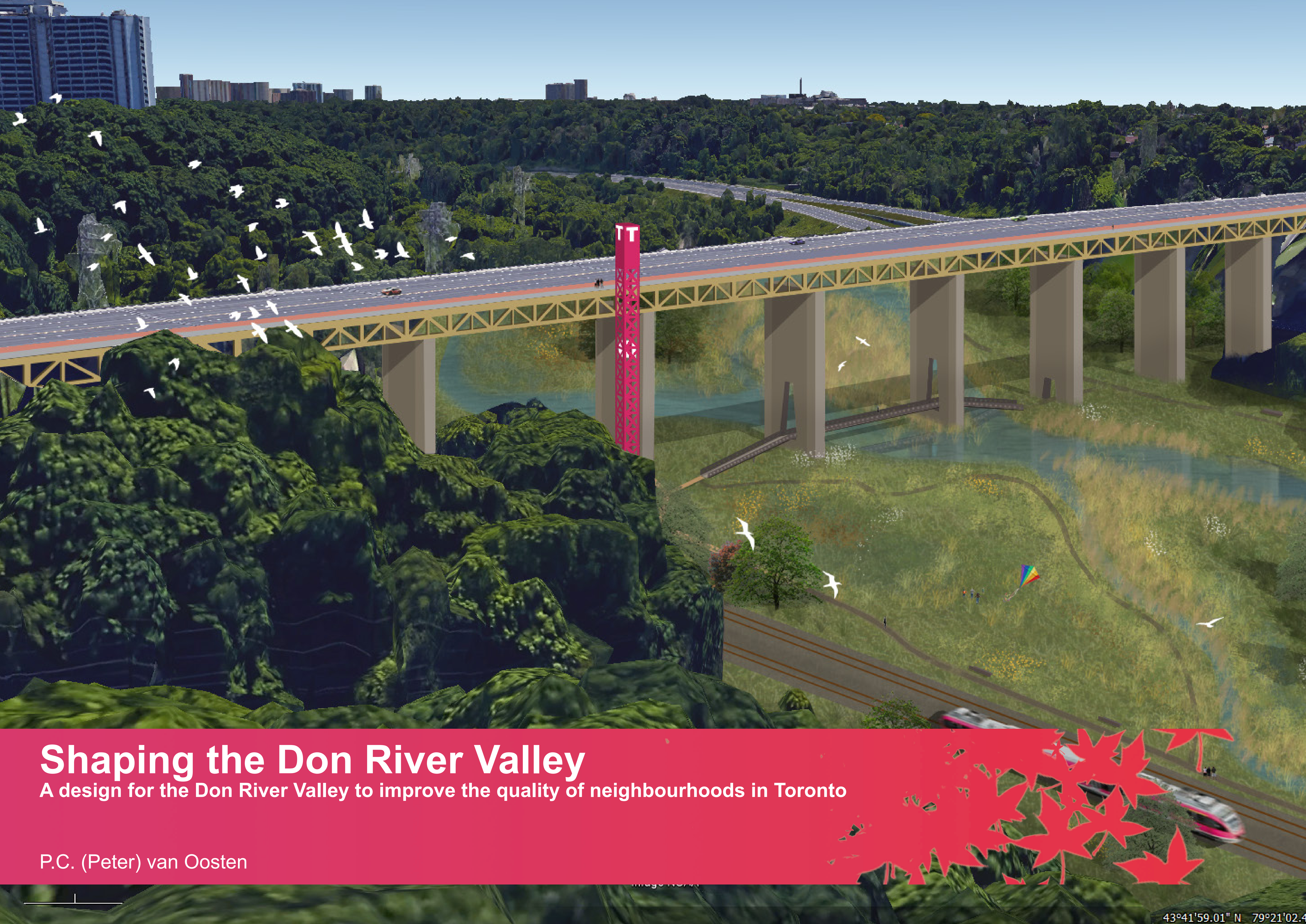

Shaping the Don River Valley

A design for the Don River Valley to improve the quality of neighbourhoods in Toronto

P.C. (Peter) van Oosten

Shaping the Don River Valley
A design for the Don River Valley to improve the quality of neighbourhoods in Toronto

Msc Thesis
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Toronto (ON), Canada

Author	P.C. (Peter) van Oosten
Student number	4322207
E-mail	pcvanoosten@gmail.com

Supervisors	N. (Nico) Tillie
	L.M. (Luisa) Calabrese
	F.D. (Frits) van Loon
External examinator	F.M. (Filippo) Doria

Studio Flowscape	
Department	Landscape Architecture
Faculty	Architecture
University	Delft University of Technology

TU Delft
Delft University of Technology

Introduction

The following project is a product of my master thesis on which I worked in the period of september 2015 until november 2016. My main supervisor, Nico, introduced me to the area of Toronto. The main focus of my project came into being after doing some research on the challenges the city was facing in combination with my own fascination for ecology: the Don River Valley. This surprising element in such a metropolitan landscape had a strong appeal, which became even greater during my two week site visit. During this time was also lucky to meet with professor L. (Liat) Margolis at the Faculty of Architecture, Landscape and Design at the University of Toronto, together with several of her students. I would hereby like to thank them for their input.

The journey of my research can be seen through this project. At the very start you will come across the area analysis in which I introduce the Don River Valley and touch upon several of the challenges the valley and its surrounding area are facing. This is followed by the framework which is the backbone of my research. An elaborated version of the methodology can be found as an appendix. Besides that the framework covers the research questions, which result in a hypothesis. The design tools build forth on the defined challenges and show the start of the design exploration. Some topics will have some extra attention because of their relevance in the later design. In the appendix I will elaborate on the topic of ecology. Next is the design. Here I answer my earlier formulated research questions through a spatial design. A short reflection will conclude the research.

I would like to thank all those who helped me through these months.

Contents

Area analysis

Research framework

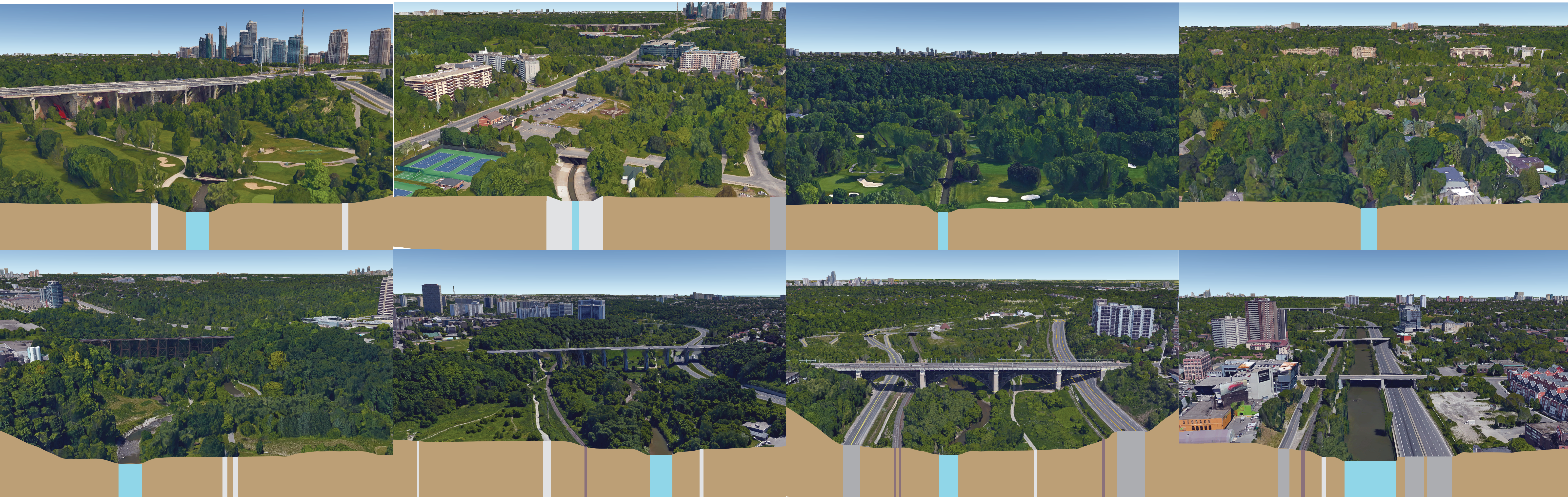
Design tools

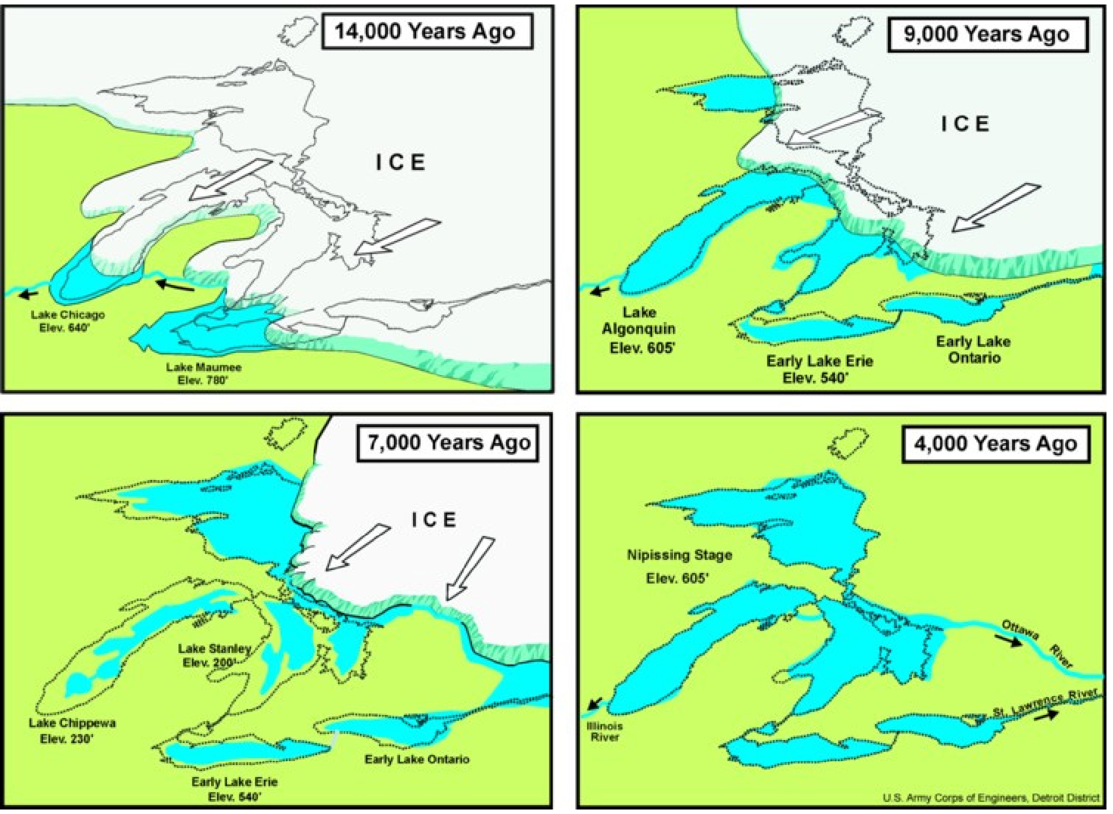
Design

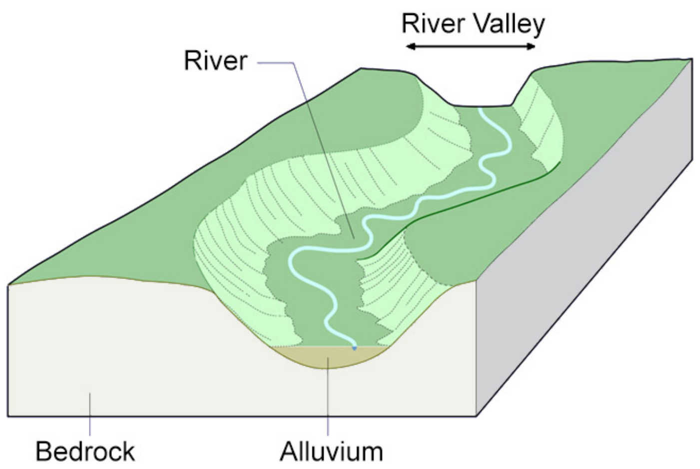
Reflection

Area analysis

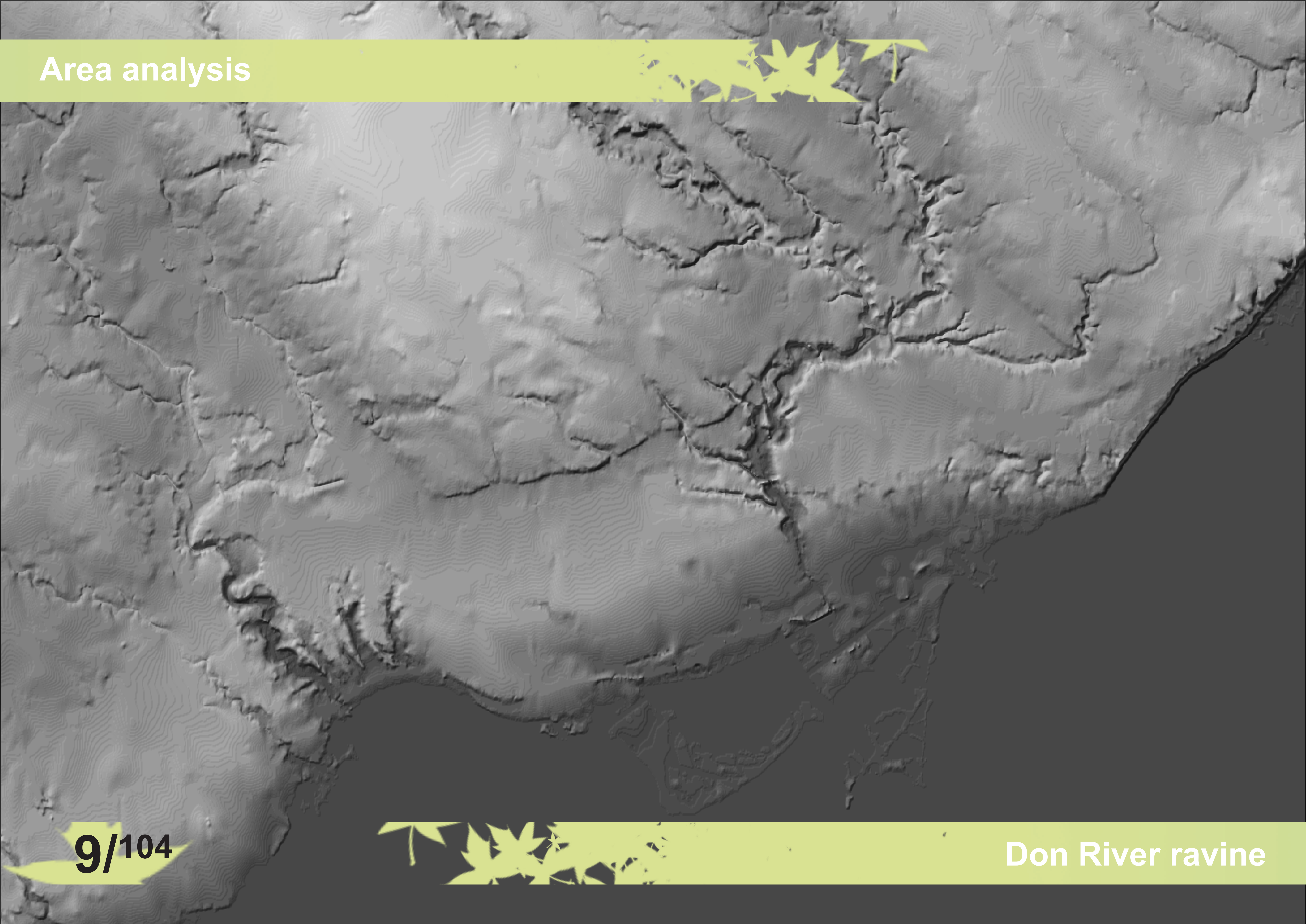
City of Toronto




14,000 Years Ago
ICE
Lake Chicago
Elev. 640'
Lake Maumee
Elev. 780'
9,000 Years Ago
ICE
Lake
Algonquin
Elev. 605'
Early Lake Erie
Elev. 540'
Early Lake
Ontario
7,000 Years Ago
ICE
Lake Stanley
Elev. 200'
Lake Chippewa
Elev. 230'
Early Lake Erie
Elev. 540'
Early Lake Ontario
4,000 Years Ago
Nipissing Stage
Elev. 605'
Ottawa
River
St. Lawrence River
Illinois
River
U.S. Army Corps of Engineers, Detroit District

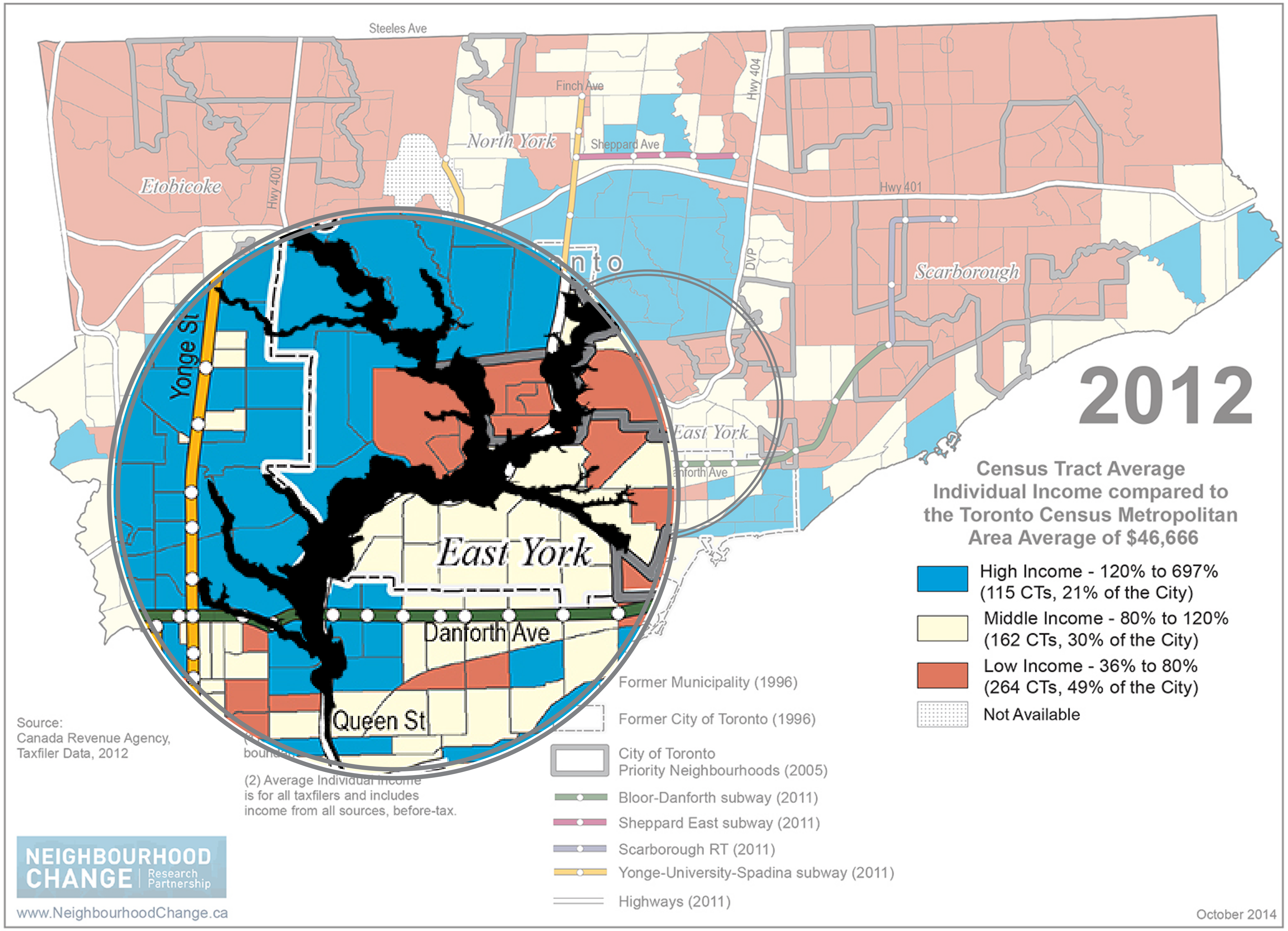

River Valley
River
Bedrock
Alluvium


Lake Scugog
Aurora
Bolton
ESCARPMENT
DU
R
DN
H
C
Lake Ontario

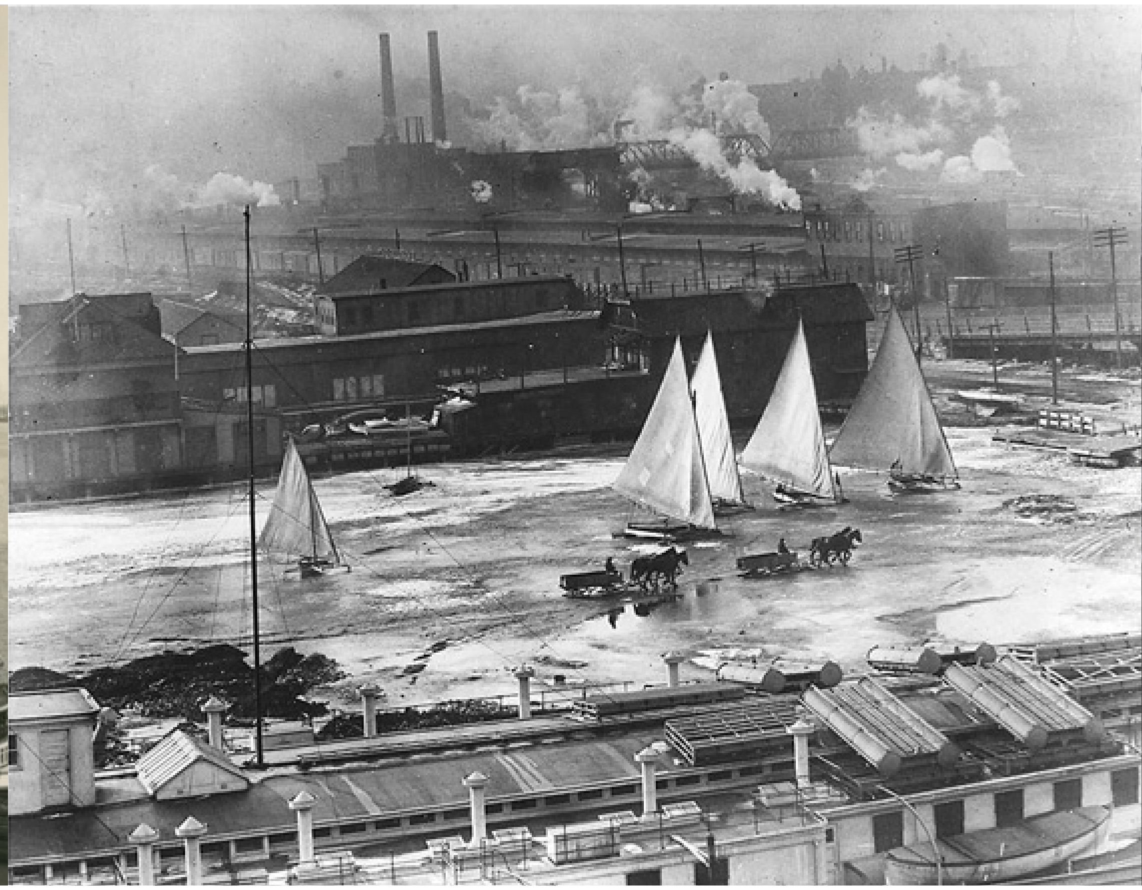


Edge neighbourhoods

Average Individual Income, City of Toronto, 2012

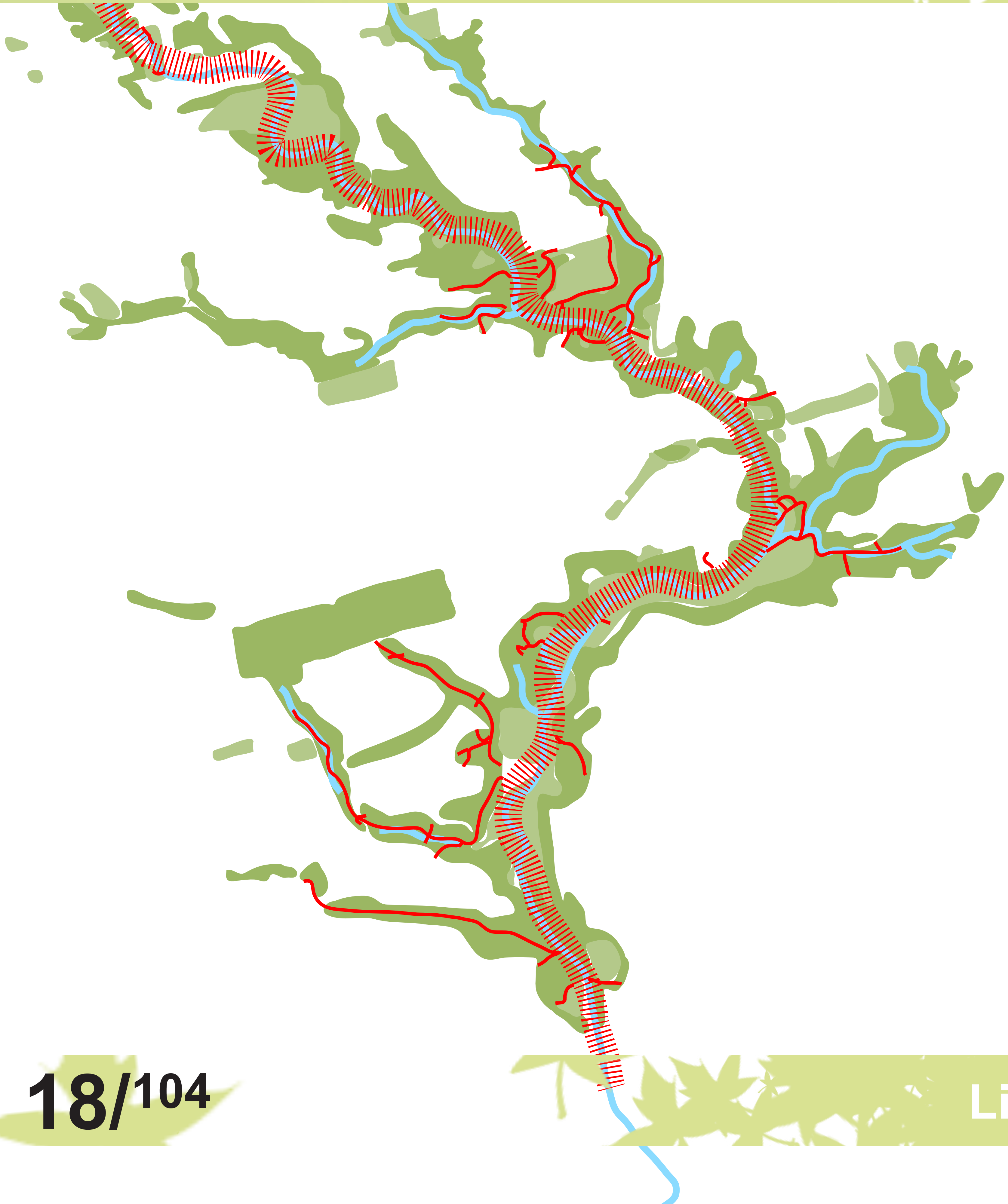


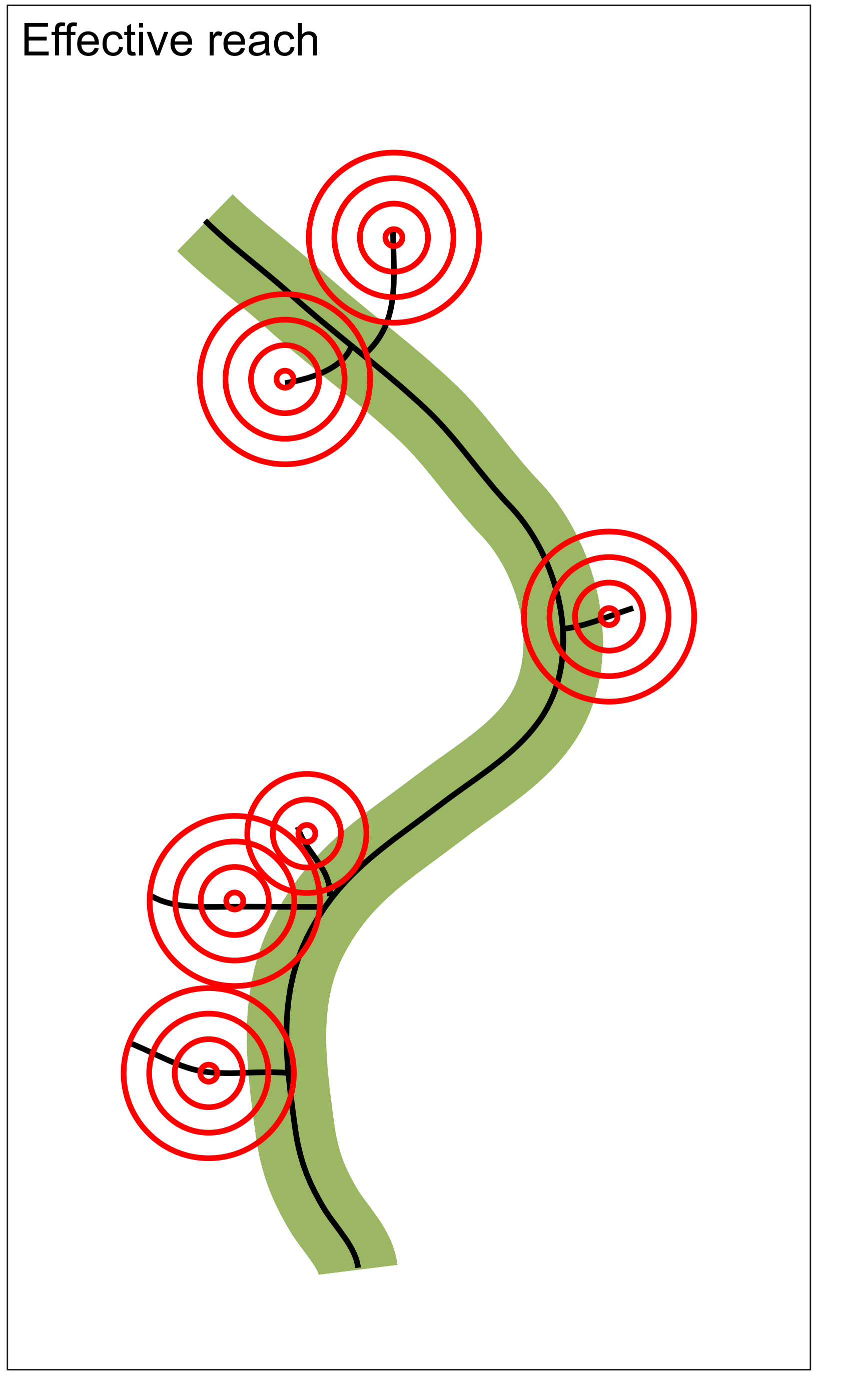
Low social areas around the river valley


1931: Oil-slicked ice on the Don ignites, destroying a footbridge. When the Cleveland’s Cuyahoga burns in 1969, the waterway — which “oozes, rather than flows,” according to Time — rallies the nascent environmental movement.

