The Sockeye Special

Reimagining the Arbutus Corridor for a Resilient Vancouver

by

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A thesis
presented to the University of Waterloo
in fulfilment of the
thesis requirement for the degree of
Master of Architecture

Waterloo, Ontario, Canada 2018
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Author's Declaration

I hereby declare that I am the sole author of this thesis.

This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

Abstract

An underutilized ribbon of land cuts through the urban fabric of Vancouver, British Columbia. Known as the Arbutus Corridor, it is the right of way for a rail line that once connected industry on opposite sides of the city. Since the last train rattled down the line in 2001, the land has sat idly waiting for a new purpose.

It is a familiar scene in postindustrial cities across North America, where landscapes of defunct infrastructure serve as a reminder of once thriving economies powered by industries that have since shifted to the periphery or overseas. This urban condition has prompted a range of responses that aim to breathe new life into these discarded spaces.

Vancouver has long been recognized as a leader in this postindustrial redevelopment movement, and cities around the world now emulate *Vancouverism* as the model for their own development. Yet, the Arbutus Corridor remains a stranded rail link snaking through the urban milieu. At just under ten kilometers in length and eighteen hectares in area, the corridor remains one of the largest unutilized spaces in the city. Running north to south from False Creek to the Fraser River, the linear site cuts a complete transect through several diverse neighbourhoods of the city.

Through these studies, the thesis will propose a reimagined Arbutus Corridor that responds to the complexity of modern urban systems and activates the collective needs and aspirations of city dwellers in the 21st century metropolis.

Acknowledgements

I owe a great deal of gratitude to the many people who helped make this thesis possible. It has been a long time in the works, from my first day of architecture studies at Dalhousie University through these final years at Waterloo. I could not have done it without you.

THANK YOU first and foremost to my incredible family: my mother Kathy, my father Albert, my brothers Matthew and Darryl. I am endlessly grateful for your constant and unyielding love and support for all of my endeavours, no matter what they are or how far away they lead me. I could not have undertaken this journey without you, and my love and appreciation for you is greater than I could ever express. To Kaleb, Oliver, and Rose-Daryl, thank you for your patience while I've been away. You have been a constant source of joy and happiness whenever I needed a smile.

THANK YOU to all of my friends who have offered advice, inspiration, or reminded me to have fun along the way. Special thanks to Manjula Singh for your counsel and conversation, both personal and academic, when I needed it most and no matter where you were in the world. To Peter Bohdal, Currim Suteria, Kate Jackson, Nada Nafeh, and Kanika Kaushal, thank you for being my family in Cambridge when everyone else thought we were different. Thank you to Andrew Winters, both for the bonfires that helped me slow down and collect my thoughts, and for sticking it out with me to the end. Thank you also to Suhaib Bhatti for helping me visualize my ideas, no matter how obscure. To all my friends back on the best coast, thank you for your patience even when long spells go by between our conversations and visits.

THANK YOU to everyone at the Dalhousie and Waterloo schools of architecture who have been a part of this journey.

To all of the students in this with me, you have been a constant source inspiration and support, and have taught me so much along the way. I am fortunate to have been surrounded by so much creativity and talent, and look forward to seeing where each of you go from here.

To the long list of faculty at both schools, I am constantly amazed by the collective wisdom and knowledge you hold. Thank you for sharing your passion and expertise, and for your patience as I have tried to absorb it all.

And thanks to the staff that keep each school running. To the administrative staff who work magic with late paperwork and the caretakers that keep our studio homes clean, your work behind the scenes does not go unnoticed. Fiona Dhanapala, I will be forever in your debt for your guidance and support when I needed it most. You are a blessing to the School of Architecture and play a greater role than you know.

A special THANK YOU to my advisory committee, Donald McKay and Andrew Levitt. I am grateful for your patience, guidance, and sage advice that kept me focused and brought this thesis together. I am grateful for your mentorship, and for showing me when I already knew the answer but didn't realize.

To my best friend, partner, and co-conspirator, Stephanie Dalo, I am eternally grateful for your constant encouragement, support, and endless supply of inspiration. My appreciation for you is boundless.

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By author.

figure 4-31A 163 Key plan showing where the design section is taken
By author, with data from the Vancouver Open Data catalogue, http://data.vancouver.ca/datacatalogue/index.htm. Accessed April 5, 2016.

figure 4-31B 164-165 1:200 design section looking east from Burrard St. along W 6th Ave.
By author.

figure 4-32A 167 Key plan showing where the design section is taken
By author, with data from the Vancouver Open Data catalogue, http://data.vancouver.ca/datacatalogue/index.htm. Accessed April 5, 2016.

figure 4-32B 168-169 1:200 design section looking north towards W Broadway along Arbutus St.
By author.

figure 4-32C 170-171 1:200 transverse design section of Broadway-Arbutus LRT Station.
By author.

figure 4-33A 173 Key plan showing where the design section is taken
By author, with data from the Vancouver Open Data catalogue, http://data.vancouver.ca/datacatalogue/index.htm. Accessed April 5, 2016.

figure 4-33B 174-175 1:200 design section looking east near W 35th Ave at Maple St.
By author.

figure 4-34A 177 Key plan showing where the design section is taken
By author, with data from the Vancouver Open Data catalogue, http://data.vancouver.ca/datacatalogue/index.htm. Accessed April 5, 2016.

figure 4-34B 178-179 1:200 design section looking north from W 45th Ave along W Boulevard
By author.

figure 4-35A 180 Key plan showing where the design section is taken
By author, with data from the Vancouver Open Data catalogue, http://data.vancouver.ca/datacatalogue/index.htm. Accessed April 5, 2016.

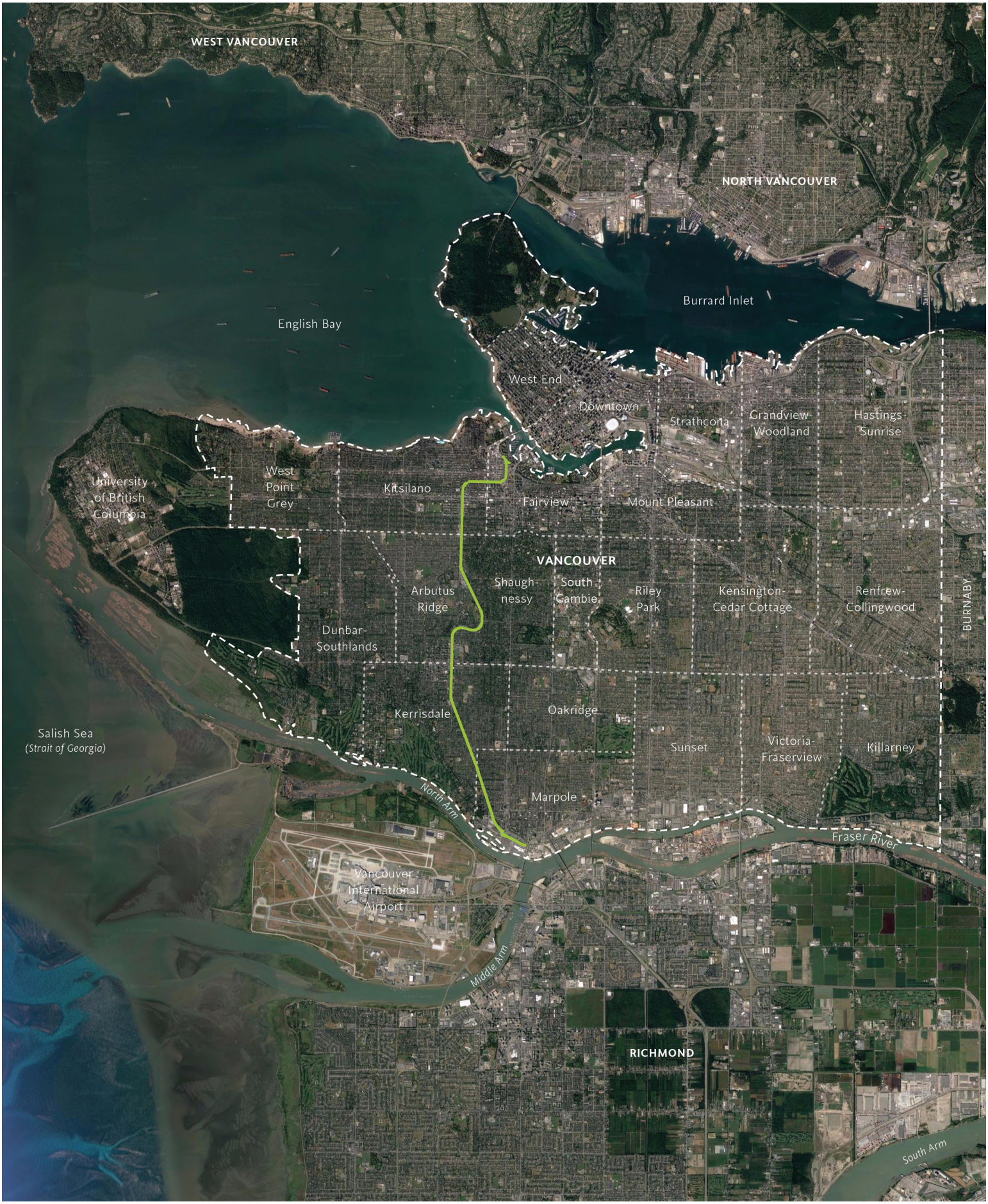
figure 4-35B 181 NTS Plan view of existing conditions at W 16th Ave + Arbutus St.
By author, with data from the Vancouver Open Data catalogue, http://data.vancouver.ca/datacatalogue/index.htm. Accessed April 5, 2016.

figure 4-35C 182-183 1:500 design plan of the W 16th Ave + Arbutus St intersection.
By author.

figure 4-34 176-177 An example of the corridor between W 2nd Ave and W 5th Ave.
By author.

figure 4-35 178-179 A multi-modal linear park through the city
By author.

figure 4-36 180-181 Walking through a Coastal Douglas Fir habitat zone
By author.


WEST VANCOUVER
NORTH VANCOUVER
Burrard Inlet
English Bay
West End
Downtown
Strathcona
Grandview-Woodland
Hastings-Sunrise
University of British Columbia
West Point Grey
Kitsilano
Fairview
Mount Pleasant
VANCOUVER
Arbutus Ridge
Shaugh-nessy
South Cambie
Riley Park
Kensington-Cedar Cottage
Renfrew-Collingwood
BURNABY
Dunbar-Southlands
Kerrisdale
Oakridge
Sunset
Victoria-Fraserview
Killarney
Salish Sea
(Strait of Georgia)
North Arm
Marpole
Fraser River
Vancouver International Airport
Middle Arm
RICHMOND
South Arm

The Arbutus Corridor

For six years, my architecture studies have led me on a journey across Canada and around the world. I have become familiar with the borroughs of New York from the seat of my bike, struggled to navigate auto-centric Tampa by public transit, and meandered through the plazas and winding markets of classical Spanish and Moroccan cities. In Canada, I am fortunate to have lived in a range of towns and cities—Halifax, Cambridge, London, Kelowna, and Pemberton—and spent time getting to know Toronto, Montreal, Ottawa, and countless other towns and regions between Sandspit and Sydney on opposite coasts. Through it all, I have often contemplated the characteristics of a place that make it special, and why I am so fond of my home town of Vancouver, where I find myself as I write the final pages of this thesis.

When those who have never visited ask about Vancouver, I often find myself first describing its incredible natural setting. Though it is perhaps the most obviously alluring quality of the city, it is one that has had a tremendous impact on me. I grew up in Coquitlam—one of Vancouver's bedroom suburbs—only three hundred metres from a forested ravine and a short ten minute hike to the ocean. Much of my childhood was spent camping with my family, and as an adult I feel most at home when I am surrounded by the mountains, meandering slowly through a damp forest valley, or taking in the fresh salt air on a rocky beach. The west coast, for lack of a better expression, is in my bones.

While nature is not always so close at hand within the city, it always maintains a presence. The southern slope of the city looks out over the mighty Fraser River and its delta. One of the last great salmon rivers, historic accounts describe returns so plentiful that you could once cross the river on the backs of Sockeye without getting your feet wet. North of the city, the tree-lined Coast Mountains rise from Burrard Inlet and are visible throughout most of the region. They are a constant lure for a city full of outdoor recreation enthusiasts of all levels. Almost every spectacular photograph of the city is set against this magnificent backdrop.

Due to its geography, the city sits at a boundary between two biogeoclimatic zones. To the north, the Coast Mountains act as a barrier to the warm, moist air at the end of North Pacific Current. This produces the unending rainy season for which the city is notorious, and which supports the rich Coastal Western Hemlock temperate rainforest that lines much of the British Columbian coast. The southern edges of the city and the Fraser River delta, however, find themselves in a minor rain shadow from Vancouver Island and the Olympic Peninsula. This relatively drier zone supports the Coastal Douglas Fir ecologies that once were home to some of the tallest trees in the world, and influences the warm, dry Mediterranean summers that the city enjoys.

Stretching across this boundary is the Arbutus Corridor. Though it once supported a popular interurban rail line between downtown Vancouver and Richmond's Steveston Village, passenger service along the corridor stopped in the 1950s as transit networks across the continent traded rails for rubber-tired buses. Freight traffic continued to use the line, but as the city deindustrialized through the 1970s and '80s, there were fewer and fewer businesses to serve. In 2001, one hundred years after it was built, the last train rattled

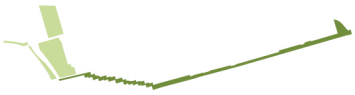
FIGURE 0-1 *(opposite) The Arbutus Corridor and the neighbourhoods of Vancouver, British Columbia. Not to scale.*

ARBUTUS CORRIDOR
Vancouver
9.5 km | 17.5 ha

ATLANTA BELTLINE
Atlanta
35 km | 150 ha

HIGH LINE
New York City
2.3 km | 3 ha

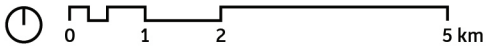
SEGRERA LINEAR PARK
Barcelona
3 km | 46 ha



TORONTO GREEN LINE
Toronto
4 km | 19 ha

LEGEND
Project Site
Adjacent Parks + Green Space

SCALE 1:100,000



down the corridor from the Molson Brewery in Kitsilano.

Though recently purchased by the city and planned to become a future greenway, the corridor was little more than an abandoned rail line when I started this thesis in 2014. In busy commercial neighbourhoods, local businesses took it for granted as a space for parking. Through residential neighbourhoods, the corridor was overgrown with invasive Himalayan blackberry and Japanese knotweed. It lay mostly overlooked by all but the closest neighbours and those who used it as a footpath or for community gardens.

At just under ten kilometres in length and eighteen hectares in area, what is left of the corridor remains one of the largest unutilized spaces in the city. While its narrow width—only twenty metres or less for most its length—is a challenge for design, the corridor is massive when compared to New York City's popular Highline and many other redeveloped industrial corridors. Stretching from False Creek to the Fraser River through a diverse range of neighbourhoods, the corridor offers endless potential to improve the city through which it winds.

That the city purchased the property is already a step in the direction. It speaks to another key reason why I love Vancouver: it is a progressive city. While the original owners of the corridor, Canadian Pacific Rail, wanted to maximize the valuable land by developing it, Vancouver proactively rezoned the land as a transportation corridor as its useful life began to wind down in 2000. While this precipitated conflict that drew out negotiations to buy the corridor, the city's vision all along was to convert the corridor into an urban greenway, complete with a streetcar.

Unfortunately, the political vision and will to transform the corridor stop at the property line. With the corridor being only a fragment of the larger city-owned corridors that include the road rights-of-way, this approach fails to recognize the extraordinarily rare opportunity to reimagine the space as a whole.

City life, and many of the things that affect it, is changing at a faster and faster pace. Climate change promises to shift local weather patterns, and is expected to result in increased immigration of refugees. Both global and local economic influences are making the city increasingly unaffordable, driving out both young talent and unskilled labour. Innovations in and diversification of transportation options can play a large role in how people navigate the city. These and other challenges and opportunities affect the long term resilience of the city, economically, socially, and environmentally. In Reimagining such a large piece of the city, it is prudent to look beyond the property line to see how the Arbutus Corridor can transform the neighbourhoods through which it passes. By considering the adjacent road rights-of-way as an extension of the corridor, there is increased potential to improve the city around it.

This thesis is an exploration of that potential. It analyzes the challenges faced by the city, and proposes a future for the corridor as an armature that fosters and supports ecological, social, and economic resilience within the city. It proposes a vision for the corridor that respects and supports the rich ecology and geography of the region, while supporting a truly diverse, resilient, and thriving city for the people who call it home.

FIGURE 0-2 *(opposite) Greenway scale comparison, illustrating the size of the Arbutus Corridor in relation to other converted rail and utility corridors.*

FIGURE 0-3 *The Arbutus Corridor, looking north towards W 16th Ave from above W King Edward Ave.*

TOWARDS URBAN RESILIENCE

part one

FIGURE 1-1 *Downtown Vancouver and False Creek today, a 'supermodel for liveable urbanism.'*

FIGURE 1-2 *(below) Downtown Vancouver and False Creek in the 1970s, before the redevelopment of False Creek industrial lands and the emergence of Vancouverism.*

The Liveable City

"If Manhattan is *the* Metropolitan City," argues Vancouver architect Matthew Soules, "Vancouver is *the* 'Liveable City.'"[1] Indeed, as urban planner Lance Berelowitz explains in his book *Dream City: Vancouver and the Global Imagination*, since the turn of the twenty-first century, Vancouver has willed its way into the global imagination as "the poster child of urbanism in North America."[2] So successfully has this story become engrained in the discourse of contemporary city-making, that architects and planners from around the world now flock to the city to learn its lessons. One result is a growing list of projects and master plans throughout the world to which Vancouver's self-branded model of urban design—*Vancouverism*—has been exported. From San Francisco, Toronto, and Fort Worth, to Dubai, Abu Dhabi, and various cities throughout China, the city has been replicated to varying degrees around the globe.[3] According to Soules, "Vancouver now seems to sit alongside well-established archetypes like Paris and Manhattan, places that cities everywhere look to as precedent."[4]

The allure is not hard to understand. Long referred to as Canada's lotusland—the northern analog to America's Los Angeles—Vancouver has truly become the dream city to which Berelowitz refers:

> *The city's spectacular setting, the intimate and apparently happy cohabitation of wild nature and built fabric, the tightly packed gleaming new condo towers downtown, the public waterfront, the vibrant neighbourhood high streets, the neat parks and lush, tree-lined suburban streets. The place seems to work.*[5]

Add to this its mild climate, diverse population, growing and increasingly diverse economy, relatively good education, infrastructure, healthcare, political stability, and a relaxed, active lifestyle; Vancouver is rightly ranked high for its many attractive qualities on the global stage.

For the past decade and a half, Vancouver has routinely been ranked by a variety of Quality-of-Life Indices (QLIs) as one of the most liveable cities in the world. From 2002 through 2010, it ranked first out of 140 cities surveyed by the Economist Intelligence Unit's (EIU's) Global Liveability Survey, and has consistently ranked third behind Melbourne, Australia, and Vienna, Austria ever since. Similarly, the Mercer Quality of Living Survey has ranked Vancouver in the top five out of 221 cities since 2010. Other lists, such as those by Monocle Lifestyle Magazine, the Lee Kuan Yew School of Public Policy, and QS, consistently rank Vancouver in the top twenty-five.

