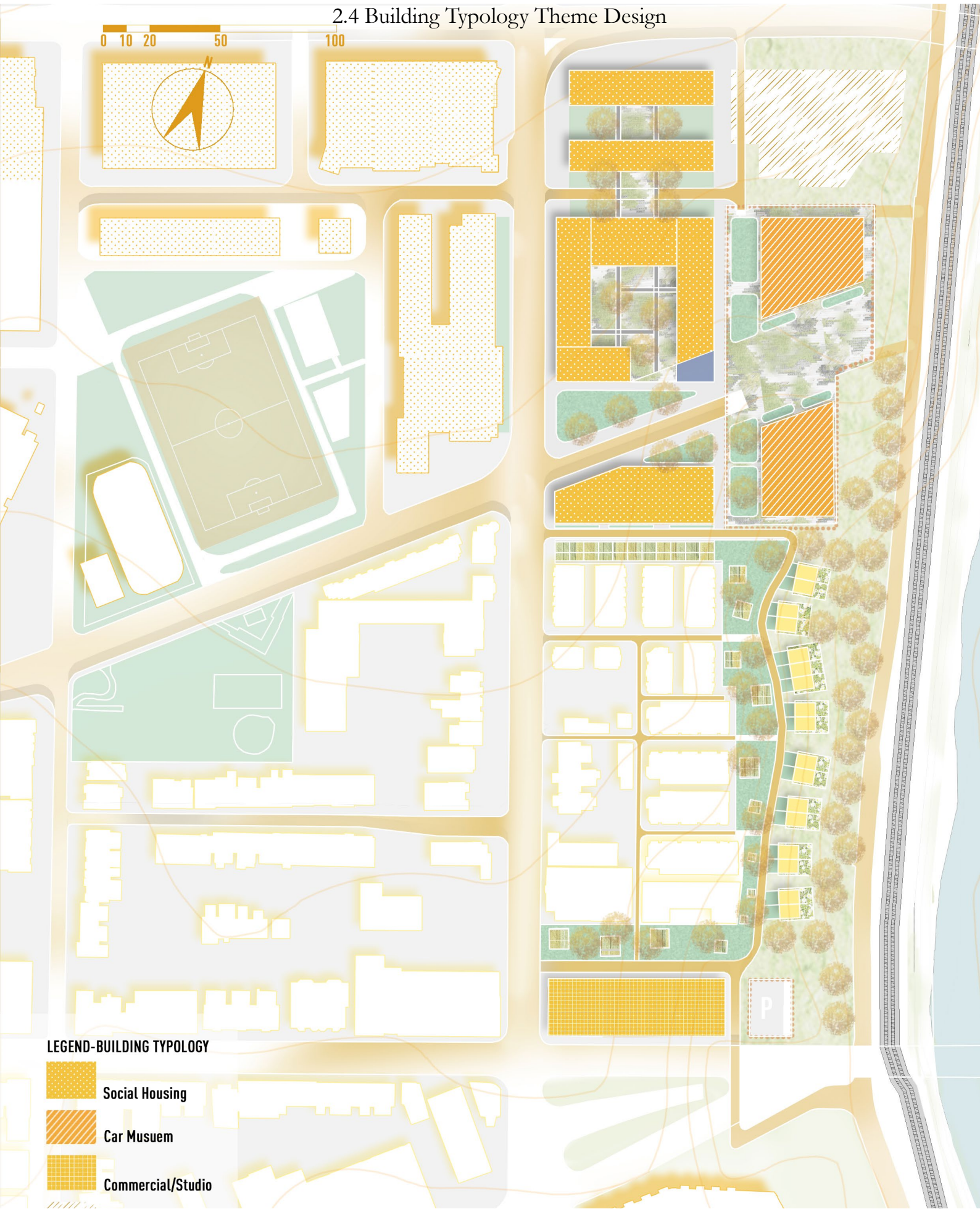


### 2.3 Transportation Network Theme Design



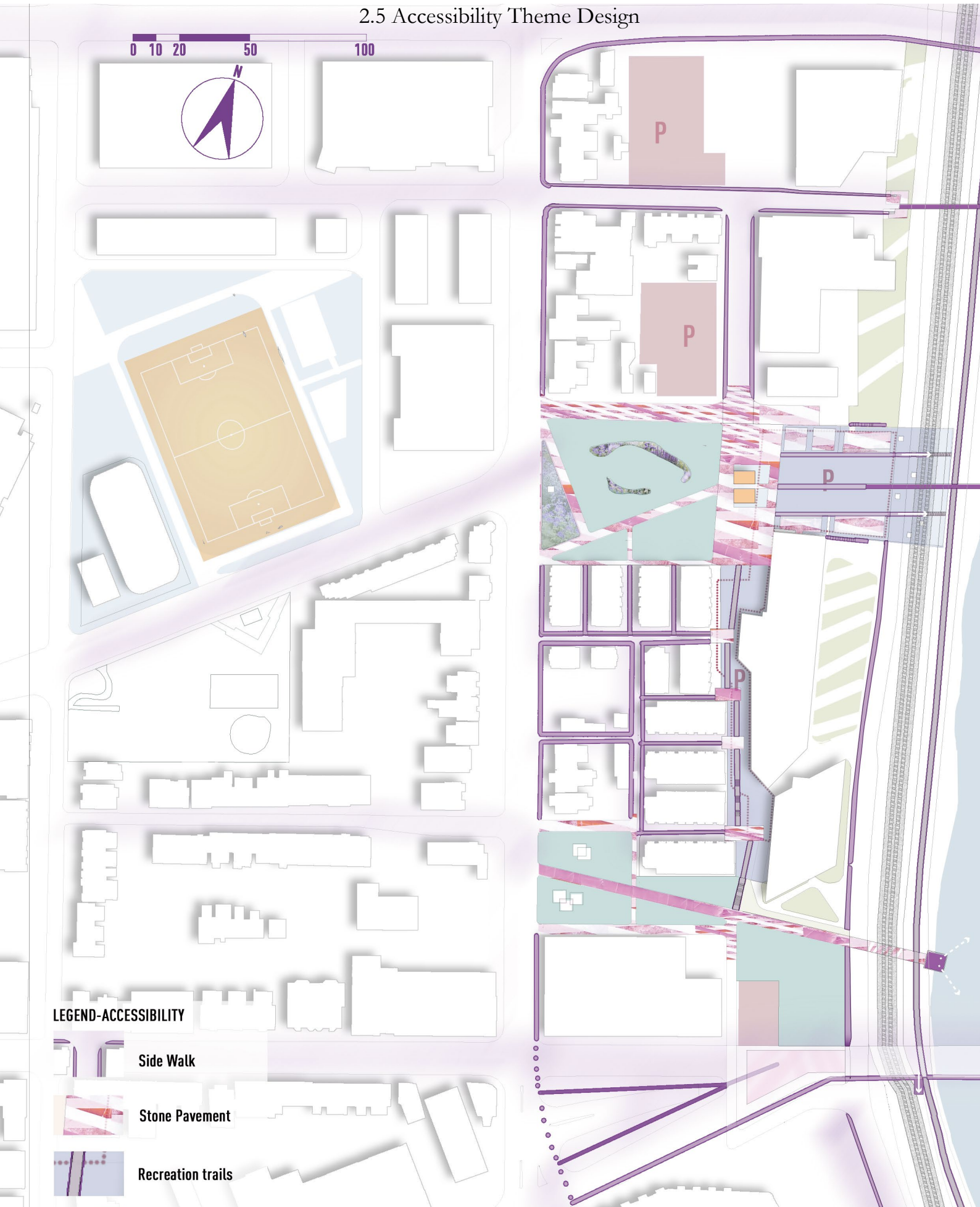


## 2.4 Building Typology Theme Design

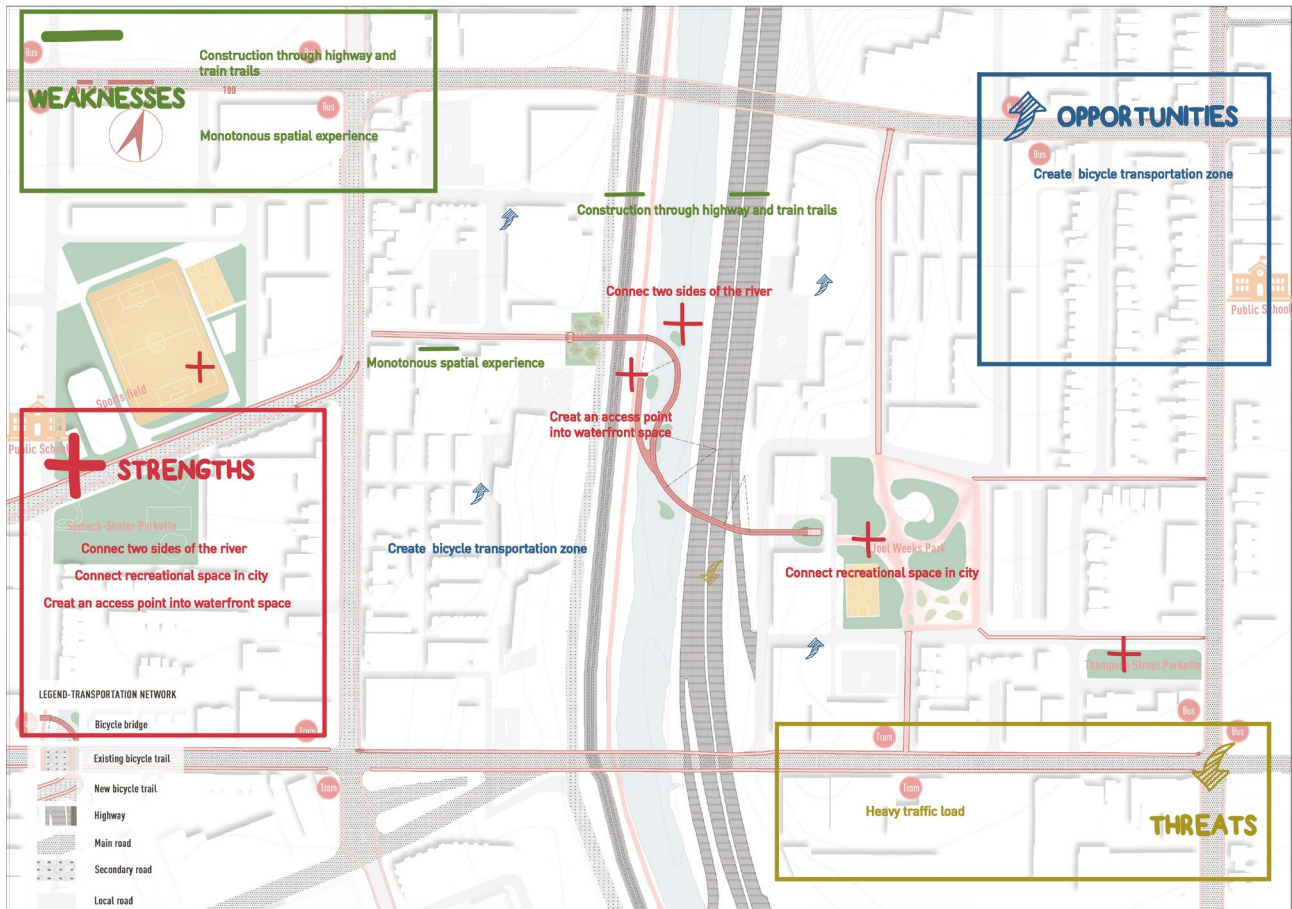




## 2.5 Accessibility Theme Design

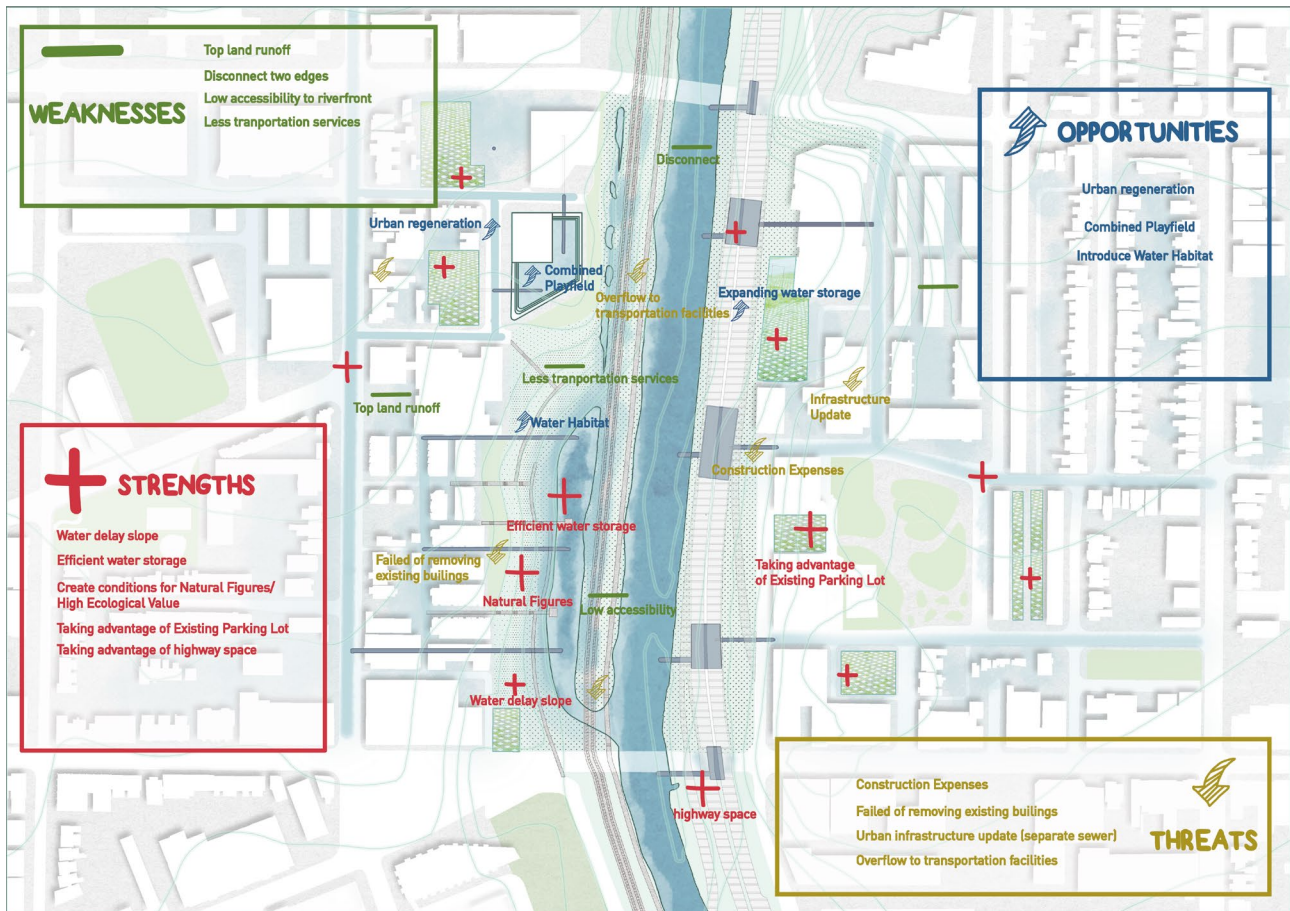






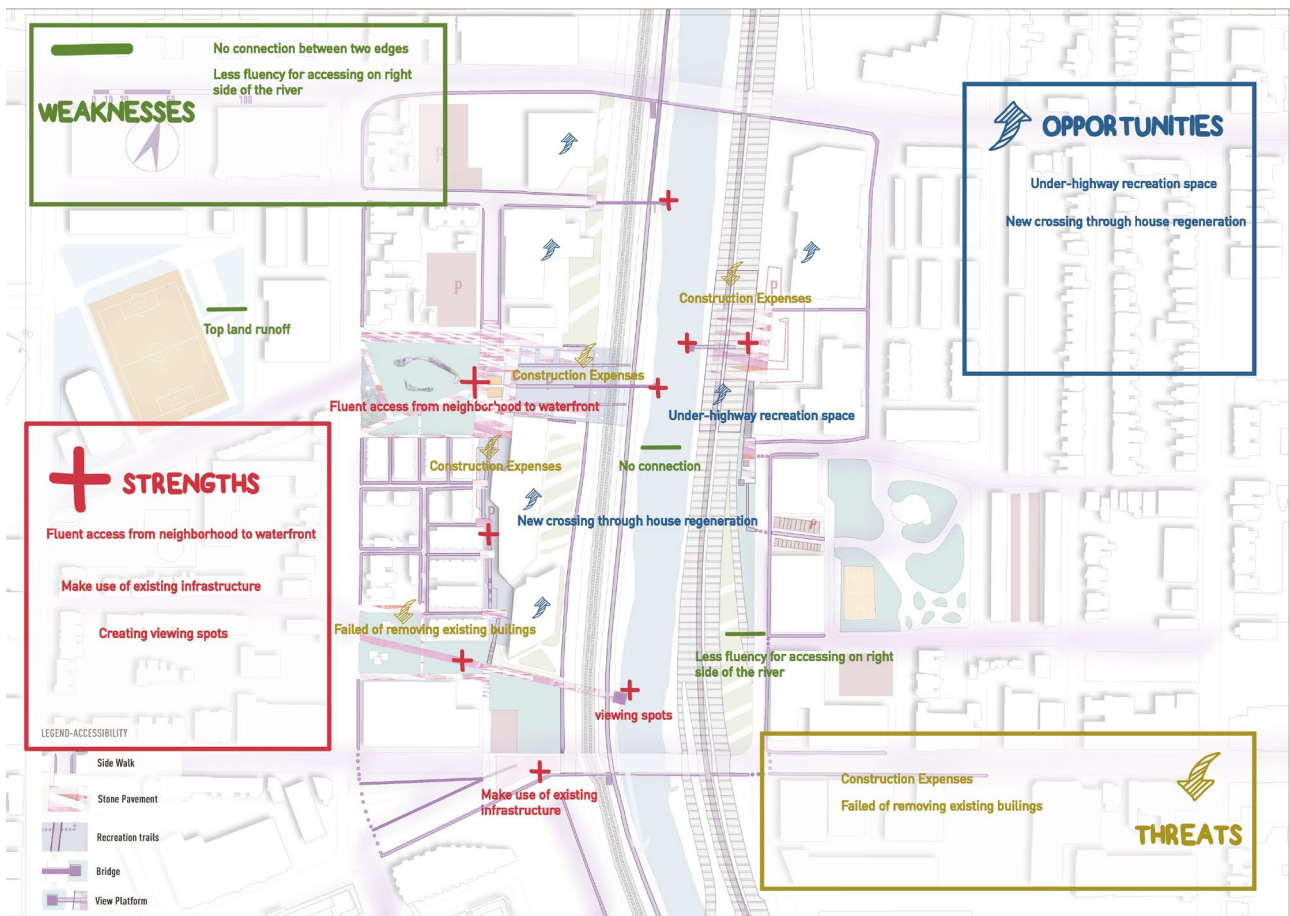
In designing transport infrastructure, the main idea is to connect two sides of the river with bicycle bridge. While the highway and railway cannot be removed in short time, the most economic way to transport through the interface is by bicycle. Thus bicycle trails need to be upgraded to assist the bicycle bridge. The whole site now is connected with bicycle circular routine