‘Death and rebirth on the Don River’ by Ray Ford (June 1, 2011)





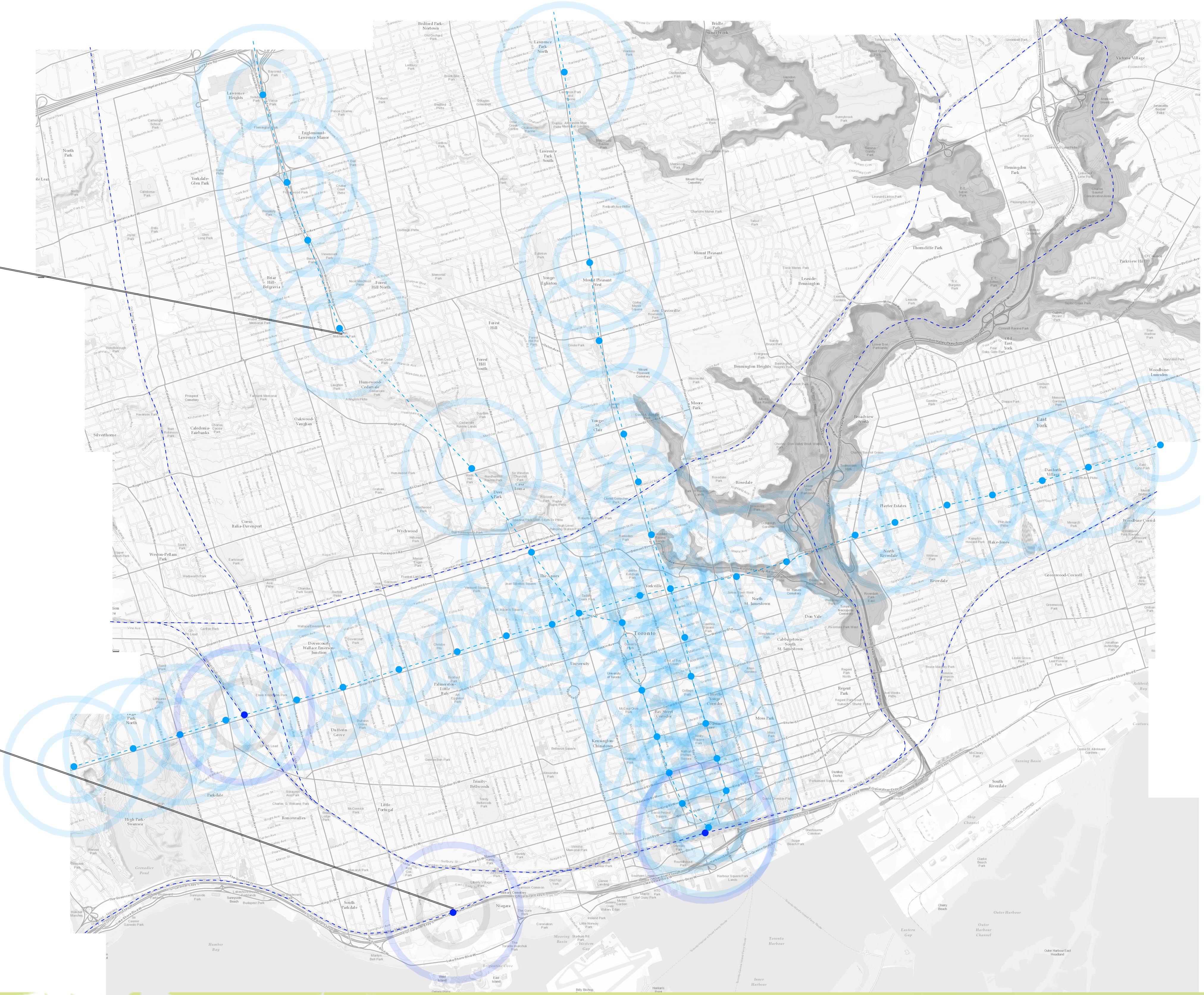
Limited entrances towards the valley

Area analysis

Infrastructure fragmenting the valley

Toronto Metro

GO train



Valley restrains the public transport system

Valley is a dead vein in the urban tissue

↓

Neighbourhoods surrounding the valley are at the edge of this urban tissue

↓

These neighbourhoods are isolated and have little connection to the public transport system

↓

This results in an attraction of residents with low incomes

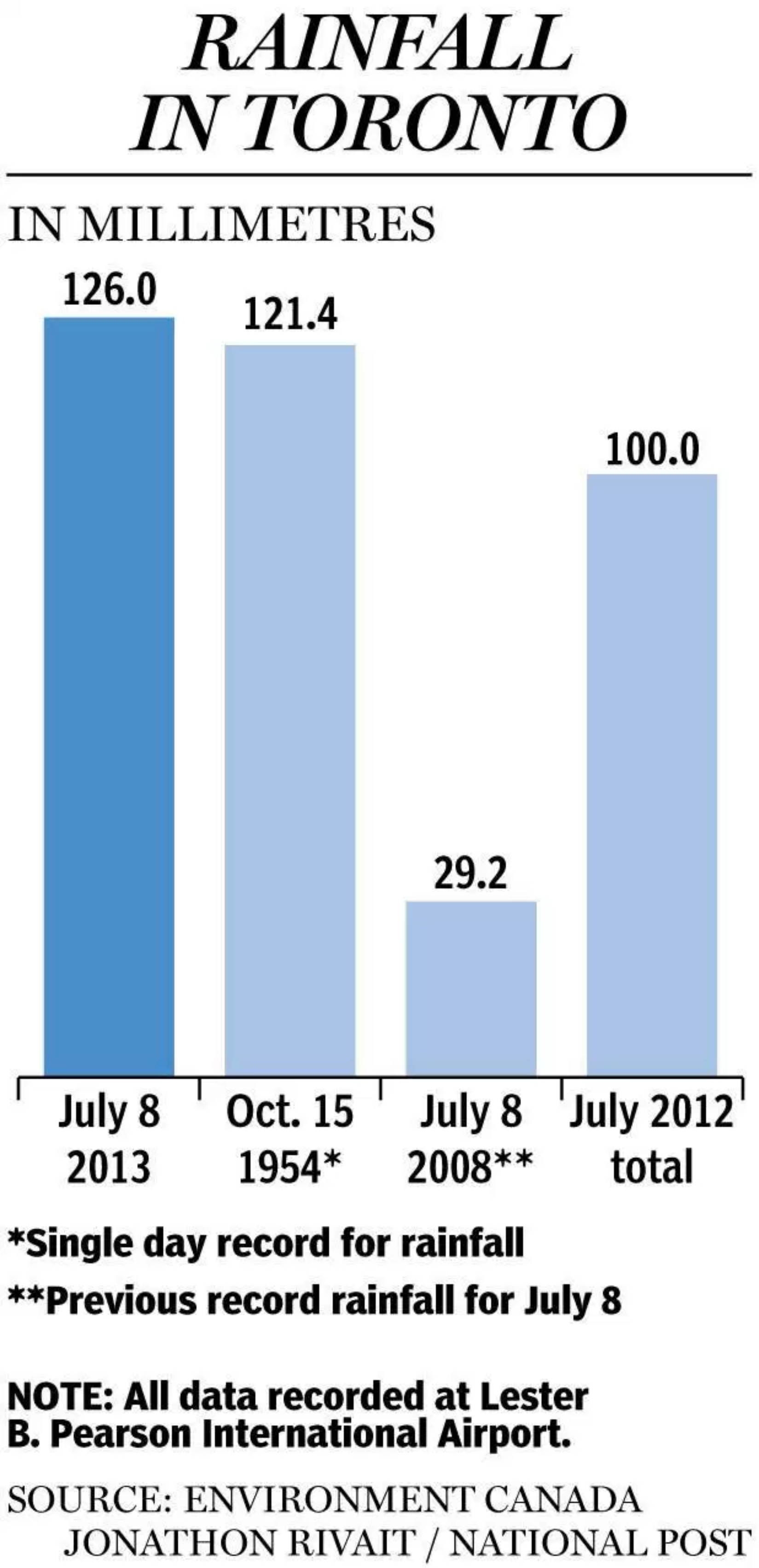
↓

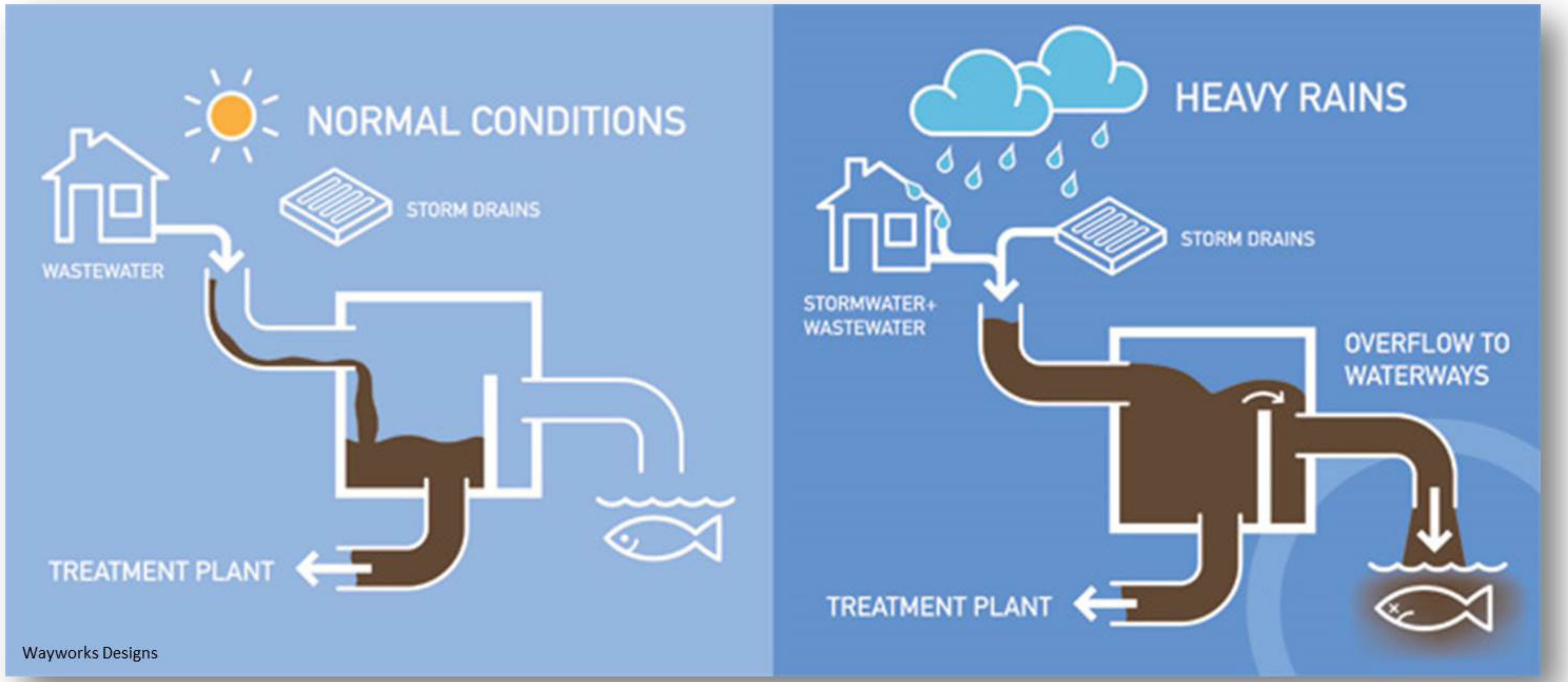
These residents are least likely to own a car

↓

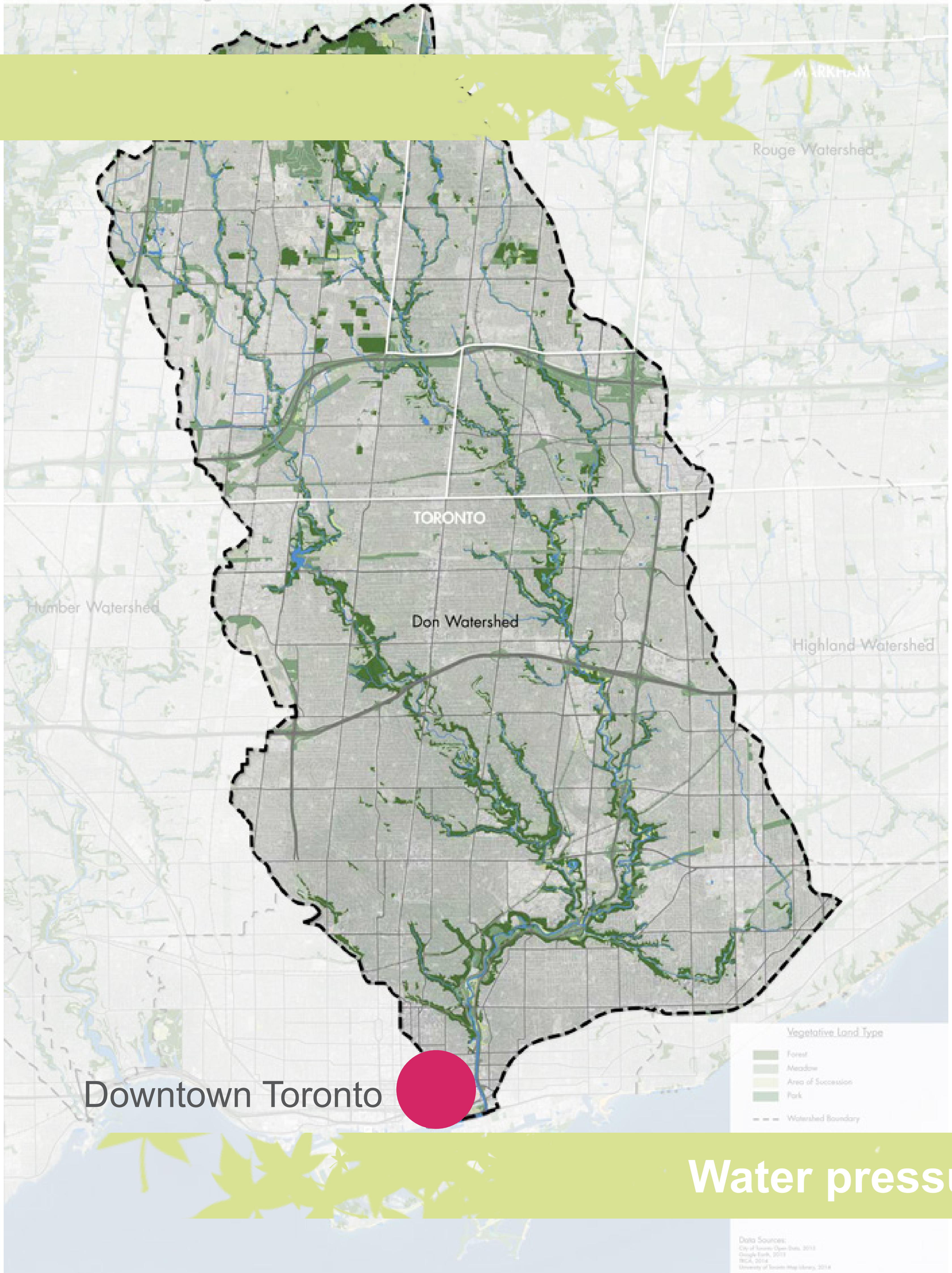
Resulting in further social isolation

Annual flood problems in Toronto

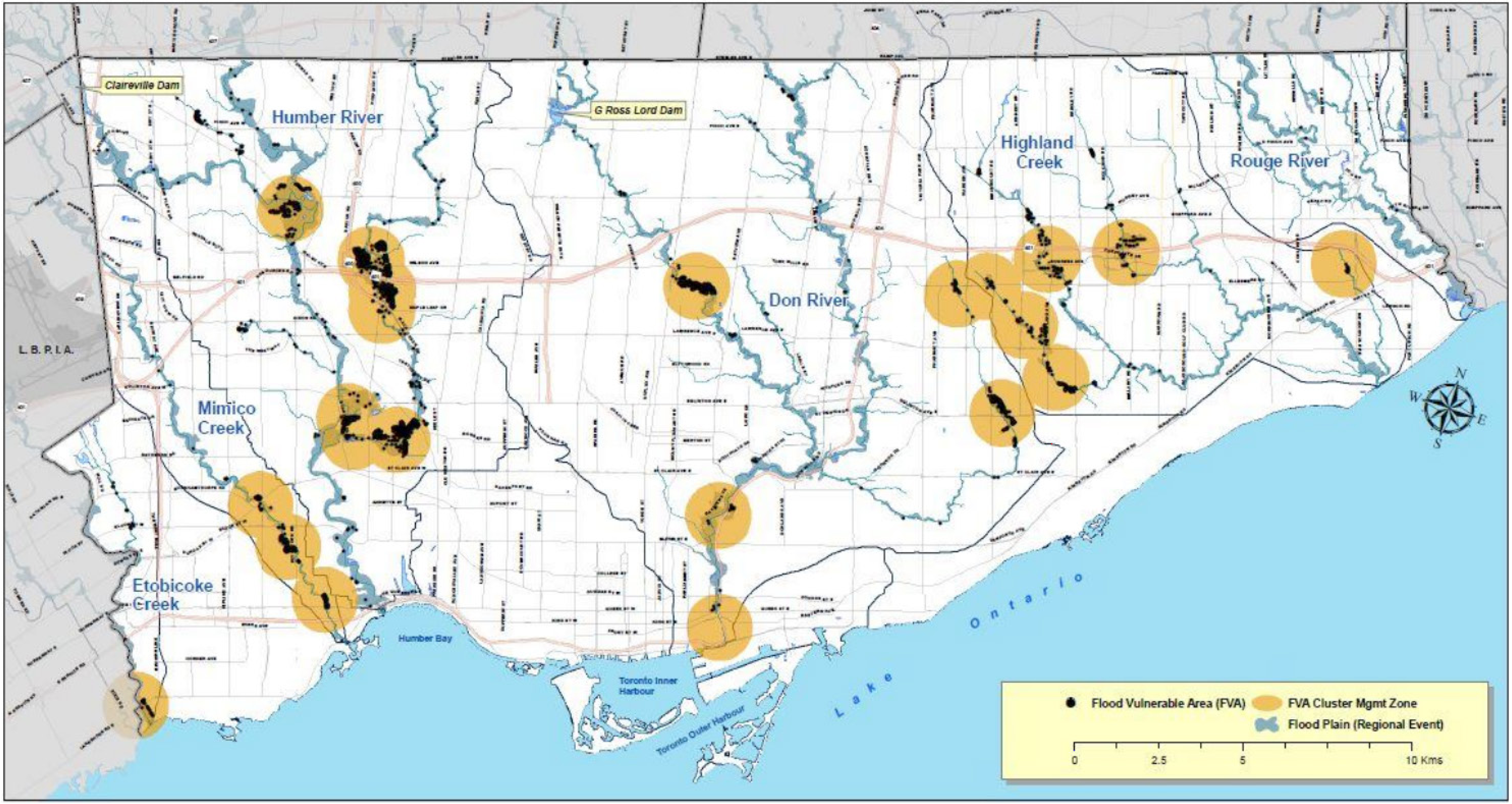


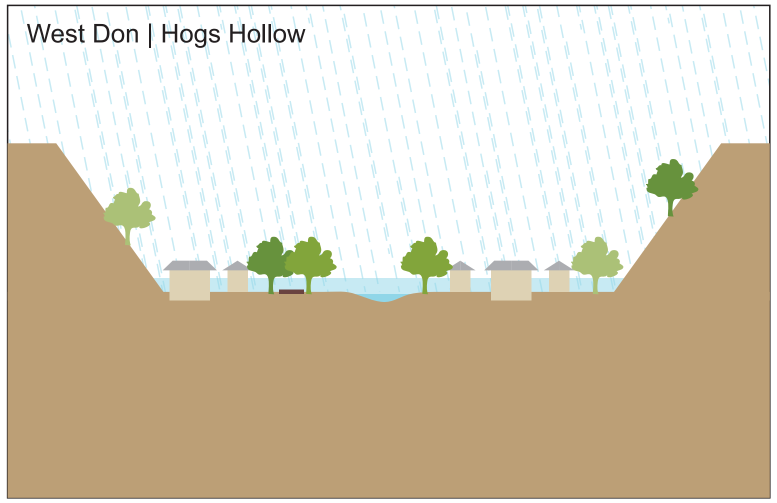


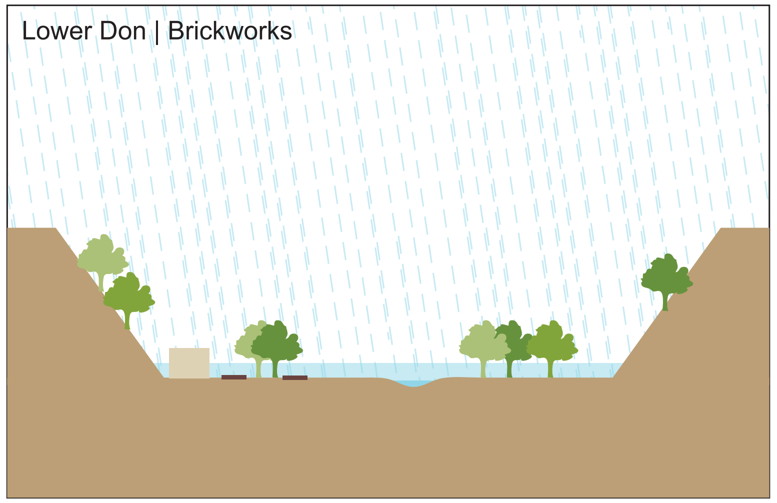
Sewage flows into the Don river at times of heavy rains

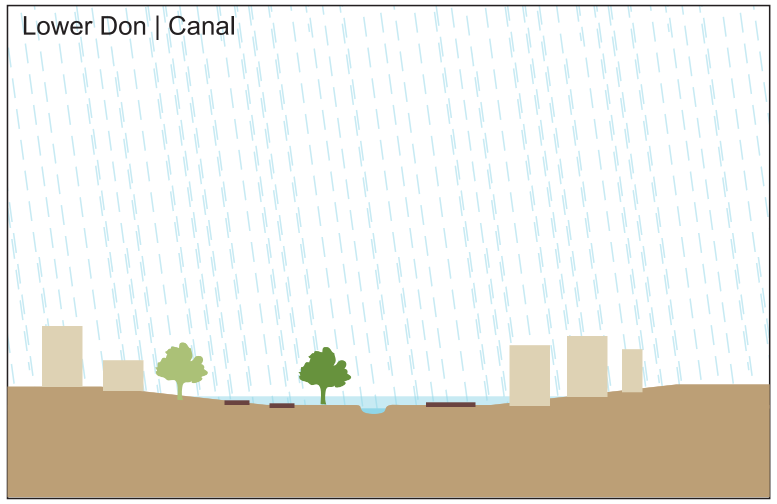


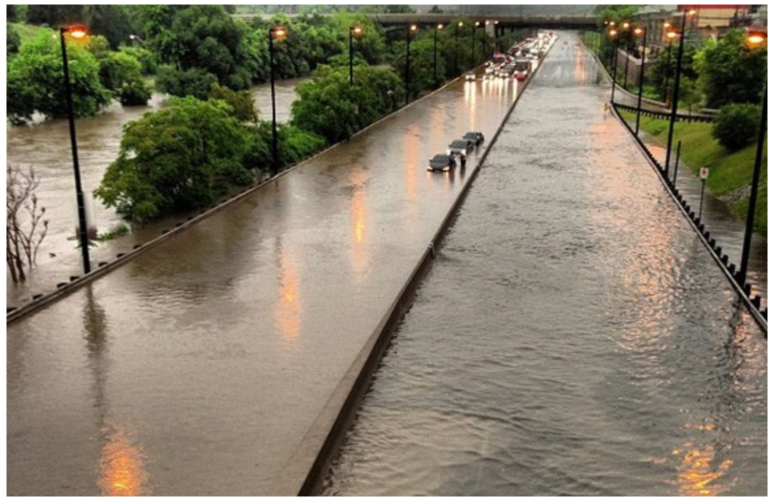
Water pressure on downtown

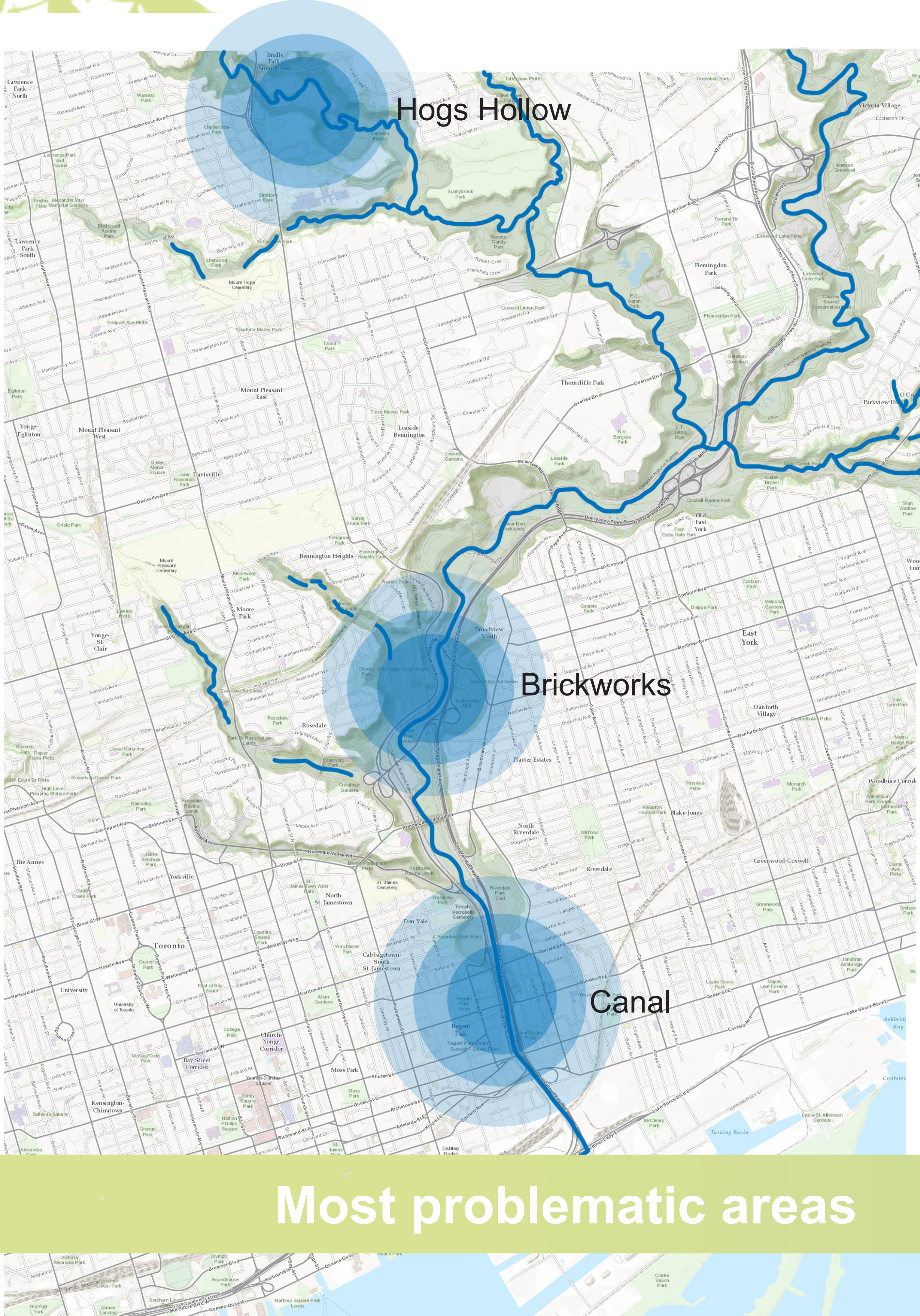

Claireville Dam
G Ross Lord Dam
Humber River
Highland Creek
Rouge River
Don River
L.B.P.I.A.
Mimico Creek
Etobicoke Creek
Humber Bay
Toronto Inner Harbour
Toronto Outer Harbour
Lake Ontario
N
W
E
S
Flood Vulnerable Area (FVA)
FVA Cluster Mgmt Zone
Flood Plain (Regional Event)
0
2.5
5
10 Kms











Most problematic areas

Low scale interventions are no solution

Toronto has to deal with high annual high rainfall peaks

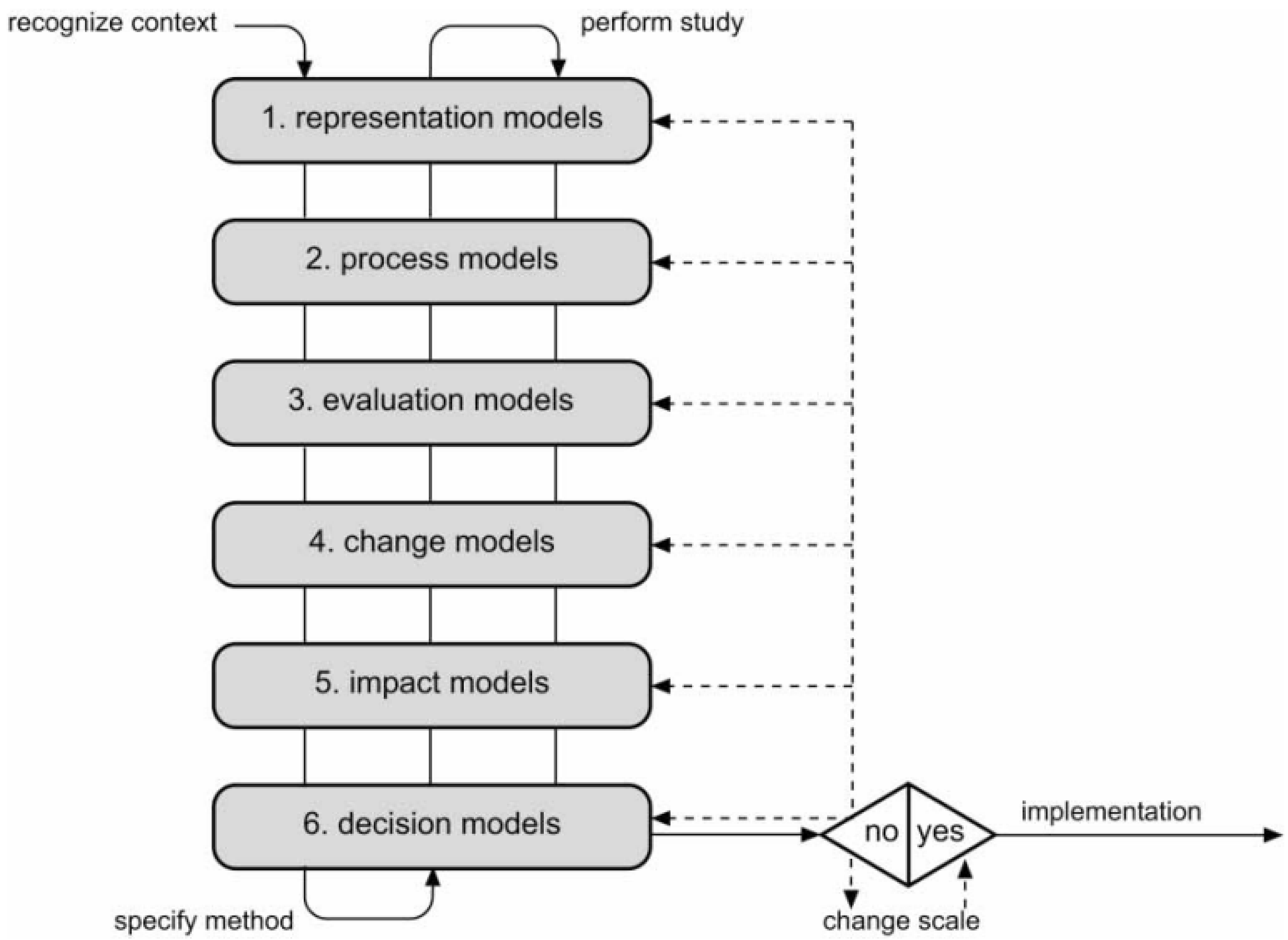
Water from a large catchment area ends up directly in the Don River Valley

Polluted water collected in the sewer system gets redirected into the valley

Next to pollution this leads to flood problems in multiple areas along the Don river

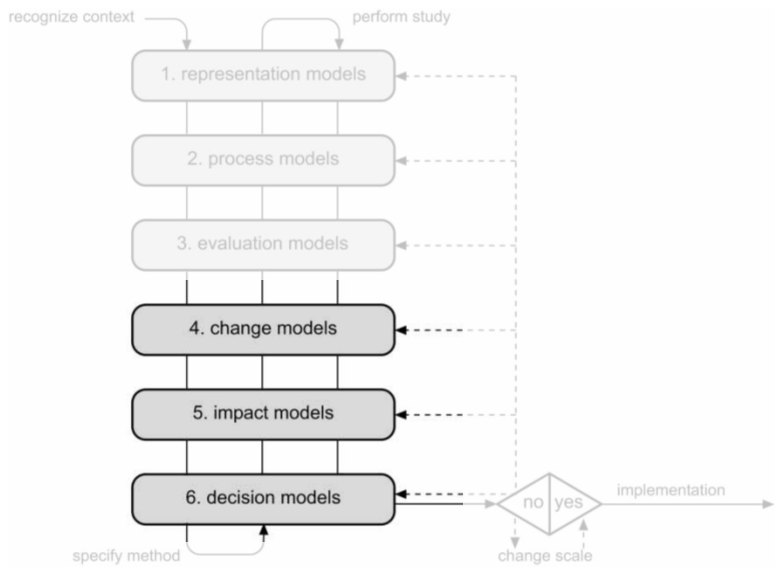
Local efforts to solve the water problem only redirect the problem to other areas

A final solution has to be found in a large-scale capacity increase and supply reduction

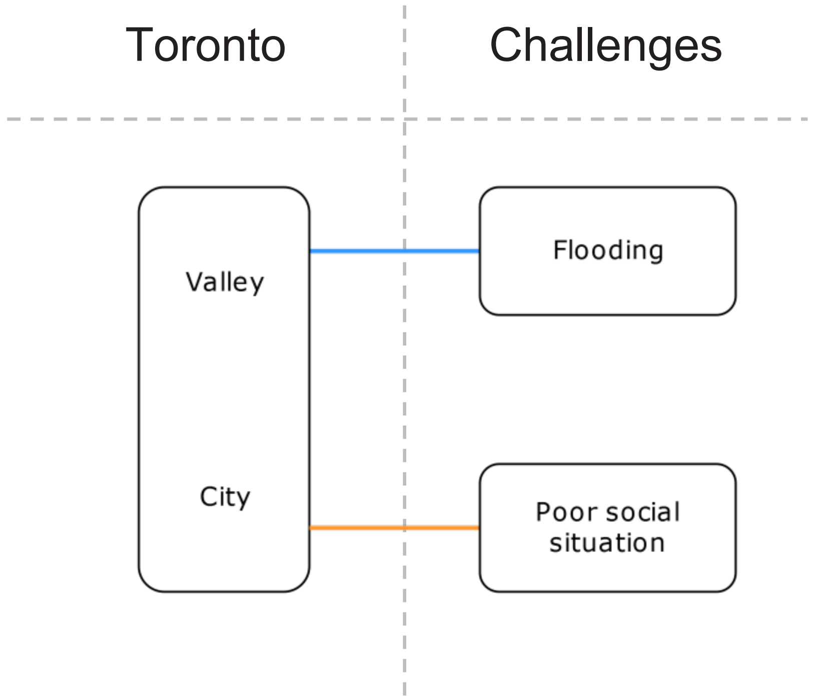


Stremke, S.; Kann, F.M.G. van; Koh, J. (2012) Integrated Visions (Part I): Methodological Framework for Long-term Regional Design. European Planning Studies 20 (2012)2. - ISSN 0965-4313 - p. 305 - 320.

