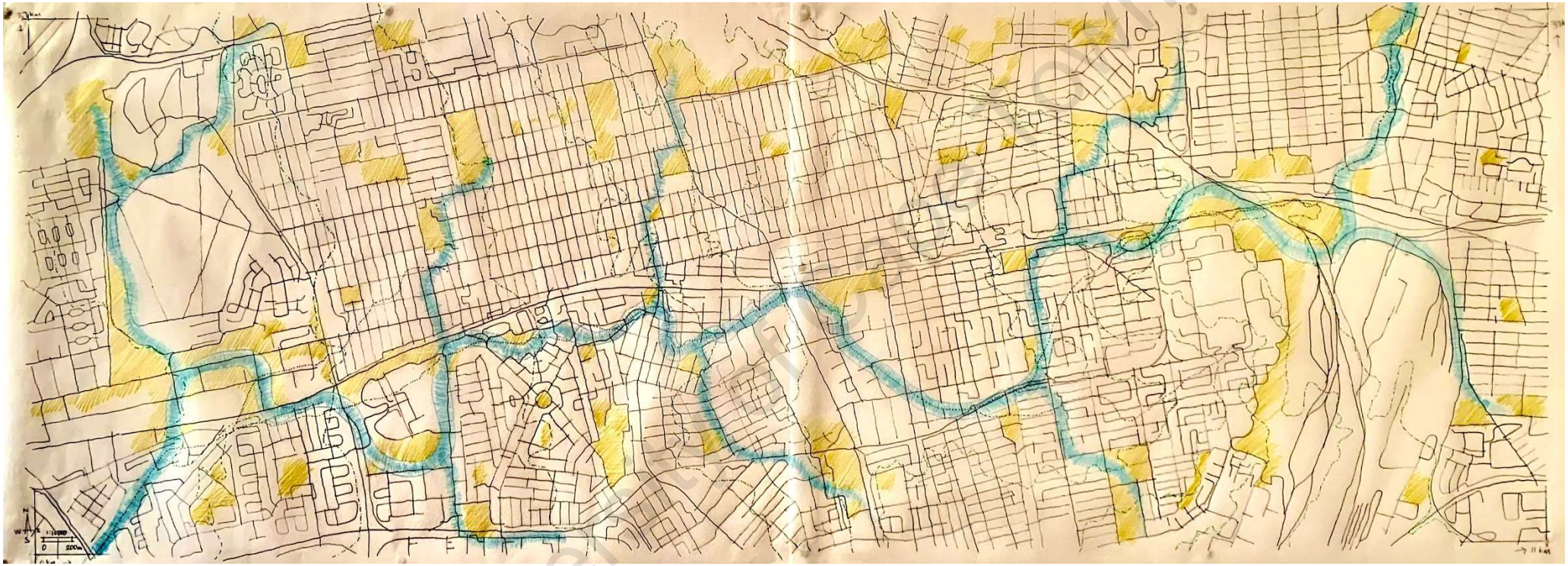
ELSIESKRAAL

River Restoration as Urban Catalyst



DENNIS MOSS

(MSSDEN002)

Urban Design Research Project - Final Thesis, December 2023

Master of Urban Design, University of Cape Town

Supervisors: Dr. Kathryn Ewing and Hedwig Crooijmans-Lemmer

University of Cape Town

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University of Cape Town

ELSIESKRAAL:

RIVER RESTORATION AS URBAN CATALYST

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Student Number: MSSDEN002

Urban Design Research Project (APG5086S), 60 Credits

FINAL DISSERTATION

December 2023

Submitted in partial fulfilment of the Master of Urban Design Degree

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Signature:

Signed by candidate

Dennis Frederick Moss

"A new type of thinking is essential if mankind is to survive and move toward higher levels."

Albert Einstein

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To my classmates, you give me great hope for the future of this country. It was a privilege to share the studio with you. I look forward to seeing you all out there in the "real world". You will go far.

To my fiancé Des, for always believing in me.

I dedicate this to my father, who inspired me to follow in his footsteps.

ABSTRACT

Water is one of the main issues of the 21st century. Climate change and biodiversity loss, driven by human development, underscore the need to restore a harmonious relationship with the planet. The current global action plan to achieve this is the United Nations' 2030 Agenda, which outlines specific goals (SDGs) to promote sustainable development.

Sustainable development cannot be achieved without "significantly transforming the way we build and manage our urban spaces" (United Nations, 2015). As urban practitioners, we have a large role to play in SDG 11, with its mission to "make cities and human settlements inclusive, safe, resilient, and sustainable" (United Nations, 2015). This requires a comprehensive understanding of the human- and natural capital available to us, and the ways in which these resources can be employed at different scales and varying contexts.

With half of the world's population now living in cities, it is in the urban environment where intervention is most crucial. Africa, in particular, is set to undergo rapid urbanisation, with estimates that its population of 1.1 billion will double by 2050 (WWF, 2020, p. 4). This will require strategic planning. Rather than contributing to the problem, resilient cities can be "the source of solutions" (UN General Assembly, 2016, p. iv). How we manage water will be key to this success.

This research project will explore the effects that river restoration can have on urban transformation. The focus will be the Elsieskraal River, which flows from the Tygerberg Hills to the Black River, through "the most diverse and densely populated range of suburbs" in Cape Town (Brown, 2009, p. 135). A series of design interventions, guided by a multi-disciplinary, systems-based approach, and informed by theory, best practice and policy, will test the potential catalytic impact of river restoration in an urban setting.

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1. INTRODUCTION

1.1 CATALYST:THE MARK RIVER

1.1.1 BACKGROUND

"More people died in the struggle against water than in the struggle against men." – Pytheas, ancient Greek geographer, 325 BCE

The Dutch are famous for their relationship to water. Because a quarter of Holland is below sea level ("Netherlands" means "lower countries"), it has always been vulnerable to flooding. Only through the use of terps (artificial hills) and dikes was the majority of its area made habitable around the 9th century. As the country grew into a great power in the 16th century, the methods of control grew more sophisticated, with the implementation of large drainage channel systems. As such, their historic settlements were inextricably linked with water. Amsterdam is a famous example of this type of urban form, particularly the Singelgracht, the historic canal district, now a UNESCO World Heritage Site.

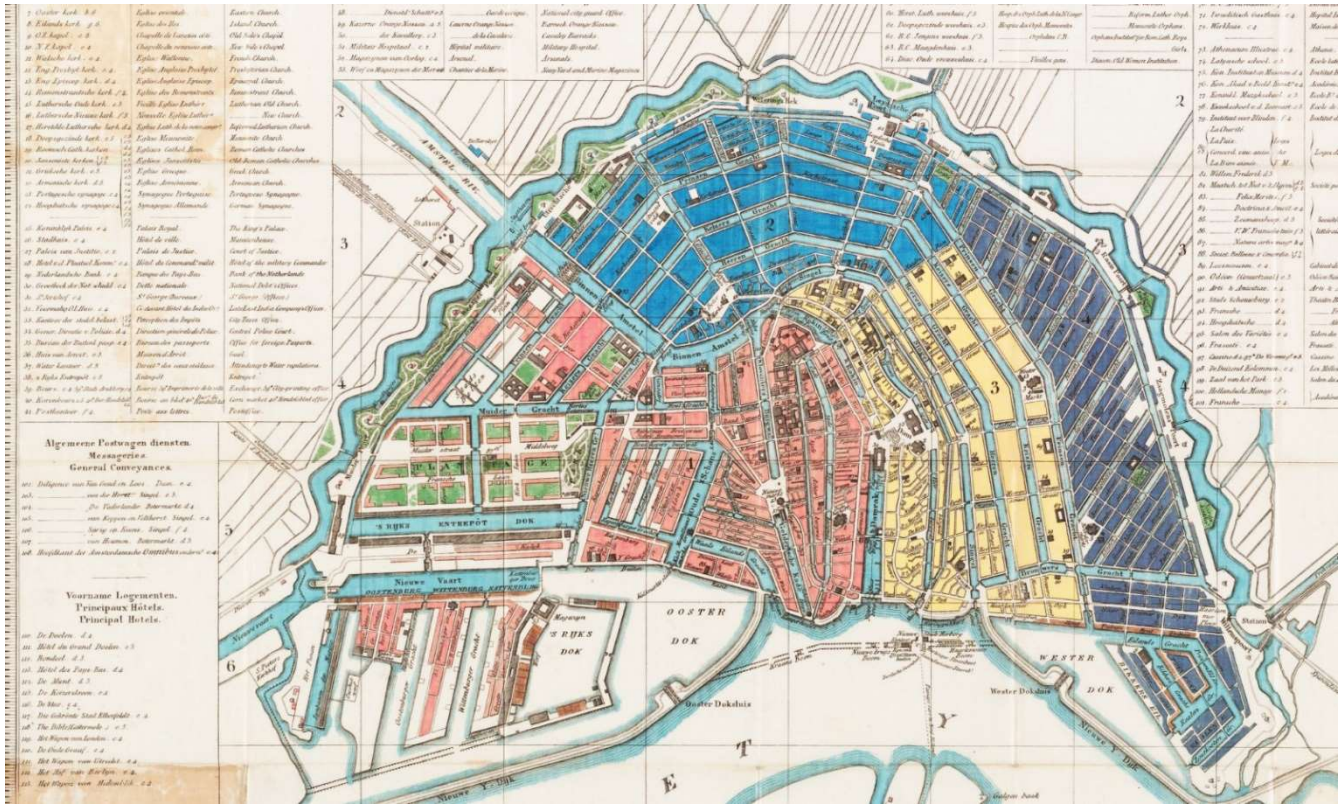


Figure 1 - The Singelgracht District, Amsterdam

Dutch cities were however not exempt from the impact of modernist car-oriented planning. With the need for increased motorway space, water was no longer the primary driver of urban form. Another contributing factor was poor water quality during the 1970s – sometimes referred to as "urban stream syndrome". This was a typical consequence of industrialisation in many settlements throughout the world. Consequently, many canals were filled in during the 20th century.

https://en.wikipedia.org/wiki/Netherlands

https://en.wikipedia.org/wiki/Singelgracht

https://whc.unesco.org/en/list/1349/

https://en.wikipedia.org/wiki/Flood_control_in_the_Netherlands

1.1.2 PARADIGM SHIFT

"At the end of the last century, people realised they had made a planning mistake…"
- Roel Klei, Breda city councillor, 2021

Fortunately, this development approach was reversed in the 1990s. Climate change, and its impact on water management, hastened the new mindset. Topics such as "sustainable and robust water systems" are now part of national policy (Dolman, 2013, p. 87). As such, many settlements are now retrofitting areas altered during the post-war period to reintroduce water.



Figure 2 - The Restoration of the Mark River in Breda

An example is the city of Breda, which diverted its river, the Mark, paved over its harbour and built Europe's first underground parking garage during the 1960s (cities-today.com). In 2007, the city wisely decided to reverse these mistakes by re-opening the harbour and river. This had a positive impact on property values, with new restaurants and residential developments emerging along the waterways.

Dolman, N., Savage, A. & Ogunyoye, F. (2013). Water-Sensitive Urban Design: Learning from Experience. Municipal Engineer, 166(2), 86-97.

https://cities-today.com/the-river-project-turning-breda-from-grey-to-green/

1.1.3 NATURAL- AND URBAN REGENERATION

The re-introduction of water has had a catalytic effect on public opinion and standards, with residents calling for a general increase of nature in the city. In line with similar restoration efforts globally, the right of plants and animals to have their own space in urban areas – "nature-inclusive design" (uia-initiative.eu) is increasingly prioritised in planning- and design decisions; and is gaining support at various scales.

An example is "GreenQuays", a river regeneration project currently under construction in a section of the Mark River in Breda. The impetus for the idea was provided by the Urban Innovative Actions (UIA) group, a European Union initiative that provides local authorities with resources to implement pilot projects in urban areas.

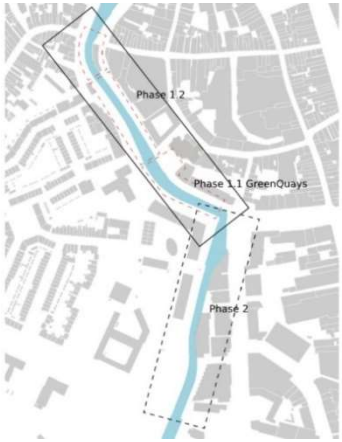




Figure 3 - GreenQuays

UIA's philosophy is bring various stakeholders together to share their "knowledge on the specific policy issue to be addressed. These include agencies, organisations, private sector, research institutions [and] NGOs". Funding is then made available for 80 % of the budget. The post-project phase is equally important, with an emphasis on lessons learned, data capture and knowledge sharing with "urban policy-makers and practitioners across Europe". Projects must therefore be not only innovative, but participative, measurable and (ultimately) scaleable. (www.uia-initiative.eu)



Figure 4 - Design Principles and Vision

The aim of GreenQuays is to re-introduce nature by creating ecosystems along the steep artificial banks of the river. Traditionally, quays – vertical structures along a river or harbour that allow ships to dock – are impermeable elements that are kept free of vegetation. Allowing plant- and animal life to inhabit this type of infrastructure required a mindset shift on the part of the authorities. Would nature compromise the structural integrity of the walls? In the long run, would this new system require more- or less maintenance (with concomitant cost considerations)? Innovation is therefore not only technical, but social.



Figure 5 - Volunteers

A range of solutions are being tested, such as trees embedded in the quay walls (rather than planted on top):



Figure 6 - Trees within Walls

The historic approach to nature in urban areas was to tame it – in the case of a river, to change its shape and alter its course; and thereby harm natural processes and drive animals out. A river was to be used, not protected. In the past century, modernist planning - with its emphasis on separating land uses through functional zoning - increased the separation between urban- and natural environments. In this tradition, a river would be ringfenced as an element physically separate from the settlement, not to be interfered with – and consequently not to be embraced.

A "nature-inclusive" approach aims to achieve a synthesis between natural- and human systems. Besides creating new space for nature to return and thrive, the quality of the public realm needs to be considered. The design of GreenQuays incorporates public space at various scales: walkways and landscaped squares along the waterway, simple (yet effective) elements like drinking fountains and seating, green walls on existing buildings (which not only look better than a hard surface, but help with urban cooling), permeable ground surfacing (which aid groundwater infiltration), and trees planted in rows and pockets.

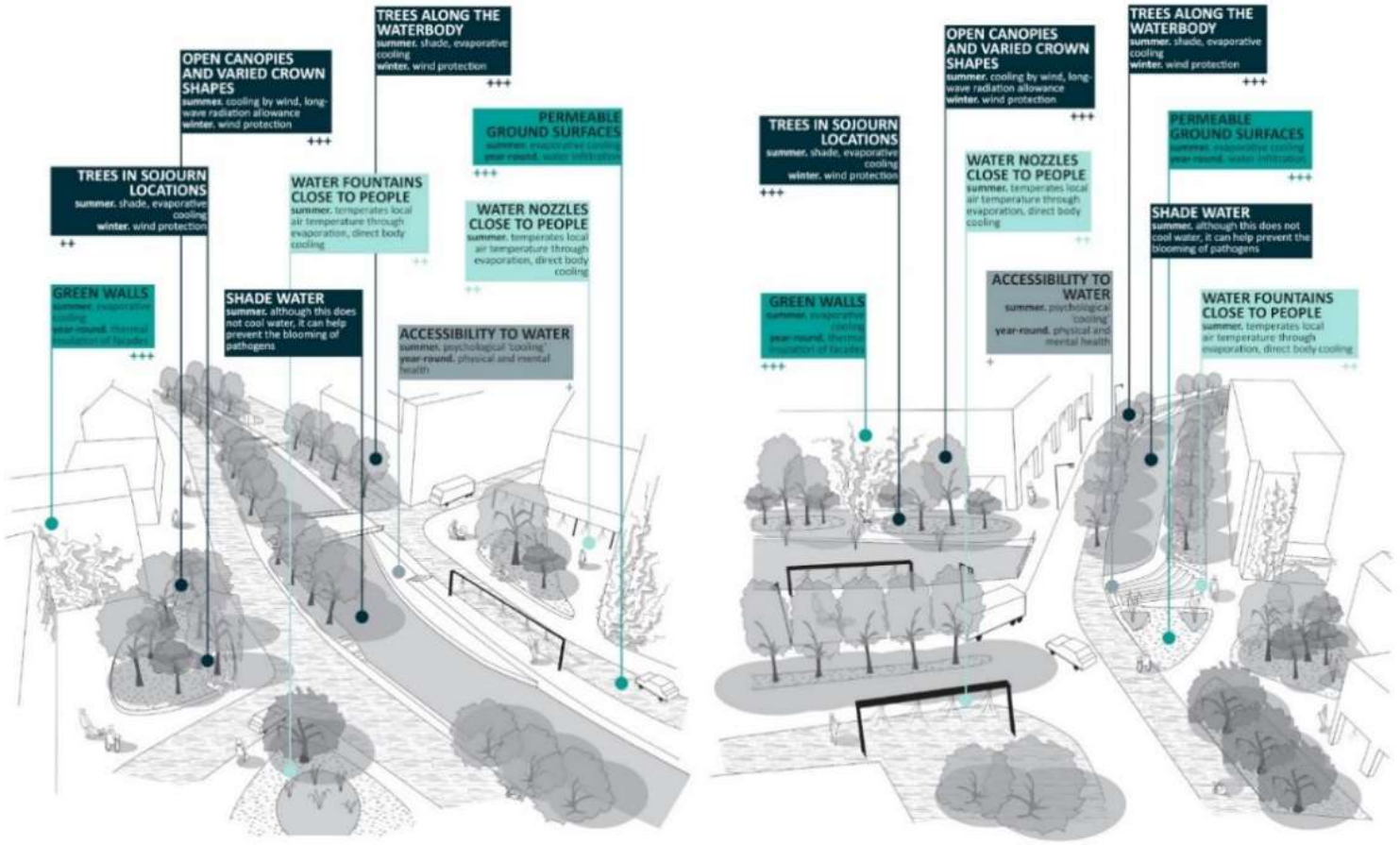


Figure 7 - Natural and Human Space

https://cities-today.com/the-river-project-turning-breda-from-grey-to-green/

https://uia-initiative.eu/en/news/greenquays-project-its-last-mile-journal-3

https://www.wur.nl/en/project/green-quays-breda.htm

https://eukn.eu/urban-voices/birgit-georgi-on-experimenting-with-nature-inclusive-quays-niqs-in-breda/

1.2 RIVERS

"Climate change is primarily a water crisis"- UN Water

https://www.unwater.org/water-facts/water-and-climate-change

For centuries, societies have relied on rivers for basic survival. The way we interact with water systems has shaped most human settlements. Rivers support plant, animal and human life. They are home to some of the most diverse ecology on earth and play an important role in livelihoods. They are essential for transport, energy, manufacturing, agriculture and fishing. They provide flood protection – both in a historic sense and in terms of current- and future climate change mitigation. Protecting these freshwater arteries, which cover less than 1% of the planet's surface (not only rivers, but wetlands, streams, lakes and aquifers) is absolutely vital. Yet, they are the most degraded ecosystems in the world.

As depressing as it is, we must pause to consider a few statistics from WWF's Living Planet Report (2022). Over the past 50 years:

- Wildlife populations have declined by 69 %. This is particularly acute in Latin America, which has seen a 94 % loss.
- Freshwater species have declined by 83 %
- Only 37 % of rivers remain free-flowing over their entire length
- We are losing 10 million hectares of forest per year – an area the size of Portugal

During this period, the global population has doubled.

Urban growth, as well as a careless approach to river management (which, essentially, originates from our broken relationship with nature) has had a profound impact on global river health. Damage to freshwater ecosystems has contributed to climate change, with an evident increase in the frequency and severity of droughts and floods over the past 50 years.

Climate change, in turn, does further damage. For example, rising sea levels can contaminate freshwater systems. Flooding damages water- and sanitation infrastructure, which causes further pollution. Drought and wildfires destroy tree cover, which exacerbates soil erosion, which reduces groundwater recharge. This increases water scarcity, with increases reliance on energy-intensive water pumping, which does further damage. Water and climate change are therefore inextricably linked.

It is a vicious cycle that needs to be broken.

https://www.wwf.org.uk/updates/why-are-rivers-so-important-and-how-can-we-protect-them

https://www.wwf.org.uk/what-we-do/protecting-our-rivers-lakes-and-freshwater

https://www.ecrr.org/River-Restoration/Urban-River-Restoration

https://www.unwater.org/water-facts/water-and-climate-change

https://livingplanet.panda.org/

https://wwf.panda.org/discover/our_focus/freshwater_practice/freshwater_biodiversity_222/

https://conservationmag.org/en/wildlife/2022-living-planet-index-report-summary-of-the-top-ten-issues

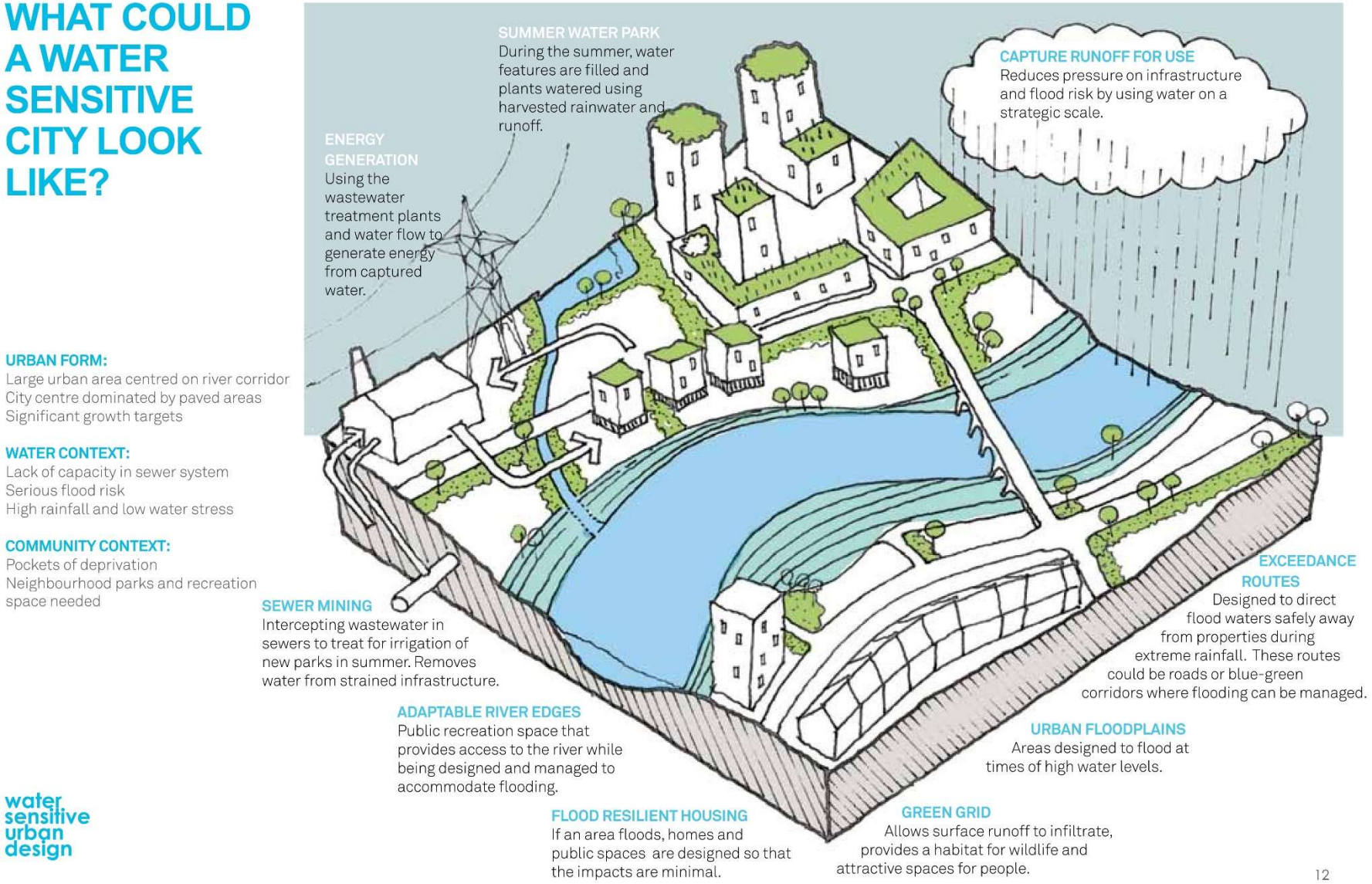


Figure 8 - Water Sensitive City

https://www.wwf.org.za/our_research/publications/?31761/The-case-for-investment-in-green-infrastructure-in-African-cities

2. RESEARCH OUTLINE

2.1 QUESTIONS

PRIMARY

- How can river restoration serve as a catalyst for urban regeneration?

SECONDARY

- Can lessons learnt at the site- and precinct level inform larger scales, and vice versa?
- Can improvements to urban- and natural infrastructure translate into a qualitative public realm?

2.2 OBJECTIVES

- To support the 2030 Agenda for Sustainable Development by localising the SDGs
- To promote urban regeneration and inclusive growth
- To create a vibrant, liveable public realm

2.3 METHODOLOGY

Considering that the research will be undertaken in a design context, the type of data that needs to be collected should be of a qualitative nature. Ideally, a combination of both primary- and secondary data is desired. The data should be evidence-based. At the urban design- and architectural scale, this entails understanding how people interact with the built environment for example. Methods to collect data include desk research (online), data analysis (open-source GIS platforms), non-participant observation, and site documentation (photographs).

https://www.scribbr.com/methodology/experimental-design/

http://ebdjournal.com/

2.4 ETHICS

Potential ethical implications of research need to be considered at all times, both in terms of human dignity and institutional liability.

Non-participant observation and site documentation requires that the researcher does not impose on the physical space of people using and moving through the study area.

Semi-structured interviews, with questions approved by the university's ethics committee, will be limited to adults over 18 years of age, with informed consent. Where a participant requests not to be identified, this will be respected. The results of the study will be made available to the public domain.

No sponsorship arrangements will exist between the student and third parties, thereby avoid any conflict of interest. All research produced will belong to the University of Cape Town.

All data collected will be appropriately referenced.

3. FOCUS

3.1 CAPE TOWN

"The webs between water flow, biodiversity, human actions and infrastructure are complex and impossible to separate, yet government policy, academic research and municipal actions often act as if they are."

https://waterstories.co.za/cape-town-water-sources

There are 10 wetlands and 14 rivers, stretching over 2000km, within the Cape Town Bioregion - an area of roughly 2500 km² which covers the city's municipal boundaries as well as the adjacent marine environment.

Except for the upper reaches of certain of these rivers, the majority of Cape Town's freshwater systems are in a poor ecological condition. Most of their lengths have been altered by urban development, affecting riverine habitats as well as water quality. As a result, their ability to provide ecosystem services – the benefits that humans derive from the natural environment (such as food, water, clean air, pollination, waste decomposition, medicine and disease

control) – have been significantly impact. Their value as natural assets, in terms of beauty and human well-being, is also reduced.

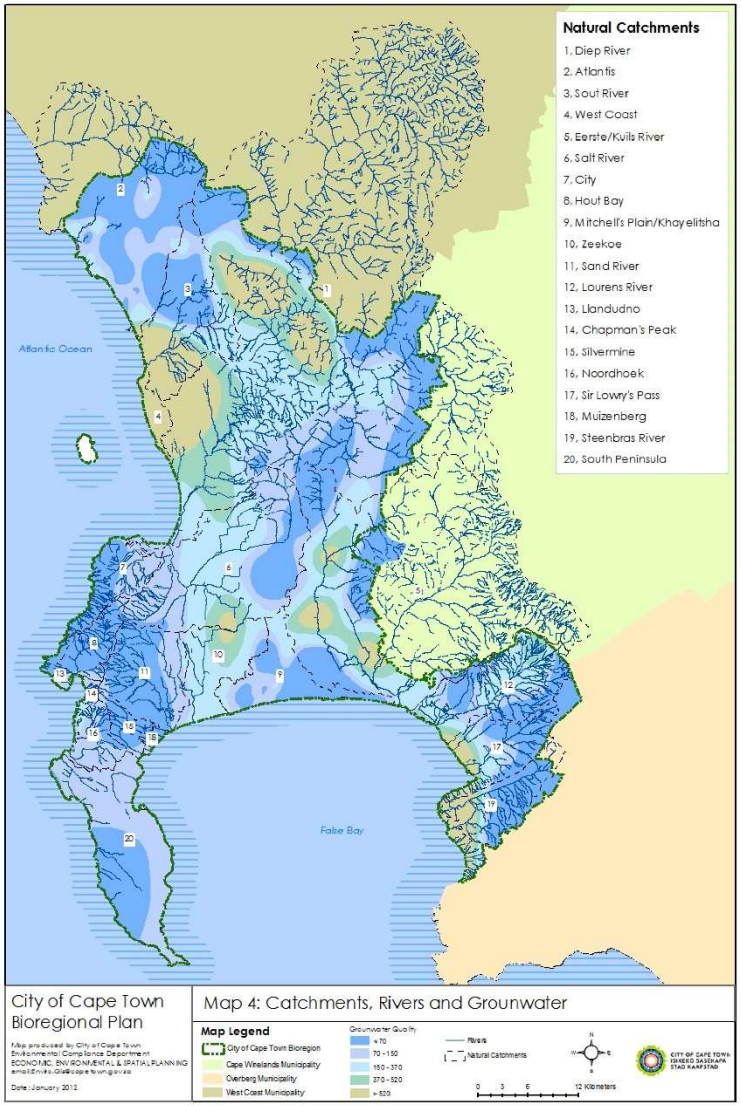


Figure 9 - Cape Town's Water Assets (Bioregional Plan, 2015, p.36)

The highest population densities in the city are on the Cape Flats, the low-lying area between the mountain and the sea, to the east of the CBD. This area was historically covered by wetlands. These have been mostly lost, and the rivers that still flow through this expanse are largely canalised – disrupting their ability to attenuate floods, filter pollutants and recharge groundwater.

The city has identified the following as priority actions in the management of its rivers:

- Reintroduce meanders in rivers, where possible
- Discourage additional canalisation
- Create habitat diversity
- Remove alien vegetation and -fish
- Maintain green belts along river corridors

To kick-start these efforts, the City of Cape Town is partnering with the C40 Cities Finance Facility to develop local restoration projects, with a focus on river corridors, public open space and flood resilience through nature-based solutions.

Bioregional Plan (2015) – 7. Biodiversity Profile – Freshwater Features – 7.3.2 Rivers – p.34

https://www.c40cff.org/projects/using-nature-based-solutions-for-flood-risk-management

https://waterstories.co.za/cape-town-water-sources

https://en.wikipedia.org/wiki/Ecosystem_service

https://en.wikipedia.org/wiki/Cape_Flats

3.2 THE ELSIESKRAAL RIVER

"It is not for us, removed from the context of their times, to pass judgement on what has gone before. Our duty is to learn from our predecessors, build on the good they have left behind, try to rectify the mistakes made and use their legacy of knowledge to do better in the future. And to remember that, all too soon, we will be the predecessors."

– Brown & Magoba, Rivers and Wetlands of Cape Town, 2009).

The Elsieskraal River flows through a densely populated and diverse section of Cape Town's northern suburbs. Its long and winding path starts in the Tygerberg Hills, from three springs on the farm Altydgedacht, as well as winter rainfall.

Its upper course runs south through Durbanville and Bellville. Along its middle section it turns west below Voortrekker Road, past Tygerberg Hospital and the Transet marshalling yards, through Parow, Elsies River and Ruyterwacht, past GrandWest Casino and Goodwood, through Thornton and Maitland. From there it turns south-west, with its lower reaches running through Pinelands, skirting Epping and Langa to the east, before joining the Vygekraal, a tributary of the Black River.

Until the turn of the 20th century, the Elsieskraal was a rural stream within a large riparian wetland system. Its flow was seasonal, and it tended to regularly overflow its banks. Until the mid-20th century, the urban footprint along its middle section was relatively minimal. The suburbs south of Voortrekker Road and the Northern Railway Line (modern day Parow Valley, Beaconvale, Elsies River, Ruyterwacht and Thornton) experienced significant growth from the 1950s onwards. Prior to this, detention dams along the river's length were sufficient flood mitigation measures.

Taking urbanisation, as well as the river's seasonal flooding characteristics, into account – the decision was made to canalise Elsieskraal's middle course. The conventional planning mindset of the time was to view the modification of the river (a not-insignificant engineering feat) as a solution. With a large section of the river, 65 %, canalised, the flooding "problem" in the area was resolved, and space was created for urban growth. In effect, however, this critical decision destabilised the river system, created further (and bigger) problems.

In a natural state, the mid-stream of a river is where it begins to slow down from its steep and fast-flowing upper course; meandering across the landscape before widening out at its lower end where it meets another body of water. A river is a system with various parts in balance; when one part is altered, the system's performance changes.

In the Elsieskraal's case, water which should have flowed slowly through the mid-stream, sinking into the ground over time, is now forced through an artificial channel. During a flood, this straight, impermeable and narrow canal forces huge volumes of water through a large area in a short timeframe, causing increased flooding downstream – a "hydraulic bottleneck" (WRC, 2009: 137). This situation is not only damaging to the surrounding urban environment, but to the river itself, leading to habitat loss

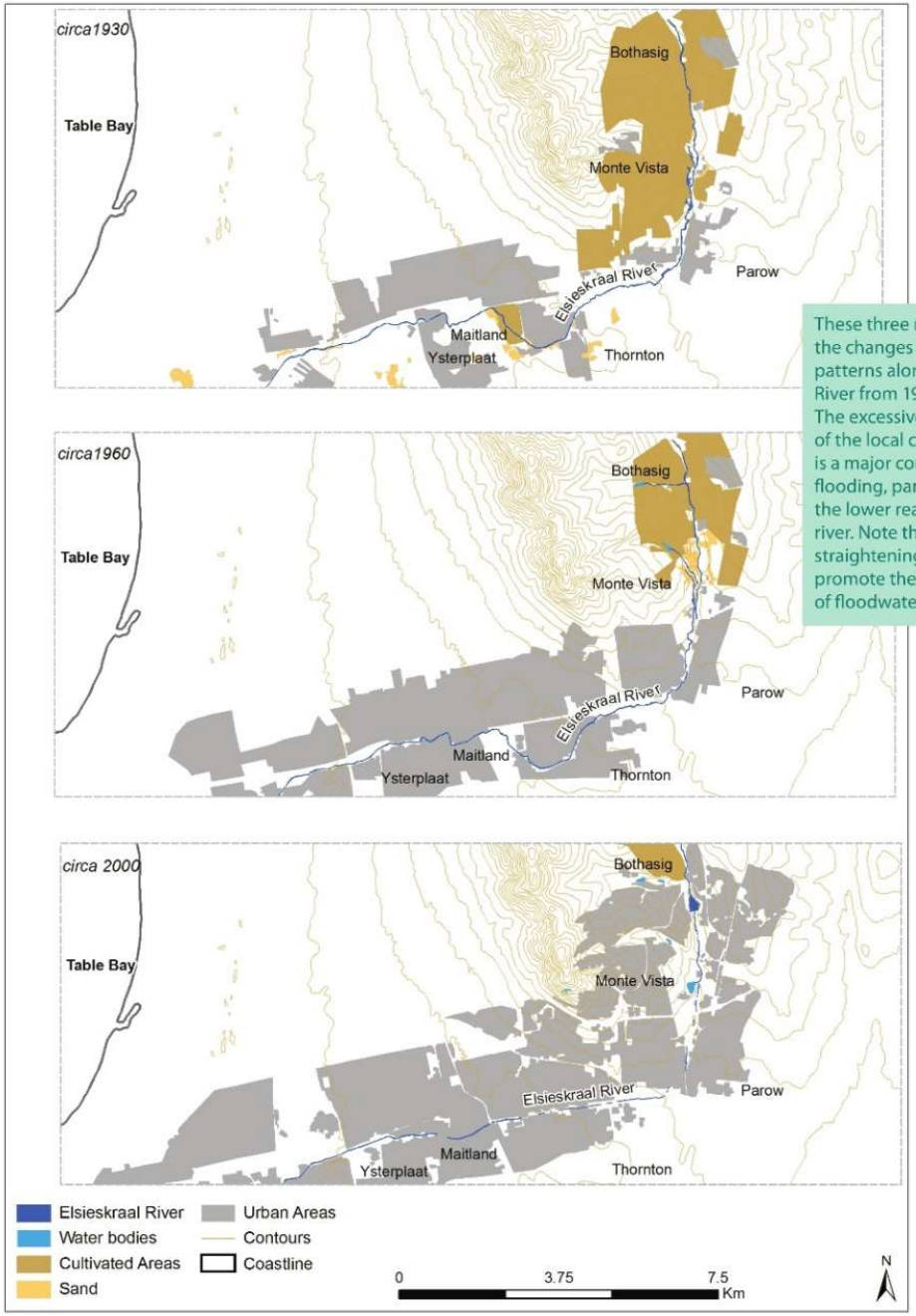


Figure 10 - Elsieskraal, 1930-2000 (WRC, 2009: 139)

and reduced ecosystem services. The ecological health of the lower reach of the Elsieskraal is therefore currently estimated as "poor". (Water Research Commission, 2009: 106).

Brown, & Magoba, R. N. N. (2009). Rivers and wetlands of Cape Town : caring for our rich aquatic heritage. Water Research Commission.

4. CONTEXT

4.1 GLOBAL

4.1.1 SUSTAINABLE DEVELOPMENT

Sustainable development is essentially about achieving a balance between human development and the carrying capacity of the environment. The Brundtland Report of 1986 gave the first formal definition of sustainable development, as that which "meets the needs of the present without compromising the ability of future generations to meet their own needs".

This is a monumental challenge, requiring not only unprecedented international co-operation, but a fundamental shift in mindsets. Regardless of opinion, humanity has no option but to strive to achieve this. As Ban Ki-Moon, a past United Nations Secretary-General, stated: ""We don't have plan B because there is no planet B."

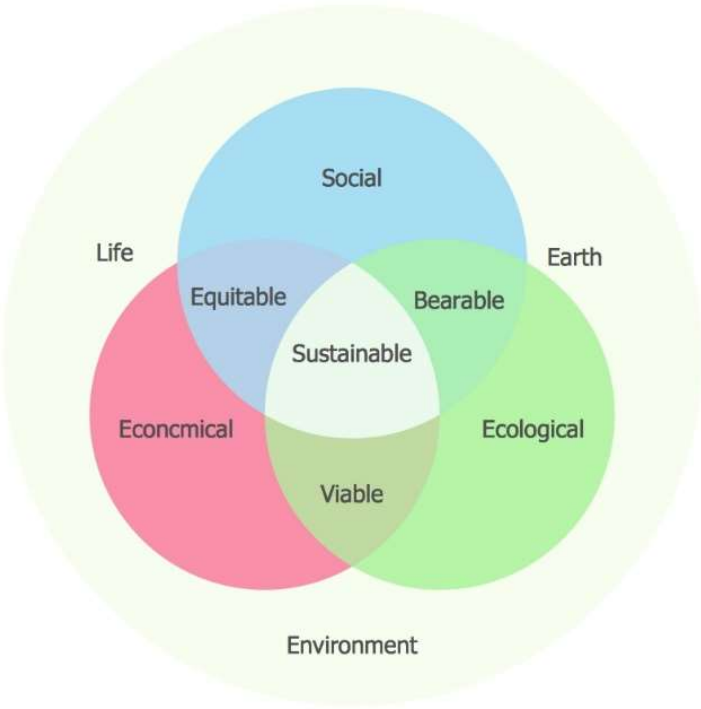


Figure 11 - Sustainable Development Diagram

https://en.wikipedia.org/wiki/Brundtland_Commission

https://en.wikipedia.org/wiki/Sustainable_development#Definition

https://en.wikipedia.org/wiki/Sustainable_Development_Goals#History

4.1.2 AGENDA 2030

The Sustainable Development Goals (SDGs) were established by the United Nations General Assembly in 2015. These are a set of 17 interdependent goals, each with various "targets", to guide global development along a path of sustainability. The intention, given the urgency of the climate crisis, is to achieve the SDGs by 2030. This has been outlined in a resolution now commonly known as "Agenda 2030". This builds on various international summits from the early 1990s, which focused on achieving consensus regarding the development of the post-Cold War world.



Figure 12 - The Sustainable Development Goals

The SDGs aim to address global challenges in a systemic manner, tackling broad issues such as climate change, inequality, poverty, energy, and economic growth. In the context of cities, and Water Sensitive Urban Design especially, achieving SDGs 3 (Well-Being), 9 (Resilient Infrastructure) and 11 (Sustainable Cities and Communities) are high priorities.

South Africa supports the SDGs, recognising that they are "as much about development and transformation as they are about the restoration of the dignity of people around the world" (Stats SA, 2019, p. i).

https://en.wikipedia.org/wiki/Sustainable_Development_Goals

https://sdgs.un.org/goals

http://www.statssa.gov.za/MDG/SDGs_Country_Report_2019_South_Africa.pdf

4.1.3 RECENT EFFORTS

GLOBAL BIODIVERSITY FRAMEWORK

"We are ready for action." – Achim Steiner, UNDP, 2022

The Convention on Biological Diversity (CBD) is a treaty in support of sustainable development which was ratified by 150 countries at the 1992 Rio Conference. The CBD encourages UN member states to create their own biodiversity strategies.

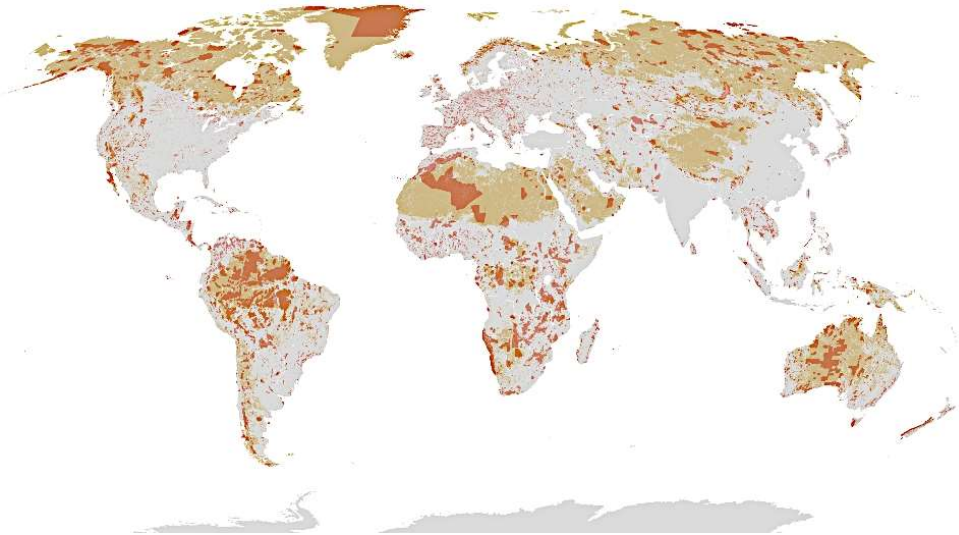


Figure 13 - Protected Areas and Wilderness Around the World

As with other UN initiatives, goals and commitments are discussed at regular international conferences. The latest, COP15 in Montreal, concluded with a landmark agreement called the Global Biodiversity Framework, which outlines 23 new targets. The most eye-catching is the "30 x 30" commitment, which aims to protect 30 % of the planet by 2030.

https://en.wikipedia.org/wiki/Convention_on_Biological_Diversity

https://en.wikipedia.org/wiki/United_Nations_Environment_Programme

https://www.unep.org/news-and-stories/story/cop15-ends-landmark-biodiversity-agreement

THE TREATY OF THE HIGH SEAS

"The land's past is becoming the ocean's present."– Douglas McCauley, UC Santa Barbara ecologist, 2023.

In striving to achieve balance with nature on land, we cannot ignore Earth's largest ecosystem: the ocean.

Most marine plastic pollution - an estimated 80 % - comes from land-based sources. Plastic is carried into natural (rivers, streams) and artificial (drainage) water systems, either as lightweight debris from landfills or litter from the street. From here it finds its way to the seas. The poster child of this problem is the "Great Pacific Garbage Patch", a large gyre (a circulating ocean current) of plastic in the central North Pacific. It covers an area of 1.6 million square kilometres – three times the size of France.

https://education.nationalgeographic.org/resource/great-pacific-garbage-patch/

https://www.wwf.org.uk/updates/how-does-plastic-end-ocean

https://www.nature.org/en-us/what-we-do/our-insights/perspectives/ten-things-high-seas-treaty/

THE FRESHWATER CHALLENGE

"The clearest sign of the damage we have done… to our rivers, lakes and wetlands is the staggering 83 percent collapse in freshwater species populations since 1970." - Stuart Orr, World Wildlife Fund, 2023

Building on the Global Biodiversity Framework, and in support of the UN Decade on Ecosystem Restoration, the "Freshwater Challenge" was announced at the UN Water Conference in New York in March 2023. In line with related commitments set for the end of this decade, it aims to restore 300,000 km of rivers and 350 million hectares of wetlands by 2030 (unep.org). With its specific focus on water-related ecosystems, it supports SDGs 6 (Clean Water and Sanitation) and -14 (Life Below Water). Led by several African and Latin American countries, it is the largest initiative of its kind in history (voanews.com); and aims to "co-create freshwater solutions with indigenous people, local communities, and other stakeholders" (unep.org).



Figure 14 - The Marilao River, Philippines

https://www.voanews.com/a/huge-river-restoration-effort-launched-at-un-water-summit-/7019439.html

https://sdgs.un.org/partnerships/action-support-un-freshwater-challenge

https://wwf.panda.org/discover/our_focus/freshwater_practice/freshwater_news/?7942466%2FLaunch-of-Freshwater-Challenge=

4.2 NATIONAL

4.2.1 GREEN INEQUALITY

Inequality is spatially entrenched in South Africa. This imbalance goes beyond disparities in urban form to include access to nature. The uneven distribution of green infrastructure across income- and racial geographies is often referred to as "green apartheid". This disparity cruelly deprives many people of the social and ecological benefits that urban greenery provides, such as physical and psychological wellbeing, social cohesion, and a sense of place (Venter, 2020, p. 1). This is evident in the public realm (streets, parks) as well as private areas such as gardens (Venter, 2020, p. 3).

The impact that access to nature (or lack thereof) has on communities, forms part of the larger debate of environmental justice. This includes vital and interrelated aspects such as food security, exposure to pollution, climate change resilience (e.g. exposure to flooding) and livelihoods. The importance of addressing the social- and environmental impacts of growth is reflected in the formation of organisations such as Earthlife Africa.



Figure 15 - Inequality: Spatially Entrenched

https://time.com/5581483/time-cover-south-africa/

https://www.archdaily.com/961483/divided-urban-inequality-in-south-africa

https://theconversation.com/we-mapped-green-spaces-in-south-africa-and-found-a-legacy-of-apartheid-143036

https://theconversation.com/how-the-environmental-justice-movement-is-gathering-momentum-in-south-africa-49819

https://earthlife.org.za/about-us/#vision-and-mission

4.3 REGIONAL

4.3.1 BIOREGIONALISM

"Too often in South Africa conservation and development are seen as opposing or irreconcilable goals." (Cape Town Bioregional Plan, 2015, p. 14)

A bioregion is an area defined by both natural (watershed boundaries, flora and fauna, climate) and human elements (local populations, knowledge and culture). Bioregionalism therefore attempts to understand places, and plan for their future growth, according to a "terrain of consciousness" rather than administrative boundaries.



Figure 16 - City of Cape Town Bioregional Plan

Cape Town's Bioregional Plan (2015) identifies the boundaries of its own distinct bioregion. This includes terrestrial and marine areas as interdependent ecosystems. Planning for this area requires the inclusion of three adjacent and overlapping biosphere reserves: the Cape Winelands, the Cape West Coast, and the Kogelberg (Cape Town Bioregional Plan, 2015, p. 22).

Cape Town's unique biodiversity has experienced extreme pressure during the past two decades due to immigration and urban sprawl (Cape Town Bioregional Plan, 2015, p. 42). A planning tool to address further biodiversity loss is the identification of Critical Biodiversity Areas (Skowno, 2019, p. 203).

https://en.wikipedia.org/wiki/Bioregionalism

City of Cape Town. (2015). Bioregional Plan.

Skowno, A. L. (2019). National Biodiversity Assessment 2018 : the status of South Africa's ecosystems and biodiversity : synthesis report. South African National Biodiversity Institute.

https://resource.capetown.gov.za/documentcentre/Documents/Bylaws%20and%20policies/Bioregional_Plan_CCT_FINAL_2015-08-19_policy_number_44854.pdf

4.3.2 THE MAB PROGRAM

The Man and the Biosphere Reserve Programme (MAB) is an international initiative, under the auspices of UNESCO, that aims to conserve our shared natural resources and ecosystems. A global network of management areas called "biosphere reserves" have been identified, with 564 listed (to date) since 1977. These are protected areas where the goals of sustainable development are encouraged and managed, by combing conservation with local economic growth.

Biosphere reserves serve three functions: conservation, development and logistics. (http://portal.unesco.org) The MAB Programme is therefore an ongoing effort to protect the natural and cultural heritage of the planet, and to demonstrate a harmonious relationship between man and nature.

While they form a worldwide network, biosphere reserves are nominated by national governments and remain under the jurisdiction of each sovereign state where they are situated. Their management takes place on the national and (especially) regional level. The number of biosphere reserves in Africa (spread across 22 countries) currently totals 52, of which six are in South Africa, namely: Kogelberg (1998), the Cape West Coast (2000), Waterberg (2001), Kruger to Canyons (2001), the Cape Winelands (2007), and Vhembe (2009).