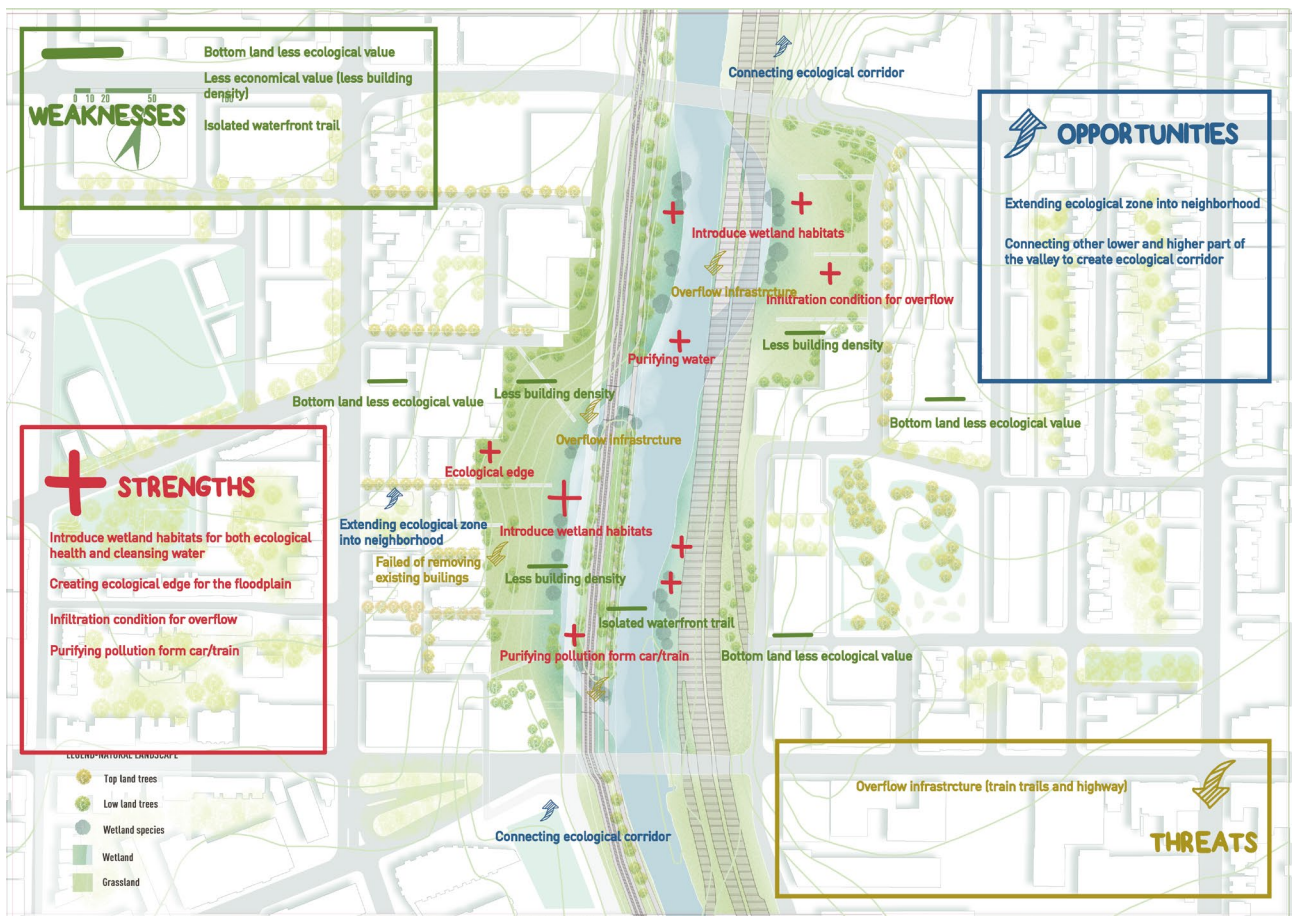


In designing water network, the emphasis shifted to controlling the water instead of healthy ecology. I used the bottom land on interface as a retain/store place for overflow storm water. According to the potentials I proposed above, the left side of the bank was innovated into a retain pond while the right side was provided with few big stormwater storage.

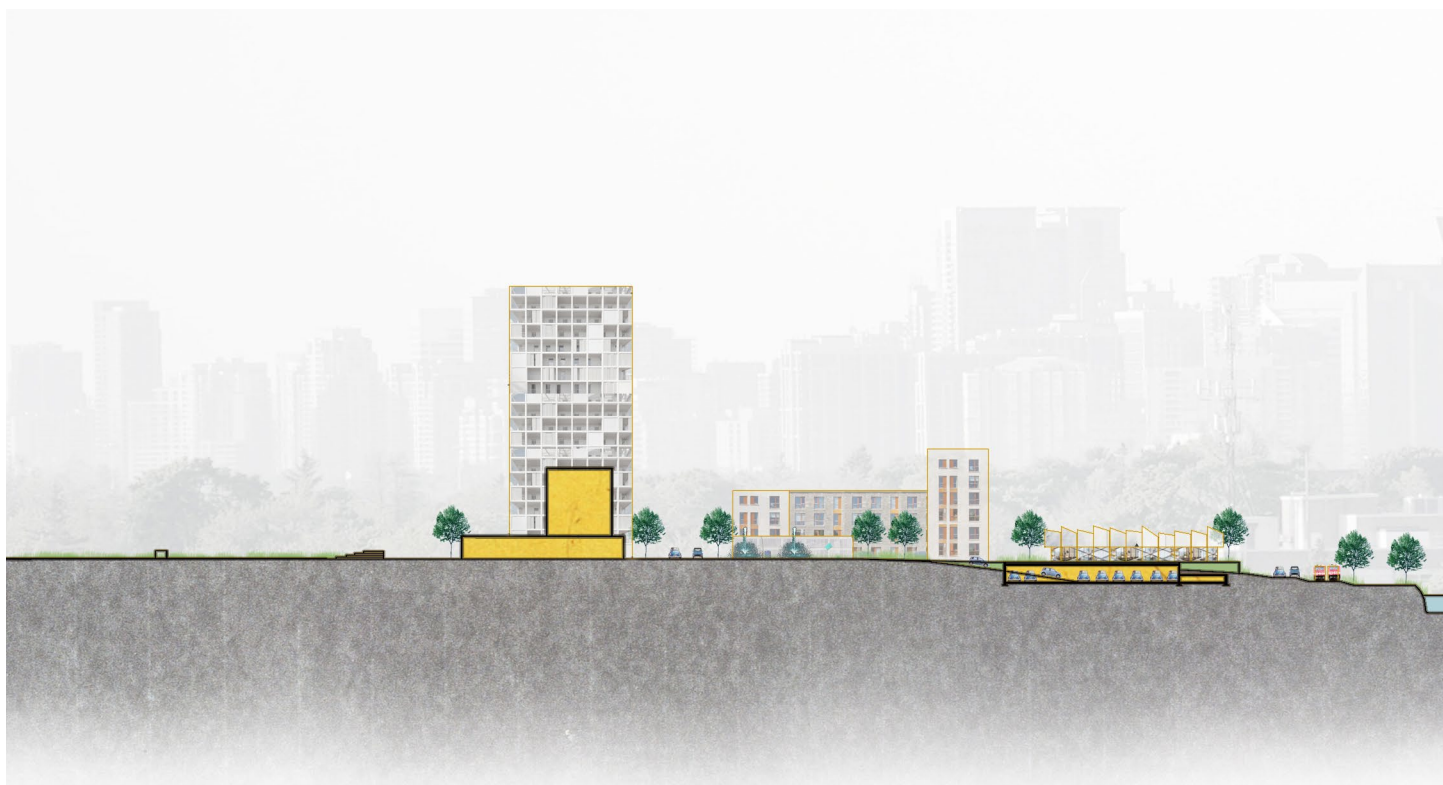
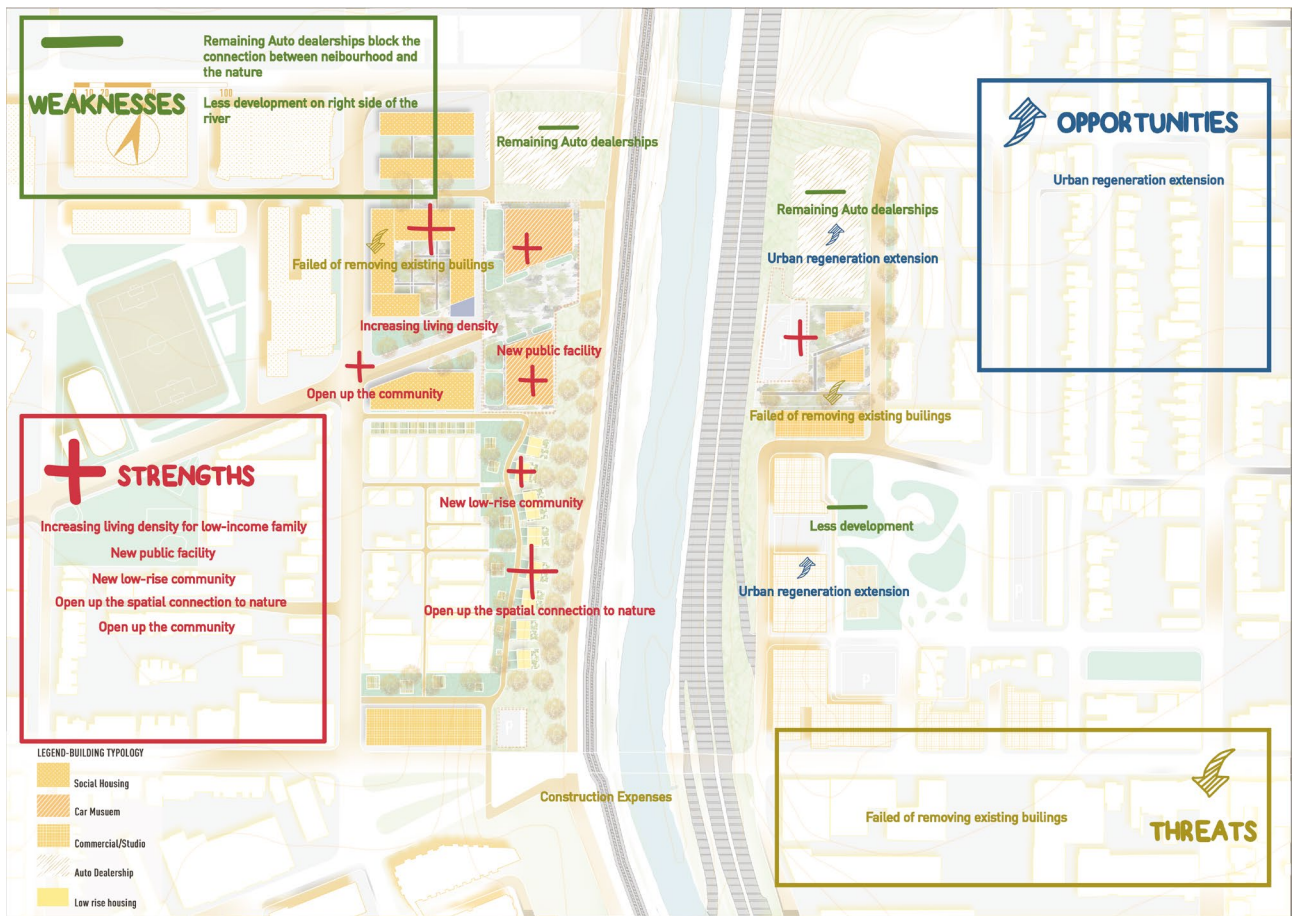
At the same time, slopes were recovered with vegetation to delay the water overflow. On the top land of the interface, separated storm water infrastructure needs to be separated from sanitary. Old water infrastructure needs to be renewed. More open water bodies can also be adapted into the top land, like water squares, gutters.