Research framework



Peter C. van Oosten (2016), Deduction and recombination



Along the Don River Valley there is a gathering of **lower social classes**, related to the valley being a **backside** within the urban tissue, leading to **isolation**

Meanwhile the Don River Valley deals with annual **flood problems** and **limited accessability**, resulting in **neglection of valuable area** which **lacks a multi-scale vision**

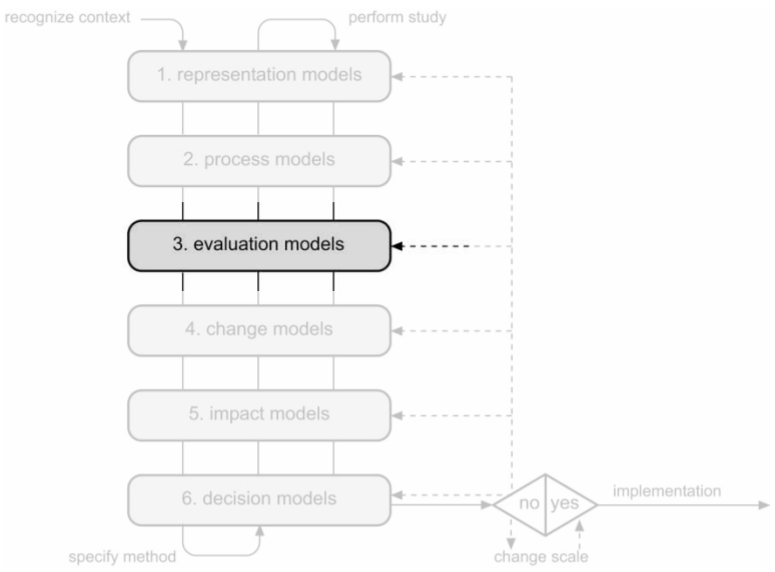
What is an effective design strategy to reconnect the City of Toronto to the landscape of the Don River Valley at the metropolitan, district and local scale?

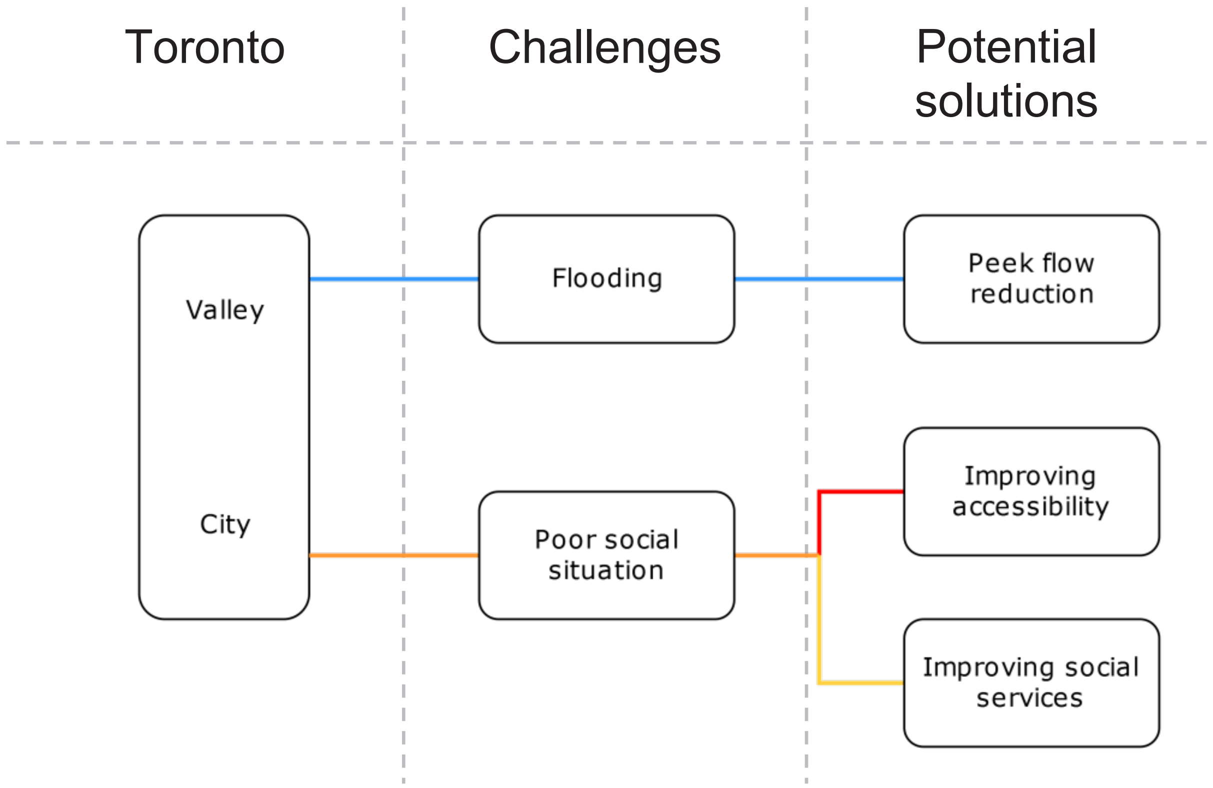
- In which way can this strategy improve the social structure of neighborhoods surrounding the Don River Valley?

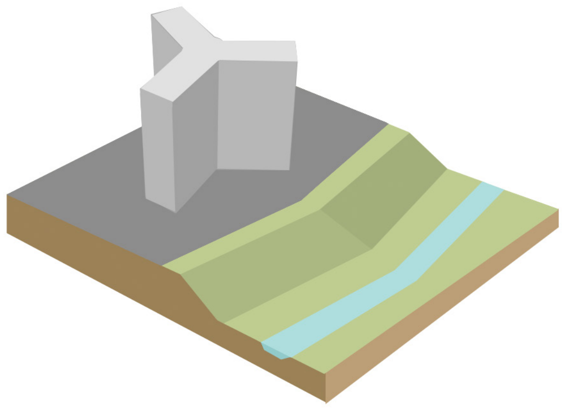
- How can this strategy deal with challenges regarding water management?

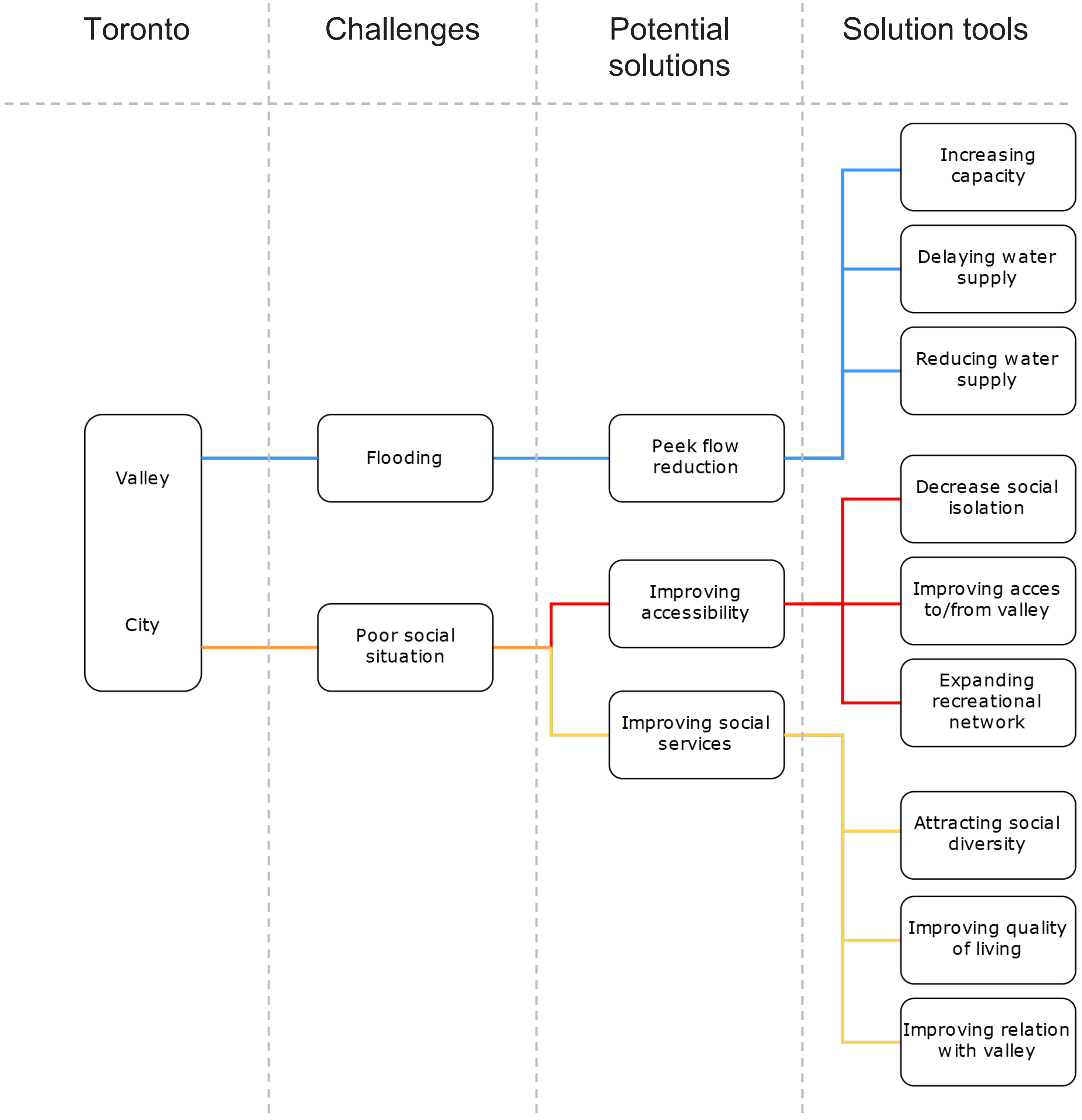
- How can design solutions for the Don River Valley and the solutions for the surrounding neighborhoods strenghten eachother?

By transforming the Don River Valley from a series of loose cross-sections into a lively and continuous metropolitan park which connects to its surroundings and at the same time works as a system


recognize context
perform study
1. representation models
2. process models
3. evaluation models
4. change models
5. impact models
6. decision models
no
yes
implementation
specify method
change scale


Toronto
Challenges
Potential solutions
Valley
City
Flooding
Poor social situation
Peek flow reduction
Improving accessibility
Improving social services





Toronto
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Potential solutions
Solution tools
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City
Flooding
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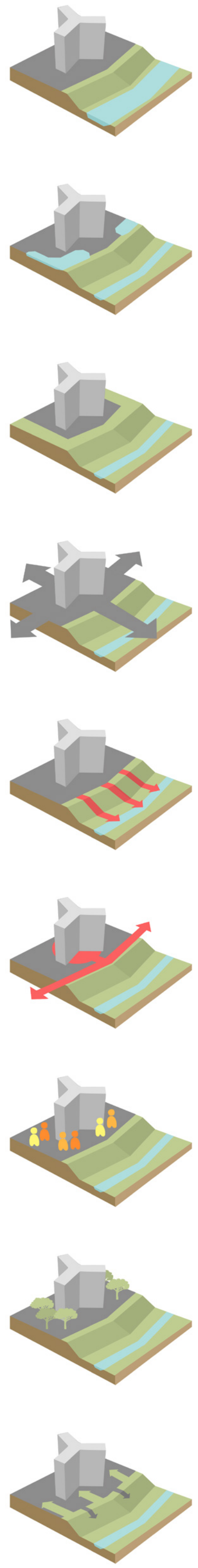
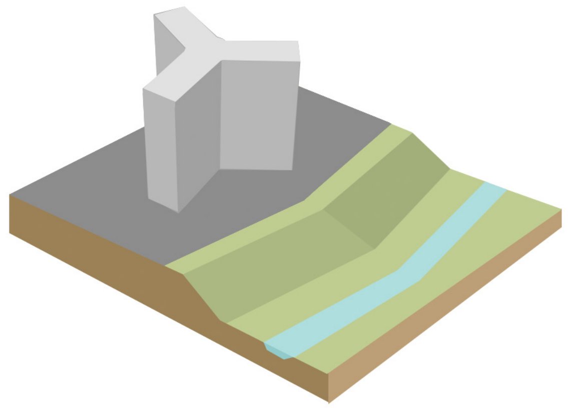
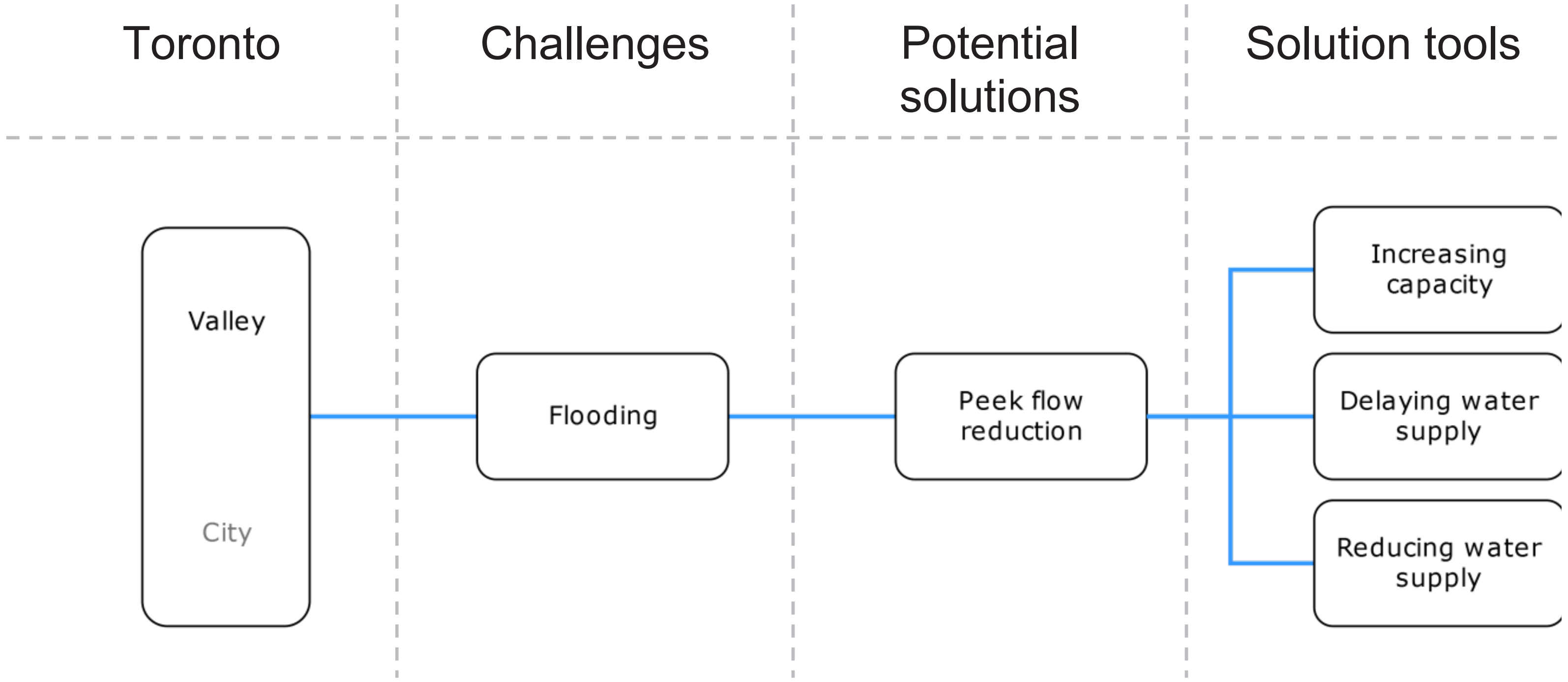
Improving accessibility
Improving social services
Increasing capacity
Delaying water supply
Reducing water supply
Decrease social isolation
Improving acces to/from valley
Expanding recreational network
Attracting social diversity
Improving quality of living
Improving relation with valley



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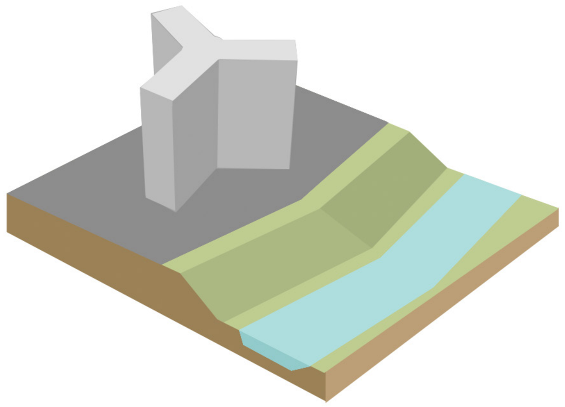
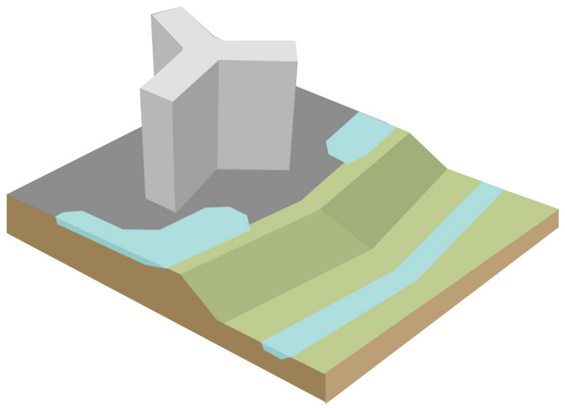
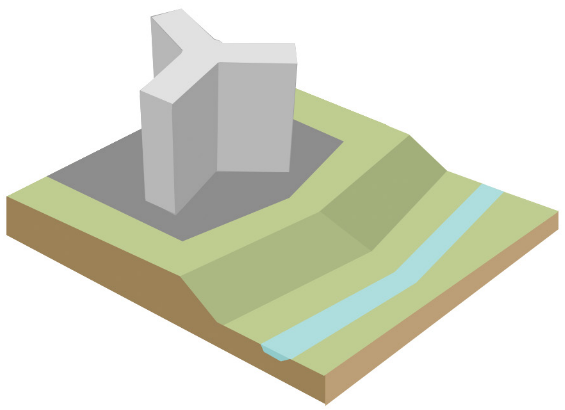
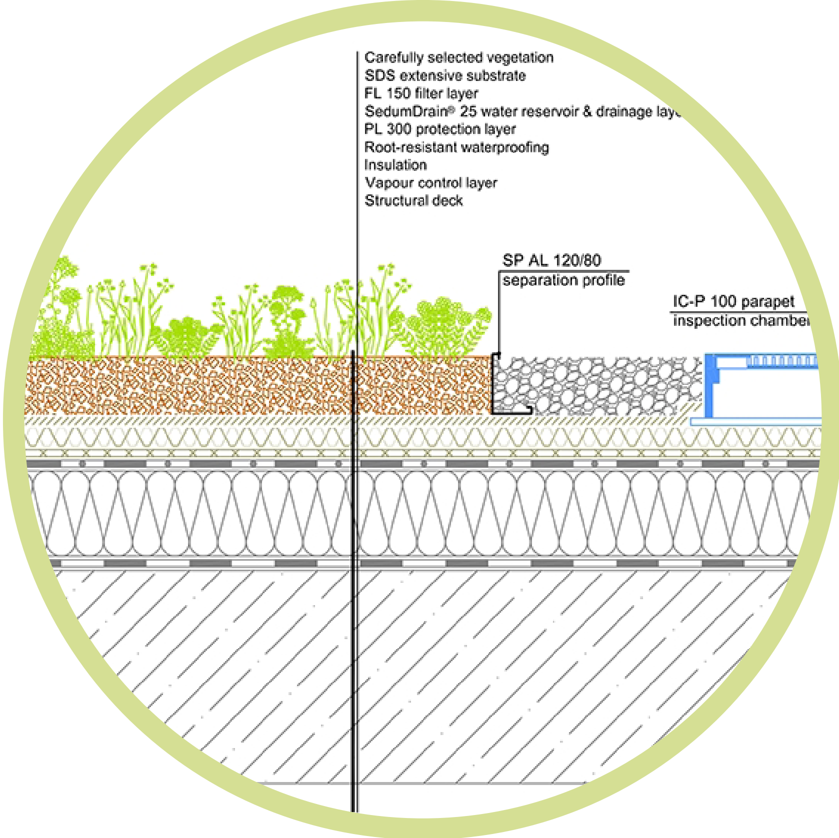
Reducing water supply









54% of percipitation uptake

Mentens, J. (2005) Green roofs as a tool for solving the rainwater runoff problem in the urbanized 21st century?

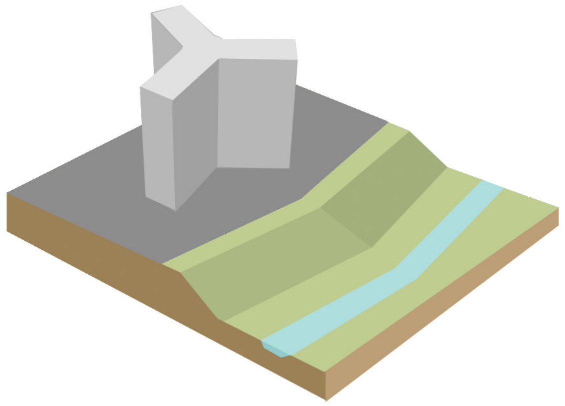
Up to 100% of percipitation uptake

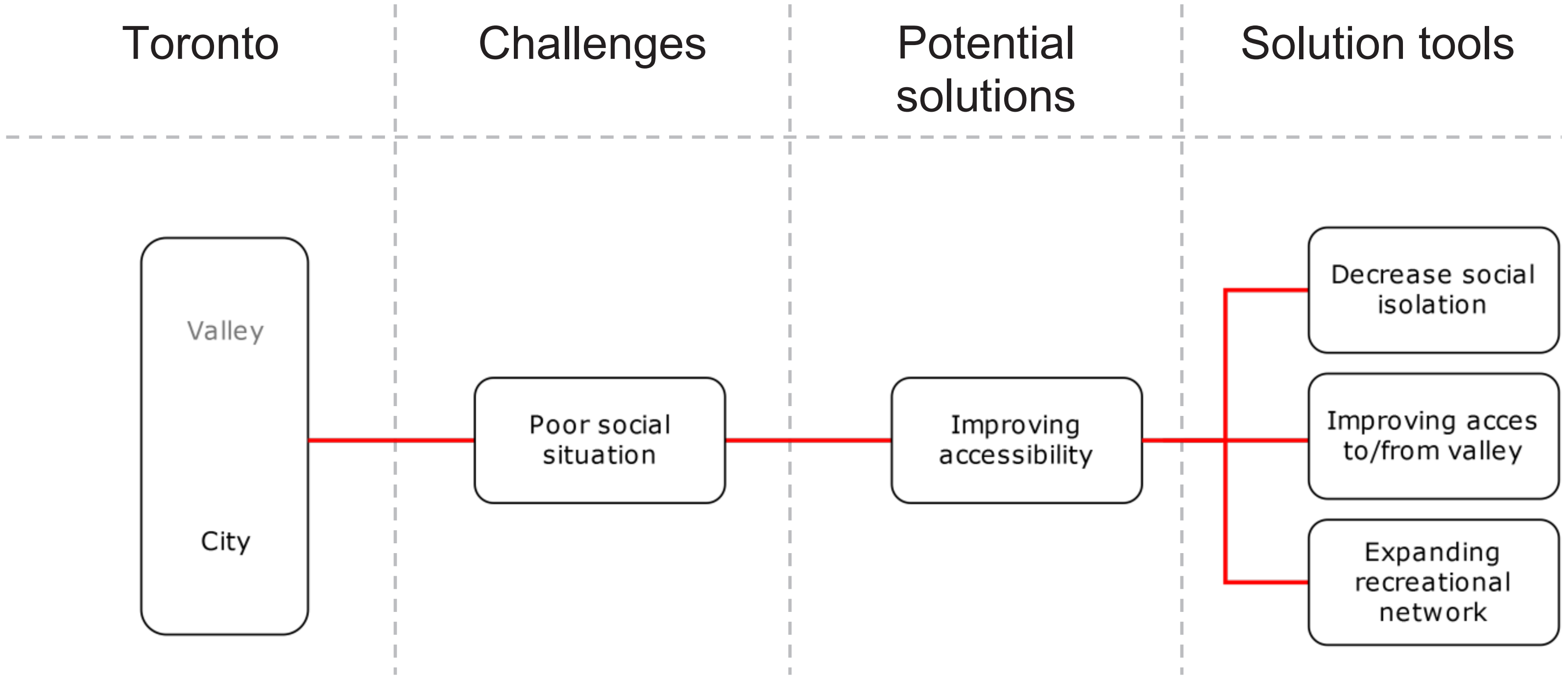
Design tools

Delaying water supply

Increasing capacity

Reducing water supply

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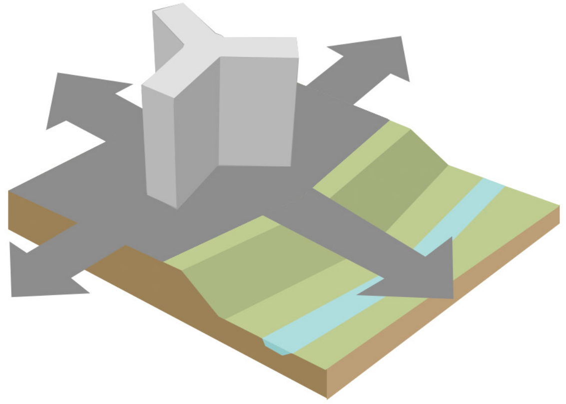
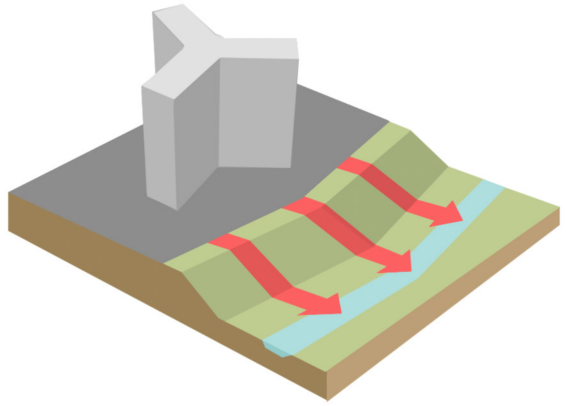
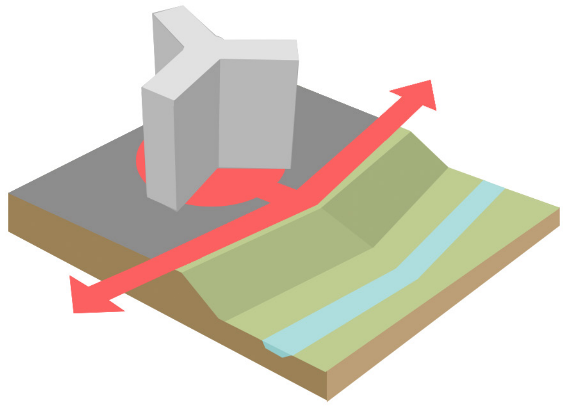
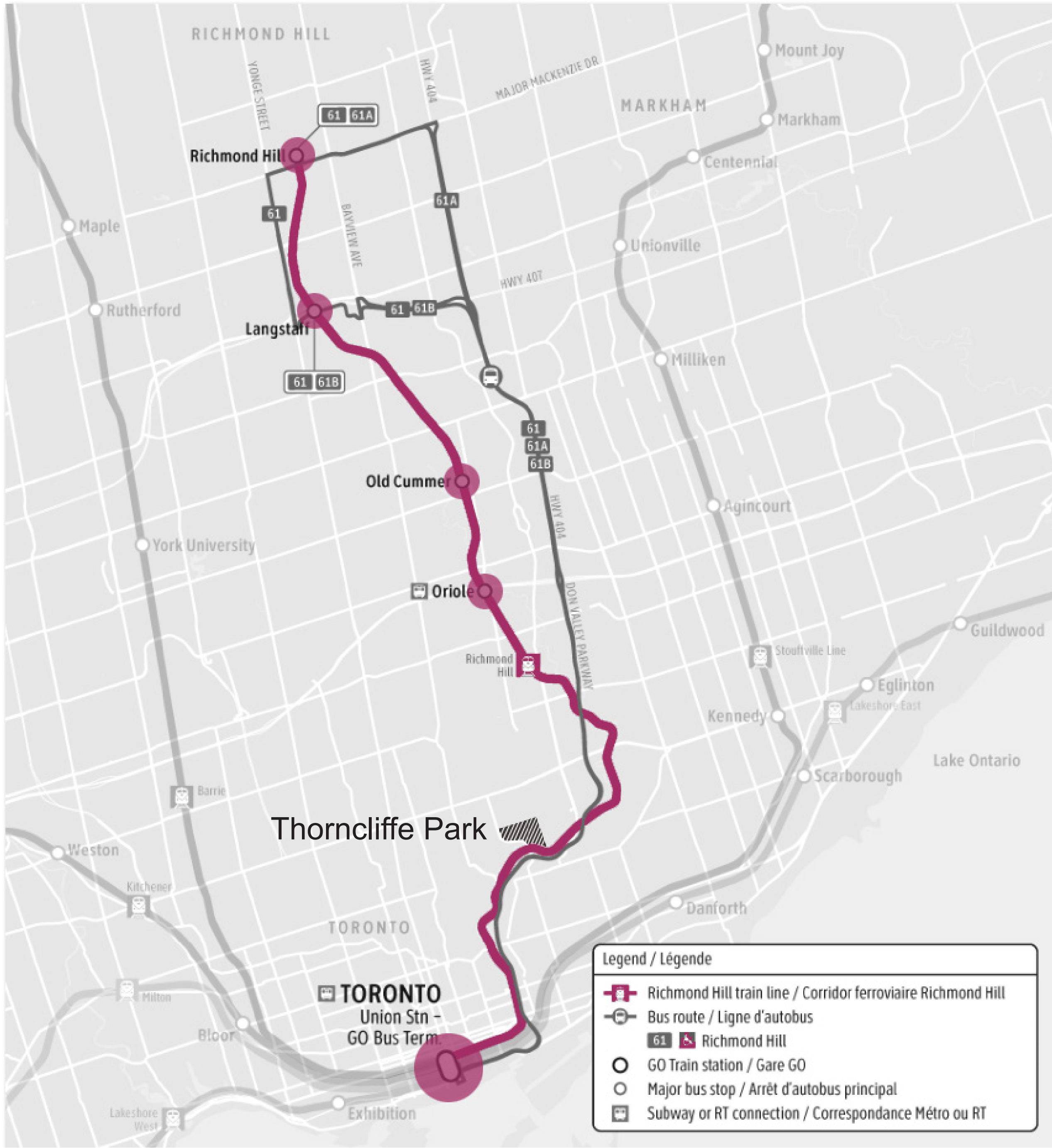