Still, the question arises whether or not such indices represent the reality of living in the cities they rank, or even if what is meant by 'liveable' is truly desirable in a city. While the EIU routinely ranks within the broad categories of stability, healthcare, culture and environment, education, and infrastructure, a one-off Best Cities survey in 2012 also looked at spatial characteristics, including green space, sprawl, natural assets, cultural assets, connectivity, isolation, and pollution. With this new category and a reweighting of the original five categories, neither Melbourne, Vienna, nor Vancouver make the Best Cities top ten. Similarly, neither the EIU nor Mercer's lists include cost of living in their analyses, since both companies sell that data separately.[6]

According to Brian Conger of the University of Calgary's School of Public Policy, these variations in which data is included can substantially alter the outcome of such lists.[7] Pointing to critics

which argue the Mercer and EIU indices favour german and english-speaking cities, respectively,[8] Conger adds about the EIU survey:

> *...nearly half the cities ranked (64 of 140) had scores above 80 per cent, meaning they present 'few, if any, challenges to living standards.' The upshot, of course, is that 'liveability', as defined by The Economist, is biased toward those cities that are the least challenging for residents. That hardly qualifies one as an exceptional city, let alone the 'best' of anything.*[9]

PricewaterhouseCoopers' Cities of the Future Report, on the otherhand, is prepared for policy-makers. On this list, which includes cost of living, Vancouver does not rank among the top twenty-five most liveable cities.[10] This salient point serves to underscore both the biased reality of QLIs, and one of the largest issues undermining liveability in Vancouver: affordability. Comparing median household income versus median cost of housing, a recent Demographia survey of 406 global housing markets ranked Vancouver the third most unaffordable market behind Hong Kong and Sydney, Australia.[11] A growing problem over the past fifteen years, the issue has reached crisis level, sparking regular debate among a public struggling to make ends meet and fresh attention from policy-makers looking to stem rapidly inflating housing costs.

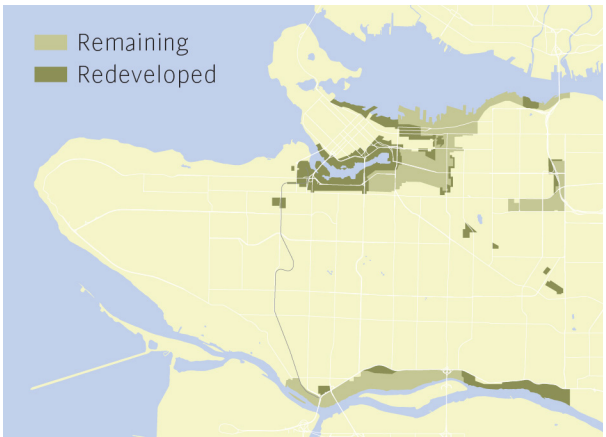


FIGURE 1-3 *Remaining industrial land in Vancouver, and that which has been redeveloped—mostly into Vancouverism style mixed-use residential neighbourhoods.*

Perhaps not so subtly suggested by his use of quotations around the title 'Liveable City,' Soules also doubts the actual liveability of Vancouverism—though not necessarily the city as a whole. Despite the sprawling suburban neighbourhoods of single detached homes that make up much of Vancouver, the rapid redevelopment and densification of the city's downtown and False Creek post-industrial landscape since the 1980s garners most of the attention when it comes to the city's liveable urbanism.

It was here that the Vancouverism model was first realized. Started in the 1990s, North America's largest urban master planned community of Concord Pacific Place "attracted large numbers of new residents to downtown high-density living at a time when such living was widely scorned."[13] As an ambitious collaboration between private developers and government planning agencies, the project was successful in providing a full range of public amenities—community centres, day care, schools, and parks—at the same time residential units became available.[14]

In what became archetypal Vancouverism, form followed function to maximize views, provide public open space and recreational opportunities, civic amenities, and commercial functions all within walking distance.[15] In built form, this was realized through a hybrid of residential point towers—with small floor plates, balconies, and generous daylight via floor to ceiling window walls—set back from human-scaled low-rise mixed-use podiums that framed a lively urban street wall, all punctuated with frequent parks and generous open space.[16] With a singular and consistent architectural expression, Vancouverism "offers an order and spaciousness that once seemed anathema to the crowded chaos of the city center."[17]

Like the many cities worldwide that have since imported Vancouverism, this typology has since been replicated throughout the city and region. Yaletown and Coal Harbour on the downtown peninsula were first, followed by ongoing expansion into Southeast False Creek, Kitsilano, and now Marpole. Slowly, it has been applied in varying degrees to civic centres in many of the city's suburban neighbours: North Vancouver's Lonsdale Quay, Burnaby's Metrotown and

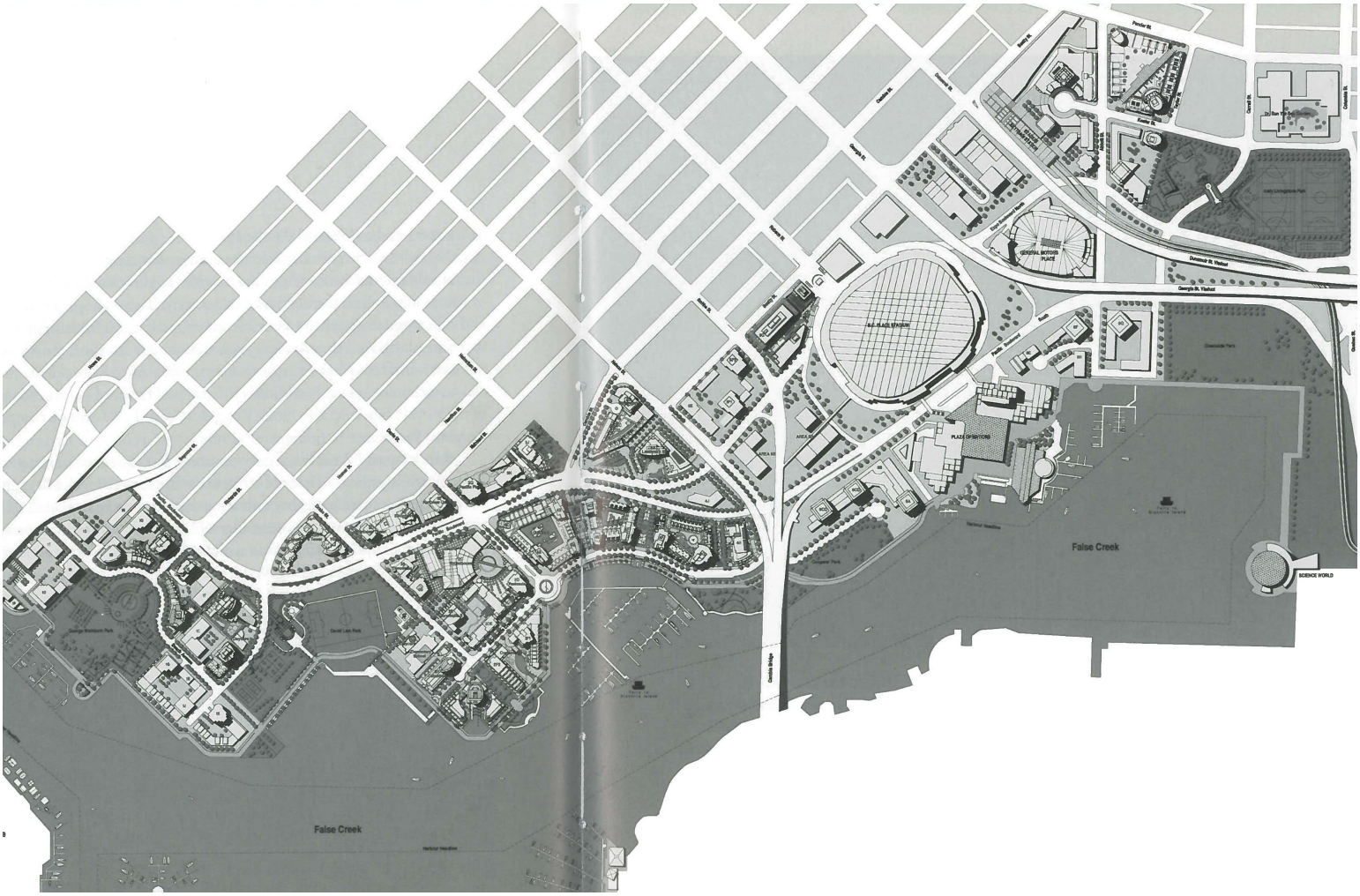


FIGURE 1-4 *The Concord Pacific Place master plan, replete with residential towers, mixed use podiums, civic amenities and generous parks along a new waterfront seawall, marked the beginning of a new urbanism model and the transformation of Vancouver.*

Lougheed Town Centre, Coquitlam Town Centre, Port Moody's Newport Village and surrounding neighbourhoods, and Surrey City Centre. By most accounts, the resultant neighbourhoods are successful, desirable, and liveable.

Soules, however, identifies a homogeneity that characterizes Vancouverism, arguing that it undermines the diversity needed to create a healthy and dynamic city. He calls it Third Way urbanism, in reference to Anthony Gidden's centrist Third Way that exemplifies "the defining political character of globalization."[18] Third Way politics aims for a post-ideological pragmatism that "produces compromise in the guise of universal consensus."[19] Similarly, Vancouverism is the compromise between suburban and urban paradigms, achieving the comfortable good life of the suburbs—"offering the consistency, predictability, and safety of homogeneous built form and social fabric"[20]—but at the larger scale of the urban.

And this homogeneity is pervasive. The purported mixed-use goods, services, and amenities cater almost exclusively to the yuppie lifestyle. Work space is "tokenistic at best."[21] Condo units are limited to one or two bedrooms, and are far too small in which to comfortably raise a family. Unsurprisingly, inhabitants—though "diverse in categories such as ethnicity and sexual orientation"—represent the singular socioeconomic demographic of middle to upper-middle class professionals.[22]

But where is the rest of the city? Consistency, predictability, and safety have never been the ingredients for a vibrant, productive, nor live-

able city. Just as ecosystems are strongest with healthy biodiversity, cities too require the diversity of people, places, and ideas that Third Way compromise seeks to flatten:

> *Where are people such as workaholic office employees, rebellious punks, senior citizens, and the truly poor in the Vancouver model? Where are recent immigrants whose social habits do not mesh with its strict codes of conduct? Where is a breadth of public space that could facilitate such diversity? Where is the spectrum of building types and scales of inhabitation—both residential and commercial—that are the physical necessity of substantive diversity?*[23]

In its blind ambition to "lend comfortable ease to city life" and diminish the chance of confrontation or collision between diverse people and ideas, Vancouverism "fails to recognize the important and positive potential of antagonism within social life."[24] This "expression of competing interests,"[25] as Soules calls it, is what drives the dialogue, production, and innovation of any healthy city.

Ultimately, *the* 'Liveable City' might not be so liveable after all. As Soules concludes, "the way the livable city limits the social and political potential of city life reveals its paradoxical reality: the livable city smothers living."[26] Whether it's rampant unaffordability or the stagnant homogeneity of Vancouverism, its clear that a different approach is needed. In place of the 'liveable city,' it's time to work towards urban resilience.

ENDNOTES

1 Matthew Soules, "The 'Liveable' Suburbanized City," *Harvard Design Magazine* 32, Spring/Summer 2010, 142.

2 Lance Berelowitz, *Dream City: Vancouver and the Global Imagination*, (Vancouver: Douglas & McIntyre, 2005), 1.

3 Soules, 142.

4 Ibid.

5 Berelowitz, 1.

6 Brian W. Conger, "On Livability, Liveability and the Limited Utility of Quality-of-Life Rankings," *SPP Communique*, 7-4 (June 2015), 5.

7 Ibid, 5-6.

8 Ibid, 6.

9 Ibid, 1.

10 Ibid, 1-2.

11 Jill Slattery, "Vancouver ranked third most unaffordable housing market in the world," Global News, January 22, 2017, accessed January 24, 2017, http://globalnews.ca/news/3198292/vancouver-ranked-third-most-unaffordable-housing-market-in-the-world/.

12 Soules, 142.

13 Ibid.

14 Ibid.

15 Ibid.

16 Ibid.

17 Ibid, 144.

18 Ibid, 143.

19 Ibid.

20 Ibid.

21 Ibid, 144-145.

22 Ibid, 145.

23 Ibid, 146.

24 Ibid.

25 ibid.

26 Ibid, 148.

FIGURE 1-5 *Yaletown, the quintessential model of Vancouverism at the west end of Concord Pacific Place.*

FIGURE 1-6 *Cypress Community Garden, July 2015. Community gardens such as this one along the corridor on W 6th Ave in Kitsilano help improve urban resilience in many ways, including improving food security, building community, providing habitat for insects and birds, providing the mental health benefits of green spaces, reducing the urban heat island effect, and assisting with storm water management.*

Towards a Resilient Vancouver

THE CASE FOR URBAN RESILIENCE

In addressing the many challenges we face today, sustainable development has emerged as a prime tool to create and maintain healthy communities and productive economies while sustaining healthy ecological systems. Yet sustainable development on its own is not enough. Sustainability strategies are often reduced to project-specific checklists which do not always anticipate or accomodate significant change within a system and often fail to account for the cumulative impacts of multiple distinct projects. Even for cities such as Vancouver where sustainable development is common, this can lead to the incremental loss of system-wide sustainability, and expose the city to vulnerabilities when conditions change.

An alternative approach is to design for resilience, which takes a system approach to support truly diverse, liveable, and sustainable communities that are able to absorb and adapt to stresses instead of breaking down. Borrowing from the ecological sciences, planner and ecologist Nina-Marie Lister defines resilience as:

> *...the ability of an ecosystem to withstand and, to some degree, absorb the effects of sometimes unpredictable and sudden changes to prevailing environmental conditions while still maintaining the majority of its structures and functions. Occasionally, such changes may result in a reorganization of the system's structures and functions into a new, or alternate steady state. As such, resilience implies transformative capacity, and straddles the tensions between stability and perturbation, constancy and change.*[1]

As Carl Folke et al of the Swedish research institute Resilience Alliance explain, this concept applies as much to cities as it does nature. In fact, while cities were once seen as independent from nature, they are now widely recognized as complex and evolving socio-ecological systems, intricately and inextricably interwoven with the regional and global natures in which they exist.[2] The common misperception that "ecosystem responses to human use are linear, predictable and controllable,"[3] Folke's group adds, is increasingly being replaced with the understanding that "natural and social systems behave in nonlinear ways [and] exhibit marked thresholds in their dynamics."[4] Crossing these thresholds is what precipitates the "sometimes unpredictable and sudden changes"[5] that Lister describes.

While the socio-ecological systems of a city represent a whole, complex metabolism of varied sub-systems, it can be overwhelming to study it as a whole. Rather, it can be helpful to divide them into the two interconnected branches of socio-economic and ecological-infrastructural layers. The resilience of cities relies upon the resilience of each of these systems. Just as vulnerabilities arise from socio-economic inequality, the depletion of ecological services or failure of infrastructure diminishes resilience and increases the potential of the entire system breaking down.

With an estimated 54.5% of the global population living in cities as of 2016, and that number expected to reach 60% by 2030,[6] the global imperative of creating resilient cities is more pressing than ever. Cities today face myriad challenges: increasing socio-economic inequality, lack of services and affordable housing, water and energy shortages, environmental degradation, and rapid population growth, among others. Climate change has already begun to exacerbate these challenges while introducing new ones. The

increasing occurrence and severity of storms, flooding, drought, extreme temperatures, wildfire, sea level rise, shrinking glaciers and increasingly precarious water supplies, loss of biodiversity, spreading of invasive species and disease, and the mass migration of climate change refugees barely begins to enumerate the growing stresses with which cities are faced.

In order to both prepare for and combat these increasing challenges, cities need to plan and build for resilience. As Folke et al explain, "more resilient socio-ecological systems are able to absorb larger shocks without changing in fundamental ways. When massive transformation is inevitable, resilient systems contain the components needed for renewal and reorganization."

TOWARDS RESILIENCE IN VANCOUVER

In recent decades, Vancouver has led a bold course towards urban resilience. Initiatives such as the Greenest City Action Plan, the Renewable City Action Plan, the Healthy City Strategy, the Transportation 2040 Plan, and countless others have been implemented to varying success. In 2016, the city was selected to join the Rockefeller Foundation's 100 Resilient Cities program. The program "helps a network of cities gain access to tools, funding, technical expertise, and other resources to build resilience to face 21st-century challenges."[7] While the city still faces many challenges on the road to resilience, these strategies and plans have collectively guided it in the right direction.

Among these initiatives, the Greenest City Action Plan is the original framework for the city's sustainability goals. As a strategy to "stay on the leading edge of urban sustainability," the plan focuses on measurable goals within ten categories to become the "greenest city in the world" by 2020. These categories are climate leadership, green buildings, green transportation, zero waste, access to nature, clean water, local food, clean air, green economy, and a lighter ecological footprint.

Out of these goals, the city developed the Transportation 2040 plan. By shifting transportation in the city towards a multimodal system that prioritizes pedestrians and cyclists ahead of automobiles, the long term goal is to create "a smart and efficient transportation system that supports a thriving economy while increasing affordability; healthy citizens who are mobile in a safe, accessible, and vibrant city; and a city that enhances its natural environment to ensure a healthy future for its citizens and the planet."[8]

Looking at transportation mode shares in particular illustrates the ongoing success the city has had in implementing these plans. While it is still no New York City when it comes to cycle infrastructure, and lags far behind the bike-centric cities of the Netherlands, the city's growing network of bike routes and new bike share program have supported a rapid expansion of its thriving bike culture. Combined with improvements to transit and pedestrian facilities, the city has already achieved its goal for half of all trips originating in the city to be made by foot, bike, or transit by 2020, and is well on track to reach two-thirds by 2040. When compared to other major North American cities, Vancouver boasts the largest percent of commuters that cycle or walk to work.