4.4 METROPOLITAN

4.4.1 SPATIAL CONSOLIDATION

Cape Town's approach to the management of urban growth, in the context of a poor "global economic forecast" (MSDF, 2018, p. 20) is consolidation, or "connected inward growth" (MSDF, 2018, p. 23). From a spatial perspective, emphasis is placed on nodes, linked by transit-oriented corridors. This will require investment in infrastructure, as well as the optimal use of vacant and under-utilised land to provide a range of housing types, as well as mixed-use development.

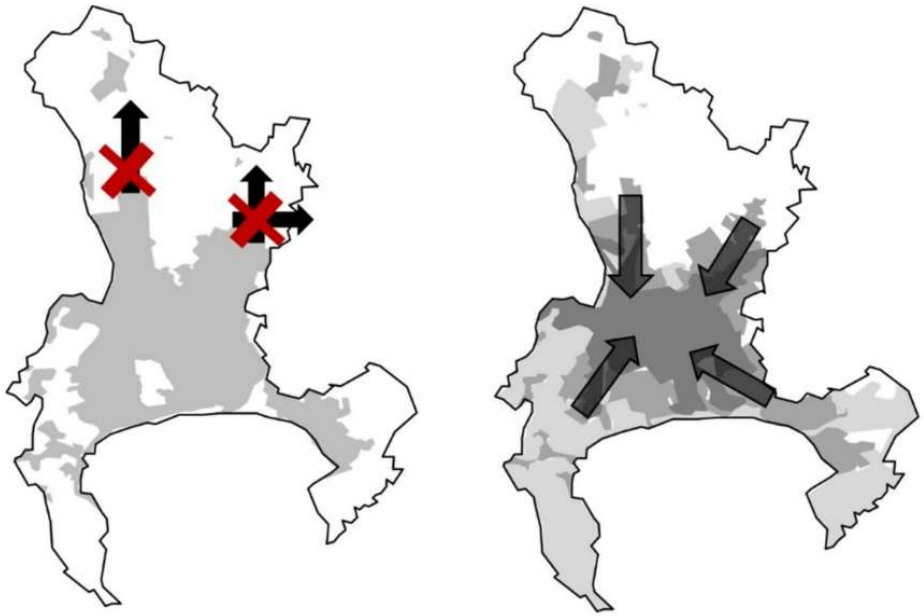


Figure 17 - Spatial Consolidation (MSDF, 2018)

City of Cape Town (2018) Municipal Spatial Development Framework

SPATIAL TRANSFORMATION AREAS

To give practical effect to the City's inward growth / consolidation strategy, the MSDF (2022) identifies four Spatial Transformation Areas (STAs):

1. Urban inner core
2. Incremental growth and consolidation
3. Discouraged growth
4. Critical natural assets

The majority of the Elsieskraal River system flows through the "Urban Inner Core". This area, also referred to as the "blue turtle" (MSDF 2022 Vol 1 p.12) due to its outline on plan, includes most of central Cape Town's existing nodes and infrastructure. The focus for this STA, in terms of attracting public- and private investment, is land- and building optimisation, and infrastructure capacity. The objective is to transform, integrate and intensify its spatial form.

4.4.2 RESILIENCE

"Cities without adequate water resources should not grow…" (Duany, 2010, p. 1)

The extreme drought of 2015-2018 almost gave Cape Town the dubious distinction of being the first world city to run out of water. As we shift from one crisis to another, "Day Zero" might seem like a distant memory. We should never forget that South Africa is a water scarce country; and must design future resilience into the urban system. Droughts, being cyclical, will need to be dealt with again. As a coastal city, Cape Town must also prepare for a potential rise in sea levels, if we fail to meet our global carbon emission targets.

The manner in which the city grows – both formally and informally - must not compromise its "ability to respond to a range of shocks and stresses associated with climate change" (MSDF, 2018, p. x).

Duany, A., Speck, J., & Lydon, M. (2010). The smart growth manual. New York: McGraw-Hill.

City of Cape Town (2018) Municipal Spatial Development Framework

The MSDF outlines three spatial strategies, informed by IDP principles and aligned with the Spatial Planning and Land Use Management Act (SPLUMA) and the SDGs. Strategy 2 ("Urban Development, Food Security and Environmental Protection") focuses on urban resilience. Substrategy 2.4 aims to manage the impact of development on natural resources, with an emphasis on "green infrastructure and critical biodiversity networks". Each strategy has certain imperatives; in this case (inter alia):

1. Biodiversity
2. Surface- and groundwater resources
3. Optimising underutilised land
4. Equitable access to green open space networks
5. Green infrastructure

(MDSF, 2022, Vol 1, p.71)

In addition to these spatial strategies, certain development directives (MDSF, 2022, Vol 1, p.67), in tandem with the City's Environmental Strategy (2017) and other policies, help to protect Cape Town's "biophysical, socio-cultural and aesthetic assets" (MDSF, 2022, Vol 1, p.67). Any development process needs to consider certain policy aspects. For example, where an ecological corridor such as a river - and its associated floodplains and wetlands - is concerned, the City's Bioregional Plan provides guidance as to the system's environmental integrity (MDSF, 2022, Vol 1, p.79). The Green Infrastructure Network (GINet), which includes "open space systems and ecological corridors" (MDSF, 2022, Vol 1, p.29) is also an important informant.

4.4.3 PUBLIC REALM

"Cities that are unwelcoming for some are unwelcoming for all…" – Rashiq Fataar, Future Cape Town, 2018

Cape Town's public realm remains exclusionary for many. Public space within informal settlements is either absent or poorly defined, dirty and unsafe. In more developed areas, public space often suffers from a lack of intensity – typical of modernist planning's "conscious de-emphasis on the structural and spatial role of the street for walking, playing, street-based trading, and social interaction" (Dewar, 2015, p. 232).



Figure 18 - Public Realm: Different Realities

The vision of inclusivity is promoted in various legislative and policy spheres, from the international (SDG 11), national (the South African Constitution) to the city scale (Cape Town's Integrated Development Plan). If this does not also manifest itself spatially in the public realm, then a big piece of the puzzle is missing, and true social cohesion will be difficult to achieve.

http://ourfuturecities.co/2018/07/10-ideas-to-transform-the-future-of-public-spaces/

Dewar, D. (2015). A Transformational Path for Cape Town, South Africa. In F. Wagner, R. Mahayni & A. Piller (Eds.), Transforming Distressed Global Communities: Making Inclusive, Safe, Resilient, and Sustainable Cities (pp. 231-244).

4.4.4 LOCALISING THE SDGs

"The sustainable development goals and targets are used as [the] foundation for the policy strategies and implementation intent and are aligned with the City's IDP objectives." – Cape Town MSDF Vol.1 (2023), p.68

The success of the Sustainable Development Goals depends on their implementation on the ground. Local governments need to ensure that the SDGs align with their own partnerships, initiatives and (most importantly) policy. In Cape Town's case, the localisation of the SDGs is outlined in its latest Integrated Development Plan (IDP) and Municipal Spatial Development Framework (MSDF) – which were both renewed in 2022.

The MSDF outlines three main spatial strategies:

1. Plan for economic growth and improve access to economic opportunities.
2. Manage urban growth, and create a balance between urban development, food security and environmental protection.
3. Building an inclusive, integrated, vibrant and healthy city.

The alignment of these strategies to the SDGs is demonstrated in statement tables, for example:

ALIGNMENT OF SDG GOALS AND TARGETS WITH MSDF STRATEGY 1 AND IDP OBJECTIVES

SPATIAL STRATEGY 1: PLAN FOR INCLUSIVE ECONOMIC GROWTH AND IMPROVE ACCESS TO ECONOMIC OPPORTUNITIES

Substrategy 1.1: Prioritise inclusive economic growth

Substrategy 1.2: Integrate land use, economic activities and transport planning that support the sustainable operation of the public transport network

Associated SDGs	SDG targets	Other	CCT IDP (2022-2027) objectives
SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.	**Target 8.3:** Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalisation and growth of micro-, small- and medium-sized enterprises, including through access to financial services.	This goal speaks to economic growth and job creation. The MSDF needs to enable faster economic growth and job creation in locations that help address Cape Town's inequality and apartheid legacy.	**Objective 1:** Increased jobs and investment in Cape Town. **Objective 4:** Well-managed and modernised infrastructure to support economic growth.

Figure 19 - Alignment of SDGs to the MSDF

This intent is also demonstrated in the IDP:

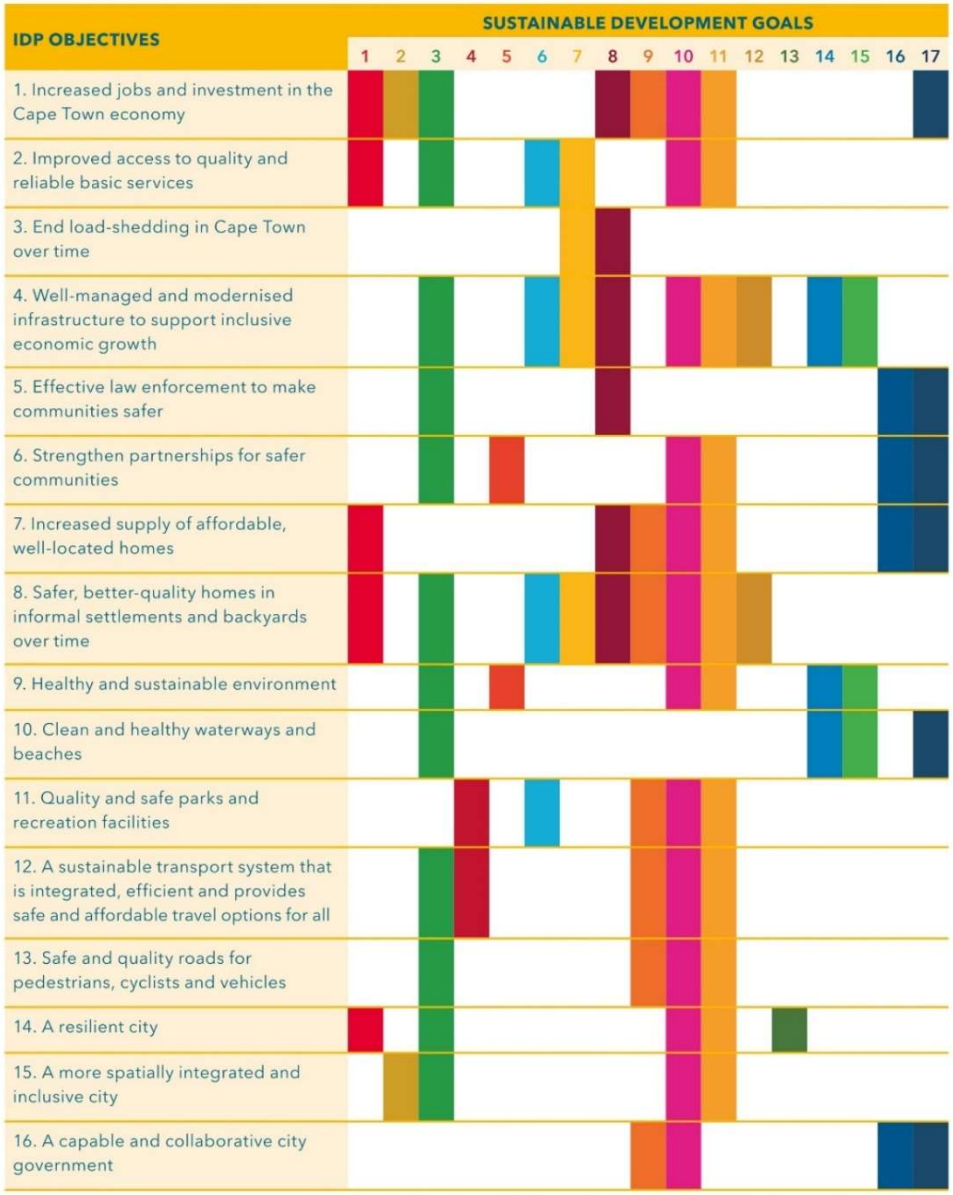


Figure 20 - Alignment of SDGs to the IDP

https://resource.capetown.gov.za/documentcentre/Documents/City%20strategies%2c%20plans%20and%20frameworks/IDP_2022-2027.pdf

https://resource.capetown.gov.za/documentcentre/Documents/City%20strategies%2c%20plans%20and%20frameworks/MSDF_Vol_I_Ch1-6_Tech_Suppl_A.pdf

https://wuf.unhabitat.org/event/localizing-sdgs

https://www.local2030.org/about-us.php

https://www.mistraurbanfutures.org/sites/mistraurbanfutures.org/files/cape_town-_final_city_report-_sdgs_project-_nov_2019-_croese_0.pdf

4.5 DISTRICT

4.5.1 TYGERBERG SDF

In terms of infrastructure and land-use, the Tygerberg SDF describes the district as:

"… defined by an integrated approach to mixed-use development… where targeted densification and intensification are focused… along high accessibility routes and nodes… in close proximity to industrial- related land uses…"

In addition, Tygerberg has a significant open space system (particularly its river corridors, as well as various parks and nature reserves), and a high availability of social services.

Cape Town (2023) Tygerberg District Plan Executive Summary – p.5

OBJECTIVES

Cape Town is divided into eight municipal planning districts. District Spatial Development Frameworks (DSDFs) provide detailed maps and guidelines for the implementation of MSDF objectives at this "second" scale.

Although the Elsieskraal River - as a large natural system - traverses human boundaries; the precincts that forms part of this study (mainly Parow, Elsies River and Ruyterwacht) fall within a specific district. The Tygerberg District, and its associated planning frameworks, is therefore an important informant for this study.

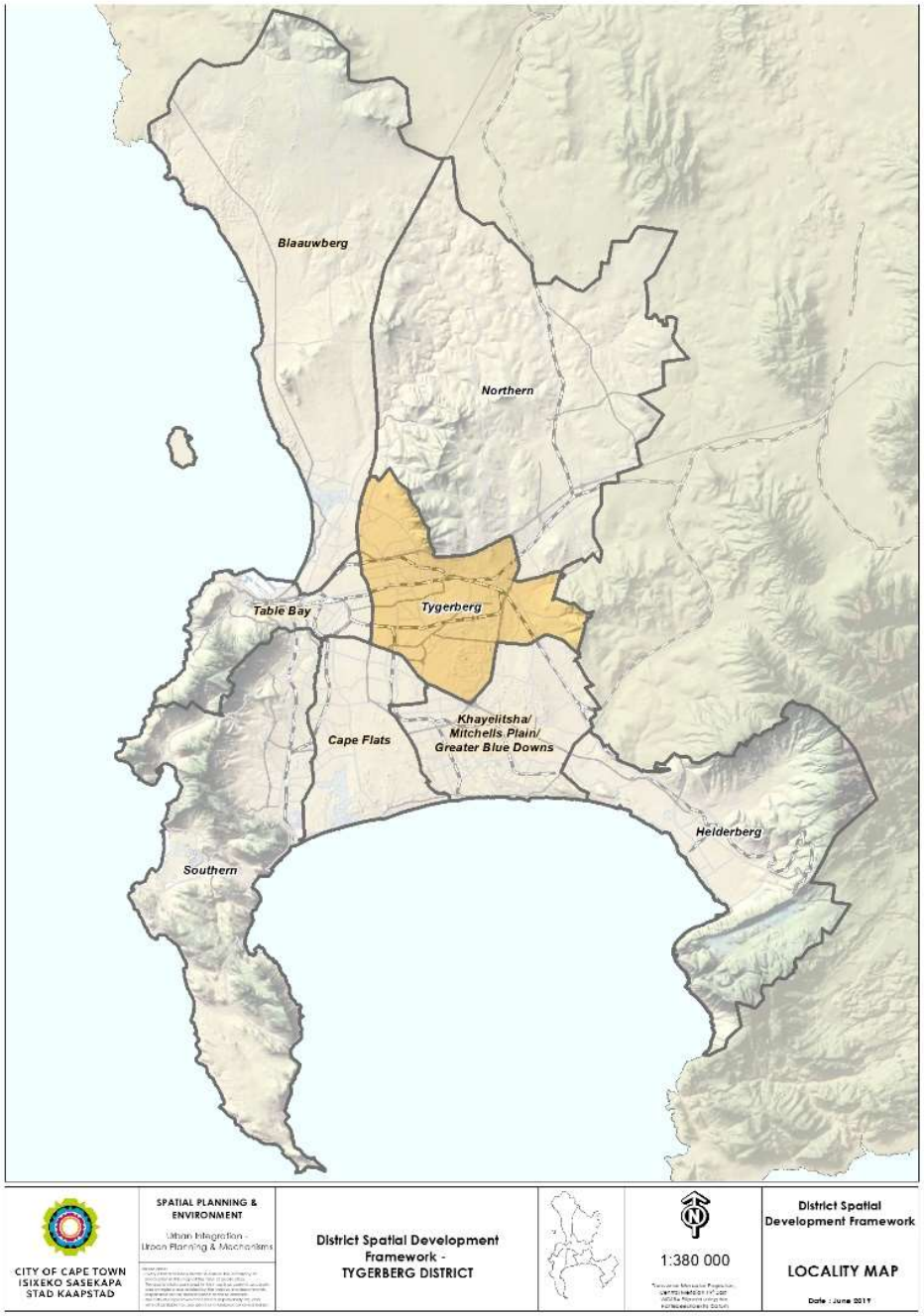


Figure 21 - Tygerberg District: Metropolitan Context

The Tygerberg SDF highlights various key development interventions. The following are of particular relevance to the study area:

1. Protection of river corridors: This comprises environmental factors - such as flood control and replenishing underground water sources - as well as the "human" aspects like access to public space.
2. Voortrekker Road Corridor (VRC): Intensification- and mix of land use.
3. Elsies River Industrial: Support for mixed-use development to boost economic growth.
4. Rail stations: The upgrading of Parow Station.

Cape Town (2023) Tygerberg District Plan Executive Summary – p.6

The SDF contains detailed District and Subdistrict maps, which indicate various existing conditions, as well as the "desired end-state" for each area. This includes spatial planning categories (for example, Biodiversity, Structuring Open Space, Waterbodies, areas identified for Mixed Use Intensification, Existing- vs New Development), transport networks (road, rail, NMT, freight), conceptual designations (corridors, nodes, clusters) and development edges (both administrative, such as metropolitan boundaries, and natural edges like as floodlines). (Tygerberg DSF p.11)

The integrated nature of these planning frameworks reflects the interconnectedness of these systems and sub-systems on the ground. Ideally, interactions between these "social, economic and ecological" spheres will yield the best results in terms of spatial development (Tygerberg DSF p.11).

A legible system of nodes and corridors is the foundation of the MSDF's spatial strategy. This in turn supports the process of land use intensification and Transit Oriented Development (TOD). (MDSF Vol 1 p.47)

Nodes are identified at three scales: Metropolitan, District and Local. Metropolitan nodes are highly accessible "spatial anchor points" (MDSF Vol 1 p.48), which support a clustering of high intensity activity. Cape Town has five: the CBD, Bellville, Claremont, Philippi and Somerset West. One of these, the Bellville CBD, falls within the Tygerberg district.

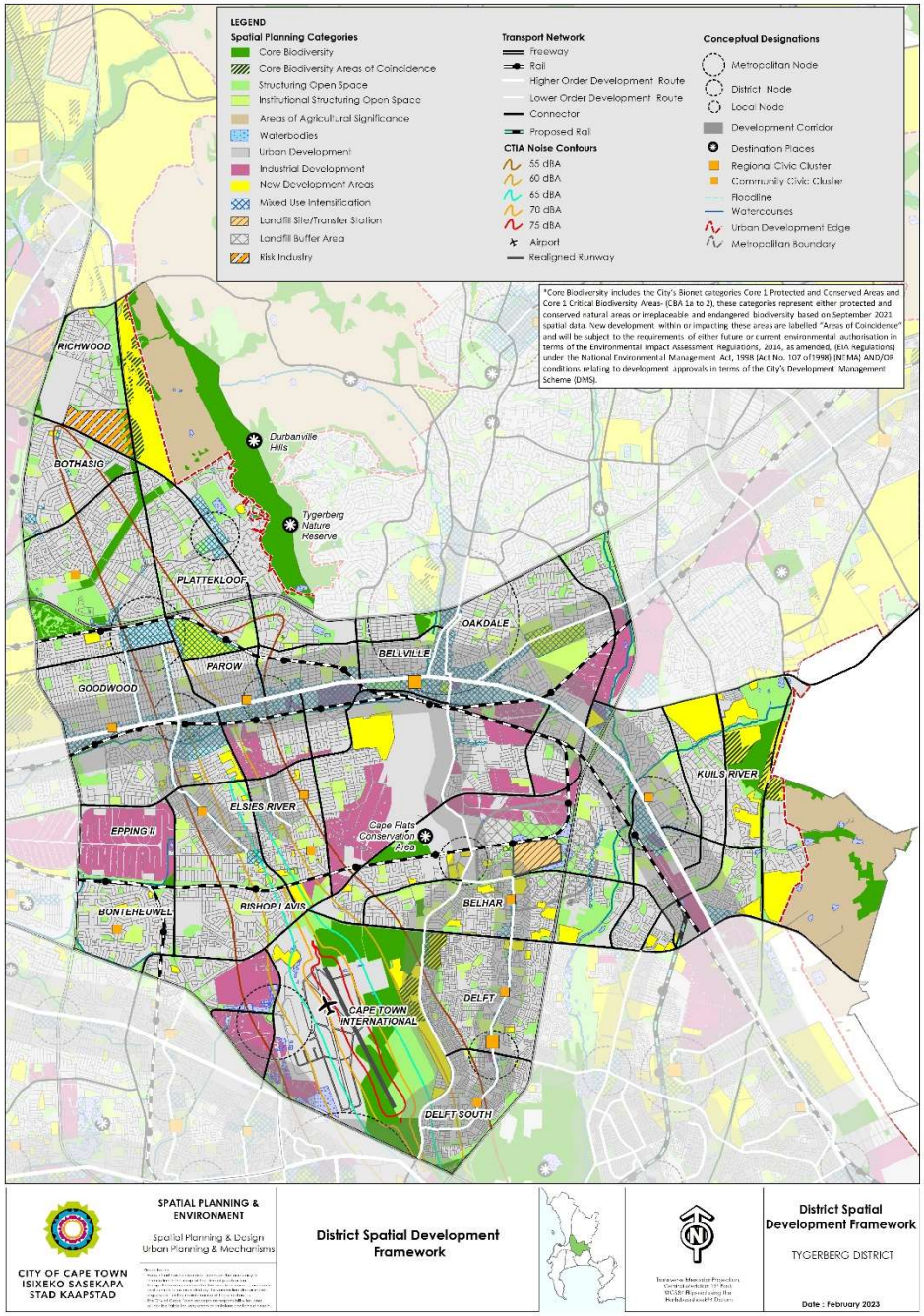


Figure 22 - Tygerberg District SDF

District nodes, as the second order, are more numerous. Examples within Tygerberg are N1 City, Cape Town International Airport and Kuilsriver (Tygerberg DSF p.23). These nodes are smaller, but still serve a vital purpose in terms of density and mix of activity. The Transit-Accessible Precincts (TAPs) concept finds expression at this scale: areas within a 500 metre walking distance of rail- and BRT stations (MDSF Vol 1 p.49). The MSDF notes, very importantly, that new TAPs can be promoted in strategic areas "to incentivise development" (MDSF Vol 1 p.50).

LOCAL NODES

The precinct adjacent to the intersection of Voortrekker- and Halt Road is identified as a "Local Node" in the Tygerberg District map (Figure 8, p.29). This includes a higher- and lower order development route, a railway line and station (Elsies), a watercourse (the Elsieskraal River), and a "Mixed Use Intensification" area that includes the industrial area, as well as the linear wedge of land between Voortrekker Road and the railway (running east past Bellville's CBD, up to the intersection with the Old Paarl Road).

In order to contribute to its metropolitan context, the district has identified various Spatial Objectives:

TARGETED INTENSIFICATION

"Employment-generating activities, retail development, social facilities, public institutions and intensive mixed-use and residential development should be encouraged…"

CONSERVING THREATENED HABITATS

"… the protection and enhancement of the Elsieskraal and Kuils River systems should be promoted as it has multifunctional roles as natural assets as well as passive recreation spaces in the district…"

HOUSING AND JOB OPPORTUNITIES

"Focus should be placed on reviving/redeveloping areas such as Elsies River industrial where economic activity has deteriorated over the past years to cater for a wider mix and range of economic activity. Opportunities for both formal and informal economic activity should be created."

MULTI-MODAL TRANSPORT

"The re-establishment of the deteriorated rail system is critical"

Tygerberg District Plan Vol 2 – 2. Spatial Objectives – 2.4 Role of the District – p.33-34

4.5.2 VOORTREKKER ROAD CORRIDOR

METROPOLITAN ROLE

To give effect to its consolidated growth agenda, Cape Town has identified three corridor-scale Integration Zones (IZs) in the MSDF (2018, p. 250): Metro South-East, Blue Downs and Voortrekker Road. Priority is given to projects within these zones that will further the City's transformation objectives.



Figure 23 - Voortrekker Road, 1971

http://www.cape-town.photos/image/1421-voortrekker-road-c1971/



Figure 24 - Voortrekker Road Today (Image Property of Author)

The Voortrekker Road Corridor (VRC) is included due to its "great potential to grow and intensify further" (MSDF, 2018, p. 244). This is based on a few factors:

Firstly, the VRC serves as a vital spatial link between two major nodes - the Cape Town CBD in the west, and Bellville CBD in the east (MSDF, 2018, p. 244).

Secondly, it has an existing transport infrastructure network (rail and road).

Thirdly, the corridor contains a mix of land uses such as business (especially in Bellville, Parow, Goodwood, Maitland and Salt River), regional healthcare, education and residential (MSDF, 2018, p. 250). Along certain sections of the VRC, street-level commercial use is combined with two to four storeys of residential on the upper levels (MSDF, 2018, p. 244). This is an urban building typology that lends itself to successful urbanism at the scale of a "main street".

The Bellville CBD has been identified as an "underperforming inner city node" with potential for residential intensification. Creating the conditions for urban renewal in this specific context will require a variety of funding models, both public and private (MSDF, 2018, p. 228).

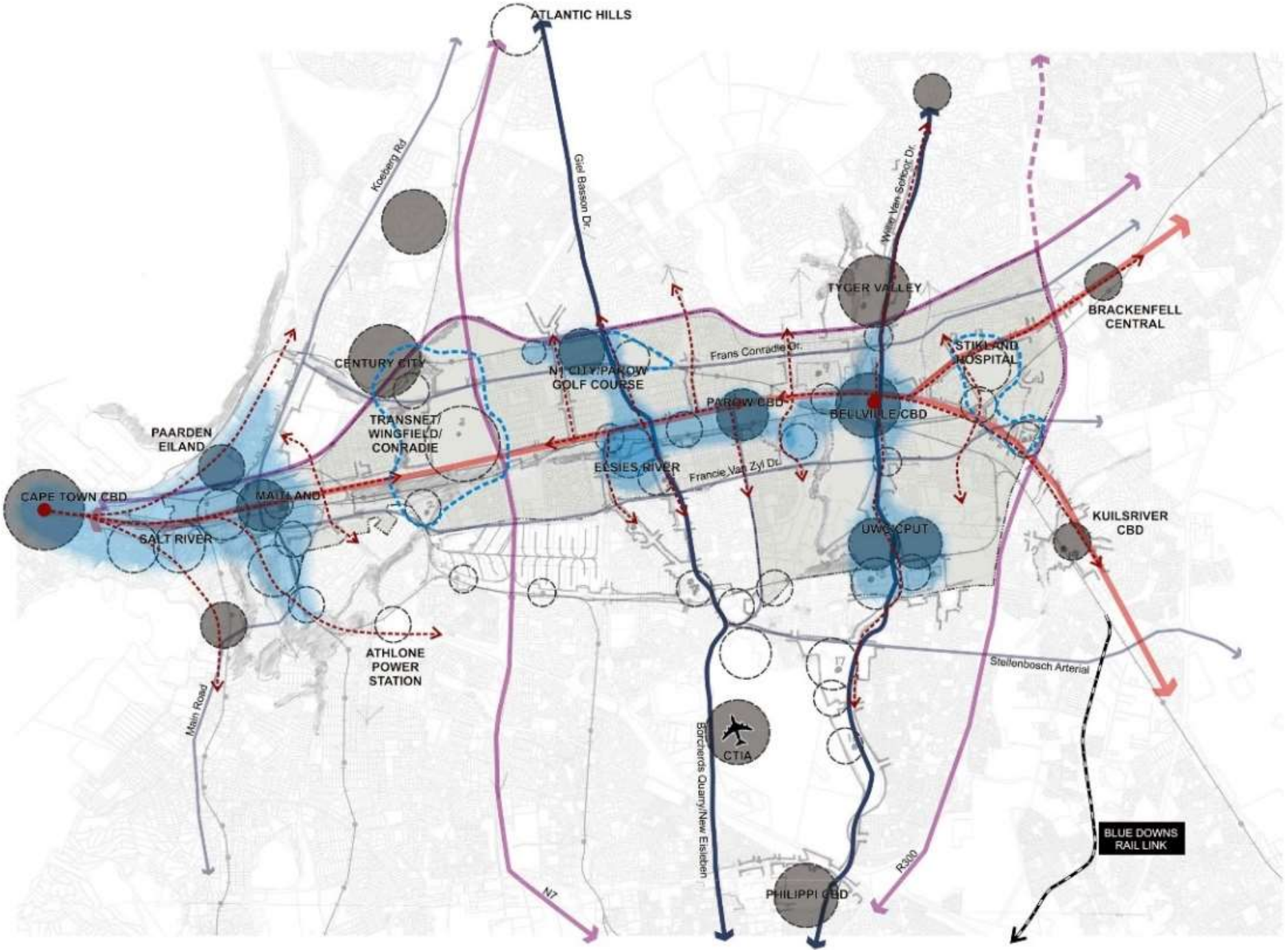


Figure 25 - Voortrekker Road Spatial Structure (MSDF, 2018)

TRENDS

A number of property trends over the past decade should be taken into consideration in the planning of urban renewal in the VRC.

These include a "relative decline in business conditions" in certain areas due to the development of Century City as a major suburban retail node (Uppink, 2016, p. 8), vacancies in industrial land uses, the development of vibrant "retail driven hotspots located in areas of high footfall by consumers who are dependent of public transport", and an increase in demand for higher density housing (Uppink, 2016, p. 27).

In terms of urban quality, a general sense of urban decay (crime, congestion, physical decline of buildings) has been noted (Uppink, 2016, p. 27).

5. THEORETICAL FRAMEWORK

5.1 UNDERSTANDING THE CITY

5.1.1 LYNCH: THE IMAGE OF THE CITY

"An EDGE may be more than simply a dominant barrier if some visual or motion PENETRATION is allowed through it... It then becomes a SEAM rather than a BARRIER... " (Lynch, 1960: 100)

Kevin Lynch's "The Image of the City" had a seminal influence on how we understand cities. He studied three American cities, Boston, Jersey City and Los Angeles, to gauge inhabitant's perception of their surroundings, what he called "imageability" - "...that shape, color, or arrangement which facilitates the making of vividly identified, powerfully structured, highly useful mental images of the environment."



Figure 26 - Understanding the City

https://ecemekren.wordpress.com/2019/10/06/kevin-lynch-the-image-of-the-city/

Lynch asked his respondents to convey their image of the city through sketches and illustrations, so as to determine the local physical elements that stood out strongly in their minds. From here he identified five categories:

1. PATHS

"channels along which the observer...moves. They may be streets, walkways, transit lines, canals, railroads. For many people, these are the predominant elements in their image."

2. EDGES

"...boundaries between two phases, linear breaks in continuity: shores, railroad cuts, edges of development, walls."

3. DISTRICTS

"...medium-to-large sections of the city, conceived of as having two-dimensional extent, which the observer mentally enters 'inside of', and which are recognizable as having 'some common, identifying character'."

4. NODES

"...points, the strategic spots in a city into which an observer can enter... primarily junctions, places of a break in transportation, a crossing or convergence of paths... or simply concentrations... of some physical character."

5. LANDMARKS

"...external... a simply defined physical object: building, sign, store, or mountain. Their use involves the singling out of one element from a host of possibilities."

Lynch, K. 1988. "The Image of the City". MIT Press.

5.1.2 NORBERG-SCHULZ: MODES OF DWELLING

The Norwegian architectural theorist Christian Norberg-Schulz identifies four "modes" of dwelling in the "inhabited landscape": the settlement, urban space, institution, and house. The way people exist on the earth is determined once they *settle* – it is therefore the first mode of dwelling.

SETTLEMENT:

This is a broad definition, encompassing all areas permanently inhabited by humans – from the rural hamlet to the modern metropolis. Norberg-Schulz sees a settlement, firstly, as a point of arrival in a landscape. There is a relationship between what is currently experienced and what is left behind. Despite the enormity of many cities, this feeling is still notable as the moment when a settlement "announces its presence". Unfortunately, as cities grow, these regional identities become fragmented.

Secondly, a settlement should have a figural quality in relation to the landscape. It serves as a goal. Norberg-Schulz states that a "*group of buildings only appear as a figure in the landscape if it is relatively dense and has a clear delimitation*" (1993: 31). Most historical settlements possess this figural quality that the author refers to. Contemporary cities generally lack this quality, due to urban sprawl. It becomes difficult to orientate oneself without prominent points of reference.



Figure 27 - Figural Quality: Stellenbosch (Property of Author)

Once the act of settling has occurred successfully, humans can proceed to the finer modes of dwelling which "*concern basic human togetherness and a place of encounter where humans exchange products, ideas and sentiments come into play*" (Norberg-Schulz 1993: 31)

URBAN SPACE

Urban space consists primarily of streets and squares. These have been the basic components of urban space for centuries and play a vital role in the life of the city. It is here that "collective life occurs" (Norberg-Schulz 1993: 31). The urbanist Roger Trancik refers these spaces as "outdoor rooms" (Trancik 1986: 8). Humans responds naturally to the comforting enclosure offered by rooms, so it is fitting to think of urban space as outdoor rooms – as consisting of "floor, wall and ceiling" (Norberg-Schulz cited in Nesbitt 1996: 419).



Figure 28 - "Outdoor Room": Barcelona (Property of Author)

Urban space is created by enclosure. This is a critical principle that was widely implemented prior to modernist city planning. The settlement was regarded as a dense collection of buildings that responded to urban patterns and

hierarchies established over long time frames. Buildings expressed certain functions and values appropriately, and related open spaces in-between responded to the human scale, were psychologically comforting, and allowed for a "*milieu of possibilities*" (Norberg-Schulz 1993: 31).

INSTITUTION

An institutional (i.e. public) building is the third "mode of dwelling". Whereas urban space provides opportunities for informal interaction between the inhabitants of a place, institutions are where common interests and values are agreed upon and experienced.



Figure 29 - Santa Maria del Fiore, Florence: Institutional

https://www.italiandualcitizenship.net/the-history-of-the-cathedral-of-santa-maria-del-fiore-il-duomo/

Institutional buildings play a significant role in the life of a city and should therefore be afforded a higher "status" than other types of dwellings. Firstly, an institution's location is vital in ensuring that it is visibly prominent and accessible to the public. In an historic settlement for example, religious buildings were always the most prominent (and expensive). They were the tallest, opened out onto a large public space, and often formed a focal point along a major axis.

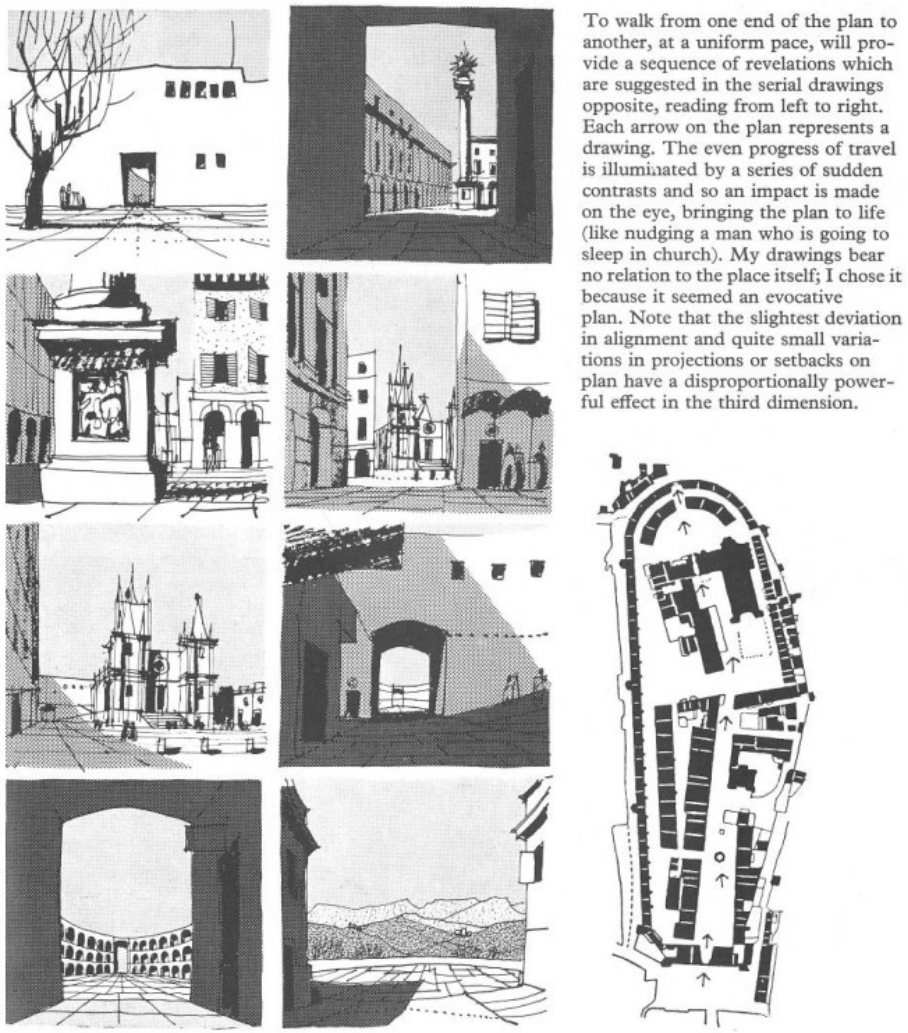
HOUSE

The fourth mode of dwelling is the house. This is the confirmation of human identity, offering security and shelter. The way that houses are grouped together has changed over time. Historically, houses were built close together, often adjoining one another. Their grouping and architectural treatment had a different logic to that of an institutional building for example.

5.1.3 CULLEN: TOWNSCAPE

Gordon Cullen's *Concise Townscape* was released in 1961, the same year as another seminal urban design text of the era, Jane Jacob's *The Death and Life of Great American Cities*.

The term "townscape" can be traced back to Thomas Sharp, an early critic of the Garden City movement – which he described as "romantic nature-worship destroying the object of its adoration". In *The Anatomy of the Village* (1946), he analysed historic English towns as sensitive extensions of the landscape (hence the name townscape). Cullen, however, was the leading figure in the development of these ideas.



To walk from one end of the plan to another, at a uniform pace, will provide a sequence of revelations which are suggested in the serial drawings opposite, reading from left to right. Each arrow on the plan represents a drawing. The even progress of travel is illuminated by a series of sudden contrasts and so an impact is made on the eye, bringing the plan to life (like nudging a man who is going to sleep in church). My drawings bear no relation to the place itself; I chose it because it seemed an evocative plan. Note that the slightest deviation in alignment and quite small variations in projections or setbacks on plan have a disproportionally powerful effect in the third dimension.

Figure 30 - "Perspective Sequence of Townscape" (Trancik 1986: 122)

Townscape explores the individual's experience of the environment as the starting point for design. The concept of *serial vision* stresses movement through space, revealed as a "sequence of revelations", as the primary test of urban quality – both emotional and aesthetic.

https://www.tandfonline.com/doi/full/10.1080/02665430802533043

https://www.udg.org.uk/sites/default/files/publications/52%20OCTOBER%201994%20-%20ISSUE%2052%201-7_0.pdf

5.2 URBAN MORPHOLOGY

5.2.1 TRANCIK: FINDING LOST SPACE

FIGURE-GROUND THEORY

Roger Trancik's "Figure-Ground Theory" is a way of understanding the relationship between "the relative land coverage of buildings as solid mass (figure) to open voids (ground)" (Trancik 1986: 97).

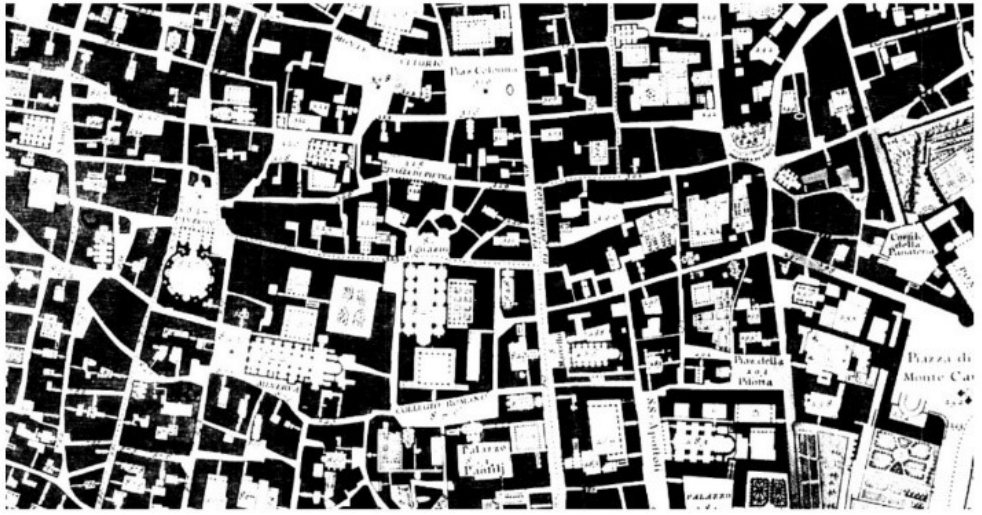


Figure 31 - Nolli's Map of Rome (Trancik 1986: 99)

Trancik cites Giambattista Nolli's map of Rome (1748) as a perfect illustration of the Figure-Ground principle:

"… *the Nolli Map reveals the city as a clearly defined system of solids and voids. The building coverage is denser than the exterior space, thereby giving shape to the public openings – in other words, creating positive voids, or "space-as-object*". (Trancik 1986: 98)

What the Figure-Ground theory shows is the urban fabric or -pattern, of a settlement. Open spaces are "carved out of" the buildings (the solids).

URBAN SOLIDS

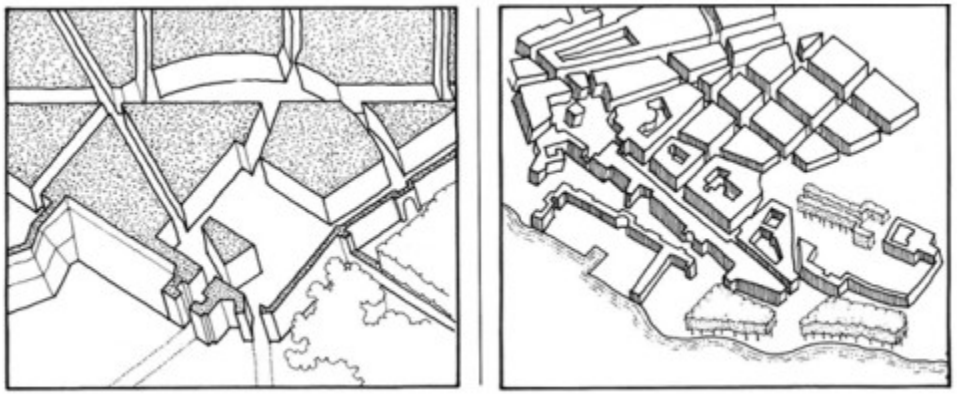


Figure 32 - Urban Solids (Trancik 1986: 102)

MONUMENTS OR INSTITUTIONS

"serve as centrepieces in the city fabric" (Trancik 1986: 101)

BLOCKS

"*According to Leon Krier, the size, pattern, and orientation of the urban block is the most important element in the composition of public spaces*." (Trancik 1986: 103)

DIRECTIONAL OR EDGE-DEFINING BUILDINGS

These are buildings that are "*generally non-repetitive, specialised forms, often linear in configuration... intentionally designed to violate the predominant field* [urban fabric] *and adjusted to face a boulevard, circle, or square, or to establish the edge of a district. They can also serve to surround and set off a monument, to define axial lines of sight, and to frame important places.*" (Trancik 1986: 103)



Figure 3-1. Piazza del Campo, Siena, Italy.
One of the most effective urban spaces in existence, the Piazza del Campo in Siena offers a number of important lessons to the urban designer. Much of its strength as a space stems from the contrast between the dense mass of surrounding buildings and the open piazza. The campanile of the Palazzo Publico serves as a vertical focal point. As early as 1262 a city ordinance governing the height and facades of buildings facing the square was effected in recognition of the role a consistent wall plays in defining the character of urban space. (From Benevolo, History of the City. *Courtesy: MIT Press)*

Figure 33 - Solids and Voids: Piazza del Campo, Siena (Trancik 1986: 62)

URBAN VOIDS

Urban voids need to be "*carved out of and pushed into the solids to provide functional and visual continuities, thereby creating an integrated, humane urban environment in which buildings and exterior space are inextricably fused*" (Trancik 1985: 103).

FIVE TYPES OF URBAN VOIDS: (Trancik 1985: 103)

ENTRY FOYER SPACE

"establishes the important transition... from personal domain to common territory"

INNER BLOCK VOID

For example, the courtyard typology - "an oasis for circulation or rest"

STREETS AND SQUARES

"*…as extensions of the home and places for discourse among neighbours, urban streets and squares traditionally formed a systematic hierarchy of order from locally controlled space to city-wide routes for communication*"

PUBLIC PARKS AND GARDENS

"Acting as nodes for the preservation of nature in the city... provide both relief from the hard urban environment and accessible recreation"

LINEAR OPEN SPACE

e.g. rivers, waterfronts, wetlands: "These formal and informal greenways slice through districts, create edges, and link places"

LINKAGE THEORY

Unlike the Figure-Ground Theory, which is concerned with space, Linkage Theory is concerned with circulation. Trancik cites Fumihiko Maki's "Investigations into Collective Form":

"*Linkage is simply the glue of the city. It is the act by which we unite all the layers of activity and resulting physical form in the city... urban design is concerned with the question of making comprehensible links between discrete things. As a corollary, it is concerned with making an extremely large entity comprehensible by articulating its parts.*" (cited in Trancik 1986: 106)

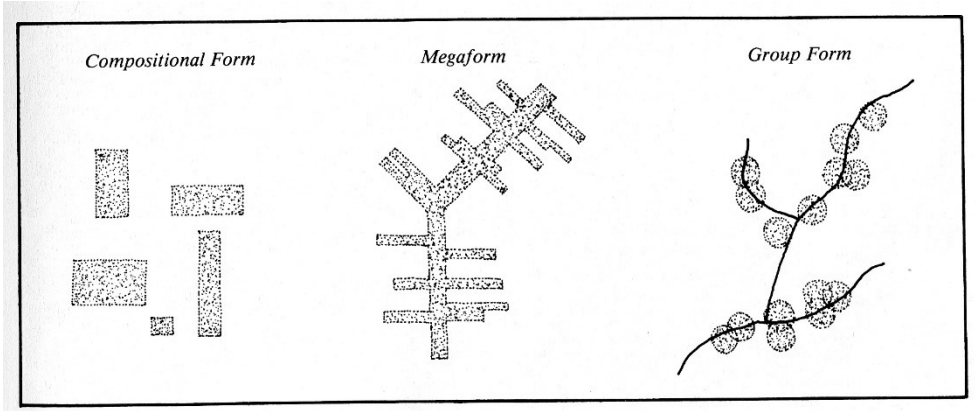


Figure 4-14. Fumihiko Maki. Three Types of Spatial Linkage.
(1) Compositional form: individual buildings are composed on a two-dimensional plane. In this type of urban form, spatial linkage is implied rather than overt and is typical of Functionalist planning methods. (See chapter 2.)
(2) Mega form: structures are connected to a linear framework in a hierarchical, open-ended system where linkage is physically imposed. Experiments in megaform were especially popular in the 1950s and 1960s.
(3) Group form: group form results from an incremental accumulation of structures along an armature of communal open space, and linkage is naturally and organically evolved. Historic towns and villages have tended to develop in this pattern.

Figure 34 - Linkage Theory: Fumihiko Maki (Trancik 1986: 107)

PLACE THEORY

Place Theory takes the two previous theories and then considers the identity of a certain place by incorporating social needs and context (historical and natural).