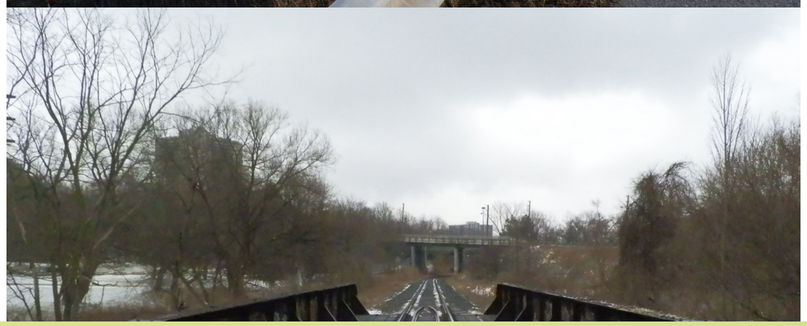





RICHMOND HILL
YONGE STREET
HWY 404
MAJOR MACKENZIE DR
MARKHAM
Mount Joy
Markham
Centennial
Richmond Hill
61 61A
61
61A
BAYVIEW AVE
Maple
Unionville
HWY 407
Rutherford
Langstaff
61 61B
61 61B
Milliken
61
61A
61B
Old Cummer
HWY 404
Agincourt
York University
Oriole
DON VALLEY PARKWAY
Richmond Hill
Stouffville Line
Guildwood
Eglinton
Lakeshore East
Kennedy
Scarborough
Lake Ontario
Barrie
Thorncliffe Park
Weston
Kitchener
TORONTO
Danforth
Milton
TORONTO
Union Stn -
GO Bus Term.
Bloor
Lakeshore West
Exhibition
Legend / Légende
Richmond Hill train line / Corridor ferroviaire Richmond Hill
Bus route / Ligne d'autobus
61 Richmond Hill
GO Train station / Gare GO
Major bus stop / Arrêt d'autobus principal
Subway or RT connection / Correspondance Métro ou RT

GO train

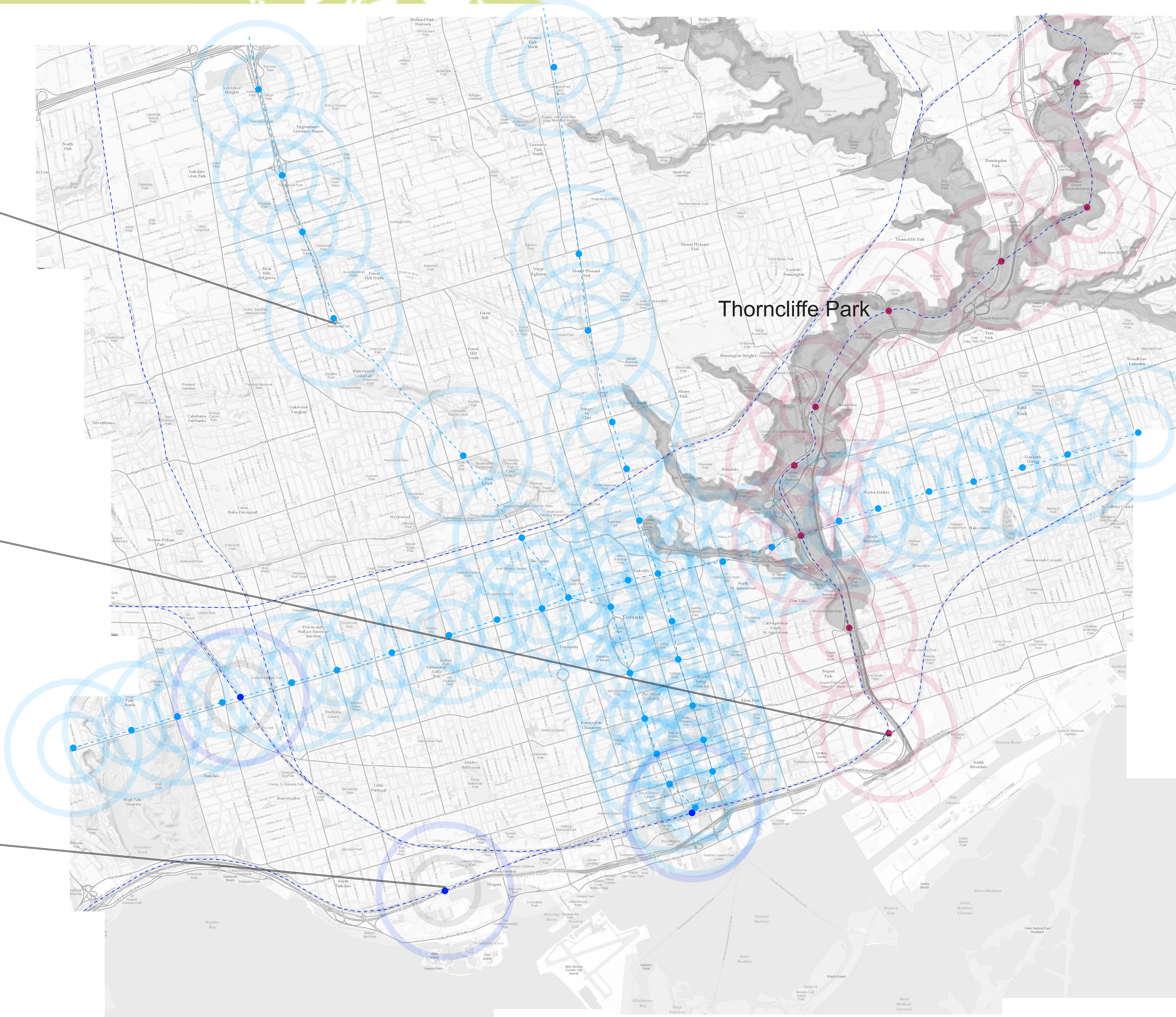

GO



Toronto Metro

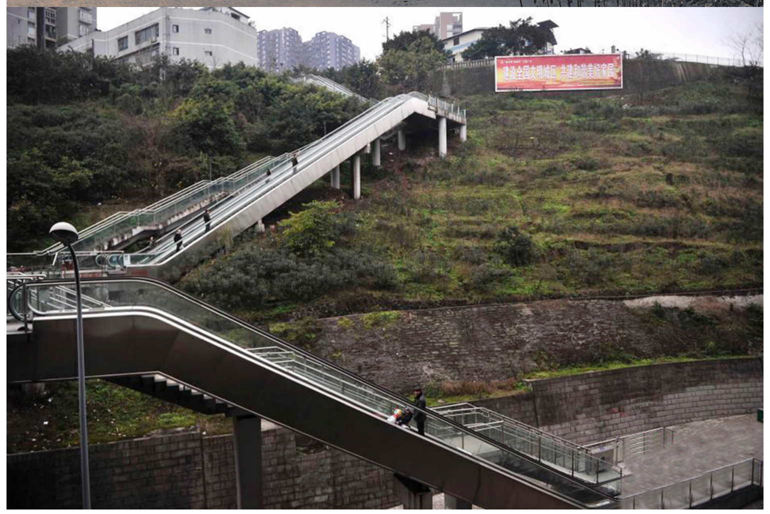
Toronto Lightrail

GO train



Decreasing social isolation

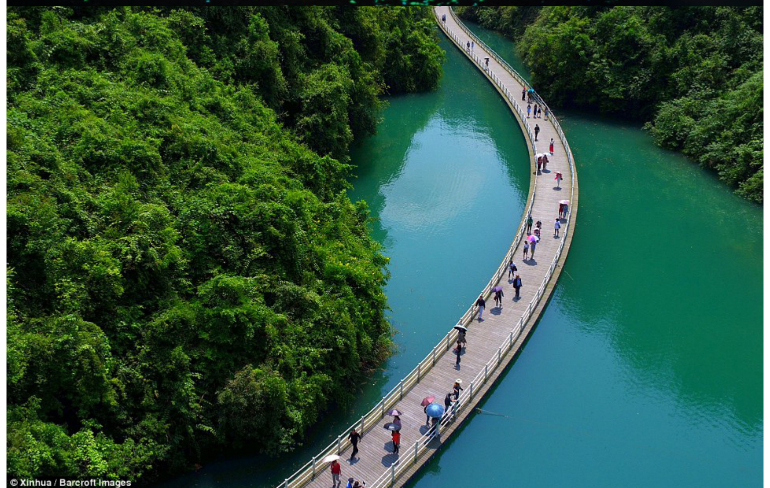


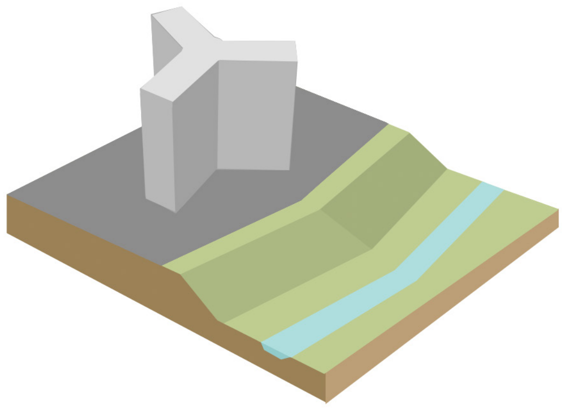


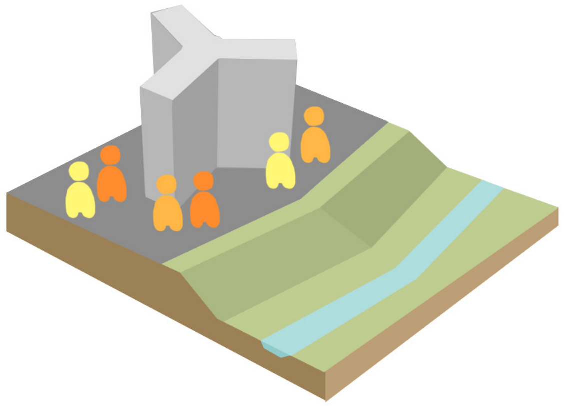
Improving acces to/from valley

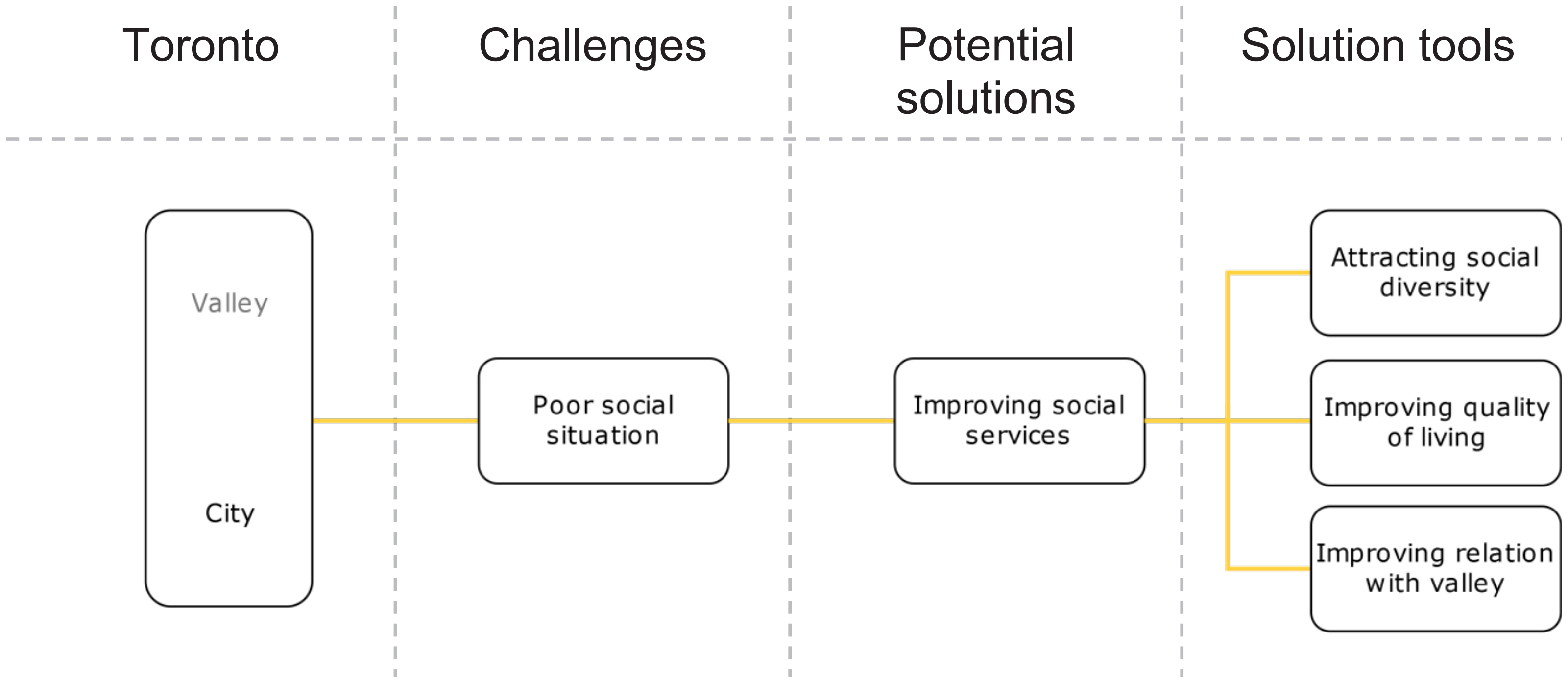



Expanding recreational network



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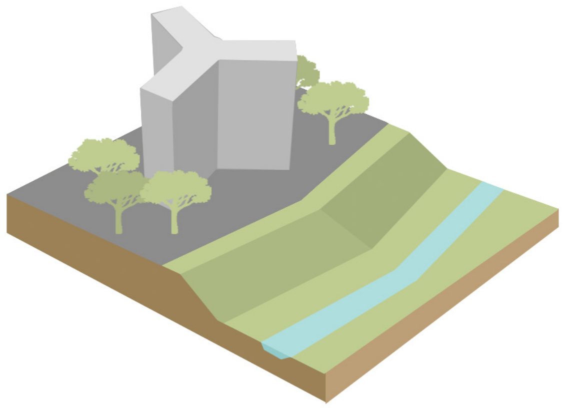
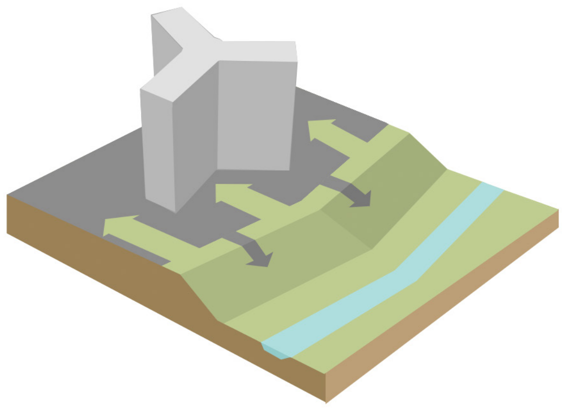




Attracting social diversity

Improving quality of living

Improving relation with valley

Area analysis

Research framework

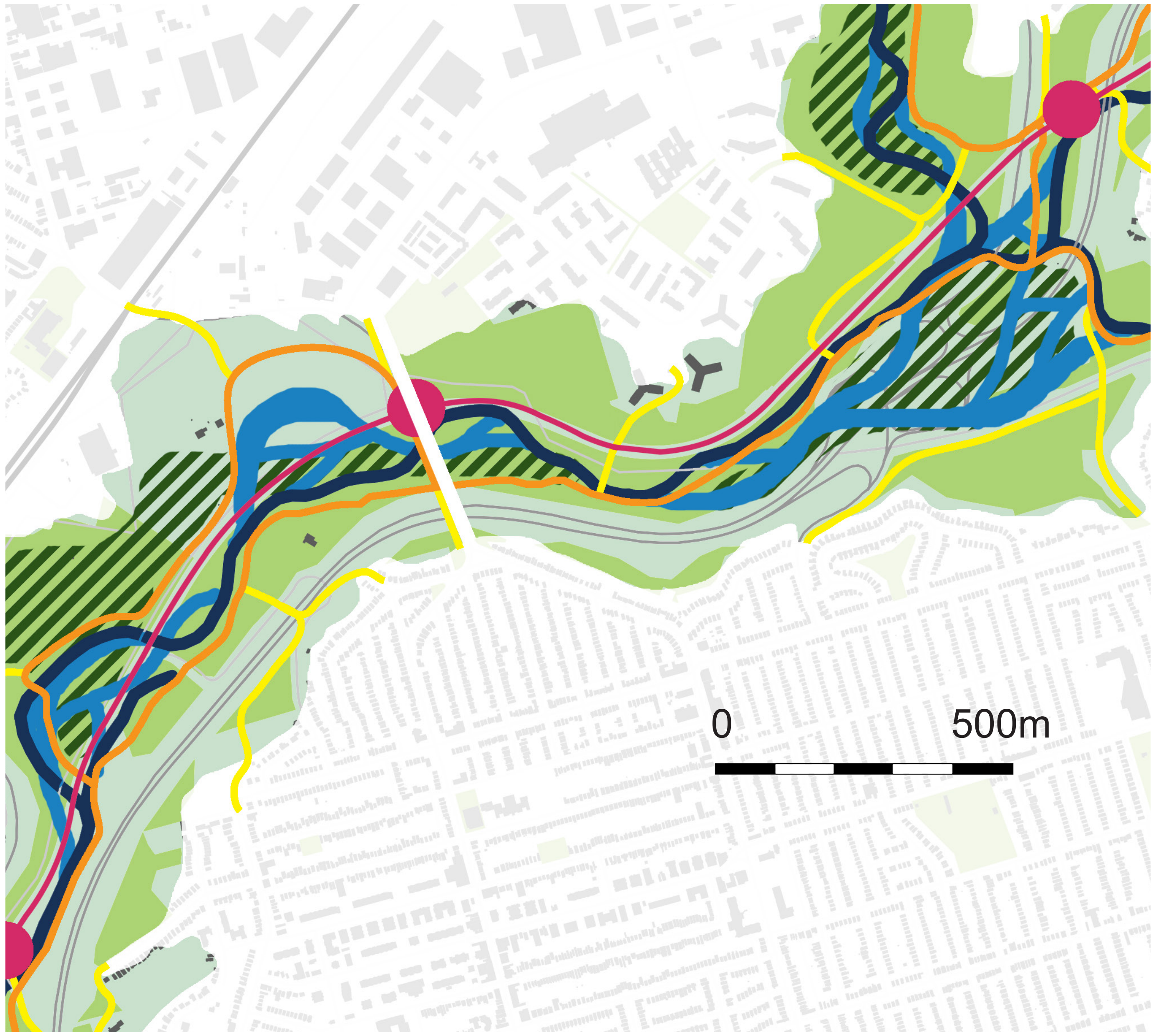
Design tools

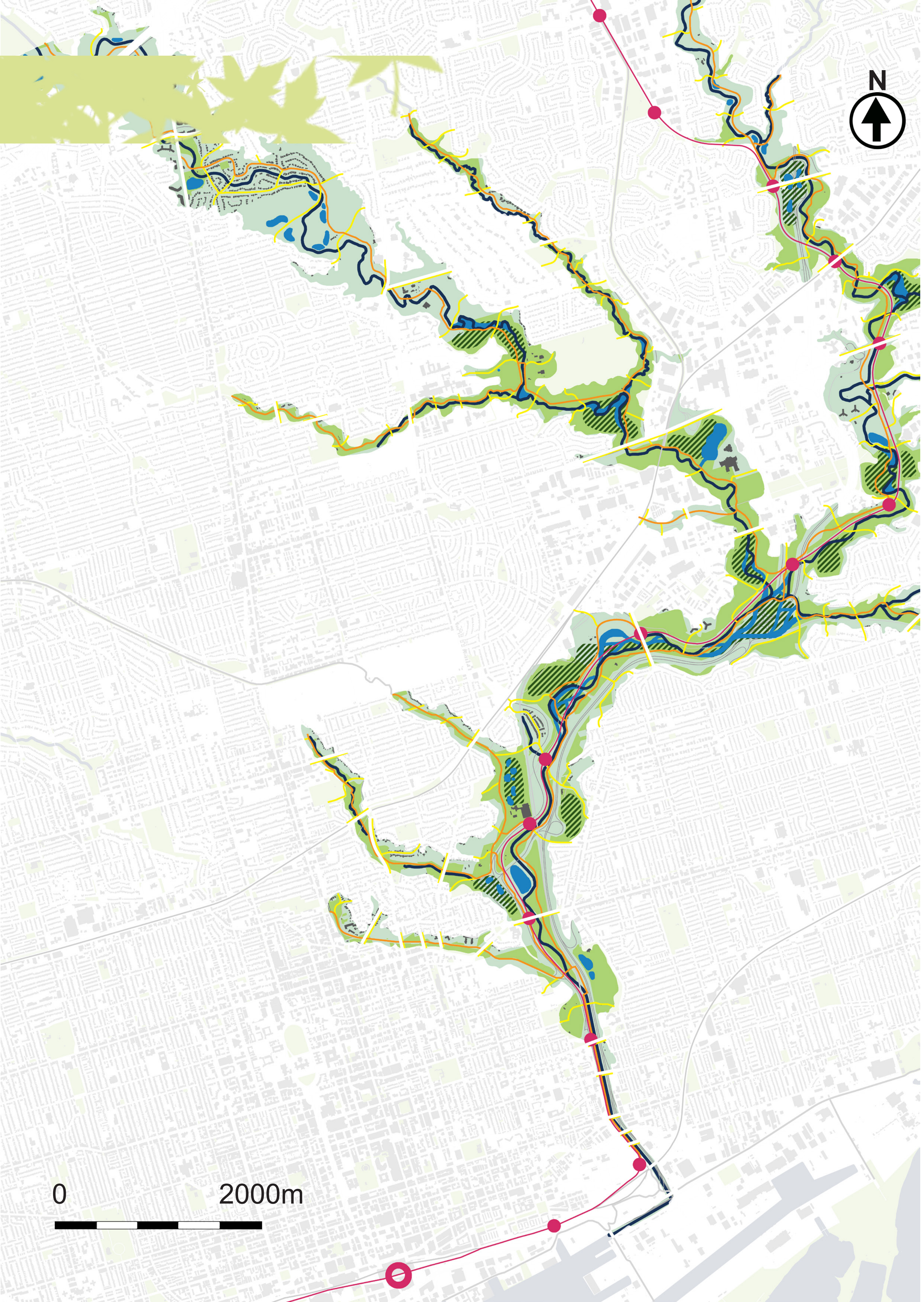
Design

Reflection

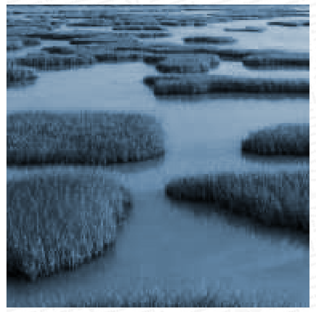
Don River Valley Park

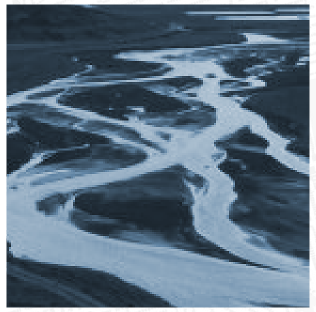
Masterplan Don River Valley Park

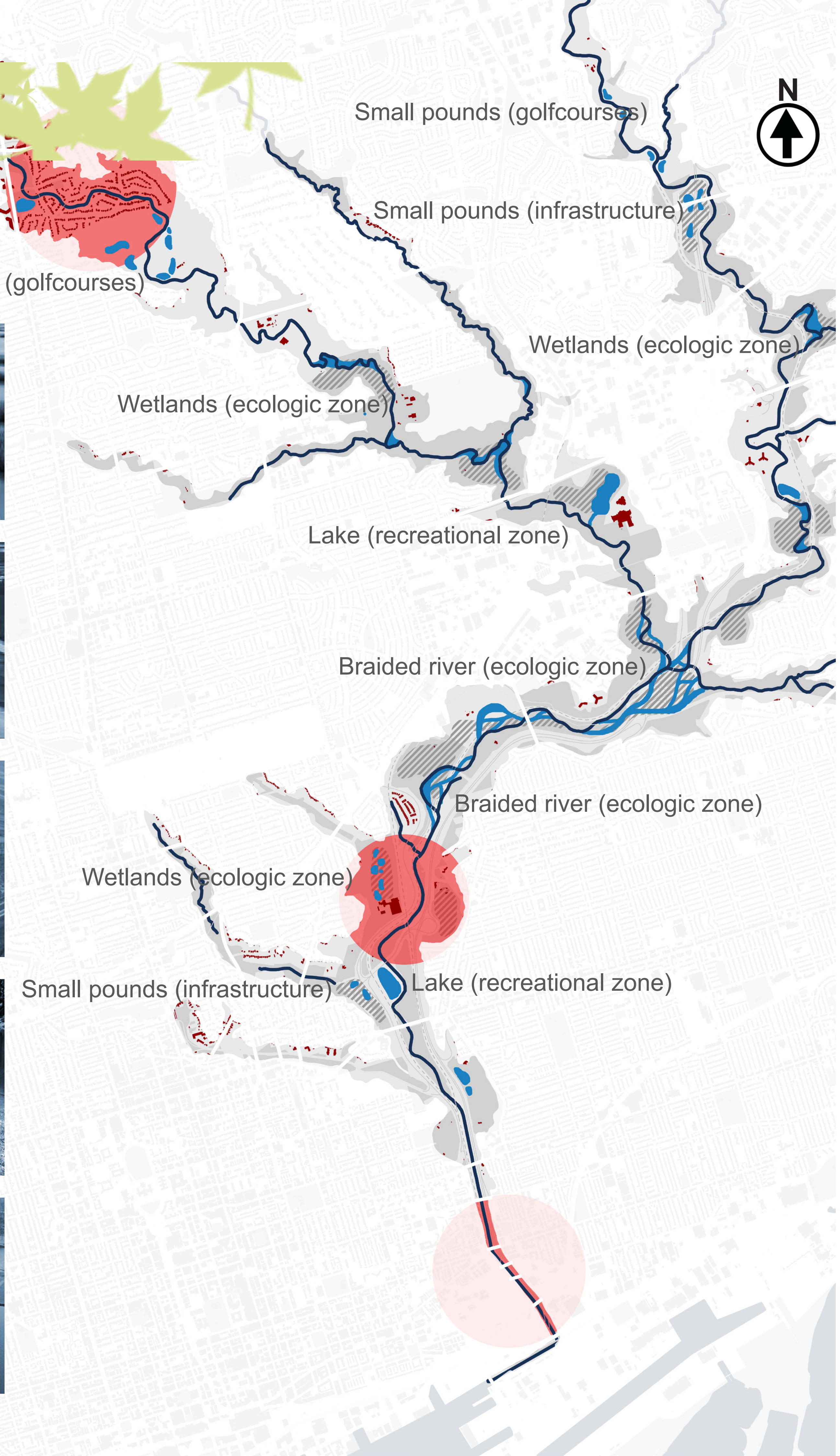




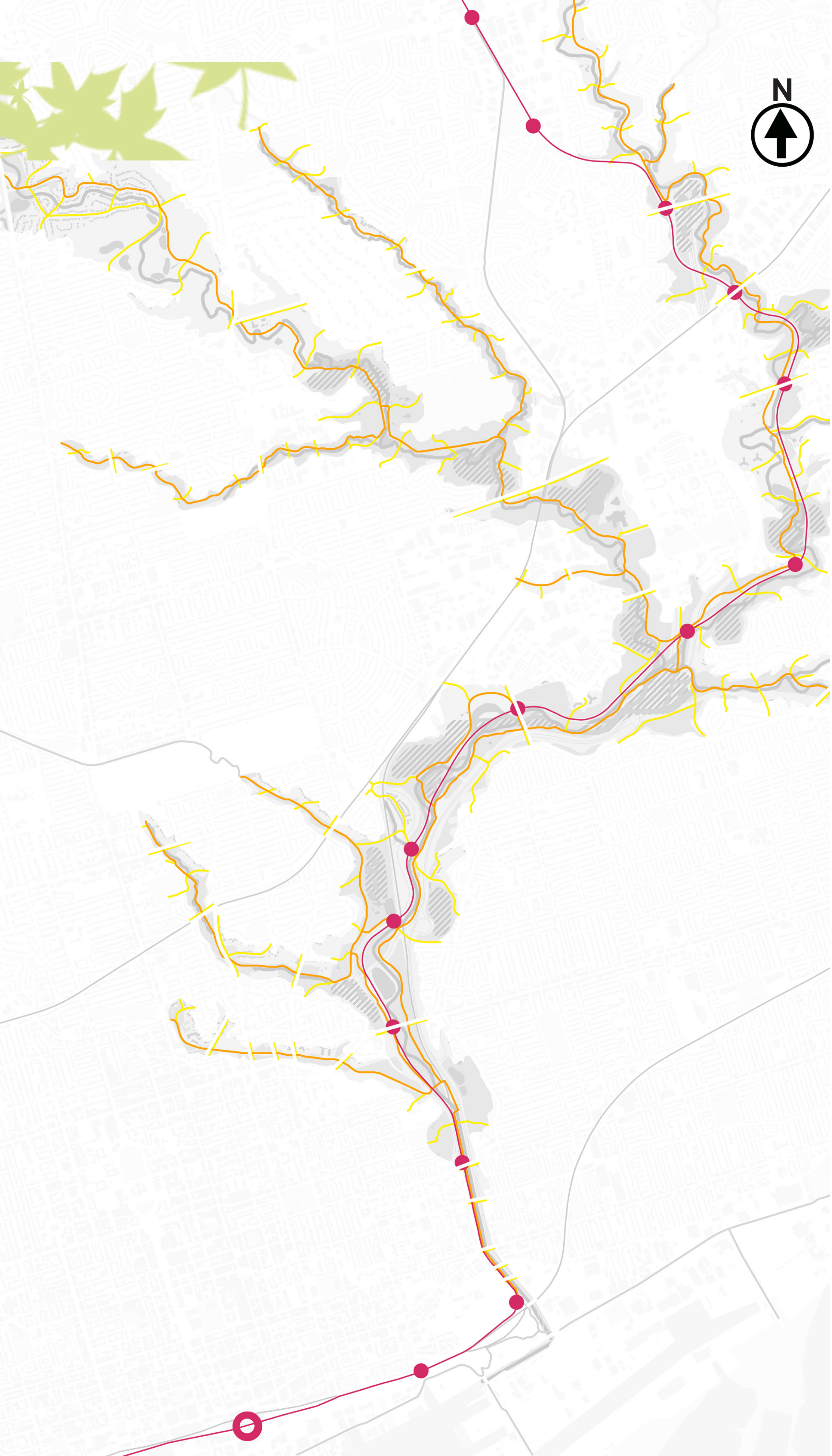
Water design themes







Access network




Lower Don River Valley Park
Thorncliffe Park
Leaside-Bennington
Bennington Heights
Broadview North
Flemingdon Park
Toronto