Despite these successes, the city recognizes there is still much to do. By leveraging the knowledge and resources from the 100 Resilient Cities program, the city's new Chief Resilience Officer aims to "integrate and harmonize [these] different approaches to address not just current problems such as affordability and equity, but longer-term issues such as climate change, migration, declining resources and the threat of natural disasters."[9]

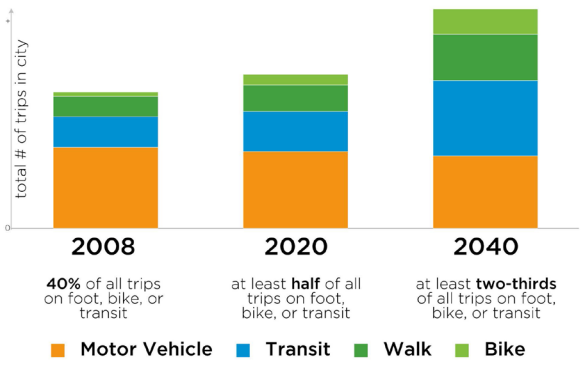


FIGURE 1-7 *Transportation Mode Share Targets from the Transportation 2040 Plan*

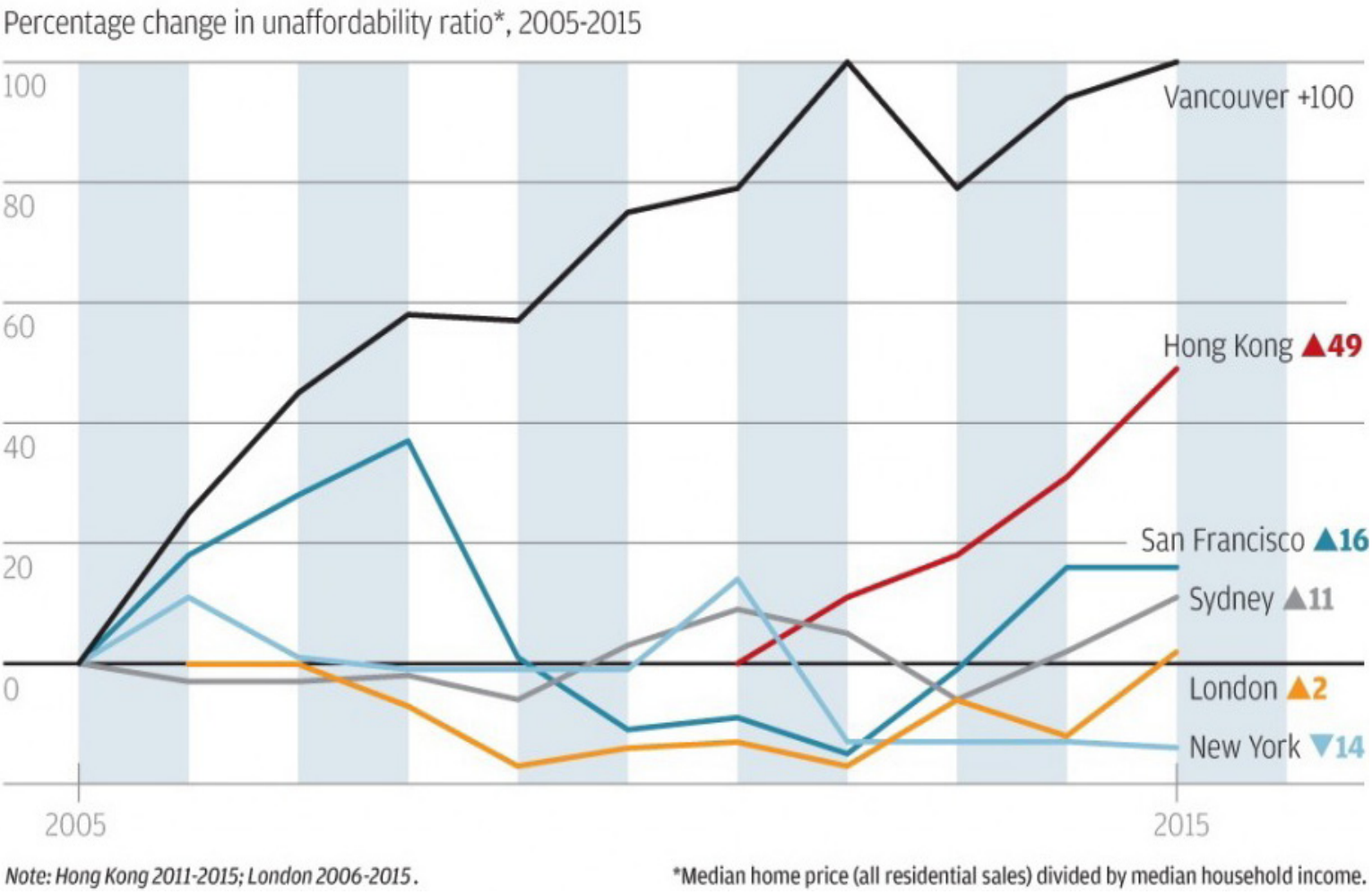


FIGURE 1-8 *Unaffordability in Vancouver increased 100% between 2005 and 2015, as median house prices doubled and incomes remained stagnant. Other than Hong Kong, all other major cities saw much smaller increases, and New York actually saw a decrease in unaffordability of 14% over the same period.*

CHALLENGES AND OPPORTUNITIES ON THE PATH TO RESILIENCE

While Vancouver has made many great strides towards urban resilience, there are still many challenges which threaten the city's capacity to survive, adapt, and transform in response to ongoing and future stresses and system changes. Transecting such a large section of the city, the redevelopment of the Arbutus Corridor is affected by many of these challenges. However, as a project of such large size, scope, and potential urban transformation, the corridor also offers many opportunities to help mitigate and adapt to many of these challenges. For others, the corridor can act as an armature to support change in the surrounding fabric of the city.

First, let us consider the socio-economic challenges faced by the city. Perhaps the largest immediate challenge facing Vancouver today is the issue of affordability. While median incomes in the city have remained virtually unchanged in recent years, property values and the cost of housing have seen a rapid increase over the same period. Though other global cities have seen similar trends over the same time period, the rapid increase of Vancouver's unaffordability ratio—the median home price divided by median household income—shows the city has been hit particularly hard.[10]

In 2015 alone, the city saw an increase in houses valued over $1 million from 65% to 91% of total stock. While citywide employment earnings that year totaled around $19 billion, this rapid increase in property values saw single family

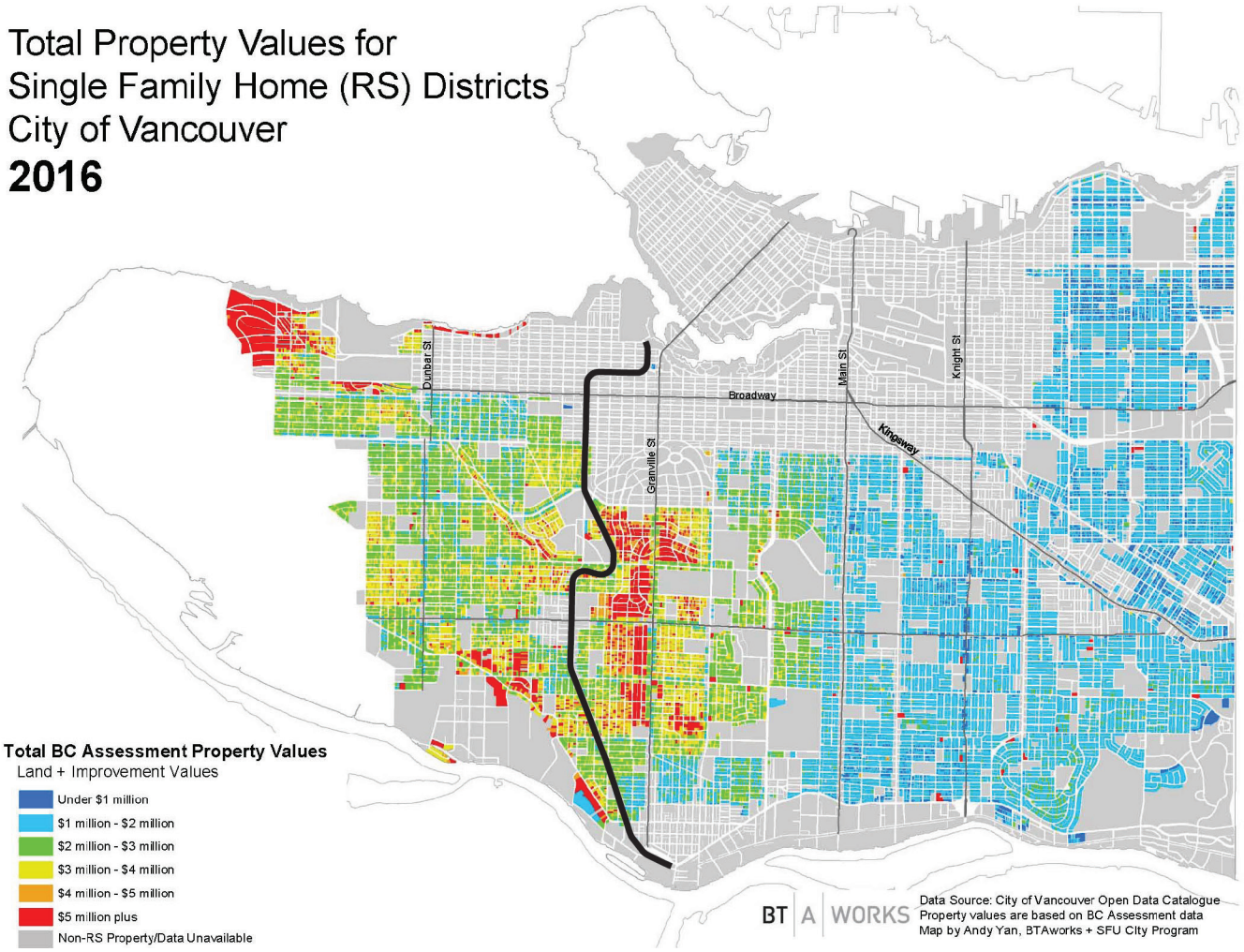
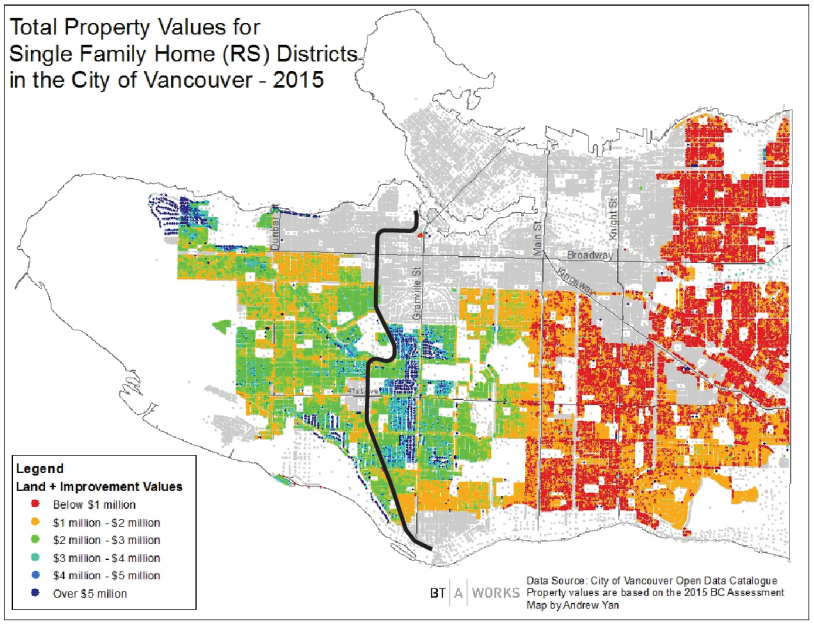


FIGURE 1-9 *2016 Property values of single family houses, which cover much of Vancouver. Housing prices have escalated to a point most Vancouverites cannot afford. West of Main St., and particularly in Shaughnessy and South Granville neighbourhoods, have some of the most unaffordable housing in the city. 91% of single family homes cost over $1 million.*

FIGURE 1-10 *(below) 2015 Property values of single family houses. 65% of single family houses in Vancouver cost more than $1 million, with much of the city's east side housing falling below this threshold.*



houses gain a massive $25 billion in value for their owners.[11]

Such rampant unaffordability can have a crippling affect on the socio-economics of the city. According to Josh Gordon of the Simon Fraser University School of Public Policy, consequences include generational inequity, dangerous leveraging and debt loads, stunted future economic viability, and generally weakened communities.

Though Vancouver still boasts one of the lowest unemployment rates among Canadian cities, many companies are finding it a challenge to attract low-skill, low-wage workers. Even at $20 per hour, which equates to less than $2,500 in net monthly income, the city is simply too expensive for many to live in when the average cost of rent for one and two bedroom apartments is $2,120 and $3,200 per month and rising, respectively.[13]

Coupled with massive increases in property taxes, small businesses have found this particularly challenging. Many have simply been forced to close up shop, undercutting the local economy and robbing the city of business diversity, expertise, and character. As was well documented in recent news, even well established and popular destination businesses have been forced to close after seeing as much as a 92% increase in property taxes over the past year.[14]

Young professionals and young families are finding it equally difficult to get ahead or buy a home. While a 20% down payment took first-time Metro Vancouver home buyers 5 years to save for in 1976, it now takes 23 years, according to study by Generation Squeeze. “Struggling with high debt loads, stagnating wages and rising costs,” the Vancouver Sun reports, “[millenials] are fast becoming an endangered species in the city.”[16] Indeed, Statistics Canada notes Vancouver has seen net annual decreases in the 25-44 demographic since 2008. City statistics pegged this exodus at an alarming 20% between the last two censuses.[17] Among those remaining, a survey by Vancity Credit Union found “more than two-thirds of those polled were considering moving elsewhere.”[18] As the Greater Vancouver Board of Trade outlines in its 2017 report on housing affordability, this demographic represents some of the most productive years in a person’s career.[19] Losing this cohort of young, enthusias-

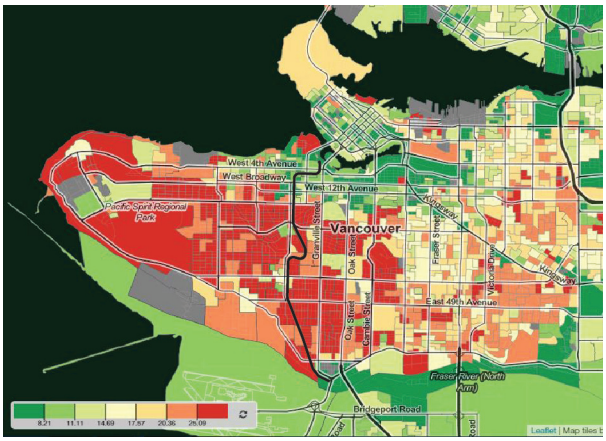


FIGURE 1-11 *Affordability Index in 2016, showing median dwelling value divided by median household income.*

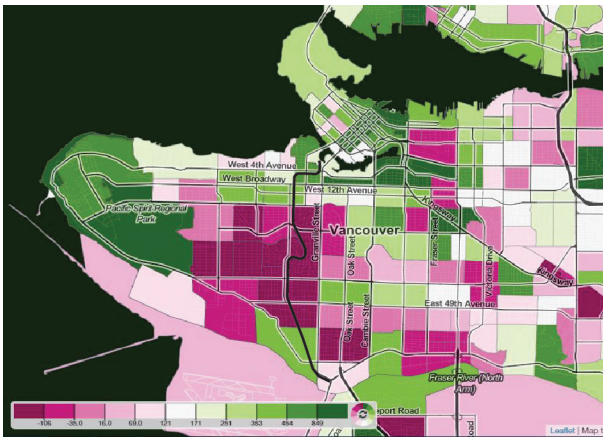


FIGURE 1-12 *Absolute Population Change from 2011 to 2016. Kerrisdale and Arbutus Ridge areas have both seen decline.*

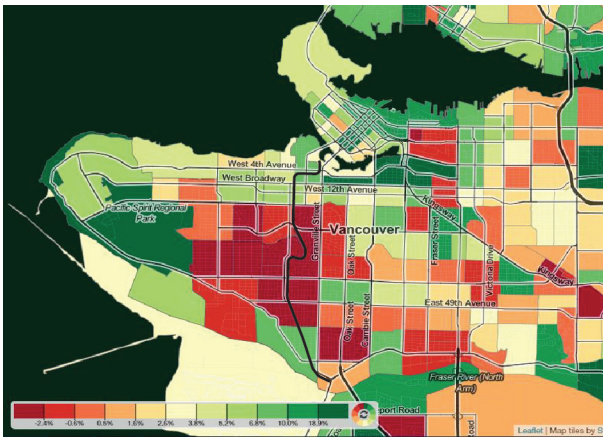


FIGURE 1-13 *Relative Population Change from 2011 to 2016. Kerrisdale and Arbutus Ridge areas have both seen decline.*

tic, and creative talent poses a massive threat to the long term success of Vancouver's economy and business investment.

Similarly, the loss of millennials living in the city can have undesirable social consequences. Unsurprisingly, this population loss is felt the most in Vancouver's west side neighbourhoods surrounding the Arbutus Corridor. Here, housing costs have increased the most and are completely beyond the reach of nearly all young professionals or families looking to buy a home. As younger demographics move out, these neighbourhoods become increasingly homogeneous in demographic makeup. This does not make for vibrant, healthy, and resilient communities, or allow for generational succession.

In order to combat the affordability crisis, it is important to understand the root causes that have created it. While there is some debate among economists and other analysts on how much each cause contributes to driving prices up, the basic underlying causes are generally agreed upon.

Internationally, the trend for soaring housing costs in global cities is driven partly by the rapid expansion of the financial economy to dwarf the real economy in recent decades. According to Geoff Dembicki of the Tyee, "by 2010, the value of all the investment capital in the 'financial economy'... was $600 trillion, triple what it had been two decades earlier," and "ten times more than all the goods and services in the 'real economy'."[21] With so much capital available, investors are pouring money into assets like real estate and driving up prices.

In Vancouver, this is exacerbated by the geographic constraints and legislated agricultural land restrictions in the region that place a limit on the expansion of urban development. Where there is residential zoned land, it is inefficiently utilized with 63% allocated for single-detached houses that support only a small fraction of the population. There simply isn't enough housing to meet the demand.

Previously, governments had failed to track foreign investment to determine how much of a problem this was. After complaints from residents of empty houses, though, new studies in 2015 revealed 70% of west-side Vancouver homes sold in a six-month period went to buyers in Mainland China.[22] While many of these multimillion dollar homes were bought outright with cash, prompting concerns of money laundering, more than a third of the owners were also declared as students or housewives with little income, allowing them to use a tax loophole to flip the properties tax-free after living in them as their primary residence for a brief period.[23]

As suspected by several long-time residents, though, many of these homes also sit vacant. Little more than a speculative investment, even-multi-million dollar heritage houses and mansions have been left to rot in the elements over several years. Photo blogs cataloguing empty homes in the city have made the rounds in local news, with drone fly-throughs of some mansions showing how neglect has transformed dream homes into tear-downs in only a few short years.

In response to these underlying causes of the affordability crisis in the city, a number of solutions have been proposed, with some being implemented. On the demand side, the provincial government instituted an additional 15% property transfer tax for foreign buyers. While the market cooled slightly after the tax was introduced, it is not clear whether it was a result of the tax or due to new regulations in China making it more difficult to move capital out of the country.[25]

Similarly, the city of Vancouver also introduced a new tax . To help control the problem of houses and apartments sitting vacant when there is such a low rental vacancy rate, the city introduced an empty homes tax. For secondary residences that are not rented out at least six months of the year, owners are subject to an additional 1% of the assessed property tax. With a 2014 study for the Vancouver Affordable Housing Agency finding 12.6% of all condominiums in the city sat unoccupied that year,[26] an extra tax like this could discourage absentee owners, or help push their units into the rental market.

