2150 LAKE SHORE GREEN INFRASTRUCTURE STRATEGY

2150 - 2194 - LAKE SHORE BOULEVARD WEST
23 PARK LAWN ROAD

TORONTO

CPPIB Park Lawn Canada Inc
FCR (Park Lawn) LP

GREEN INFRA-STRUCTURE STRATEGY

1.1/ INTRODUCTION

This Green Infrastructure Strategy has been prepared by Arup on behalf of the land owners, FCR (Park Lawn) LP and CPPIB Park Lawn Canada Inc., in support of an Official Plan Amendment application for the redevelopment of 2150-2194 Lake Shore Boulevard West and 23 Park Lawn Road (“the site” or “2150 Lake Shore”). This document is also intended to provide input into the City’s Secondary Plan for the site and immediately adjacent lands.

This Green Infrastructure Strategy explores possible strategies to address urban and climatic challenges. The main components of this approach include stormwater management, flood mitigation, urban heat island mitigation, increased biodiversity, enhanced air quality, improved water quality and healthy soils, as well as the more anthropocentric functions such as increased quality of life through recreation and providing shade and shelter within the city.

1.1.1 DRIVERS & SOLUTIONS

Drivers

We live in a time of unprecedented global change and challenge, with threats that include climate change, biodiversity loss, and resource scarcity – all of these issues are urgent, large scale and interconnected.

Legislative responses to these challenges are being developed at global, national and regional scales, helping us to define how this project can contribute positively, whilst balancing environmental, social and economic needs.

City developments usually form an impermeable paved layer on top of green space, which destroys habitats, can reduce biodiversity and has irreversible effects on the environment. Development also prevent natural hydrological cycles and increases the volumes of polluted runoff entering our stormwater infrastructure and therefore increasing the flood risk. With climate change set to increase the frequency and intensity of storms, the risk of flooding to and around the site could increase with time.

Solutions

In response, a sustainability vision has been developed and translated into the masterplan’s sustainability strategy. The vision is delivered through tailored objectives and strategies that comprehensively address sustainable development at both the masterplan and building level. The green infrastructure strategy aims and objectives are for the development to make a positive contribution to the urban environment and help sustain and enhance the environmental quality of the city. The planting, protection, and maintenance of large growing shade trees on both public and private lands are an important aspect of the project.

The project should incorporate sustainable urban drainage principles which mimic the natural hydrological cycle to protect resources, improve water quality, improve air quality, create habitats, and implement restorative ecological principles.

Solutions to managing increasing volumes of rain include subsurface infiltration beds, green roofs and permeable paving. Drainage solutions such as separate sewers for rainwater and sewage water and local rainwater treatment via roadside infiltration beds are also included. The system aims to make use of planting and permeable paving to filter stormwater before discharging into Lake Ontario.

Green infrastructure naturally cools the urban district on hot summer days which helps create new urban spaces for people to meet and socialize. They also have a valuable role in carbon sequestration, the development of a diverse and healthy ecology and an increase in biodiversity.

1.2/ GUIDING DOCUMENTS

1.2.1 TORONTO GREEN STANDARD

The Toronto Green Standard (version 3) covers a broad range of requirements related to delivering the green infrastructure strategy:

- Water efficiency to reduce potable water use for buildings and landscaping;
- Water balance and stormwater retention;
- Water quality of stormwater runoff draining into Lake Ontario;
- Integrate landscapes and habitats
- Performance measures to enhance the urban forest to minimize the impact of new development on ecological systems relating to bird collision deterrence, creation of habitats, improved biodiversity and increasing the tree canopy;
- Reducing the effect of an Urban Heat Island using green roof and shading the sites non-rood hardscape.

The project must demonstrate compliance with Tier 1 of the TGS. Tiers 2 through 4 are currently optional, however compliance with these higher tiers is targeted for the Lake Shore Boulevard project where appropriate.

1.2.2 WET WEATHER FLOW MANAGEMENT

The Wet Weather Flow Management (WWFM) Guidelines have been referred to and used in the stormwater strategy to address impacts of runoff, in order to protect watersheds and infrastructure. Within Goal B1.3 of Toronto's First Resilience Strategy, it is acknowledged that "The Wet Weather Flow Master Plan will be 18 years old in 2021 and can be updated to integrate resilience". It is also noted that the City intend to review and update the WWFM guidelines, and consider climate change adaption, however the time frame for this is unknown.