Design with nature

Fauna species of high regional concern*

*L1-L3 rating according to Ecological Land Classification (ELC) System of the Ontario Ministry of Natural Resources (MNR)

Mink
Mustela vison
L3, Lower Don East

Northern leopard frog
Rana pipiens
L3, Lower Don

Beaver
Castor canadensis
L3, Lower Don

Pileated woodpecker
Dryocopus pileatus
L3, Lower Don

Eastern red-backed salamander*
(*occurrence needs confirmation)
Plethodon cinereus
L3, Lower Don

Wood duck
Aix sponsa
L3, Lower Don

least flycatcher
Empidonax minimus
L3, Lower Don

Masterplan Lower Don River Valley Park

Light rail station

Wildlife patch

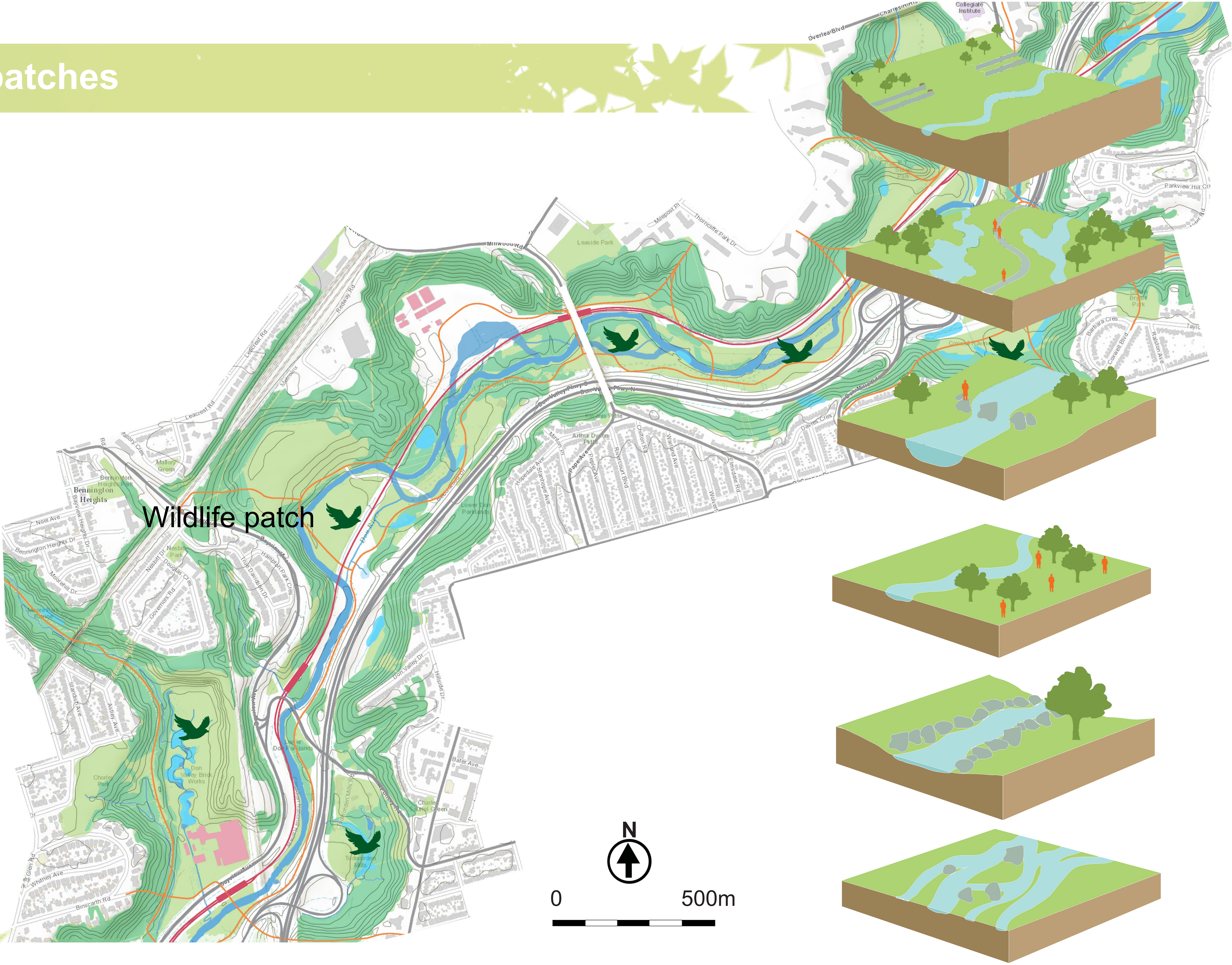
Water recreation

Outdoor recreation

Exercising

Valley exit

Wildlife patches

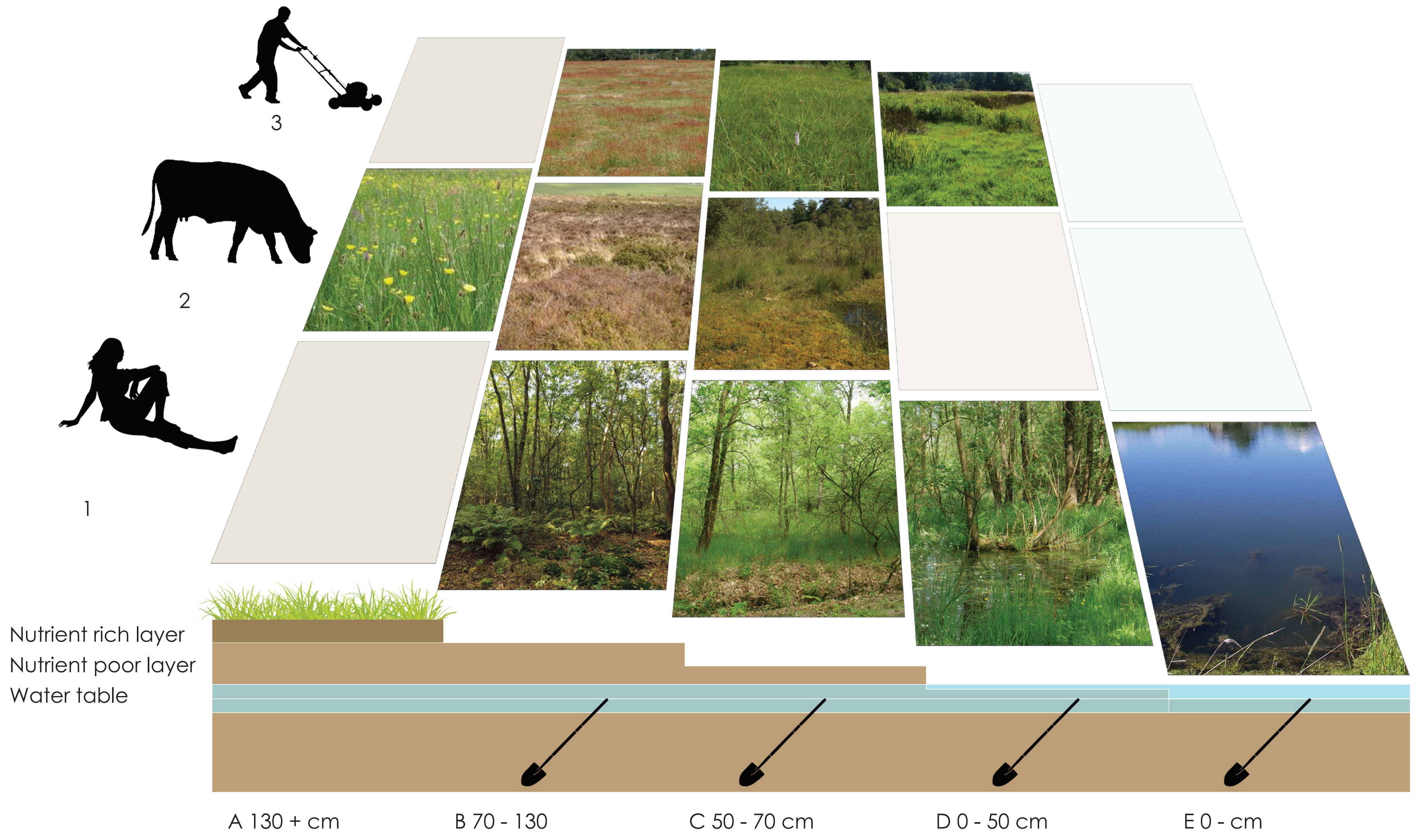


Wildlife patch

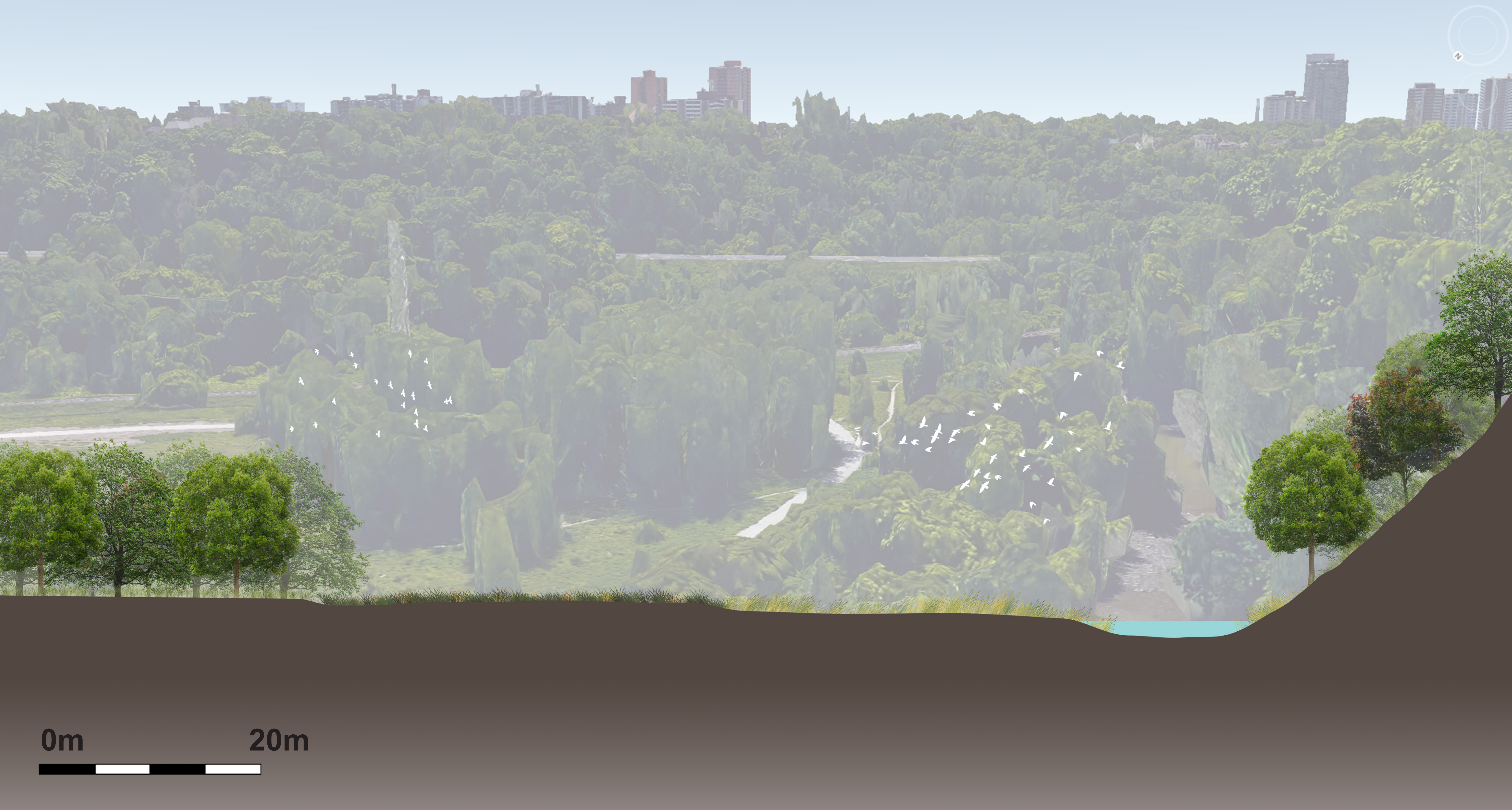
Current situation

Wildlife patch

Future situation



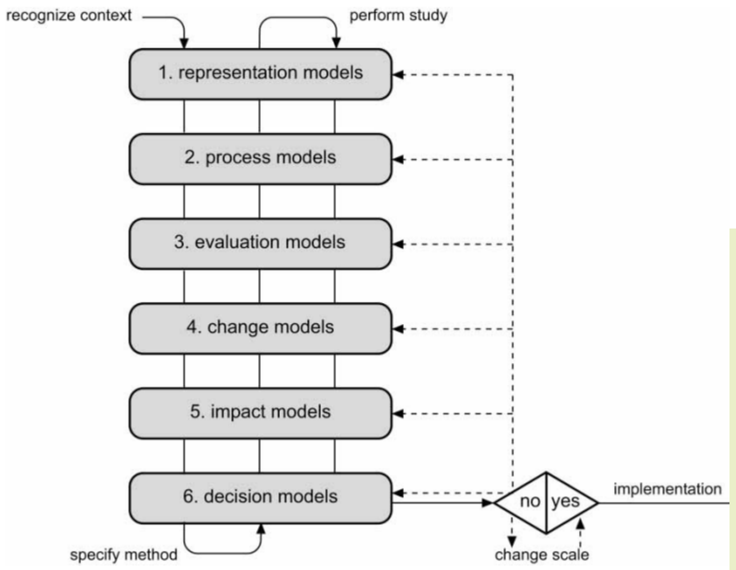
A2	Rich grassland
B1	Dry forest
B2	Dry heath
B3	Poor dry grassland
C1	Moist forest
C2	Moist heath
C3	Poor moist grassland
D1	Swamp forest
D3	Poor wet grassland
E1	Pond


0m
20m

Exploration & education

Early morning bird watching

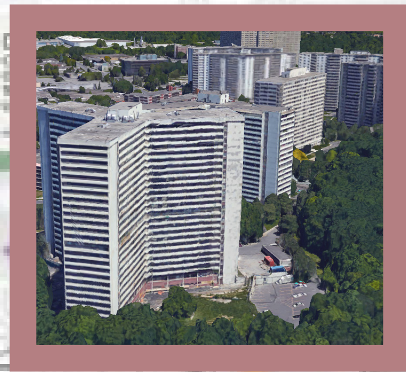

Thorncliffe Park



1. Analyse spatial structure
2. Analyse functional structure
3. Improve spatial structure
4. Create connections to valley
5. Reducing water runoff
6. Improve social spatial structure

Aerial view

Thorncliffe Park



Socially isolated neighborhood

Thorncliffe Park

- Small green patches
- Large grey area
- No clear spatial structure

1. Analyse spatial structure

Thorncliffe Park

Sport facility

Supermarket

Religious building

School

Library

- **Poor relation between space and function**

3. Improve spatial structure

Thorncliffe Park

4. Create connections to valley

5. Reducing water runoff into valley

Thorncliffe Park

Neighborhood park

Cliff park

Valley park entrances

Sport facility

Event and market square

6. Improve social spatial structure

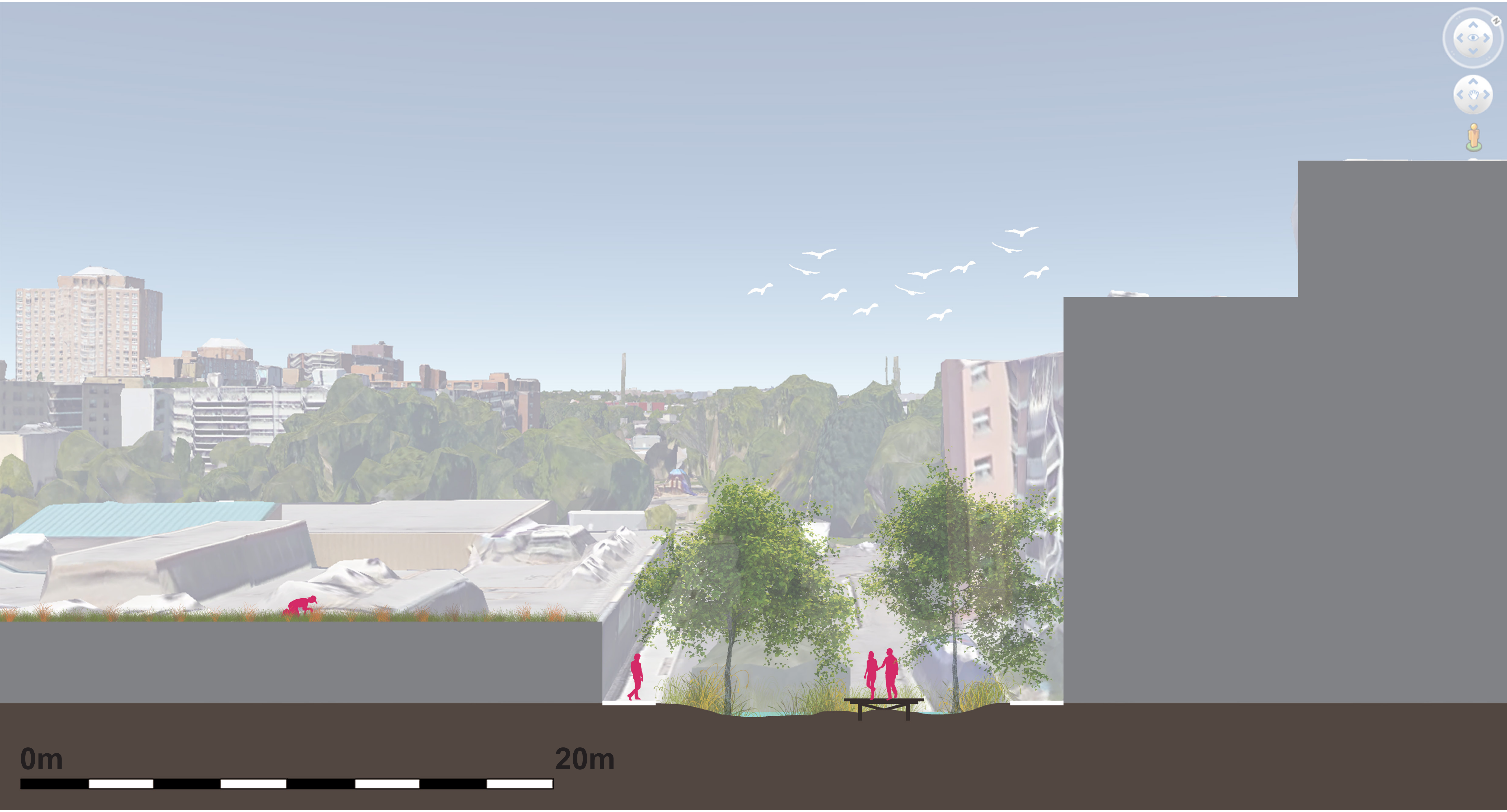

C
B
A

Current situation

Future situation

A: Green veins

Future situation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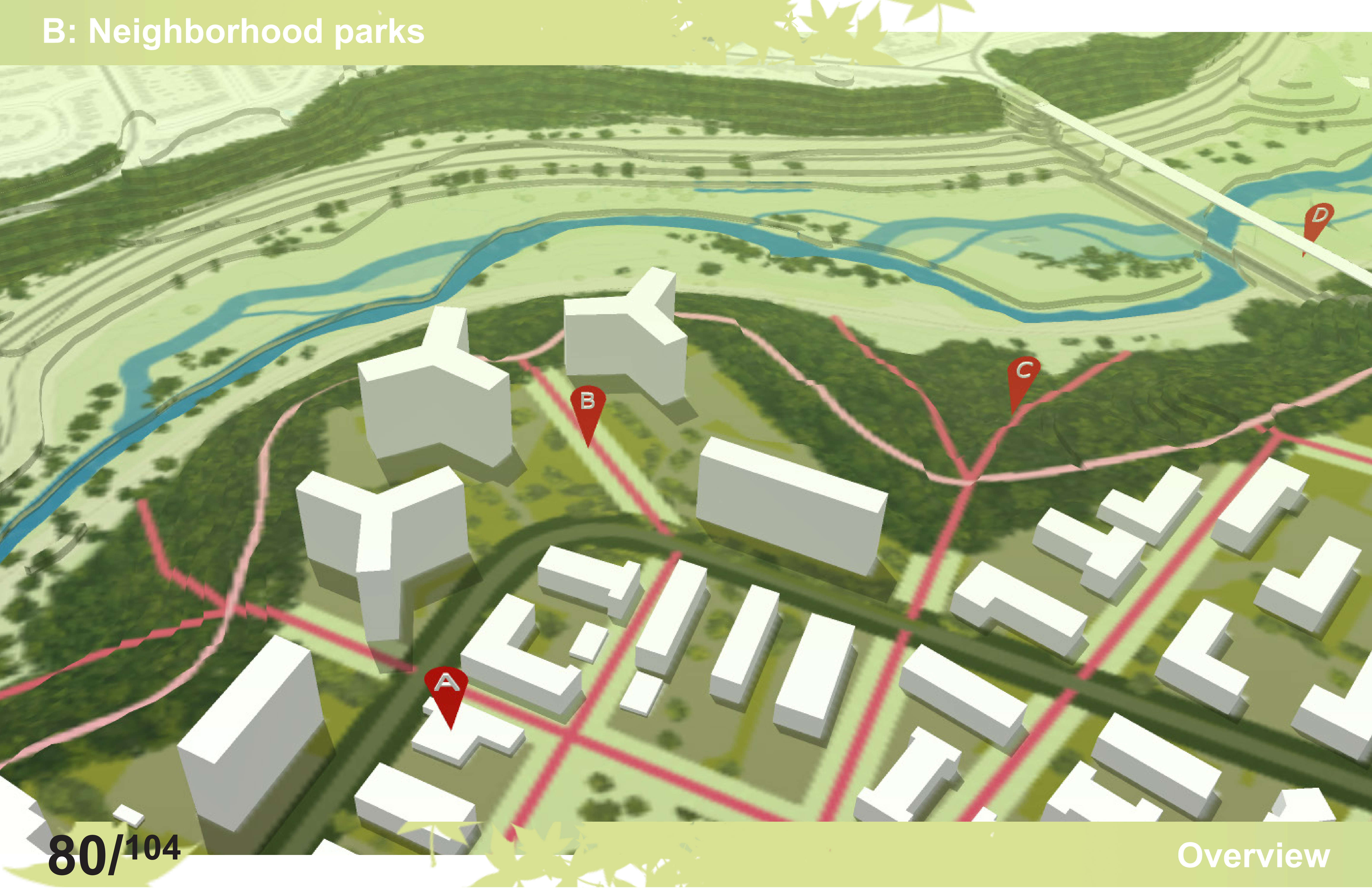
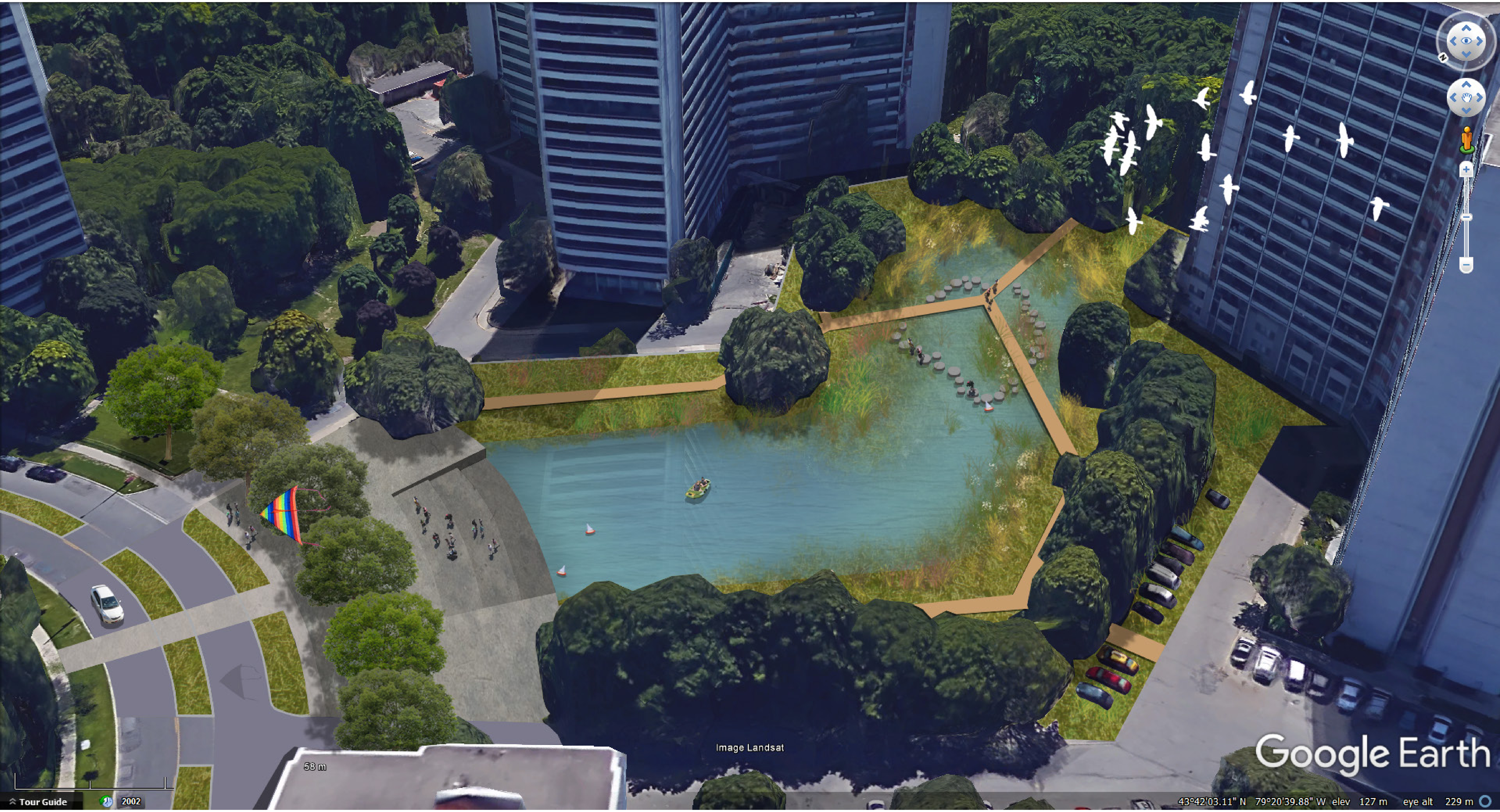
Unwinding & refreshing