Additional demand side solutions that have been a part of the public conversation include restrictions on foreign ownership and tracking foreign investment and laundering. A progressive property surtax deductible against income tax is another option that targets a surtax on foreign buyers, non-resident owners, and potentially income tax evaders.[27] Regulation to reel in

developers who have been found marketing new properties in Hong Kong and China before they are made available to the local market might be another solution.

In addition to these solutions to help curb less desirable demand, there are a multitude of capacity side solutions that can help alleviate the shortage of available housing in the city and region. First and foremost among these is an increase in both housing form and housing tenure in new builds. In order to support a diverse community, a truly diverse range of housing options are needed.

While the majority of new developments around Vancouver in recent decades have focused on Vancouverism style point towers and mid-rise condominiums, this housing form is not suitable for large demographics of the community. Housing in the city today is mostly an either or between single-detached houses or compact tower condominiums.[28] Housing options in neighbourhoods along the Arbutus Corridor are a clear representation of this problem. Other than a few mid-rise condominium complexes along W 6th Avenue and near the intersection of W Broadway and Arbutus Street, the line is surrounded almost entirely by blocks of single-detached houses. What is needed is the development of new intermediate housing forms, or what is more commonly known today as the Missing Middle.

Coined by Daniel Parolek of Opticos Design Inc. in 2010, Missing Middle housing represents a spectrum of multi-unit or clustered housing types. These include duplex, triplex and fourplex houses, courtyard apartments and bungalow courts, townhouses, multiplexes, and live/work spaces.[29] In addition to being an appropriate scale of housing to increase density while transitioning from single-detached houses, these housing typologies support smaller, more well designed units with a smaller building footprint, and which cater to a more diverse range of inhabitats in terms of age, family size, and income. They are of high enough density to support transit in walkable neighbourhoods, have small building footprints, and tend to require reduced off-street parking.[30]

According to Parolek, Missing Middle housing options also help alleviate opposition to increased density since buildings can be scaled to gradually increased in size, and tend to fit better with existing vernacular architectural styles than mid-rise developments and towers. This allows a sort of covert densification of existing city fabric without compromising the heritage character of neighbourhoods, bringing in more households to support businesses without increasing perceived density.[31] Unlike the homogenous, cookie cutter neighbourhoods that Vancouverism typologies support, the diversity of Missing Middle neighbourhoods supports some of the most resilient communities in cities around the world.

At the bottom end of the Missing Middle spectrum, the rise in accessory dwelling units (ADUs) has also shown promise for increased densification of suburban neighbourhoods while maintaining existing character. More commonly known as laneway houses in Vancouver, these offer the owners an additional revenue stream from their existing property, while making the

FIGURE 1-14 *Missing Middle housing forms occupy a spectrum of typologies between single-detached houses and mid-rise condominiums. They support dense, walkable, and transit friendly communities, and offer a wide range of housing choices for the diversity of inhabitants that make up a healthy community.*

single-detached home available on a small scale to renters.

Some recent examples of successful suburban infill projects in Vancouver have used a hybrid triplex/ADU model to fit up to eight units on two properties which previously had been only two single-detached homes. While there are many examples to be found in the city, the Union Street EcoHeritage project by Shape Architects in collaboration with the city is an excellent example. In the space of two existing houses, the project fits in seven new units, all while maintaining the heritage character of the original buildings and the historic Strathcona neighbourhood in which they are situated. While this project in particular fused a modern architectural language to the historic houses, other examples in the city are impossible to distinguish from their neighbours, only revealing how many units they contain under close inspection.

In addition to increasing density within suburban neighbourhoods, projects like this could play a significant role in saving much of the city's architectural heritage as well. According to Joseph Dahmen of the University of British Columbia School of Architecture, up to one in four houses in the city could face demolition by 2030. Using a tool to identify the relative value of houses to the property on which they sit, Dahmen found that half of the single-family homes in the city already have relative values below 7.5%. Far below what is generally considered a healthy relative value, these homes face greater than a 50% chance of being demolished in the near future.[32]

FIGURE 1-15 *Accessory Dwelling Units such as this laneway house in Vancouver increase density in zones of single-detached houses and provide alternative housing options while acting as a source of income for owners.*

FIGURE 1-16 *The Union Street EcoHeritage project converted two heritage homes into seven comfortable, well designed units while maintaining the heritage character of the homes and neighbourhood.*

Beyond an increase in greater housing forms, a larger variety of housing tenure options is also needed. According to the City of Vancouver, a healthy rental vacancy rate is between 3% and 5%.[33] With actual vacancy in the city an alarmingly low 0.7%, it is clear that the current supply of rental housing is insufficient to meet the demand.[34] This type of housing market drives up rental prices, can force renters into dangerous situations, and pushes stable housing out of the reach of many. For others, it becomes increasingly difficult, if not impossible, to save enough to purchase their own property.

Other than ownership and rental housing tenures, other models such as community land trusts, co-op and co-housing, and shared ownership/shared equity housing have become an increasingly appealing alternative to many in recent years. Such tenure models can provide increased housing security over rentals, and offer a greater variety of housing options to those who cannot afford to or choose not to own.[35]

Subsidized housing also works well with many of these tenure models. In Toronto, St. Lawrence Market is a commonly cited, successful example of a dedicated mixed-use, mixed-income affordable neighbourhood. Instead of the low quality, undesirable housing that best describes countless social housing developments, St. Lawrence Market integrates market-priced housing with public, non-profit and co-op residences together with a

range of civic services and amenities to support a healthy community.[36] Because subsidies are income based and applied to rent, rather than building cheap housing en masse, the neighbourhood and its buildings are still desirable nearly forty years later. For four decades, it has been a healthy community with a diversity of inhabitants.

Unfortunately, federal government programs to build new non-market co-op or social housing ended in 1993 and tax incentives for purpose-built private rental construction ended in the 1970's and 80's.[37] In BC, provincial programs for social housing ended in 2002.[38] Without these programs, social housing has failed to keep pace with rising demand. Many buildings that house some of society's poorest and most vulnerable have simply been left to deteriorate, while others have been sold to developers to capitalize on the valuable land.

After decades of taking a back seat to private developers on affordable housing, however, governments are finally starting realize intervention is needed. Over the past several months, both the City of Vancouver and the federal government have announced new housing plans. Critics argue the federal strategy doesn't go far enough, though, and fails to address the root causes of the problem. Band-aid solutions like a $2,500 per year voucher for low-income households will do more to line the pockets of landlords than it will to create more affordable housing.[39]

The city's plan is more ambitious, with a target of 72,000 new units being built over the next ten years, two-thirds of which are rental. In addition to 12,000 new units of social and supportive housing, the plan also prioritizes Missing Middle housing options catering to the young professionals and families who are rapidly leaving the city. Other initiatives will expedite permits for affordable housing, expand developer incentive programs, work towards rental-only zones, and focus on rentals around transit stations.[40]

This focus on transit-oriented affordable housing is an important aspect. As Skytrain rapid transit has expanded throughout the city and region, increased property values surrounding stations have overwhelmingly resulted in the replacement of old rental buildings with expensive, high density, free-market condominiums. According to Kishone Roy of the BC Non-Profit

FIGURE 1-17 *Vancouver Housing Strategy 10-year goals.*

Housing Association, "the only people that can afford to live along transit lines in Metro Vancouver are people who can afford a car—and the people who need transit can't afford to live along those transit lines."[41] While we want transit to be accessible to everyone, we first must make sure it is available to those for whom it is the only viable option to get around.

Ultimately, while the affordability crisis undermines the liveability of the city, there is still hope. Despite the critical nature of this inequality and its impact on the socio-economic stability of the city, each of these initiatives and potential solutions is an opportunity to improve the resilience of the city and those who call it home.

In addition to the socio-economic challenges and opportunities on the path to a resilient Vancouver, the city is also faced with numerous ecological-infrastructural challenges that offer their own opportunities for resilience.

Chief among these challenges is climate change, and the many impacts it will have on the city. While the climate crisis disproportionately affects developing nations, and will surely cause an increase in environmental refugees to cities like Vancouver in the coming decades—further reason to tackle housing capacity and the affordability crisis—Vancouver is not immune to environmental impacts of its own. Among these

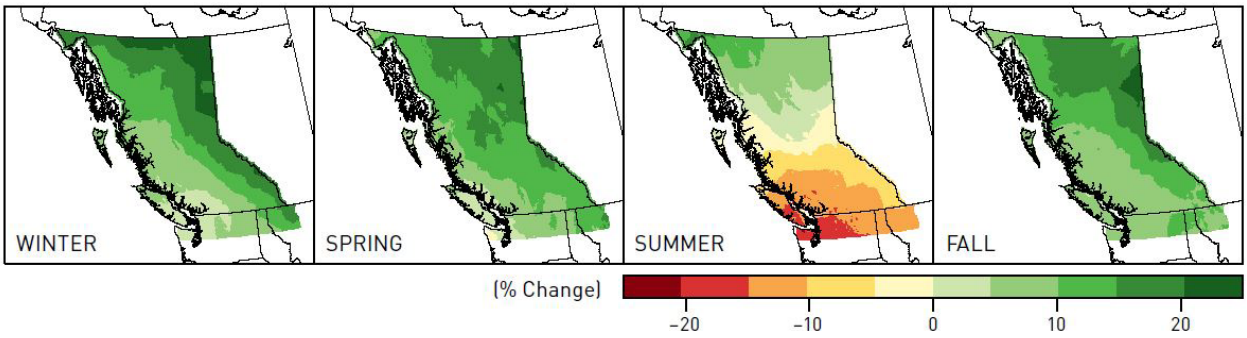


FIGURE 1-18 *Seasonal mean precipitation change in the 2050s (2041-2070) relative to the 1961-1990 baseline period.*

challenges are changing precipitation patterns, increasing average temperatures, and the subsequent shift in biogeoclimatic zones that these changes will cause.

Among the thirty-six metropolitan regions in North America with over two million inhabitants, Vancouver is the wettest.[42] While the geography of the region causes all this rain to fall unevenly—from 2,522 mm annually in North Vancouver to only 1,189 mm per year at the Vancouver International Airport in Richmond—the City of Vancouver proper still earns its Rain City moniker with 1,457 mm and an average 168 days of precipitation each year.[43] And it is only going to get wetter.

In a study of climate impacts on British Columbian watersheds and ecosystems, the provincial government projected a 6% annual increase in precipitation for the south coast by 2050.[44] However, this increase is not expected to be evenly distributed. While fall, winter, and spring will become increasingly wet with 9%, 6%, and 7% increases in seasonal precipitation, summers are expected to become increasingly dry with a 13% decrease in rainfall.[45]

Along with these changes to precipitation patterns, the study also projects an average 1.5 °C increase in air temperature over the same time period.[46] This increase is expected to be fairly consistent throughout the year, with the smallest changes in spring at 1.3 °C and the largest in summer, at 1.7 °C.[47] Further significant increases of up to 6 °C are expected within 100 years.[49]

In combination with geography, air temperature and precipitation patterns are some of the largest forces which influence the distribution of different ecosystems. In British Columbia, the biogeoclimatic classification system is used to describe the provinces fourteen different ecosystems based on climate, soil characteristics, vegetation, animals, and microorganisms. As vegetation the most easily studied component of each ecosystem, it forms the basis of classification, and zones are typically named after one, two, or three of the climax species.[48]

Historically, Vancouver sits at a boundary between two of these zones. Along with much of the British Columbian coast, the wetter northern slopes of Vancouver and the North Shore (North Vancouver and West Vancouver) are characterized by the Coastal Western Hemlock (CWH) biogeoclimatic zone. This zone makes up the temperate rainforest for which the west coast is known. South of Vancouver, the Fraser River delta sits in a minor rain shadow from Vancouver Island and the Olympic Mountains in Washington. With significantly less annual precipitation, this region is home to the warmer, sunnier, and drier Coastal Douglas Fir (CDF) biogeoclimatic zone.

Because of the significant shifts in precipitation and temperature patterns projected over the coming decades, this zone boundary is expected to shift north as the CDF zone expands across lower mainland British Columbia. As the local climate shifts, so too will the distribution of vegetation. Though wild vegetation will naturally show a delayed reaction over several generations, planning for this shift in built environments can ensure better adaptability and success rates by minimizing environmental stresses on ecologies in the short term.

Along the Arbutus Corridor and throughout Metro Vancouver, therefore, it is prudent to choose plant species strategically. While herba-

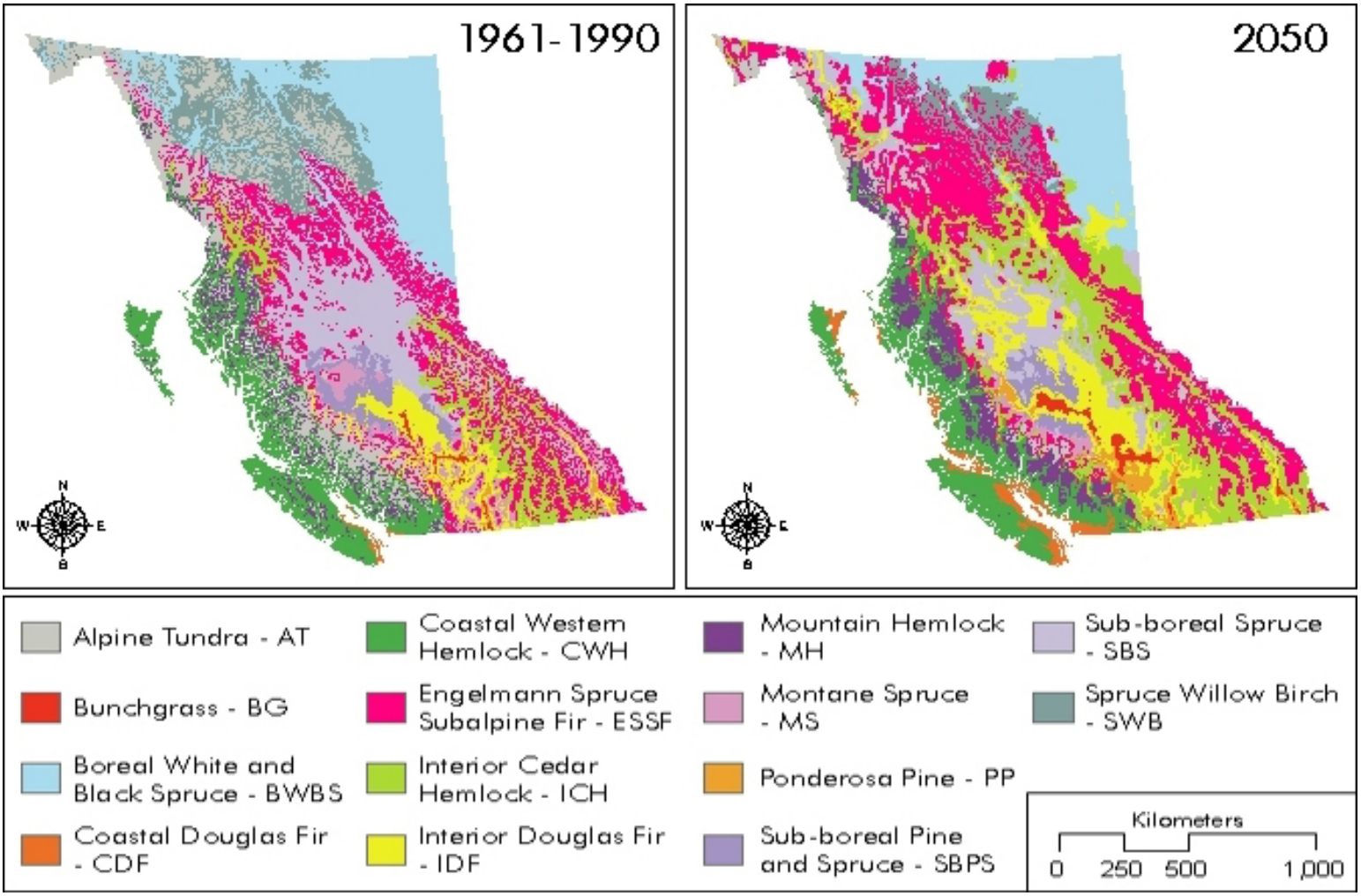


FIGURE 1-19 *Projected shifts in biogeoclimatic zones due to climate change. Vancouver, the lower mainland, and the eastern shore of Vancouver Island are expected to shift from Coastal Western Hemlock temperate rainforest ecologies towards drier Coastal Douglas Fir ecologies.*

ceous plants and shrubs with a short life cycle can be introduced based on year to year or short term conditions, long-life species such as trees need to be able to adapt to future conditions. Among trees typical of CWH and CDF ecosystems, those that do well with both increased precipitation but also higher annual temperature and periods of drought are likely to be more successful.

While this planting strategy is an adaptive response to climate change, increasing planting in general is seen as a mitigative measure and can offer many benefits when done correctly. Especially for cities that see significant rainfall, stormwater management has become an increasingly challenging infrastructural problem. As climate change produces more severe storms, cities are finding their storm drains increasingly challenged to handle the volume of water.

Reducing impervious surfaces such as asphalt and concrete has been a successful strategy to allow this water to infiltrate the ground where it falls. An extension of this is directing surface water into bioswales. Acting as holding ponds, bioswales allow extra time for rainwater to absorb into the ground, while appropriately chosen plant species assist in filtering out toxins from the water. As little more than a specialized planter bed, they can easily be integrated into sidewalks, curb bump-outs, and parking lots. Across the continent, bioswales have been well demonstrated to buffer stormwater, help prevent flooding, recharge the water table, and reduce the expense of sewer system upgrades and maintenance on already stressed city budgets.

Increasing vegetated space in the city is also beneficial in other ways. Notwithstanding climate change, cities are already warmer than surrounding regions due to the heat island effect. While vegetated green roofs can play a large role both in improving microclimates and in reducing heating and cooling energy use in buildings, the evapotranspiration and shade provided by ground level trees and plants can also play a significant role in this regard. In a study of park microclimates during the summer, researchers found the regulation of air temperature, humidity, and solar radiation exposure provided by trees made outdoor spaces exponentially more enjoyable for users.[50]

In addition to user comfort and the ecological-infrastructural benefits of stormwater control, several studies now show the physiologically and psychologically restorative benefits of greenspace to urban dwellers. In fact, a recent study was able to quantify the benefits of additional trees on residents' health:

> *[Having] 10 more trees in a city block, on average, improves health perception in ways comparable to an increase in annual personal income of $10,000 and moving to a neighborhood with $10,000 higher median income or being 7 years younger. We also find that having 11 more trees in a city block, on average, decreases cardiometabolic conditions in ways comparable to an increase in annual personal income of $20,000 and moving to a neighborhood with $20,000 higher median income or being 1.4 years younger.*[51]

According to the study, these benefits apply in multiple ways. In addition to promoting physical activity and increasing both the physchological and cardio-vascular benefits of that activity compared with exercise in other settings, greenspace has been shown to reduce non-accidental mortality, physician assessed-morbidity, income-related health inequality's effect on morbidity, blood pressure and stress levels, and sedentary leisure time.[52] Increasing street trees, it turns out, literally makes people younger and healthier, improving lives and reducing stress on overburdened healthcare systems.