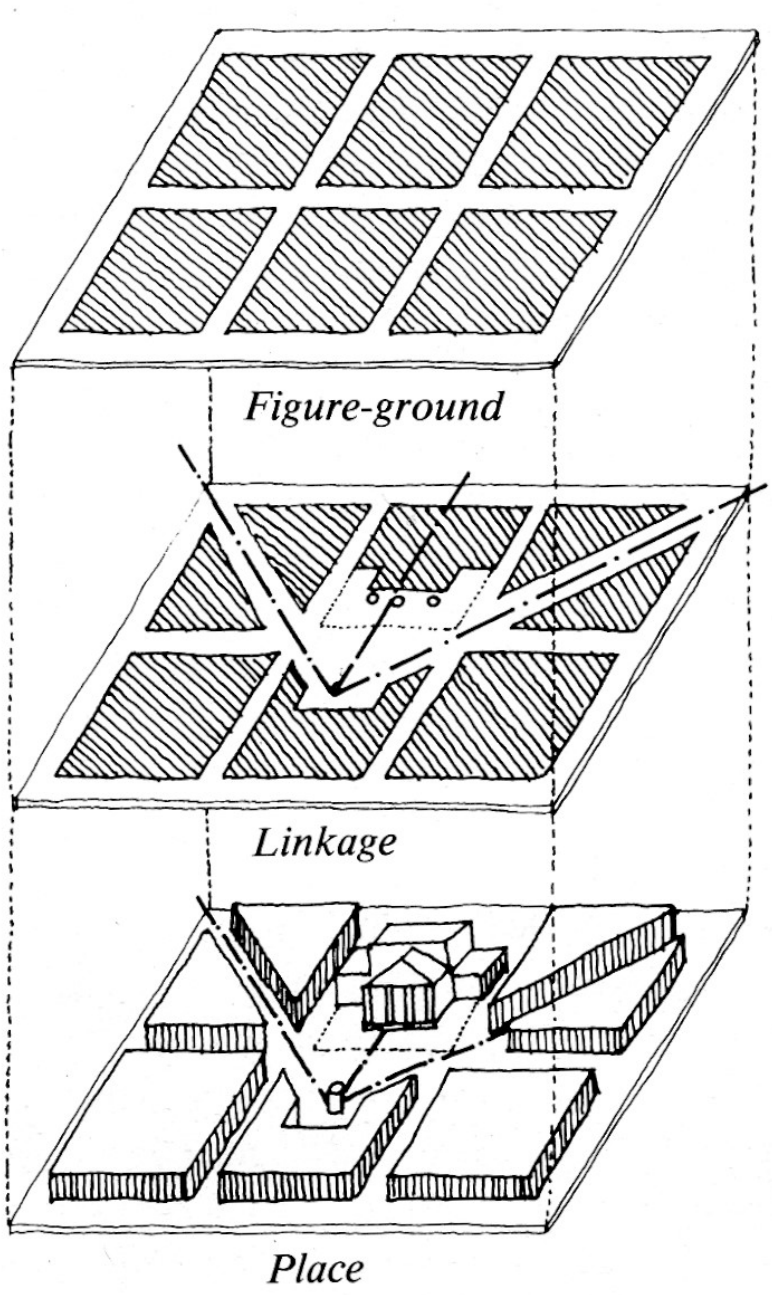


Figure 35 - Three Urban Design Theories (Trancik 1986: 98)

FIVE INTEGRATING PRINCIPLES TOWARDS URBAN DESIGN

Trancik argues that "an integrated approach must combine the spatial definition of the figure-ground theory with the connective qualities of the linkage theory and the social responsiveness of the place theory" (Trancik 1986: 219).

Meaningful urban design should therefore aim to give structure to solids and voids (buildings and urban spaces), organise the links between these parts, and responds to the needs of the particular area (region).

Trancik identifies the five integrating principles in urban design:

1. LINKING SEQUENTIAL MOVEMENT

Reference is made here to the sense of movement between interrelated spaces. He calls this a sequence. Sequences place stress on the "*movement and transition from one space to the next, in contrast to the static quality of many modern compositions*" (Trancik 1986: 220). Moving from a minor square, through a dense urban fabric, to a major square is an example of sequential movement that is linked.

When moving through a tightly-knit urban space, one will experience different views as new focal points come into sight. This is an urban landscape in the true sense – an unbroken field of solids and voids, set according to established hierarchies, that is not broken by out-of-scale buildings or the anti-space so common in modern cities. Crossing a vast parking lot to reach a shopping centre, on the other hand, is an example of a static composition – of "anti-space".

2. LATERAL ENCLOSURE AND EDGE CONTINUITY

The quality of urban space depends largely on the character of its frontage and the continuity of walls. It is at this edge where the public and private realm is separated, through various degrees of transparency and opacity.

3. INTEGRATED BRIDGING

An example of integrated bridging (i.e. An inhabited bridge, or a building that spans over a void below) is the Ponte Vecchio in Florence, Italy. Trancik calls this "a building that is a bridge, a bridge that is also a building". It illustrates the "possibility of using bridging devices to overcome gaps in the city fabric" (Trancik 1986: 224) without breaking the lateral enclosure and edge continuity mentioned above. This integrating principle can therefore be applied when barriers in the urban fabric need to be overcome – whether it be a canal, road or railway line - thereby avoiding "anti-space".

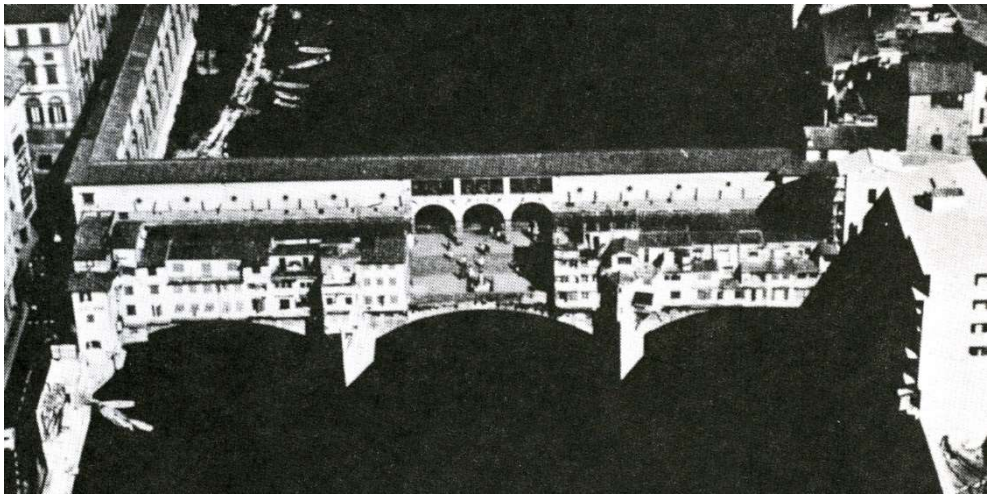


Figure 36 - Integrated Bridging: The Ponte Vecchio, Florence (Trancik 1986:224)

4. AXIS AND PERSPECTIVE

An axis is a system of visual orientation, through lines of sight, which produce a hierarchy of urban space. This links elements at the macro-scale; it determines how precincts within a settlement relate to each other, and reinforces the urban order described by Norberg-Schulz in "Modes of Dwelling" (i.e. settlement, urban space, institution, house)

5. INDOOR / OUTDOOR FUSION

As mentioned in Figure-Ground Theory, the urban field consists of solids and voids. The relationship and transition between "indoor" solids and "outdoor" voids must therefore be considered.

5.3 HUMANISM

5.3.1 ALEXANDER: PATTERN LANGUAGE

"... I am trying to make a building which is like a smile on a person's face…" – Christopher Alexander (Grabow, 1983)

Christopher Alexander's signature work, "Pattern Language" (1977), explains in detail how meaningful urbanism can be promoted through the application of a set of rules (or patterns). He believed that ordinary people, not just trained experts, should be able to contribute to the design of houses, neighbourhoods and cities.



Figure 37 – Pattern 61: "Small Public Squares" (Alexander, 1977: 313)

Along with Jane Jacobs, he was one of a handful of humanist urban thinkers in an era dominated by modernist planning dogma. His theories originated from the observation of historic towns and cities, and the fact that they exhibit a sense of "wholeness". Despite his contemporaries dismissing his work as regressive and nostalgic, Alexander's ideas became a touchstone as a powerful and participatory guide for placemaking.

This system addresses all scales, from the settlement to buildings and their construction. Alexander describes 253 interconnected patterns, arranged by scale - each illustrated by evocative diagrams. When used together, they form a "language".

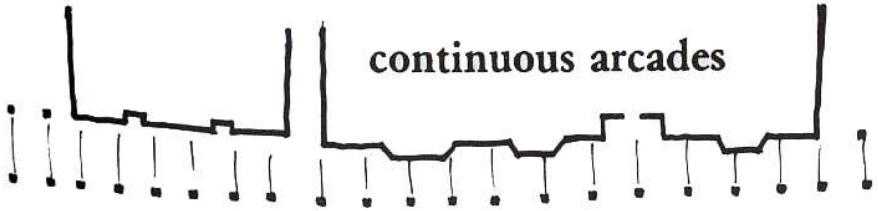


Figure 38 – Pattern 119: "Arcades" (Alexander, 1977: 583)

In considering the Elsieskraal study area, the following patterns are relevant:

9. Scattered Work – "The artificial separation of houses and work creates intolerable rifts in people's inner lives"

11. Local Transport Areas – "Cars… kill all social life"

14. Identifiable Neighbourhood – "People need an identifiable spatial unit to belong to"

15. Neighbourhood Boundary – "The strength of the boundary is essential"

16. Web of Public Transportation – "The entire web… can only work if all parts are well connected"

18. Network of Learning – "Decentralise the process of learning… through contact with many places"

20. Mini-Buses – "…Take people from any point to any other point"

22. Nine per cent Parking – "When the area devoted to parking is too great, it destroys the land"

25. Access to Water – "People have a fundamental yearning for great bodies of water"

30. Activity Nodes – "Community facilities scattered individually… do nothing for the life of the city"

31. Promenade – "A place where you can go to see people, and to be seen"

32. Shopping Street – "Shoppers… need convenience, and access from… pedestrian paths"

34. Interchange – "Surround… with workplaces and housing types"

35. Household Mix – "One-person households, couples, families with children… side by side"

36. Degrees of Publicness – "Three kinds of homes… quiet… busy… and those that are more or less in between"

37. House Cluster – "Identifiable clusters… around some common land and paths"

46. Market of Many Shops – "Establish frequent marketplaces, each one made up of smaller shops"

47. Health Centre – "Develop a network of small health centres"

48. Housing in Between – "Build houses into… all those parts of cities… which tend to be "non-residential"

51. Green Streets – "There is too much hot hard asphalt in the world"

55. Raised Walk – "Any pedestrian path along a road… should be… above the road… make it as wide as possible"

56. Bike Paths – "Bikes are cheap, healthy and good for the environment"

57. Children in the City – "Develop one system of paths that is extra safe"

60. Accessible Green – "People need green open places to go to; when they are close they use them"

61. Small Public Square – "Make a public square much smaller than you would at first imagine"

64. Pools and Streams – "Allow them to run through the city; make paths for people to walk along them and footbridges to cross them"

68. Connected Play – "Lay out common land, paths, gardens, and bridges so that groups of… households are connected by a swath of land that does not cross traffic"

72. Local Sports – "Scatter places for… sports through every work community and neighbourhood"

85. Shopfront Schools – "Set up tiny independent schools"

88. Street Café – "Encourage local cafes to spring up in each neighbourhood"

89. Corner Grocery – "Combine them with houses"

92. Bus Stop – "Build bus stops so that they form tiny centres of public life… together with several other activities… outdoor shelter, seats, coffee bar, tree places, public bathrooms…"

93. Food Stands – "Simple, inexpensive food on the street"

95. Building Complex – "Never build large monolithic buildings"

100. Pedestrian Street – "Arrange buildings so that they form pedestrian streets"

106. Positive Outdoor Space – "Give some degree of enclosure"

114. Hierarchy of Open Space – "People always try to find a spot where they have their backs protected"

119. Arcades – "Covered walkways at the edges of buildings… play a vital role in the way that people interact with buildings"

120. Paths and Goals – "Place goals at natural points of interest… then connect the goals to one another to form paths"

121. Path Shape – "Streets should be for staying in, and not just for moving through"

126. Something Roughly in the Middle – "A public place without a middle is quite likely to stay empty"

Alexander, C., Ishikawa, S., Silverstein, M. Jacobson, M. Fiksdahl-King, I. & Angel, S. 1977. "A Pattern Language: Towns, Buildings and Construction". New York. Oxford University Press.

https://en.wikipedia.org/wiki/A_Pattern_Language

5.4 WALKABILITY

5.4.1 DOVEY: ASSEMBLAGE AND THE URBAN DMA

"Walkability is not one thing but an irreducible multiplicity of properties" – Dovey (The Urban DMA, 2018).

Dovey's *Urban DMA* refers to three criteria in promoting walkability in cities: Density, Mix and Access. These principles originated with Jane Jacobs, who brought important ideas (now considered logical, but groundbreaking in the early 1960s) to urban design theory. Drawing from her observations of everyday life in New York, she pioneered concepts such as *small blocks* (permeability), *diversity*, *concentration* (density) and *mixed use*.

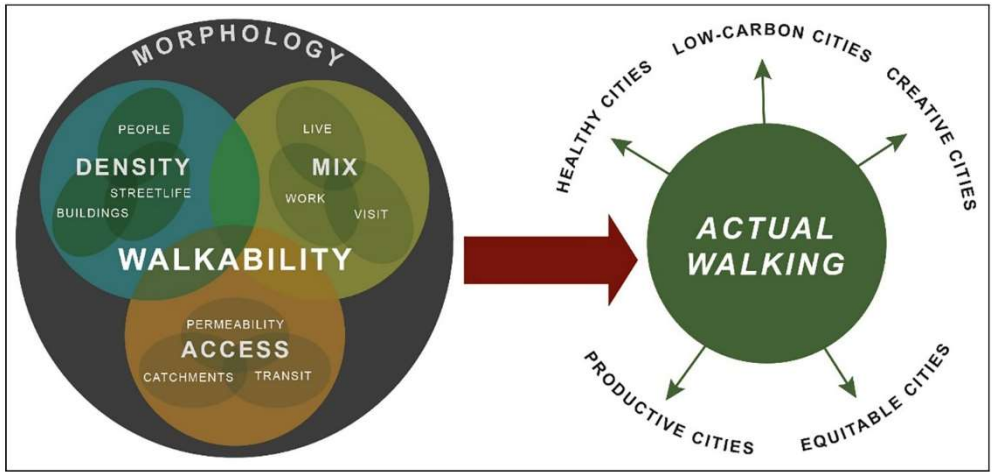


Figure 39 - The Urban "DMA" and Walkability (Dovey & Pafka, 2018)

Dovey takes this further by applying the concept of assemblage to urban walkability. This draws from the philosophical concept of assemblage – the notion that the relationship between parts are not necessarily fixed and stable, but dynamic. He then applies this to Density, Mix and Access, to explore their inter-relationships, and what this means for walkability.

Assemblage is an approach that "… tries to understand the city not only in terms of current properties but also in terms of … what it could become", seeing the city therefore as "a space of possibility" (Dovey, 2016).

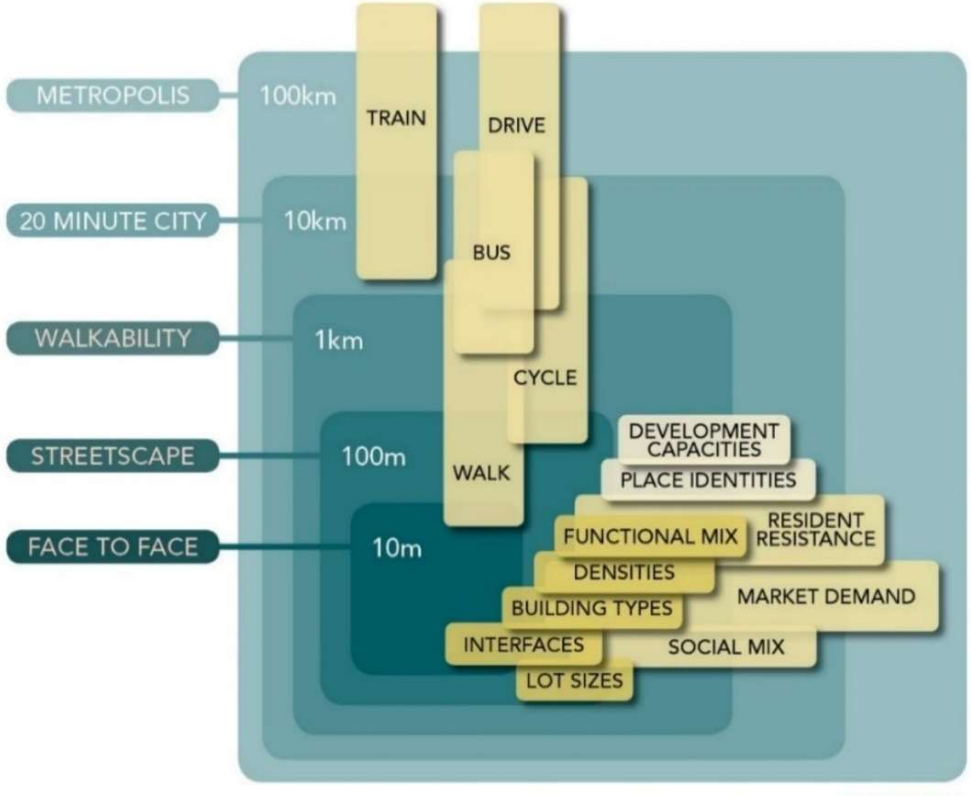


Figure 40 - Multi-scale Thinking (Dovey, 2016: 255)

https://theconversation.com/what-makes-a-city-tick-designing-the-urban-dma-67227

https://storymaps.arcgis.com/stories/2fcf5727d3c747e488bac09fc9000b9c

https://en.wikipedia.org/wiki/Assemblage_(philosophy)

Dovey, & Pafka, E. (2020). What is walkability? The urban DMA. Urban Studies (Edinburgh, Scotland), 57(1), 93–108. https://doi.org/10.1177/0042098018819727

Dovey, & Pafka, E. (2016). The science of urban design? Urban Design International (London, England), 21(1), 1–10. https://doi.org/10.1057/udi.2015.28

6. LITERATURE REVIEW

6.1 GREEN INFRASTRUCTURE

6.1.1 DEFINITION

Green Infrastructure (GI) is increasingly being incorporated into planning processes. GI has many definitions, and its application is always context dependent, but it is commonly understood as the integration of the natural environment into cities. Nature, in its incorporation as a functional element of the urban system, can therefore be seen as a type of "infrastructure" in itself, hence the name.

Water management – how it moves through the urban system, and the extent to which it is retained for human use or allowed to return to its natural cycle – is an important component of GI. It is therefore sometimes referred to as "blue-green infrastructure" - as a combination of "blue" (watercourses and -bodies, as well as aquatic ecosystems) and "green" (trees, parks, gardens) components.

Grey infrastructure, such as roads, pipelines, reservoirs, dams and wastewater treatment plants, incurs higher capital- and maintenance costs than GI (Hansen, 2017, p. 1). The way water moves through the system in the traditional "grey" sense not only puts pressure on urban infrastructure but contributes to pollution. As it crosses impermeable surfaces on its way back to its final (engineered) destination, stormwater picks up vast amounts of toxins. Grey infrastructure, while important, prevents nature from doing its job.

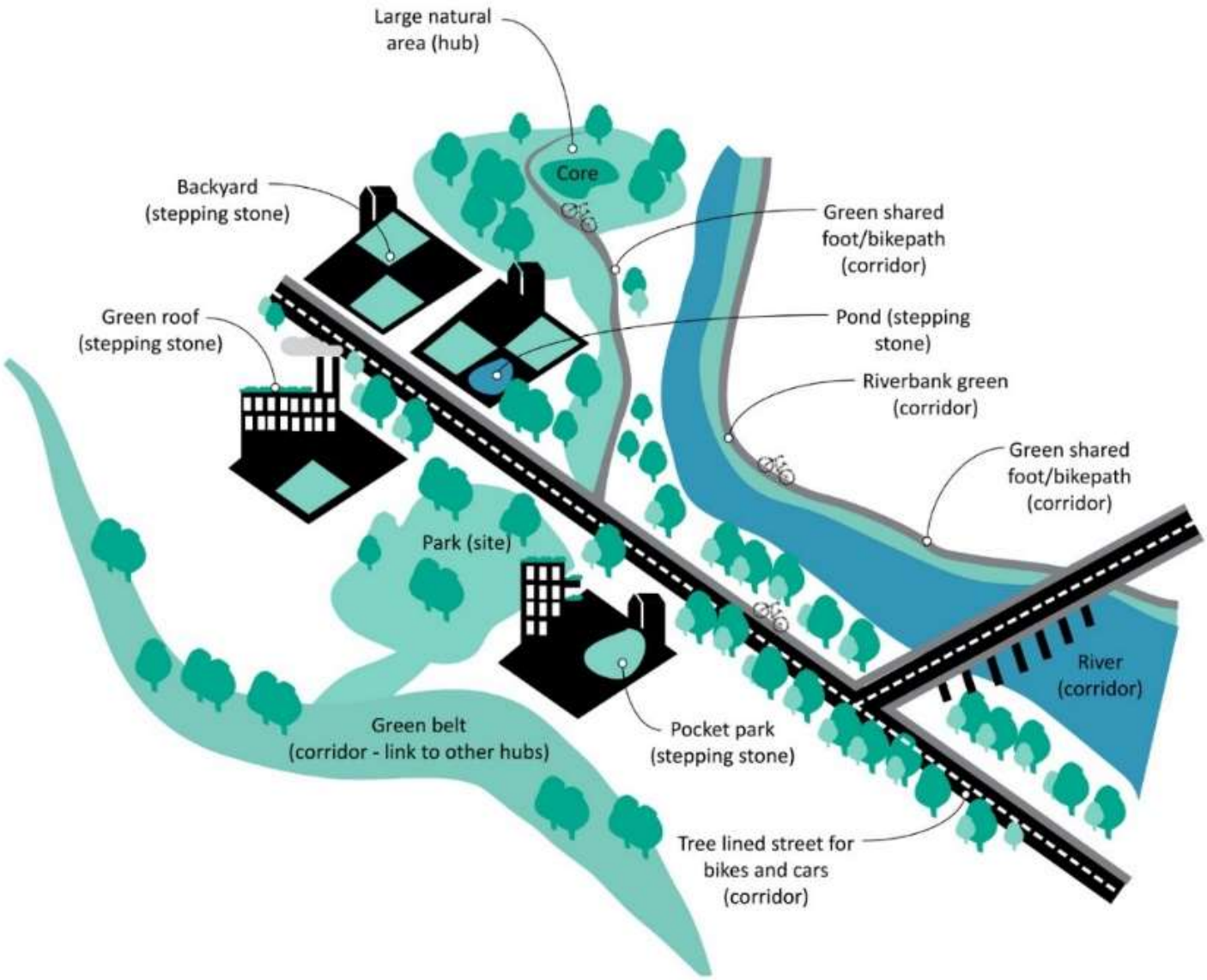


Figure 41 - Green Infrastructure

The importance of allowing this process to occur is recognised in local policy. The Department of Rural Development and Land Reform's *Guidelines for the Provision of Open Space in South Africa* highlights this natural "flow of materials" as "absorptive space" (2017, p. 17). Absorptive spaces have "amenity value within settlements, providing passive recreation opportunities, as well as productive value" (DRDLR, 2017, p. 88).

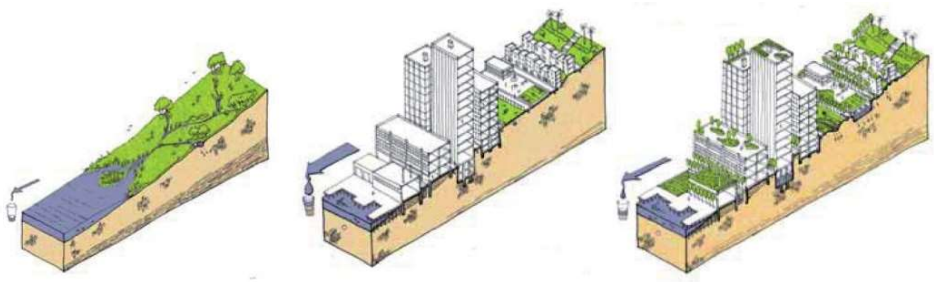


Figure 42 - Absorptive Space (DRDLR, 2017: 17)

https://en.wikipedia.org/wiki/Blue_space

https://en.wikipedia.org/wiki/Green_infrastructure#Types_of_green_infrastructure

Hansen, R., Rall, E., Chapman, E., Rolf, W., Pauleit, S. (eds., 2017). Urban Green Infrastructure Planning: A Guide for Practitioners. GREEN SURGE. Retrieved from http://greensurge.eu/working-packages/wp5/

https://info.ecogardens.com/blog/what-to-know-about-green-versus-gray-infrastructure

Department of Rural Development and Land Reform. (2017). Guidelines for the Provision of Open Space in South Africa.

GI offers important ecosystem services – the "benefits that people obtain from ecosystems". These can be grouped into four categories: provisioning (food, water, fuel), regulating (climate- and disease mitigation, waste treatment, water quality), cultural (recreation, spiritual wellbeing), and supporting (soil, pollination, nutrients) services (Millennium Ecosystem Assessment, 2005, p. 39).

Millennium Ecosystem Assessment (Program). (2005). Ecosystems and Human Well-Being: Synthesis (Millennium Ecosystem Assessment Series) (1st ed.). Island Press.

6.1.2 TYPOLOGIES

GI is essentially a multi-functional network of both designed (human) and natural elements within urban environments. Examples include urban forests and street trees, parks of various sizes (urban parks, pocket parks), gardens (botanical, community, private), green buildings (incorporating vegetation and water management into roofs and walls), water elements (the "blue" – lakes, ponds, rivers, canals, estuaries, streams, wetlands), and various methods to effectively deal with stormwater (bioswales, permeable paving, rain gardens, constructed wetlands, and detention basins) (Hansen, 2017, p. 6).



Figure 43 - Stormwater Bioretention Systems, Melbourne

Wong, T., Roger, B. & Brown, R. (2020). Transforming Cities through Water-Sensitive Principles and Practices. One Earth 3 (4), p. 436-447. ISSN 2590-3322.

Hansen, R., Rall, E., Chapman, E., Rolf, W., Pauleit, S. (eds., 2017). Urban Green Infrastructure Planning: A Guide for Practitioners. GREEN SURGE. Retrieved from http://greensurge.eu/working-packages/wp5/

6.1.3 IMPLEMENTATION

GI should be approached as an integral part of social upliftment. Including local communities in the decision-making process will ensure that it is not only effectively implemented, but well managed in the long term. A participatory approach will help to avoid "empowering those in advantage positions or encouraging resistance from narrow interest groups to policies designed for the public interest" (Hansen, 2017, p. 36).



Figure 44 - Seoul Greenway, South Korea

https://development.asia/case-study/revitalizing-city-reviving-stream

GI needs to be adapted to local natural (climatic) and human (cultural) conditions (Borelli, 2015, p. 5). The scale at which GI is implemented will affect its multi-functionality, as "it cannot be expected that small greenspaces in densely built areas [will] provide for intensive recreational use and at the same time be species rich habitats" (Ahern, 2011, p. 273). These conflicts of function need to be considered when considering "spatial and temporal dimensions" (Hansen, 2017, p. 31)

Implementation challenges vary across scales. Globally there is a "knowledge gap" - a lack of information on the current conservation status of green infrastructure (United Nations, 2020, p. xxiii). At the municipal level, "path dependencies" - a preference for conventional service delivery approaches, and a resistance to change - can hamper the process (Pasquini, 2019, p. 9). Strategically, and in terms of resource constraints, green infrastructure initiatives could start as small-scale experiments (Pasquini, 2019, p. 14).

Hansen, R., Rall, E., Chapman, E., Rolf, W., Pauleit, S. (eds., 2017). Urban Green Infrastructure Planning: A Guide for Practitioners. GREEN SURGE. Retrieved from http://greensurge.eu/working-packages/wp5/

Borelli, S., Chen, Y., Conigliaro, M., & Salbitano, F. Green infrastructure: A new paradigm for developing cities. In Proceedings of the World Forestry Congress Conference Paper, Durban, South Africa, 7–11 September 2015.

Ahern, J., Kazmierczak, A., Liu, L., & Pauleit, S. (2011). Multifunctional Green Infrastructure Planning to Promote Ecological Services in the City. In Urban Ecology (pp.272-285). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199563562.003.0033

United Nations. (2020). World Cities Report 2020: The Value of Sustainable Urbanization. United Nations. https://doi.org/10.18356/27bc31a5-en

6.1.4 WATER SENSITIVE URBAN DESIGN

"WSUD is not so much a collection of technologies as a philosophy that sees the need to design and manage urban areas in a water sensitive manner." (Armitage et al, 2014, p. 4)

Water Sensitive Urban Design (WSUD), also known as Low-Impact Development (LID) and Sustainable Drainage Systems (SuDS), is a development approach that aims to integrate the full water cycle into urban systems. The overarching goal is the holistic integration of stormwater, groundwater, wastewater and water supply into engineering and land-use planning decision-making.

WSUD works with – rather than against – nature. It therefore has sustainable development as its foundation. It represents a paradigm shift in how we both harness and protect the environment in settlements, and has specific implications for water-related infrastructure, especially stormwater systems.

A defining characteristic of WSUD as a process is its multi-disciplinary nature. At the decision-making level, this includes collaboration between various stakeholders – professionals (planners, architects, landscape architects, urban designers, engineers), scientists (for example, ecologists), the public sector (local authorities, utility companies), various institutional bodies (universities, banks), NGOs, housing associations, and many others.



Figure 45 - Water Sensitive Urban Design

Abbott, J,. Davies, P., Simkins, P., Morgan, C., Levin, D. & Robinson P. (2013). Creating Water Sensitive Places: Scoping the Potential for Water Sensitive Urban Design in the UK. Construction Industry Research and Information Association (CIRIA). ISBN: 978-0-86017-733-3

https://en.wikipedia.org/wiki/Water-sensitive_urban_design

Armitage et al (2014). Water Sensitive Urban Design (WSUD) for South Africa: Framework and guidelines

Speed et al (2016)

6.2 RIVER RESTORATION

6.2.1 OBJECTIVES

"Complete recovery of river processes and functions is often not possible to achieve due to irreversible catchment changes… However, rivers are dynamic and have a remarkable ability to recover." – River Restoration Centre, UK

Rivers are complex natural systems. When undertaking urban river restoration, the (equally complex) layers and inter-relationships of the "human" environment must also be understood. Where a river system flows through an urban area, we must accept that complete recovery of its original characteristics and functions is not possible. The objective is rather to assist its recovery. The process needs to take various factors into consideration, such as morphology (both natural and urban), hydrology, biology and socio-economics. Restoration schemes must provide multiple benefits. The traditional approach to river management did not consider the entire system; focusing only on water pollution, for example.

https://www.therrc.co.uk/why-restore

6.2.2 SCALES OF INTERVENTION

The only way to even begin this enormous task is by utilising various techniques at different scales – for example:

CATCHMENT MANAGEMENT

This scale considers the relationship between river systems (the individual dynamics of upper, middle and lower courses, for example) and human activities which can disrupt this, such as agriculture and dams.

FLOODPLAIN AND WETLANDS

These play a vital role in flood mitigation, and are an important transition between aquatic and terrestrial ecosystems.

RE-MEANDERING

This entails the partial- or complete removal of a straightened channel, with a natural, sinuous form (bends of various shapes and sizes) – even in places where there never were meanders. This greatly improves the river's natural flow and allows for habitat diversity.

DAYLIGHTING

Also known as "de-culverting", this refers to opening up buried watercourses. While this entails the "loss" of useable space for roads and buildings, the net effect is always positive. The whole is ultimately greater than the sum of its parts.

IN-STREAM ENHANCEMENT

Small-scale measures can be implemented within the stream itself, where the option to alter the river's course and footprint is not available (in dense urban areas, for example).

https://www.therrc.co.uk/why-restore

RRC (2021) Manual of River Restoration Techniques – Restoring Meanders to Straightened Rivers – 1.6 Opening Up a Culverted Stream – Ravensbourne River (Bromley, London)

Klaver, Irene J. 2018. "Meandering and Riversphere: The Potential of Paradox ." – p. 57-58

6.3 URBAN REGENERATION

6.3.1 VISION

Urban regeneration, in the South African post-1994 context, falls into two categories. "Pro-poor" regeneration (informal settlement upgrading for example) focuses on addressing apartheid neglect through the provision of basic services such as housing. (Massey, 2020, p. 267)

"Pro-growth" regeneration, such as gentrification, focuses on investment. This is a complex phenomenon, given that local governments require regeneration to remain competitive. This always includes the involvement of the private sector, which is primarily motivated by profit. If not managed carefully, gentrification can lead to the displacement of poorer residents, further exacerbating inequality (Massey, 2020, p. 272).

Massey, R. (2020). Urban Renewal in South African Cities. In The GeoJournal Library (pp. 265–282). The GeoJournal Library. https://doi.org/10.1007/978-3-030-25369-1_17

6.3.2 DENSIFICATION

Urban regeneration cannot be achieved through fragmented, low density development. Medium- to high densities are required to ensure the viability of public transport systems, facilitate economic opportunities, and reduce resource use. Aside from functional considerations, higher densities also help to create attractive, vibrant and walkable urban environments. Density in itself will not guarantee urban quality (Cape Town Densification Policy, 2012, p. 5), but a lack of density will make the task almost impossible.



Figure 46 - Densification: Voortrekker Road

City of Cape Town (2012) Densification Policy

6.3.3 TRANSIT

Transit-Oriented Development (TOD) is an urban planning model that focuses on the relationship between land use and travel patterns. TOD requires a high density mix of uses (residential, commercial, recreation), in close proximity to a central transit node, supported spatially by smaller block sizes. Pedestrianisation must also be prioritised over traditional car-oriented planning and design (for example, less space dedicated to parking lots).

TOD has been adopted in many cities, including Cape Town. The *TOD Strategic Framework* (2016) aims to change the "built form of the city" in order to "create urban efficiencies and enable social equality and economic development." (City of Cape Town, 2016, p. 6). A fundamental objective is to promote the "greater use of public spaces with sound urban design to create a sense of place…" (City of Cape Town, 2016, p. 23).

https://en.wikipedia.org/wiki/Transit-oriented_development

City of Cape Town (2016) Transit-Oriented Development Strategic Framework

6.3.4 SOCIAL INFRASTRUCTURE

Transformation has both spatial and social dimensions. Achieving a truly liveable, inclusive city requires a "comprehensive, multifaceted and holistic approach" (Brown-Luthango, 2020, p. 16). In addition to spatial integration such as densification and TOD, provision should be made for social infrastructure such as educational, healthcare and cultural facilities. This is especially critical in a South African context, where poverty and inequality is ever present.

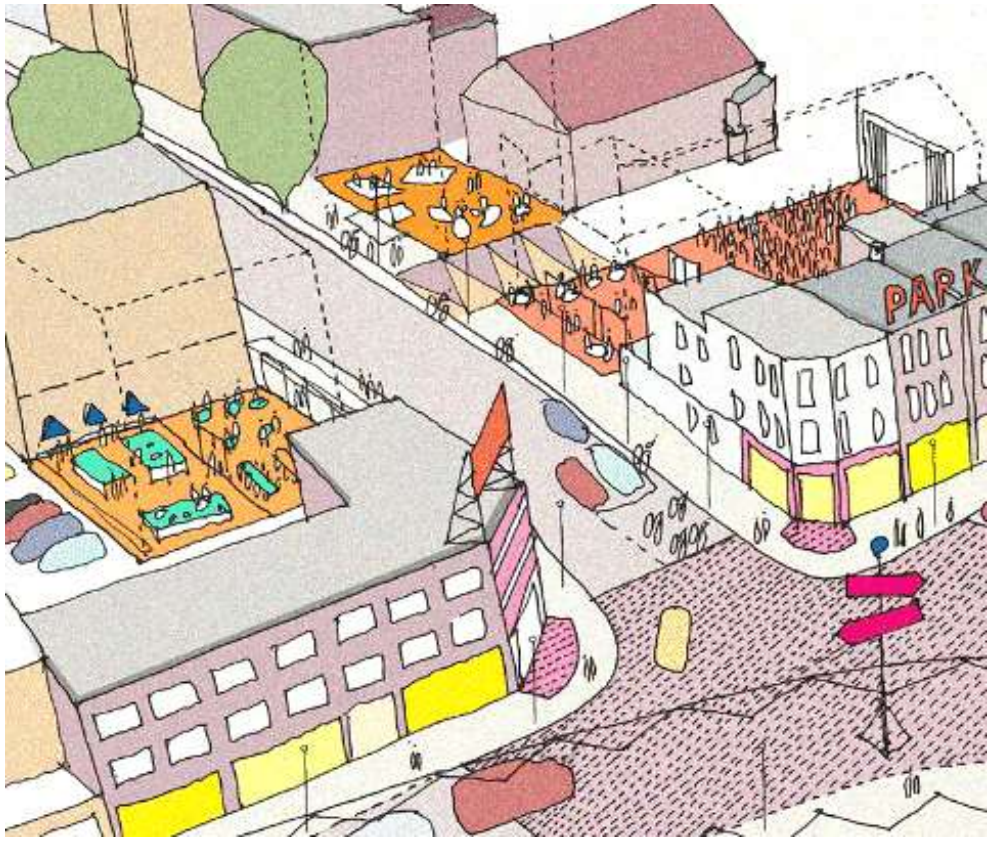


Figure 47 - Social Infrastructure

http://www.social-life.co/blog/post/Call_for_examples/

Brown-Luthango, M. (2020). Neo-liberalism (s), socio-spatial transformation and violence reduction in Cape Town – lessons from Medellin. Cogent Social Sciences, 6(1),1827524. DOI: 10.1080/2331886.2020.1827524

7. CASE STUDIES

7.1 STEP ONE: CATALYST

7.1.1 THE RRC

"In these times of biodiversity, climate and health crises, there is now a growing and sustained public and political focus on our natural landscapes for health & well-being, economic green recovery and nature-based solutions." – RRC Strategic Plan 2022-2025



Figure 48 - The River Restoration Centre

https://www.therrc.co.uk/manual-river-restoration-techniques

The River Restoration Centre (RRC) is a non-profit organisation based in Bedfordshire. Their focus is to provide training and advice regarding the restoration and management of river systems and floodplains in the UK. They also play a vital role in knowledge exchange by maintaining the National River Restoration Inventory (NRRI), a best practice database of 5350 UK projects, and running RiverWiki – which includes 1500 case studies from over 30 European countries.

Since 2000, the RRC has also hosted the Network Conference, an annual gathering of academics, engineers, contractors, and government agencies. The 2023 conference's declaration stresses the "*need to increase the scale and rate… of restoration actions*".

https://www.therrc.co.uk/river-restoration-conference-declaration

https://www.therrc.co.uk/national-river-restoration-inventory-nrri

https://www.therrc.co.uk/eu-riverwiki

https://restorerivers.eu/wiki/index.php?title=Main_Page

https://www.therrc.co.uk/river-restoration-conference-declaration

https://www.therrc.co.uk/previous-rrc-conferences

https://www.therrc.co.uk/sites/default/files/files/aboutus/rrc_strategic_plan_2022-2025_v05.23.pdf

THE RIVER REHABILITATION MANUAL

The RRC's *Manual of River Restoration Techniques* is a compendium of 69 case studies in the UK. The examples include a range of restoration approaches, across various implementation scales – for example:

RESTORING MEANDERS TO STRAIGHTENED RIVERS

This technique has many possibilities, such as:

- New meanders along existing channels - where the existing channel, such as a canal for example, remains partly functional

1.4 New meanders to one side of existing channel

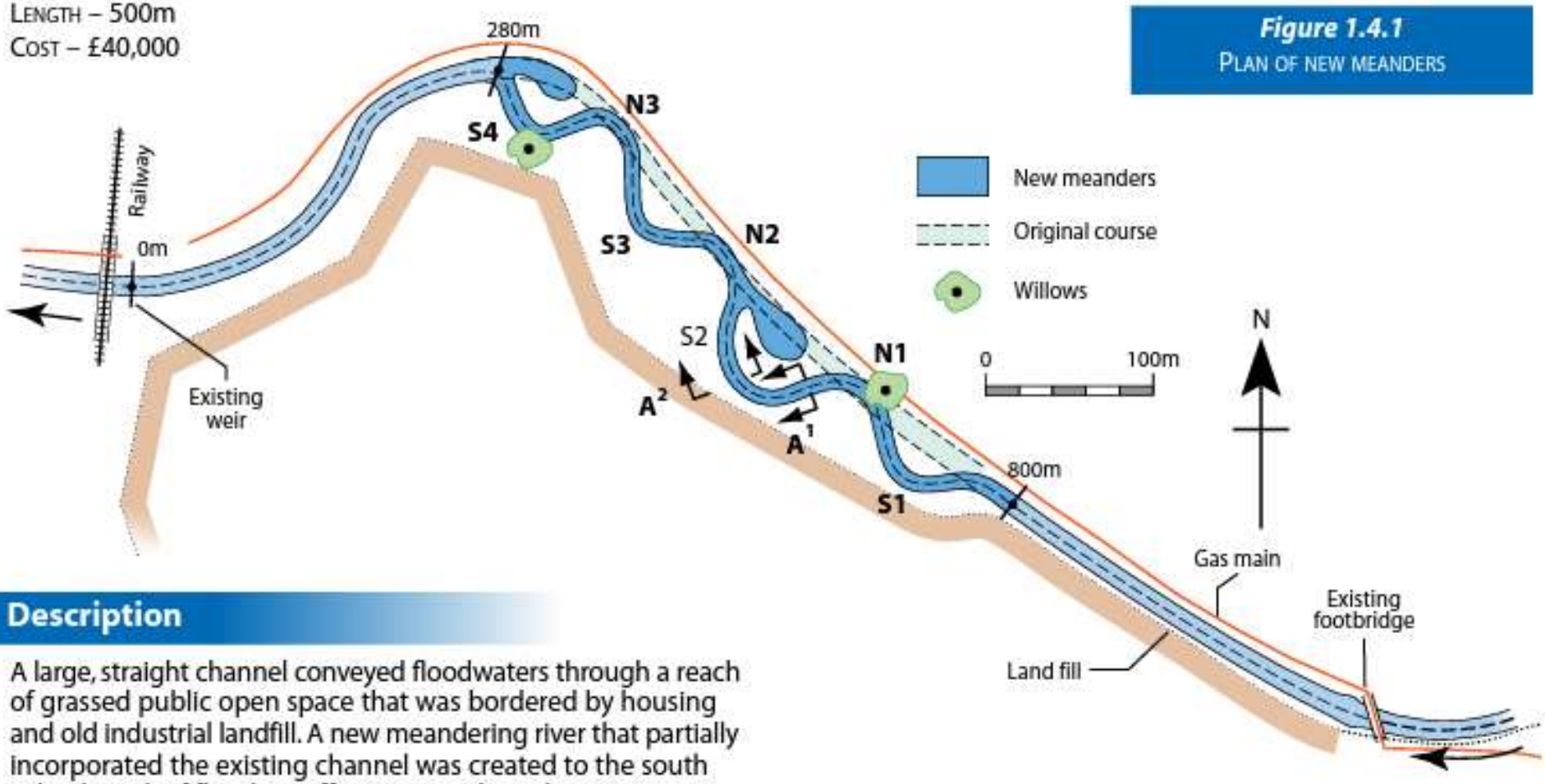
River Skerne

Location - Darlington, Co Durham, NZ301160

Date of construction - Autumn 1995 to Spring 1996

Length – 500m

Cost – £40,000



Description

A large, straight channel conveyed floodwaters through a reach of grassed public open space that was bordered by housing and old industrial landfill. A new meandering river that partially incorporated the existing channel was created to the south side. The risk of flooding, affecting people and property, was safeguarded.

Figure 49 - Skerne: New Meanders Along an Existing Channel

- Entirely replacing a channel with new meanders
- Opening a culvert - a type of "daylighting"
- Reconnecting remnant meanders

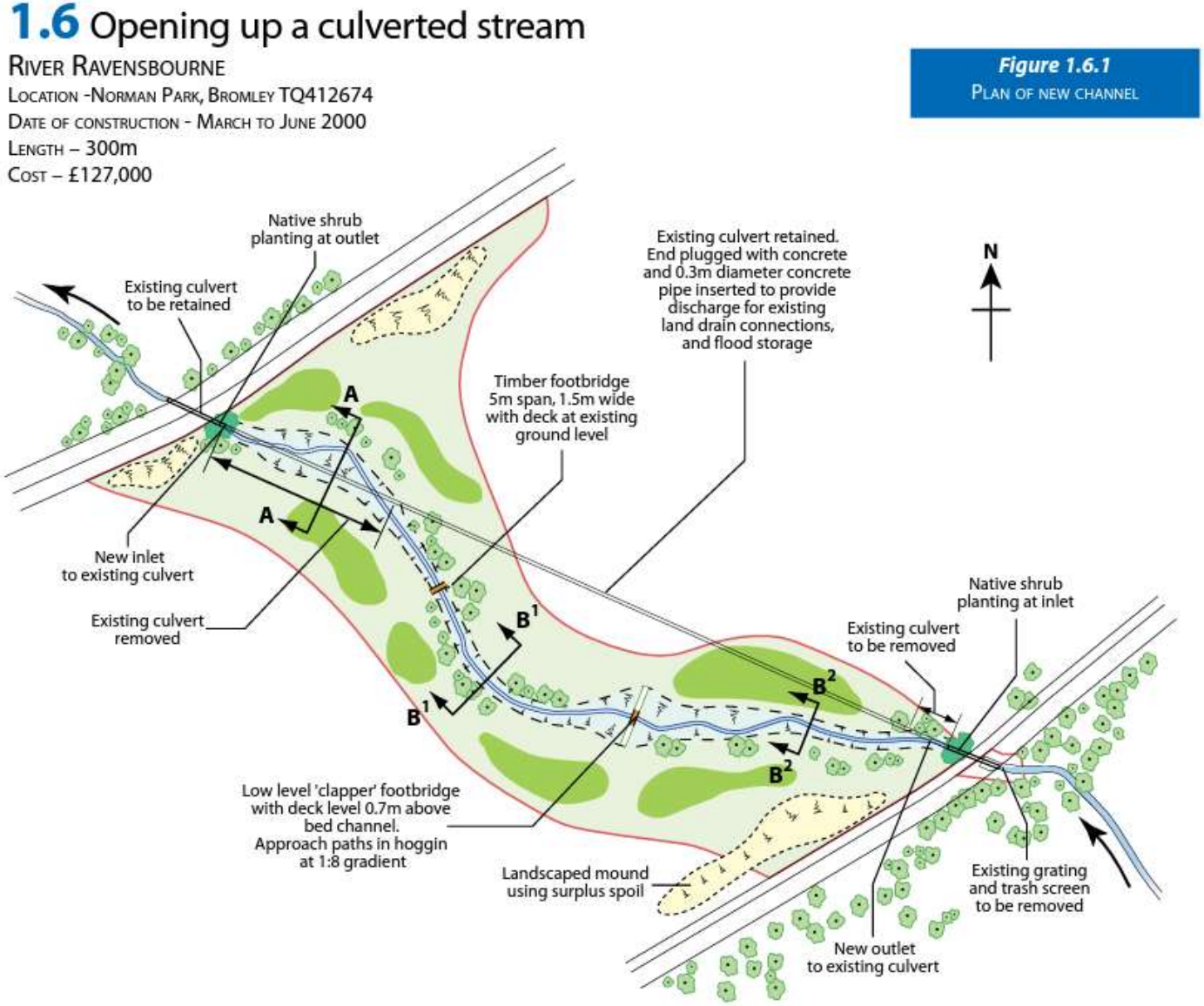


Figure 50 - Ravensbourne: De-Culverting or "Daylighting"

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/1.5_Marden.pdf

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/1.6_Ravensbourne.pdf

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/1.7_Little_Ouse.pdf

ENHANCING HISTORIC RIVER FEATURES

Examples include:

- Backwaters – river sections that have little to no current. These are important micro-habitats for plants and animals.