1.2.3 TORONTO GREEN STREETS TECHNICAL GUIDELINES

Toronto's Green Streets Technical Guidelines outlines the City of Toronto's approach to stormwater management to improve air quality, increase biodiversity and enhance the public realm. The guidelines encourage the use of green infrastructure to turn stormwater from waste to resource, to creating attractive streetscapes and a healthier environment.

"A Green Street is a road or street that incorporates green infrastructure, which includes natural and human-made elements such as trees, green walls, and Low Impact Development (LID) stormwater infrastructure that provide ecological and hydrological functions and processes."

The guidelines and selection tools have been used to assess a range of green infrastructure options appropriate for the site street types and conditions.

Toronto's Green Streets Technical Guidelines outlines a 'long list' of green infrastructure solutions for consideration. The guidelines include selections tools which were used to narrow down the list of green infrastructure solutions to those most appropriate for the density of the development and for different street types.

Green infrastructure solutions considered most appropriate for 2150 Lake Shore site are:

- Green roofs;
- Urban forest canopy, native herbaceous planting, green walls, street trees;
- Infiltration trenches, rain gardens, swales, perforated pipe systems;
- Stormwater tree pits /tree trenches, trees in soil cells;
- Trees in open planters, precast tree planters, movable planters;
- Permeable pavements;
- Bioretention in parks, planters and curbs;
- Photoluminescent road markings, photocatalytic paving, cool pavements; and
- Ecopassages, light limitation, LED lighting.

1.2.4 TORONTO'S FIRST RESILIENCE STRATEGY

Toronto's First Resilience Strategy sets out the City's vision of a resilient city. Urban resilience is the capacity of individuals, communities, institutions, and systems within a city to survive, adapt, and thrive in the face of the chronic stresses and acute shocks they experience. In the case of Toronto, the challenges of flooding and extreme heat pose the greatest and fastest growing risk to residents. Green infrastructure has the potential to contribute to managing and mitigating the likely impacts of climate change and flood risks.

1.3 / CLIMATE CHANGE

The following documents were reviewed with respect to climate change and flood risk;

- Ontario Ministry of Environment Policy Review of Municipal Stormwater Management in the Light of Climate Change, 2019
- Toronto's First Resilience Strategy, 2019
- Summary of the Flood Resilient Toronto Project, 2019

Within Toronto's First Resilience Strategy, Goal B1 states that Toronto needs to become more resilient to the shocks and stresses of changing climate.

At present, the WWFM guidelines do not have mandatory climate change allowances that need to be applied onto rainfall intensities, which take into consideration the predicted increased in intensity of rainfall in the future. It is not known when these will be established, or when these will be incorporated into local design guides. Nonetheless, given the project's aim to be resilient to future shocks and stresses, it is recommended that conservative allowances are made at this stage and can be refined at a later stage.

1.4/ EXISTING CONDITIONS

1.4.1 FLOOD RISK - FLUVIAL

The existing site is relatively flat at an approximate elevation of +85m. The site lies in the vicinity of two rivers; The Humber River to the north-east, and the Mimico Creek to the West. Lake Ontario is approximately 250m away from the site.