This is good news for Vancouver, which already has a significant urban tree canopy. In a study of tree coverage in major cities, the MIT Senseable City Lab used Google Street View imagery to calculate the percent tree canopy coverage as perceived from the ground. With a median Green View Index of 25.9% coverage, Vancouver tied for the third highest tree canopy along with Sydney, Australia. Tampa and Singapore scored 36.1% and 29.3%, respectively.[49]

The MIT ranking, however, does not tell the whole story. As it is based on Google Street View imagery, the Green View Index mostly captures street trees, which represent just 11% of Vancouver's trees.[50] Trees on private land and in parks simply do not impose a large visual footprint when viewed from the street. As a single snapshot, the Green View Index also fails to illustrate changes to the city's tree canopy over time.

Between 1996 and 2013, more than 23,000 healthy, mature trees were cut in the city. According to the city's Urban Forest Strategy, this reduced the city-wide tree canopy by close to 500 hectares, or 4.5% of total city area.[55] While most of the city's street trees are ornamental or otherwise non-native species, most of these cut trees represented mature native species that provide critical bird and animal habitat as well as countless ecological services. Replacement trees, if and when they are planted, are typically small, non-native, and are planted in spaces where they are intended to stay small. Among those replace-

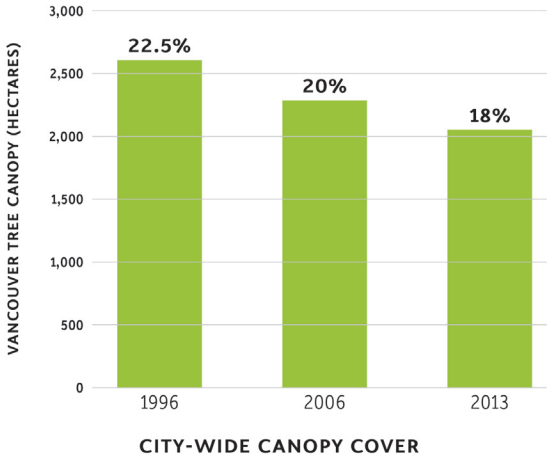


FIGURE 1-20 *The total area of city-wide tree canopy cover declined substantially over two decades.*

ments, Vancouver says 35% die or are removed within the first year.[56] For native bird populations which have shrunk 35% since 1970 and which rely on these trees for habitat, this loss has been devastating.[57]

Birds are not the only species in decline, either. While many vertebrate species have experienced population declines and struggle with the challenges of climate change, invertebrate species have been hit particularly hard. While we tend not to pay a lot of attention to the non-charismatic species around us, insects form the foundation of the terrestrial food chain. According to a 2014 study in Science, 67% of monitored insect species at the time showed a 45% decline in abundance.[52] Bee species in particular have been hit hard recently, with colony collapse disorder threatening the pollinators who help produce much of our food.

With increased stress at all levels of global ecological systems, it is important to ensure the health and biodiversity of even the smallest species. The larger any given population is, the more likely it is to adapt and survive under changing conditions.

Within the city and along the Arbutus Corridor, this places additional weight on the importance of habitat for a diversity of species. In addition to absorbing stormwater and recharging the water table, vegetated spaces should be planned with native pollinator and other insect friendly species to support a healthy local insect population. Increasing insects, in the end, will also help bolster struggling bird populations.

Pollinators also help the community gardens that line much of the corridor. While these gardens are a place of community gathering and help build social ties, they also increase resilience through food security within the city.

Ultimately, healthy trees, bioswales, native plants, and gardens are critical to the resilience of the city. While any trees can provide the health benefits and microclimate benefits discussed, native species would be preferred. Native trees and plants provide specific habitat to endemic species, and form the basis for a robust and resilient local ecology. This in turn provides the most ecosystem services to benefit the community.

On the other end of the ecological-infrastructural spectrum is transportation. Over the past two decades, the city has successfully promoted a shift to multi-modal transportation options. Today, more than half of all trips that originate in the city are by foot, bike, or transit. With the rapid increase in electric bikes and conversion kits like the Copenhagen Wheel making cycling more accessible than ever, the city hopes to increase that number to two-thirds by 2040.

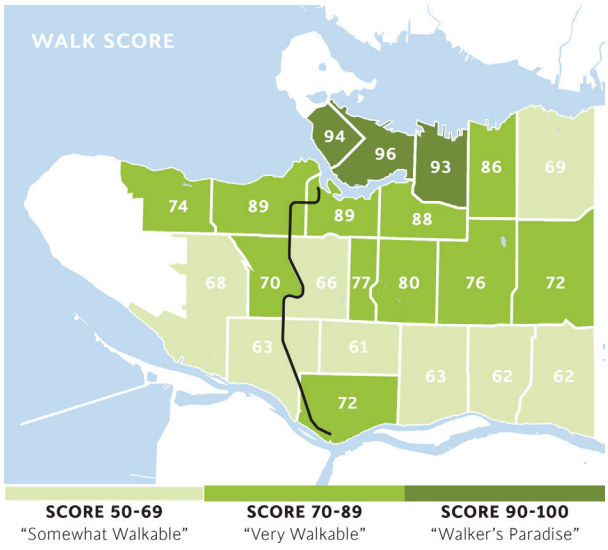


FIGURE 1-21 *While the city is generally pedestrian friendly, it is easier to run daily errands on foot closer to downtown.*

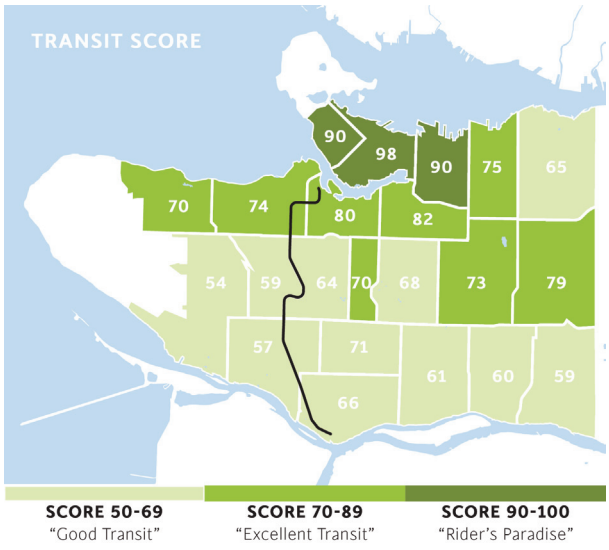


FIGURE 1-22 *Transit infrastructure is focused on downtown, and service decreases away from the city core.*

So far, however, this multi-modal success is not evenly distributed across the city. While the city enjoys a high average walkability score from walkscore.com, individual neighbourhood scores decrease the farther they are from the downtown core. Unsurprisingly, as the two are closely linked together, walkscore.com's transit score breakdown varies similarly across the city.

Much like the walkability and transit score ratings, bicycle commuters are also most common in the neighbourhoods surrounding downtown. While the downtown peninsula itself has few cycle commuters, this is likely due to most downtown residents capitalizing on the ease of walking or taking transit in that neighbourhood.

Taken together, the decrease in mode share for each of these transportation modes as you travel south represents an opportunity for the Arbutus Corridor. It is clear that walkability, as well as transit and bicycle infrastructure can be improved to encourage more residents from southern Vancouver neighbourhoods to use these modes.

However, it is also important to read these trends relative to neighbourhood demographics. Along the corridor, these southern neighbourhoods are also the more expensive enclaves of the city. As previously discussed, they are home to older, richer residents and generally less demographically diverse. Many of the younger generations who are more inclined to take transit or cycle cannot afford to live here. Increasing transit and bicycle ridership, therefore, is just as much dependent on improving housing diversity and affordability in these communities.

On the path to increased urban resilience, the benefits of multi-modal transportation options are numerous. Among these, if residents are able to avoid owning a car entirely, they are able to save a substantial amount of money. In a November, 2017 blog post, London Bicycle Cafe owner Ben Cowie tallied up just how much a Canadian cyclist can save over a lifetime of bicycle commuting. With a full accounting of the purchase, maintenance, and operational costs for both bicycles and personal vehicles, Cowie makes a convincing argument that cyclists can save up to $3,000 per year over drivers while improving their health and getting to work faster at the same time.[53]

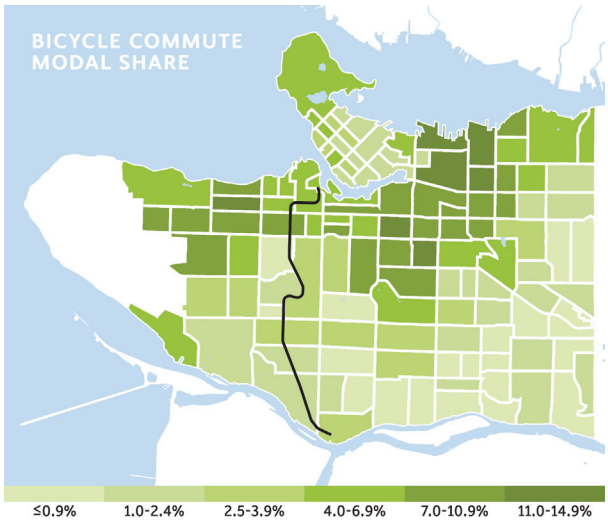


FIGURE 1-23 *Cyclists as a percent of all commuters is highest in neighbourhoods surrounding downtown.*

While supporting a healthy and active lifestyle, alternative modes are also good for the environment. In the fight against climate change, reducing vehicle miles traveled reduces carbon emissions. The redundancy of multiple modes also increases the resilience of a community in the event of a disaster.

Only a few short years ago, Long Beach, New York was overrun with cars. Despite a decent transit network, buses were seldom used, and every household had multiple vehicles. Residents were in stiff competition with tourists for space to park. Come Hurricane Sandy, and many of those vehicles were destroyed by a surging ocean. While replacing vehicles was a low priority as residents cleaned up and rebuilt, the bus network was able to take over the transportation needs of the community.[54]

Despite the ongoing push to diversifying modes of transportation, Vancouver is still largely shaped around the automobile. Across the city, only two narrow corridors of sidewalk and a grass strip are dedicated for people, while vehicles receive up to 60% or more of the road right-of-way. While some streets now have shared bike lanes, or better yet protected bike paths, the cross section of the typical street has changed

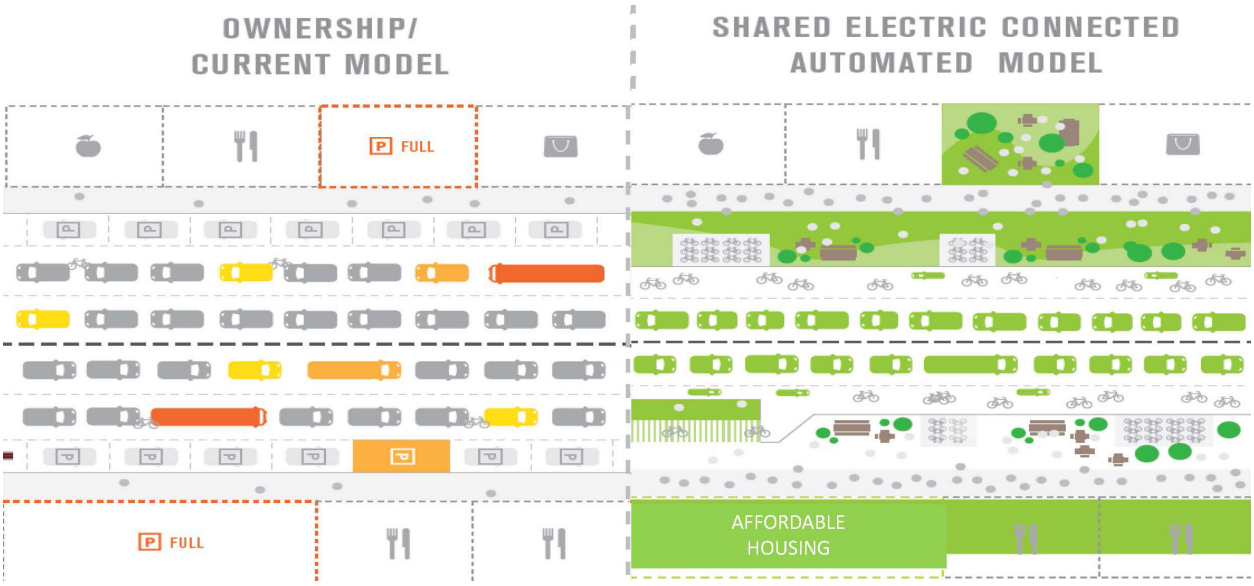


FIGURE 1-24 *Planning for reduced traffic due to shared and autonomous vehicles using road space more efficiently, San Francisco Smart Cities proposes reallocating extra road space to bicycle and pedestrian uses.*

little and a significant amount of area is still dedicated to vehicles.

With changing technology, however, there is an opportunity to reimagine this space, and reprioritize people over vehicles. The most disruptive among these is the evolving technology of autonomous cars. With Ford beginning winter weather testing of autonomous vehicles in 2016,[55] and GM announcing vehicles without steering wheels or pedals to be released as soon as 2019,[57] it will not be long before self-driving vehicles become the new normal on our roads.

Coupled with on demand services such as Lyft and Uber, as well as increasingly popular car share programs like Car2Go and ZipCar, autonomous vehicles promise to dramatically increase road use efficiency and reduce the total number of vehicles on the road. With high costs to operate cars in Vancouver, coupled with the high cost of living and growing rapid transit service, car ownership is already on the decline in the city.[58] While in some jurisdictions transit has a negative stigma, owning a car in Vancouver is increasingly becoming the more undesirable option. Shifting people to alternative transportation modes will further drive down traffic on Vancouver's streets.

This technology also represents an opportunity for reduced parking. With such high land values in the city, providing subsidized parking is becoming increasingly difficult to rationalize. While some surface parking will still be needed, excess fleet parking of shared vehicles can be underground or at the edge of the city.

With road space being used much more efficiently, and a reduced demand for on-street parking, it becomes possible to reclaim excess and redundant street surface for walking, cycling, transit, vegetation, and public space. In the history of the city, this is an unprecedented opportunity to reimagine the shape of the public domain for people instead of cars.

Altogether, Vancouver faces myriad challenges on the path to resilience. It is also presented with endless opportunity to face those challenges and reshape the city for the people who call it home. While some of these opportunities should help shape policy and changes to the fabric of the city around the Arbutus Corridor, others can inform the design and redevelopment of the corridor itself. In this way, the design and redevelopment of the Arbutus Corridor can help create a more resilient Vancouver.

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FOR
STEVESTON

THE SOCKEYE SPECIAL

part two

Remnants of Vancouver's Past

FIGURE 2-1 *180° Panorama looking north from the corner of W 37th Avenue at Arbutus Street, circa 1919. Development of Point Grey began with the establishment of the Lulu Island rail line—now the Arbutus Corridor—which made previously remote farmland and forests in the CPR land grant south of Vancouver accessible. Barely discernable in the field are farm workers and cows. Across the tracks, many of the original craftsman style homes can still be found today.*

Vancouver is a city of layered histories. At only 130 years old, it is by most accounts a young city on the world stage. But considering only the current incarnation of Vancouver since its founding belies a rich history of native settlement, much of which now lays buried beneath the streets and buildings of the city. Stretching from False Creek in the north to the banks of the Fraser River in the south, the Arbutus Corridor acts as a link that weaves together both of these histories.

Established in 1901, the Arbutus Corridor started as the Lulu Island Line, part of the Canadian Pacific Railway network linking Vancouver with the cannery town of Steveston to the south. With CPR freight service and hourly electric passenger trams, the line opened up vast tracts of previously remote southern Vancouver. By enabling the rapid growth of Kerrisdale, Eburne (Marpole today) and surrounding areas, the line played an important role in the formation of the city we see today.

Well before colonists settled the Vancouver area, however, First Nations inhabited the region for as long as 10,000 years. While many historical villages and cultural sites have long since been destroyed or built over, fragments of two such sites lay at opposite ends of the corridor, providing a link to a time before the city and helping the region's original inhabitants define themselves within the context of the city today.

FIGURE 2-2 *August Jack Khatsahlano, his wife Swanamia (Marrian) and a child in a dugout canoe, looking east at the Kitsilano Indian Reserve in 1907.*

FIGURE 2-3 *(next page) Burrard Inlet before settlers arrived in Vancouver, based on information gathered from Squamish and Musqueam elders in 1932, illustrates how many villages once populated the region.*

FIRST INHABITANTS

By 1791, when Spanish Lieutenant José Maria Narváez became the first European to explore the area of what is now Vancouver, the region had already been occupied by First Nations for close to 10,000 years.[1] At a time when all of New York State was home to only 200,000, historians believe the area had been one of the most densely populated regions in what is today Canada, with up to 100,000 spread around the Salish Sea.[2] In Vancouver, the rich environment had supported countless permanent and seasonal villages in overlapping territories of the Squamish, T'sleil Waututh, and Musqueam First Nations.[3]

While Narváez was the first European to make contact with local villages, beating British Captain George Vancouver by a year, the impacts of settlement and colonialism had already taken a catastrophic toll in the region. Spreading via native trade routes across the continent like a wildfire, smallpox reached the west coast as early as 1782, resulting in the decimation of local populations. By some estimates, the epidemic was an unescapable wave of death, wiping out up to 95% of natives across the province in a few short years.[4]

Reports from those voyages describe an eerie silence, and countless ruined villages scattered with human remains, abandoned to the forest.[5] The remaining villages and survivors that they found were a mere shadow of the rich, cultured, and thriving coastal nations that had existed only a few short years before.