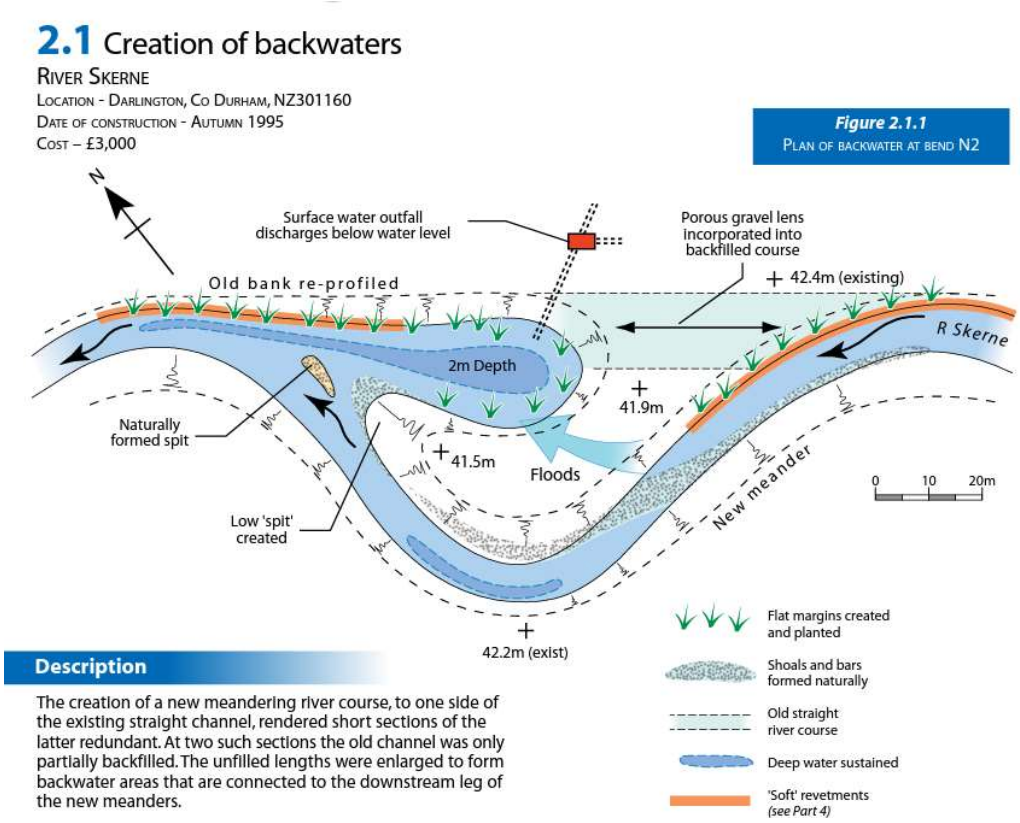


Figure 51 - Skerne: Backwaters

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/2.1_Skerne.pdf

- Deflecting the current within a channel - to cause a variation in the flow current
- Small bays - to provide shelter during high flows

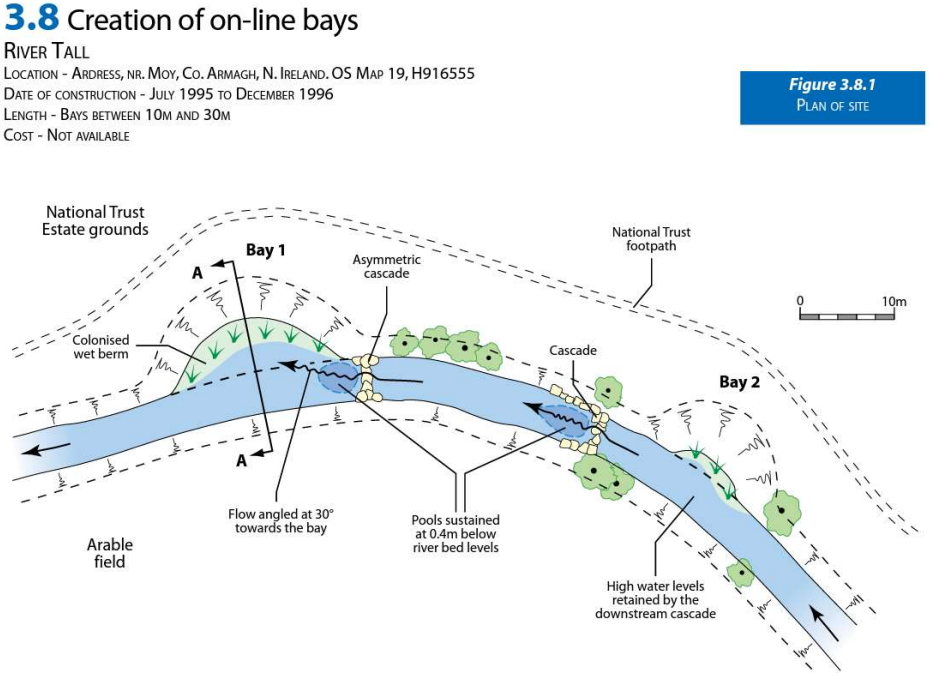


Figure 52 - Tall: On-line Bays

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/3.8_Tall.pdf

- Introducing gravel to the stream bed

https://en.wikipedia.org/wiki/Backwater_(river)

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/3.1_Skerne.pdf

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/3.9_Chess.pdf

PROTECTING RIVER BANKS

Various "green-grey" river engineering techniques can be used, such as:

- aquatic vegetation - native plants that have adapted to living in-stream)
- coir mats and -pallets (biodegradable natural fibres)

- willow spilling - rods woven around stakes to form a wall-like structure, which is then backfilled with soil to provide protection against rapid flows
- geo cell systems
- vegetated concrete blocks
- vegetated gabions - wire mesh baskets filled with stone, with soil infill to promote growth

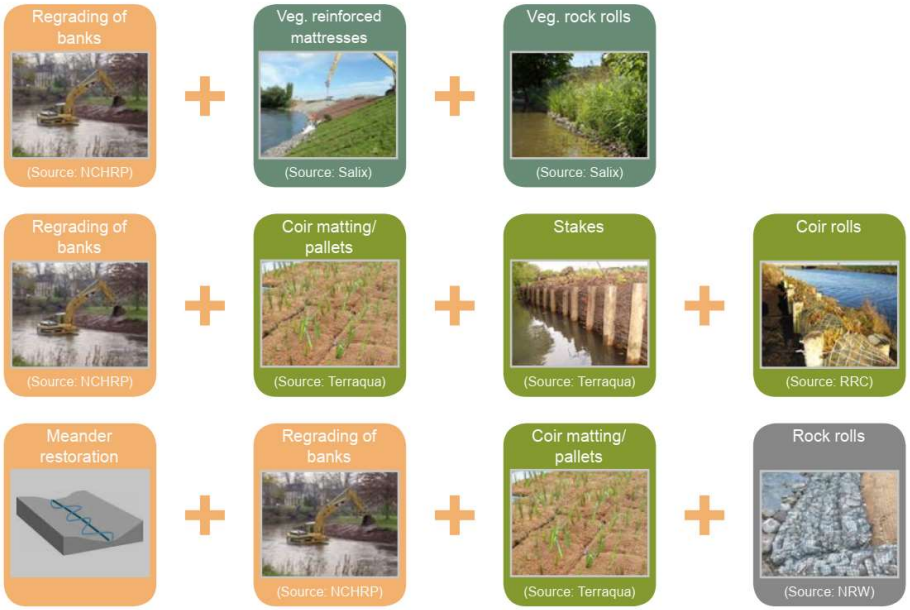


Figure 53 - Green Infrastructure: A Combination of Methods

Roca, M. and Escarameia, M. and Gimeno, O. and de Vilder, L. and Simm, J.D. and Horton, B. and Thorne, C. (2017) *Green approaches in river engineering - supporting implementation of Green Infrastructure*. HR Wallingford, Wallingford. ISBN 978-1-898485-16-2

https://eprints.hrwallingford.com/1250/

https://www.therrc.co.uk/sites/default/files/general/MOT/Decision_support/ds4_v2.pdf

https://www.therrc.co.uk/sites/default/files/general/MOT/final/3.12_nene.pdf

CREATING FLOODPLAIN WETLAND FEATURES

Examples include:

- Scrapes – shallow ponds that form in low spots. These provide "off-river" habitat for animals and plants. They rely on ground- and surface water, and are therefore usually seasonal.

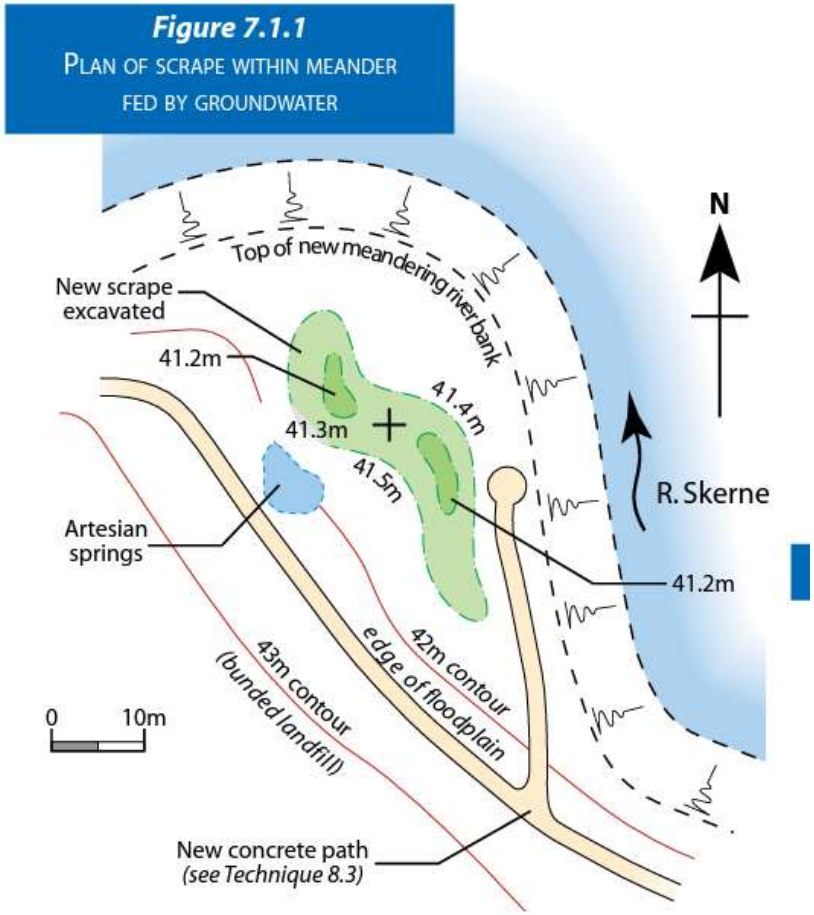


Figure 54 - Skerne: Scrapes (Wetland Features)

- Mosaics – a combination of ponds, islands and pools of varying size, depth and permeability. Deep ponds, for example, increase the diversity of habitat and restricts an over proliferation of wetland plants. Shallow ponds attract amphibians and wading birds. Islands encourage nesting.

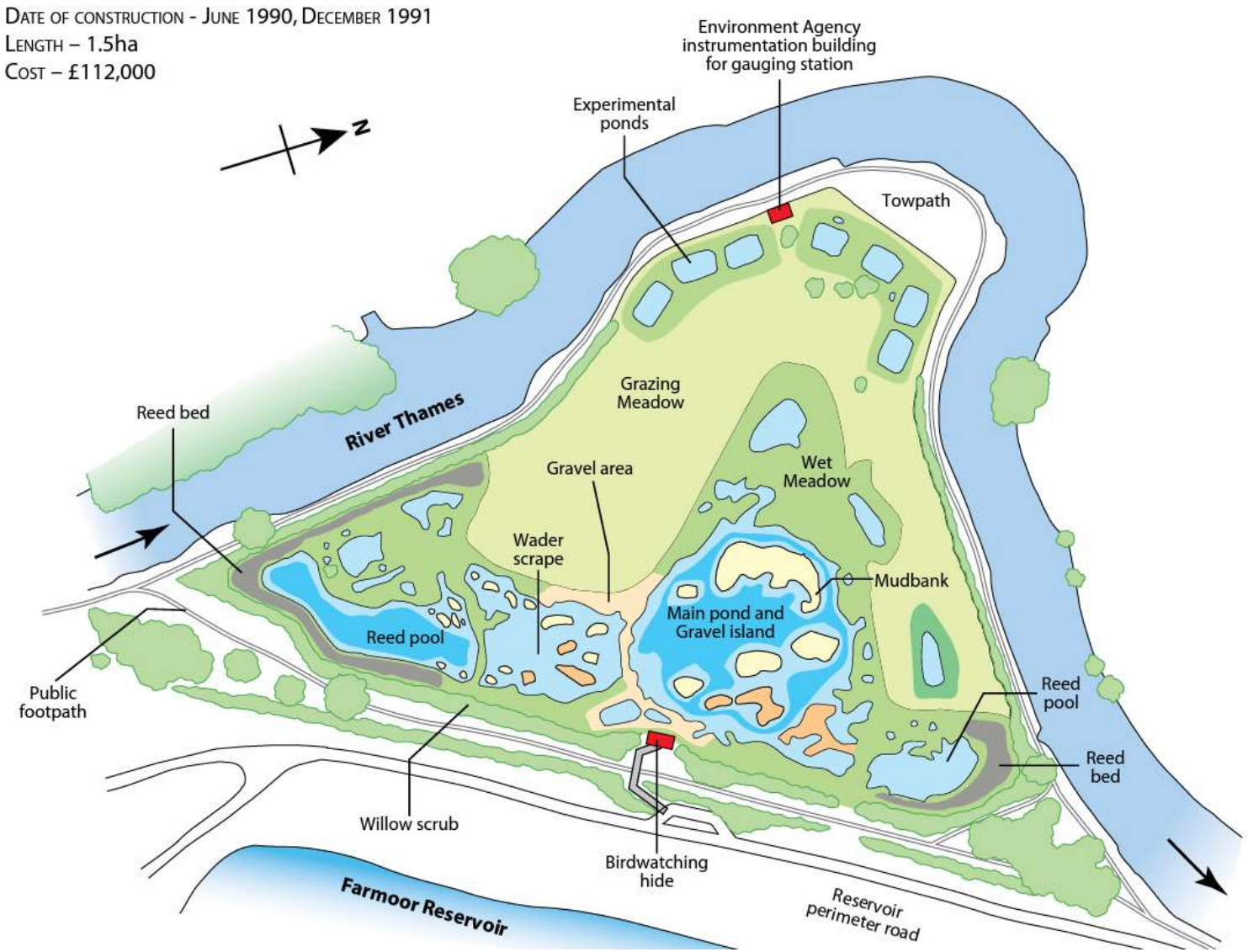


Figure 55 - Thames: "Wetland Mosaic"

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/7.1_Skerne.pdf

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/7.2_Pinkhill_Meadows.pdf

https://en.wikipedia.org/wiki/Wader

PROVIDING PUBLIC ACCESS

For example:

- Urban riverside access (low gradient ramps from public movement routes down to the river course)
- Watercourse crossings – for example, small pedestrian and -NMT bridges

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/8.5_Marden.pdf

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/8.3_Skerne.pdf

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/8.2_Cole.pdf

Each study provides a detailed description of the technique, as well as an assessment of its subsequent performance.

The RRC stresses that the Manual is not a design manual; in other words, the techniques "*cannot be transferred to another site without due consideration and appropriate design*". River restoration requires collaboration between various people (consultants, scientists, authorities, contractors) as well as consultation with affected parties such as property owners and local communities. The implementation of any of these techniques in practice will undoubtedly require detailed technical input from river experts. For the purposes of a design research project however, breadth- versus depth of knowledge is critical. If the implications of restoration techniques are broadly understood - in terms of context, scale, material, hierarchy and phasing for example – then the foundations for potential future interventions are laid.

https://www.therrc.co.uk/sites/default/files/general/MOT/new_introduction_v2.pdf

https://www.therrc.co.uk/manual-river-restoration-techniques

https://eprints.hrwallingford.com/1250/

7.1.2 THE RIVER MARDEN

BACKGROUND

The River Marden, a tributary of the Avon River, flows through the historic market town of Calne in Wiltshire, England. From the mid-18th century, Calne's main industry was pork processing. In the 1930s, the Harris Bacon Factory was built in the centre of the town, next to the Marden River. The business declined in the 1970s, and the building was demolished in 1984. Following this, this section of the Marden was canalised.



Figure 56 - The canal, prior to the river's restoration

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/8.5_Marden.pdf

In the late 1990s, Calne experience rapid economic growth. The need for new housing, retail and civic buildings led to several urban regeneration projects. One of the first initiatives was the redevelopment of the old factory site in 1999.

Due to high land values at the prominent location, the feasibility of the project hinged on removing the existing canal. This catalytic step freed up valuable space, which allowed for the creation of an attractive public precinct

comprising housing, a community hub with a library, and retail components. At the heart of these new elements is the restored river, where priority was given to natural flood management, habitat creation, and public access to the water.

DETAIL

The linear site is roughly 50m by 100m, with the river flowing westwards. The canal flowed in a straight line, with two weirs (vertical drops) along this stretch, which prevented the passage of fish. At its western edge there were two culverts. It is bounded by two roads to the south and west, with an intersection at the south-western corner. Existing buildings along the south-eastern edge had to be considered.

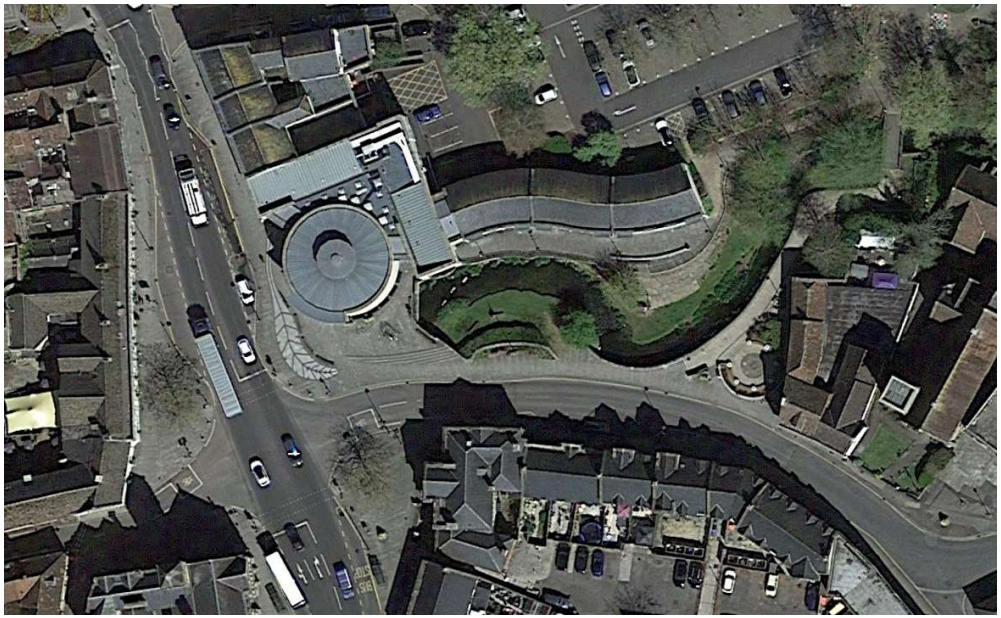


Figure 57 - The site: Corner of Church- and Curzon St (Google Earth)

The Marden project is an example of a small-scale double meander. In terms of the river dynamics and ecology, the meander creates space for features such as shoals (shallow sand banks), riffles (shallow rocky sections with fast-flowing water, which help to stabilise the river bed) and pools, and habitat for plants and animals. From an urban perspective, it creates new public space with access to water and nature.

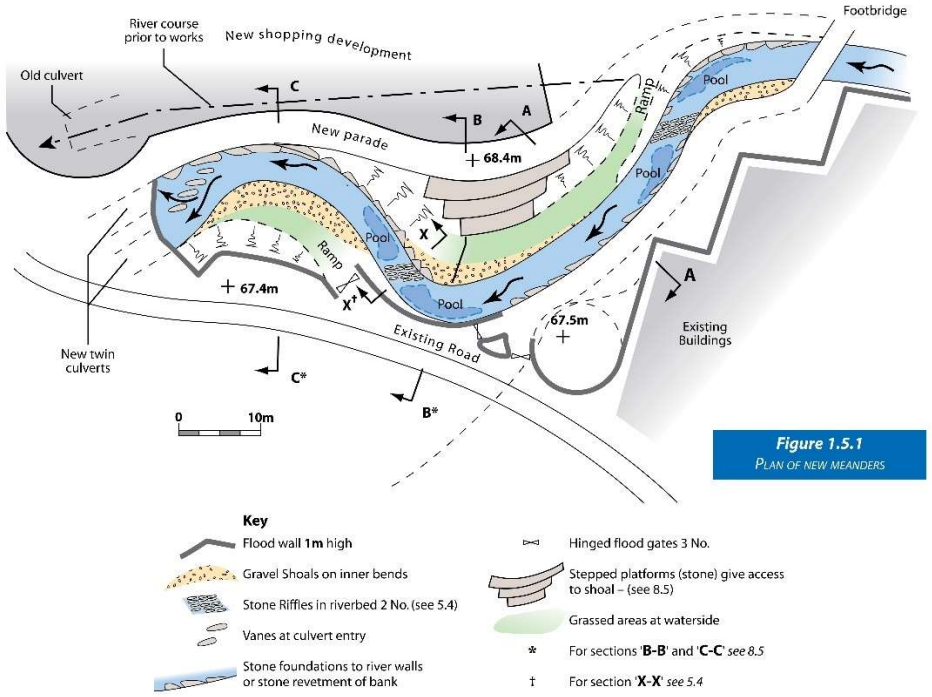


Figure 58 - Design Strategy

https://www.therrc.co.uk/sites/default/files/general/MOT/Low-res/2021_1-2_comp.pdf

This interface incorporates various design elements such as ramps, seating, retaining walls with permeable barriers (railings) on top for increased visual connection, stepped platforms, a footbridge, and a parade running along its length. The relationship of the parade to the river "edge" varies according to the meander - in certain places it runs alongside it, which produces a steep section; in other parts it has a larger offset, which allows for access to the water. The way in which this natural asset is experienced is therefore dynamic and interesting.

Beyond the "internal" dynamics of the re-meandered river – i.e. everything that happens within and immediately around it - shifting the watercourse to the south was beneficial to the urban context. The proposed community- and commercial building could be placed along the northern edge, where the

canal used to be. To the south, east and west, a new relationship was established between water, road and building.



Figure 59 - Public Access

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/8.5_Marden.pdf

A critical aspect of the project is flood mitigation. Hydraulic conditions – taking gradients, water velocity and flood levels into account - were a fundamental design informant. With the north-south road along the western edge as a fixed element (given that no changes to the road were desired), the longitudinal profile between the culvert's invert and the existing upstream level (to the east) would be steep. This would produce high water velocity during a flood event.

The design response is always two-fold; a balance between the dynamics of the flowing water (in this case, the river would scour downwards due to the combination of gradient and meander), and its urban context (roads, buildings and public space infrastructure that needs to be protected from water). The solution was a series of retaining walls and floodgates.

The new scheme significantly increased flood mitigation capacity for the precinct. When the river flooded in 2012, these features performed as planned, thereby protecting the town centre. The public interface elements closest to the water (the seating – both the stone steps and conventional timber benches – as well as the ramps) were able to withstand temporary submersion. General material specifications are water resistant, such as steel railings instead of timber, for example. A certain amount of post-flood maintenance, such as cleaning debris and silt, will always be necessary.

The choice of dense aquatic plant types near the water is also important, both for their flood resilience and the creation of riverine habitat.

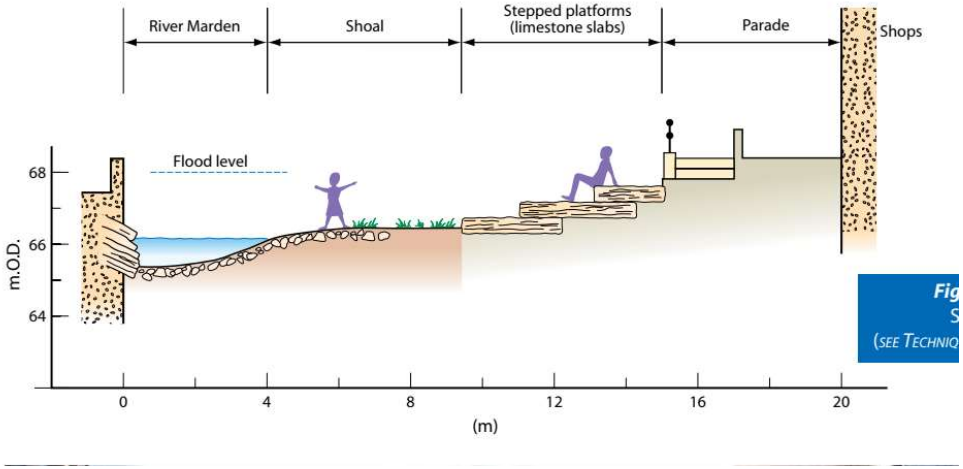


Figure 60 - Section

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/8.5_Marden.pdf

IMPACT

"Calne now has a beautiful 'natural' flowing river that is a delight to visit. By any measure this is a very successful project." – Denis Robson, chairman of the Canal & River Park Assocation

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/8.5_Marden.pdf

The project has been a great success; addressing both the "natural" (biodiversity- and stormwater) aspects, as well as the "urban" factors (access to the river, mixed-use intensification and ultimately urban regeneration). Wagtails, ducks and fish have occupied the site, and it is popular and well used by the public – particularly by young people who enjoy "messing about

in the river". Today, the River Marden is an important biodiversity corridor for Calne.



Figure 61 - Successful Urban River Restoration

https://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/8.5_Marden.pdf

https://www.gazetteandherald.co.uk/news/headlines/nostalgia/14277244.loss-of-bacon-factory-was-huge-blow-for-calne/

https://restorerivers.eu/wiki/index.php?title=Case_study%3ARiver_Marden_at_Calne

https://historicengland.org.uk/services-skills/education/educational-images/ct-harris-bacon-factory-calne-3308

https://www.gazetteandherald.co.uk/news/headlines/nostalgia/14277244.loss-of-bacon-factory-was-huge-blow-for-calne/

www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/1.5_Marden.pdf

https://www.francisfrith.com/river-marden/maps

https://www.calne.gov.uk/news/welcome-to-the-river-marden-new-short-film/

https://en.wikipedia.org/wiki/Wilts_%26_Berks_Canal

https://www.wiltshire.gov.uk/media/11442/Planning-for-Calne-July-2023/pdf/Planning_for_Calne_July2023.pdf?m=638239986809470000

https://en.wikipedia.org/wiki/Shoal

https://en.wikipedia.org/wiki/Riffle

7.2 STEP TWO: TRANSFORMATION

7.2.1 MEDELLIN, COLOMBIA

INTEGRAL URBAN PROJECTS

"Our most beautiful buildings must be in our poorest areas." – Sergio Fajardo, mayor of Medellín 2003-2007

(https://mg.co.za/article/2014-05-15-citys-social-urbanism-offers-a-model/)

Medellín is often held up as a model of transformative urbanism. From its violent low point in the early 1990s, it is now an inspiring example of a resilient, liveable and inclusive city.

One of the early examples of this new mindset is the Fajardo administration's targeted policy programmes called Proyectos Urbanos Integrales ("Integral Urban Projects") or PUIs (Schwab, 2018), which were promoted as a vehicle for investment in marginalised communities. Community participation, not only around the decision-making table, but throughout the life cycle of the projects, was an integral part of the upliftment process.



Figure 62 - Parque Biblioteca España, Santo Domingo Savio, Medellín

https://www.archdaily.com/2565/espana-library-giancarlo-mazzanti

One of the key strategies of the PUIs, along with improved mobility as well as opportunities for housing and commerce, was a focus on the upgrading of public open spaces in poor neighbourhoods (Schwab, 2018, p. 125). An example is the network of "library parks", which are not only cultural and educational assets, but contribute to the legibility of the public realm through their strategic locations as civic buildings.

GREEN CORRIDORS

"… We have hired lots more gardeners, and we've been able to train many people who had no work. When you see the bees, when you see the birds again in these corridors, where there were none, that is when you understand that life is returning." – Federico Gutiérrez, mayor of Medellín



Figure 63 - Medellin

www.c40knowledgehub.org/s/article/Cities100-Medellin-s-interconnected-green-corridors?language=en_US

The *Green Corridors* project was initiated in 2016 and forms part of the city's broader "Greener Medellín for You" programme. It has been included in the Cities100 report highlighting innovations in tackling the climate crisis.

The Joaquín Antonio Uribe Botanical Garden trained disadvantaged community members as gardeners, planting thousands of trees in 30 corridors throughout the city. The results are measurable, with temperature reductions of up to 3 degrees Celsius. This is expected to decrease further in the coming decades.

www.c40knowledgehub.org/s/article/Cities100-Medellin-s-interconnected-green-corridors?language=en_US



Figure 64 - Medellin

www.c40knowledgehub.org/s/article/Cities100-Medellin-s-interconnected-green-corridors?language=en_US

https://www.seforall.org/stories-of-success/video-medellin-green-corridors-project

https://www.c40knowledgehub.org/s/article/Cities100-Medellin-s-interconnected-green-corridors?language=en_US

https://www.unep.org/pt-br/node/25230

https://www.c40knowledgehub.org/s/article/Cities100-2019?language=en_US

8. SITE

8.1 PRECINCTS

The following are important precincts along the mid-stream section of the Elsieskraal (urban/river) corridor. While human movement systems are multi-directional, the river flows west only along this area. For the purposes of this study, and during the design process especially, it has been useful to see it in this order:

8.1.1 BELLVILLE

Bellville was founded as a railway station on the Cape Town to Stellenbosch / Strand line. It is considered as Cape Town's secondary metropolitan node (after the CBD), with significant commercial, industrial, governmental, medical and educational activity, civic institutions, and higher-order transportation infrastructure. It is centrally located in the Northern Suburbs, sharing boundaries with Durbanville, Parow, Brackenfell, Kuilsriver and Belhar.

Bellville is generally characterised by urban decay, with most private investment having migrated north to Tygervalley in the past 30 years. The regeneration of its CBD is highlighted in local policy, and is prioritised as a key component of the *Catalytic Land Development Programme* (MSDF Vol.1, 2023 – p.48) – strategic projects that focus on the provision of affordable housing, economic opportunities and community services.

https://www.sahistory.org.za/place/bellville-suburb-cape-town

https://en.wikipedia.org/wiki/Bellville,_South_Africa

https://thisis.capetown/home/explore/live/neighbourhoods/bellville/

http://thehda.co.za/index.php/projects/catalytic

8.1.2 PAROW

Parow is a linear suburb west of Bellville and Tygerberg, defined by Voortrekker Road to the north and the railway (Northern Line) to the south. It was established in 1865 by a shipwrecked Prussian captain, Johann Parow, and proclaimed as a village in 1901. The area has a substantial commercial footprint, with a high number of shopping centres that grew along Voortrekker Road from the 1960s onwards.

https://www.sahistory.org.za/place/parow#:~:text=Parow%20was%20a%20residential%20suburb,village%20was%20proclaimed%20in%201901.

http://www.capetown.conf.co.za/parow.htm

8.1.3 ELSIES RIVER

The area of Elsies River lies to the west of Goodwood. It was established by the VOC as "Elsjescraal", a company outpost, in 1682. It was later sold to a Belgian free burgher, Pieter Jansz, in 1700. By the mid-19th century, "Elsies" operated mainly as a railway halt, or "halte" (Dutch for "stop" or "resting place"). A *halt* is a simple train station, with only a rail platform and no station building. The Elsies River halt was a major stop on the Transatlantic Rail from central Cape Town. At the time, the Elsieskraal River also flowed nearby, providing water for people travelling by horse and wagon to meet the train. Important public buildings were established at this point, notably the Arcadia Coffee House. Today, the only memory of this node's past character is in the name of the primary vehicular route, Halt Road.

In the 19th century, many Coloured people moved to the area, making rental arrangements with local landowners. This influx increased during the Great Depression and into the 1940s, mainly due to the ample river and wood that the river provided. The timber industry in the new industrial area, and businesses in nearby Voortrekker Road, provided significant employment opportunities.

During the Apartheid era, the Group Areas Act designated Elsies as a Coloured neighbourhood. In the 1980s, it was the scene of civil unrest when protesting high school students were killed by police.

Elsies has a good provision of schools, libraries, shops and civic buildings. The Elsies River community has a proud heritage, with a rich tradition in music, academics and sport. It is, however, not without its problems, particularly gang-related crime.

https://en.wikipedia.org/wiki/Elsie%27s_River#:~:text=3%20Notable%20residents-,History,the%20hands%20of%20many%20landowners.

https://www.facebook.com/groups/capetownhistoricalsociety/posts/482049279469490/

https://www.sahistory.org.za/place/elsies-river

https://www.netwerk24.com/netwerk24/elsies-river-has-a-history-to-tell-20150922

https://old.amu.ac.in/emp/studym/99995933.pdf

https://www.washingtonpost.com/archive/politics/1980/06/18/racial-grievances-erupt-into-fatal-riots-in-s-africa/180d1887-bd0a-4d1a-b5a5-635e79604eab/

https://ewn.co.za/topic/elsies-river-gang-violence

ELSIES RIVER INDUSTRIAL

The industrial area occupies the northern part of the Elsies River neighbourhood. It is bounded by four major roads: Voortrekker Road (north), Jan van Riebeeck Drive (east), Epping Avenue (south) and Halt Road (west). The precinct is split roughly in the middle by the canalised remnant of the river. The northern segment of these two halves is divided in two again by the railway line, which has its own station and taxi rank.

CITY IMPROVEMENT DISTRICTS

In addition to its prioritisation in local planning policy, Elsies Industrial is an example of a "City Improvement District" (CID) – also known as a "Special Rating Area" (SRA). These are defined geographical precincts that receive extra municipal services, through additional property rates, for "top up" services. This can apply to any type of land use (commercial, residential, industrial). CIDs are initiated and managed by local property owners for the benefit of their communities. Examples can include increased safety measures (such as lighting), social upliftment programs, cleaning, infrastructure upgrades, and so forth.

The general objective of CIDs is to improve the quality of the public urban environment, and safeguard property values in the process. At heart, they are Public-Private Partnerships (PPPs), which ensure an element of accountability.

The Elsies River Industrial Area established its own SRA / CID in 2015, following concerns amongst property- and business owners about crime, homelessness and "general urban degradation".

https://www.capetown.gov.za/Family%20and%20home/residential-property-and-houses/private-properties/special-rating-areas

https://resource.capetown.gov.za/documentcentre/Documents/Procedures%2c%20guidelines%20and%20regulations/FAQ%20-%20ENGLISH.pdf

https://elsiesrivercid.co.za/

8.1.4 RUYTERWACHT

Ruyterwacht, west of Elsies River, was originally known as "Epping Garden Village". It was established in 1938 as a suburb for the poor white population. Its name was changed to Ruyterwacht in 1986.

Like Pinelands, its layout was inspired by the Garden City Movement – self-sufficient satellite communities, typically planned in a concentric pattern with central open spaces and radial boulevards, separated from the city by greenbelts. Garden Cities ideals originated as a response to the overcrowded industrial cities of the 19th century. They were founded on principles developed by Ebenezer Howard:

- Generous green spaces (public parks, gardens,, tree-lined streets)
- Mixed-tenure homes
- Walkability
- Integrated transport
- Cultural and recreational buildings
- Communal ownership of land

Many of these principles are still relevant today.

The area has been earmarked for infrastructural upgrades, with the Urban Mobility Directorate initiating a road resurfacing project in late 2023. Beyond road safety (both pedestrian and vehicular), the intention is to lay "the groundwork for a more vibrant and interconnected community".

https://en.wikipedia.org/wiki/Ruyterwacht

https://en.wikipedia.org/wiki/Garden_city_movement

https://www.gardencitiesinstitute.com/advocacy/garden-city-principles

https://socialhistoryportal.org/index.php/news/articles/110054

https://journals.co.za/doi/pdf/10.10520/AJA0259188X_1540

https://capetown.today/reinvigorating-ruyterwacht-a-bold-road-resurfacing-initiative-in-cape-town/

https://core.ac.uk/download/pdf/14918873.pdf

8.1.5 THORNTON

Thornton lies to the west of Ruyterwacht. Like Pinelands further downstream, it is primarily residential, with a number of open spaces and schools, as well as an abundance of trees. It is bounded by Maitland to the north, and Epping to the south.

https://en.wikipedia.org/wiki/Thornton,_Cape_Town

https://www.sahistory.org.za/article/cape-town-segregated-city

8.1.6 PINELANDS

Pinelands has protected heritage status as South Africa's first Garden City. Prior to its development in the 1920s (in response to a need for housing after the First World War) it was a farm named Uitvlugt - with thousands of pine trees, hence its later name. It was also briefly used as a quarantine station for Black Africans during the bubonic plague in 1901. During Apartheid, it was a white-only area.

The suburb is primarily residential, with low densities. It also has a range of churches, schools and sports clubs.

An important new local node in north-eastern Pinelands, adjacent to Thornton, is Conradie Park, a mixed-use development with social housing, commercial space, two schools and a public park along the Elsieskraal canal. This is one of the first examples of the Western Cape Government's "Better Living Model Exemplar Projects" (BLMEP).

https://en.wikipedia.org/wiki/Pinelands,_Cape_Town

https://pinelandshistory.co.za/

https://www.gardencitiesinstitute.com/think-piece/pinelands-a-south-african-garden-city

https://www.gardencitiesinstitute.com/resources/garden-cities/pinelands

https://www.pelteret.co.za/content/000207/The-Garden-City-of-Pinelands-South-Africa.pdf

https://www.groundup.org.za/article/conradie/

https://www.dhk.co.za/projects_type/conradie-park-dhk-architects/

https://www.westerncape.gov.za/betterlivingmodel/sites/

9. DESIGN

9.1 RATIONALE

9.1.1 THE SYSTEM

- Two systems are in need of help – the river, which needs to have its natural functions restored as far as possible, and the urban environment ("city") surrounding it, which is spatially fragmented and in need of new growth.
- The solutions for these respective systems is inherently linked. Restoration and regeneration processes cannot happen in isolation. One cannot happen at the expense of the other. One system's health affects the other, and vice versa.
- Both need to be understood at various scales. The river along its entire length, within a watershed; the city from its role in the region, to its internal hierarchies and movement systems, to districts with specific histories and priorities, to the urban corridor, where activities are concentrated, down to individual precincts of varying character.
- Strategies and priorities for both systems are outlined in local policy and theory, some of it current and some of it dating back decades. All of it relevant.
- These need to align with what is happening in the world at large. In terms of our work as urban designers, the climate crisis is a key starting point when looking at improving the efficiency of settlements. The UN has provided the roadmap for how to tackle this. We just need to pay attention. This seems to be happening.
- We do not have much time, or substantial resources, to achieve these goals. We therefore need to collaborate and approach things differently than before.

9.1.2 THE URBAN CORRIDOR

- There is an urban corridor of strategic and historic importance to the northern suburbs of Cape Town: Voortrekker Road. The corridor is not only the road and its buildings - it includes a "buffer zone" on either side, in the same way that a river has a buffer zone. Within this zone are important elements: businesses, schools, civic institutions, train stations, shops of various sizes. Even a casino.
- The area has substantial existing infrastructure, some of which was historically used to divide people. There is therefore a distinct contrast between north and south. In comparison to the north, the area south of the road and railway line is fragmented.
- The south needs help, but it should also benefit the north.
- The type of help is outlined in local policy, for example – housing, education, sport and recreation, employment, safety.

9.1.3 THE RIVER

- There is a river running through the urban corridor. It is in a poor condition. It is mostly canalised. In certain stretches, it disappears underground. In other areas, there are considerable open spaces either side of it - but these are unsafe, unused, and unloved because the river is not celebrated.
- The river' needs to be restored, and ideally re-meandered. This has been a priority for almost two decades.
- Similar urban river restoration efforts are underway all over the world, providing valuable and inspiring examples of best practice.
- Removing the existing canal, where possible, is a catalyst. It frees up space for other uses and activities where the canal once was. This is a key consideration, because restoring the river will be costly (and invariably upset many people at first). Taking these steps must have additional benefits for the project(s) to be feasible. Unfortunately, saving the environment in itself is not enough.

9.1.4 ACTIVATING THE EDGES

- Wherever the river is restored, and even where it is not, there is potential for new mixed-use nodes. These address regeneration and -growth needs, and improve the performance of the urban system (Density, Mix, Access…)
- These nodes should be placed all along the length of the mid-stream river corridor, not only in newly-created areas, but in existing spaces that are underutilised. For example, on vacant land along the railway line, at intersections with the potential for intensification, near existing activity nodes such as transport interchanges, even on top of large parking lots or under-utilised buildings. They are infill nodes.
- The nodes will activate the edges of the river corridor, by combining different uses in different combinations. Thereby ensuring that it is never empty during the day or night.
- The nodes must sensitively engage with the new river edge, and the existing urban context.

9.1.5 CONNECTING THE DOTS

- Once the river is restored, and the nodes are in place, we must encourage various types of movement along the corridor.
- This movement needs to be different from the existing transport routes. Not fast, but slow. Moving through the new multi-use corridor emphasises the qualitative over the quantitative.
- A well-articulated new NMT (walking, cycling, skating) route or path, flowing through the corridor in the same way as the river - sometimes running next to the water and sometimes crossing it – will draw people from one node to another.
- The path must respond to its immediate context; widening at certain places to create places of rest or activity, and sometimes going over or under existing movement routes (the roads and railway).
- This route must also connect with higher order urban nodes, as well as existing NMT routes.

9.2 FRAMEWORK

The final catalytic design solution for the Elsieskraal mid-stream precinct is a multi-use open space corridor, with a revitalised river at its heart, mixed-use nodes (incorporating housing, sport and economic functions) strategically placed along its length - to link with existing infrastructure and encourage activity along the edges; all connected by an organic, lively, flowing NMT route.

The full set of drawings are included in Section 15 at the end of this document.

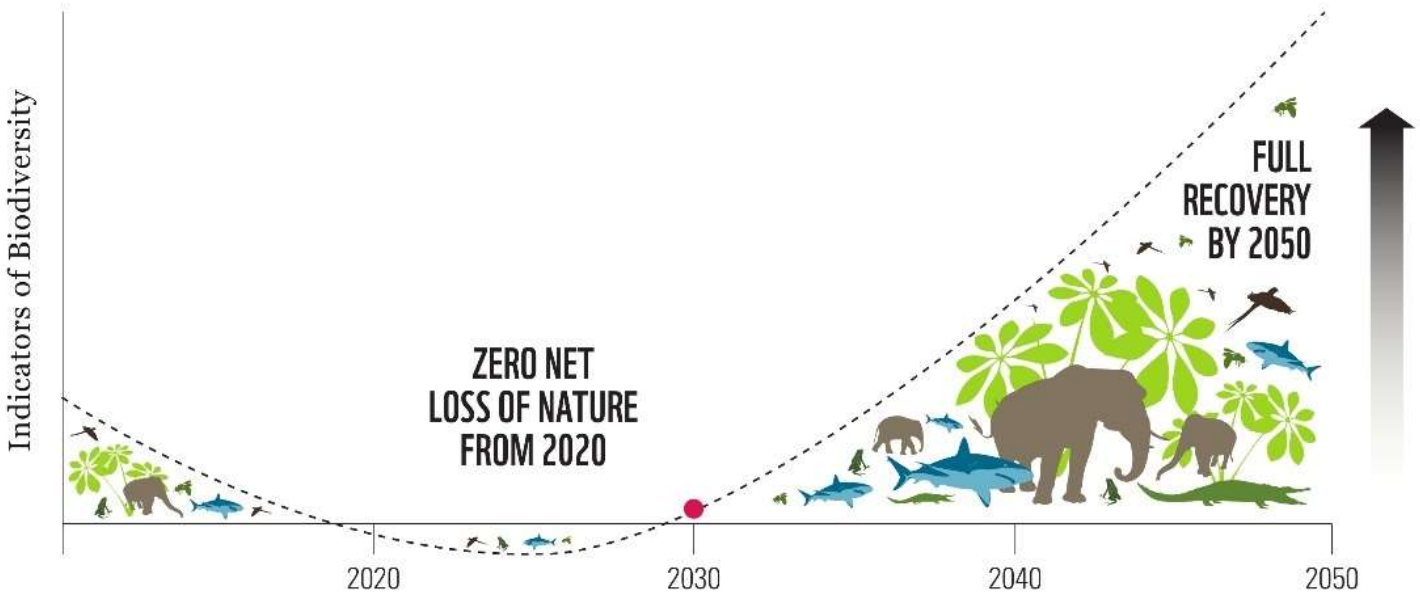


Figure 23: Nature Positive by 2030
A measurable global goal for nature. Source: Locke et al. (2021)[193].

Figure 65 - A "Nature Positive" Future

https://wwflpr.awsassets.panda.org/downloads/lpr_2022_full_report.pdf

10. CONCLUSION

By helping to restore the natural function of a river, as a catalyst for a regeneration process, with a focus on the creation of a multi-functional public corridor, the research project addresses natural- and urban stresses, by increasing systemic (infrastructural, economic, institutional and social) resilience.

BECOMING NATURE POSITIVE

"We know that transformational change – game-changing shifts – will be essential to put theory into practice. We need systemwide changes in how we produce and consume, the technology we use, and our economic and financial systems. Underpinning these changes must be a move from goals and targets to values and rights, in policy-making and in day-to-day life." – The Living Planet Report (WWF, 2022: 4)

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13. DECLARATIONS

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B. Declare that:

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ii. Except as stated below, neither the substance or any part of the thesis has been submitted in the past, or is being, or is to be submitted for a degree in the University or any other University.

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DECLARATION

I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

I have used the APA convention for citation and referencing.

Each contribution to, and quotation in, this project from the work(s) of other people has been attributed, and has been cited and referenced.

I declare that this project is my own work and I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

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14. ETHICS APPROVAL

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

2023/07/24

EBE/00311/2023

RE: Research Ethics Committee Project Approval Letter

Dear Dennis Frederick Moss,

Your application for ethics review of your project titled

Elsieskraal: River Restoration as Urban Catalyst

has been reviewed and evaluated by the

Engineering & Built Environment Committee.

You may proceed with your research project titled:

Elsieskraal: River Restoration as Urban Catalyst

Please note that should:

(i) any serious or adverse effects to participants occur and/or,

(ii) aspect(s) of your current project change and/or

(iii) any unforeseen events that might affect continued ethical acceptability of the project occur then you should immediately report this to the approving REC. You may be required to submit an amendment to this application, in order to determine whether the changed aspects increase the ethical risks of your project.

Based on the information supplied your application has been successful and is approved.

Please note the following additional conditions associated with this approval:

(i) The reviewer noted that the submitted research proposal, specifically the methodology section, provides limited information about the research process, beyond stating that it will be qualitative and listing the methods that will be used. It does not provide any information about who will participate in the research i.e. who will be interviewed and how the research participants will be enrolled in the study. The reviewer nevertheless came to the conclusion that the proposed research is low-risk. It would help, however, for the methodology and the list of interviewees to be made more explicit, latest in the dissertation.

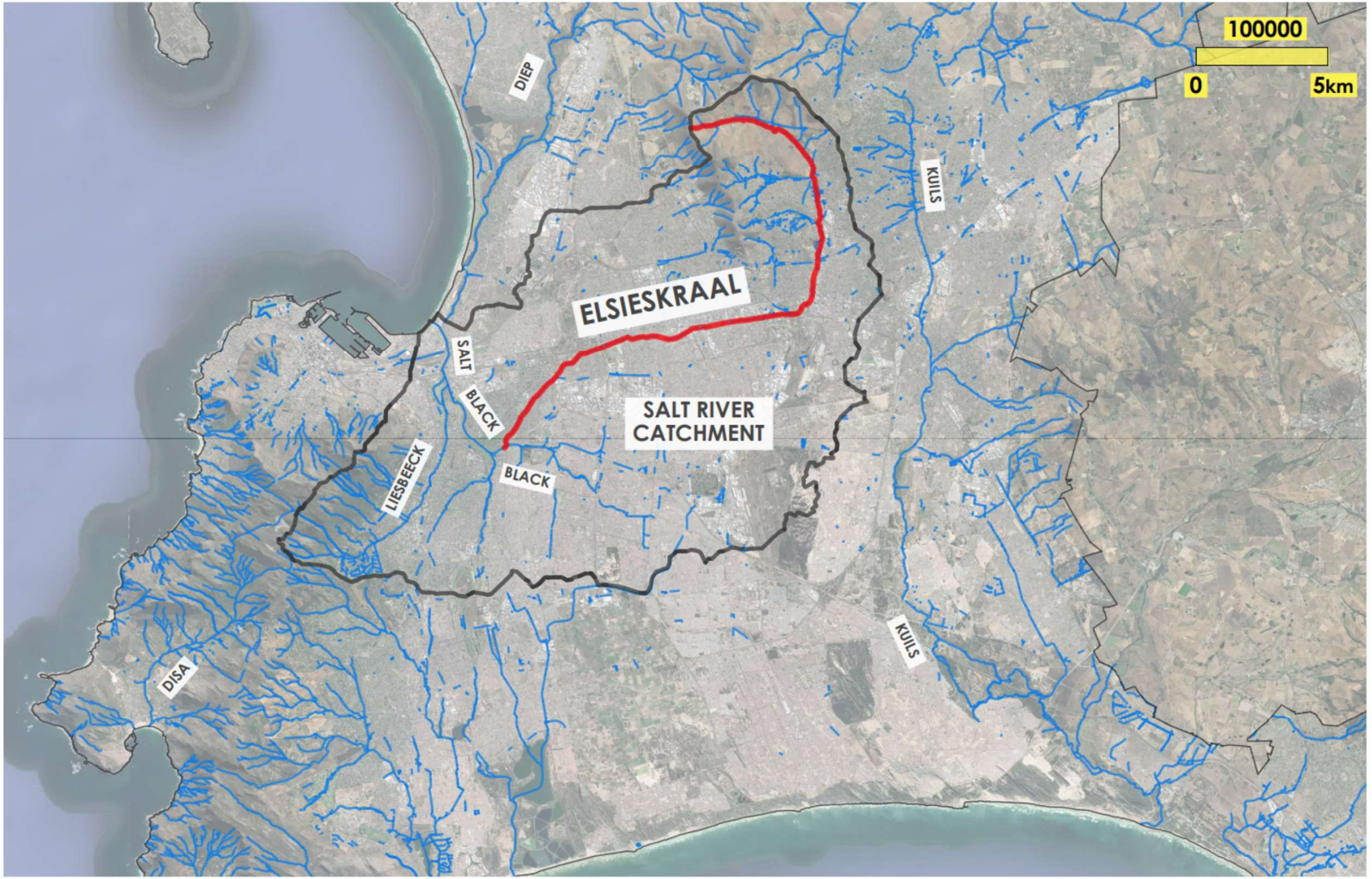
Regards,

Engineering & Built Environment Committee.