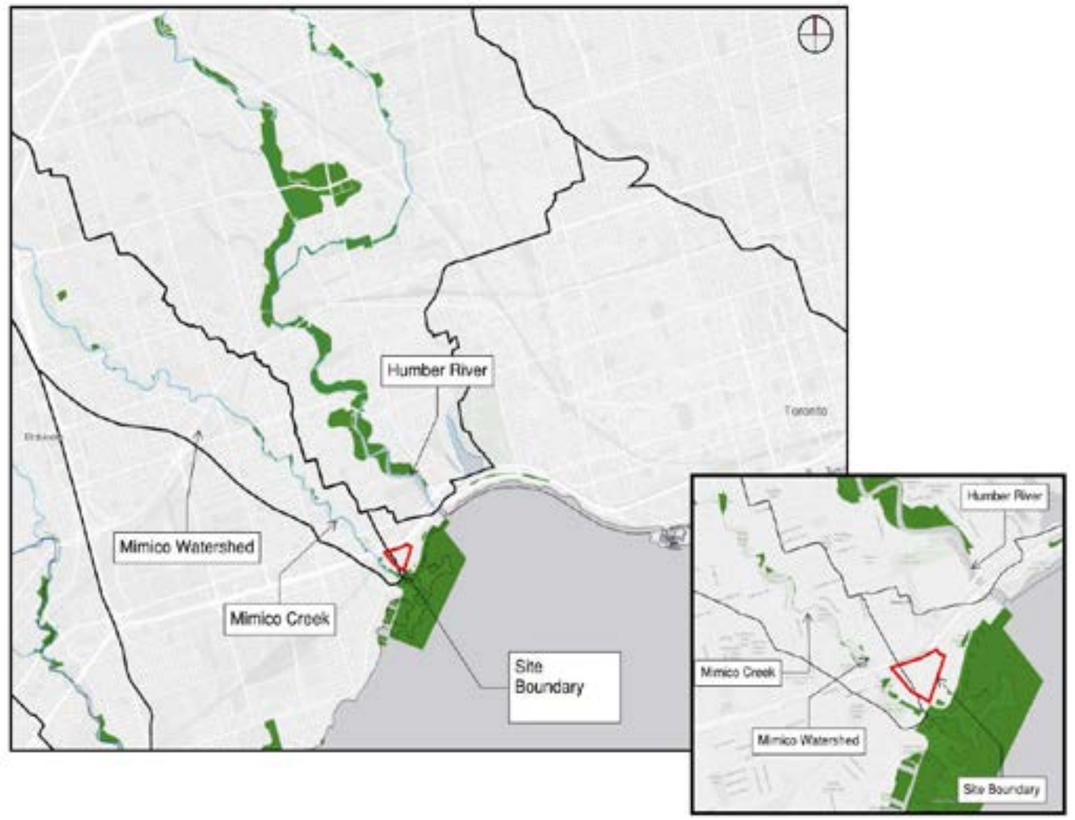

Figure 1 - Site location in relation to nearby watersheds

The long term (1918-2018) maximum water level recorded in Lake Ontario is 75.81m, which occurred in June 2017. The flood map (Figure 2) shows that the 100-year flood level of the Mimico Creek is +79.40 just south of the Gardiner Expressway. Given that the elevation on Park Lawn Road is approximately +84.00m, there is very low risk of flooding to the site from Mimico Creek. Given that the site does not lie within the Humber watershed, there is very low risk of flooding to the site from this watercourse also.