By first contact, the surviving Musqueam were the main inhabitants occupying what is now Vancouver, centred in their village at the mouth of the Fraser River.[6] Across Burrard Inlet on the North Shore was the T'sleil Waututh village, while the Squamish, whose main territory centred around Howe Sound to the north, occupied permanent villages in present day Stanley Park and on the banks of False Creek.[7]

All along the shores of Vancouver today, evidence of middens and campsites indicate several permanent and temporary campsites with several millenia of activity. Oral histories indicate False Creek as a particularly rich and diverse source of sustenance that was shared peacfully between the three groups.[8] By 1860, the Squamish formed the village of Snauq as a permanent settlement. In 1869, the colonial government set aside an indian reserve around the village, later limiting it strictly to the Squamish.[9]

In 1899, the removal of a right-of-way for an extension of the CPR rail began a long process of fragmentation of the reserve, as parcels were cut out for industry and government. A second right-of-way for the Lulu Island rail line, today the Arbutus Corridor, was cut out of the reserve in 1901. With the city of Vancouver encroaching on the valuable reserve land, the provincial government forced the remaining inhabitants to leave the reserve in 1913, after which the remaining land was portioned out for the Burrard Street Bridge right-of-way, military use, and private sale.[10]

In 2002, the Squamish reclaimed a small portion of their former reserve—the then-unused rail rights-of-way—after a decades long legal challenge to the land. On what is essentially the northern bookend of the Arbutus Corridor, the Squamish plan to construct a multi-use, high density complex of condominium towers, commercial and cultural space in the near future.[11]

At the opposite end of the city, middens and archeological evidence reveal Musqueam occupation stretching back at least 9,000 years.[12] Upstream of the Musqueam village site, around which their reserve is located today, the Marpole Midden is one of several sites in close proximity to contain generations of ancestral burial remains, buried houses, artifacts, and waste. Before siltation extended the Fraser River delta farther west, it was a large and important village at the mouth of the river.[13] In the 1880s and 1920s, the midden was subjected to excavations, with countless cultural artifacts being removed for museum collections.[14]

As one of Western Canada's largest precontact middens, the site was declared a national historic site in 1933, though this offered little protection. Plans to develop a property on the site into a condo tower unearthed intact burial grounds during excavations, prompting protests and forcing a halt to construction. Eventually, the Musqueam were able to purchase the property, which sits adjacent to the south end of the Arbutus Corridor. Plans are to restore the site archeologically, and to construct an interpretive centre and park to celebrate Musqueam culture today.[15]

CANADIAN PACIFIC RAIL AND THE BIRTH OF VANCOUVER

In the spring of 1858, the discovery of gold on the Fraser River drew tens of thousands of hopeful prospectors looking to strike it rich.[16] Until this time, a handful of farmers and Hudson's Bay Company fur traders were the only non-natives to be found on the mainland.[17] With the rapid influx of miners, however, Vancouver Island Governor James Douglas sought to ensure British control and rule of law, proclaiming mainland British Columbia as a colony of the British Crown on November 19 of the same year.[18]

In 1860, settlement began in earnest when the new colonial government enabled settlers to pre-empt up to sixty-five hectares of land, which they could later purchase after making improvements. Natives were corralled in small reserves allocated at two hectares per person.[19] In a few short years, most of the Vancouver area not set aside as government reserve was claimed for farmland or under timber leases.

As $30 million in gold flowed from up river and a local timber industry began to boom, the small settlement steadily grew.[20] In 1870, the Granville Townsite was surveyed. Centred around the saloon of John "Gassy Jack" Deighton, which served workers from the nearby Hastings Mill, the township became known as Gastown.[21]

INDIAN VILLAGES
BURRARD INLET
BEFORE THE WHI
KEE-KHAALSUM EAGLE HARBOR
CHULKS KEW BEACH
EYE-SYCHE
STUCKALE
GREAT NORTHERN CANNERY
SMULLAQUA
SKAYWITSUT Pt ATKINSON
NAVY JACKS Pt - CHUTAUM
PROSPECT POI
CHANTS
SIWASH ROCK-
SLA-KAY-UL-SHT
SECOND BEACH
STAITWOUK
SPANISH BANKS—POOKCHA
ENGLISH BAY- AY-
KITSILANO BEACH
SKWA-YOOS
KOKOHPAI
SASAMAT St
E-YALMO
E-YALMO
SIMSAHMULS
BAYSWATER St
TSA-ATSLUM
JERICHO
CHITCHILAYUK
POINT GREY
ULKSEN
KULLAKAN
HILIPHAPAILTH
CEDARS
POINT NO POINT
HOMULSOM
KY-OOHAM
CHE-AHTUN
MAHLY
MUSQUEAM

AND LANDMARKS

AND ENGLISH BAY

TEMAN CAME

CAPILANO RIVER

HOMULCHESON

USTLAWN INDIAN RESERVE

TLATHMAHULK

LYNN CREEK

STEETSEMAH

SEYMOUR CREEK

MOODYVILLE

UTHKYME

SAHIX.

KWAHULCHA

WHAWHEWHY

CHAYCHILWHK

PIPELINE-CHAY-THOOS

BEAVER LAKE-AHHA-CHUA

WHOI-WHOI

BROCKTON Pt-PAAPEEAK.

LOST LAGOON CHUT-WHAH-ULCH

DEADMANS Is-SQUTSAHS

HASTINGS MILL KUMKUMLYE

CHETCHAILMUN

HUPHAHPAI

SUGAR REFINERY

CEDAR COVE

PUCKAHLS

LUCKLUCKY

WATER St

BROUGHTON St

AY-AY-YUL-SHUN

HOWE St

SMAM-CHUZE

MAIN St

KIWAHUSKS.

SNAUQ

FALSE CREEK

AUNMAYTSUT COMBIE St

SKWA-CHICE

C.N.R. YARD

BURRARD BRIDGE

INTERPRETATION

Musqueam	existing village	Squtsahs	"an island"
Mahly	" "	Chulwhahulch	"dry passage"
Che-ahtun	a boulder. Legend, Creation	Puckahls	"white rocks"
Ky-ooham	" " dogs howl	Lucklucky	"beautiful grove"
Homulsom	" " Creation	Kumkumlye	"grove of vine maples"
Huphapailth	"place of cedartrees"	Chetchailmun	group of boulders
Kullakan	a boulder. Legend, fence	Huphahpai	"place of cedars"
Chitchulayuk	" " big mind	Steetsemah	a former village
Tsa-atslum	"a cool place"	Chaychilwhuk	Seymour Creek
Pookcha	big sand bar	Whawhewhy	"little place of masks"
Kokohpai	a small bay "rabbit tree"	Kwahulcha	Lynn Creek
Eyalmo	a former village "good camp"	Uthkyme	Snake slough"
E-eyalmo	" " "	Sahix	"a point"
Simsahmuls	"tool stones"	Ustlawn	"head of bay"
Skwayoos		Tlathmahulk	"Saltwater creek"
Snauq	a former village	Homul cheson	a former fort
Aunmaytsut	"commit suicide"	Swywee	a lagoon
Kiwahusks	"two points opposite"	Chutaum	a point
Skwachiee	"deep hole in water"	Smullaqua	a "bay," tragedy"
Smamchuze	a former cove	Stuckale	refers to skunk
Ayayulshun	"another soft under feet"	Skaywitsut	"go around point"
Ayulshun	"soft under feet"	Chulks	"stone in sling"
Staitwouk	a beach and small creek	Kee-khaalsum	
Slaykayulsh	Legend. "He is standing up"	Stoaktux	Rocks "all cut up"
Chants	" his fishing line	Chakai	
Sahunz	" his wife (Kneeling)	Tumts	a bay
Chaythoos	a former village. "high bank"	Eyesyche	protected waters
Ahha-chua	a "lake" and creek	Ulksen	All Point Grey
Whoi-Whoi	a great village. "masks"	Kwy-yowka	Steveston
Pahpee-ak	Brockton Pt	Whykitsen	Terra Nova

MAJOR J. S. MATTHEWS. V.D.
CITY ARCHIVIST.
VANCOUVER.
...om information given verbally by aged
...ns of the Squamish and Musqueam tribes
1932
...pproved, Squamish Indian Council.

Copyright

FIGURE 2-4 *The Granville Townsite in February 1886, just prior to the incorporation as the City of Vancouver in April, and the great fire that destroyed nearly every structure in the city that June.*

One year later, in 1871, British Columbia joined confederation upon the promise of a transcontinental rail link to the rest of Canada.[22] Though plagued with scandal and early delays, construction of the rail line was completed by the Canadian Pacific Railway Company (CPR) in 1885. The following summer, the first transcontinental train arrived in Port Moody on July 4, 1886.[23]

However, fortunes for the original terminus community were to be short lived. In 1884, CPR had secretly negotiated with the province to extend the rail 20 km farther to Granville. In exchange, the company received two sizeable land grants: 2,350 hectares south of False Creek and nearly 200 hectares adjacent to the townsite. When news broke in early 1885 that Granville would be the western terminus of the Canadian Pacific Railway, the townsite exploded from approximately 100 buildings to nearly 1,000 in only six months.[24]

On April 8th, 1886, just prior to the arrival of the first train in Port Moody, Granville was officially incorporated as the City of Vancouver. Two short months later, though, brush-clearing fires that grew out of control swept through the city. In less than an hour, nearly every building in the city was destroyed.[25]

Despite the devastation of the fire, residents were determined to rebuild. Within days, the newspaper was printing once again,[26] and a new city hall was established under tent. Soon, a new Vancouver with all the conveniences of a modern city—electricity, piped water, telephones, sidewalks, streetlights, parks, and even an opera

house—was beginning to emerge from the ashes.[27]

The increased investment and rapid population growth quickly stimulated the growth of new farms, sawmills, wholesalers, real estate firms, and builders.[28] In an effort to draw development towards their large land grant south of False Creek and induce freight business, CPR built the first Granville Street Bridge and leased waterfront land to industry at bargain rates.[29] Quickly, Vancouver transformed from a humble sawmill town to become an important port city, connecting Great Britain with its asian colonies along an all British route,[30] and serving as a resource hub for regional mining, forestry, and fisheries industries. In five short years, from 1886 to 1891, the population in the city had grown from approximately 1,000 to 13,709.[31]

THE SOCKEYE SPECIAL

By 1890, Vancouver had piped water from the Capilano Reservoir, electric lighting, and telephone service across the city. Though the latter two of these were relatively new innovations, they had already become regular conveniences in North American cities. In 1888, however, when the Vancouver Street Railway Company was founded, that technology had sparsely been demonstrated.[32]

When the first electric streetcar rolled down Main Street on June 26th, 1890, it was one of the first electric street railways to operate in Canada. By February 1891, the company's four cars had transported 340,000 passengers between residential and commercial districts at a fare of five cents per trip.[33] On June 3, the Westminster and Vancouver Tramway Company launched the first electric interurban line in North America, running passengers and freight between Vancouver and New Westminster.[34] However, despite successful beginnings, premature expansion and global recession drove both companies into receivership. They were purchased by the British Columbia Electric Railway Company (BCER) in 1897.[35]

In 1901, after canneries in Steveston shipped a record 16 million pounds of sockeye salmon to overseas markets in a single year, CPR hoped to generate new business by connecting the productive fishing community with the rail and shipping port in Vancouver.[36] The company created the Vancouver and Lulu Island Railway, built a swing span bridge over the north arm of the Fraser River, and with the hard work of thirty men, added eight miles of track in just twenty-two days. Steveston, previously a full day trip from Vancouver along the rough dirt and corduroy surface of the North Arm Road (Granville Street today), was now only a one hour ride from the city.[37]

Intended mainly to serve the canneries and their workers, the line was dubbed 'The Sockeye Limited,' and ran passenger and freight service in mornings and evenings beginning July 2, 1902.[38] Unfortunately for CPR, the canneries preferred to ship from their own docks rather than through Vancouver. Unable to turn a profit, the company ceased passenger service on the line in 1905 and leased the track to BCER.[39]

After three months electrifying the line and building three new trolley cars, BCER launched the Lulu Island Line as their second passenger and freight interurban route on July 4.[40] Ridership quickly quadrupled from 7,000 per week that August to 28,000 in September of 1909.[41] Making use of the new interurban and paddlewheelers from New Westminster farther upstream on the

FIGURE 2-5 *False Creek, 1890. Recently completed rail trestles already crossed False Creek from the downtown peninsula (far right shore), bisecting the Kitsilano Indian Reserve on the forested peninsula at left with CPR rail lines. The original site of Snauq village along the rich waters of False Creek, this reserve continued to be squeezed by development until the native inhabitants were forcibly relocated to other nearby reserves in 1913 and the land sold to government and industry.*

Fraser River, it was not uncommon for crowds of 10,000 - 15,000 spectators to gather in Steveston for the opening of the fishing season.[42] Before long, the Lulu Island Line was officially dubbed by its popular nickname, the Sockeye Special.

In the decade beginning in 1901, Vancouver's population grew fourfold as the city experienced massive growth.[43] With easier access to outlying areas by way of interurbans, development spread to the suburbs before the city itself was fully filled in. As the new communities expanded, BCER extended the electric streetcar network, spurring even further development and investment.[44]

Along the Lulu Island Line, which offered regular daily service every half hour from 5:00 am until midnight,[45] middle class communities of single detached homes sprung up in Kitsilano and Kerrisdale. Farther south along the Fraser, the existing community of Eburne continued to grow with new rail connections for its lumber and shingle mills.[46] And in a successful bid to draw the city's wealthy elite from their prestigious neighbourhood in the West End, CPR poured $2 million into an exclusive new subdivision of large estates in Shaughnessy Heights.[47]

Despite rail access, the lack of roads and civic improvements in the western sections of South Vancouver caused frustration for new residents. In 1908, they separated from the working class municipality, creating the new upper-middle class Municipality of Point Grey. With the aim of creating beautiful residential district complete with public parks and good quality curved streets, the new municipality quickly established the first planning by-laws in the area. New municipal taxes were also introduced to discourage the land speculation that had become rampant throughout the region.[48]

By this time, both the CPR and BCER had greatly influenced the final shape of the city. Along the Lulu Island Line, Kerrisdale and Marpole (formerly Eburne) emerged as busy neighbourhood centres amidst a sea middle-class of suburbs, while Shaughnessy remained a prestigious enclave of the city's elite. Over the next several decades, development in Vancouver, Point Grey, and South Vancouver continued as neighbourhoods filled in. In 1929, Point Grey and South Vancouver amalgamated with Vancouver.

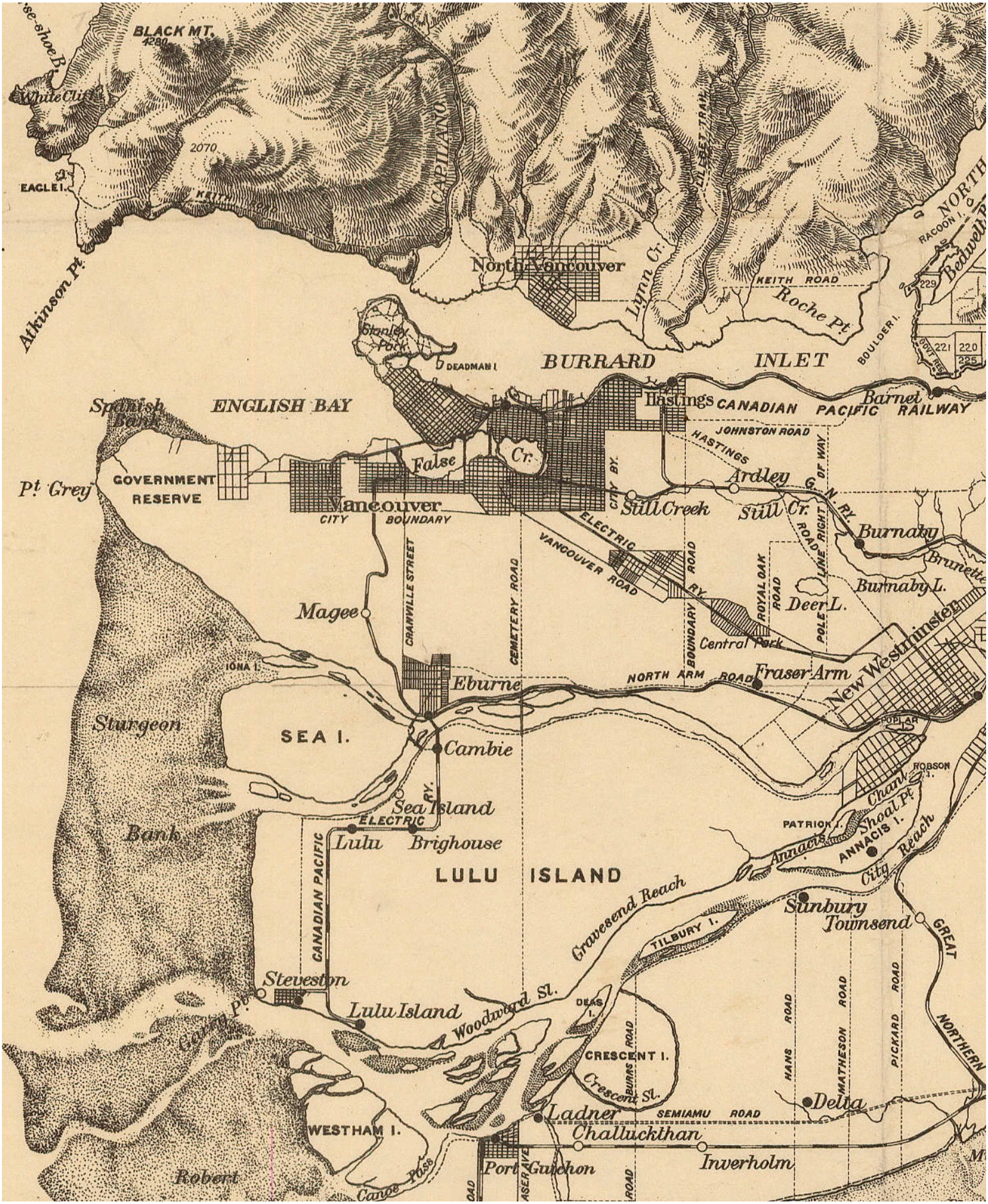
The growing popularity of automobiles beginning in the 1920s spelled trouble for the interurban and street car lines. BCER was competing for space in narrow streets, and struggled with maintaining aging tracks, electrical lines, and rail cars[49] while governments began to subsidize automobile infrastructure.[50] In 1948, the 'Rails to Rubber' program started a transition to diesel and electric trolley bus service as infrastructure required replacement.[51]

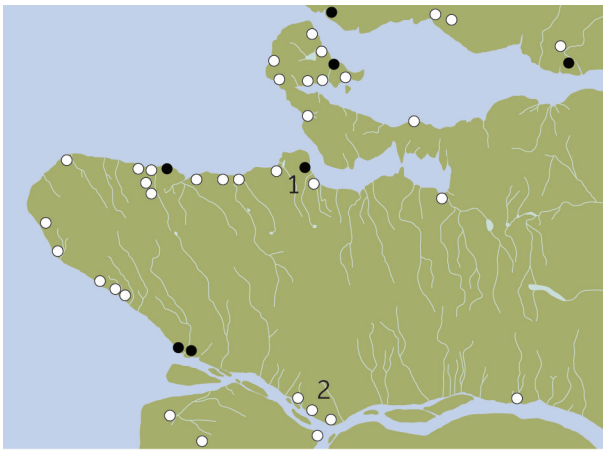
On June 17, 1952, the Sockeye Special made it's final run along the Arbutus Corridor between downtown Vancouver and Marpole. Though service continued between Marpole and Steveston for a few more years, the last trip across Lulu Island was made on February 28, 1958. The Sockeye Special was the last operating interurban in British Columbia to cease operation.