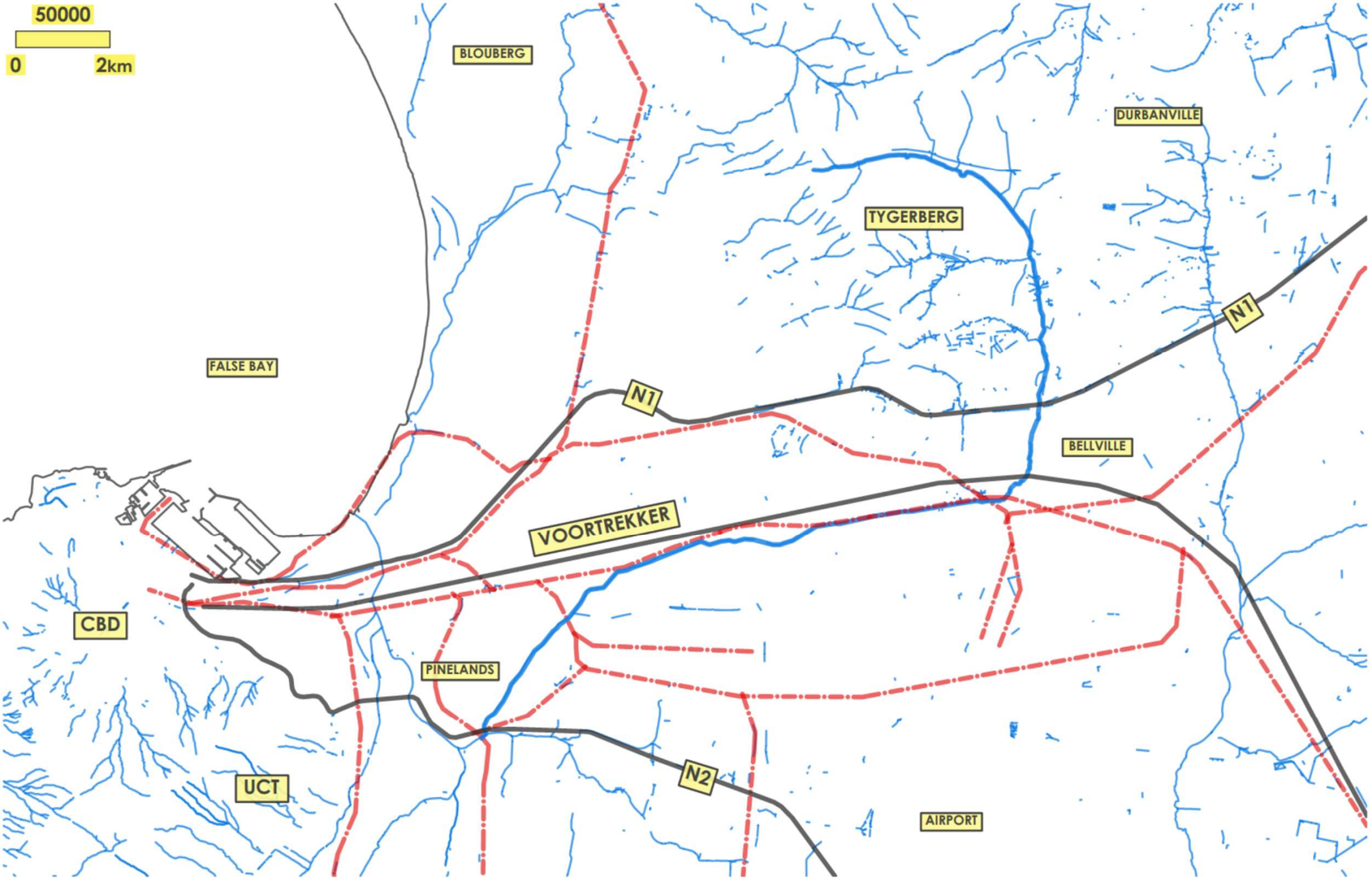
15. FINAL DESIGN

SITE
CONTEXT

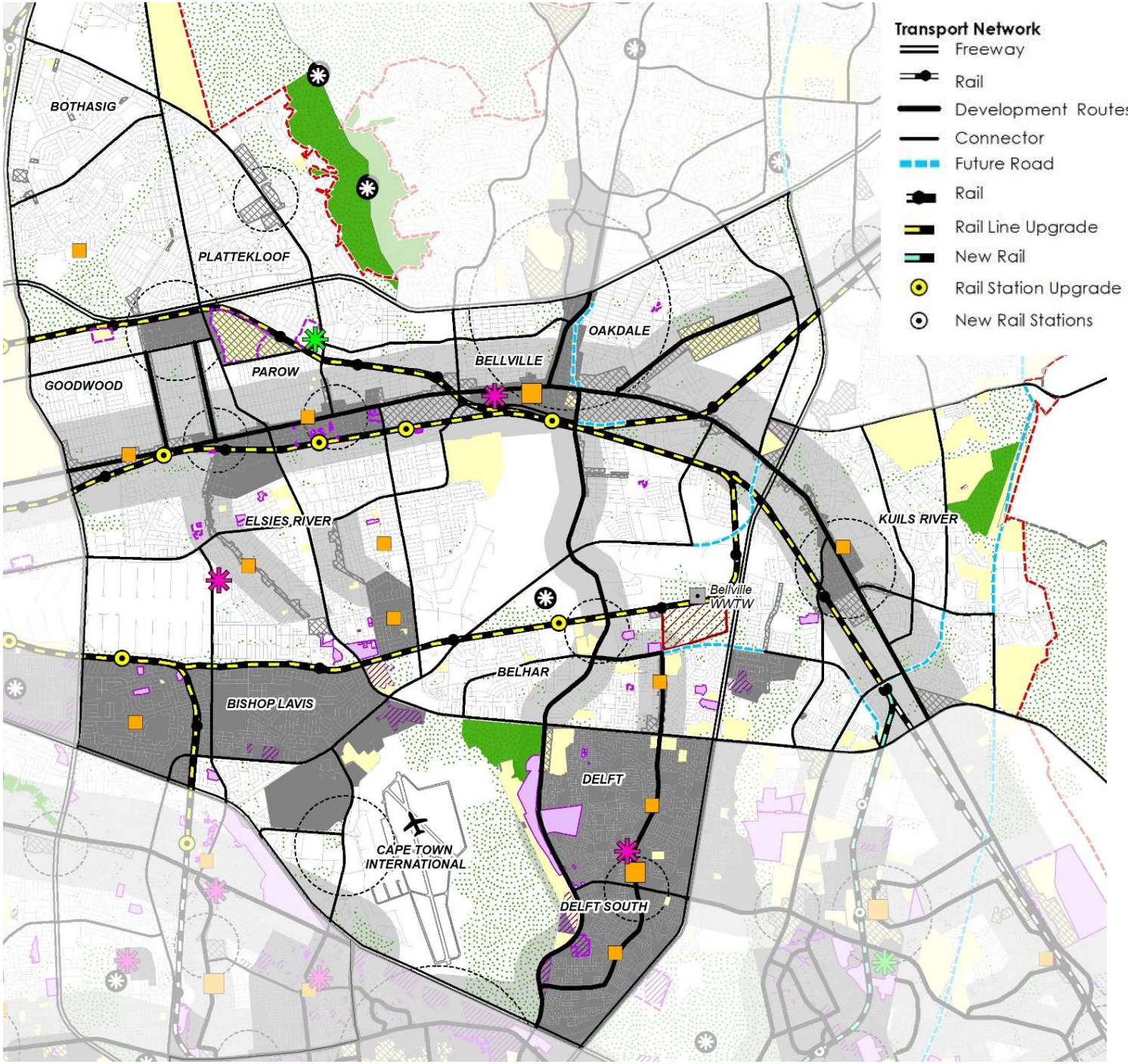
SITE > **ELSIESKRAAL** > CONTEXT > REGION AND CATCHMENT



SITE > **ELSIESKRAAL** > CONTEXT > VOORTREKKER CORRIDOR



SITE > **TYGERBERG** > URBAN RESTRUCTURING & UPGRADING



Transport Network
- Freeway
- Rail
- Development Routes
- Connector
- Future Road
- Rail
- Rail Line Upgrade
- New Rail
- Rail Station Upgrade
- New Rail Stations

LEGEND
Spatial Planning Categories
- Environmental Focus Areas
- Structuring Open Space
- Waterbodies
- New Development Areas
- Mixed Use Intensification
- Development Focus / Urban Support Focus Areas
- Landfill Site/Transfer Station
- Higher / Lower Order Development Corridor

Publicly Assisted Housing
- Projects in Planning
- Sites for Investigation
- Informal Settlements

Conceptual Designations
- Metropolitan Node
- District Node
- Local Node
- Destination Places
- Regional Recreational Hub
- Integrated Recreational Facility
- Regional Civic Cluster
- Community Civic Cluster
- Wastewater Treatment Works (WWTW)
- Urban Development Edge
- Metropolitan Boundary

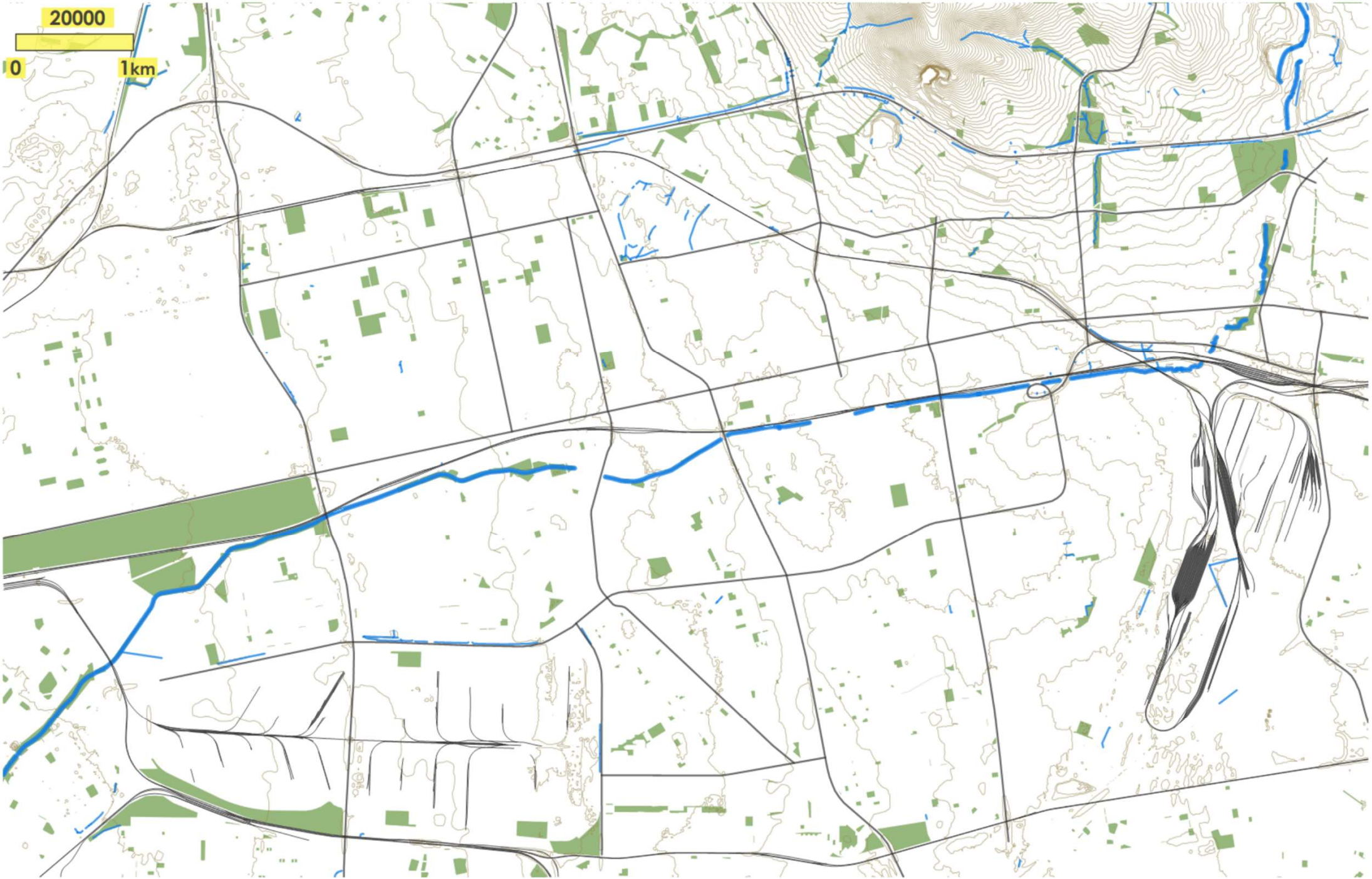
SITE

FOCUS

SITE > **MID-STREAM** > URBAN



SITE > **MID-STREAM** > NATURAL



SITE > MID-STREAM > **PAROW**



SITE > MID-STREAM > **ELSIES INDUSTRIAL**



SITE > MID-STREAM > **ELSIES INDUSTRIAL**



SITE > MID-STREAM > **RIVERTON-RUYTERWACHT**



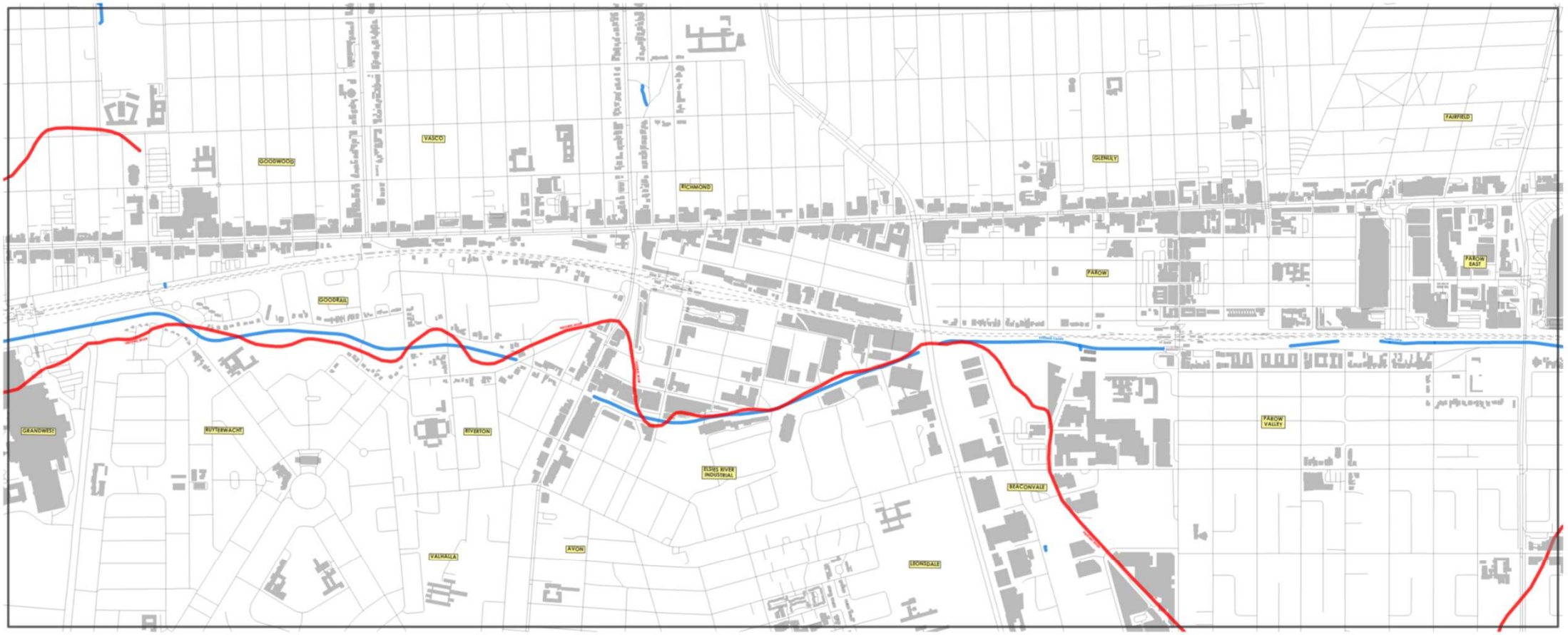
SITE > MID-STREAM > **GOODWOOD-GRANDWEST**



SITE

ANALYSIS

ANALYSIS > **ELSIESKRAAL** > HISTORIC RIVER vs EXISTING CANAL



ELSIESKRAAL
HISTORIC / CURRENT

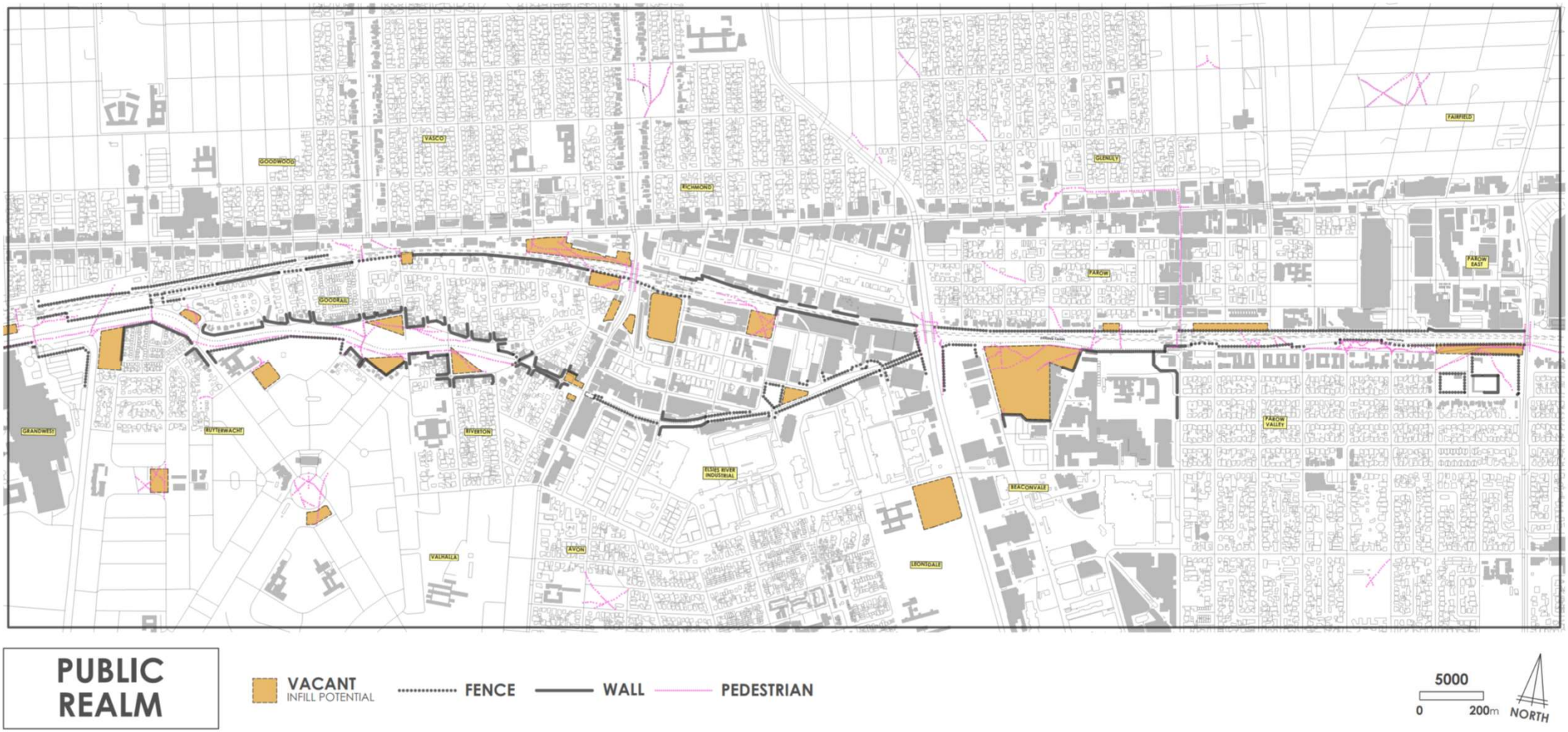
RIVER
HISTORIC

CANAL
EXISTING

5000
0 200m

NORTH

ANALYSIS > **PUBLIC REALM** > EDGE CONDITIONS, VACANT SITES



ANALYSIS > **OPEN SPACE**



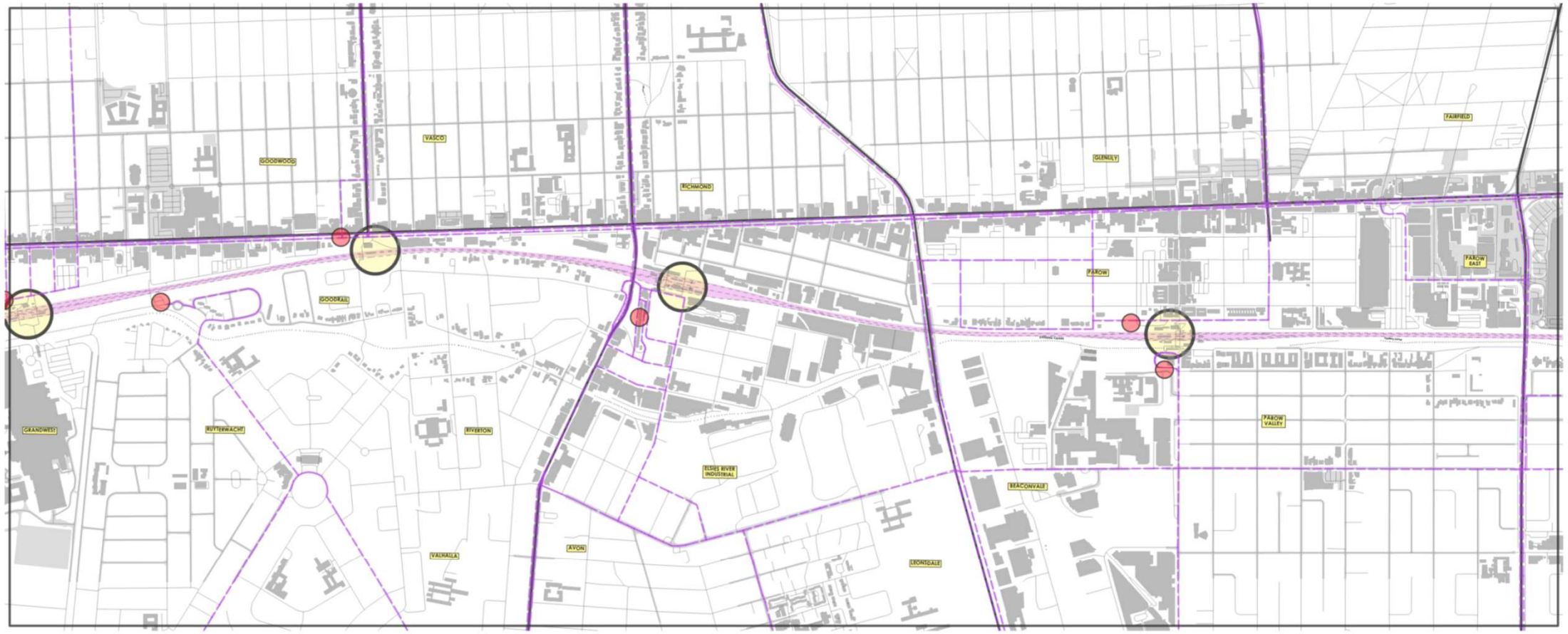
OPEN SPACE

OPEN SPACE
PUBLIC AND PRIVATE

TREE (EXISTING)

5000
0 200m
NORTH

ANALYSIS > **TRANSPORT** > ROAD, RAILWAY, TRAIN STATION, TAXI STOP



TRANSPORT

TRAIN STATION

TAXI STOP

TAXI ROUTE

ROAD

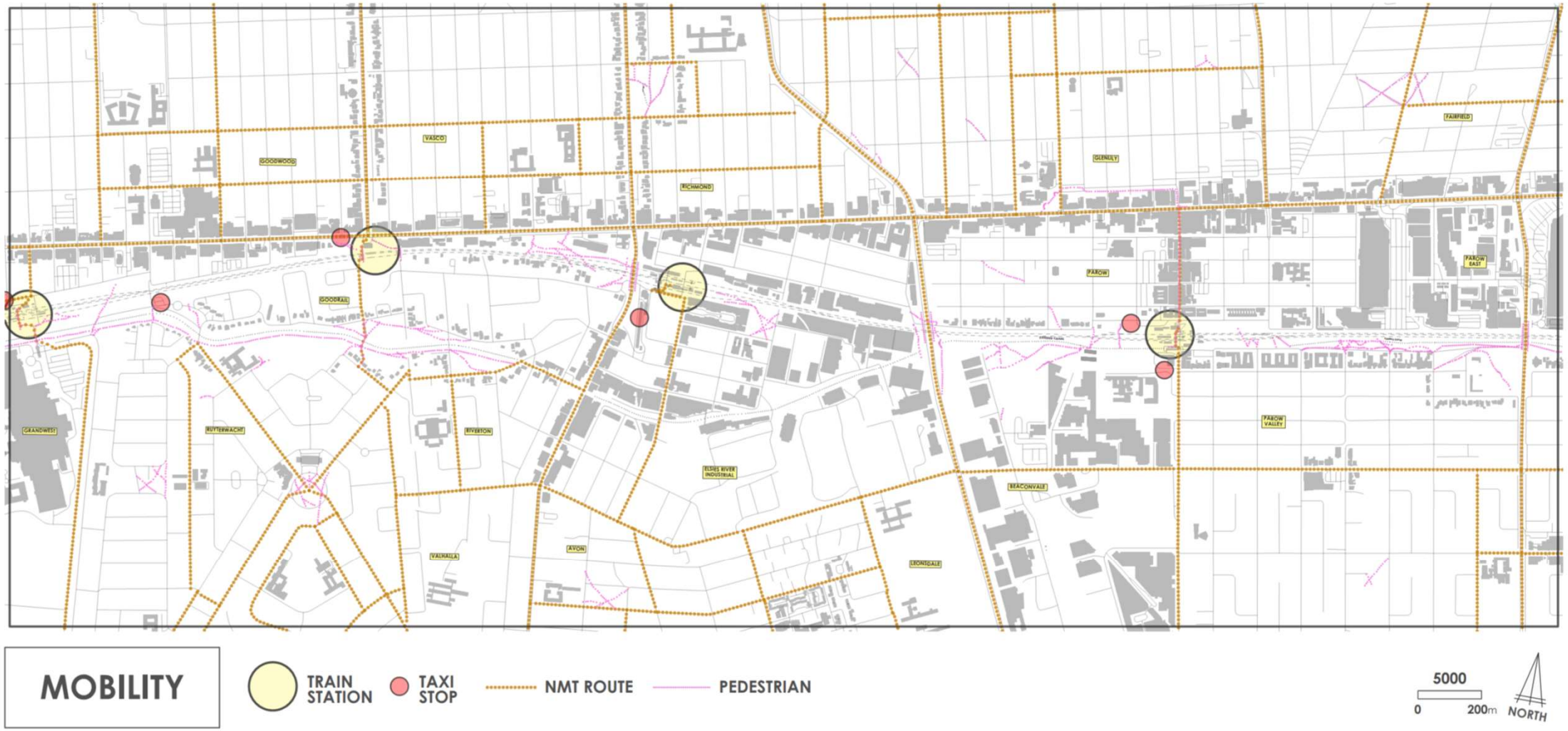
RAILWAY LINE

5000

0 200m

NORTH

ANALYSIS > **MOBILITY** > NMT, PEDESTRIAN, TRAIN STATION, TAXI STOP



ANALYSIS > **BUILDING HIERARCHY**



BUILDING HIERARCHY

PRIMARY
(HIGHER ORDER)
eg. INSTITUTIONAL, EDGE-DEFINING, NODAL

SECONDARY

OTHER

5000
0 200m
NORTH

ANALYSIS > **SOCIAL** > COMMUNITY, EDUCATION, RECREATION, WORSHIP

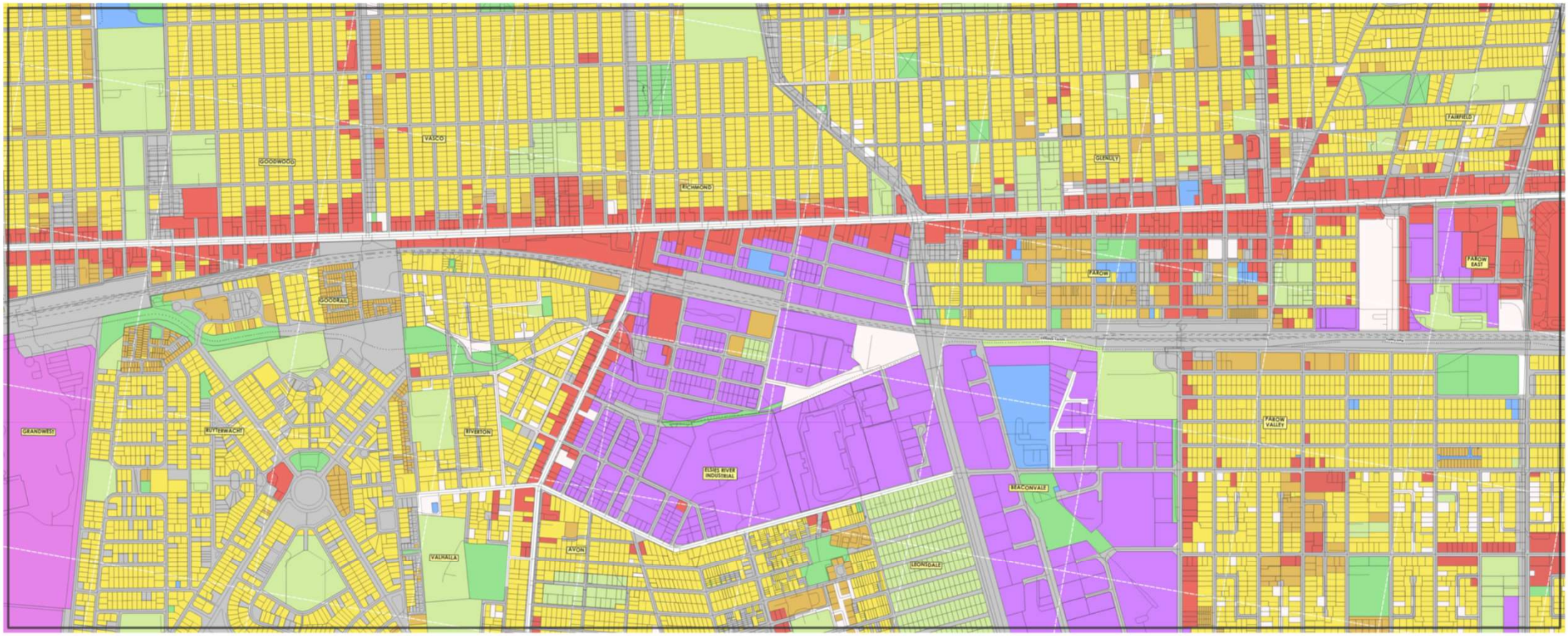


SOCIAL INFRASTRUCTURE

- **COMMUNITY** — CIVIC CENTRE, LIBRARY, MULTI-USE VENUE
- **RECREATION** — PARK, SPORT
- **EDUCATION** — SCHOOL, ECD, COLLEGE
- **WORSHIP** — RELIGION, SPIRITUALITY (INCLUSIVE)

5000
0 200m NORTH

ANALYSIS > **ZONING** > RESIDENTIAL, BUSINESS, INDUSTRIAL, OPEN SPACE

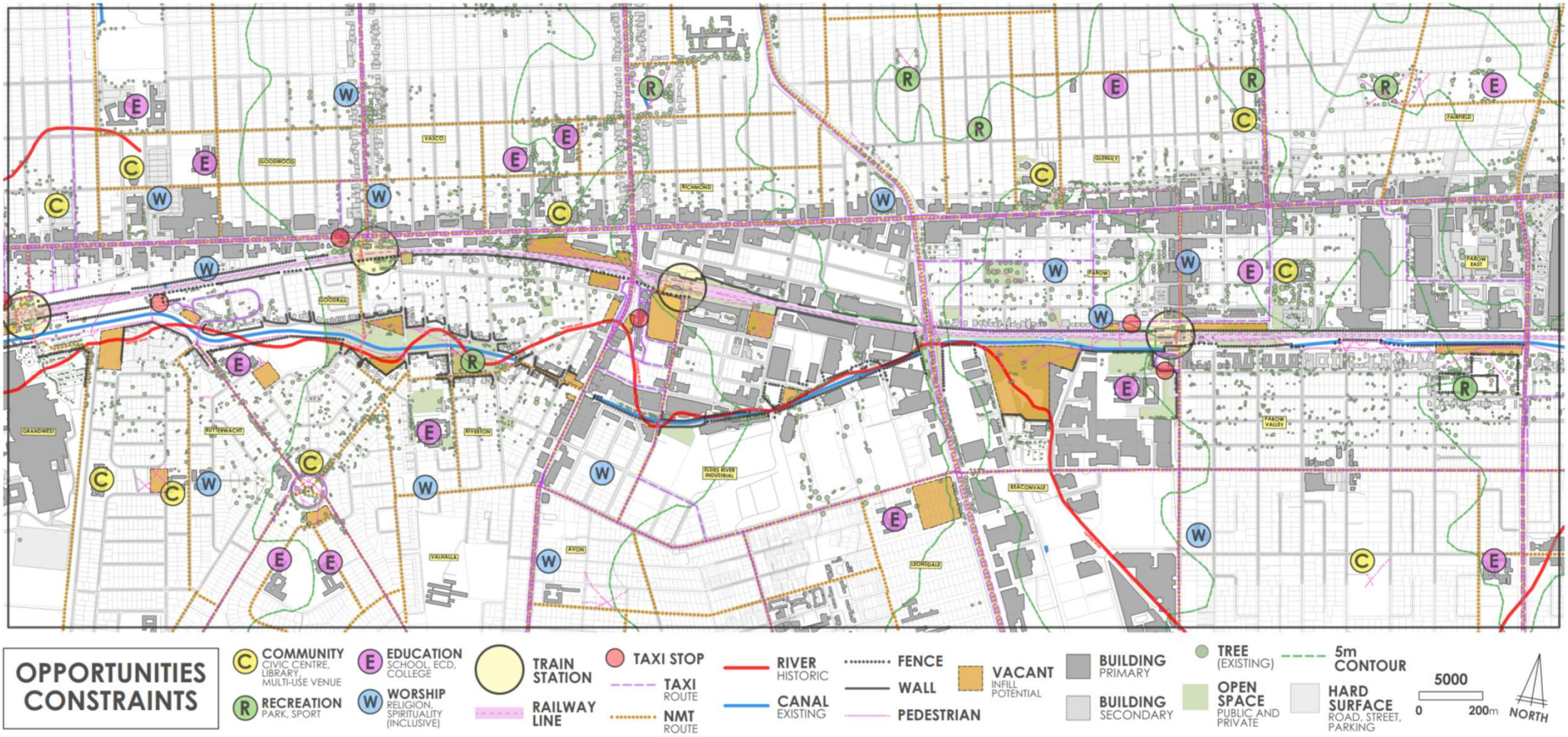


ZONING

- BUSINESS
- INDUSTRIAL
- SINGLE RES
- GENERAL RES
- OPEN SPACE
- COMMUNITY
- TRANSPORT
- UTILITY

5000
0 200m
NORTH

ANALYSIS > OPPORTUNITIES & CONSTRAINTS



DESIGN
CONCEPT

CONCEPT > **RIVER RE-MEANDER** (CATALYST)



CONCEPT > **NODES** (MIXED USE)



CONCEPT > **MOVEMENT** (NMT PATH)



CONCEPT > **EDGE** (MIXED-USE CORRIDOR)



CONCEPT > **EXTEND** (EXISTING INSTITUTIONAL + FUTURE MIXED-USE NODES)



CONCEPT > **CONNECT** (URBAN CORRIDOR)



CONCEPT > **MIXED-USE CORRIDOR**



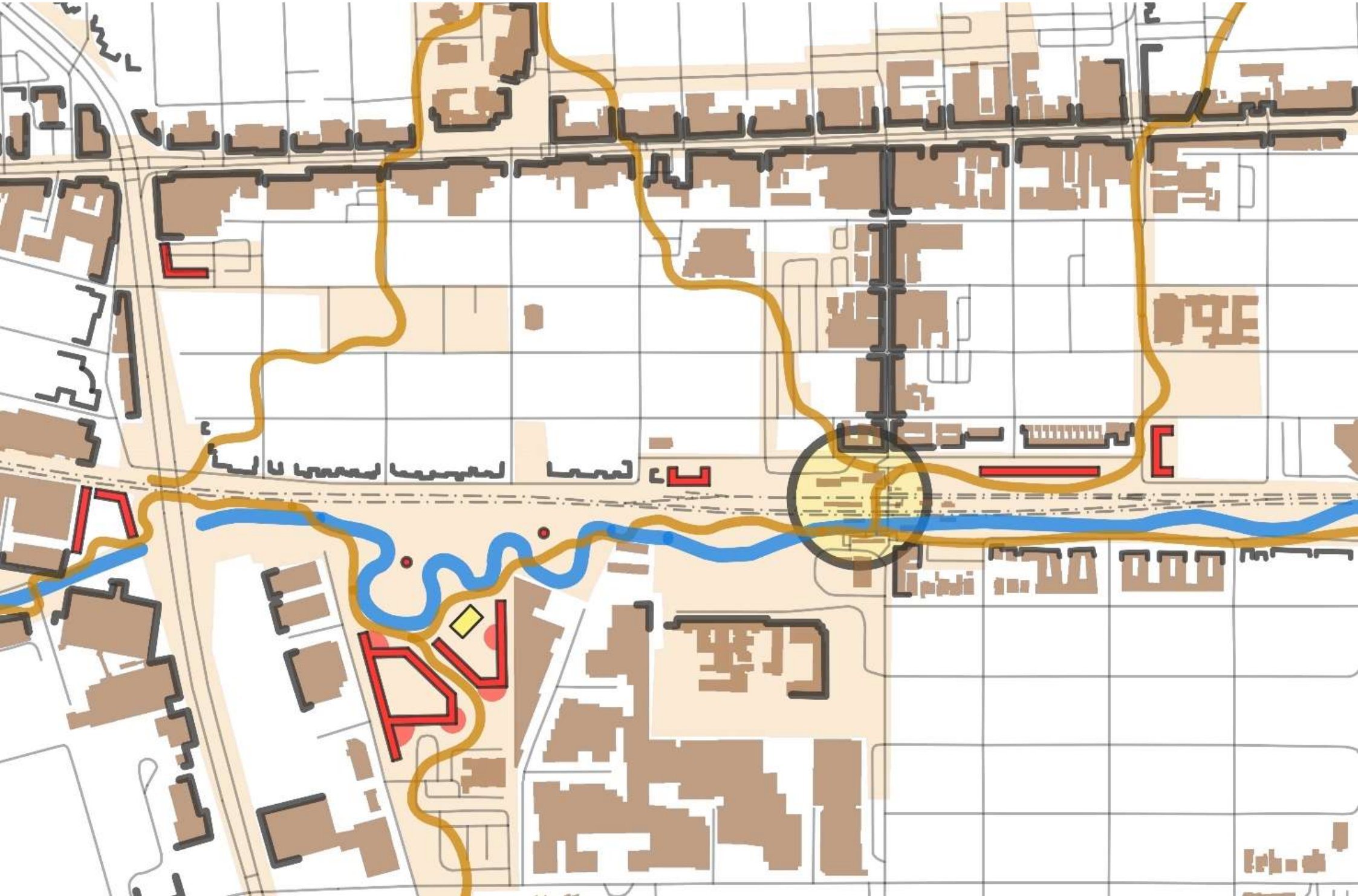
CONCEPT > MIXED-USE CORRIDOR



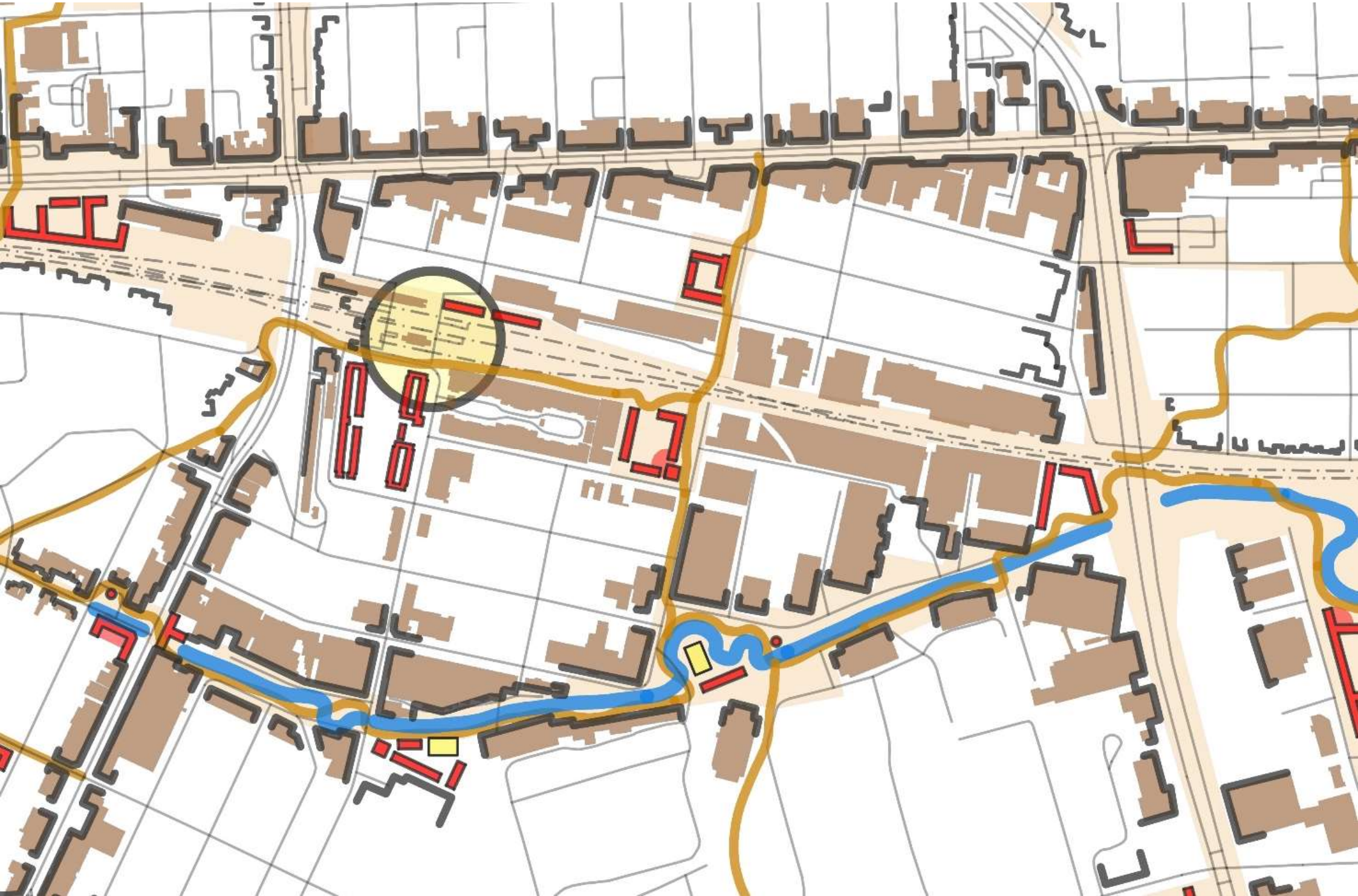
CONCEPT > MIXED-USE CORRIDOR



CONCEPT > **MIXED-USE CORRIDOR**



CONCEPT > MIXED-USE CORRIDOR



CONCEPT > **MIXED-USE CORRIDOR**



DESIGN
PROCESS

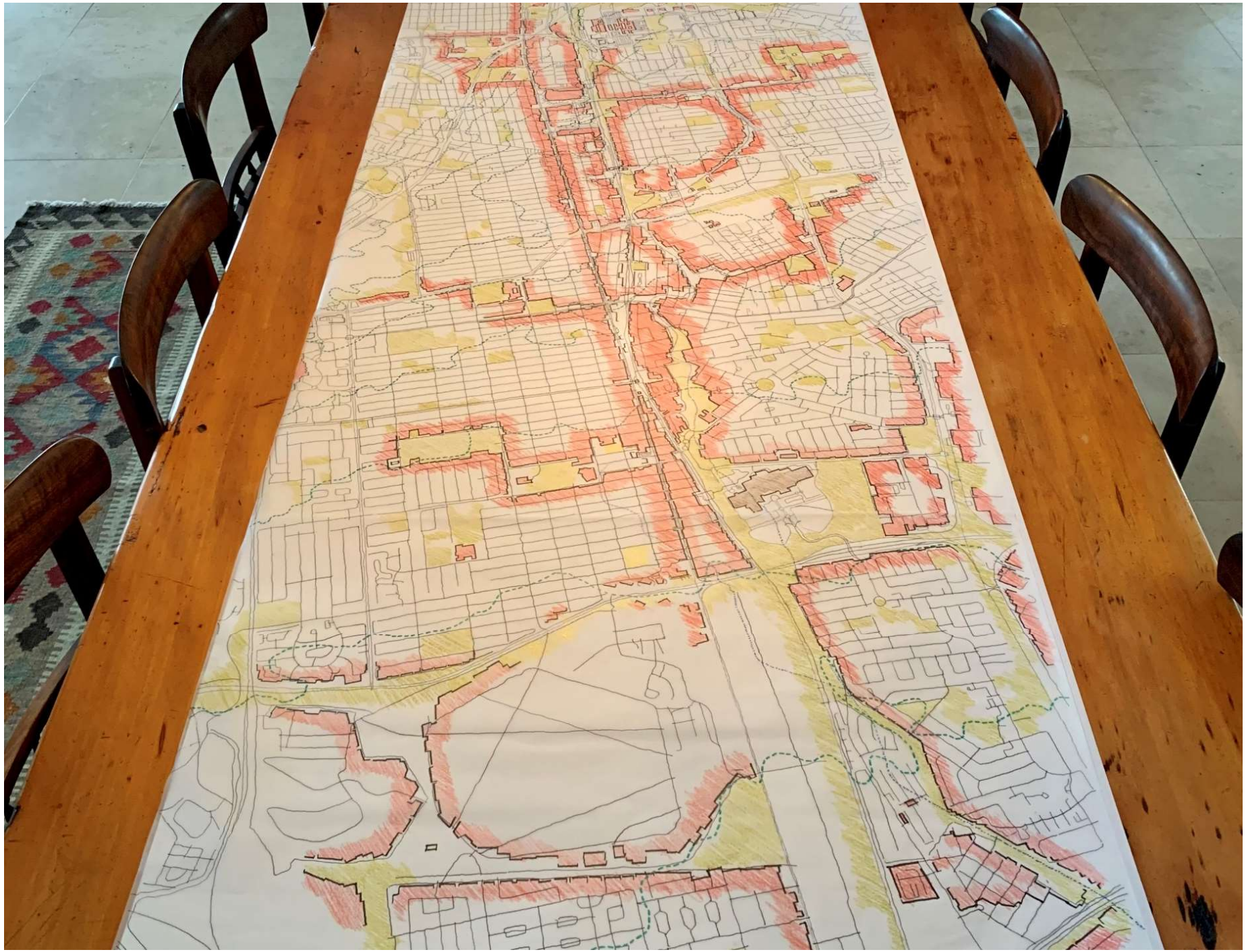
DESIGN > **REVIEW 2** > RIVER AS A SYSTEM... FLOODING MID-STREAM



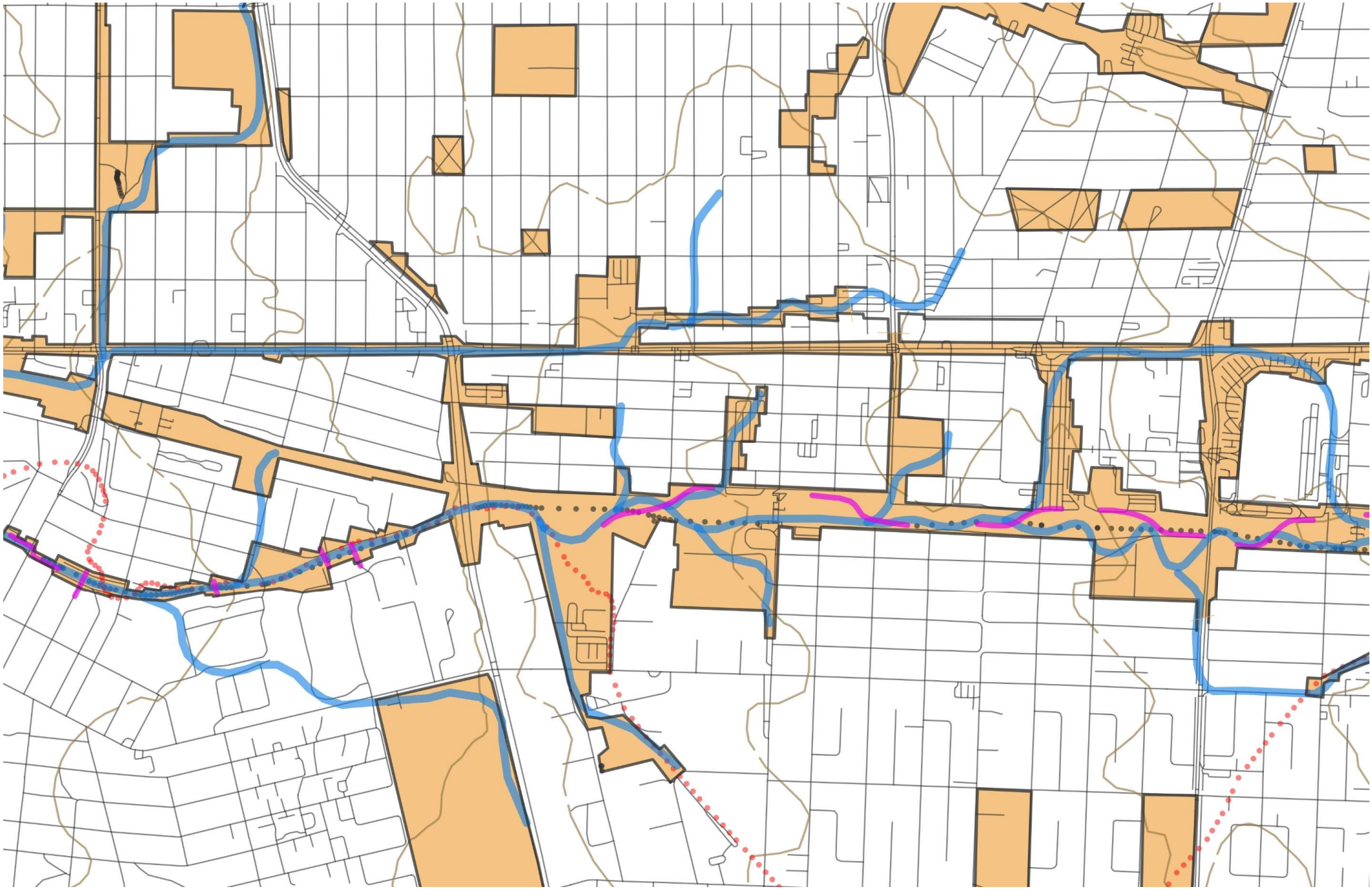
DESIGN > **REVIEW 3** > LARGE-SCALE RE-MEANDER… CONNECT OPEN SPACE