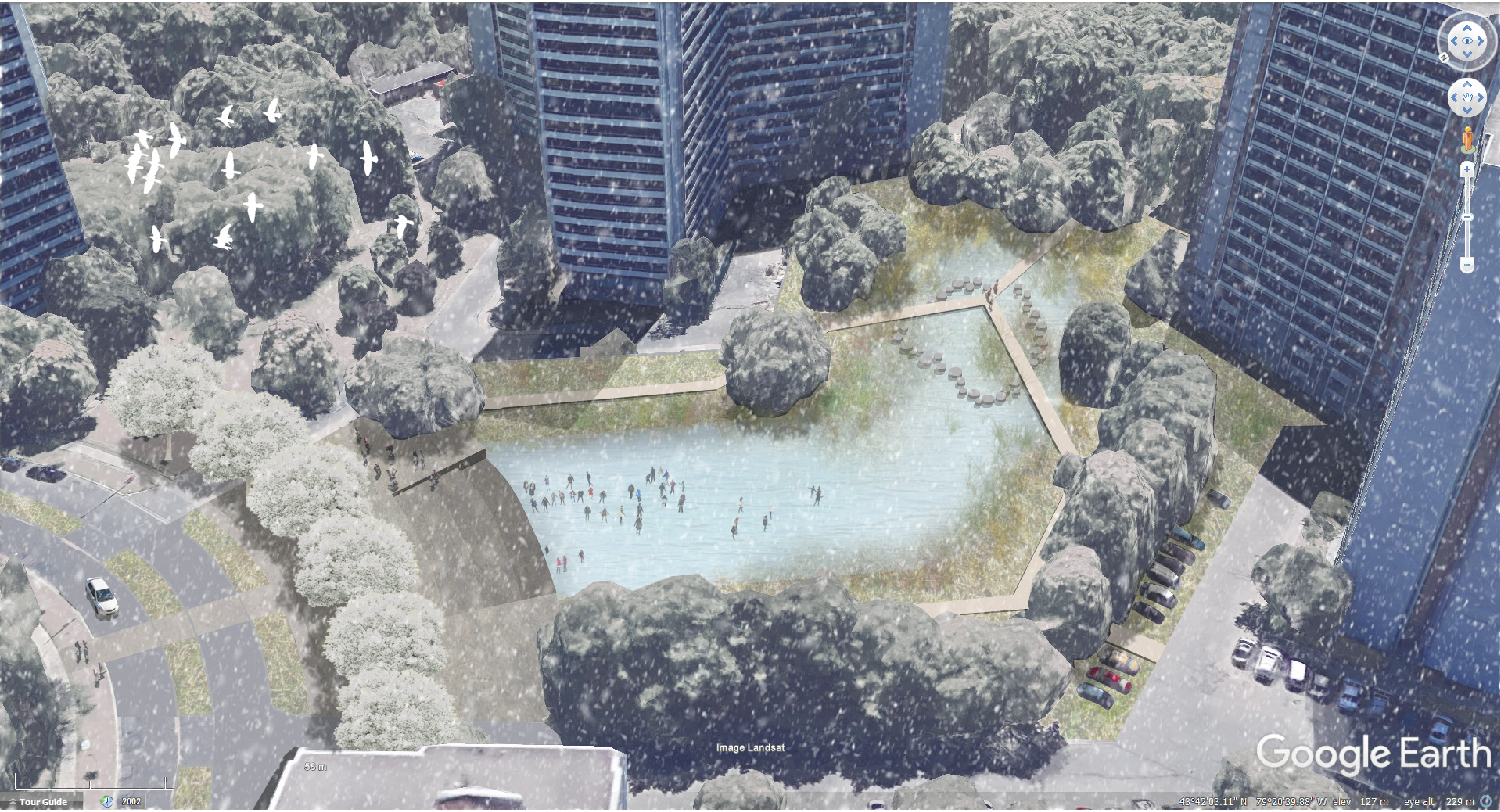
Lunch hour walk after the rainfall


A
B
C
D

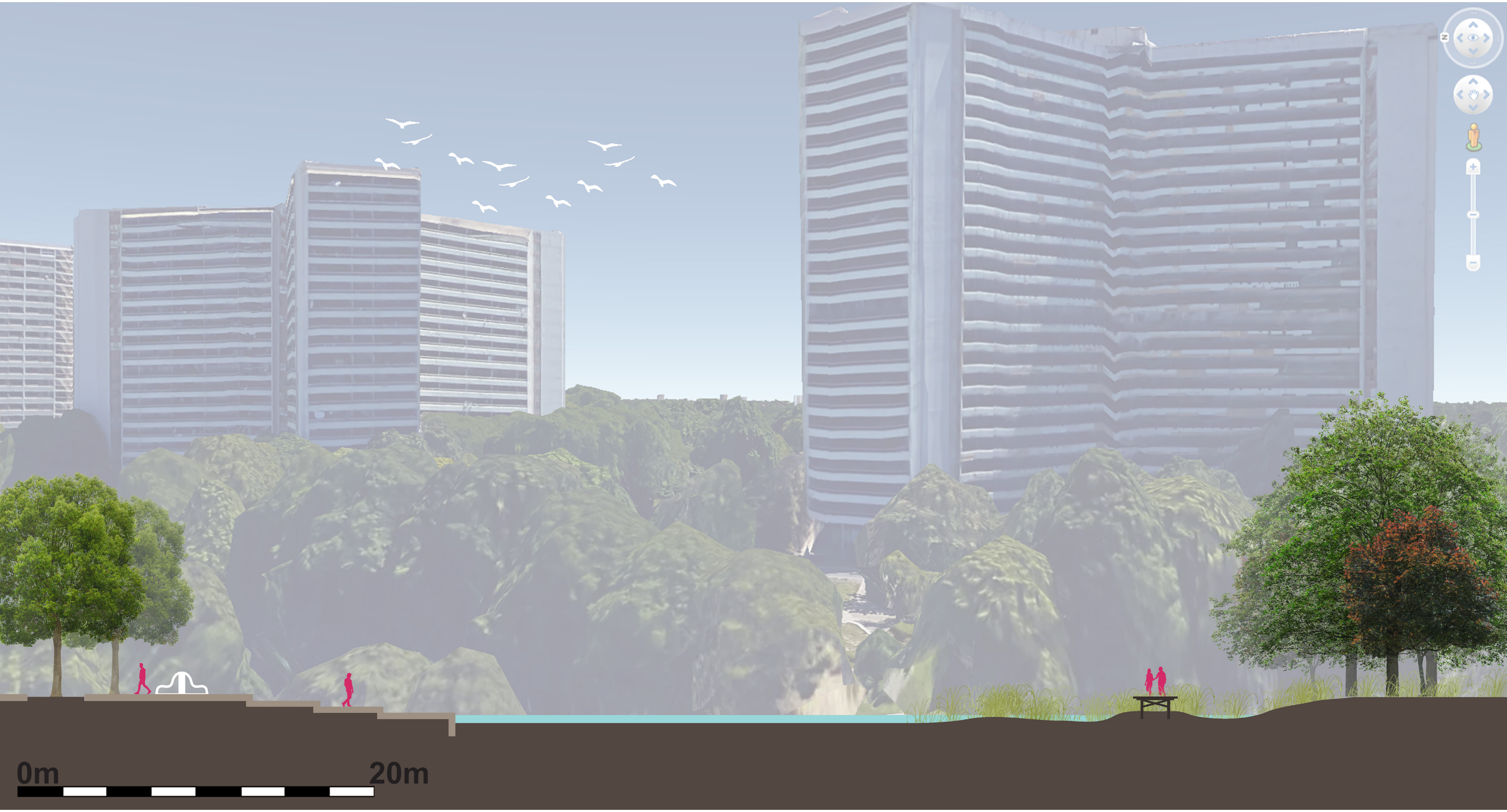
Current situation



Future situation



Future situation



Two faced lake

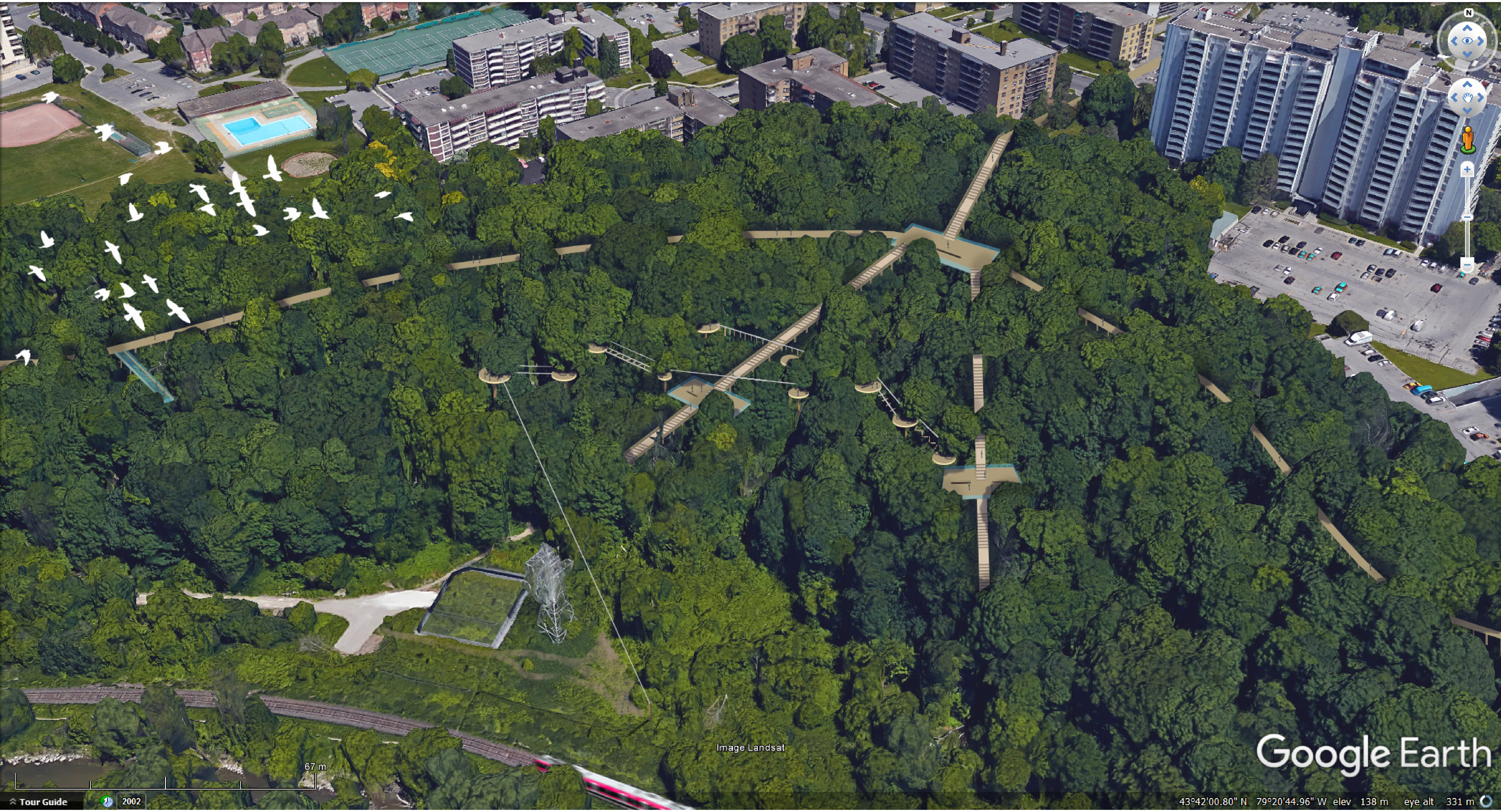
Gathering & playing

Warm midsummer night's party

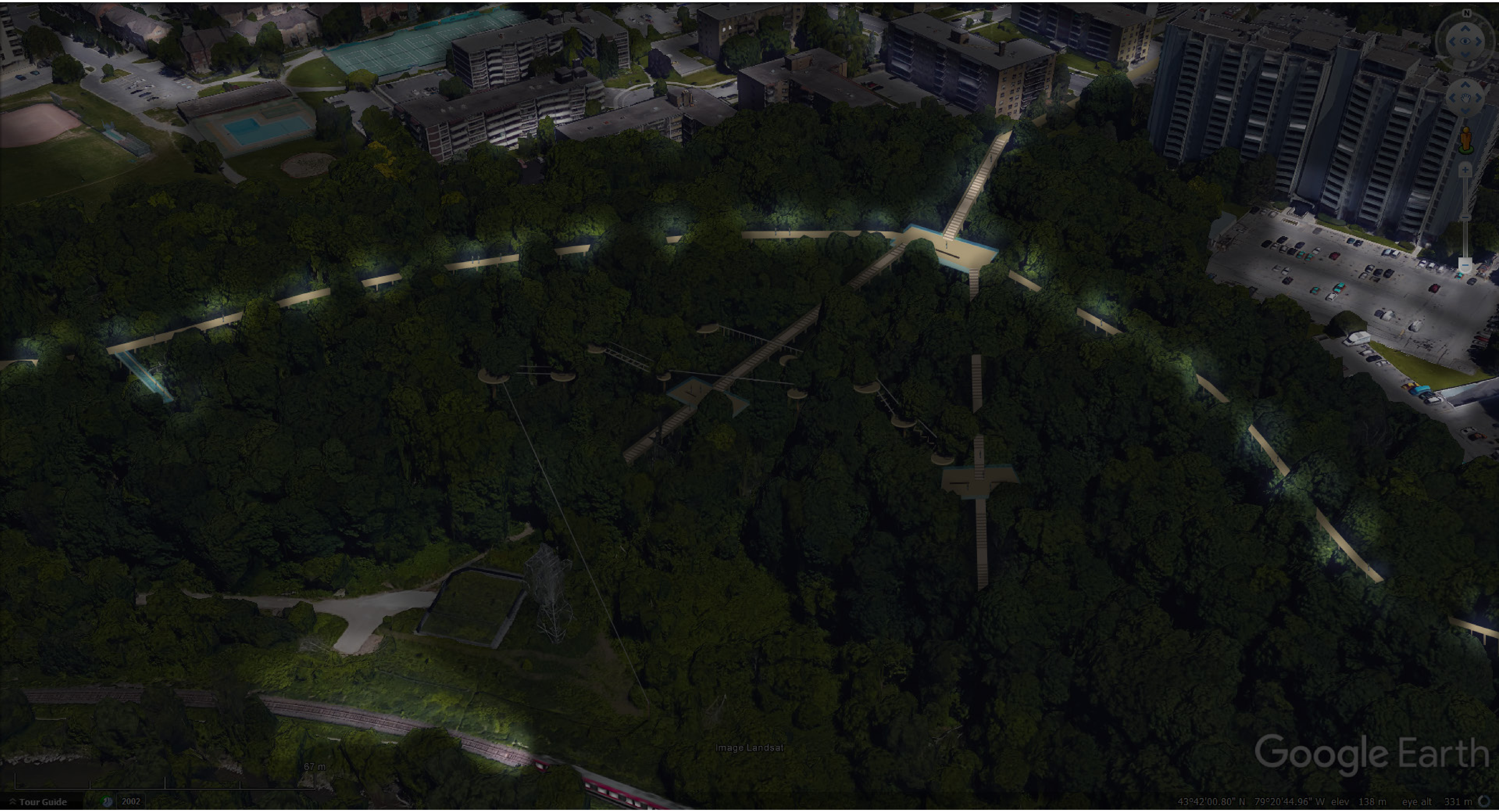

A
B
C
D

C: Cliff park

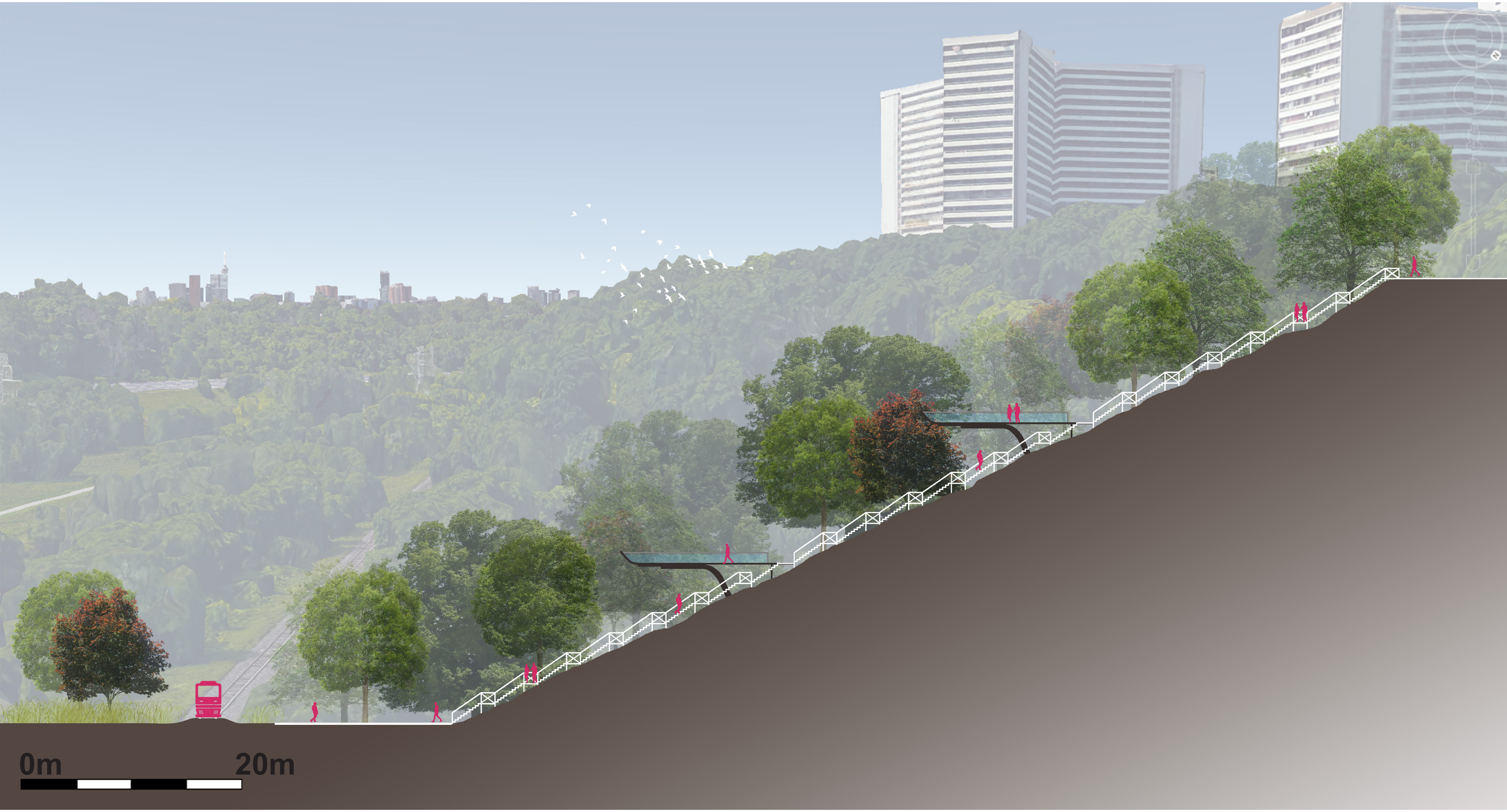
Current situation



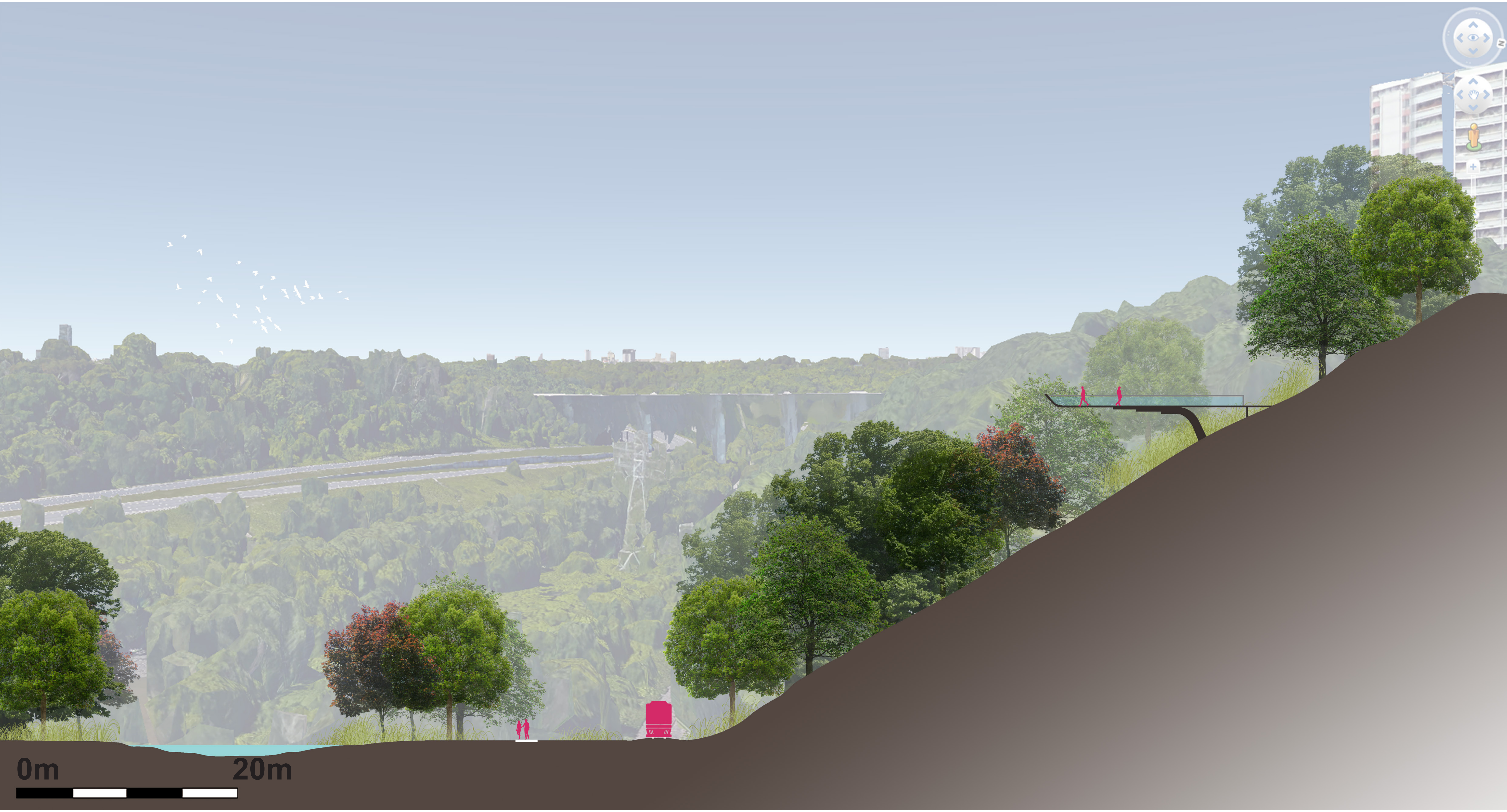
Future situation



Future situation



Stairs and balconies



Viewpoint

Exercising & adventuring






Sunny autumn day walk


A
B
C
D

D: Thorncliffe station

Current situation

Future situation

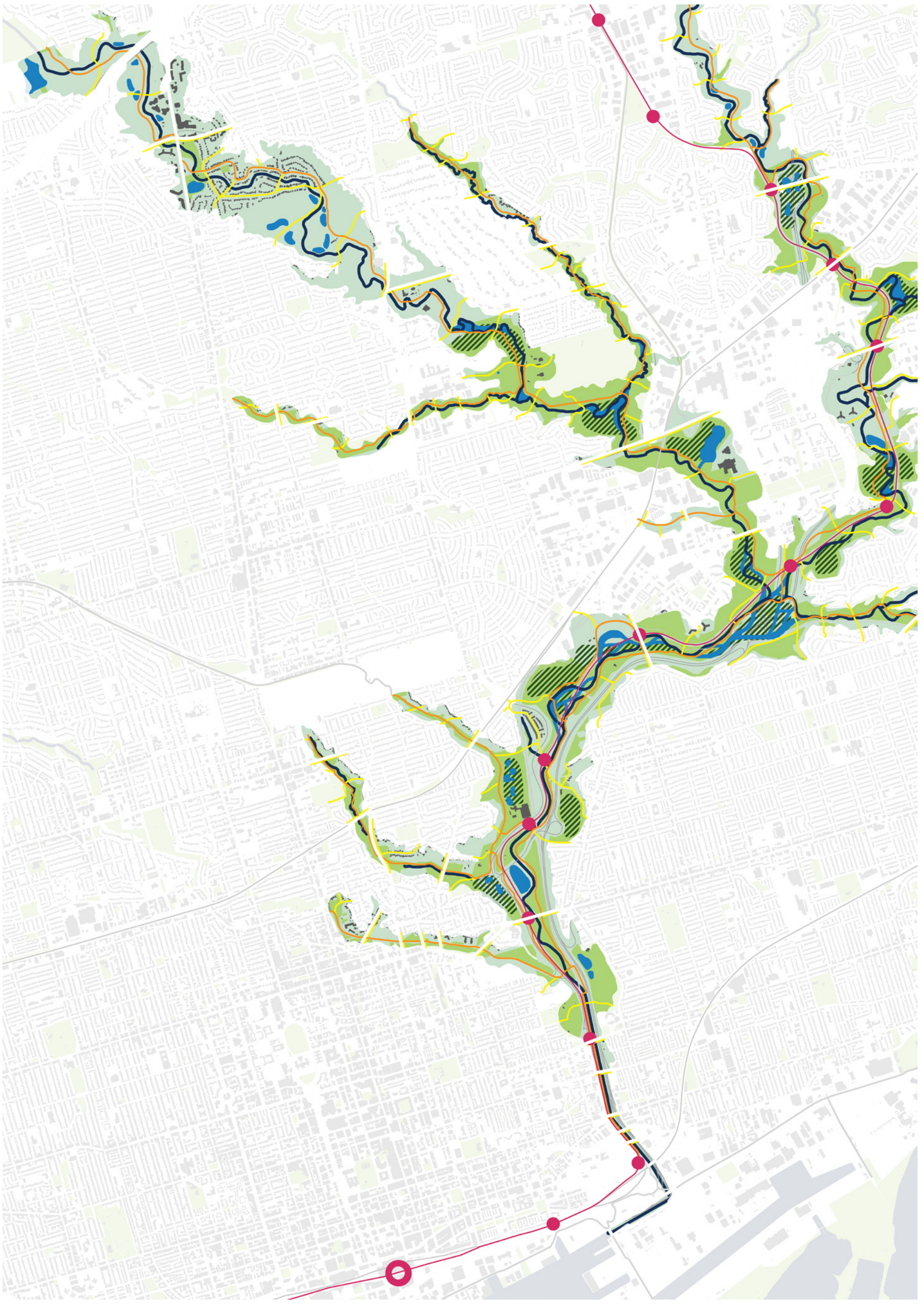
D: Thorncliffe station

Outdoor recreation & travelling

D: Thorncliffe station

Stormy homecoming after work

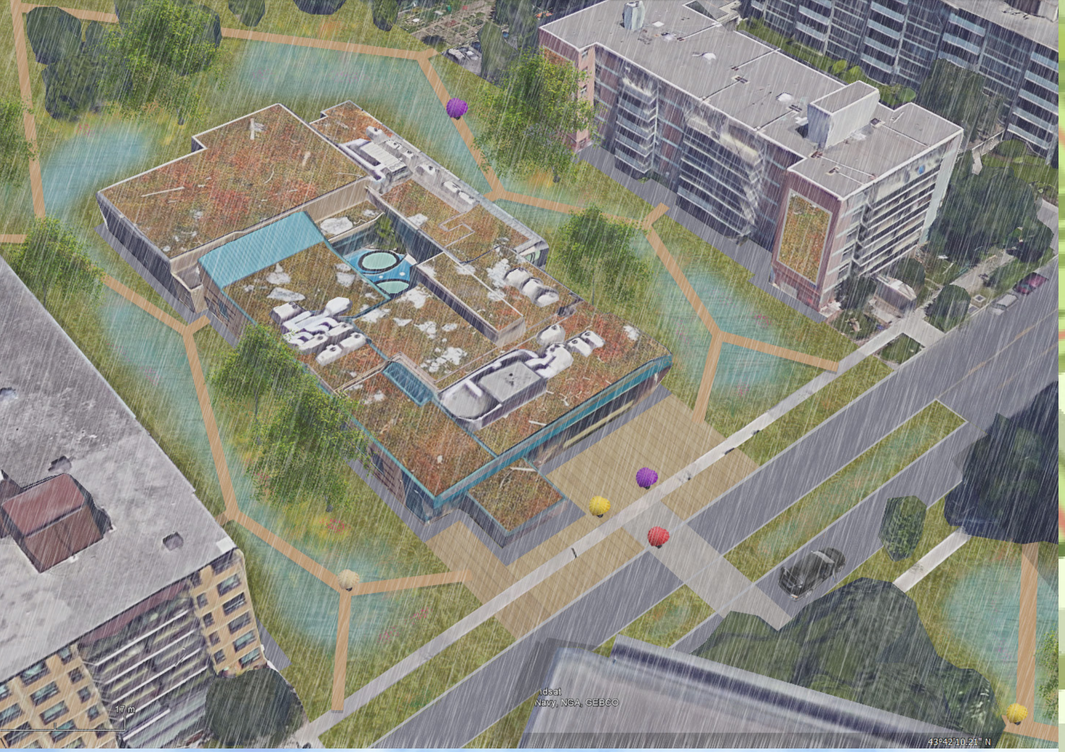
What is an effective design strategy to reconnect the City of Toronto to the landscape of the Don River Valley at the metropolitan, district and local scale?



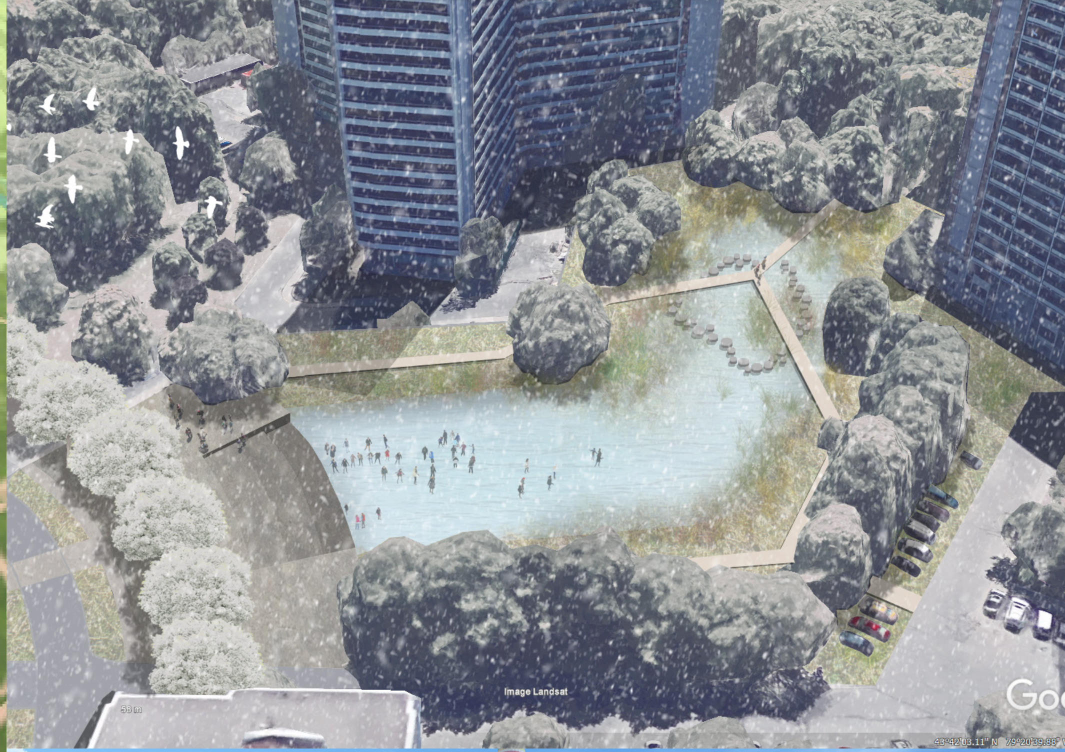
Don River Valley Park
Metropolitan scale

Lower Don River Valley Park
District scale

Cliff Park & Neighborhood parks
Local scale




A
B
C
D




LIBRARY

Appendix I: Methodology

Appendix II: Ecology

DEDUCTION AND RECOMBINATION

Peter C. van Oosten, 4322207

DEDUCTION AND RECOMBINATION

INTRODUCTION

Landscapes inhabit a high degree of complexity. This is for a considerable amount due to the landscape being a holistic entity where a multitude of aspects that define characteristics of the landscape all influence each other in either a direct or indirect way. Within such a system any change within the entity will alter other aspects. The practice of landscape design has to deal somehow with this complexity. There are multiple methods for doing so. This paper will show the characteristics and practical use of one methodology that has my personal preference. This preference comes forth from its ability to process the landscape characteristics in a rational way that it is applicable to any situation. Next to that, its uses within the design practice reach from the very first analytical steps all the way into the stage of landscape intervention. The methodology has common ground with several popular methods and multiple names would be applicable to different stages, though through this paper the specific methodology which is covered will be referred to as a method of 'deduction and recombination', for its tendency to systematically deal with the complexity of the holistic landscape by deducing information through the use of thematic layers after which new insights will be gained from recombination.

THEORETICAL BASIS

One of the first to give notion of a holistic view on the landscape was Ian McHarg in what would be one of his best known works: Design with Nature (1969). McHarg acknowledged the complexity of the intertwined landscape and addressed the need for a method to be able to get a grip on the landscape from a designers perspective. He uses the example of Staten Island, where a value determination was required prior to the planning of the site. The first step he took was categorizing the aspects of the landscape into thematic layers that consisted of closely related elements of the landscape, which he indicated as 'major data categories'. In the case of Staten Island these categories involved, but were not limited to natural processes such as hydrology, geology and wildlife, for these were defined as the main acting layers within this specific area. He then mapped the concerned layers by their respective themes in a way that would leave him able to assign a value to the specific conditions.

This valuing is at the core of the next step. McHarg stated in his method that 'Once it has been accepted that the place is a sum of natural processes and that these processes constitute social values, interference can be drawn regarding utilization to ensure optimum use and enhancement of social values.' (McHarg 1969, p.104) What can be drawn from this is that information regarding optimal suitability can be gained by the recombination of information within layers, for nature exhibits both opportunities and restrictions to human use. Staten Island was subject to multiple possible developments. McHarg's aim was to identify the entire area for its intrinsic suitability for all prospective developments. When looking at a specific development, one will see that not all layers of the landscape play an equal value in the suitability determination. For example, when looking at the suitability of a highway, general data on climate is of little significance, while elevation might be vital in decision making. From such notions a value system can be constituted. When passing all layers through this value assessment and recombining them, a map can be created that is able to give insight in the highest suitable places for, following the example, the creation of a highway. (Image 1)

A big advantage of this method is the rational attitude of it, because it borrows its information from exact sciences. It is unlikely to contain major errors because of this. In addition it is very explicit. Everyone would come up with the same results, assuming they accept the method and evidence. This eliminates the distant judgement of the planner or architect.

A more recent model that shows a similar attitude towards the landscape is the so called Triplex model (Kerkstra & Vrijlandt 1988). Partly based on the ideas of McHarg, this model is given shape by the notion that one can differentiate between three major layers within any landscape: the abiotic, biotic and anthropogenic layer. It shows that through the complexity of the landscape, general statements can be made. These allow both for a structured design process and the ability to compare projects on these specific categories. While limiting McHarg's layer division by including only three layers, it simultaneously expands the layer approach by the addition of the 'human' or 'social' layer. By doing so a more complete picture of the holistic landscape is gained where humans are part of the system.

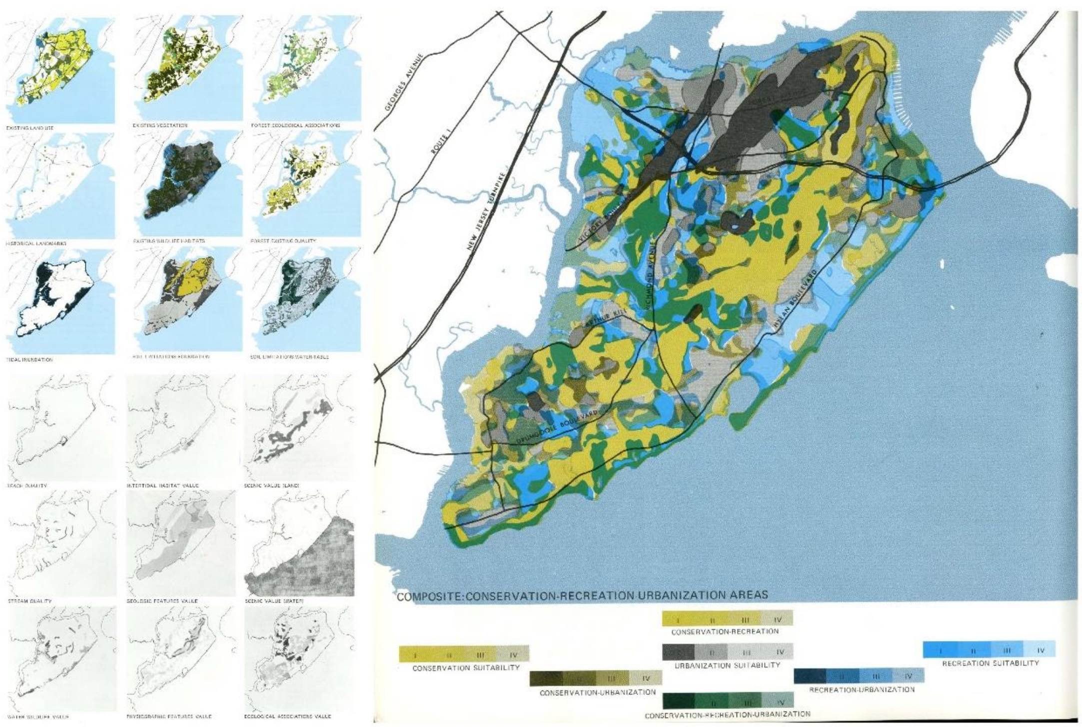


Image 1: Separate layers and their composite map as used by Ian McHarg

METHOD

Deduction and recombination should not be seen as an attempt to create a new methodology on the face of its predecessors, but rather as a personal attempt to process the gained knowledge while at the same time looking for ways to expand it so that it becomes a guiding line through the complete design process.