While the electric streetcar system was replaced by a new network of bus routes, interurban routes were simply phased out. Communities that grew alongside interurbans, connected by rapid, regular service across multiple cities in the region, became largely isolated save for the automobile. Only after three decades, with the opening of the Expo Line Skytrain in 1986, did

FIGURE 2-6 *Billy Steves' passenger and mail coach on the North Arm Road (Granville Street), ca. 1895.*

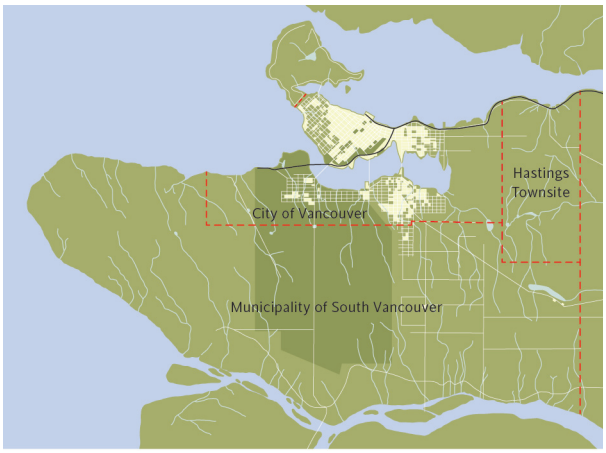
FIGURE 2-7 *(opposite) Vancouver and surrounding communities in 1913, showing the full extent of the Lulu Island Line between Vancouver and Steveston.*


BLACK MT.
4280
White Cliff
2070
EAGLE I.
KEITH
Atkinson Pt.
CAPILANO
North Vancouver
Lynn Cr.
LILLOOET TRAIL
KEITH ROAD
Roche Pt.
RACOON I.
BOULDER I.
229
221
220
225
Stanley Park
DEADMAN I.
BURRARD
INLET
Spanish Bank
ENGLISH BAY
Hastings
CANADIAN PACIFIC RAILWAY
Barnet
JOHNSTON ROAD
HASTINGS
Pt Grey
GOVERNMENT RESERVE
False Cr.
CITY BY.
Ardley
G. N. RY.
OF WAY
RIGHT
Vancouver
CITY
BOUNDARY
Still Creek
Still Cr.
ROAD
LINE
Burnaby
Brunette
ELECTRIC
VANCOUVER ROAD
Burnaby L.
Deer L.
ROYAL OAK ROAD
POLE
Magee
CRANVILLE STREET
CEMETERY ROAD
BOUNDARY ROAD
RY.
Central Park
New Westminster
IONA I.
Eburne
NORTH ARM ROAD
Fraser Arm
Sturgeon
SEA I.
Cambie
POPLAR
ROBSON
Chant
Shoal Pt.
PATRICK I.
ANNACIS I.
Annacis
Sea Island
RY.
ELECTRIC
Bank
Lulu
Brighouse
CANADIAN PACIFIC
LULU ISLAND
City Reach
Gravesend Reach
Sunbury
Townsend
TILBURY I.
GREAT
Steveston
Woodward St.
DEAS I.
Lulu Island
Garry Pt.
CRESCENT I.
BURRS ROAD
Crescent St.
HANS ROAD
MATHESON ROAD
PICKARD ROAD
NORTHERN
Delta
Ladner
SEMIAMU ROAD
WESTHAM I.
Challuckthan
Inverholm
Robert
Port Guichon
Canoe Pass
FRASER AVE
ROAD



● Village
○ Midden or Campsite
1 Snauq Village
2 Marpole Midden

FIGURE 2-8 *Before colonization, 1860*



Roads
Rail
Municipal Boundary
Developed Area
CPR Land Grant

FIGURE 2-9 *Early Vancouver, 1900*

Prior to colonization, Vancouver was a thick temperate rainforest with some of the largest trees in the world. Forests, tidal mudflats, extensive creeks, and wetlands were rich in biodiversity and provided year round sustenance to the Musqueam, Squamish, and Tsleil-Waututh First Nations.

Though False Creek provided a bounty for all of the local nations, the Squamish were the first to make a permanent village at Snauq, where the north end of the Arbutus Corridor now lays under the Burrard Street Bridge. Forced from the land in 1913, the Squamish have now reclaimed the section of the Lulu Island Line right-of-way that falls within their former reserve at this location.

Musqueam villages were centred around the mouth of the Fraser River, and shifted over time as the river delta grew seaward. Remains found at the Marpole Midden indicate a large village had occupied what was then the mouth of the river as far back as 3000 years. This site, partly owned by the Musqueam today, sits adjacent to the southern terminus of the Arbutus Corridor.

Founded in 1886, the first fourteen years of Vancouver's growth centred around the downtown peninsula and False Creek's Mount Pleasant neighbourhoods. In 1890, the city's first electric streetcar traveled down what is today Main Street. The following year, North America's first electric interurban tram ran along the Kingsway corridor to New Westminster. Still, most of the area remained remote with little road access even though much of the thick old-growth forest had already been cleared by loggers.

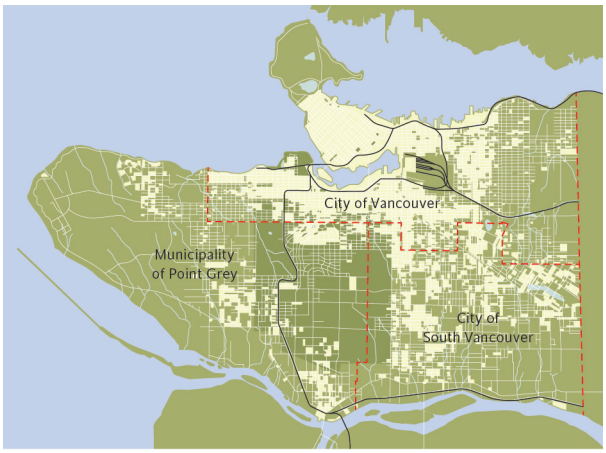


FIGURE 2-10 *Lulu Island Line, 1920*

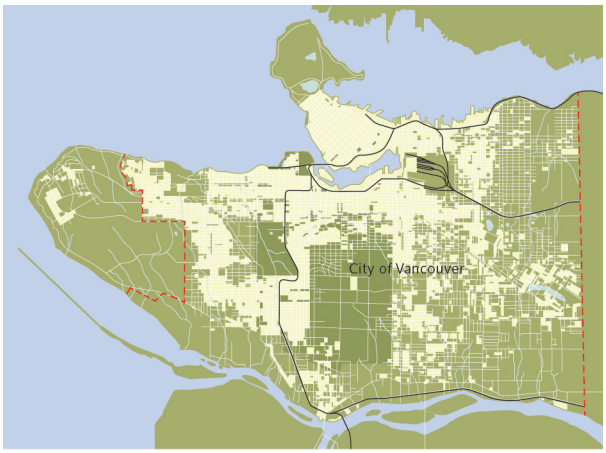


FIGURE 2-11 *Growth of Kerrisdale, 1930*

Hoping to cash in on a booming fisheries and canning industry in Steveston to the south, CPR built the Lulu Island Rail Line connecting Vancouver to Steveston in 1901. By 1905, the BC Electric Railway operated an electric interurban along the route, providing access and spurring rapid development in Point Grey and Richmond alike during booming years of growth for the city. Kerrisdale and Eburne (now Marpole) emerged as the two major centres along the line.

Although CPR's goal of shipping Steveston salmon out through Vancouver's port never materialized, the interurban became a busy and important route for cannery workers, and the line was nicknamed the Sockeye Special. From 1905 through 1958, the interurban ran hourly from 5am until midnight. Starting at 85 cents for a return trip, the 7,000 weekly riders quadrupled by 1909 when fares were reduced.

By this time, much of False Creek had been filled in as the waterfront became a hub for industry.

The return of booming growth coupled with some of the earliest Canadian zoning bylaws saw the city reach capacity in the 1920s, leading to its amalgamation with Point Grey and South Vancouver in 1929. Interurbans, along with an expanded electric streetcar system, saw the infill of exsting centres and slow expansion into the surrounding area.

Most of the city growth throughout this period took place in the neighbourhoods of Kerrisdale and Shaughnessy, centred around the Lulu Island Line. While some of the suburban neighbourhood that would fill out the city in later decades was yet to come, the city had largely taken its current form by this period.

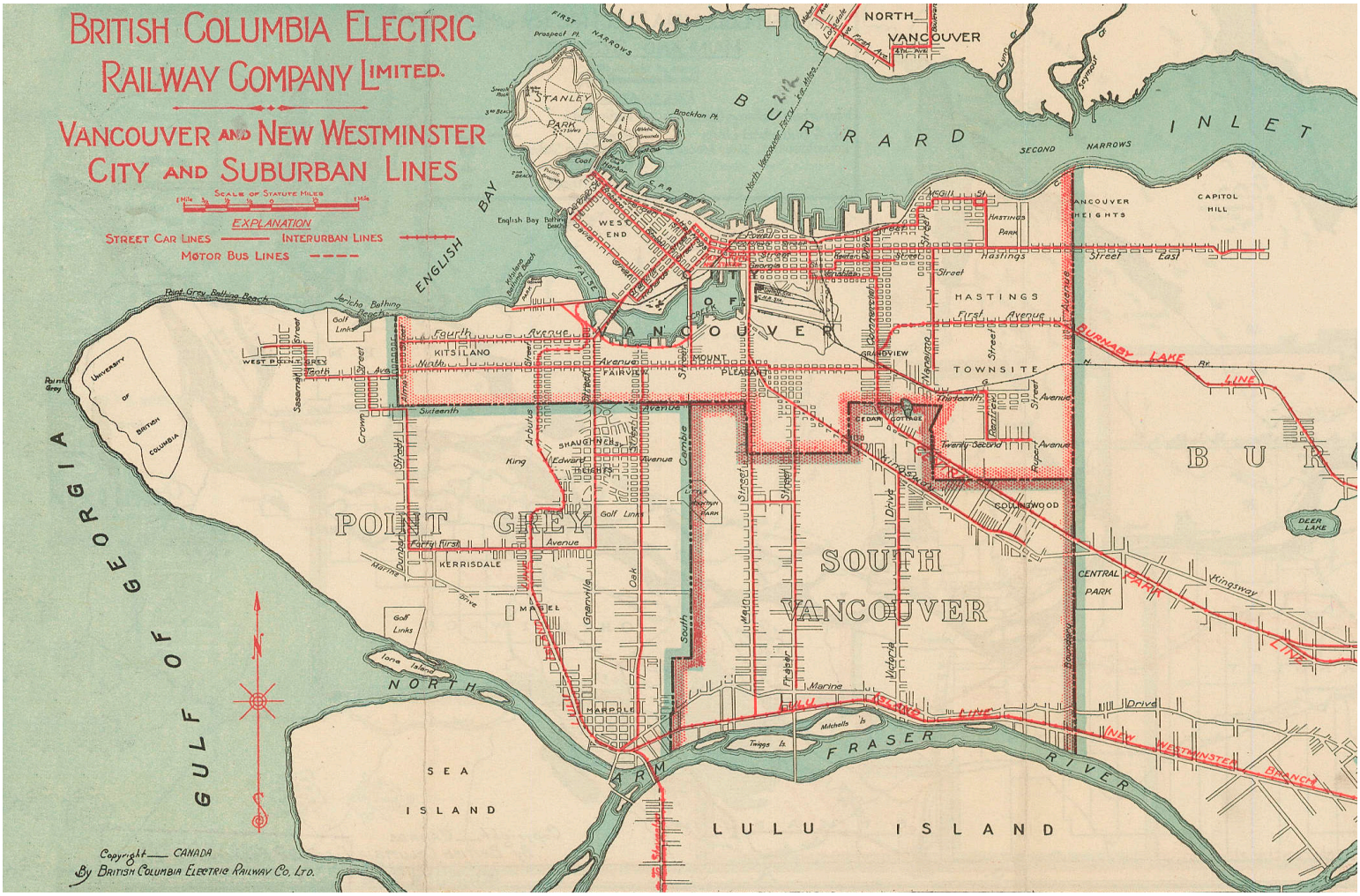


FIGURE 2-12 *The BC Electric Railway streetcar and interurban network in 1923.*

some of the original interurban routes begin to be replaced with modern rapid transit. Still, with several new lines having been added in the decades since, the Sockeye Special route remains little more than a memory.

Despite the end of passenger service in 1958, CPR continued to ship freight along the line for several decades. The redevelopment of Vancouver's industrial waterfront beginning in the 1970s, however, precipitated the decline of clients. In May 2001, the last shipment along the line was made to the Molson Brewery near False Creek.

Unused by CPR since, the corridor has slowly deteriorated and become overgrown with invasive plants. Community gardens along the line have slowly expanded from adjacent city land into the rail right-of-way, and a well worn footpath along its length serves as the only reminder of the corridor's history as a transportation link through the city.

ENDNOTES

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3 Davis, 3.

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51 "A short history of interurbans."

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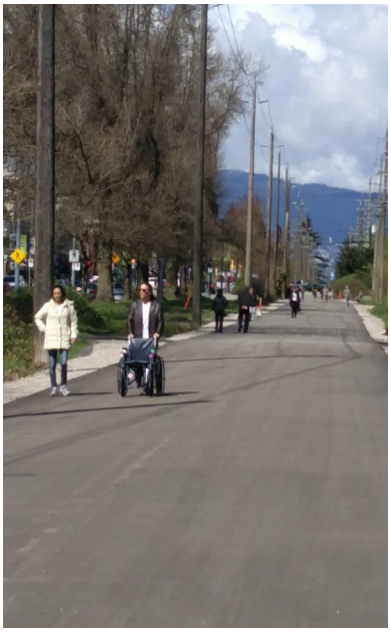
FIGURE 2-13 *W 6th Ave at Cypress St, April 24, 2017. Even on an early Monday afternoon in April, the corridor and new multi-use path supports a diversity of use.*

FIGURE 2-14 *(bottom left) W Blvd at W 43rd Ave, April 24, 2017. Pedestrians on the new temporary asphalt path in Kerrisdale.*

FIGURE 2-15 *(bottom right) W Blvd at W 15th Ave, April 24, 2017. The new multi-use path serves as an official bike route, and helps support the city's new bike share program and thriving bike culture.*



Reclaiming Space in the City

In May 2001, the last freight train ran along the Arbutus Corridor to CPR's only remaining customer on the spur: the Molson Brewery. Ninety-nine years after the first car rattled from downtown Vancouver to Steveston, the line sat idle. Tracks that played a formative role in the development of the city fell into disrepair, and much of the right-of-way became overgrown with Himalayan blackberry.

For fifteen years, it seemed CPR had forgotten about the line. Sitting unused, the corridor was quickly repurposed by the community. Extensive community gardens—which already lined the margins between the rail rights-of-way and streets in Kerrisdale and Kitsilano—expanded a few metres into the new space. Separated from the roadway, the corridor became an ideal foot and cycling path through the city, and developed well worn paths with the frequent use.

Behind the scenes, however, the company was embroiled in a dispute with the city. Beginning in 1999, as the railway company prepared to decommission the line, it started exploring development options for the valuable land that passes through some of the city's most desirable neighbourhoods. The city, hoping to see the corridor repurposed as a transportation corridor and greenway once it was no longer needed for industry, quickly rezoned the entire corridor for transportation only. Outraged, CPR began a legal battle to have the zoning overturned. In 2006, the Supreme Court of Canada upheld the city's right to rezone the land.

Over the next several years, attempts were made for the city to purchase the land from CPR. With the railway valuating the land at $100 million based on development potential, and the city appraising it at $20 million for a transportation corridor, the two parties were far from reaching a deal.

In 2014, CPR attempted to increase the pressure on the city to renew negotiations in their favour. Threatening to reactivate the line and begin storing rail cars on it, they began repairing the dilapidated tracks, bulldozing community gardens that encroached on the right-of-way, and threatening pedestrians and cyclists who used the corridor as a trail with fines for trespassing. Eventually negotiations did resume, and an agreement was reached. In March 2016, it was announced that the city of Vancouver would purchase the corridor for $55 million.

That summer, the city began making temporary improvements to ensure the public could use the space until a new vision for the corridor can be developed. The rail tracks from Fir Street to Milton Street—most of the length of the corridor—were removed and replaced with a temporary asphalt multi-use path lined with occasional park benches. Though the once busy pathway became empty with CPR's trespassing warnings, life has returned in full force. The new pathway is frequently active with cyclists and pedestrians along its full length, a hopeful sign for the newest corridor in the city's greenway network.

In January and February of 2017, the public was invited to share their own vision for the future of the corridor through a series of open houses and an online questionnaires. In March, after more than 4,000 participant interactions including almost 3,000 questionnaire responses,[1] the city compiled a summary report of participants' vision and values for the corridor. The highlights were both promising and unsurprising given the progressive nature of Vancouverites:

FIGURE 2-16 *The City of Vancouver Greenways Plan. The Arbutus Corridor is one of many greenways in a growing network across the city.*

FIGURE 2-17 *(opposite) Citizens' desired use, values, and infrastructure requirements for the Arbutus Greenway, summarized from the Arbutus Greenway Public Consultation.*

- Provide a high-quality, accessible public space for walking and cycling;
- Create a safe, comfortable, and welcoming destination with places for gathering, socializing, and relaxing;
- Connect to neighbourhoods, parks, and other points of interest along the greenway, as well as the broader transportation network; and
- Keep green spaces: Places for tranquility, to reconnect with nature, to grow food, and to nurture ecosystems and biodiversity.[2]

Beyond these broad values, the summaries of responses to three key questions provide a clear image of the inclusive, multi-modal, and ecologically resilient corridor that residents envision.[3]

These values will help guide the design of the future corridor.

ENDNOTES

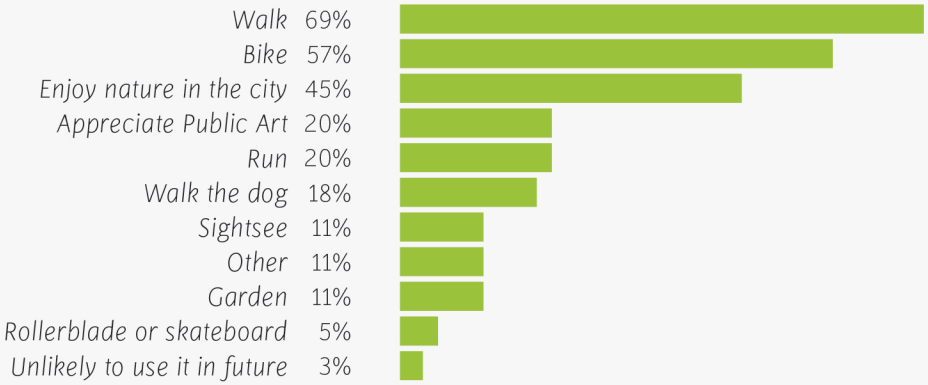
1 City of Vancouver, *Consultation Summary Report: Vision and Values for the Future Arbutus Greenway*, March 2017, accessed April 2017, http://www.vancouver.ca/files/cov/arbutus-greenway-consultation-march-2017.pdf, 3.

2 Ibid, 4.

3 Ibid, 12-13.

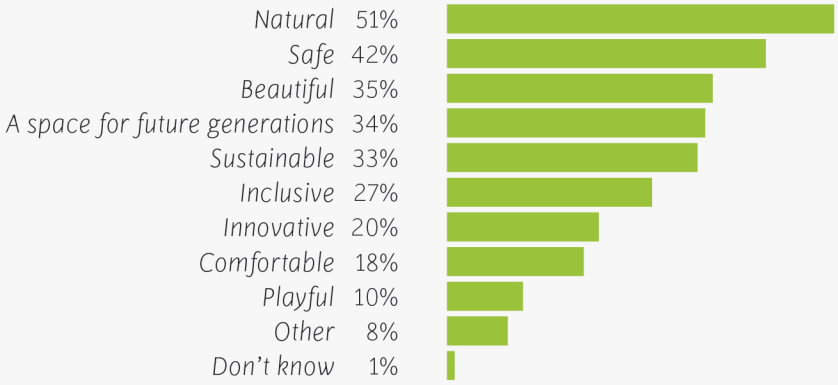
HOW WOULD YOU LIKE TO USE THE FUTURE ARBUTUS GREENWAY?