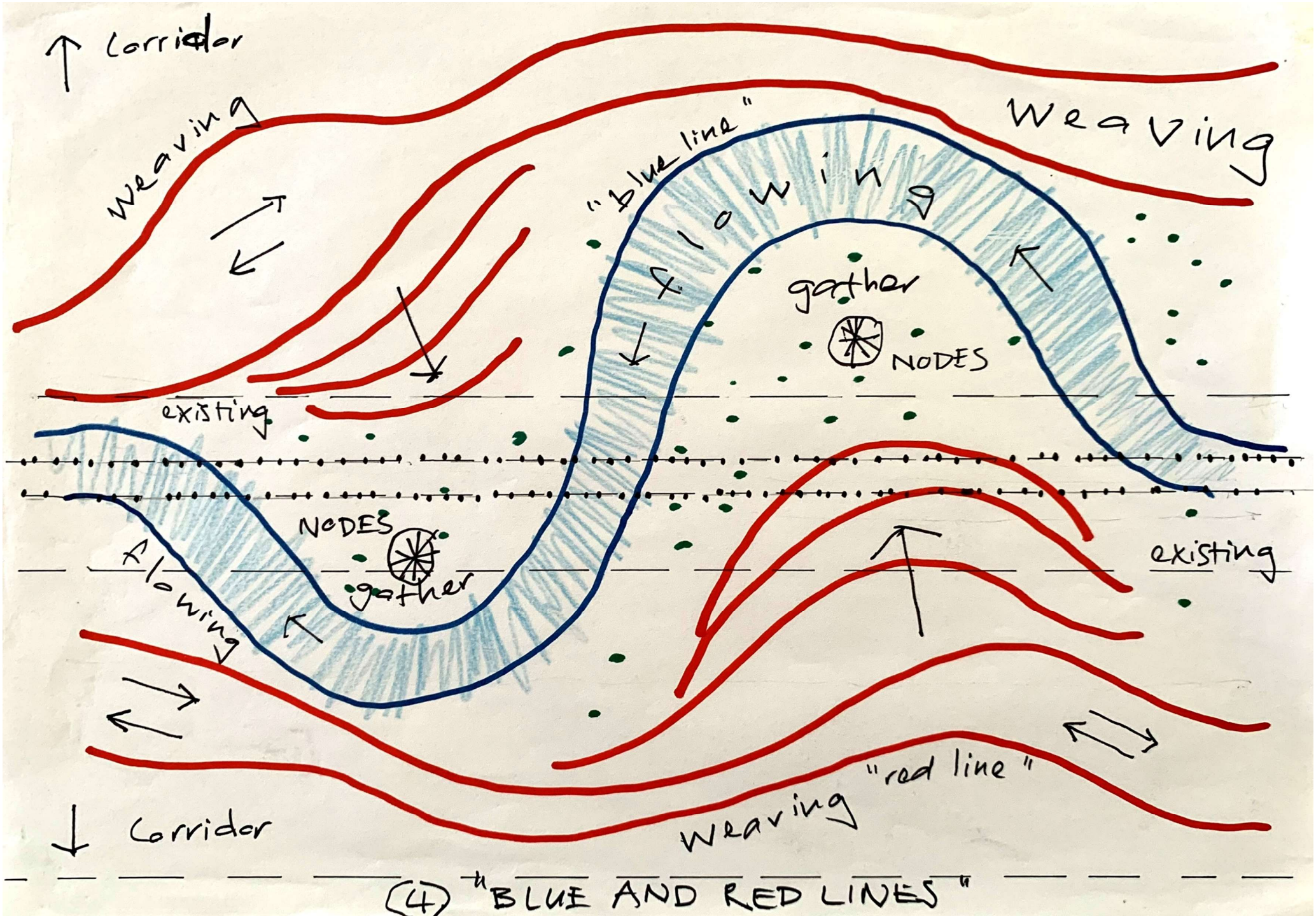


DESIGN > **MILESTONE 2** > PUBLIC REALM … EDGE QUALITIES

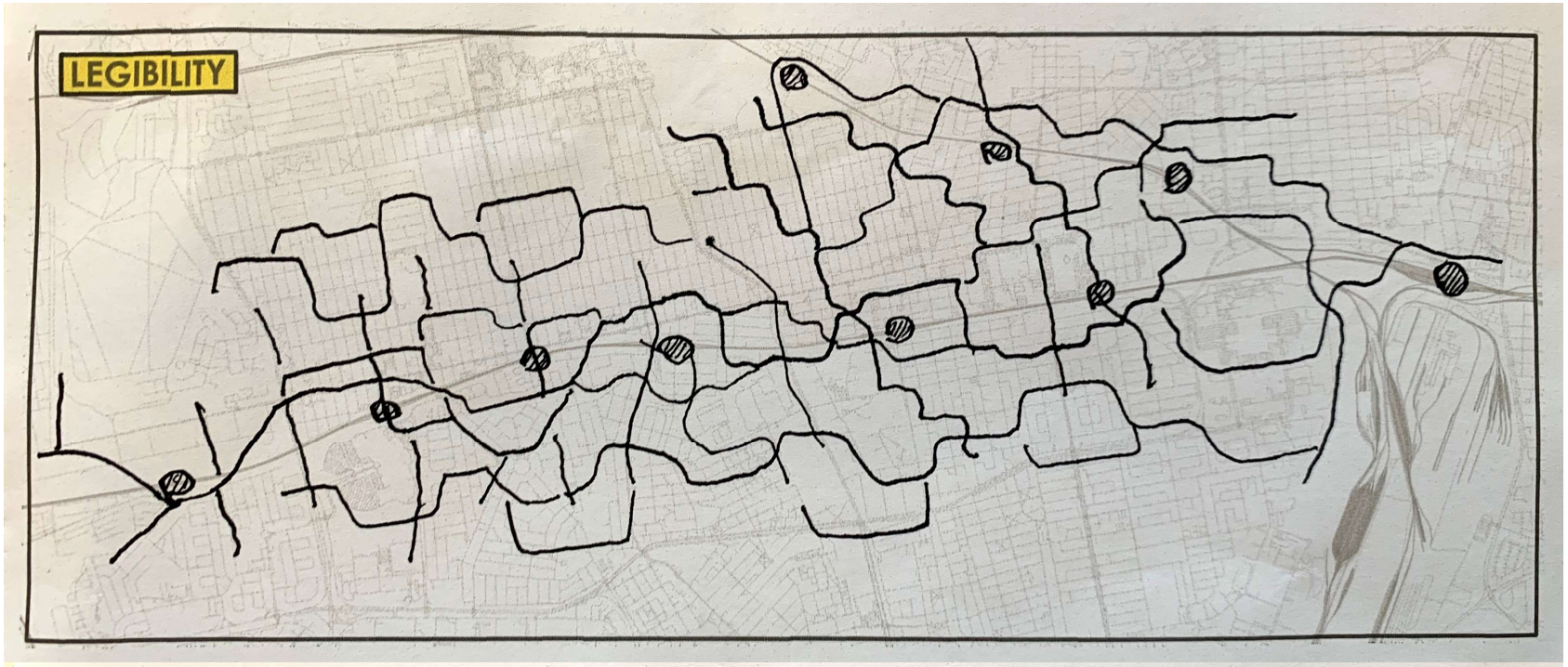


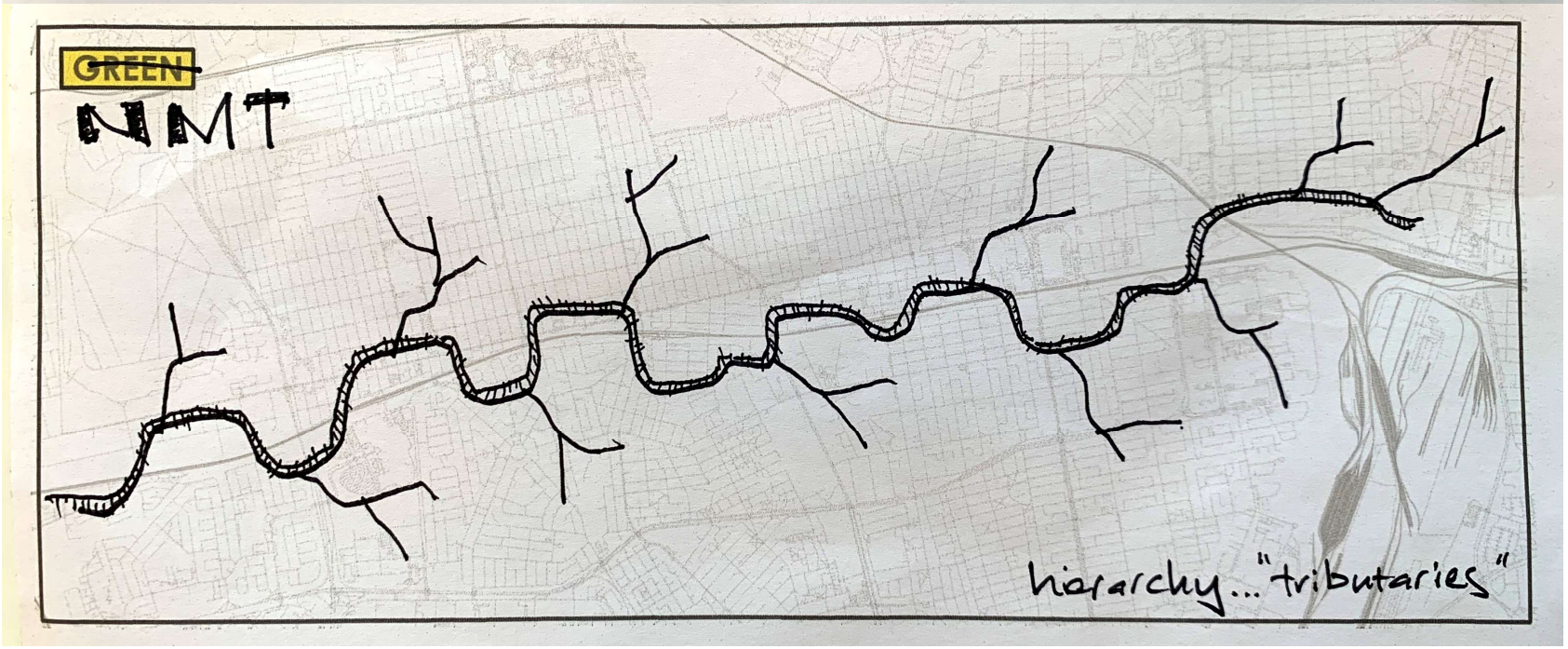
DESIGN > **REVIEW 4** > PUBLIC REALM… HISTORIC vs EXISTING RIVER



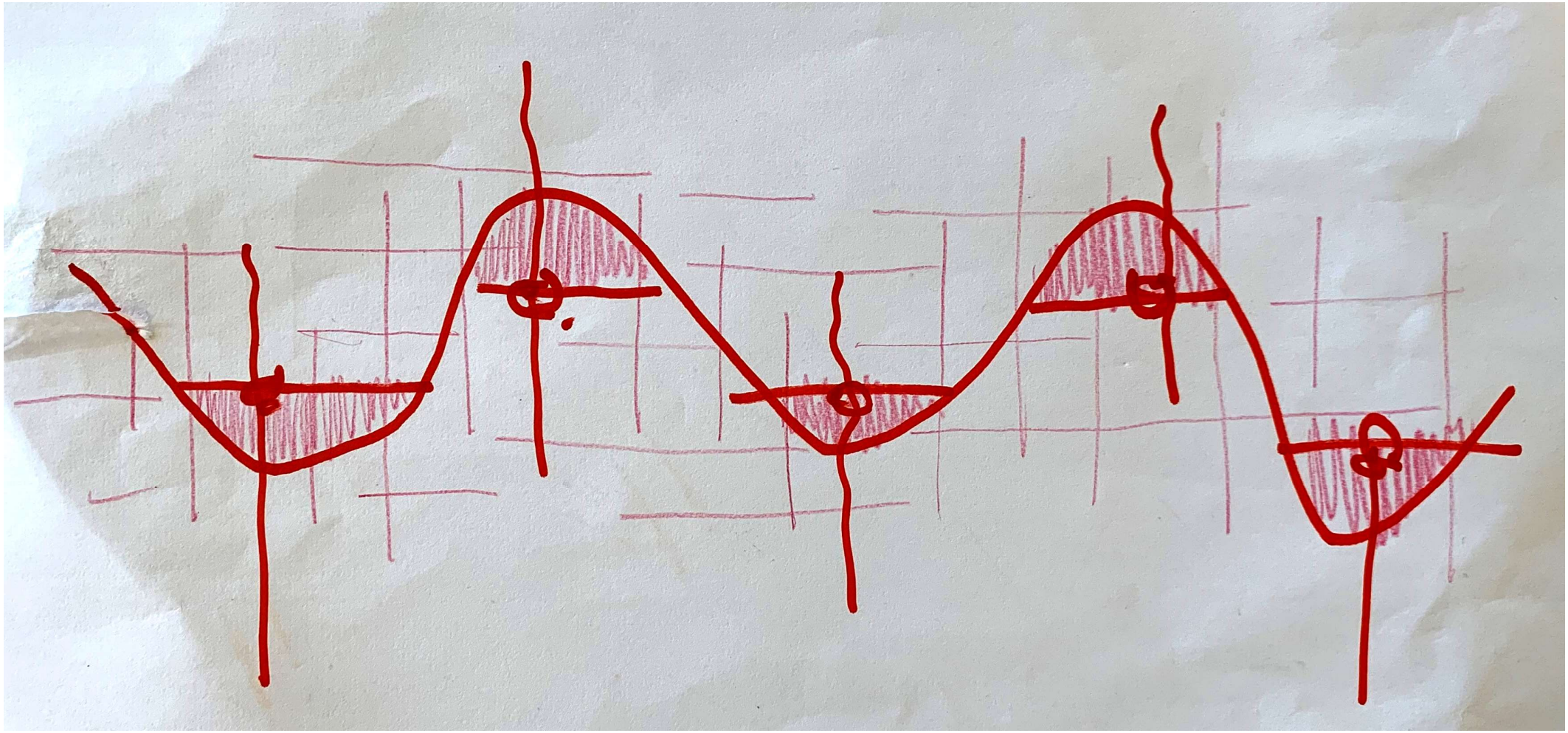

Corridor
weaving
"blue line"
flowing
weaving
gather
NODES
existing
NODES
gather
flowing
existing
Corridor
weaving
"red line"
(4) "BLUE AND RED LINES"

DESIGN > **REVIEW 5** > EXISTING (RIGID) vs NEW (FLOWING)

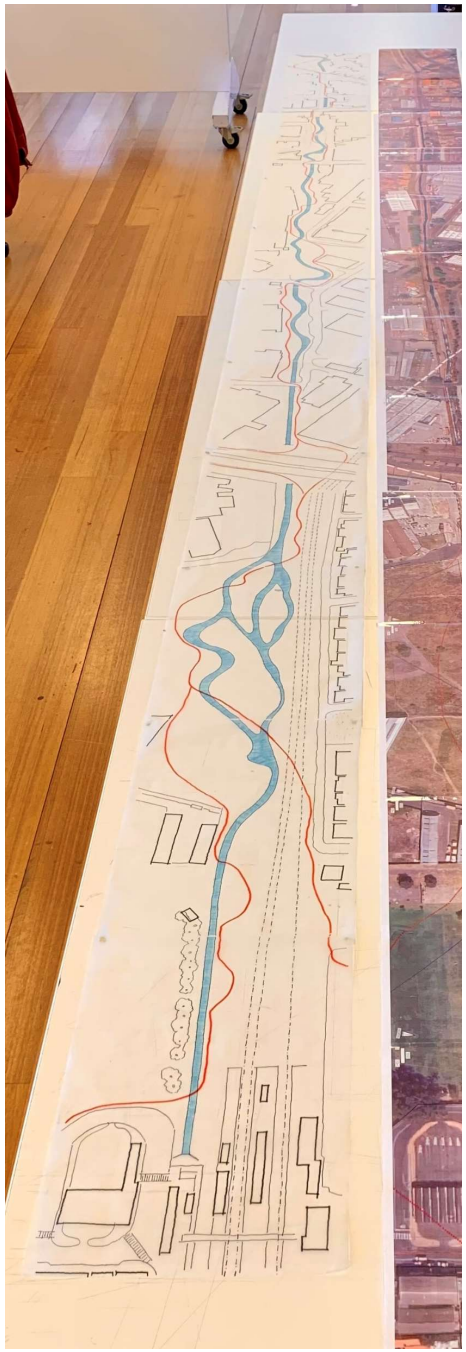


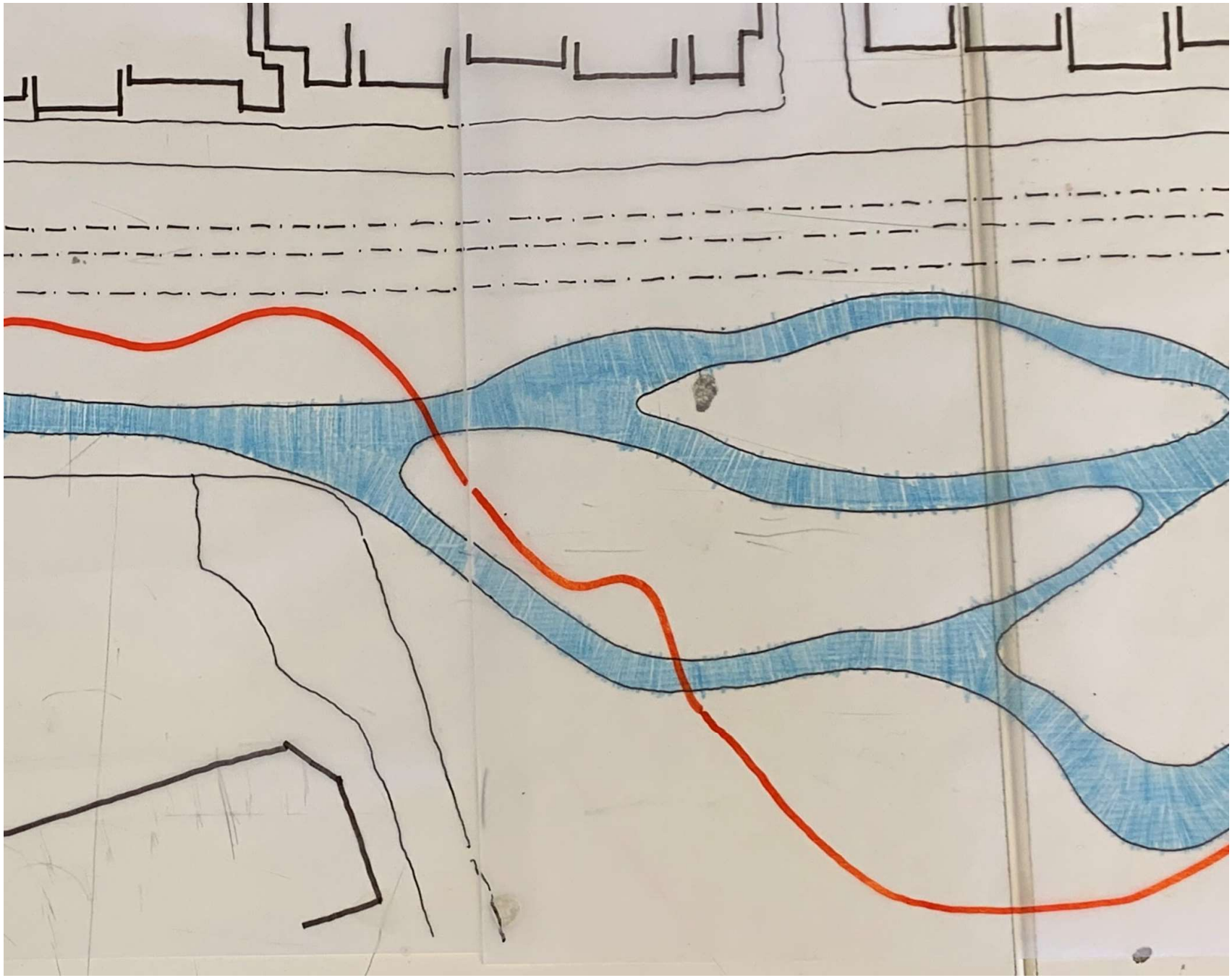


DESIGN > **REVIEW 5** > MEANDER AS CATALYST... PUBLIC SPACE

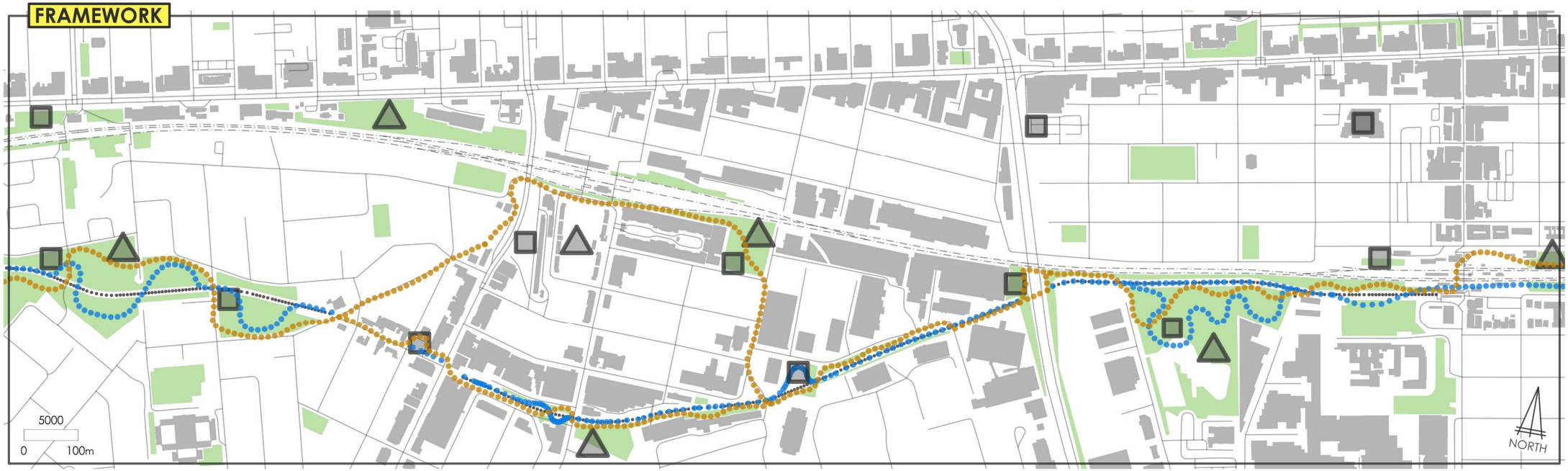


DESIGN > **REVIEW 6** > DETAIL MEANDER (WATER) + MOVEMENT (NMT)



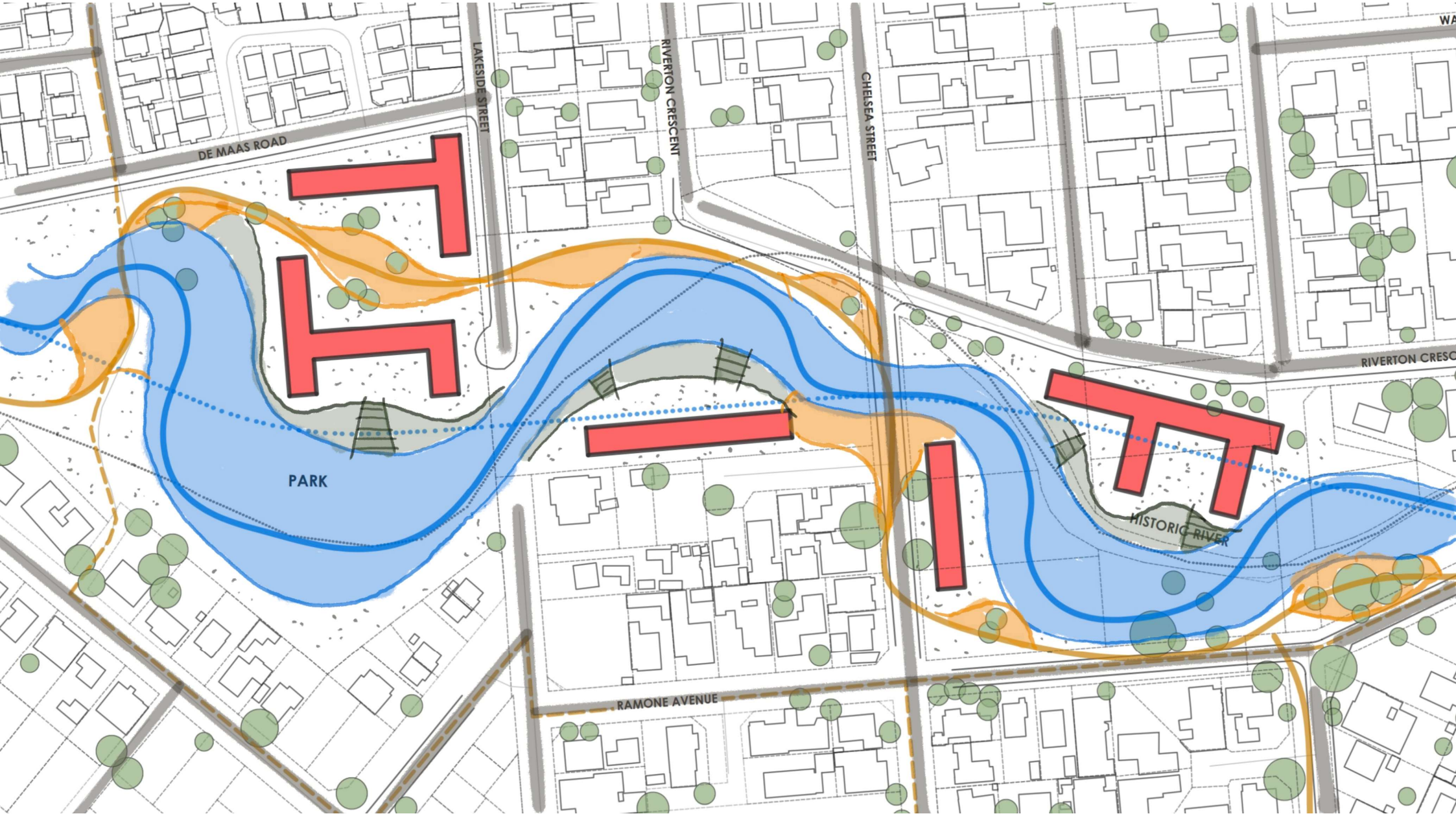


DESIGN > **MILESTONE 3** > MEANDER + NODES (HOUSING / TRADE)