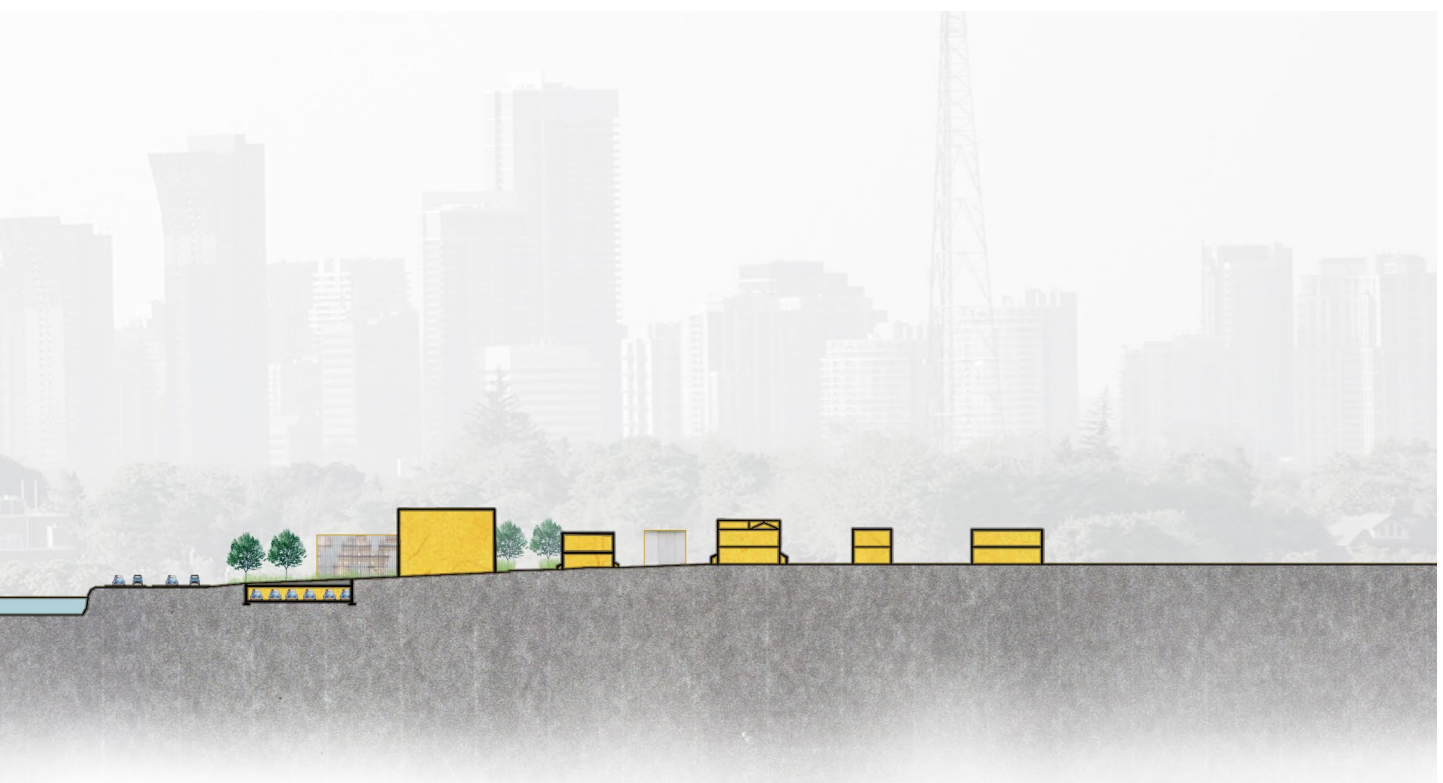
In designing accessibility, the acent is to make convenient spatial experience for people accessing from urban to waterfront recreational space. In order to acchieve the goal, I raise up recreational space on top of parking lots, to create connection in community to get rid of the influence of auto dealership. Besides, few viewing platforms are set here to attract people cross through parks, public space into the waterfront space. I also proposed the under-highway recreational space, but its's highly cost to construct and maintain.



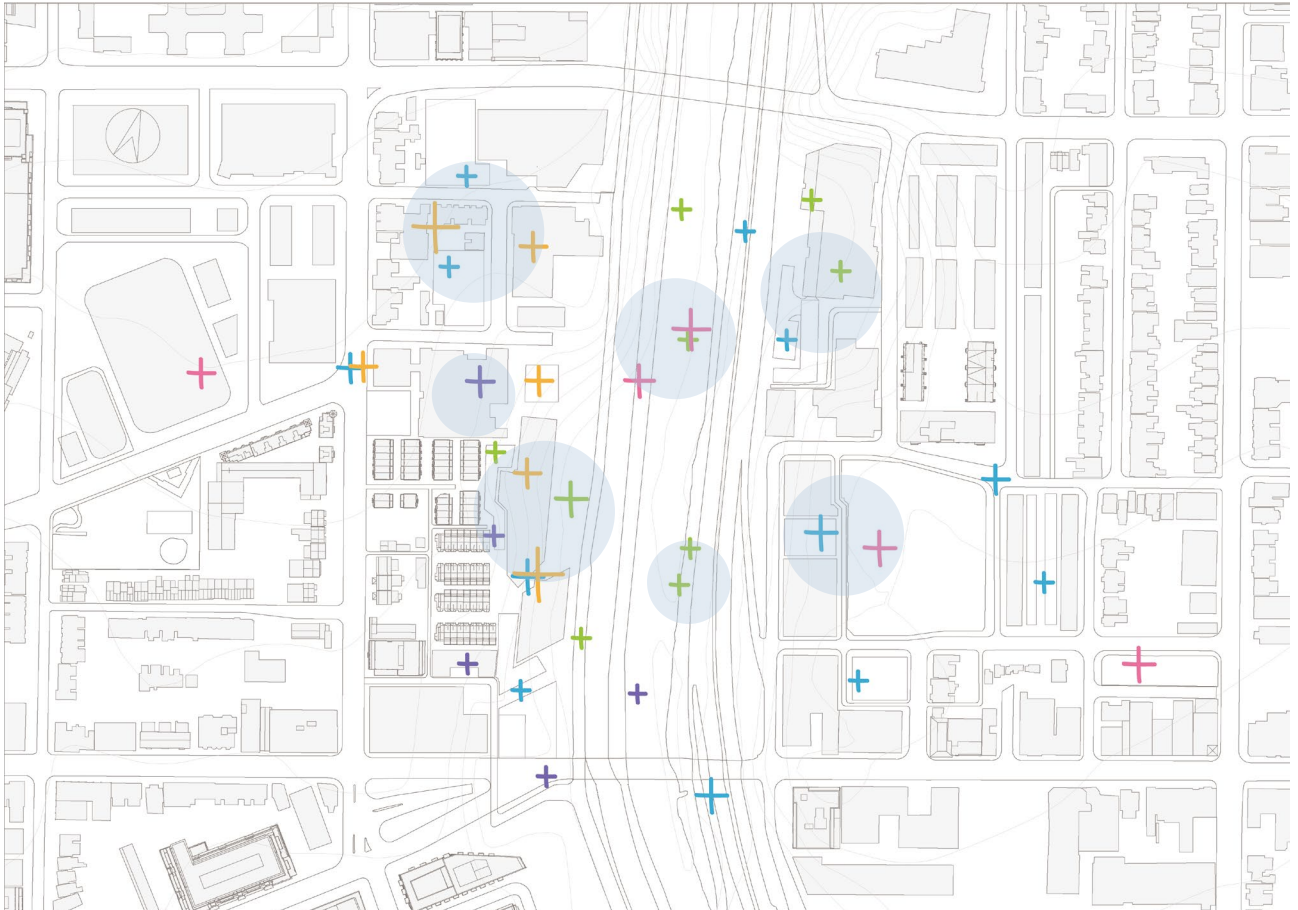
According to the Geomorphology distribution of the soils, I chose to dig out the soils here and make more river space for both side of the landscape. Water is flowing into the bottom land of the interface. In this case, wetland was turning back to the bottom land. In addition to that, gentle slopes on interface is planting with grass and shrubs, top land is covered with tree groups to connect the ecological zone on city.