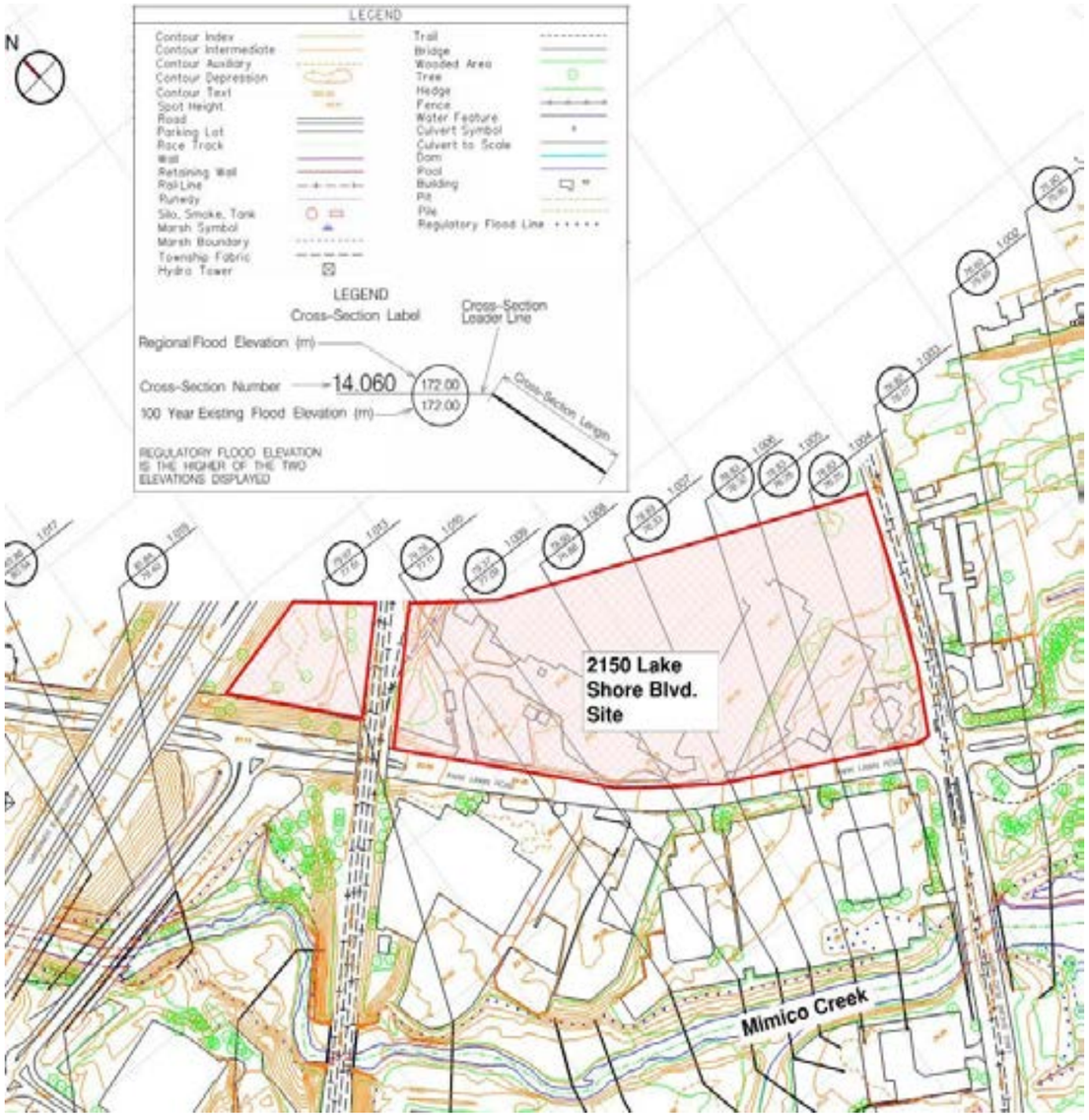

Figure 2 - TRCA flood map for Mimico Creek

1.4.2 FLOOD RISK - GROUNDWATER

A borehole (BH13-1) located south of Lake Shore Boulevard includes a monitoring well. This monitoring well records groundwater +74.8m, approximately 10m below existing ground level. A second borehole BH9 completed in 1969 and located adjacent to the north-western boundary of the site records groundwater level of +83.8m, approximately 7m below ground level.

Numerous other boreholes record groundwater within the upper 1m below ground, suggesting a perched water table might exist within the fill. The site comprises around 9m of mostly normally consolidated soils (silts, clayey silts, and silty clays) above bedrock (shale). The groundwater table is below the soils near the top of the shale and is at a similar elevation to Lake Ontario.

Therefore, the risk of groundwater flooding the site surface is low, but as the proposed design consists of deep basements which will go into the shale and into the groundwater table, there is a risk of basement flooding from groundwater.

1.4.3 FLOOD RISK - SURFACE WATER

City Utility Mapping (CUMAP) shows existing surface water sewers around the site, along Lake Shore Boulevard and Park Lawn Road. It is assumed that the surface runoff from the previous use (Christie Cookie Factory) drained into a Ø300mm concrete pipe in the south of the site, which outfalls into the Mimico Creek. Google imagery indicates that approximately 70% of the site was previously impermeable, however it is unknown whether the remaining 30% green areas of the site infiltrated into the ground, or ran off into the sewer. The existing site is relatively flat, so there is a risk of surface water flooding, however as the site is currently vacant, it can be assumed that there is no risk to life or property.

1.5/ OBJECTIVES

For the concept masterplan, the key objectives relative to the green infrastructure strategy are;

- Manage stormwater to achieve an appropriate level of flood protection;
- Maintain or preferably reduce the risk of flooding to adjacent sites;
- Adhere to the City of Toronto Green Roof Bylaw and incorporate this into the stormwater retention strategy;
- Optimise the use of green infrastructure (GI) to enhance the quality of stormwater runoff;
- Promoting infiltration to sustain groundwater systems and maintain interflow patterns;
- Support the City of Toronto's ambition to drastically increase tree cover;
- Create a network of public spaces, gardens and plazas which will improve microclimate and also create wildlife corridors that promote biodiversity.

1.6/ GREEN INFRASTRUCTURE STRATEGY

1.6.1 SURFACE WATER CONTROL

The most appropriate stormwater drainage strategy will consider; proposed site levels, infiltration rates, the capacity of existing sewers, the proposed landscape strategy, the level of flood protection to be provided (i.e. return period) and climate change considerations. On the 2150 Lake Shore site the following measures are recommended for stormwater management:

- Retain runoff from roofs and hard surfaces through infiltration, evapotranspiration, water harvesting and reuse.
- Use green roofs as shown in Figure 3 to capture a portion of the rainfall that falls on buildings. According to the City Bylaw, the requirement ranges from 20-60% of the available roof space of a building.
- Within public realm areas, tree pits should be used to store and infiltrate stormwater. Around 30m^3 of soil is required per tree pit.
- Other 'green street' elements can be used to convey flows from the road into the raingarden/tree pits and enable ground water recharge, refer to Figure 4, Figure 5 and Figure 6.
- Where there are long stretches of road with no tree pits, car parking bays could be made of permeable paving so that infiltration can still take place.
- Areas of planned flooding in public parks, as shown in Figure 7.
- Based on guidance from Toronto and Region Conservation Authority (TRCA) and assuming typical hydraulic conductivities, the infiltration rates at the site are on the order of 10 to 30 mm/hour. According to the WWFM guidelines, the minimum infiltration rate is 15mm/hour and typically, the design must be sufficient to fully drain the stormwater quality design storm runoff volume within 72 hours. Percolation tests are required to determine site specific infiltration levels, so that the overall green infrastructure and retention strategy is tailored to site specific conditions. If rates are favourable, there is opportunity to infiltrate all surface water, minimising run-off from the site.

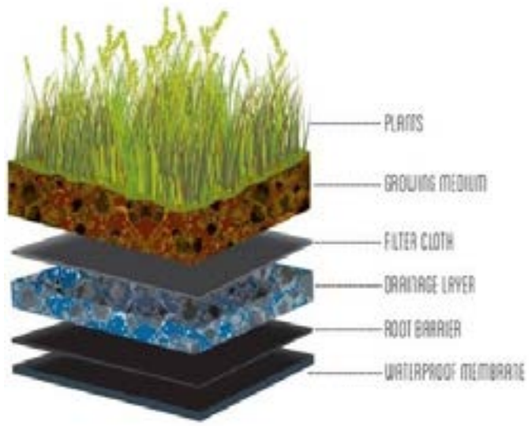

Figure 3 - Green Rood build-up (Source: Restoration Gardens Inc)