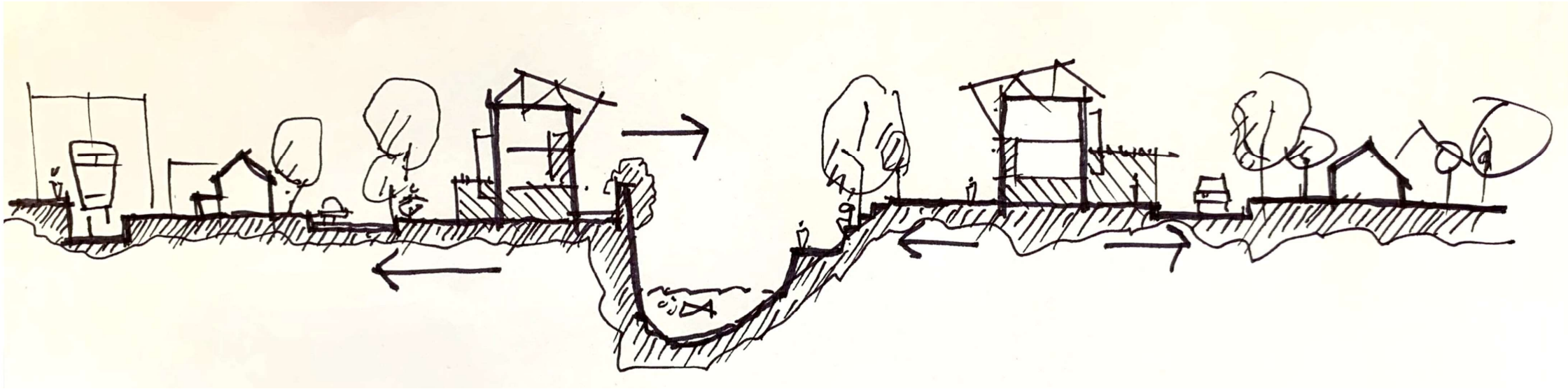




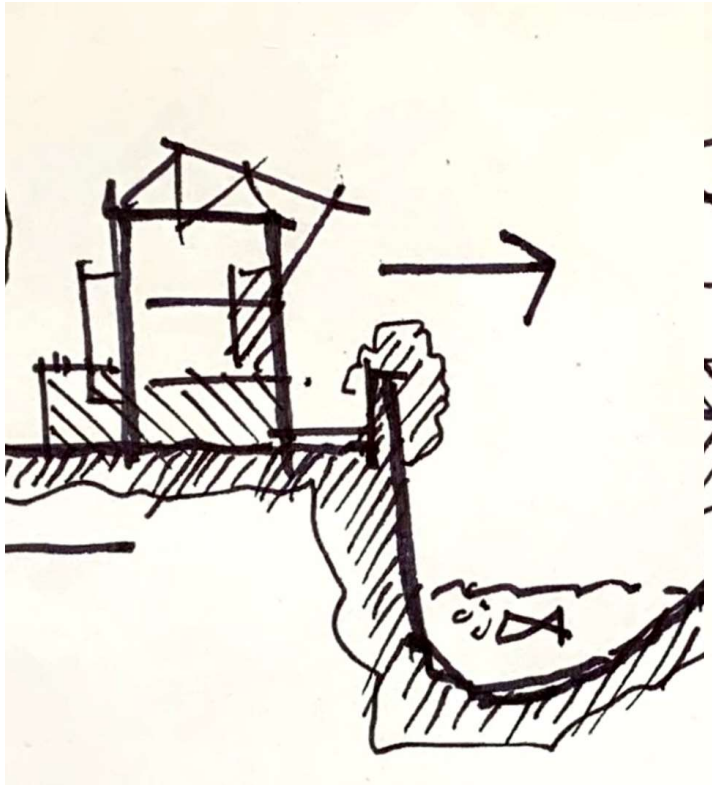
DESIGN > **REVIEW 7** > RIVER INTERFACE LAYERING… BUILDING FOOTPRINTS

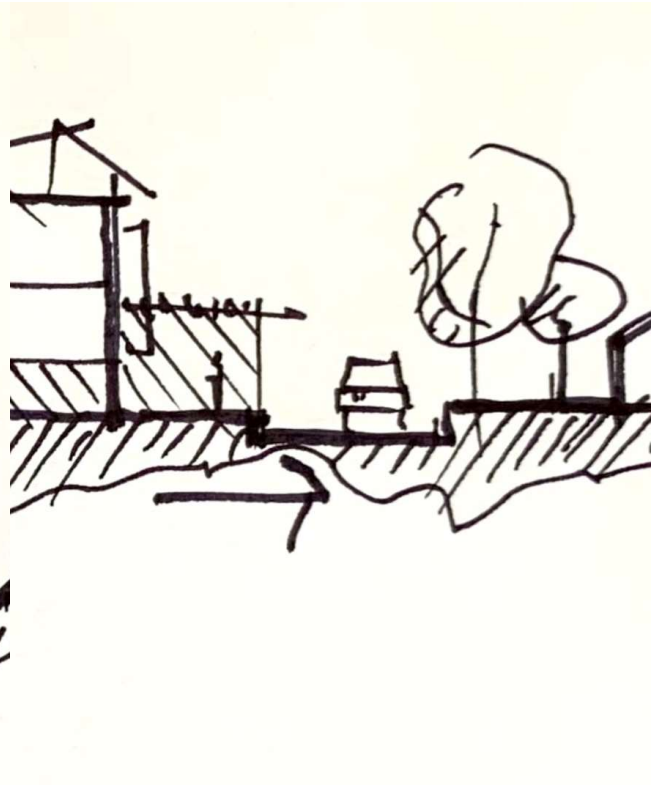


DESIGN > **REVIEW 7** > TYPICAL SECTION… RIVER INTERFACE







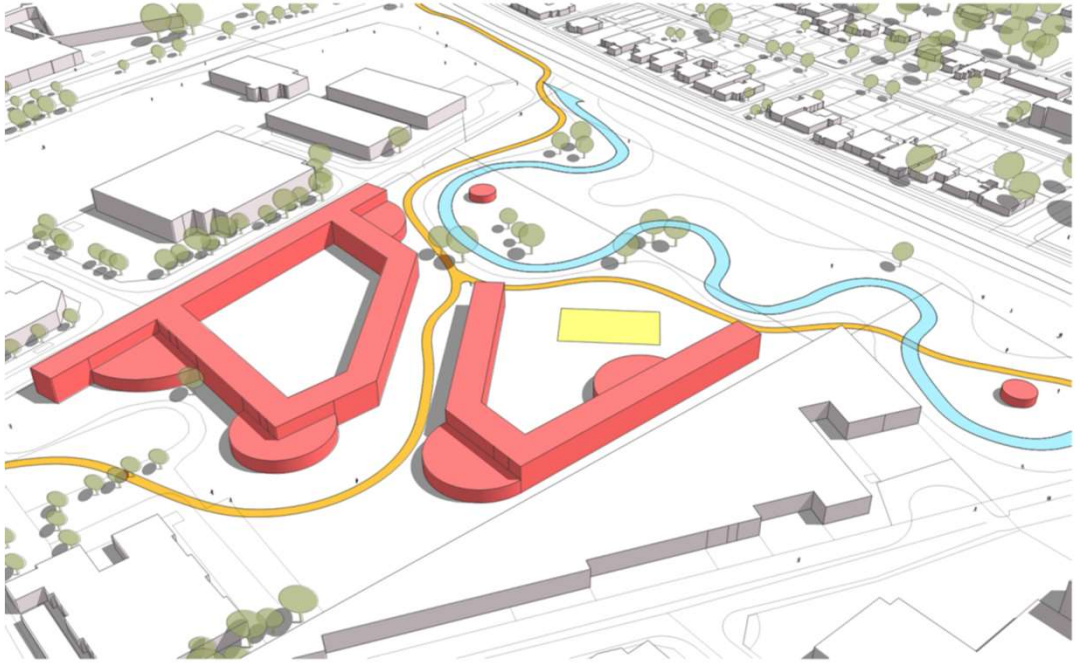


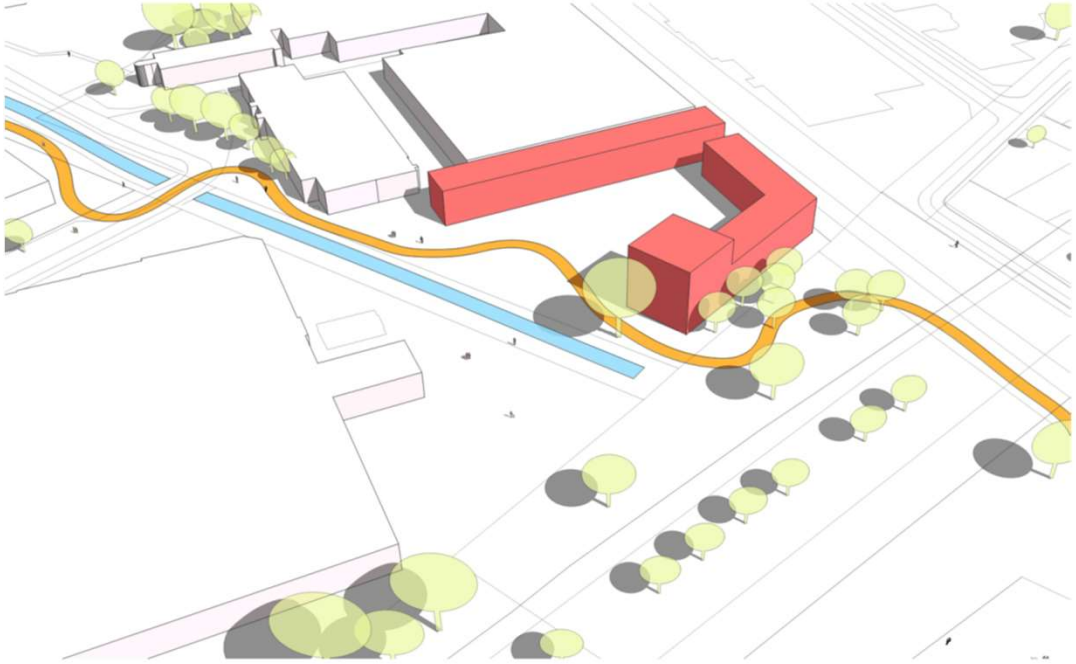
DESIGN

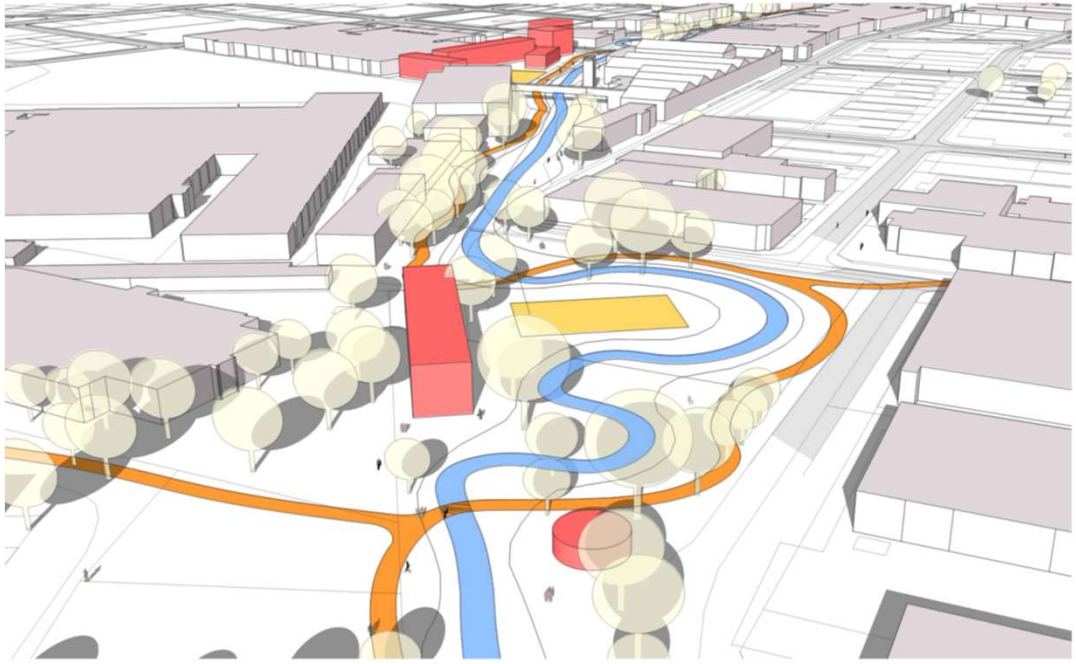
VOLUMETRIC

DESIGN > **VOLUMETRIC** > WATER, MOVEMENT, NODES

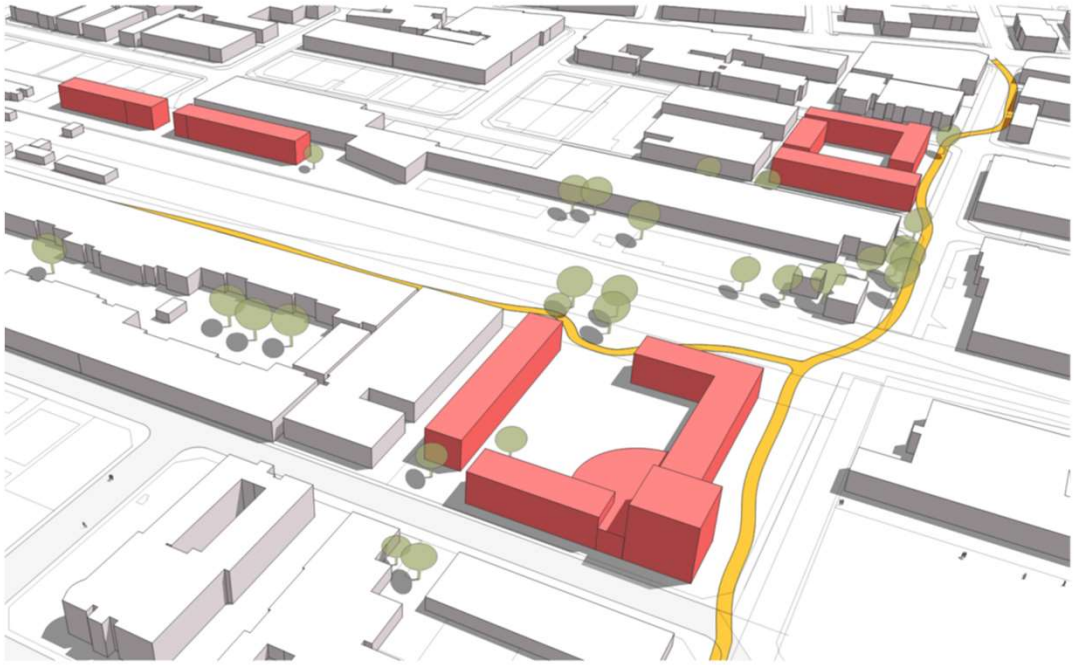


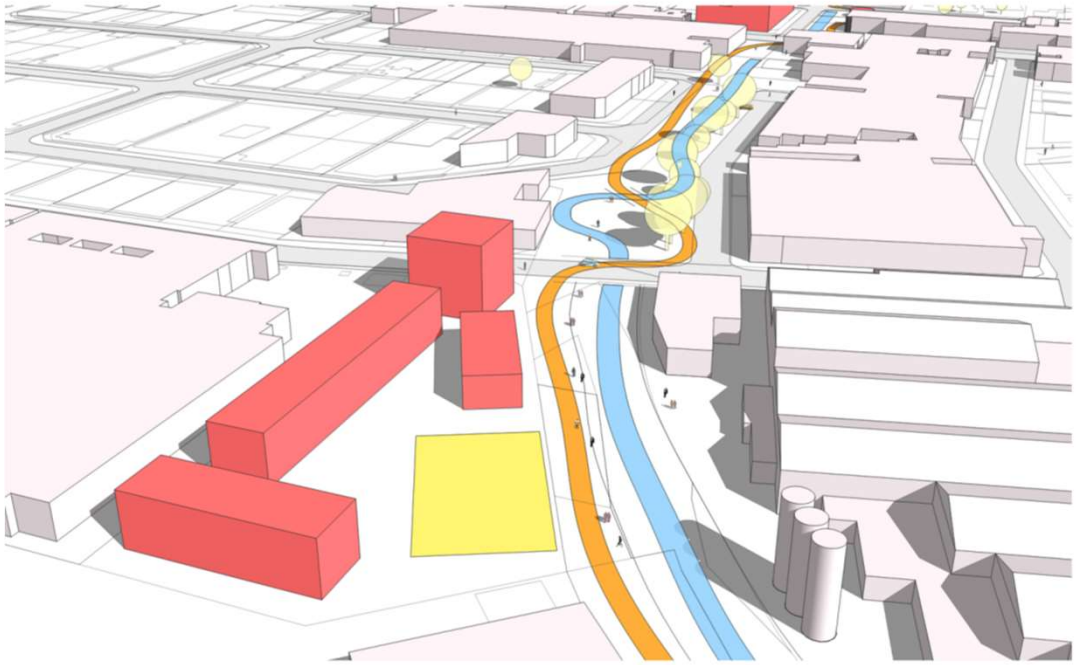






DESIGN > **VOLUMETRIC** > WATER, MOVEMENT, NODES





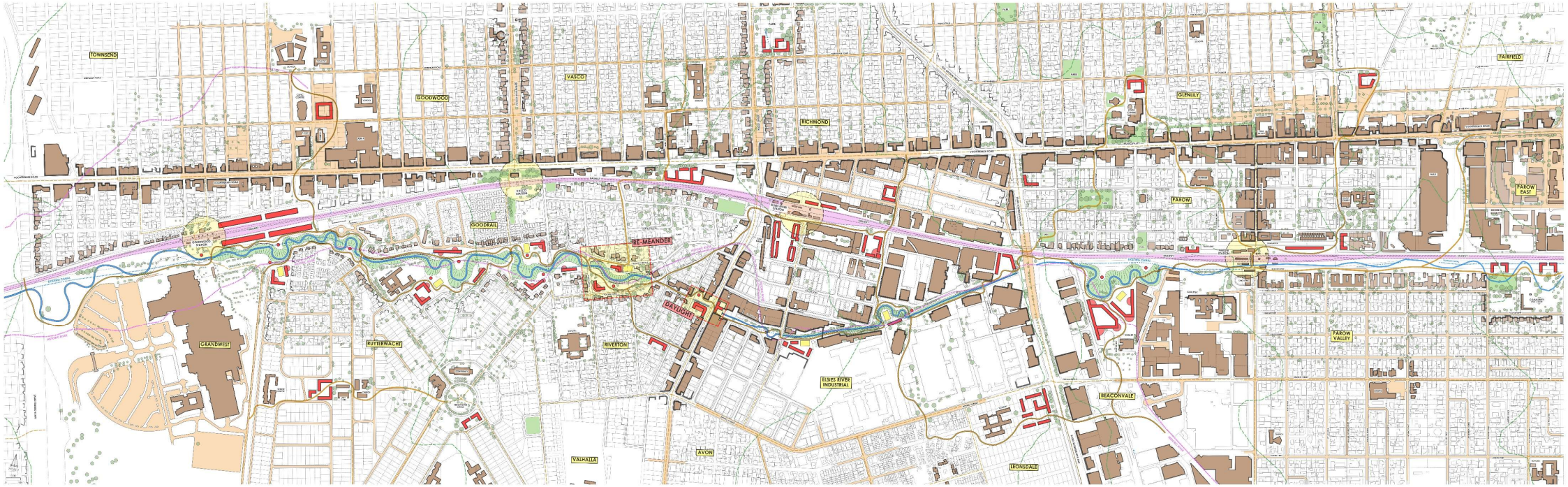




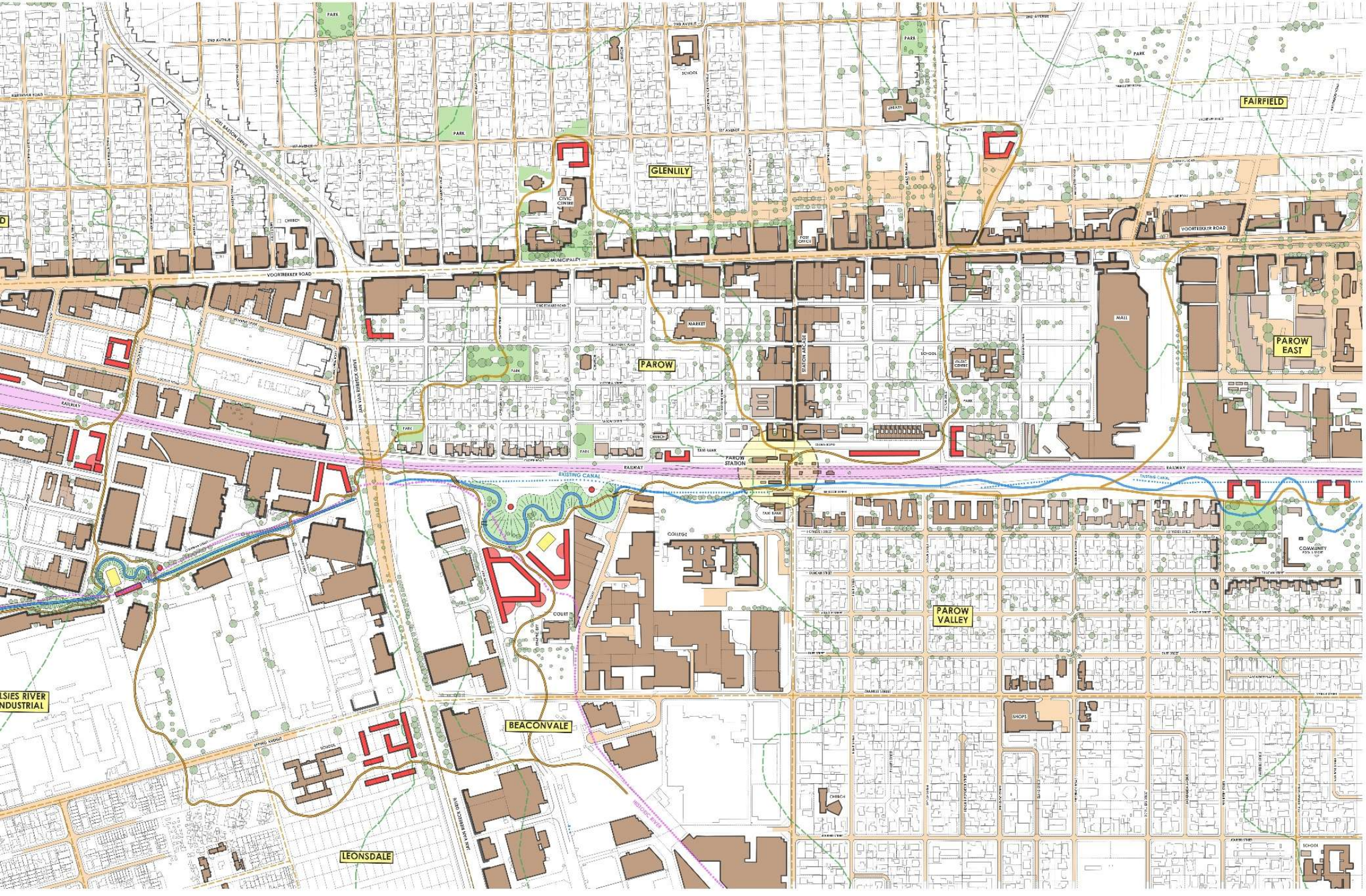
DESIGN

FRAMEWORK

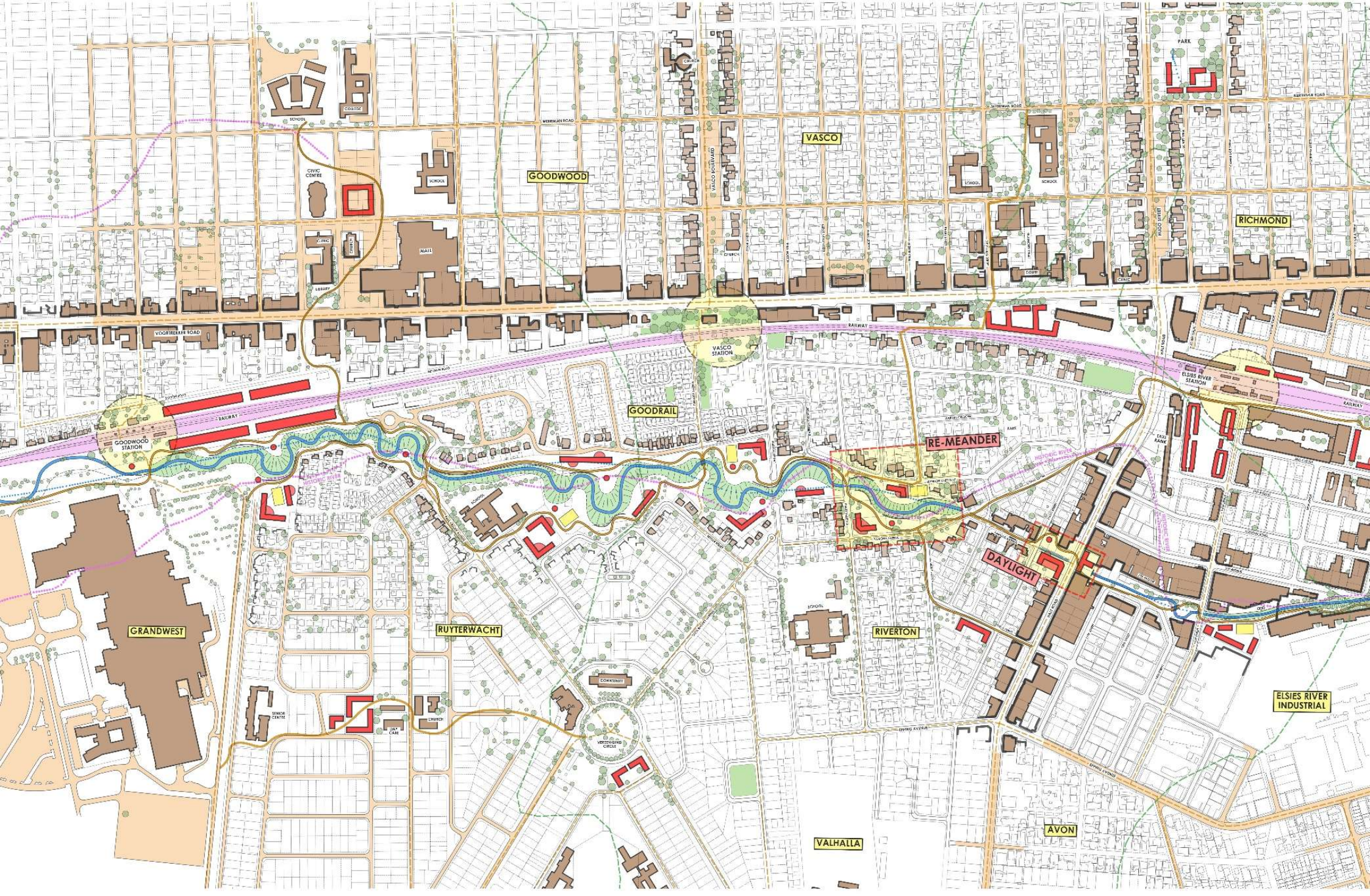
DESIGN > **FRAMEWORK**



DESIGN > **FRAMEWORK**



DESIGN > **FRAMEWORK**



DESIGN

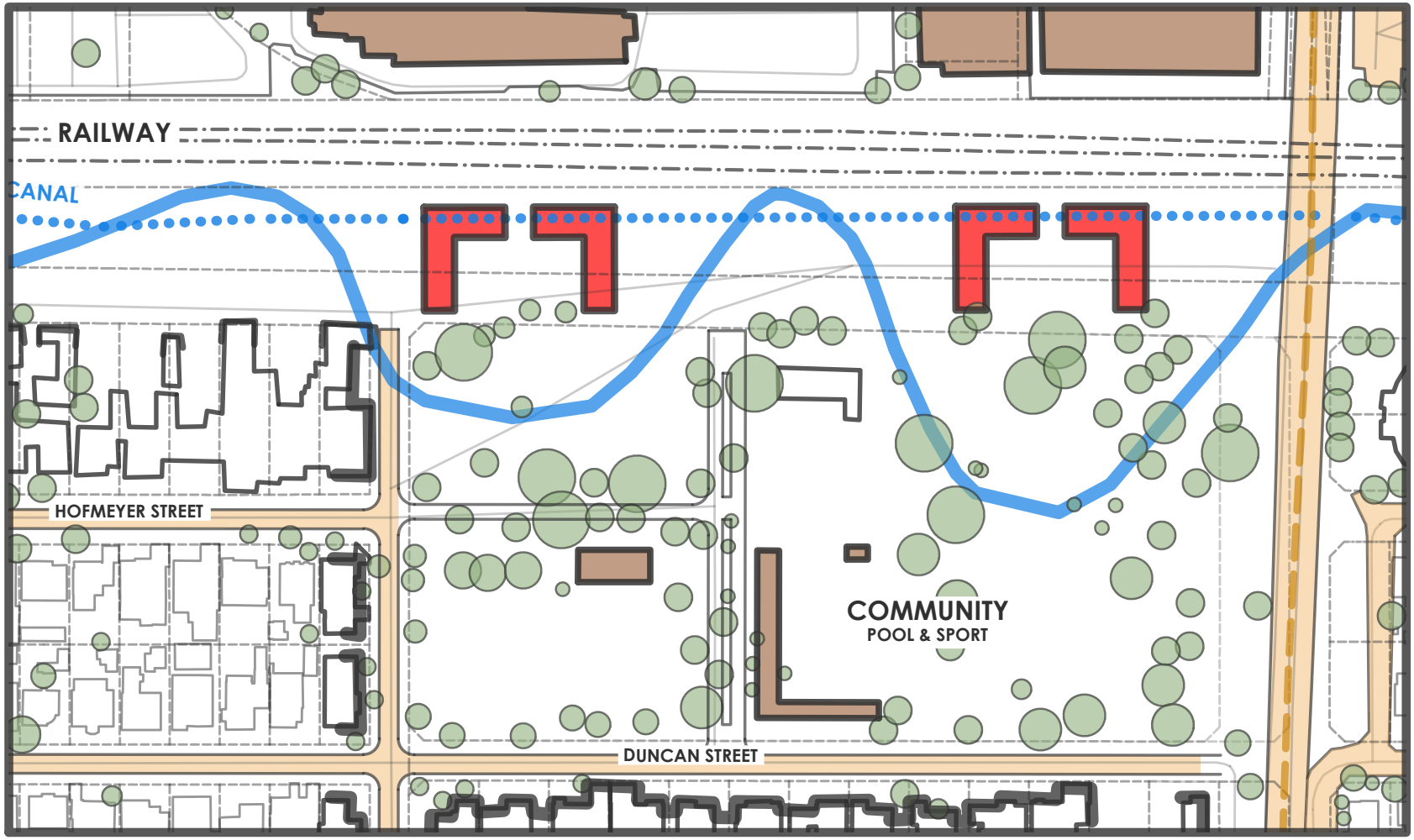
FRAMEWORK

EXTRACTS

1:2000

PAROW EAST

1:2000 0 50m





NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
- GATHERING POINTS
  MINOR CIVIC NODES
  eg. COFFEE STAND, GAZEBO, RESTROOMS
- SPORT
  BASKETBALL COURT

EXISTING

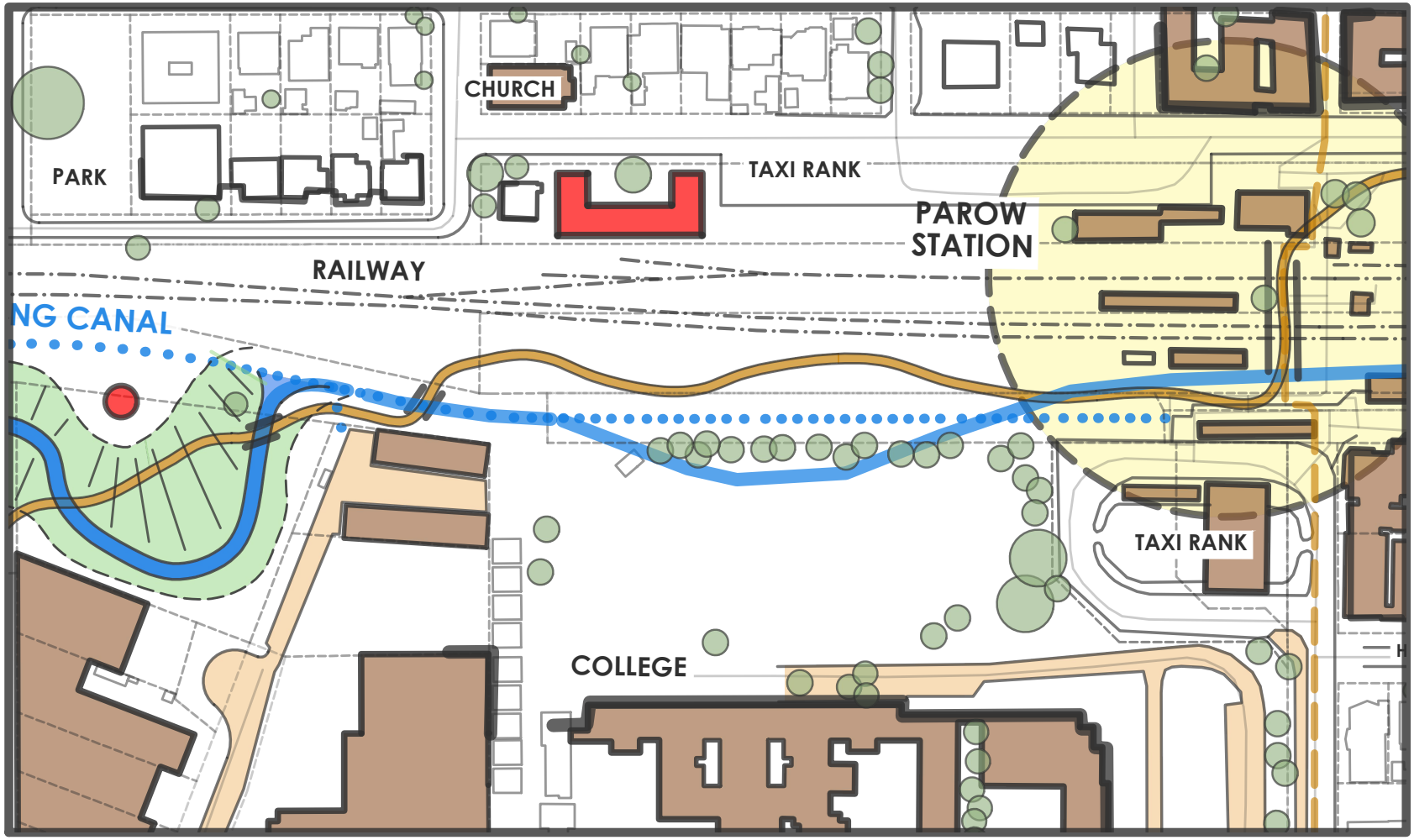
- TREE
- BUILDING
  PRIMARY (HIGHER ORDER)
  eg. INSTITUTIONAL, EDGE-DEFINING, NODAL
- BUILDING
  SECONDARY
- BUILDING OTHER
- ROAD / STREET
- NMT ROUTE
- RAILWAY LINE
- ERF BOUNDARY
- EXISTING CANAL
- HISTORIC STREAM

CONTEXT: MID-STREAM CORRIDOR

1:50000 0 1km

PAROW / BEACONVALE

1:2000 0 50m





NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
- GATHERING POINTS
  MINOR CIVIC NODES
  eg. COFFEE STAND, GAZEBO, RESTROOMS
- SPORT
  BASKETBALL COURT

EXISTING

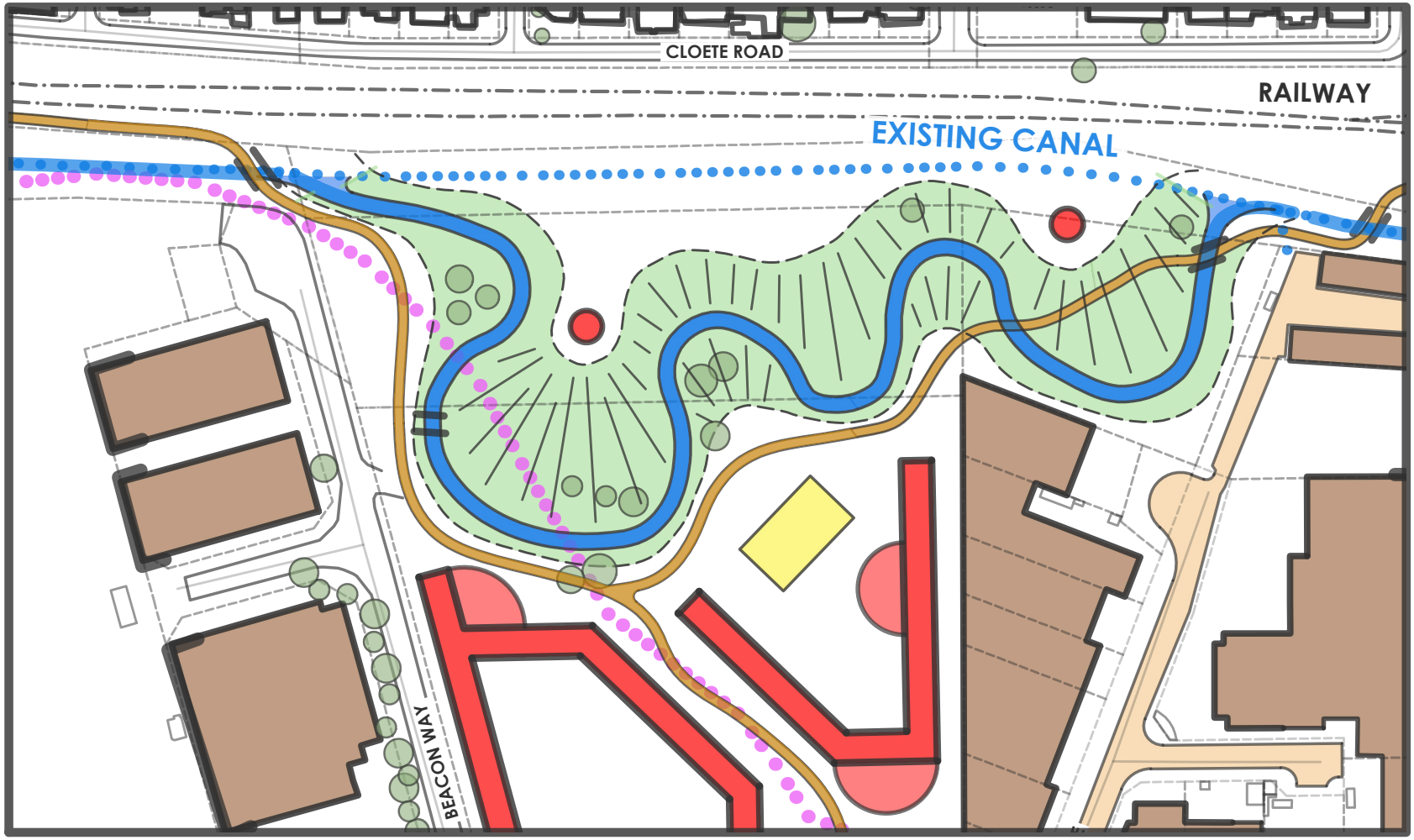
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- RAILWAY LINE
- ERF BOUNDARY
- EXISTING CANAL
- HISTORIC STREAM

CONTEXT: MID-STREAM CORRIDOR

1:50000 0 1km

BEACONVALE

1:2000 0 50m





NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
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- SPORT
  BASKETBALL COURT

EXISTING

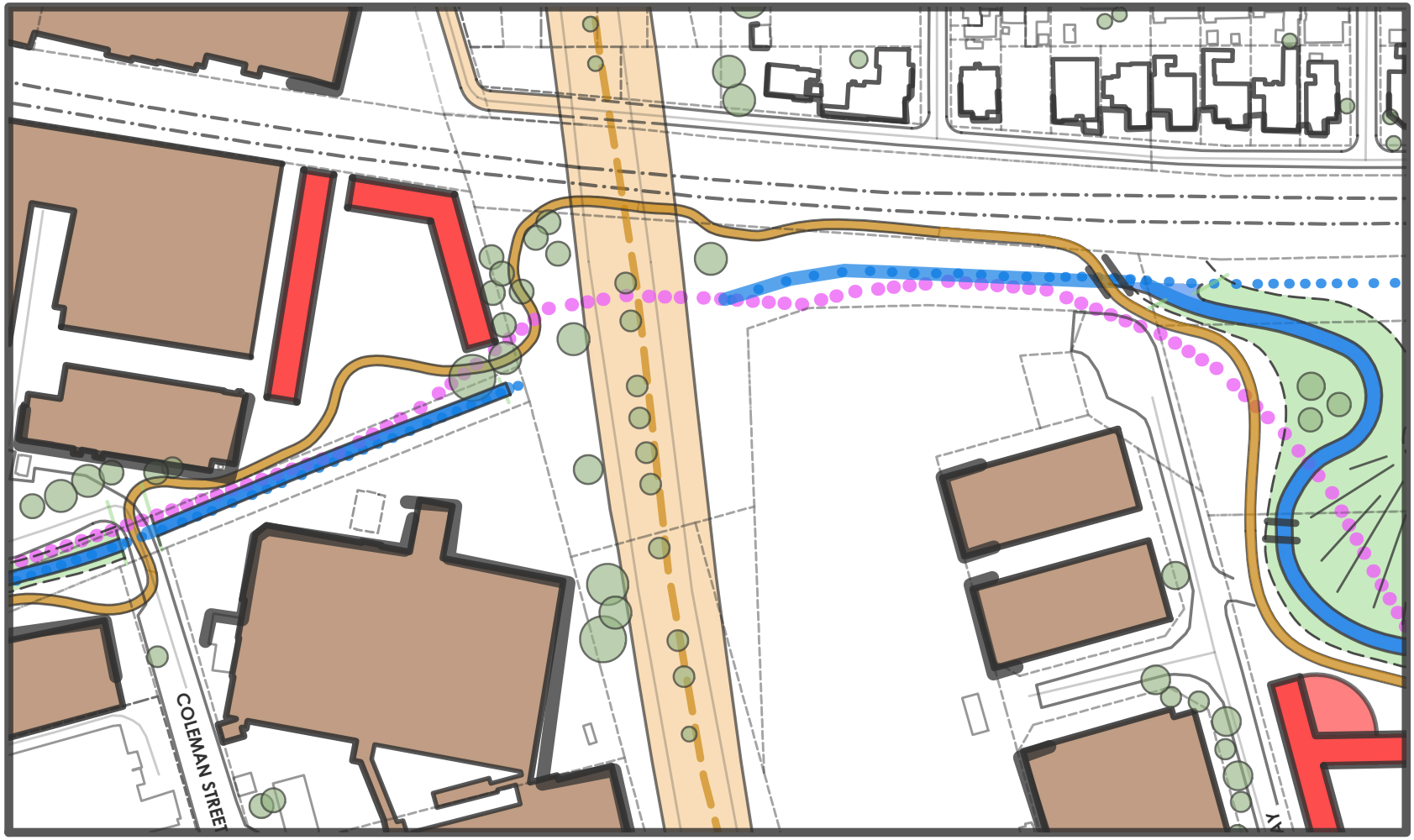
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- EXISTING CANAL
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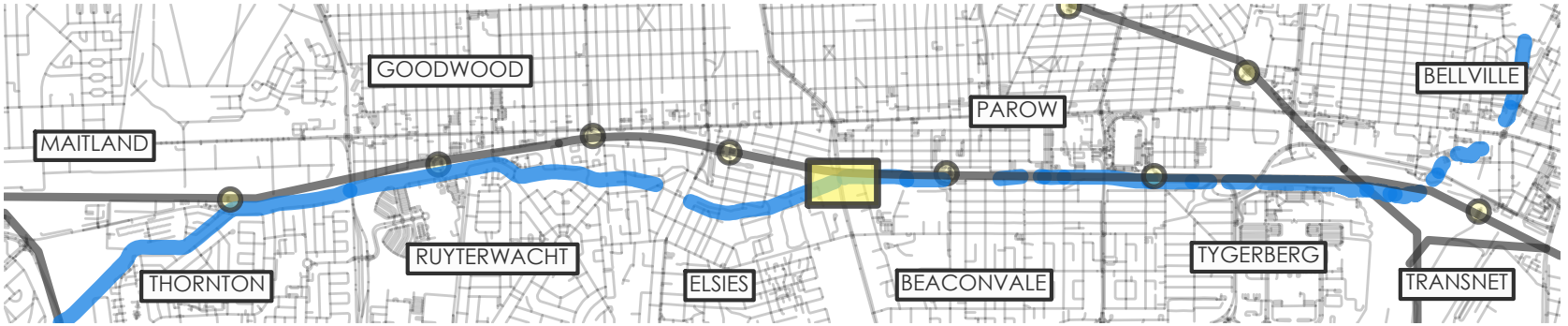
CONTEXT: MID-STREAM CORRIDOR

1:50000 0 1km

BEACONVALE / ELSIES RIVER INDUSTRIAL

1:2000 0 50m





NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
- GATHERING POINTS
  MINOR CIVIC NODES
  eg. COFFEE STAND, GAZEBO, RESTROOMS
- SPORT
  BASKETBALL COURT

EXISTING

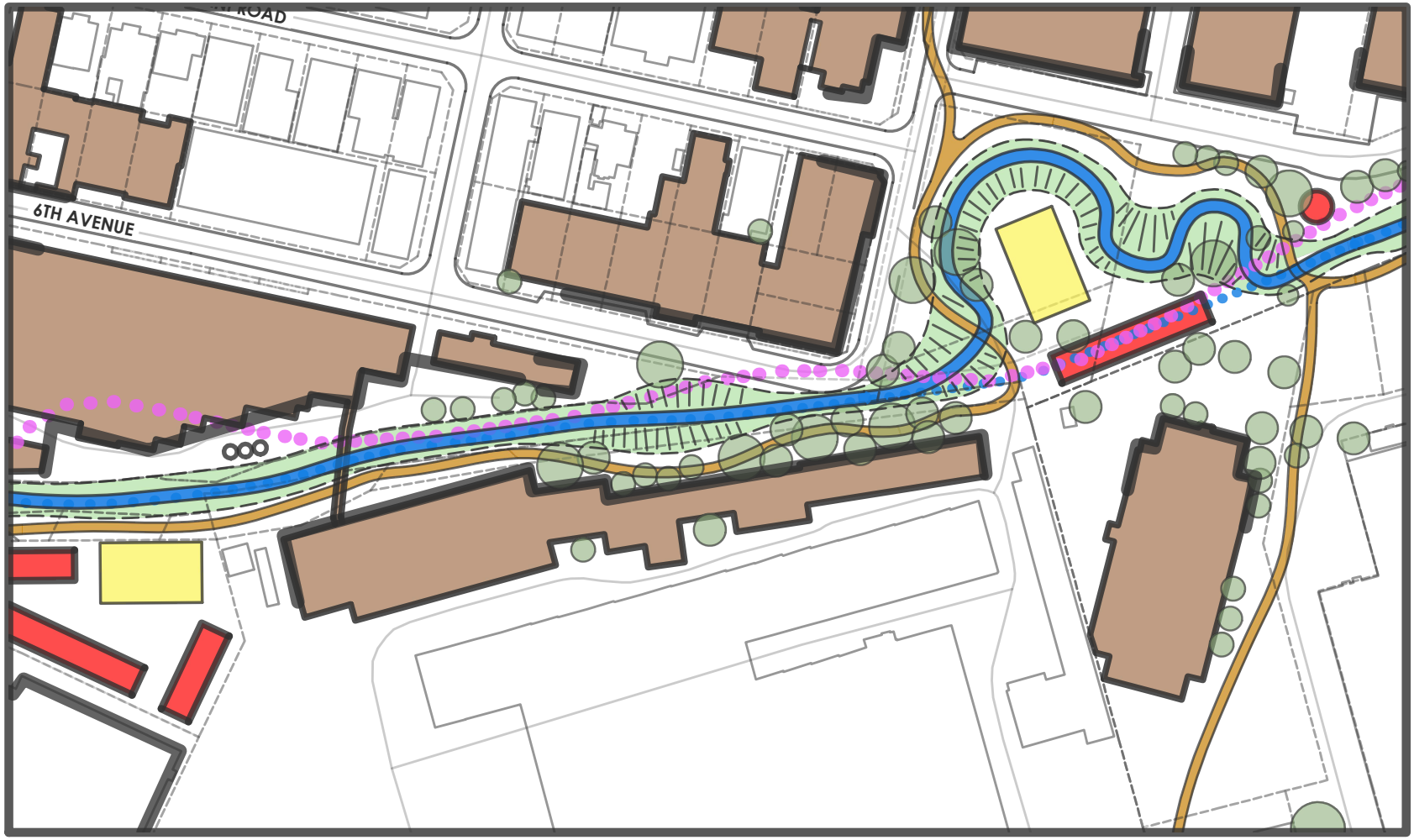
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- ROAD / STREET
- NMT ROUTE
- RAILWAY LINE
- ERF BOUNDARY
- EXISTING CANAL
- HISTORIC STREAM

CONTEXT: MID-STREAM CORRIDOR

1:50000 0 1km

ELSIES RIVER INDUSTRIAL

1:2000 0 50m



NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
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  BASKETBALL COURT

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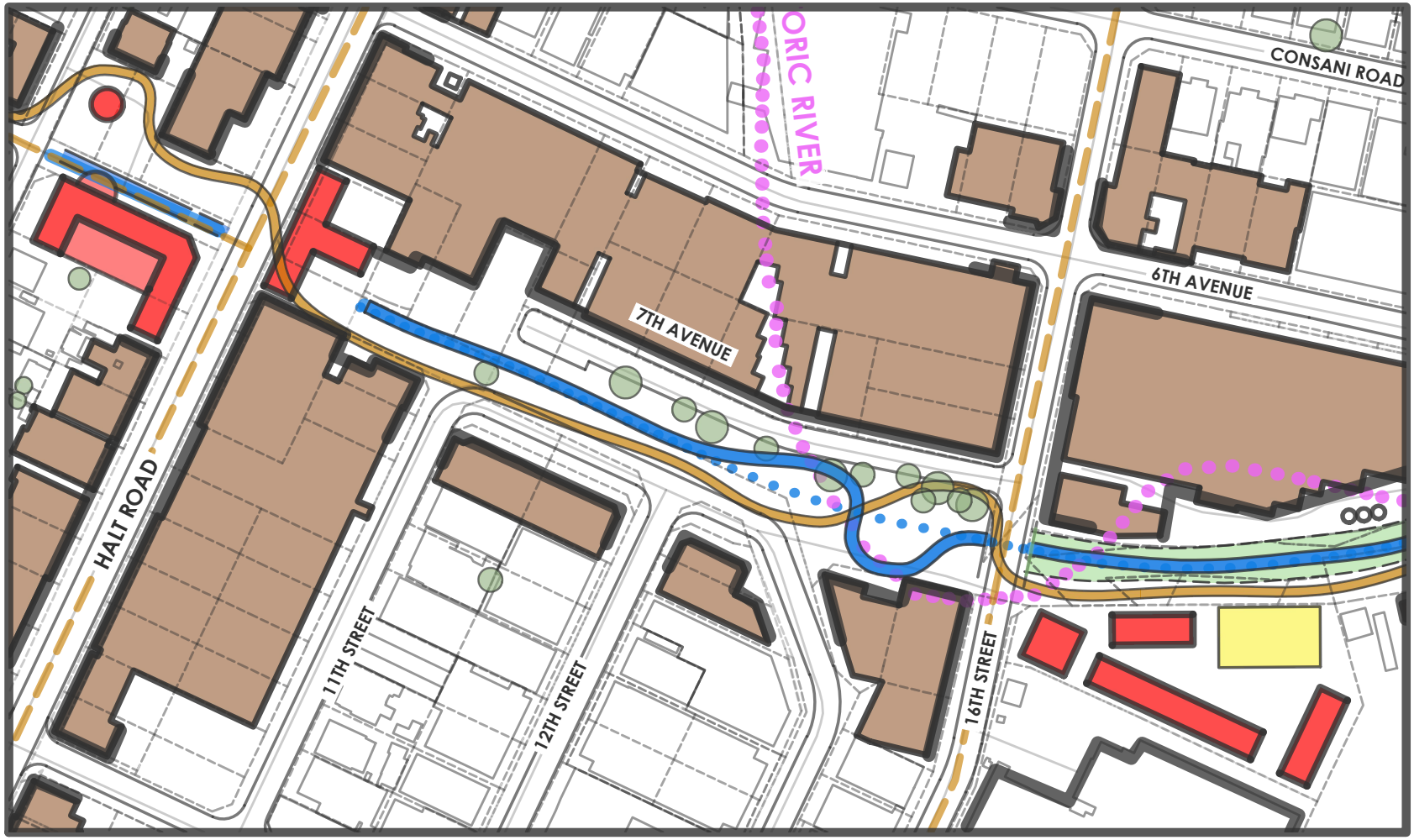


CONTEXT: MID-STREAM CORRIDOR

1:50000 0 1km

ELSIES RIVER INDUSTRIAL

1:2000 0 50m





NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
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  BASKETBALL COURT

EXISTING

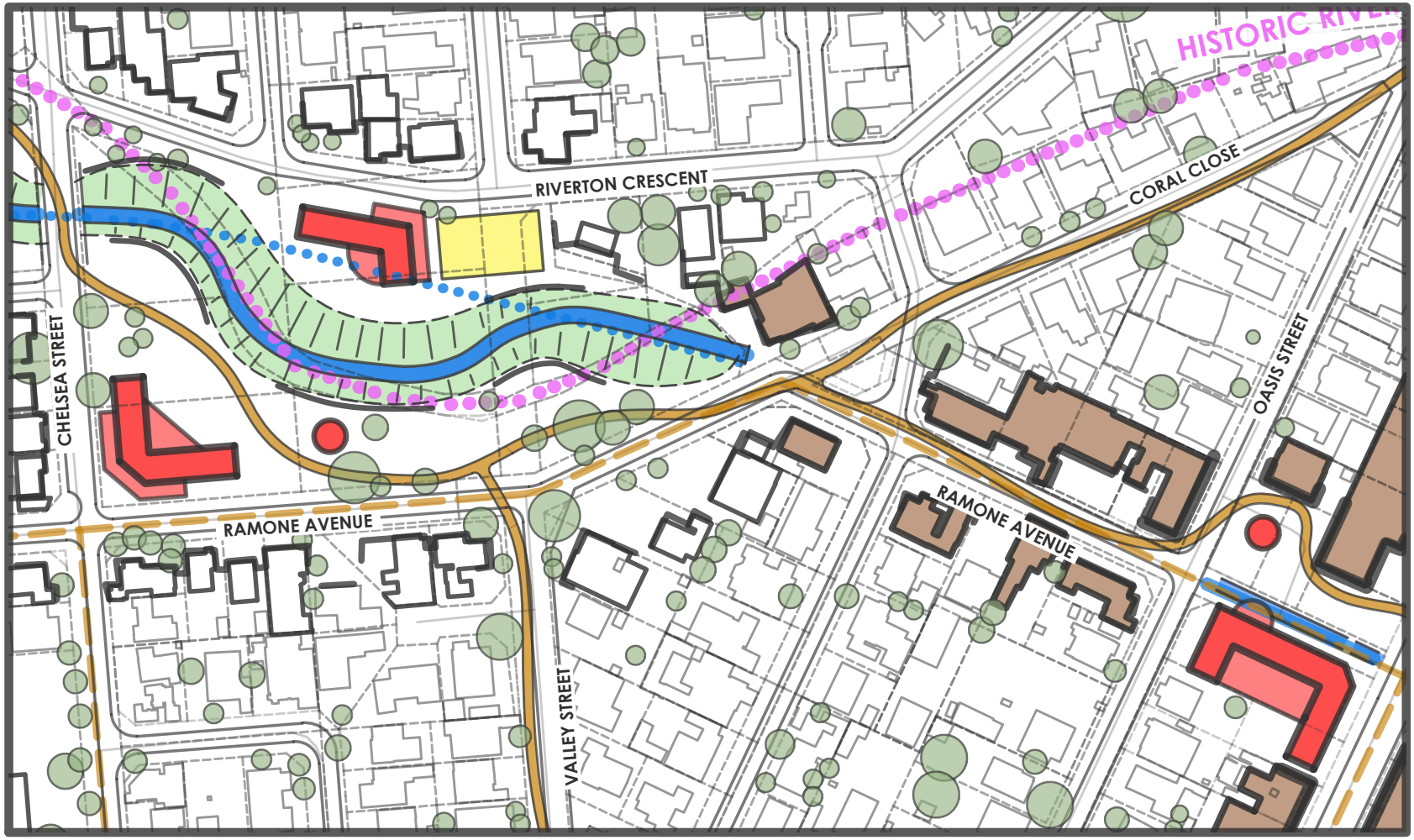
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- ROAD / STREET
- NMT ROUTE
- RAILWAY LINE
- ERF BOUNDARY
- EXISTING CANAL
- HISTORIC STREAM

CONTEXT: MID-STREAM CORRIDOR

1:50000 0 1km

ELSIES RIVER INDUSTRIAL / RUYTERWACHT

1:2000 0 50m





NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
- GATHERING POINTS
  MINOR CIVIC NODES
  eg. COFFEE STAND, GAZEBO, RESTROOMS
- SPORT
  BASKETBALL COURT

EXISTING

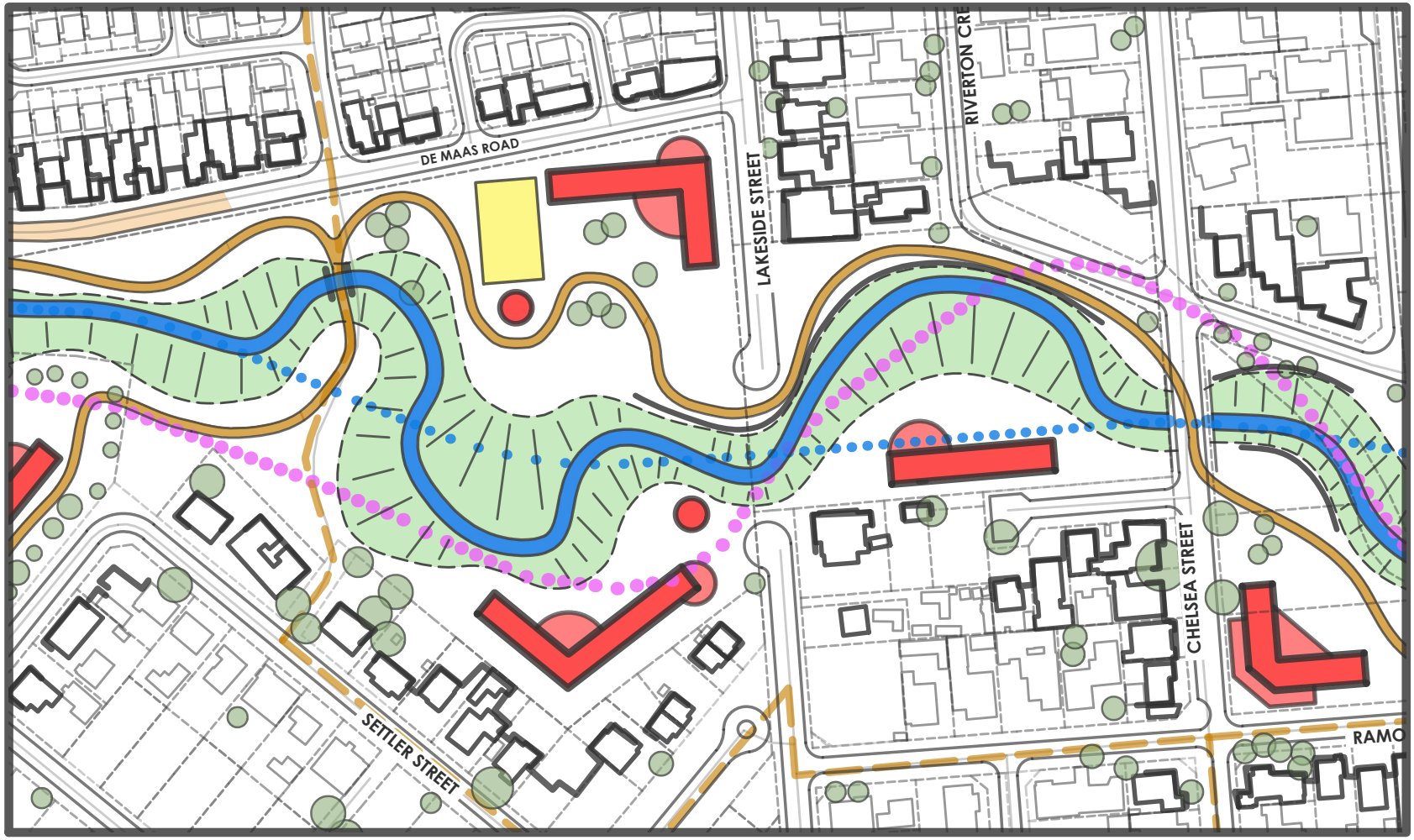
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- BUILDING
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  eg. INSTITUTIONAL, EDGE-DEFINING, NODAL
- BUILDING
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- BUILDING OTHER
- ROAD / STREET
- NMT ROUTE
- RAILWAY LINE
- ERF BOUNDARY
- EXISTING CANAL
- HISTORIC STREAM

CONTEXT: MID-STREAM CORRIDOR

1:50000 0 1km

RUYTERWACHT

1:2000 0 50m



NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
- GATHERING POINTS
  MINOR CIVIC NODES
  eg. COFFEE STAND, GAZEBO, RESTROOMS
- SPORT
  BASKETBALL COURT

EXISTING

- TREE
- BUILDING
  PRIMARY (HIGHER ORDER)
  eg. INSTITUTIONAL, EDGE-DEFINING, NODAL
- BUILDING
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- EXISTING CANAL
- HISTORIC STREAM

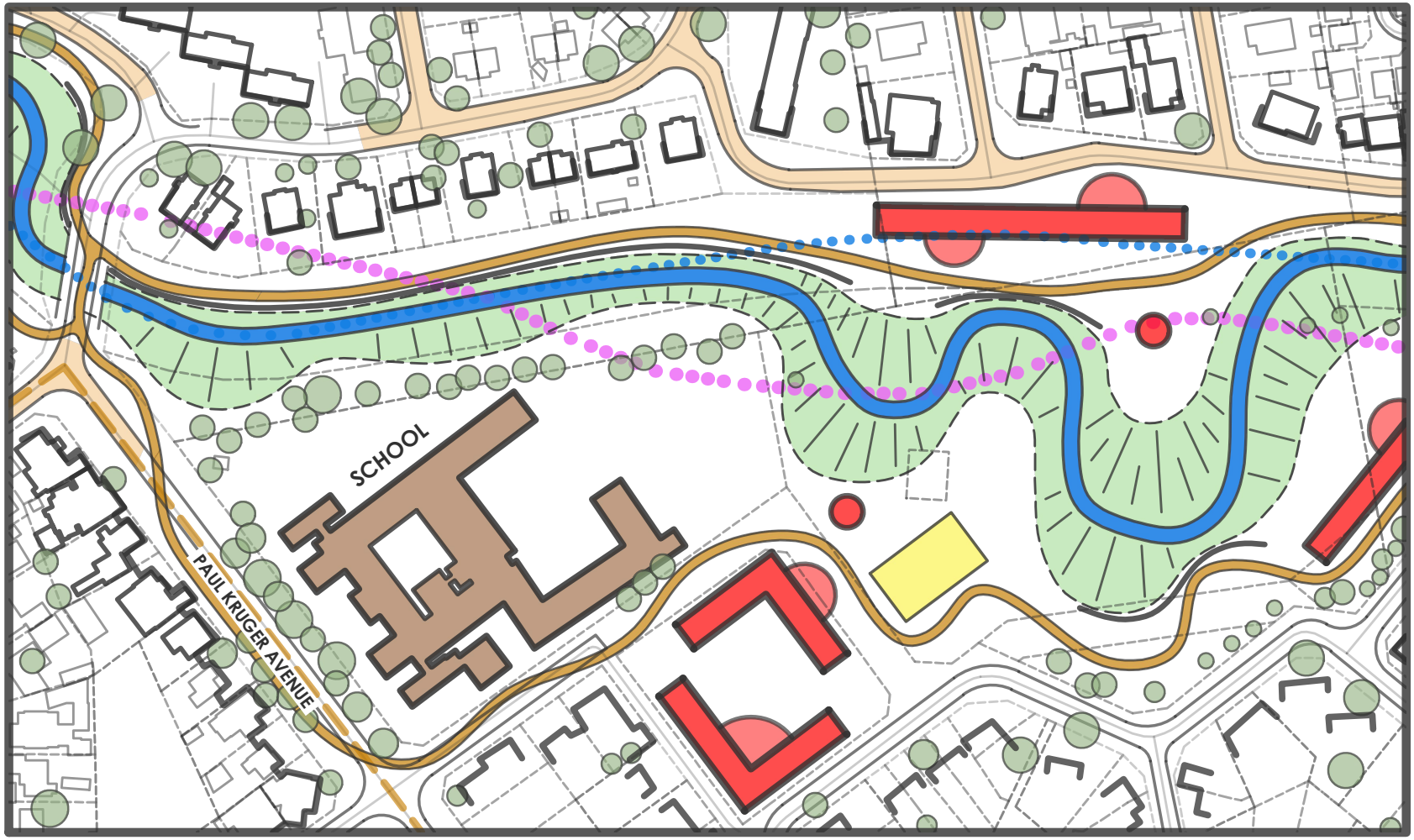


CONTEXT: MID-STREAM CORRIDOR

1:50000 0 1km

RUYTERWACHT

1:2000 0 50m





NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
- GATHERING POINTS
  MINOR CIVIC NODES
  eg. COFFEE STAND, GAZEBO, RESTROOMS
- SPORT
  BASKETBALL COURT

EXISTING

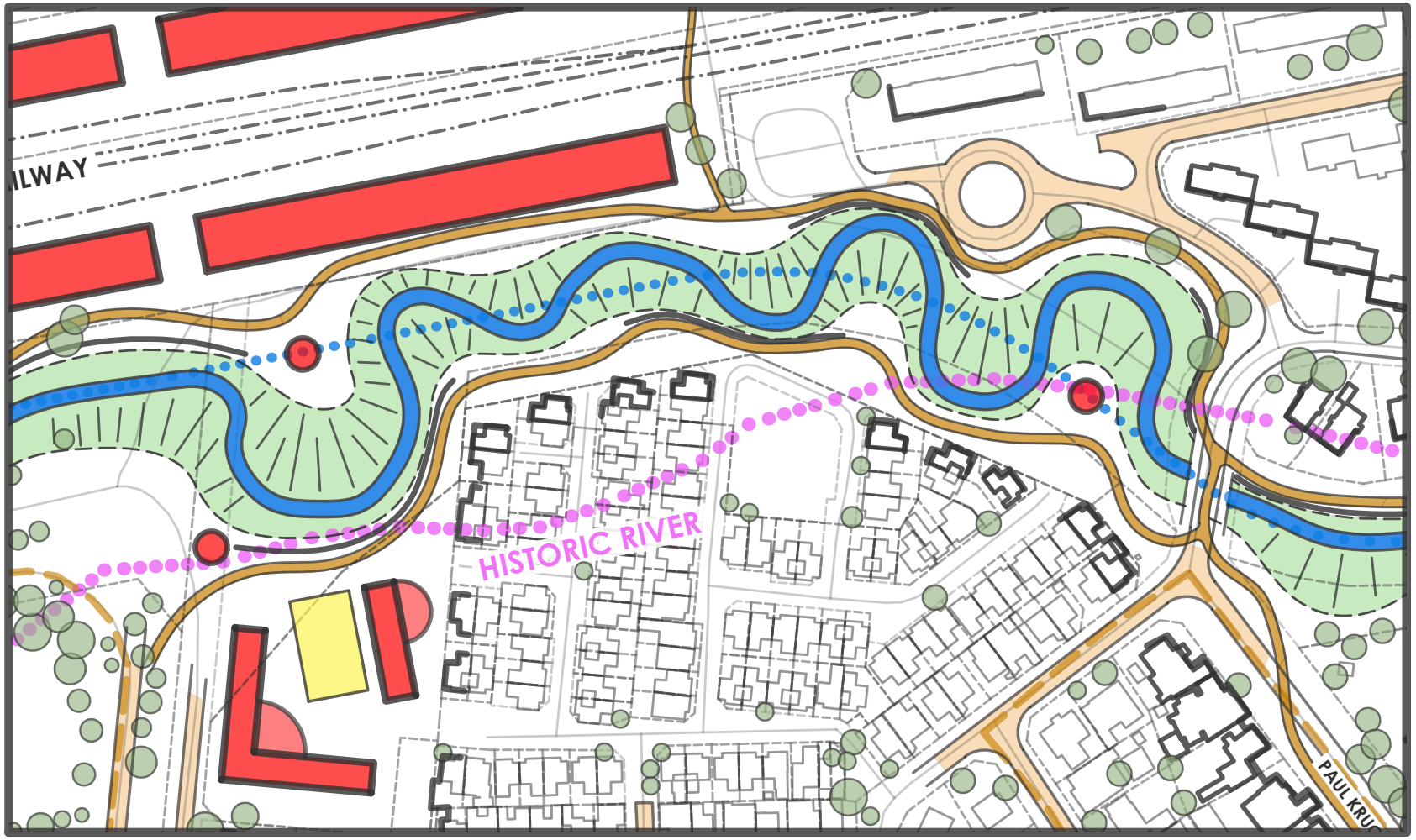
- TREE
- BUILDING
  PRIMARY (HIGHER ORDER)
  eg. INSTITUTIONAL, EDGE-DEFINING, NODAL
- BUILDING
  SECONDARY
- BUILDING OTHER
- ROAD / STREET
- NMT ROUTE
- RAILWAY LINE
- ERF BOUNDARY
- EXISTING CANAL
- HISTORIC STREAM