In designing building typology, the main idea is to extend the urban development of Regend Park into waterfront space and even extend to the other side of the river, and conserve the neighborhood near Trefann Court. Most auto dealerships and storage factories on interface are removed into this plan to create innovative public space for old and new neighborhood. More social housings are built here to accommodate low-income families here and new public building is built here for attracting local residents.

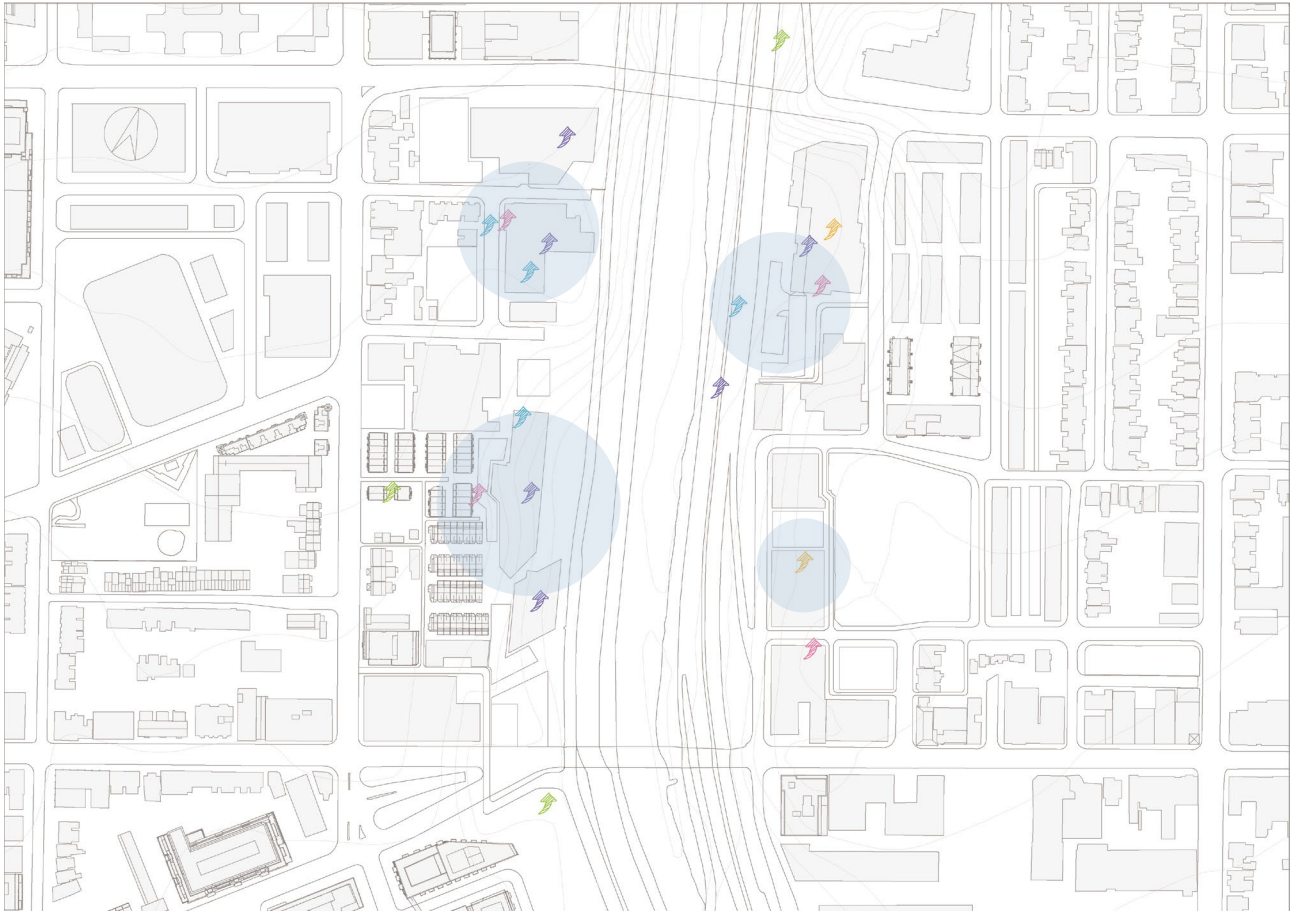


## 2.6 Evaluation of the Theme Design



*Strengthens collage*

After the design application of each dimension, I used SWOT strategy to evaluate the strengthens/weaknesses/Opportunities/ Threates of the design. Here is the conclusion from the SWOT analysis. I put the strengthens and opportunities aspects together, and found out there are few places where multi-functional space was requested.









*opportunities collage*

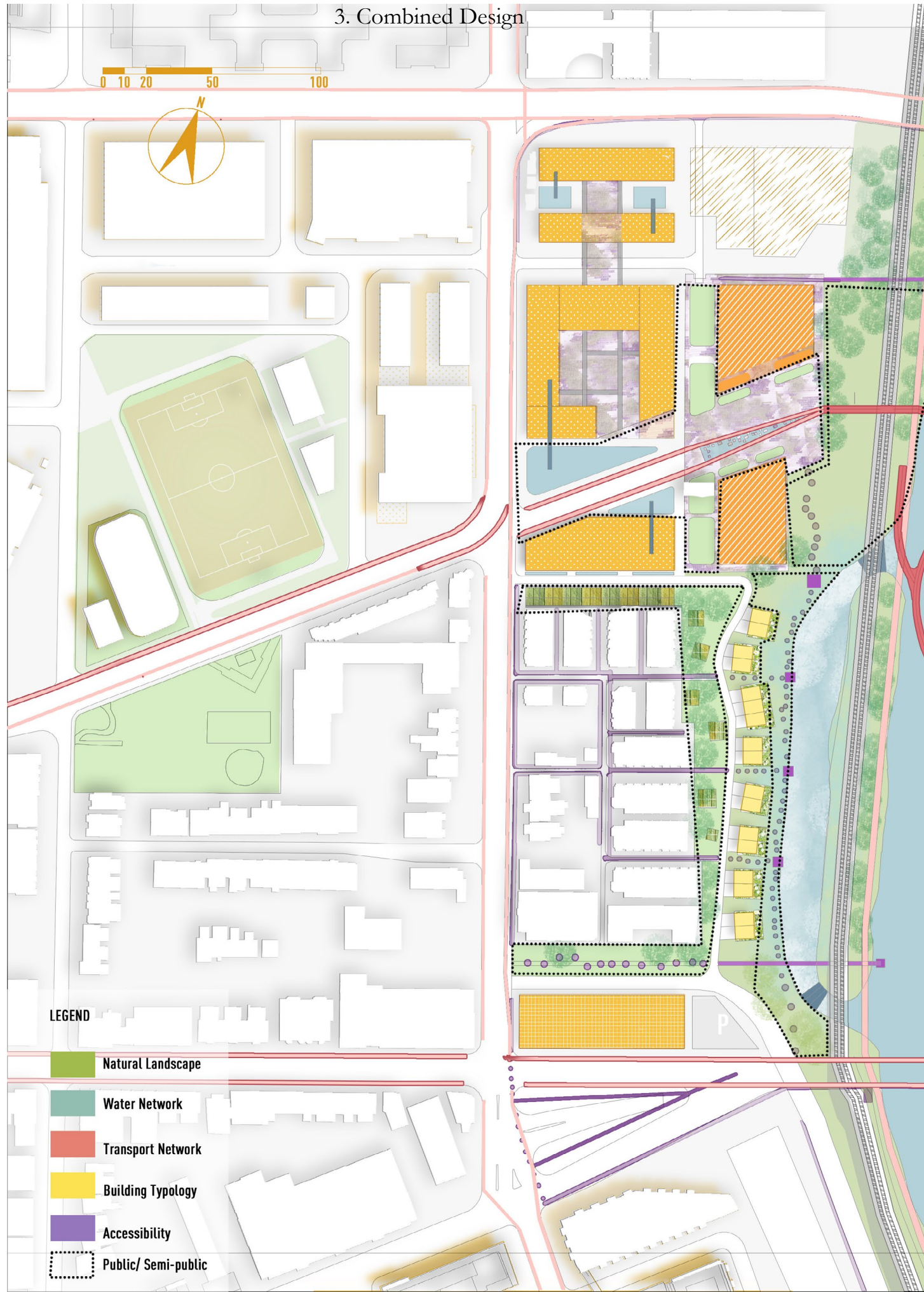
While most frequent "strengthen" spot requires multi-functional intervention in the following combined design, "opportunities" spots show the potential of the connection to certain extent.