Figure 4 - Rain Gardens Sheffield, UK

Figure 5 - Rain Gardens and Tree Pits, South Station Street, Etobicoke- York

Figure 6 - Conveying flows to tree pits/rain gardens

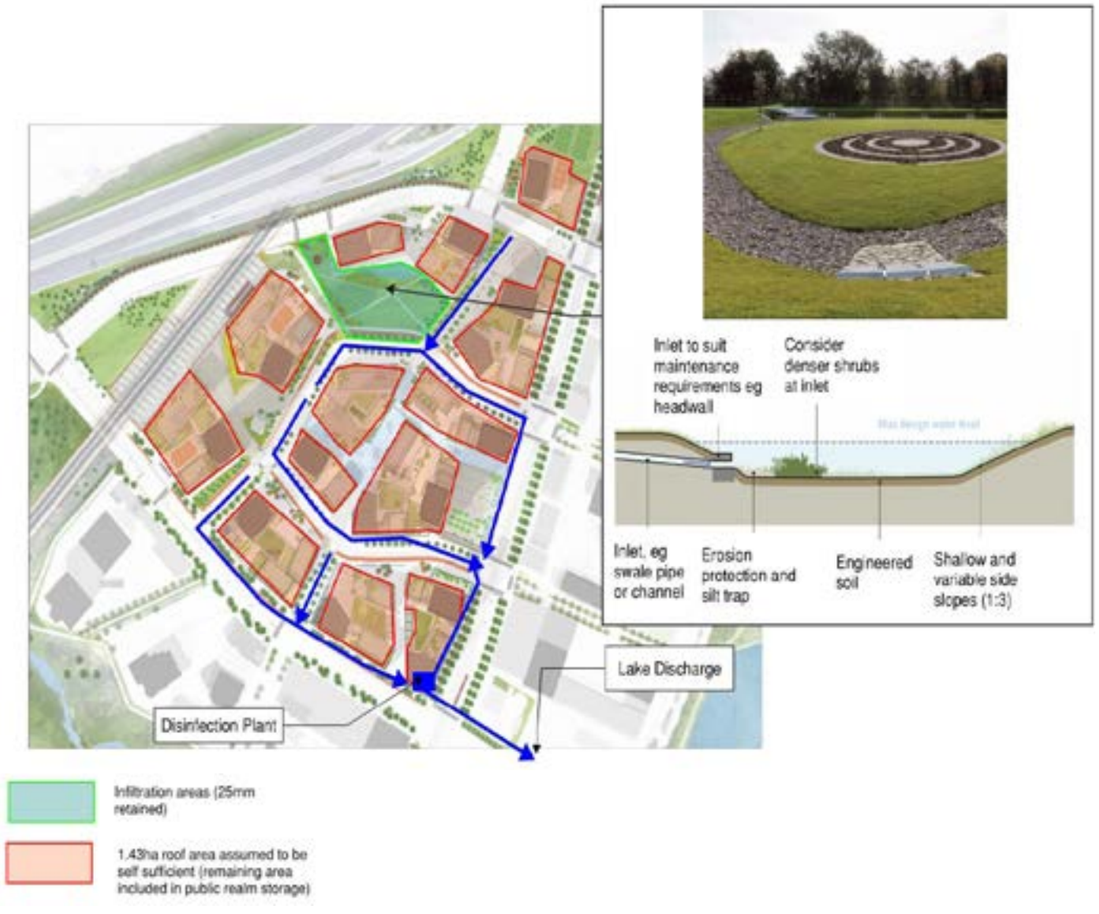

Figure 7 - 2150 Lake Shore Stormwater Strategy

Public Park

The Christie Cookie park will be a public park to the north of the site. The intention is to create a significant lawn area and a gradation of planting characters that allow various and diverse plant communities to coexist: formal, semi- formal, wild. This vegetation complexity coupled with the variations in topography will create areas of different character, interest, access, proximity and interaction.

The proposed park should be self-sufficient in managing its stormwater locally as there is sufficient space to use green infrastructure and designating areas of planned flooding/ponds. The area is shown in green on the 2150 Lake Shore stormwater strategy plan (Figure 7). As the proposed park is a public neighbourhood area, it will not receive run off from any other parts of the 2150 Lake Shore. If site investigations show favourable infiltration rates, any storm water which falls on the proposed park should infiltrate into the soil. There should be an overflow into the pipe network on the proposed loop road for extreme events.

Figure 8 - Proposed Christie Cookie Park Landscaping (indicative)

1.6.2 GREEN LANDSCAPING

The landscape design shall aim to extend the natural landscape of the Mimico Creek ravine landscape. There is opportunity for the site to incorporate ecological corridors with naturalised planting alongside infrastructure such as the Gardiner expressway and railroad which could reduce the visual impacts.

Tree planting, if optimised, could create identity, seasonal interest and mitigate wind and heat island effects. The 2150 Lake Shore landscape is shown illustrativly in Figure 10. The site may use tree canopies stepped across the multi-level site; to connect parks and embankments with various podium gardens, roof gardens, balconies and sky terraces to maximise the tree canopy. The 'green skyline' could be composed of an accumulation of public / semi-public and private green spaces. City nature, if fully integrated, could become the backbone of the area's future identity and urban life.

Generally, a diverse selection of tree species, preferably in shared tree trench conditions, with a target of 30m^3 of soil per tree is preferred. Guiding documents such as Tree Planting Solutions in Hard Boulevard Surfaces – Best Practices Manual will assist the design team in developing preferred planting solutions.

Lake Shore Boulevard and Park Lawn Road are to be transformed into urban boulevards with abundant tree planting, expanded sidewalks & cycle lanes and safe pedestrian crossings (Figure 10).

The proposed Relief Road embankment alongside the northern boundary (Figure 9 and Figure 10) can be re-graded and landscaped to become a green buffer which has the potential to form a visual screen, act as an acoustic barrier, reduce air pollution and create a linear 'park'. This linear park creates a green corridor connecting the upper Mimico Creek to Lake Shore Boulevard and then onto Humber Bay Shore, to Lake Ontario.

Figure 9 - Indicative location of Relief Road Embankment

Figure 10 - Illustrative Masterplan of green infrastrucutre and landscaping

1.7/ CONCLUSIONS / NEXT STEPS

The concept masterplan design aims to integrate as much green infrastructure as possible, and the following have been considered appropriate measures for the site;

- Green roofs;
- Urban forest canopy, native herbaceous planting, green walls, street trees;
- Infiltration trenches, rain gardens, swales, perforated pipe systems;
- Stormwater tree pits /tree trenches, trees in soil cells;
- Trees in open planters, precast tree planters, movable planters;
- Permeable pavements;
- Bioretention in parks, planters and curbs;
- Photoluminescent road markings, photocatalytic paving, cool pavements; and
- Ecopassages, light limitation, LED lighting.

The next steps required, would be to;

- Determine infiltration rates of soil on the site which would determine which Tier of the TGS is appropriate;
- Determine the downstream capacity of the existing municipal stormwater sewers around the site, which would determine the preferred stormwater discharge strategy (i.e. sewer discharge or Lake discharge).