CONTEXT: MID-STREAM CORRIDOR

1:50000 0 1km

RUYTERWACHT / GOODWOOD

1:2000 0 50m





NEW

- RIVER
- NMT PATH
- "CORE" BUILDING
  DEPTH 9m
  (LIGHT AND VENTILATION)
- EXTENSIONS
  INCREASED FOOTPRINT ON GROUND FLOOR FOR PUBLIC FUNCTION
- GATHERING POINTS
  MINOR CIVIC NODES
  eg. COFFEE STAND, GAZEBO, RESTROOMS
- SPORT
  BASKETBALL COURT

EXISTING

- TREE
- BUILDING
  PRIMARY (HIGHER ORDER)
  eg. INSTITUTIONAL, EDGE-DEFINING, NODAL
- BUILDING
  SECONDARY
- BUILDING OTHER
- ROAD / STREET
- NMT ROUTE
- RAILWAY LINE
- ERF BOUNDARY
- EXISTING CANAL
- HISTORIC STREAM

CONTEXT: MID-STREAM CORRIDOR

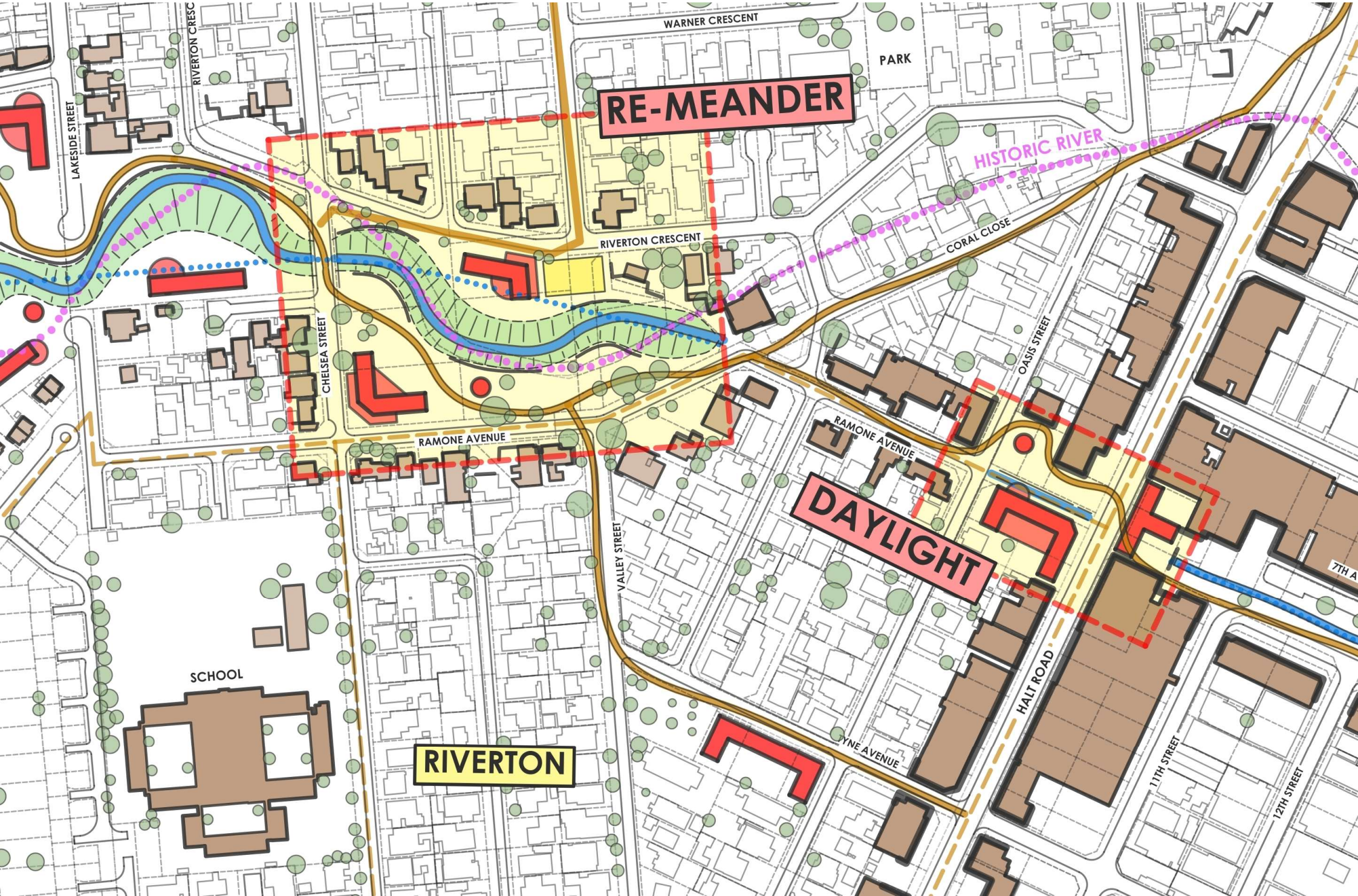
1:50000 0 1km

DESIGN

DETAIL

DAYLIGHTING + RE-MEANDERING

DESIGN > **DETAIL** > DAYLIGHTING + RE-MEANDERING



DAYLIGHTING > **HALT ROAD** > EXISTING (VIEW 1)



LOOKING SOUTH DOWN HALT ROAD

DAYLIGHTING > **HALT ROAD** > EXISTING (VIEW 2)

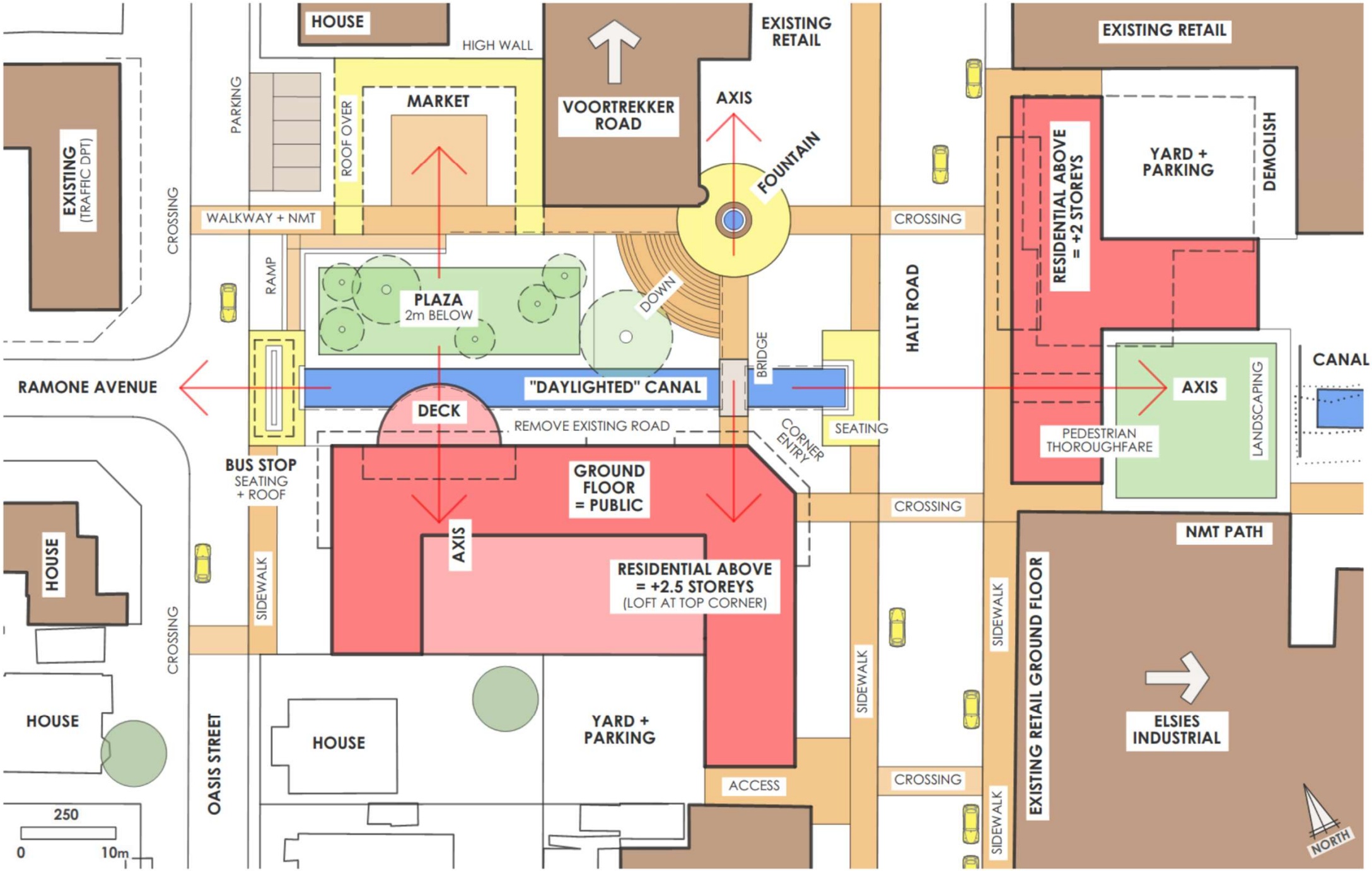


LOOKING SOUTH-EAST FROM OASIS STREET TOWARDS RAMONE AVENUE

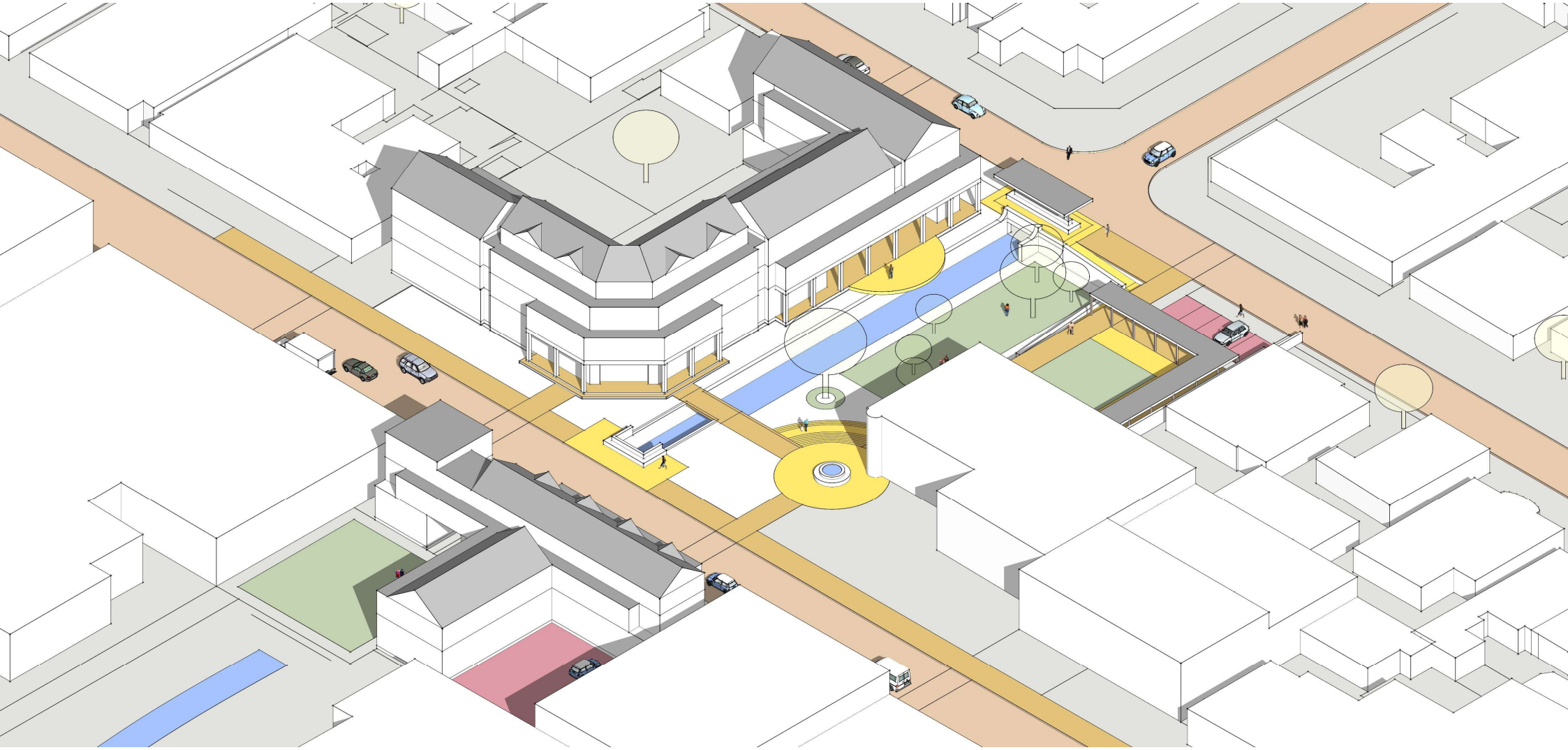
DAYLIGHTING > **HALT ROAD** > EXISTING



DAYLIGHTING > **HALT ROAD** > DESIGN (PLAN)

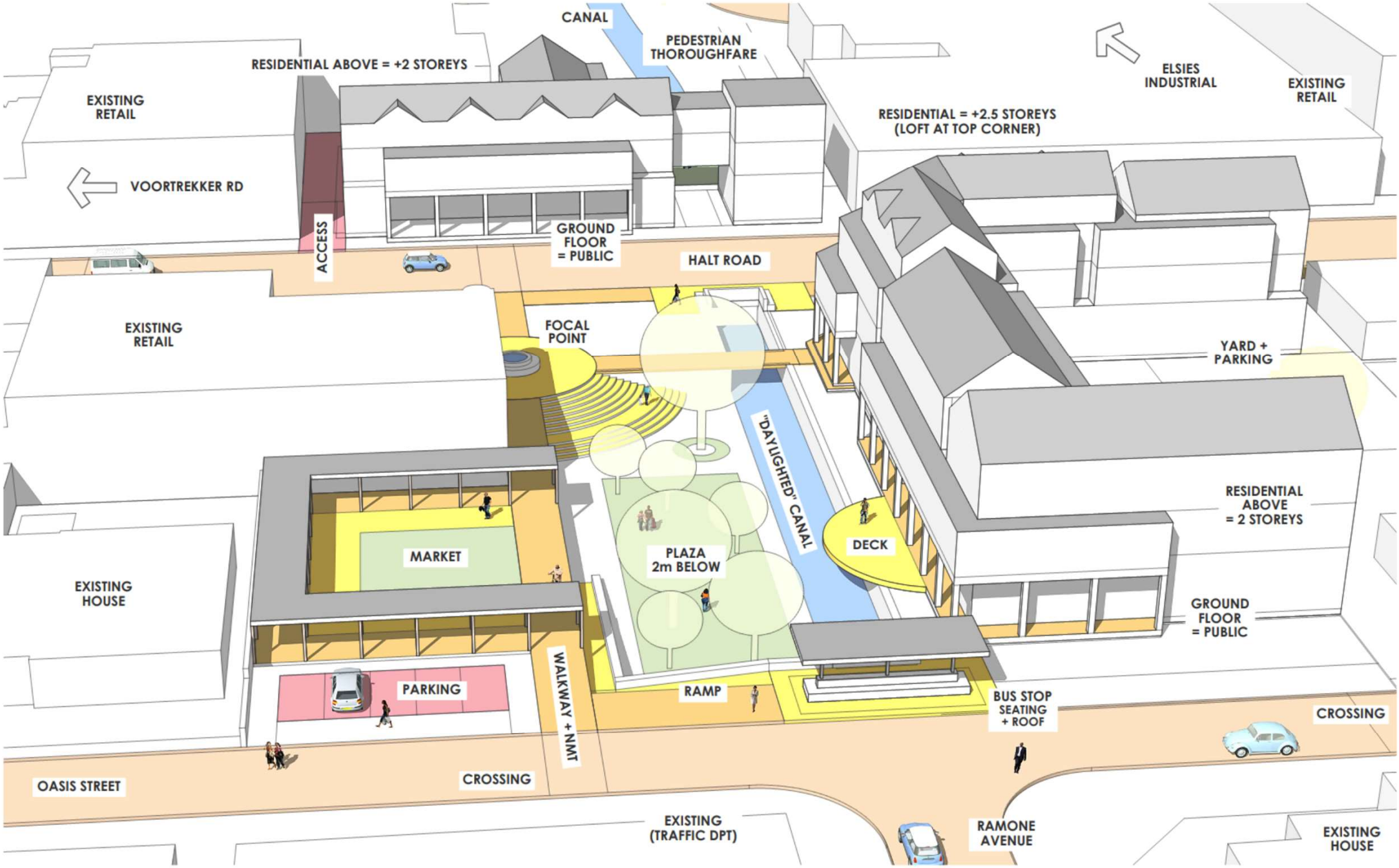


DAYLIGHTING > **HALT ROAD** > DESIGN (VIEW 1)



ISOMETRIC VIEW, LOOKING SOUTH-WEST

DAYLIGHTING > **HALT ROAD** > DESIGN (VIEW 2) > BIRD'S EYE, LOOKING EAST

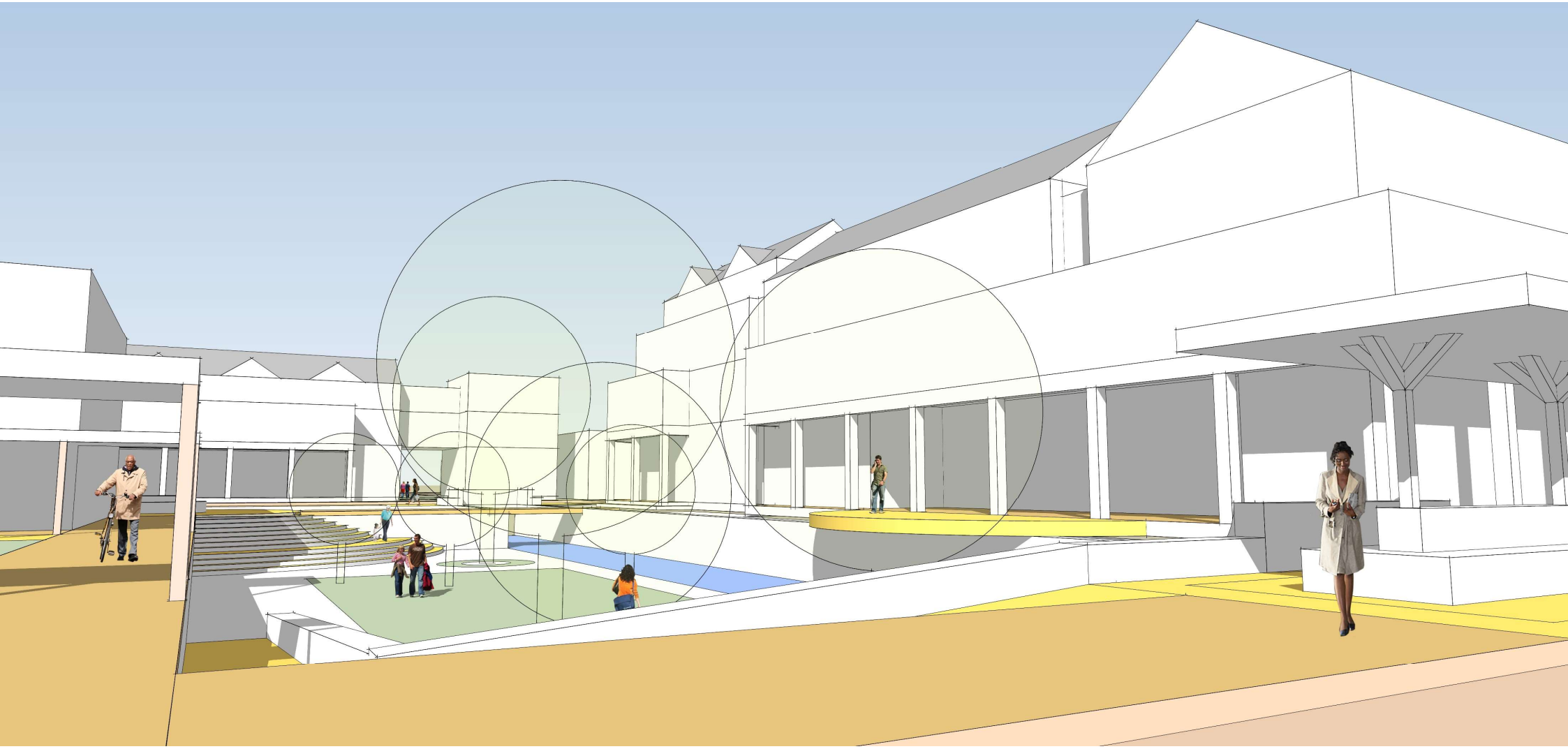


DAYLIGHTING > **HALT ROAD** > DESIGN (VIEW 3)



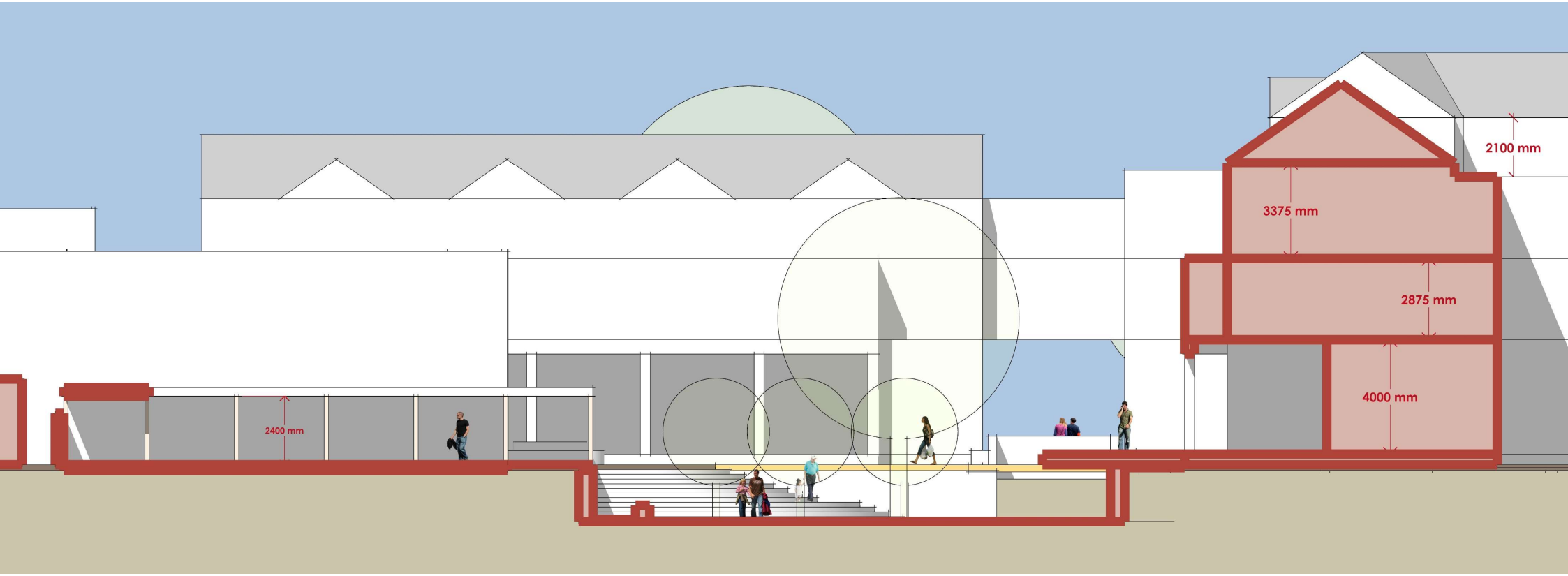
LOOKING WEST FROM ELSIES INDUSTRIAL AREA

DAYLIGHTING > **HALT ROAD** > DESIGN (VIEW 4)



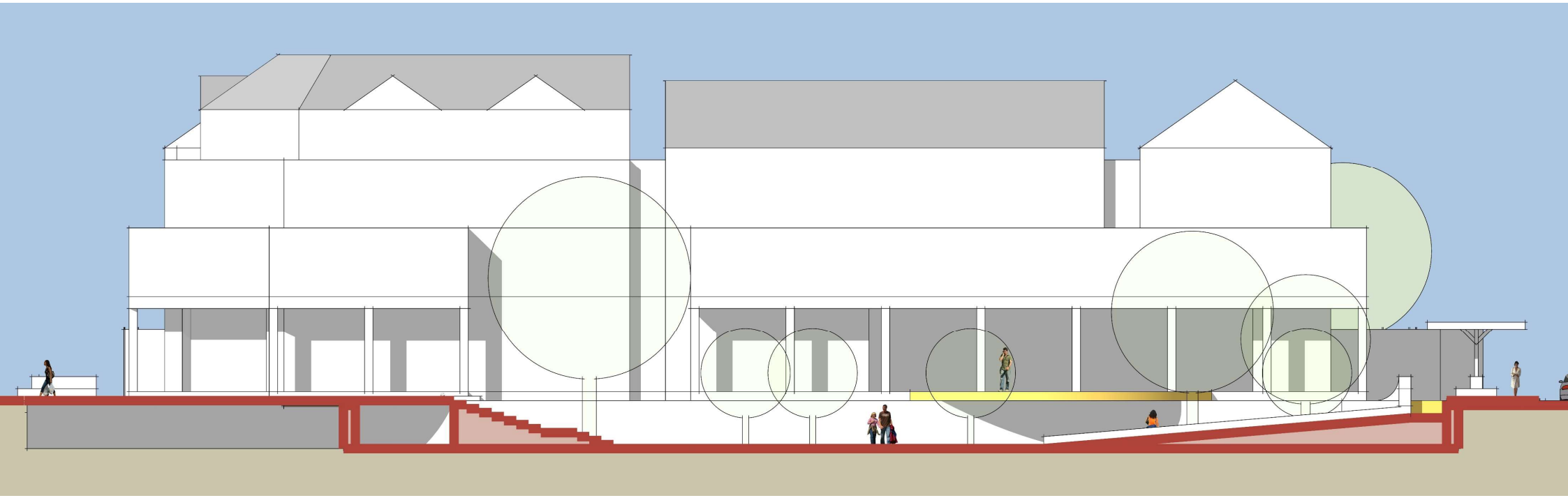
LOOKING EAST FROM OASIS STREET

DAYLIGHTING > **HALT ROAD** > DESIGN (SECTION 1)



LOOKING EAST

DAYLIGHTING > **HALT ROAD** > DESIGN (SECTION 2)



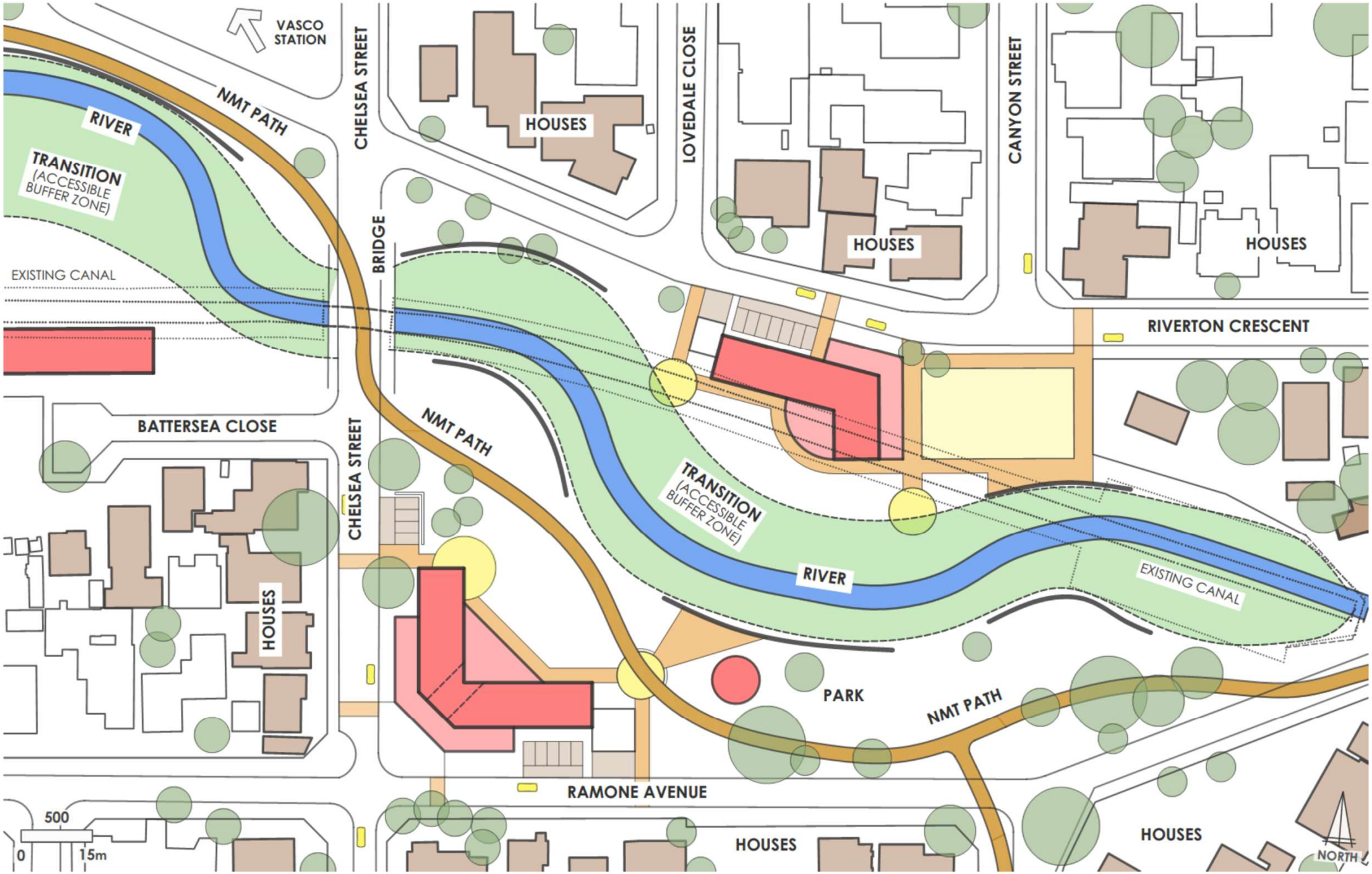


LOOKING SOUTH

RE-MEANDER > **RIVERTON** > EXISTING



RE-MEANDER > **RIVERTON** > DESIGN (PLAN)



RE-MEANDER > RIVERTON > **CHELSEA ST** > EXISTING (VIEW)

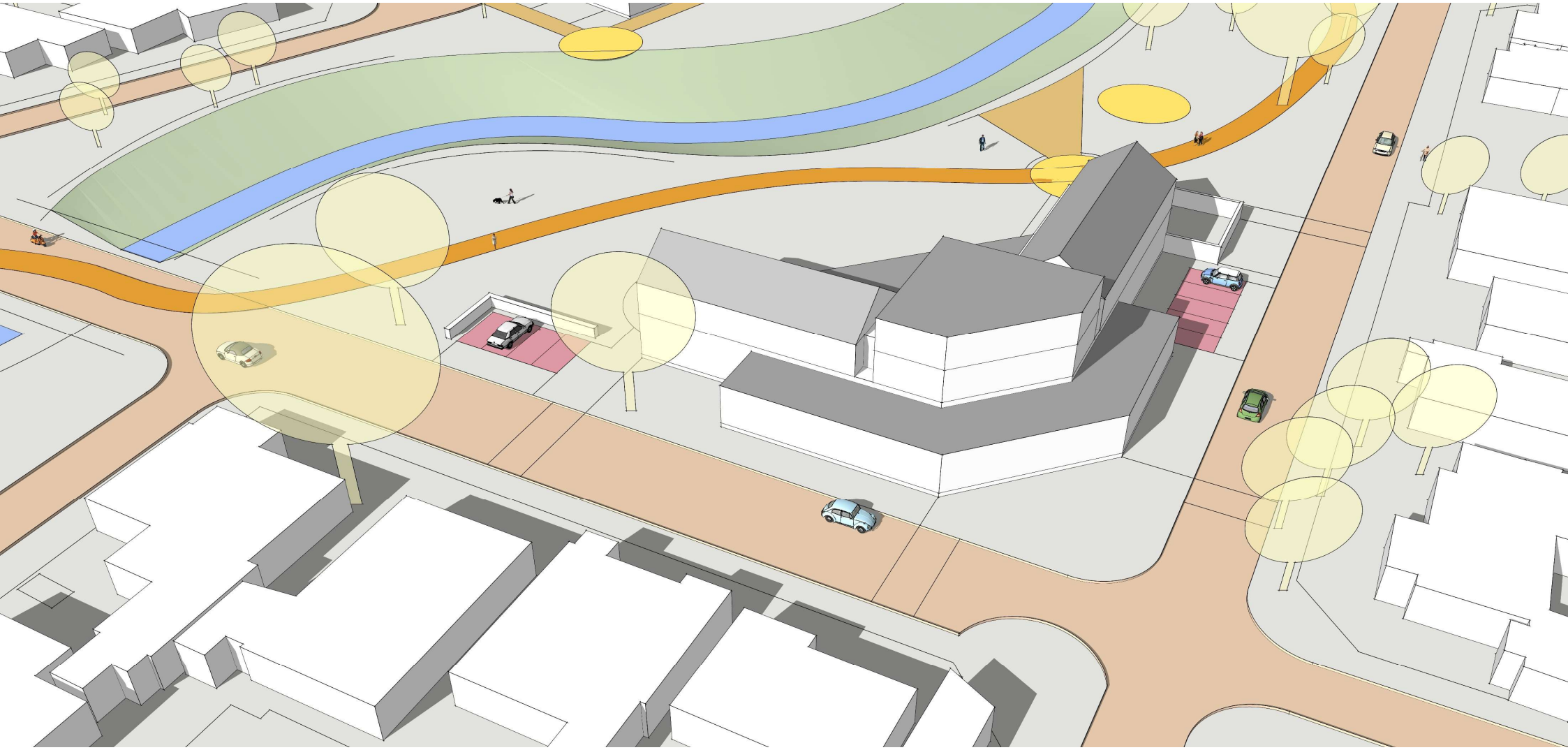


LOOKING SOUTH FROM BRIDGE OVER CANAL

RE-MEANDER > RIVERTON > **CHELSEA ST** > DESIGN (PLAN)

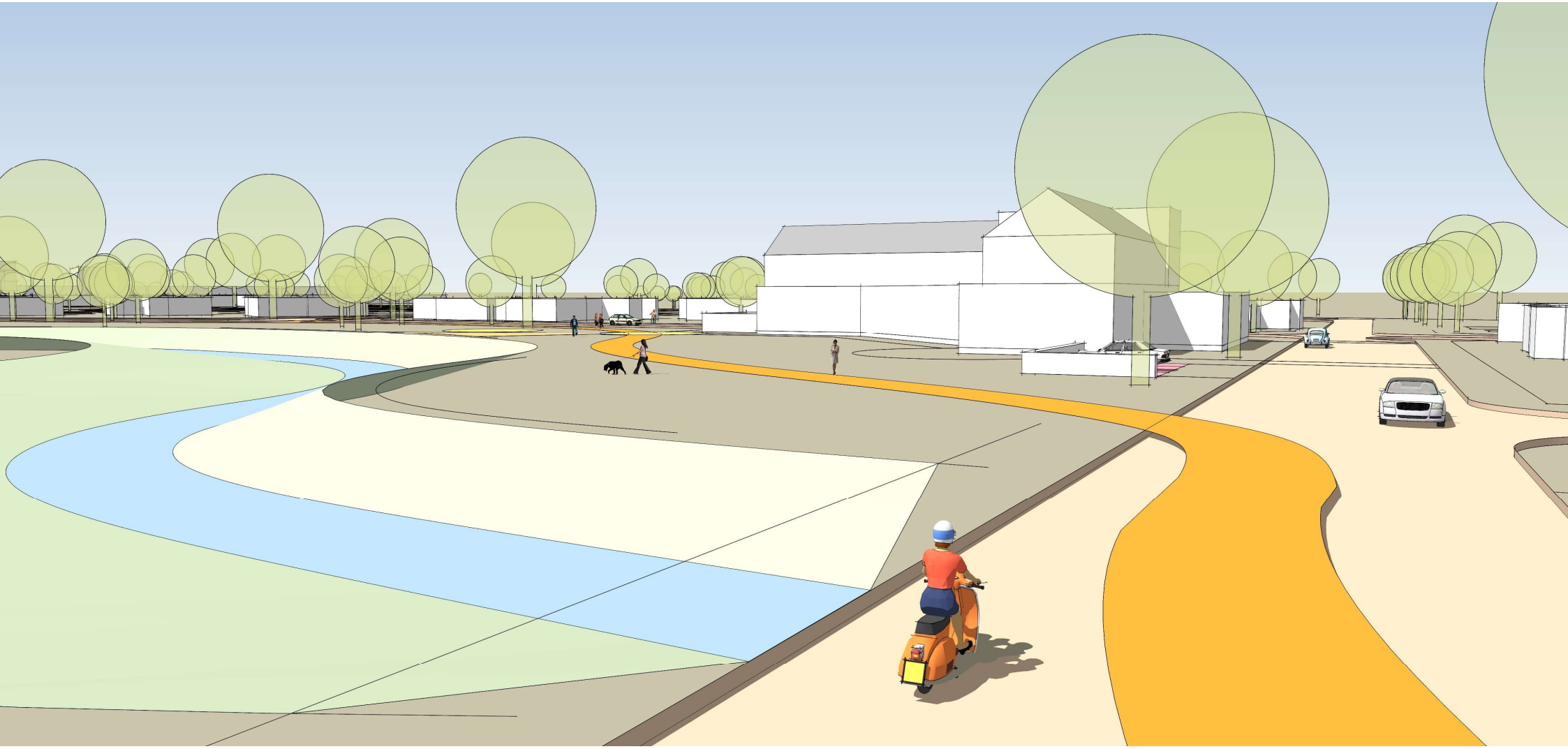


RE-MEANDER > RIVERTON > **CHELSEA ST** > DESIGN (VIEW 1)

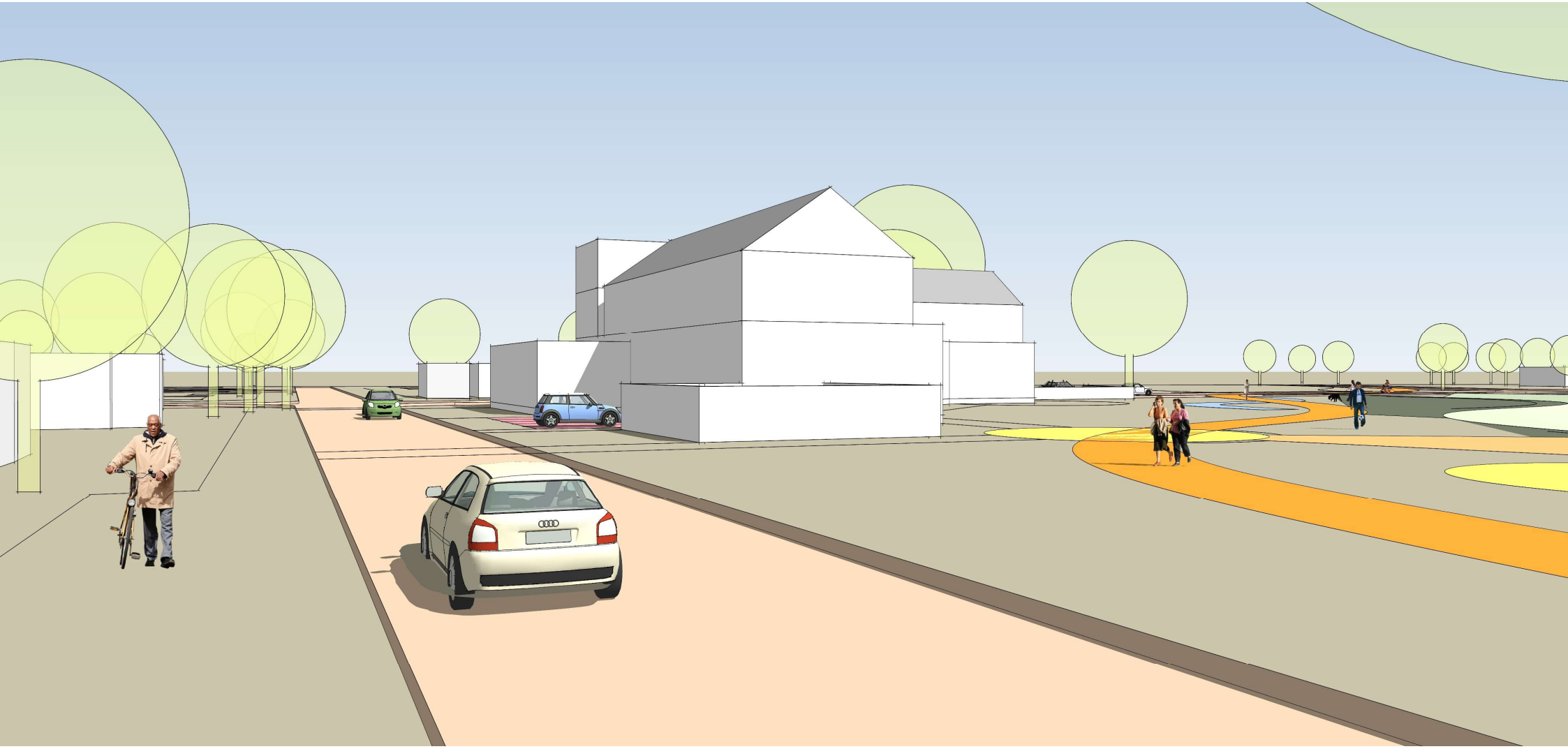


LOOKING NORTH-EAST FROM CORNER OF CHELSEA + RAMONE

RE-MEANDER > RIVERTON > **CHELSEA ST** > DESIGN (VIEW 2)



LOOKING SOUTH-EAST FROM BRIDGE OVER RIVER



LOOKING WEST FROM RAMONE AVENUE

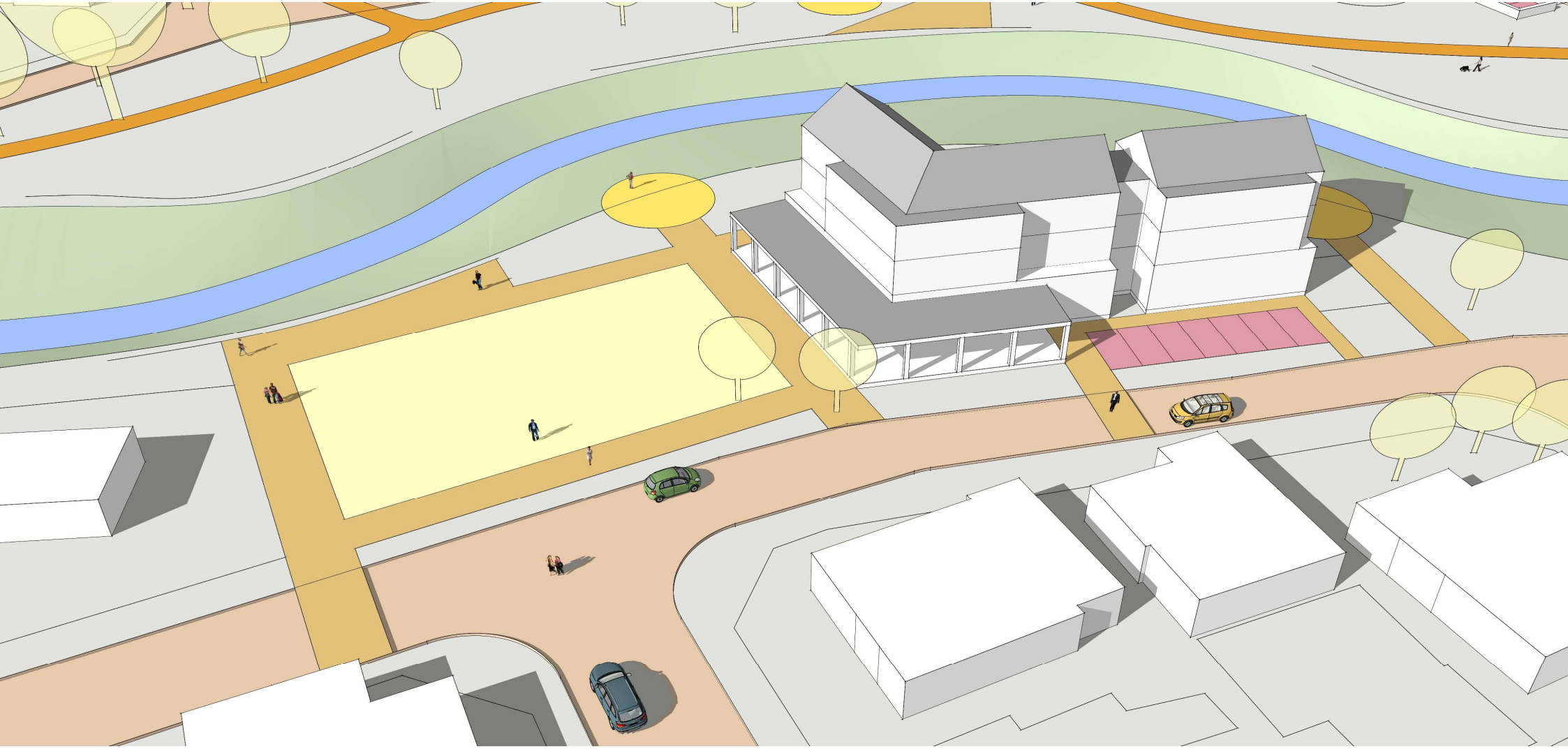


LOOKING WEST FROM CORNER OF RIVERTON CRESCENT + CANYON STREET

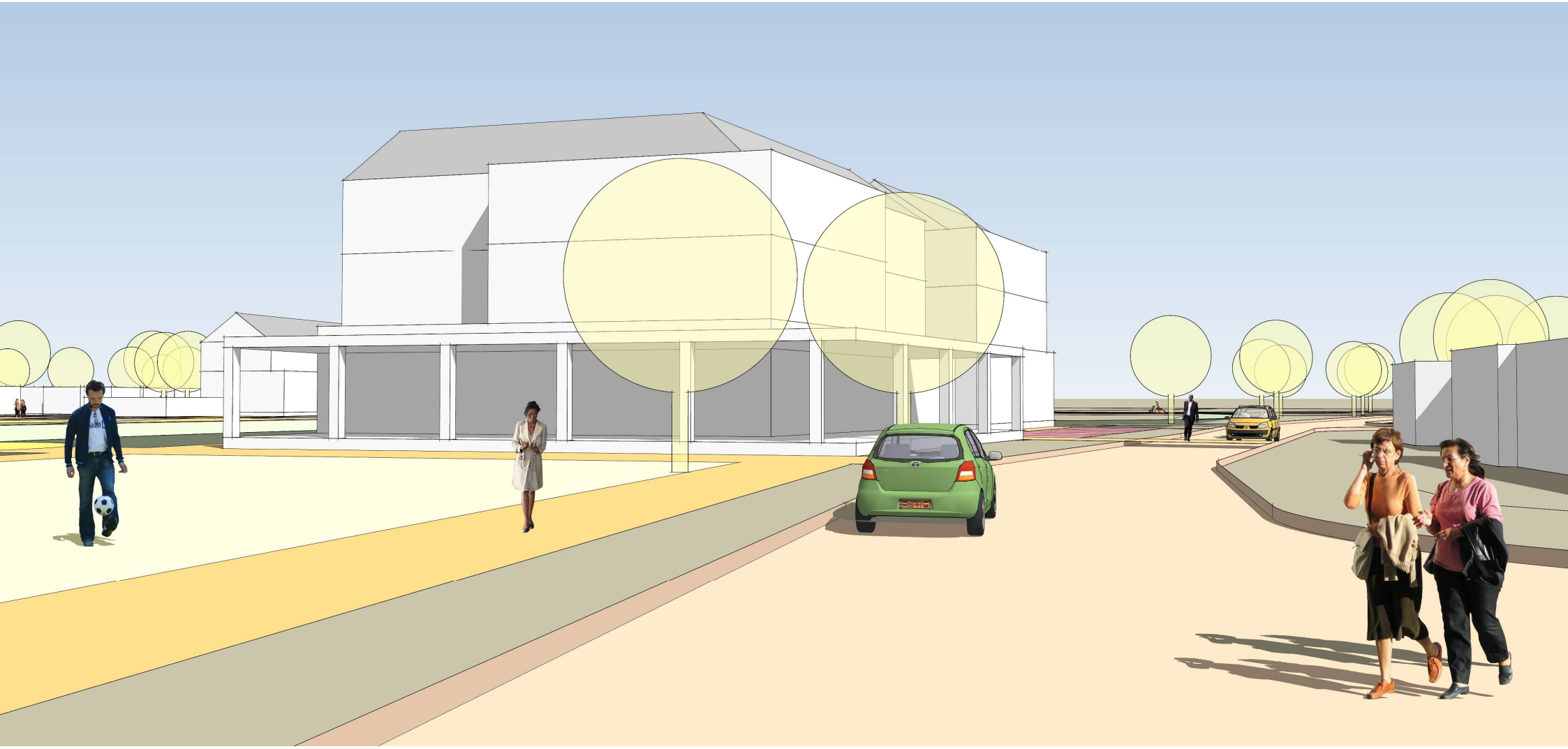
RE-MEANDER > RIVERTON > **RIVERTON CRESCENT** > DESIGN (PLAN)



RE-MEANDER > RIVERTON > **RIVERTON CRESCENT** > DESIGN (VIEW 1)



LOOKING SOUTH FROM CANYON STREET



LOOKING WEST FROM CORNER OF RIVERTON CRESCENT + CANYON STREET



LOOKING NORTH-WEST FROM RAMONE AVENUE