### 3. Combined Design

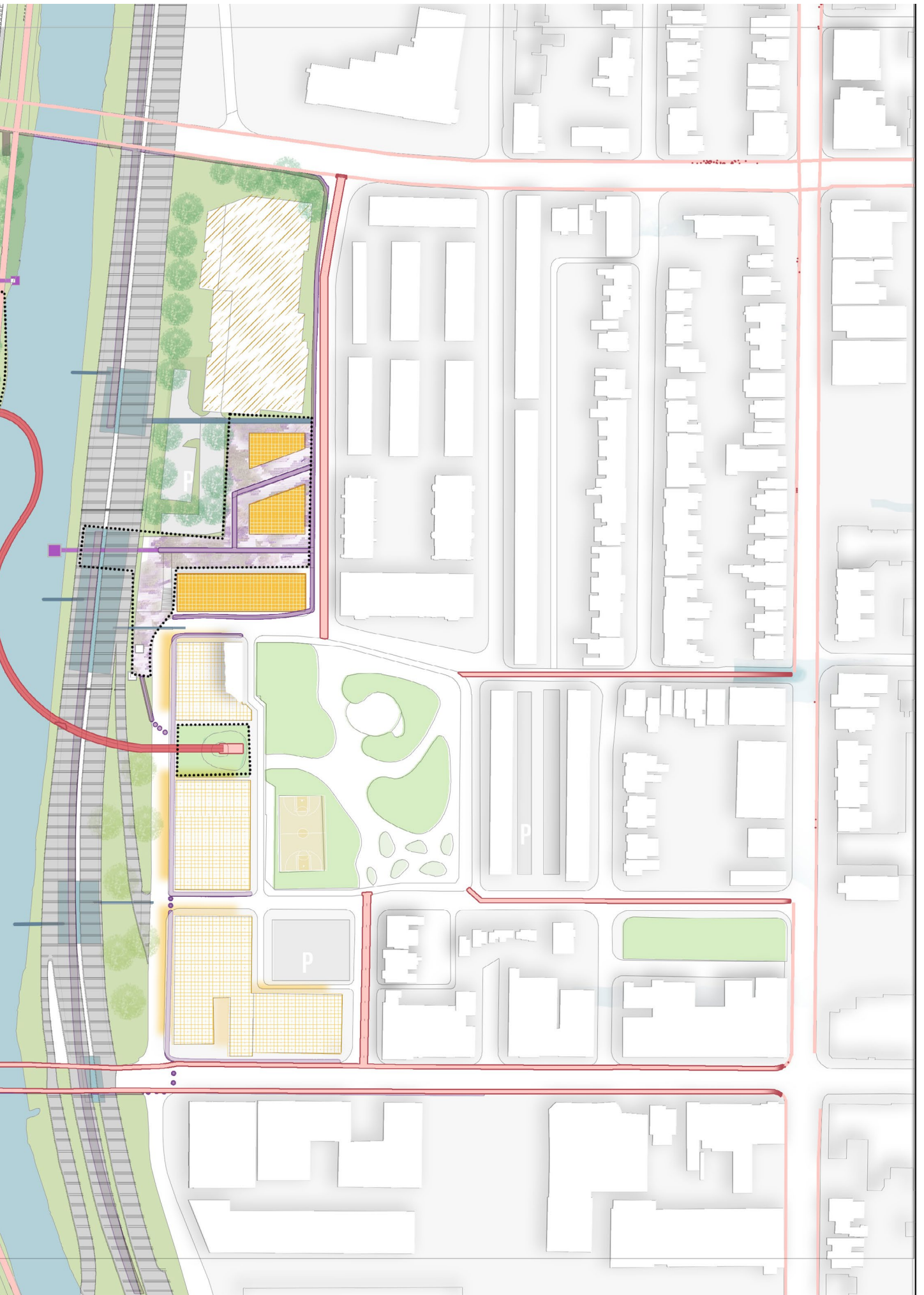


#### LEGEND

-  Natural Landscape
-  Water Network
-  Transport Network
-  Building Typology
-  Accessibility
-  Public/ Semi-public



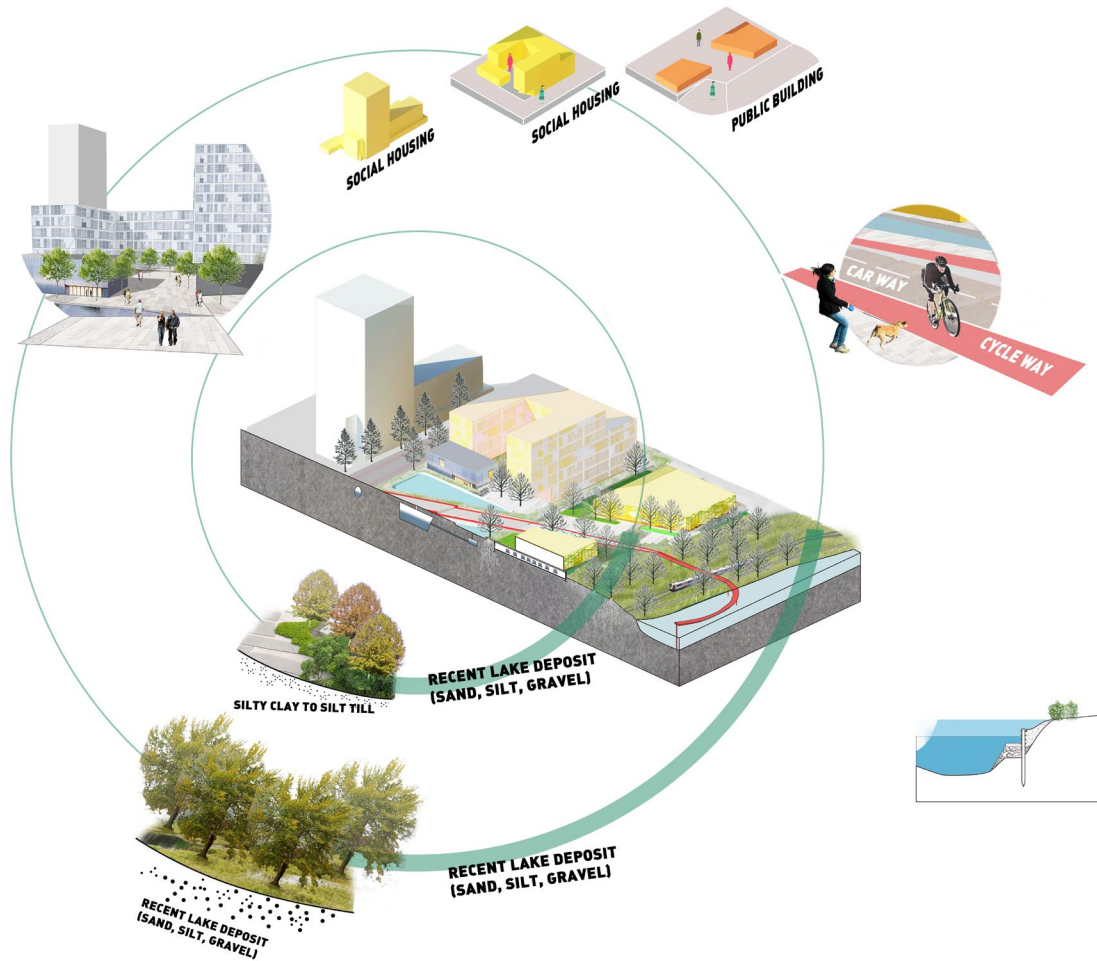
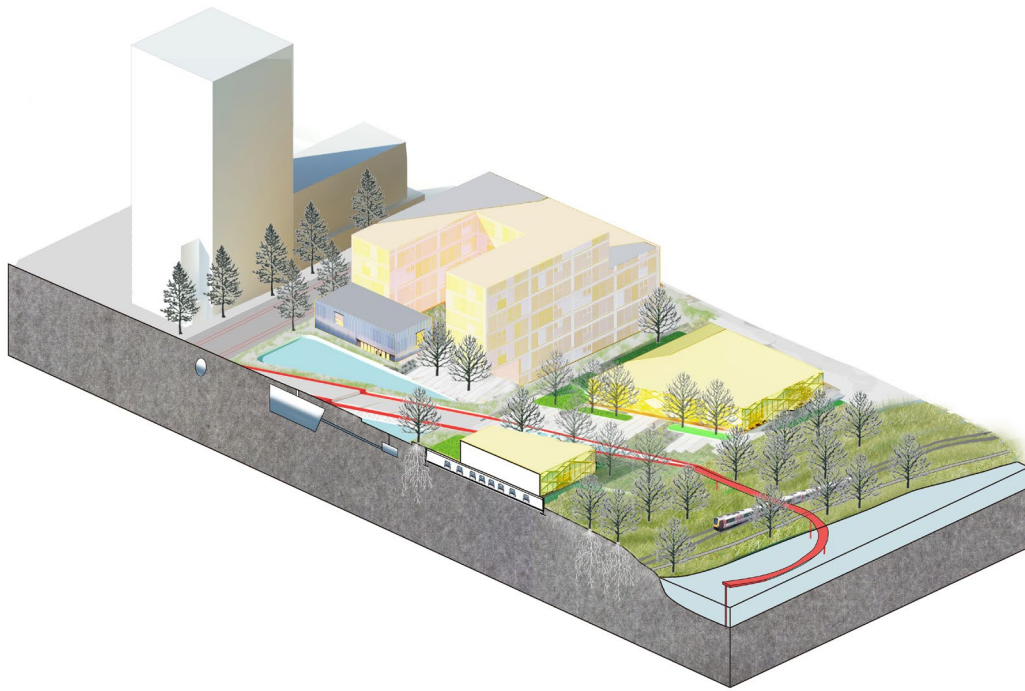