The method is already introduced at the very start of the design process, when the first exploration of the site is made. Sharing the holistic view which Ian McHarg thoroughly described nearly fifty years ago, it will not come as a surprise that the first steps will follow a similar pattern by starting with analyzation through layering of the landscape. While nowadays this step is considered to be fairly common and will be applied by many designers almost unconsciously , its importance for the design practice should not be underestimated.

The layering process is both a part of the process and a process on itself. Layering elements of the landscape is about decision making and understanding. The designer has to become conscious about the layers that act within the landscape, which requires knowledge of the landscape. To be able to divide the landscape in layers is at the very core of understanding how it works as a system.

In addition the designer is now able to see the landscape layers in their isolated form. Important here is that by conceiving the structure of these layers on an empty canvas, the system within those layers becomes apparent. Something which gets lost in the complexity of the bigger system. While doing so, first problems within the system of layers might already reach the surface. Problems that can lead to a better understanding of the landscape on the bigger scale, may give clues about problems that appear in other layers and will likely start the creative process of the designer. Furthermore, the isolated form will make it easier to link the project to other projects by their similarities, benefitting the understanding and decision making of the landscape designer.

At this point the designer should start to recombine the layers. This is most effective when it is done with a certain aim. This aim is defined by the project or by the designer. For example, when looking for the best place to suit a highway, one should likely look at a combination of layers which deal with topography and soil quality, while layers dealing with climatologic information will be of less importance. Again, this decision making will increase the understanding of the landscape, but less general and already more aimed towards layers which have relevance to the aim of the project.

Combining layers step by step will simultaneously build the knowledge of the system. The combination of specific layers allows for the exploration of friction points, while also exposing opportunities.

Another valid way to make use of this step is by combining layers without a predefined intention. By doing so, one might come across relations between layers that are formerly unknown or could not be understood by observing the complete system at once. This way of working could be very useful when the project does not define a clear problem statement or when the designer is not known with the main actors of the problem, leaving him unaware of which layers to combine.

Both in the stage of deduction and during reconstruction there are layers which will show a greater significance than others. When considering a multitude of projects, there are layers which will always tend to show a great significance. This tendency to repeatedly be critical within the analysis of the landscape make them essential for the understanding of landscapes in general. They can therefore be

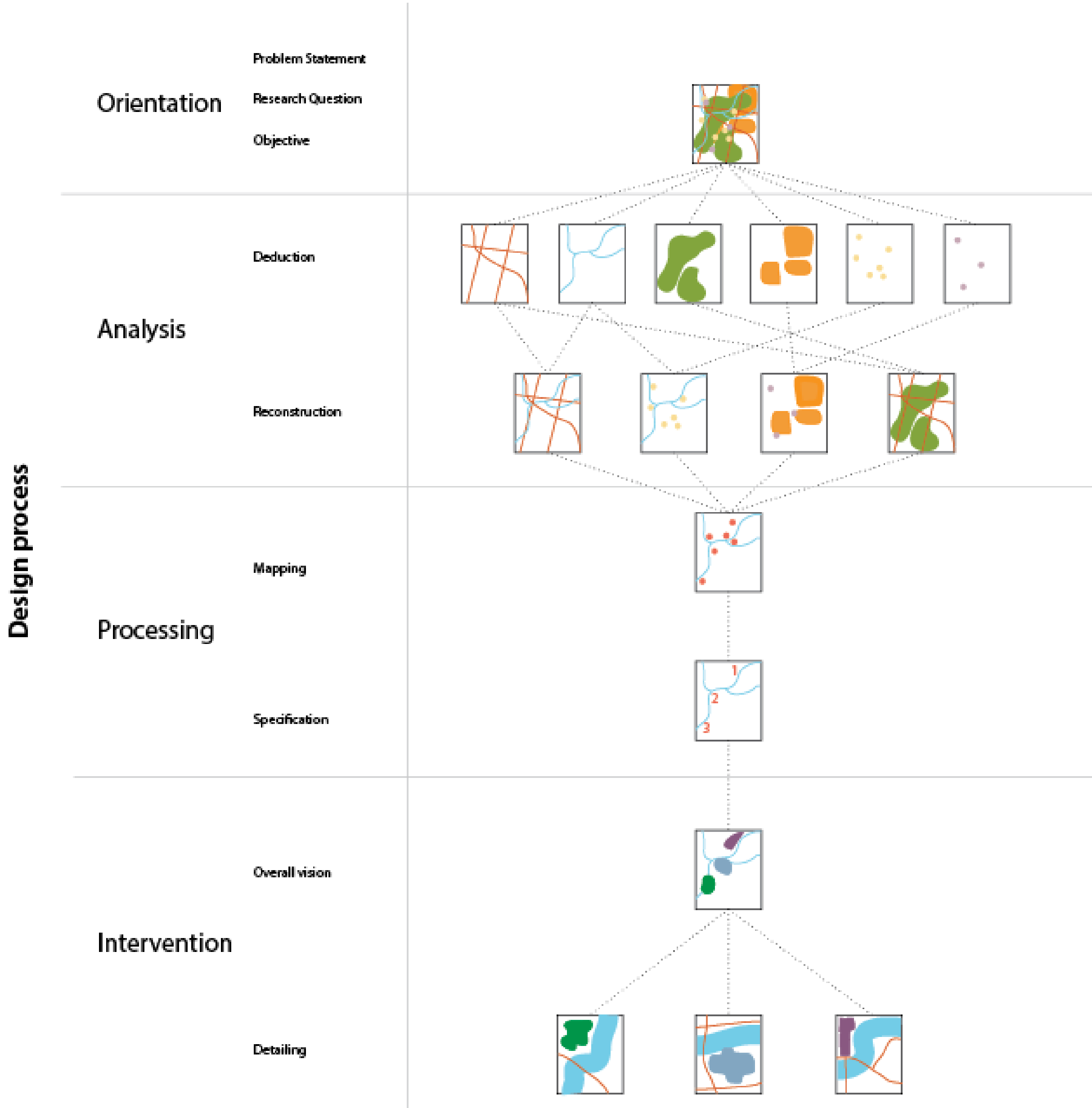


Image 2: Design process following Deduction and recombination methodology

considered to be 'Critical layers'. The significance of those critical layers is often due to their characteristics being either very restraining or supporting to other layers. A good example of such a layer is the geomorphological layer. The properties of this layer are expressed mainly through spatial characteristics. These show up to be a major actor in defining places of settlement, even in the earliest periods of human existence. While humans have grown to be less dependent on their environment through time, these spatial properties retain to be influential nonetheless. This results in a practical use within for example the stage of deduction, where understanding of the isolated geomorphological layer equals understanding of the basic properties of co-occurring layers. Other examples of critical layers are the hydrological layer and the soil layer.

The result of the former steps will most likely have you ending up with different friction point and/or places that show opportunities. The only step that has to be taken from here is the mapping of these points, creating an overview of places that might require interventions. At this point it is about valuing these possible intervention areas. One way of doing this is by valuing all friction points evenly. An intensification of points will in this case equal a greater desire for intervention. Which will then result in the most problematic areas being looked at. Another way, which requires more though, is valuing each point separately in relation to other points. Reason for this might be a preference towards certain thematic problems. This preference could for example be defined by the initial assignment or by the interest of the designer. Again, areas which show the highest intensity will be addressed as design areas, though the intensity will in this case be defined by the total of the values that were addressed.

From here the designer should be able to start the stage of specification within the process. Considering all of the above he will be equipped with knowledge of the project requirements, relevant knowledge of the landscape layers and a mapped result of both friction areas and areas of opportunities. Specification of areas to be designed on can be the result of the valuing process which was applied within the stage of mapping, though this is not necessarily the case. Many considerations can end up making the decision for areas which the project will deal with. An example could be a selection based on the mutual differences between selected areas. This approach is validated when the goal of the designer could be to show the range of design interventions which the project area could undergo. Another example could be based on the geographical position of the areas in a case where this will show will a relevance to the project. Validation could in this case be based on financial or client-based considerations. In the end all of the above should be able to be applied as a result of earlier steps.

This marks the point where the design process starts to deal with the actual intervention. This will not be discussed as detailed as earlier steps, for it tends to follow a more organic process which depends greatly on the preference of the designer. Though it should be noted that every step taken will show its relevance through this further process of weighing and decision making. One should also make notion of the fact that while the methodology on itself is a linear process, its application might show reoccurring steps through different time intervals. (Image 2)

USE

The method of deduction and recombination is applied within my current project. Both validation and potential alterations are partly lacking for this reason. Apart from that, several notions can already be made regarding the application. To get to that point, a short introduction on the project is required.

The project regards a design on the Don River Valley in Toronto, Ontario, as part of the Master program Landscape Architecture at the TUDelft. While there are guiding requirements regarding the design, a specific project definition is lacking, leaving me with a blank canvas to start with. A combination of personal preference and practical reasons direct me to the city of Toronto and a focus on the ecological layer within the city.

At this point the project area is more or less defined, together with a directional theme. It also marks the start of the analyzing phase where layering is introduced within the methodology. Though in reality the pace of a project is not as structured as methodologies might suggest. This is also why the methodology should always be considered as a guiding line through the project more than a blueprint. Fact is that the start of this project included a lot of general exploration of the area, both through maps and stories, already painting the first stripes on the fictional canvas. News stories in particular gave me many clues on challenges which the Don River Area was facing such as floodings and erosion and the degree of measurements that were taken to control them. I realized that many of those stories include a vital dimension for the understanding of the holistic landscape not included in most maps: time. Stories would therefore enrich the method. Only then I concluded that while McHarg tended to deal with the landscape as a static entity, maps on themselves did not provide that limitation. At this point I tried to note mentions of water problematics on a map together with time notifications. This would be one of the basic layers that came forth from the first analysis. Without additional maps I already concluded that the flooding problem was apparent in a big area, though merely a few times a year and causing problems in only three main areas.

At the point where I started combining maps, this newly created map already showed its use. Obviously it contained valuable information regarding the faced challenges in the particular area, but I also got an idea about frequency of floodings, periods of floodings and even a bit on the intensity of floodings. This map I then combined with two other maps which contained information on the occupation and relief of the landscape, for I suspected those layers to be related to respectively flood problems and floodings in general. From there I was able to conclude that floodings which were mentioned as problematic only occurred in areas where human structures occupied flood zones of the river, though with a frequency of several times every year. At the same time the map told me something about the areas where, although floodings were just as frequent, they would not be notified as problematic, giving me clues about possible areas for solutions such as water retention areas. However, the found frequency got me to look for solutions which deal with peaks.

Similar steps of recombination were applied to a multitude of other layers. Sometimes leading the portraying previously undiscovered relations, while at times also failing to find new insights. By doing so, the method gave me a head start in the creative process. And although right now I reached the point where I will start the phase of intervention, I will more likely than not go again through earlier steps when encountering new questions.

CONCLUDING

For now it is still early to draw conclusions about the method, for it is barely used at this point. Then again similar methods have proven their validity over and over again. By making use of the universal medium of maps it fits itself to a wide array of cases. While at the same time the method deals with the specific qualities in a way which allows the outcome to be very site specific.

The methodology becomes more of an exact science by the processing of information from exact sciences, which eliminates personal judgement in the analysis stage for a great deal. Personal input can be given at the point where choices are made concerning valuation. This still means that everyone should get the same output when the input is equal, though the input can differ between users of the method.

Improvements can be made at the point of data processing. Geographic Information System (GIS) lends itself very well for the usage of this layered data. It is not yet widely available in most places, though cities like Toronto have taken their first steps in making this type of information accessible. At the point where designers learn how to use GIS based data, a lot can be gained in the field of analysis. GIS based applications are able to process and make calculations on data with an accuracy not achieved by most commonly used methods. For this specific methodology it would show its usefulness in the combination of maps, their valuation, but also their representation. This is still an aspect I aim to address within my project.

In addition to that the methodology is at risk of becoming a guide for a predominantly theoretical approach of dealing with the landscape, while the act of landscaping requires first and foremost the experience of the landscape itself, which can only be gained by visiting the site itself. Because in the end we are creating a future experience.

LITERATURE

McHarg, I. (1969) *Design with Nature.* Philadelphia: Natural History Press

Chung, C.K. (2015) *Transformations of Urbanising Delta Landscape: An Historic Examination of Dealing with the Impacts of Climate Change for the Kaoping River Delta in Taiwan.* Delft: TUDelft

IMAGES

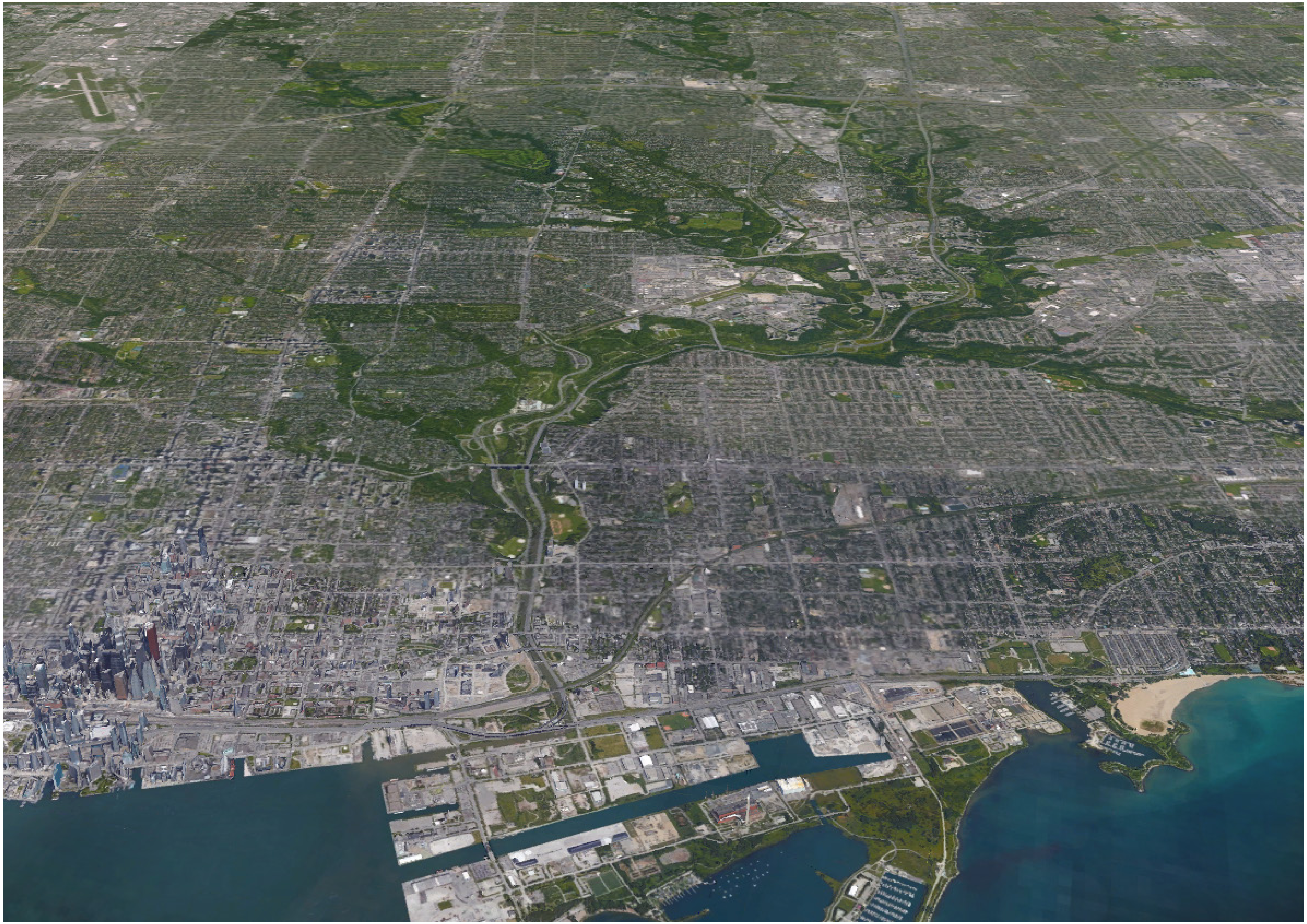
Image 1: McHarg, I. (1969) *Design with Nature.* Philadelphia: Natural History Press

Image 2: Peter van Oosten

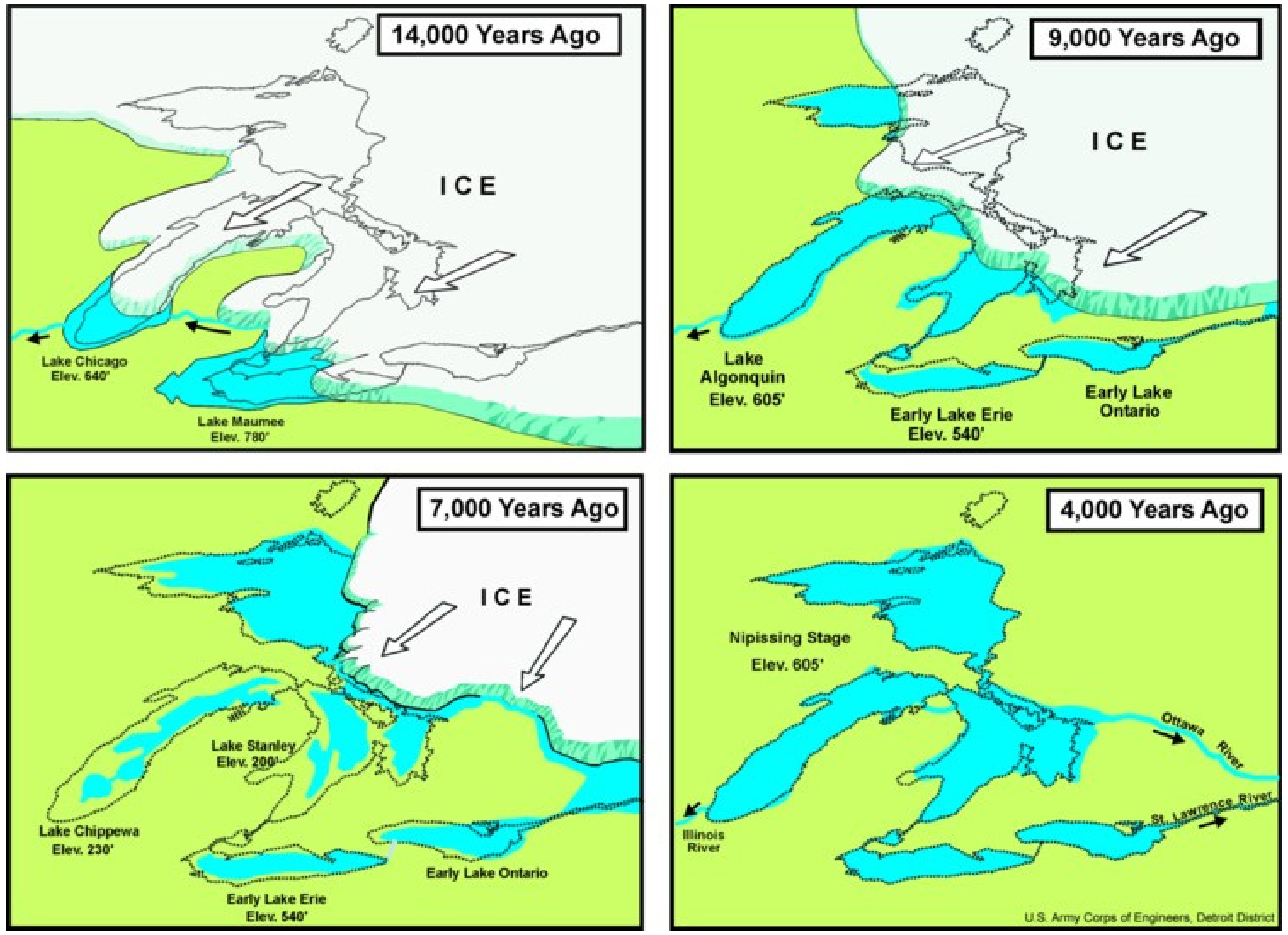
Natural processes

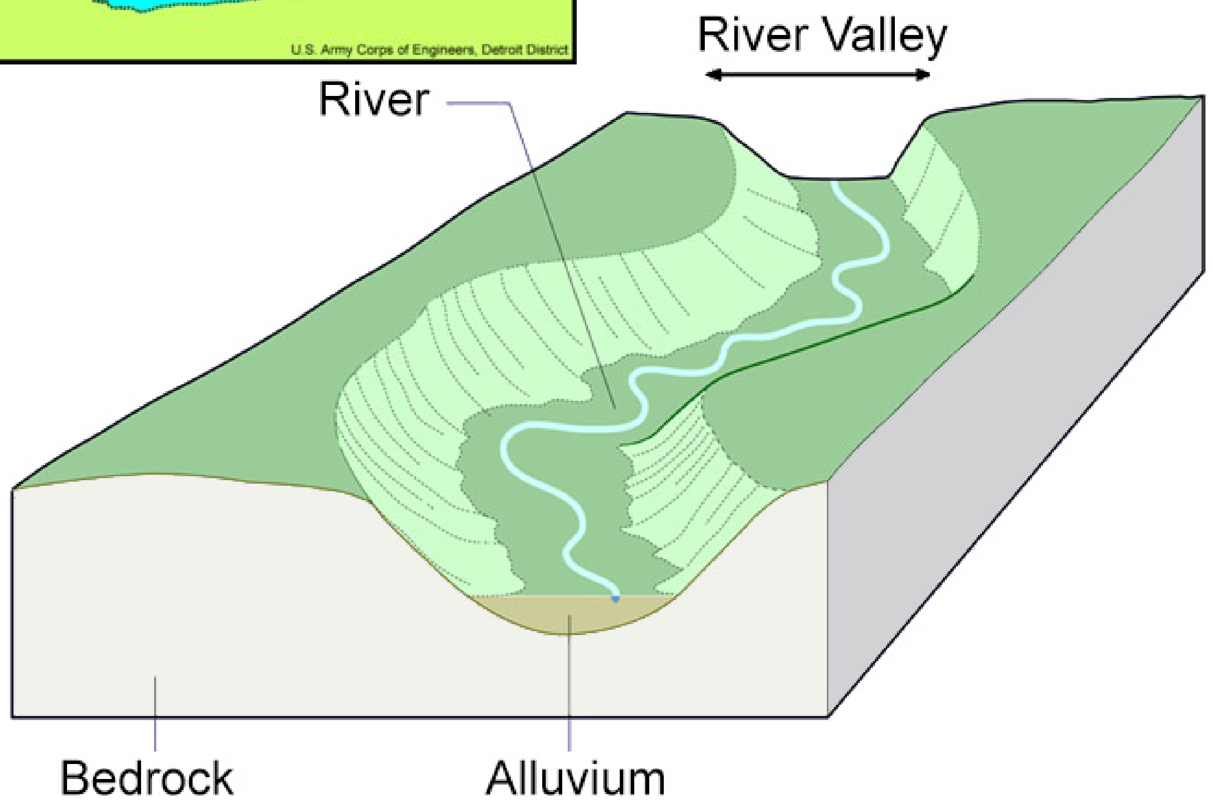
Peter C. van Oosten, 4322207
Supervisors: Nico Tillie, Luisa Calabrese

Don River area

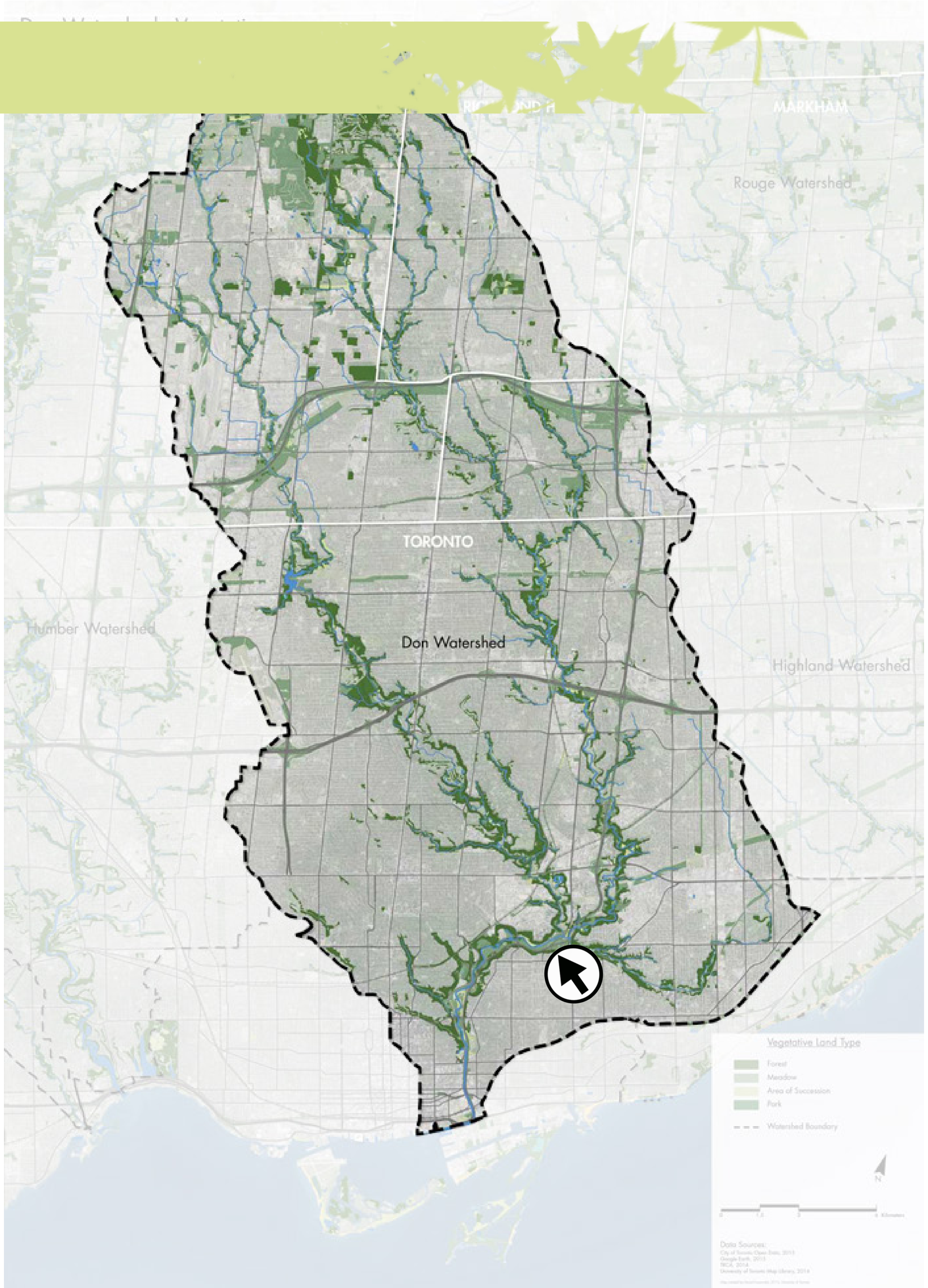


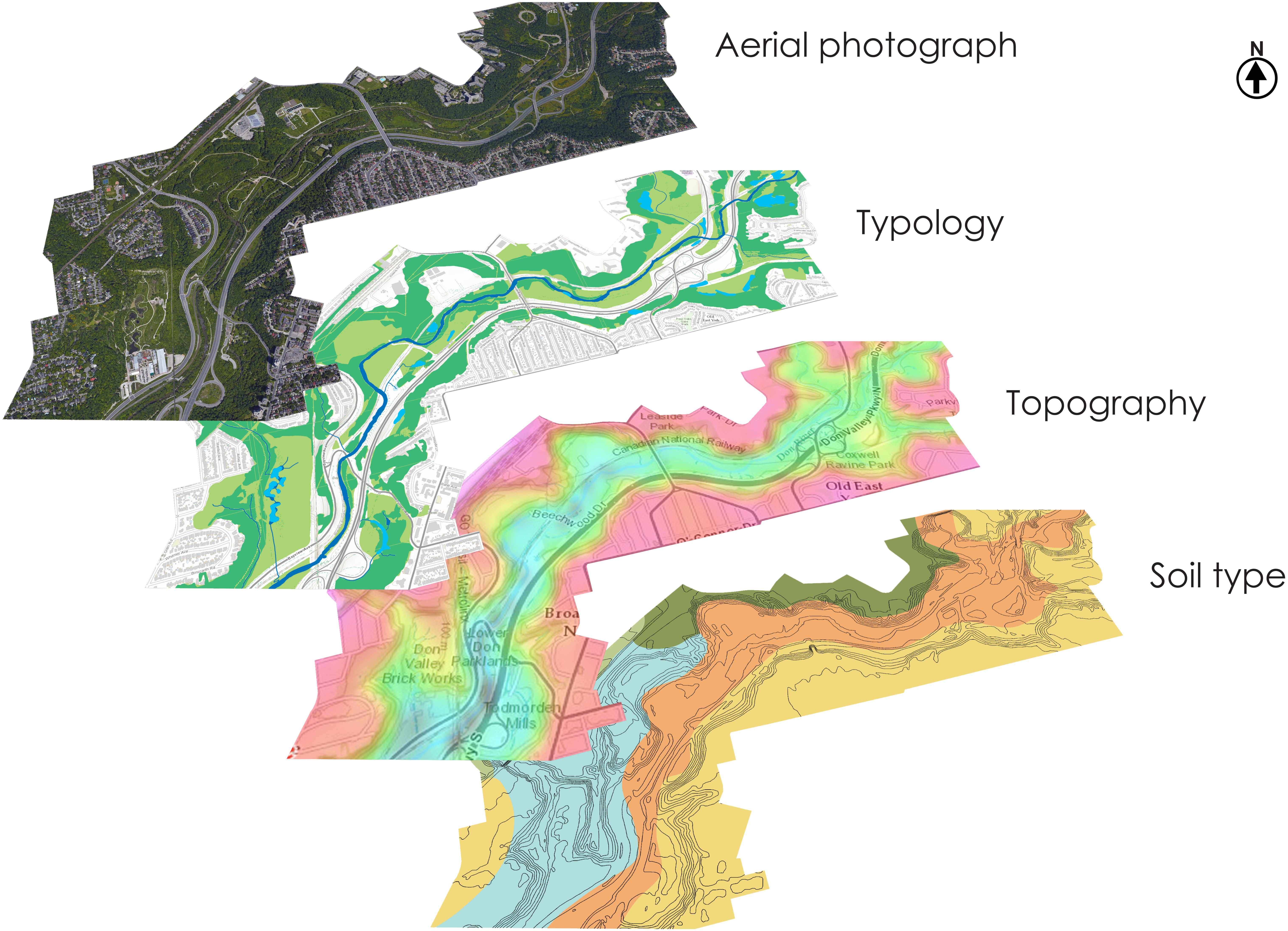
Formation of Don Valley





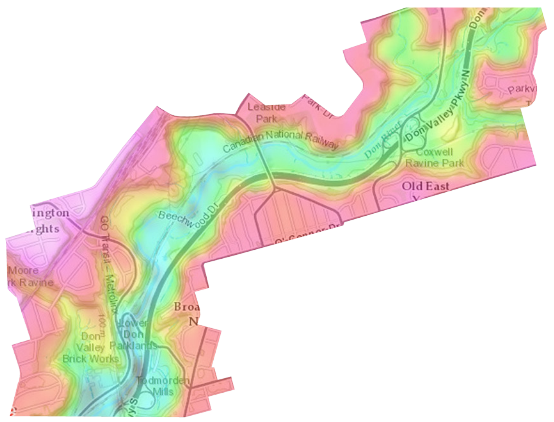
Don Watershed




Aerial photograph
Typology
Topography
Soil type
N
Leaside Park
Canadian National Railway
Don Valley Pkwy
Coxwell Ravine Park
Old East
Beechwood Dr
Lower Don Parklands
Don Valley Brick Works
Todmorden Mills