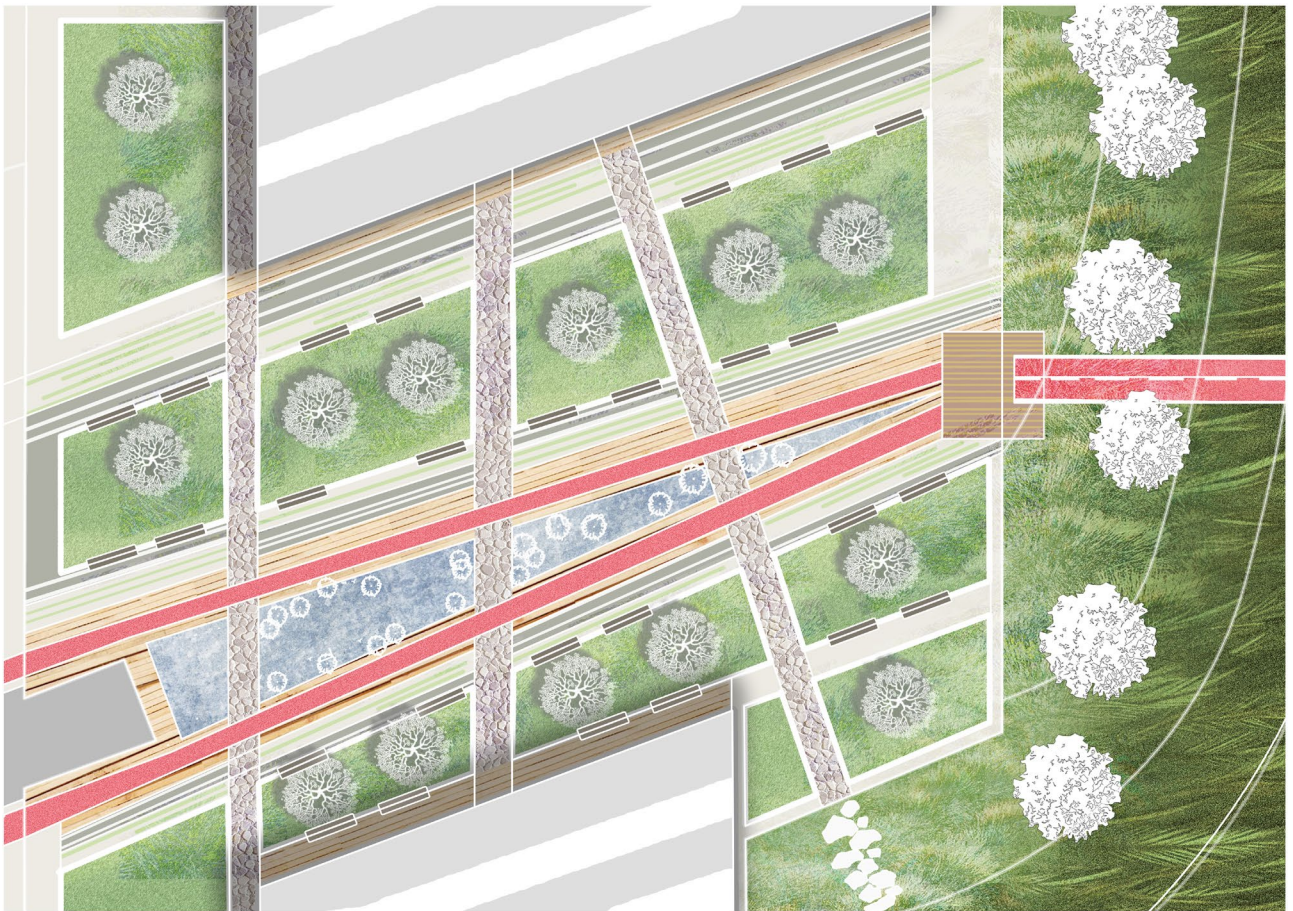
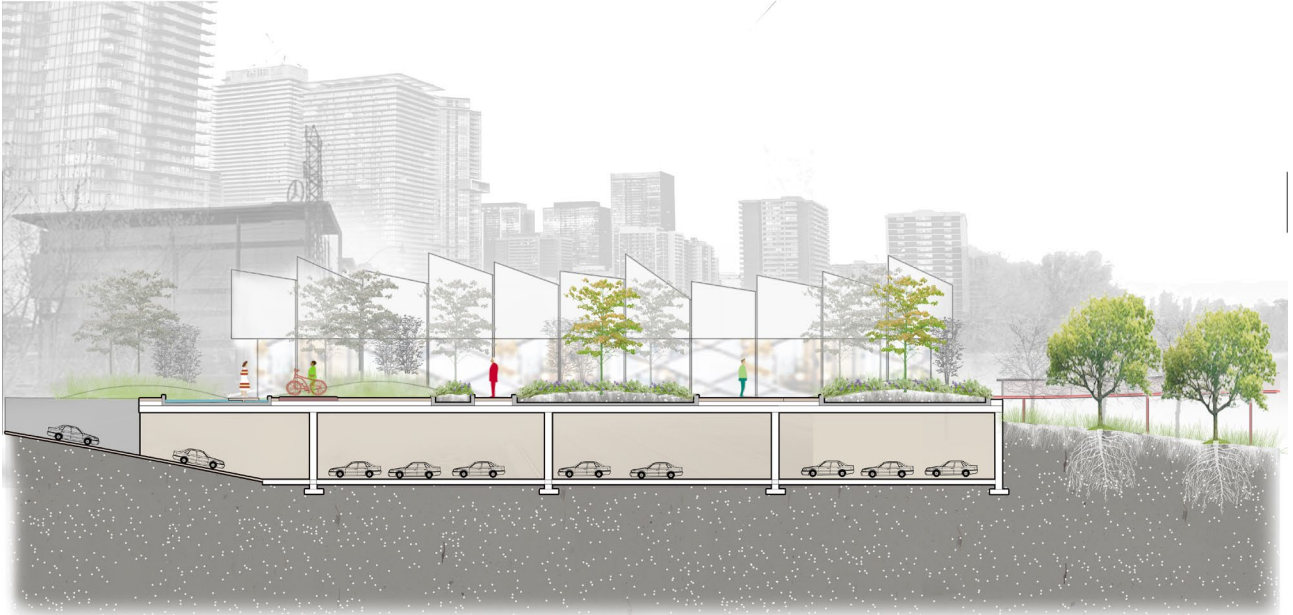