Typology

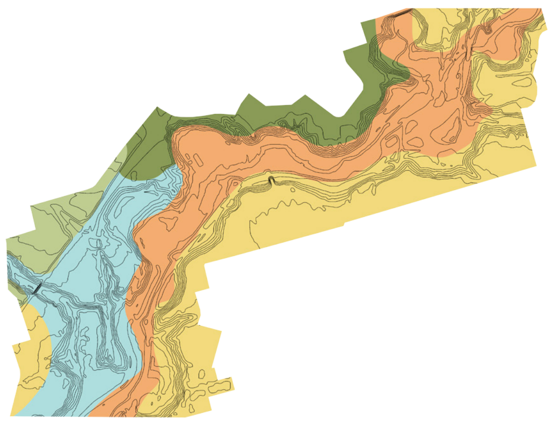
- River zone
- Wetlands
- Woodland
- Meadow
- Urbanized



Topography

- 129 MAMSL*
- 111 MAMSL*
- 93 MAMSL*
- 75 MAMSL*

*Meters above mean sea level



Soil type

- Foreshore-basinal deposits
- Modern alluvial deposits
- Stone poor, carbonate-derived silty to sandy till
- Undifferentiated older till and stratified sediment
- Massive-well laminated

Typology

Streams

- Mainly through own modern alluvial deposits
- Average base flow is 4 m3/s
- Maximum flows are estimated at 1700 m3/s
- Most of the banks are enforced, leading to a lot of pressure during percipitation
- Pressure on streams result in floods and erosion

Wetlands

- About 0.2% of the watershed
- About 1% of the natural cover
- Mainly along Don River and at bottom of slopes
- Enforced banks limit the occurence of wetlands
- Help maintain and improve upon biodiversity and provide many local level ecosystem benefits

Woodland

- About 9% of the watershed
- About 56% of the natural cover
- Mainly dry forests on sandy valley slopes
- Swamp forests on tableland clay layer mostly gone due to urbanization
- Don has a much lower forest cover compared to neighbouring watersheds

Meadow

- About 7% of the watershed
- About 43% of the natural cover
- Mainly hydro corridors; vacant properties within industrial zones, and fallow farm fields are not marked here
- Under pressure of development, apart from the hydro corridors
- Can potentially be restored forests, apart from the wet hydro corridors

General

- Direct area loss due to development (less at slopes)

- Long term alterations due to changes in hydrology, disturbance regime, and species composition
    Causes include road construction, drainage alterations and global climate change

- Deposition of nitrates and other nutrients can occur through air pollution as well as fertilizers, storm water runoff, yard waste dumping, and siltation

- Inability of native communities to re-establish themselves on disturbed sites in urban regions, especially where soils have been moved or fill dumped

- Aggressive non-native species

- Clearing and manicuring of habitat

- Increased predation from an increase in the local population of predator species that thrive alongside human developments

Woodland

- Disturbance of floodplain forests due to heavy floods
- Collapse of pieces of mature forest into eroding channels
- Cleared mature forest cannot be quickly replaced by restoration elsewhere
- Removal of dead wood and clearance of shrub under storey

Meadow

- Solidification of soil and general loss of individuals due to trampling both by humans and pets

Streams and wetlands

- More rapid erosion of bluffs and stream banks
- Loss of dynamics due to design interventions aimed at flood control

Species of high regional concern

Flora and fauna species are considered of regional concern if they rank L1-L3 based on their scores for seven criteria:

1. Local occurrence
2. Local population trend
3. Continent-wide population trend
4. Sensitivity to development
5. Area-sensitivity
6. Mobility restriction
7. Habitat dependence

Wood duck
Aix sponsa
L3, Lower Don

Pileated woodpecker
Dryocopus pileatus
L3, Lower Don

least flycatcher
Empidonax minimus
L3, Lower Don

Flora species of high regional concern*

Fauna species of high regional concern*

*L1-L3 rating according to Ecological Land Classification (ELC) System of the Ontario Ministry of Natural Resources (MNR)

Beaver
Castor canadensis
L3, Lower Don

Mink
Mustela vison
L3, Lower Don East

Northern leopard frog
Rana pipiens
L3, Lower Don

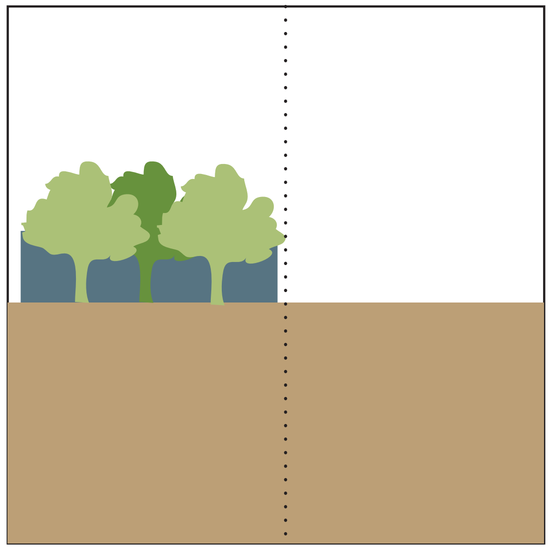
Eastern red-backed salamander*
(*occurrence needs confirmation)
Plethodon cinereus
L3, Lower Don

Aim

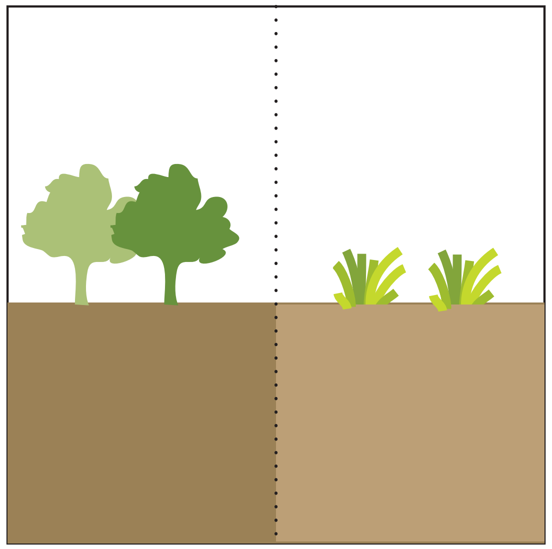
- Protect and improve biodiversity
- Retain and recover terrestial natural heritage
- Protect elements of the natural system before they become rare
- Promote improved ecological function of the natural system as a whole

Regional Terrestrial Natural Heritage System Strategy (TRCA, 2007)

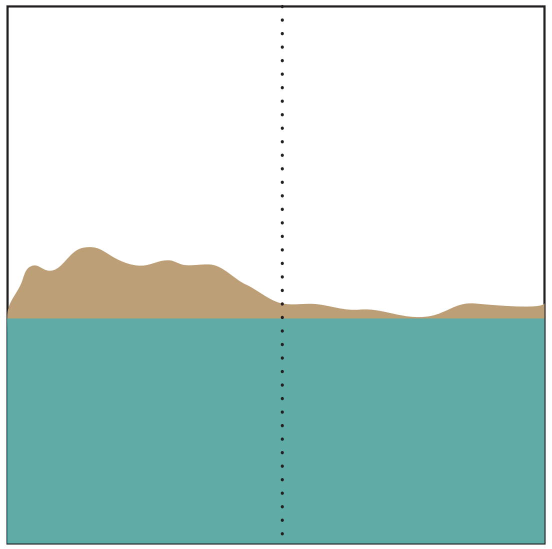
Biodiversity levers



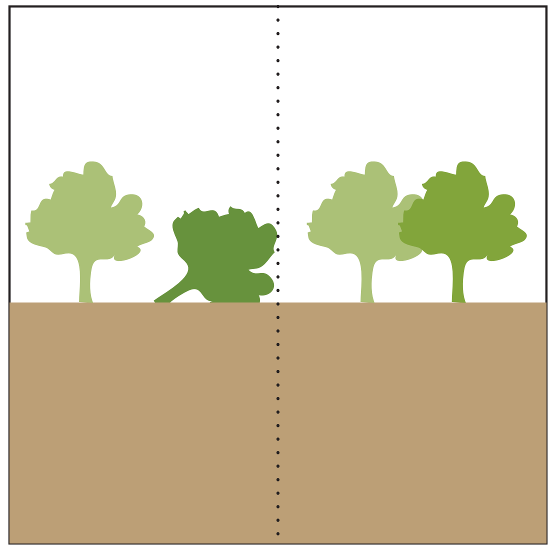
Light



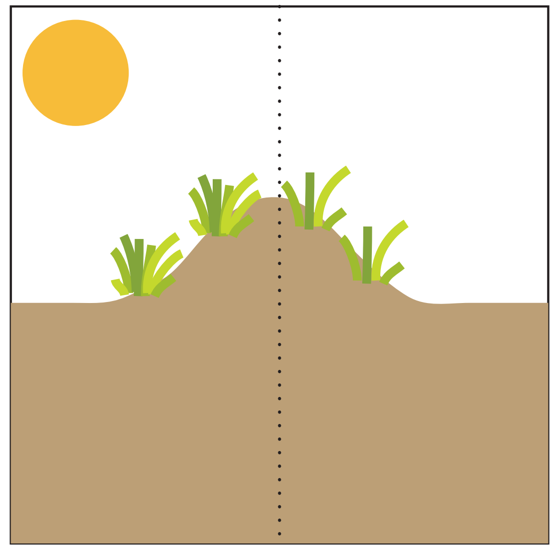
Soil type



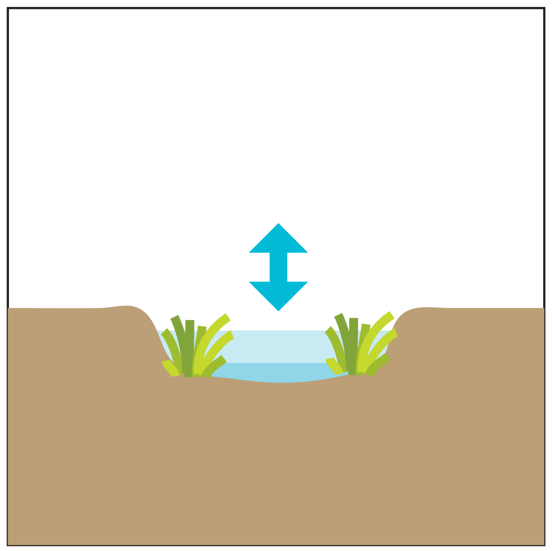
Elevation



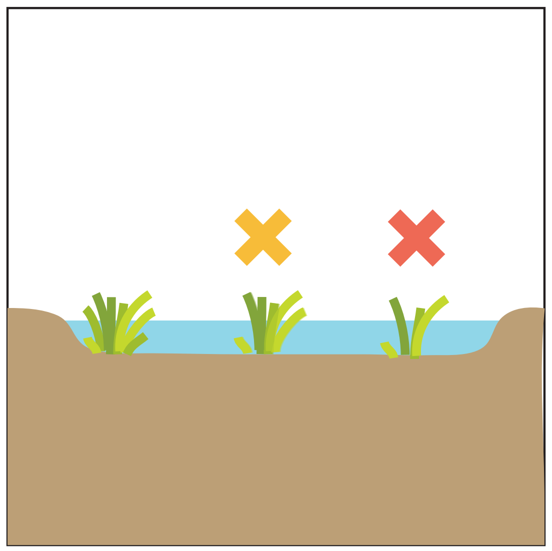
Disturbance



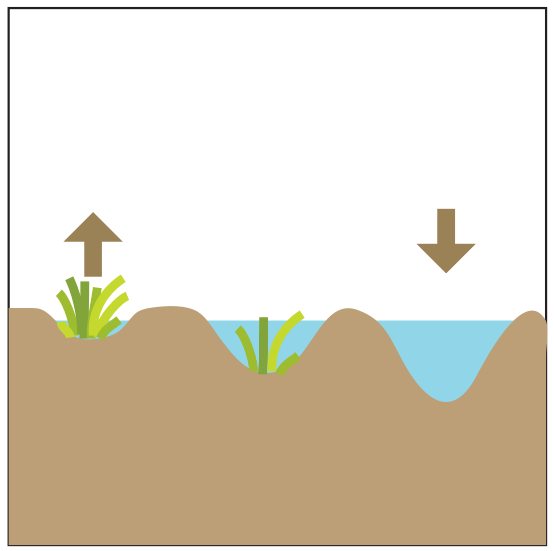
Orientation



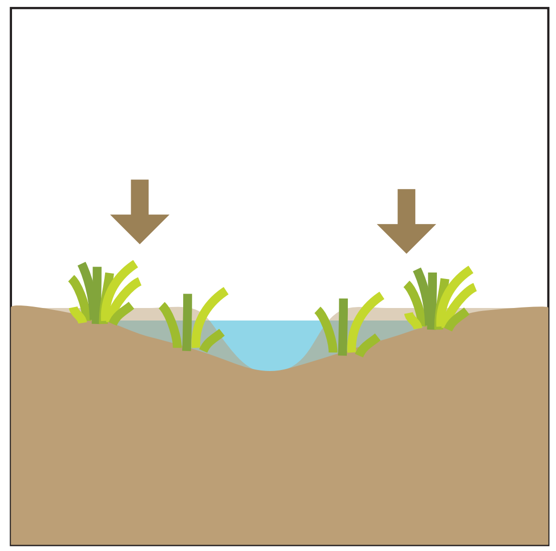
Allow dynamics



Differ maintenance

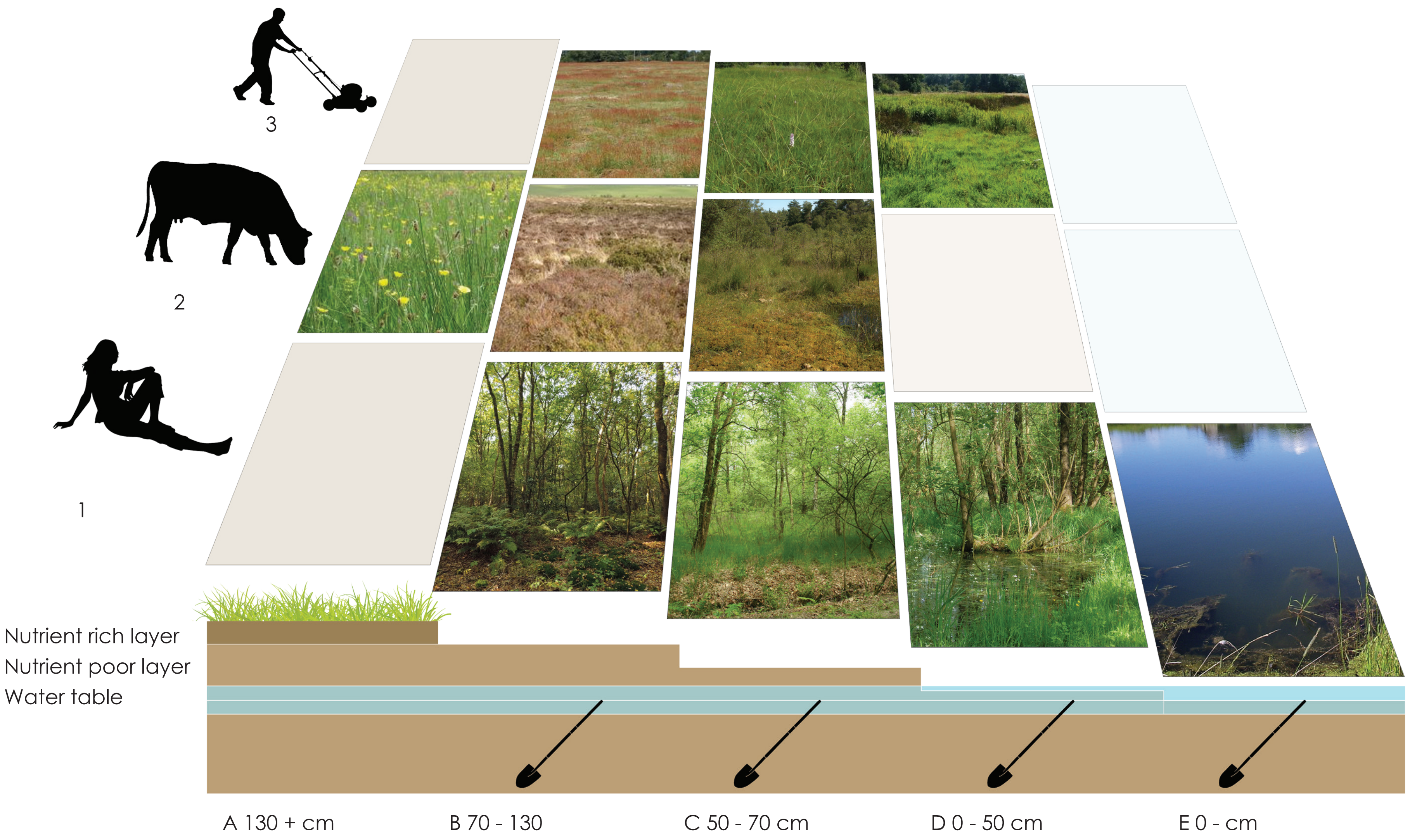


Differ water level



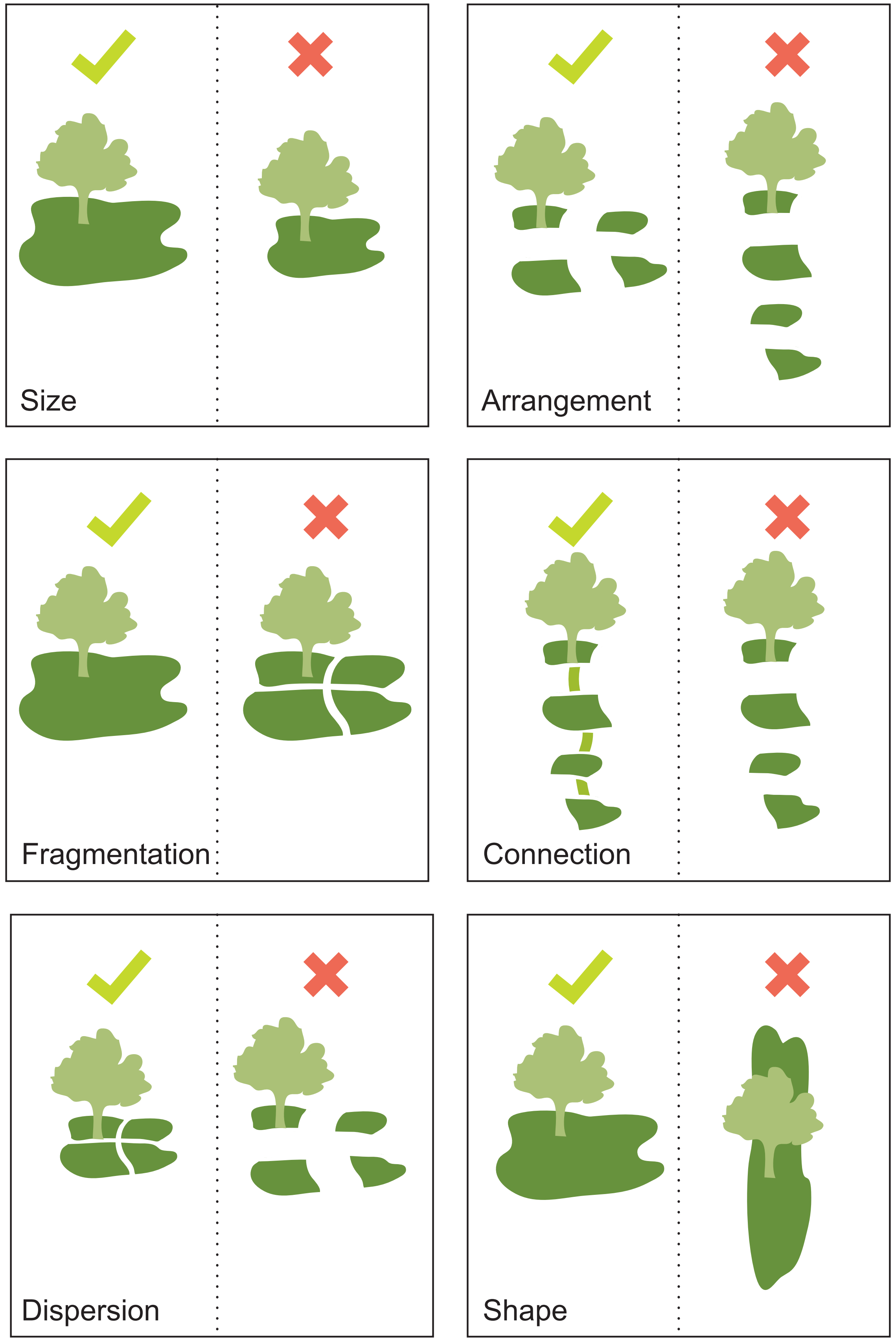
Allow gradual slope

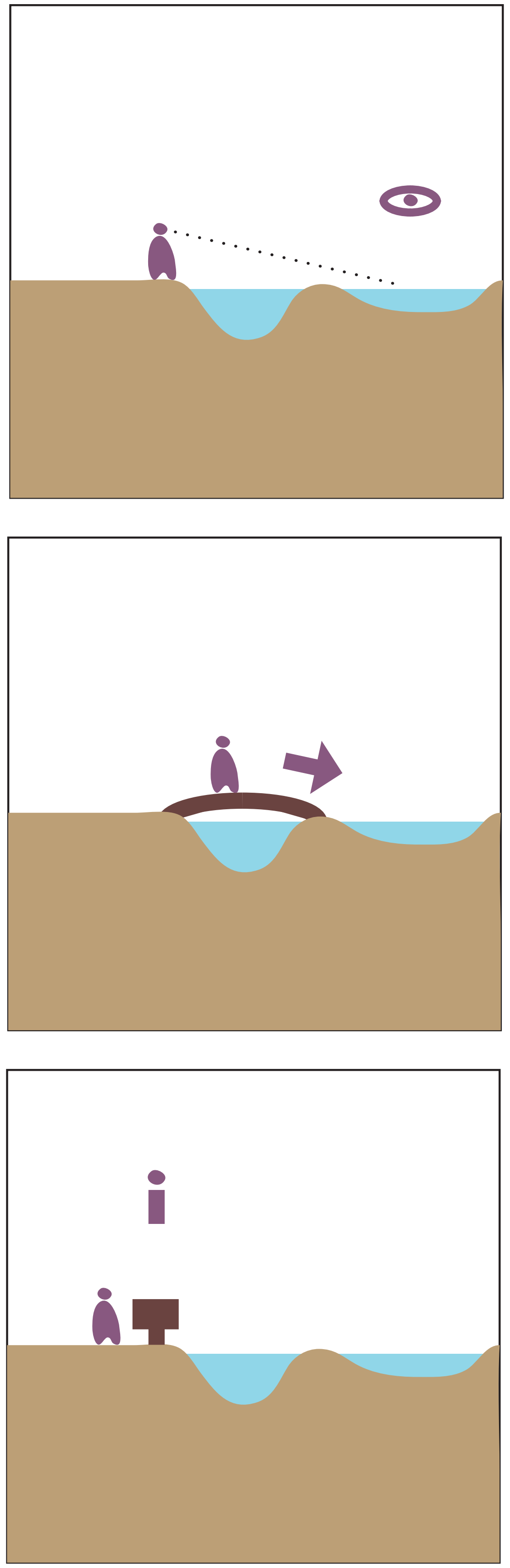
Biodiversity levers



A2	Rich grassland
B1	Dry forest
B2	Dry heath
B3	Poor dry grassland
C1	Moist forest
C2	Moist heath
C3	Poor moist grassland
D1	Swamp forest
D3	Poor wet grassland
E1	Pond

Habitat improvement & awareness



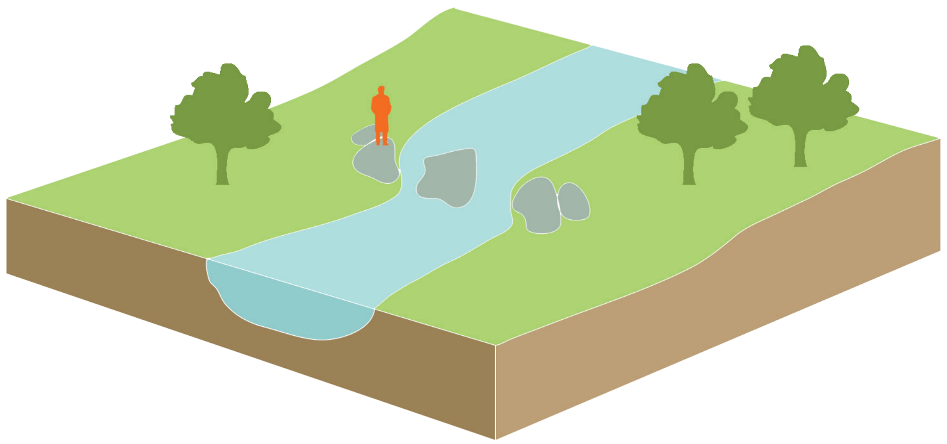


Visibility

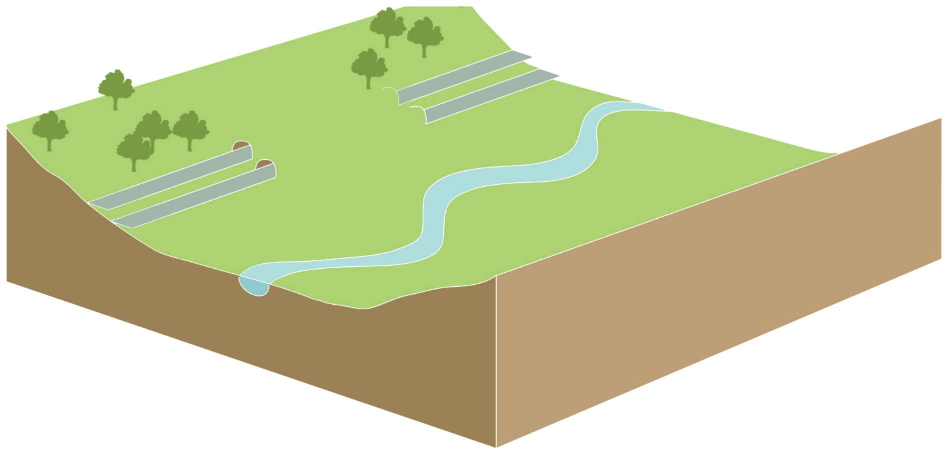
Accessability

Clarity

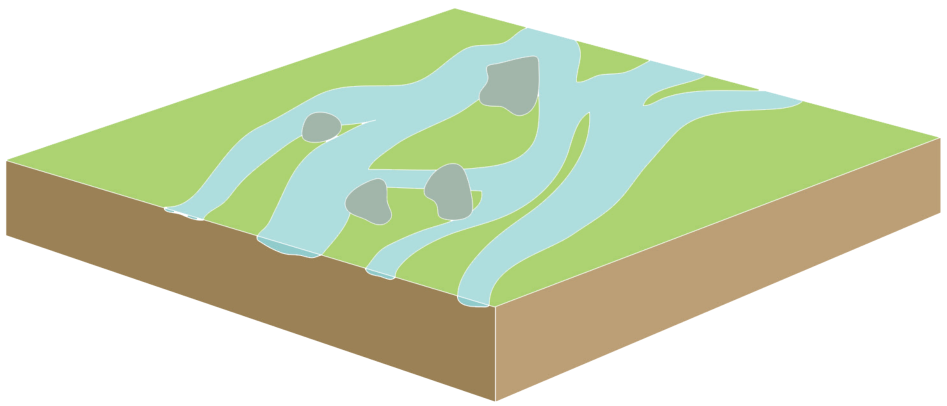
Possible interventions



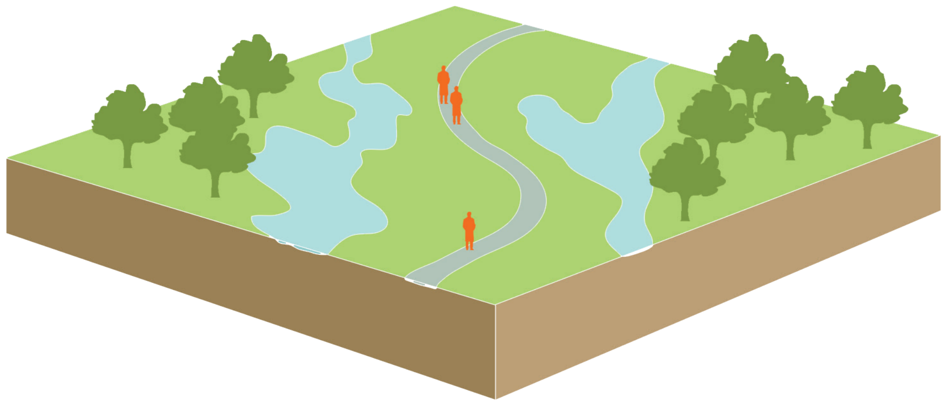
Restore oxygen levels by restoring natural disturbance of river by means of waterfalls



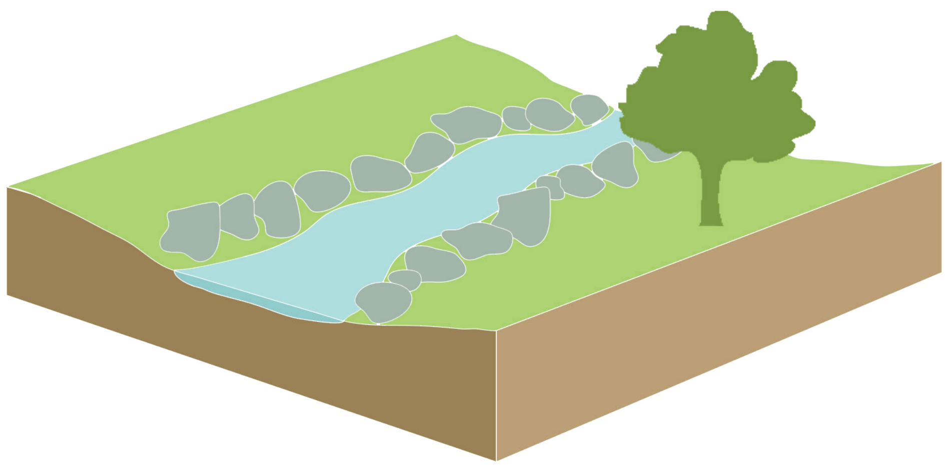
Bridge major obstacles to restore habitat connection



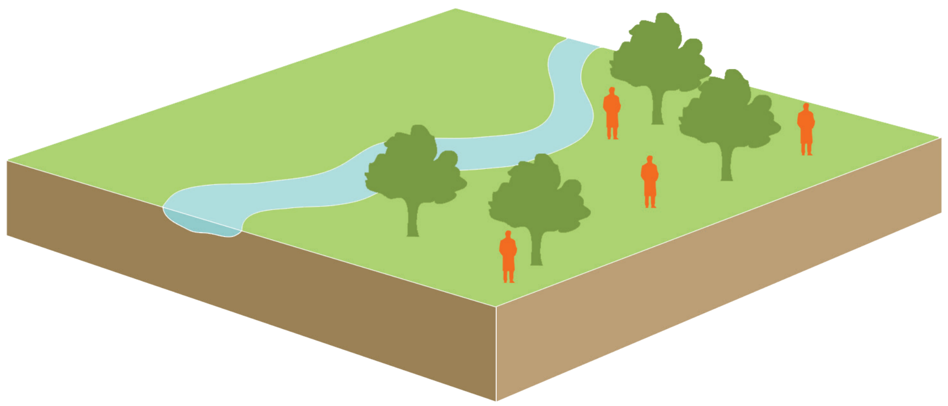
Restore native habitats by restoring river flow to former dynamism



Use wetlands to provide protected habitats and restrict public access



Using natural materials for flood protection to create habitat opportunities



Restore new areas with resilient vegetation to address recreational demands and provide opportunities for nature appreciation and recreation.

Impression