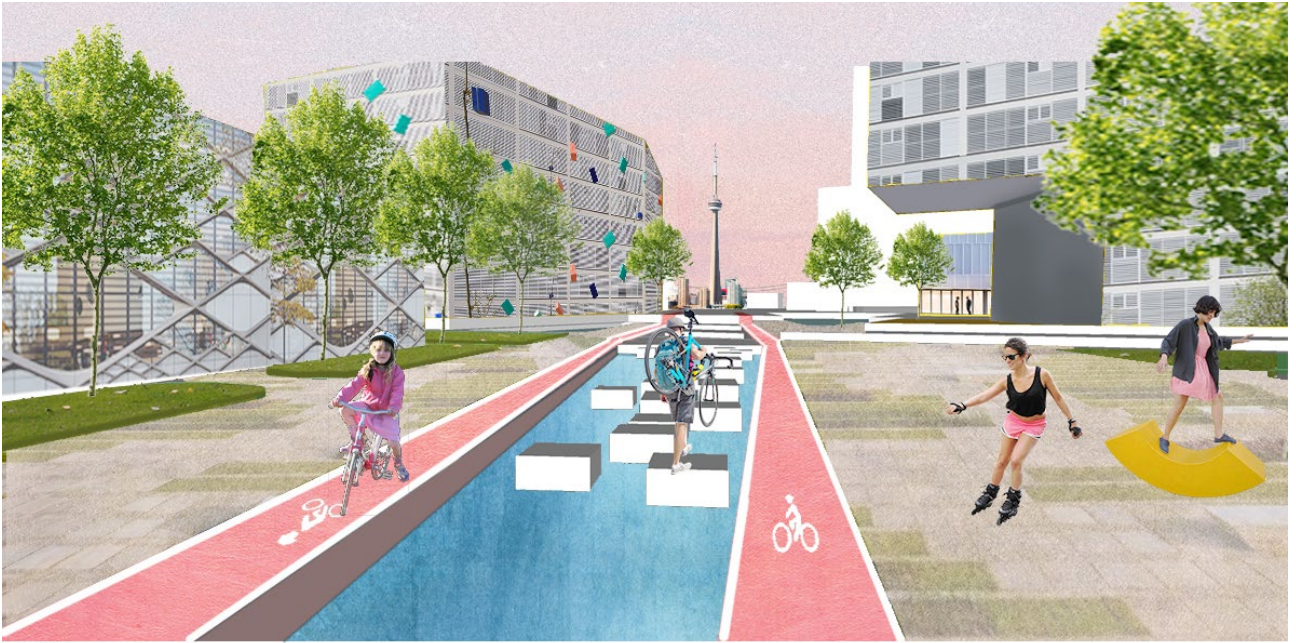


**PART SIX**  
**DETAIL DESIGN**

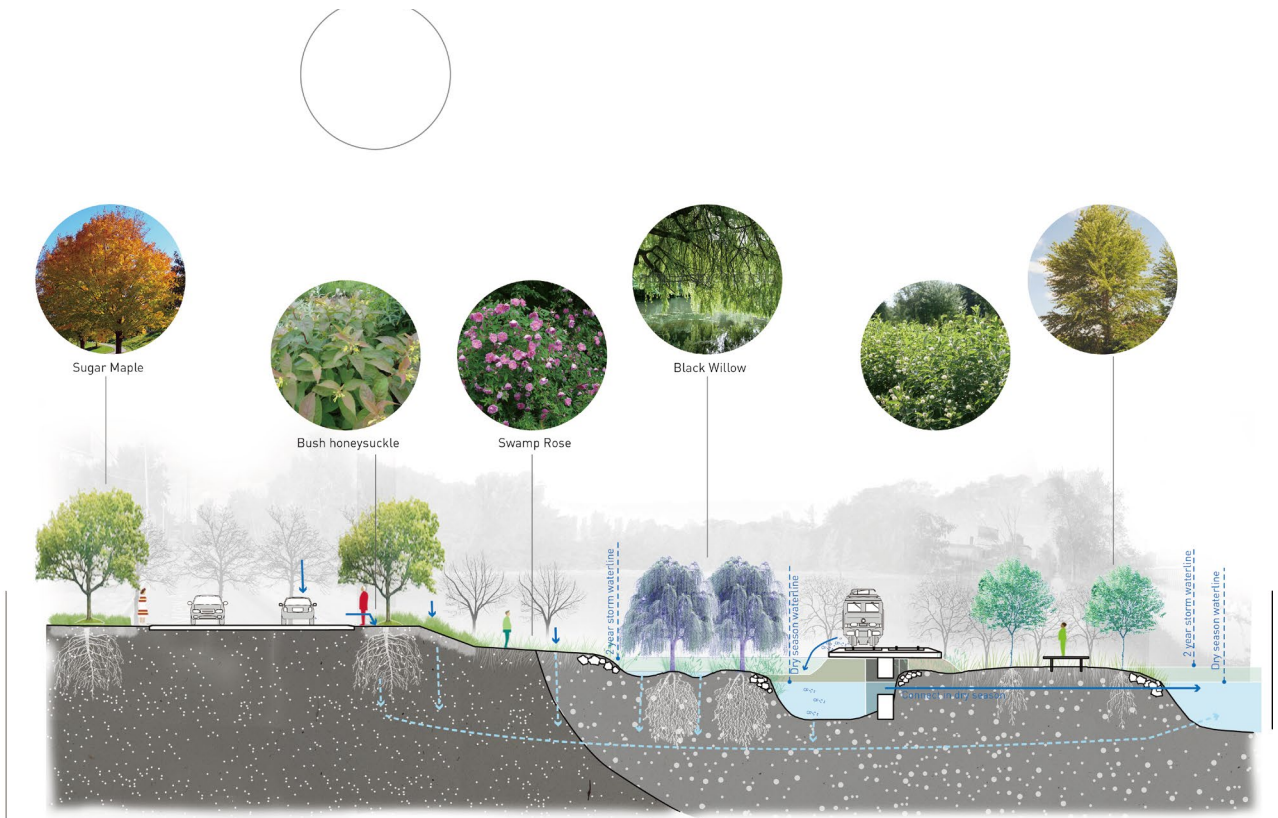
# 1. Zone A







# 1. Zone B



**PART SEVEN**  
**REFLECTION**



Being inspired by the emphasis on the interaction of humans and their environment, and to actually integrate flows and scapes by landscape infrastructures in my graduation lab Flowscape, my fascination is to study how to balance the human culture and the natural environment in urban area, how to integrate flows of natural and human system with scapes of urban territory.

While natural environment and urban environment influence on each other, the interaction between human induced factors and nature environment add more vulnerability of the whole landscape. In order to study with these interactions, I developed the concept of 'interface'. It is the territory where human system and natural system confront and be porous into each other. Being in the unique position between urban and nature, interface conveys the most frequent urban dynamism and natural process. Thus interface is a changing structure. In that case, on top of the concept of interface, how to add adaptivity is the most important issue because of the volatile forms of interface.

In conclusion, the main objective of my project is to use the concept of "adaptive interface" as an instrument to facilitate the interactions between urban and nature. In city Toronto, there are a lot of struggles between urban and nature because the interwoven ravine systems in the grand region, which exactly meets my design objective. So in the beginning of my project, I chose the experimental site - the Lower Don area, where natural ravine system is siting within Downtown Toronto.

Following the structure of landscape studio, "research-by-design" is the method framing my project. "Research-by-design is about study through design using knowledge acquired by design research." There are two main steps in my project: 1.experimental design, 2.design study. The first part of my graduation project is acquiring knowledge through analyzing the interface of Lower Don River. The situation was analyzed by mapping tools and sections. After that, I started to compare my project with some precedents in urban planning, architecture design, and landscape architecture subjects, transforming their relative spatial compositions into the Lower Don River interface to find the design principle of it. The later part is applying these acquired design principles through landscape architectural design, specifying the principles through one area in the experimental site, in order to adjust the research principles and derive the design principles from that.

While doing the project, I figured out that it's an effective way to use several dimensions on adaptive interface to frame both experimental design and design strategy. These dimensions are the focusing points of the living landscape from quick development to slow development. The clue for this approach is the Dutch three layers approach which

distinguishes three layers in the spatial organization – substratum, networks and the layer of the occupation pattern. In the consideration of Toronto interface and to my personal interests as a landscape architecture student, I decided to focus on these five layers in the end: Natural landscape, water network, transportation network, building typology and accessibility. While doing experimental design parts with these five layers, I found it was a powerful structure to analyze Toronto interface through different aspects, and finding the principles for each aspects, providing the potential solutions. Some of these principles place more emphasis on urban aspects while some focus on nature aspects.

The five-dimension-approach is also contribute to identifying design principles in the later part of my project. In corresponding to the principles on five dimensions, I tested these principles on one area in Lower Don interface where all those dimensions are involved within. Natural landscape principles were applied into one design for mainly optimizing the ecological value of the site; Water principles were focusing on solving the problems of wet-weather overflows and the polluted open water; Transport principles were adapted into the Toronto network systems to facilitate the slow traffic zone on site; Buildings principles were combined with functional values of the site to reconstruct the spatial relationship between buildings and nature; Accessibility principles were emphasizing on creating more comfortable spatial experience from urban to nature.

The five-dimension-principles were justified within the certain context and new principles were generated through the designing. In order to identify the design principles which can be used in developing other urban-nature interface, I combined these one-dimensional design by evaluating strengthens, weakness, opportunities, threatens of each design and recomposing them in a certain way to reach an integral design. After the combined design, I already found out that there is the sixth dimension: public/ semi-public space, which can be the machine to combine other dimensions and become the new dimension for the interface.

In the view of Flowscapes studio, the principles for planning and design are: multi-functionality, connectivity, integration, communicative and social-inclusive design process and long term strategy. And so are the design principles for developing the adaptive interface. Developing a changeable and adaptive landscape structure for interface, it's crucial to consider different roles of it, the ecological, spatial, functional and social roles especially. And by doing the research and design with 5 dimensions, the design results are adaptive to the uncertainties and dynamism of interface.

This research-by-design for developing adaptive interface provides me a new lens on viewing the landscape infrastructure. The final design is not a solitary infrastructure design but an adaptive landscape structure for green, blue and transport infrastructure.

The concept of adaptive interface for me is a powerful tool to develop the place in-between urban environments and natural environment. In considering of the context of Toronto interface and due to my personal preference, I chose five dimensions to research and design on. This may lead to certain limitation of design principles, and the principles should be justified through designing repeatedly in the same site or in different sites. But within the structure of dimension-approach for developing adaptive interface, the design is open-ended which can be repeated and provide new principles for interface. Interface here is the powerful idea of studying urban nature interaction, which is proved in this project.

The other important thing with the project is that this is a extending of Dutch Layer Approach. The Dutch Layer Approach is a powerful tool for spatial planning and policy making. However, the hierachy limits the appliance for landscape architecture. I think with the experiment of my project, the importance of using the layer approach in landscape architecture is proved as well.

In the end, thanks for the amazing experience here in master track. Thanks for the whole year's tutorial from my both mentors Steffen and Fransje. With their inspiration, I really gain a lot of knowledge from this educational journey, and further more, the confidence and enthusiasm in design major. Last but not the least, thanks for the supporting from my familiy, especially my mom, and all the encouraging and company from my dear friends.

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