(select up to 3)



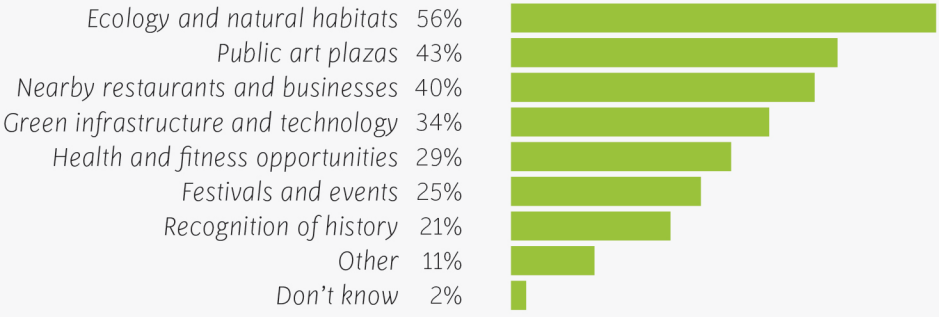
WHICH OF THE FOLLOWING VALUES BEST ALIGN WITH YOUR VISION FOR THE FUTURE ARBUTUS GREENWAY?

(select up to 3)



IN ADDITION TO HIGH-QUALITY INFRASTRUCTURE FOR WALKING, CYCLING AND FUTURE STREETCAR, WHAT WOULD ATTRACT YOU TO THE FUTURE ARBUTUS GREENWAY?

(select up to 3)



A CORRIDOR THROUGH THE CITY

part three

Mapping the Corridor

The maps and drawings within this chapter aim to illustrate the nature of the urban context in which the Arbutus Corridor is situated. This analysis will serve to inform appropriate design responses across a variety of conditions along the line. The extent of the chapter as the bulk of the thesis is in direct response to the importance of understanding the line. Because of the length of the corridor, there is no one intervention or design that would be appropriate for its full length. In order to respond to the varied character and qualities that exist along the corridor, it is therefore necessary to study the changing conditions along its length and at a variety of scales.

The Arbutus Corridor, though narrow in width, represents one of the last large undeveloped parcels of land in the city. Though an average of only twenty metres in width, its nine and a half kilometre length gives it a total area of approximately seventeen and a half hectares.

While the line and its corridor originally ran all the way from the False Creek trestle adjacent to the Burrard Street Bridge to the North Arm Bridge that spans the Fraser River, it no longer quite spans from water to water. At the north end, the portion of the rail right-of-way within the former Kitsilano Indian Reserve now belongs once again to the Squamish Nation. In the south, the rail right-of-way between Milton Street and Hudson Street remain the property of CPR.

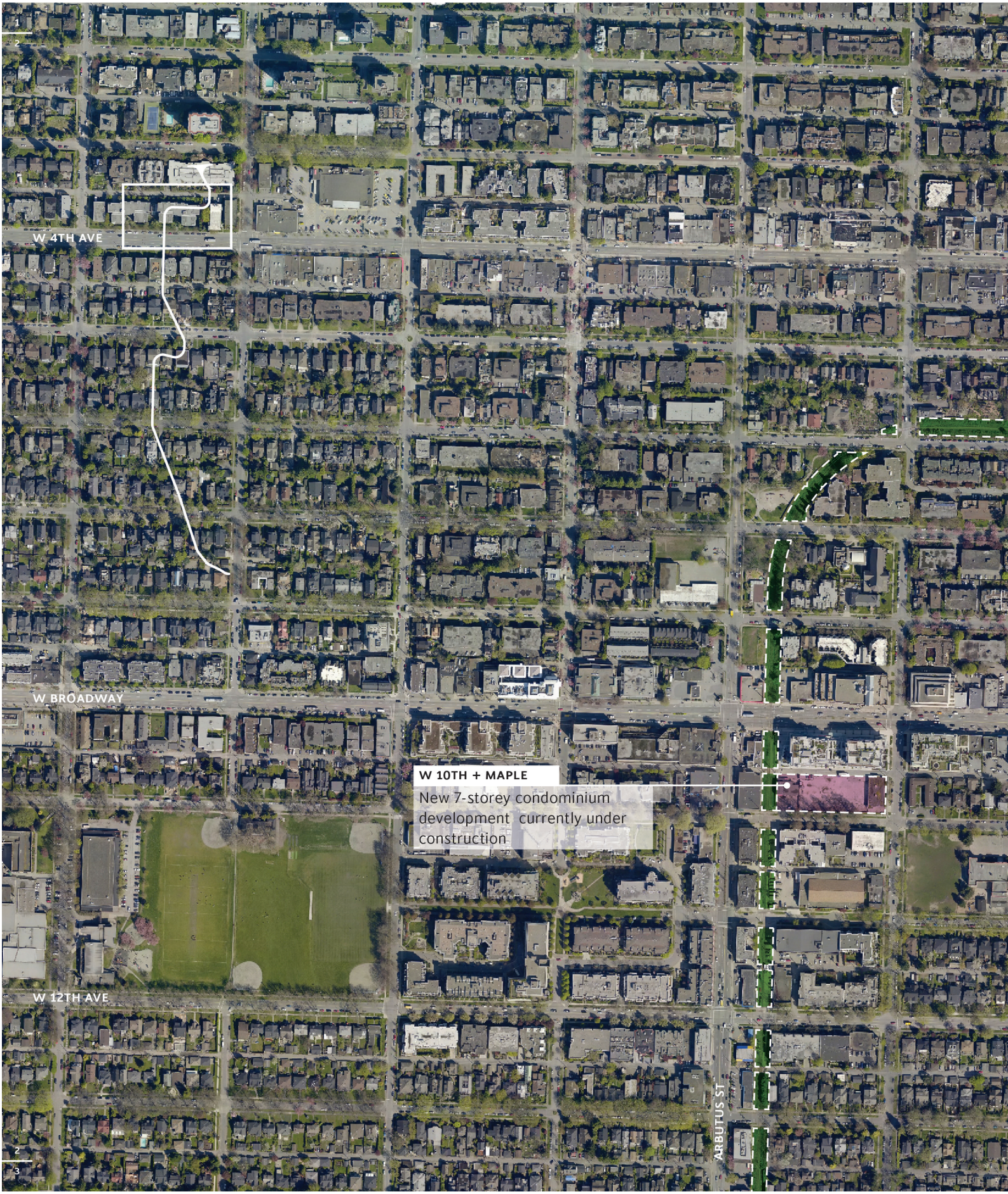
However, this southern section sits unused and the swing span of the North Arm Bridge has been removed, cutting off the last few industrial properties in Richmond that would otherwise still be connected to this spur. While officially the city did not purchase the stretch of corridor between Milton Street and Hudson Street, this portion remains a part of this design thesis since the deal between the city and CPR happened after the thesis was started, and this section remains ripe with potential as part of the larger greenway design.

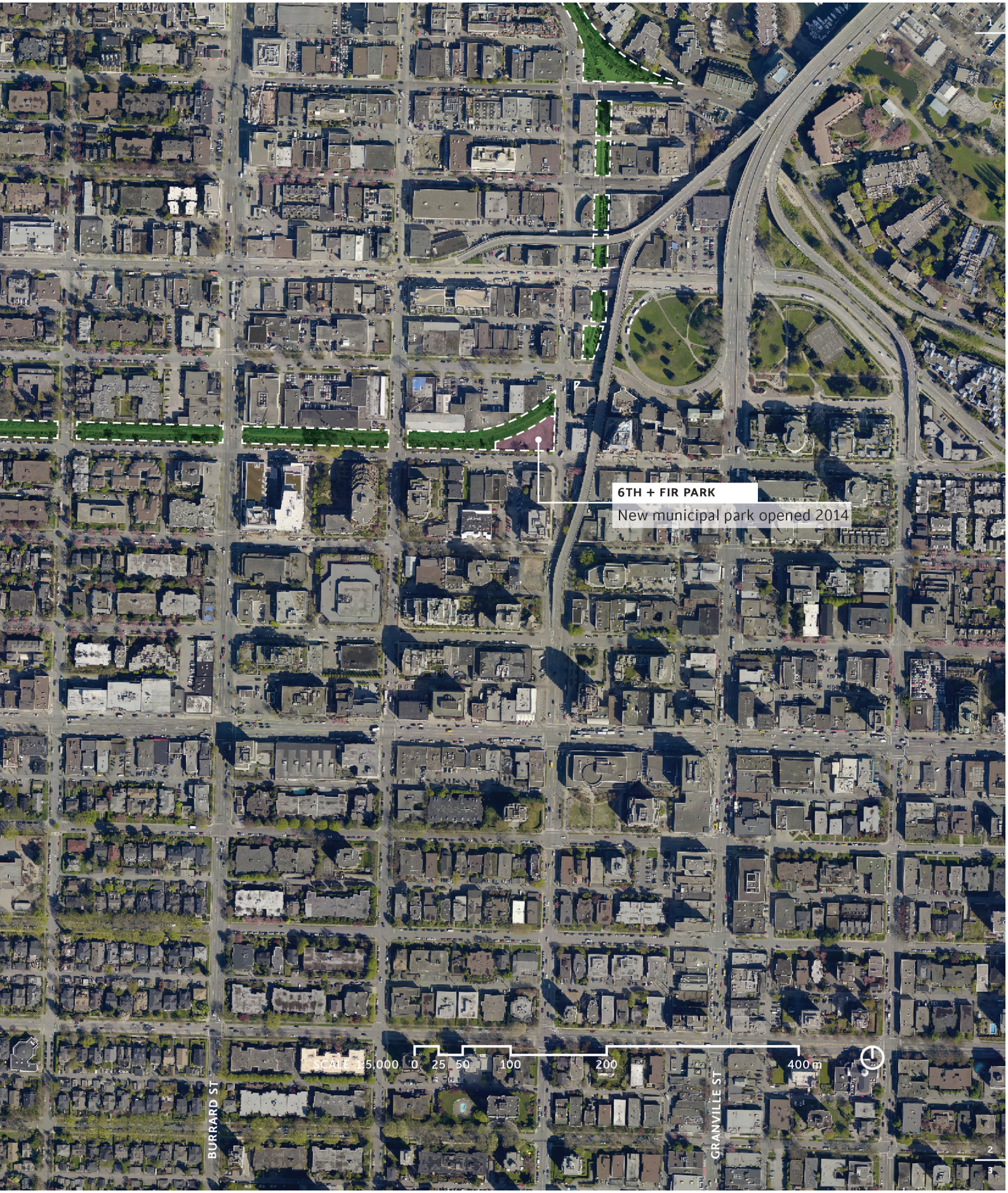
FIGURE 3-1 *(opposite) The Arbutus Corridor and the City of Vancouver. Key plan for figure 3-2. Not to scale.*

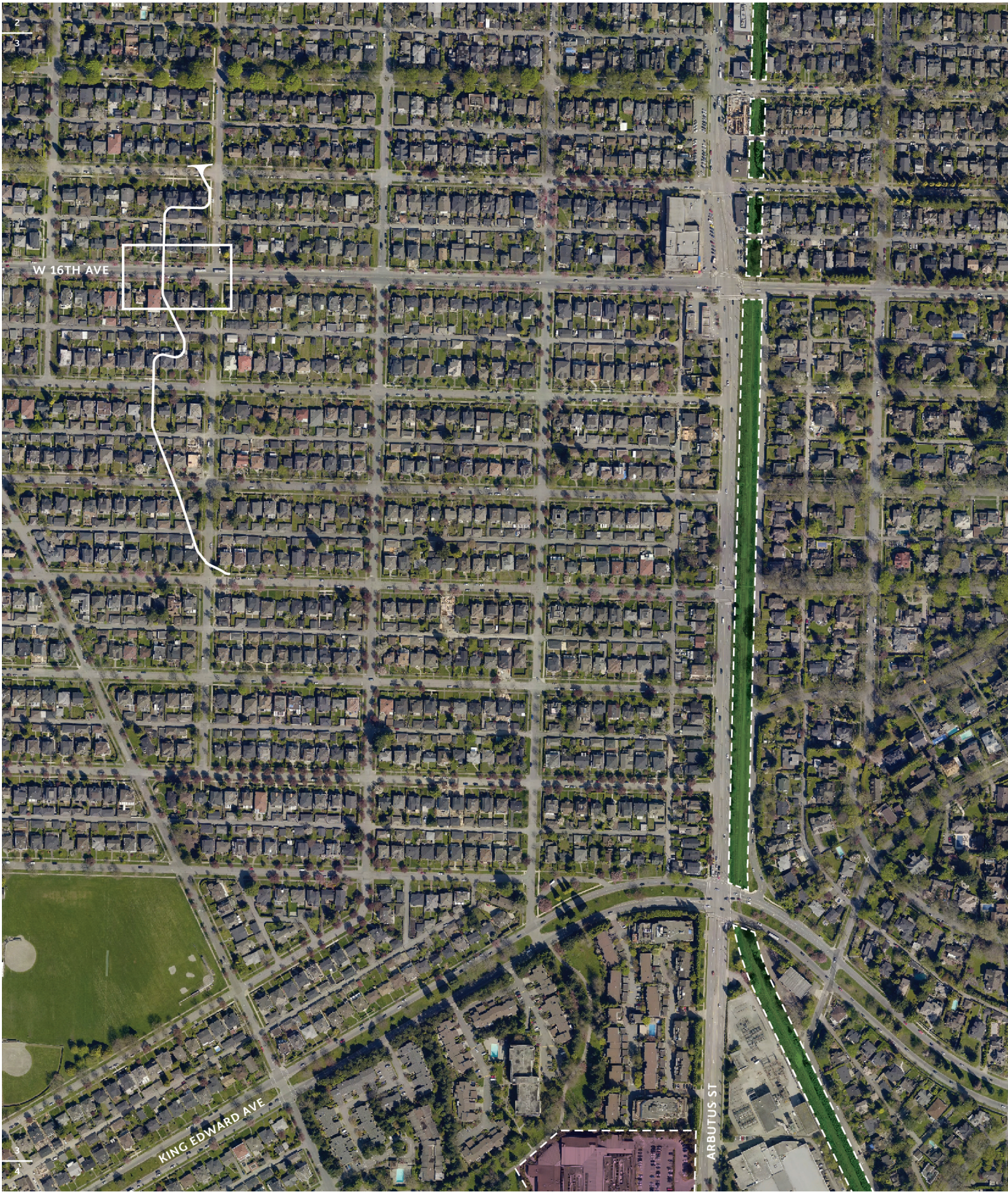
FIGURE 3-2 *(next 8 pages) The Arbutus Corridor at 1:5000. This recent orthophoto of the city shows the context in which the corridor exists today. At the north end, significant future developments are planned at the foot of the Burrard Street Bridge, while mid-rise redevelopments are slowly taking place throughout what is mostly single detached homes along the line. Subsequent figures of larger scale plan views and illustrated sections show in more detail the make up of each different typology along the corridor.*

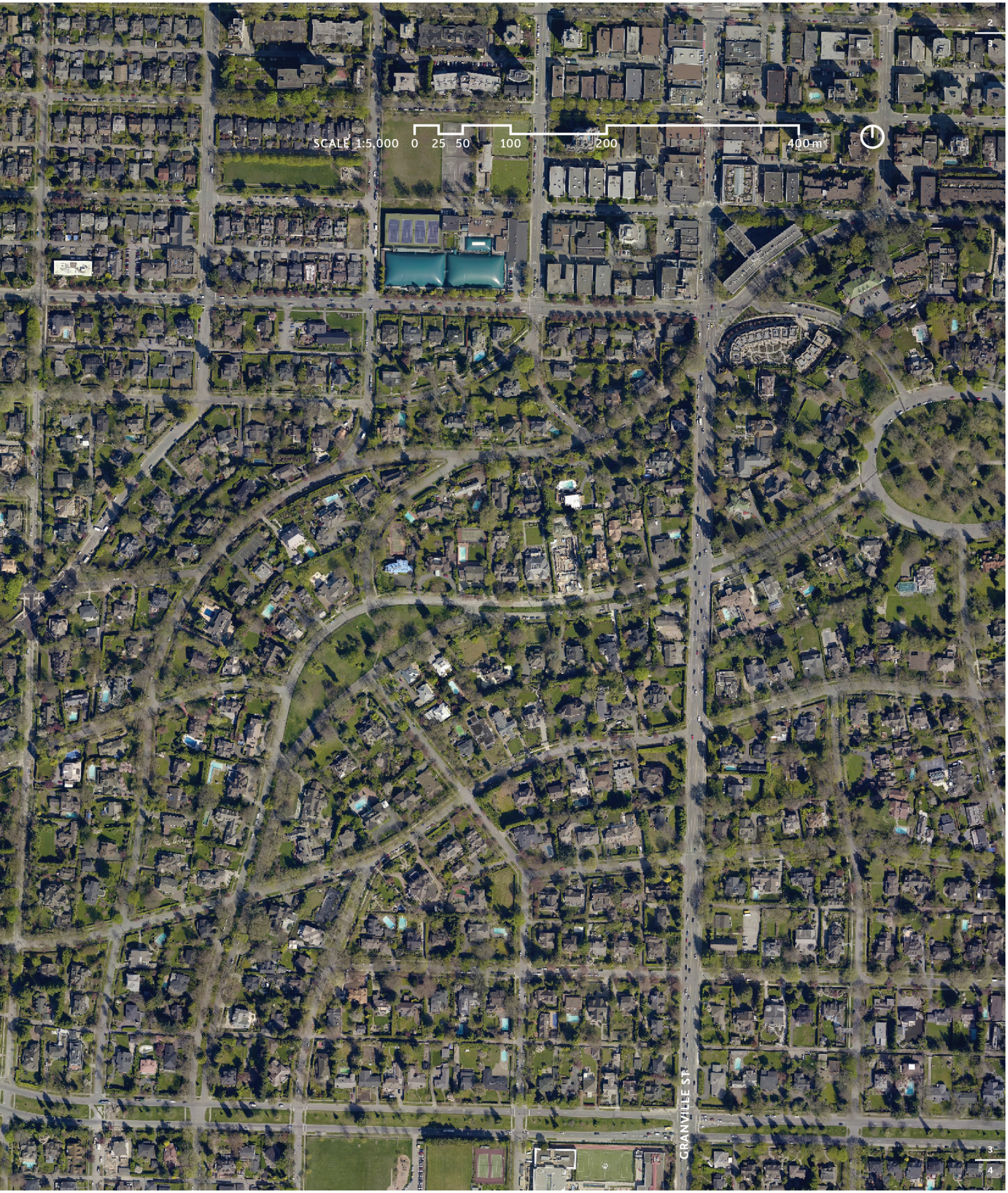
CORNWALL AVE
W 1ST AVE

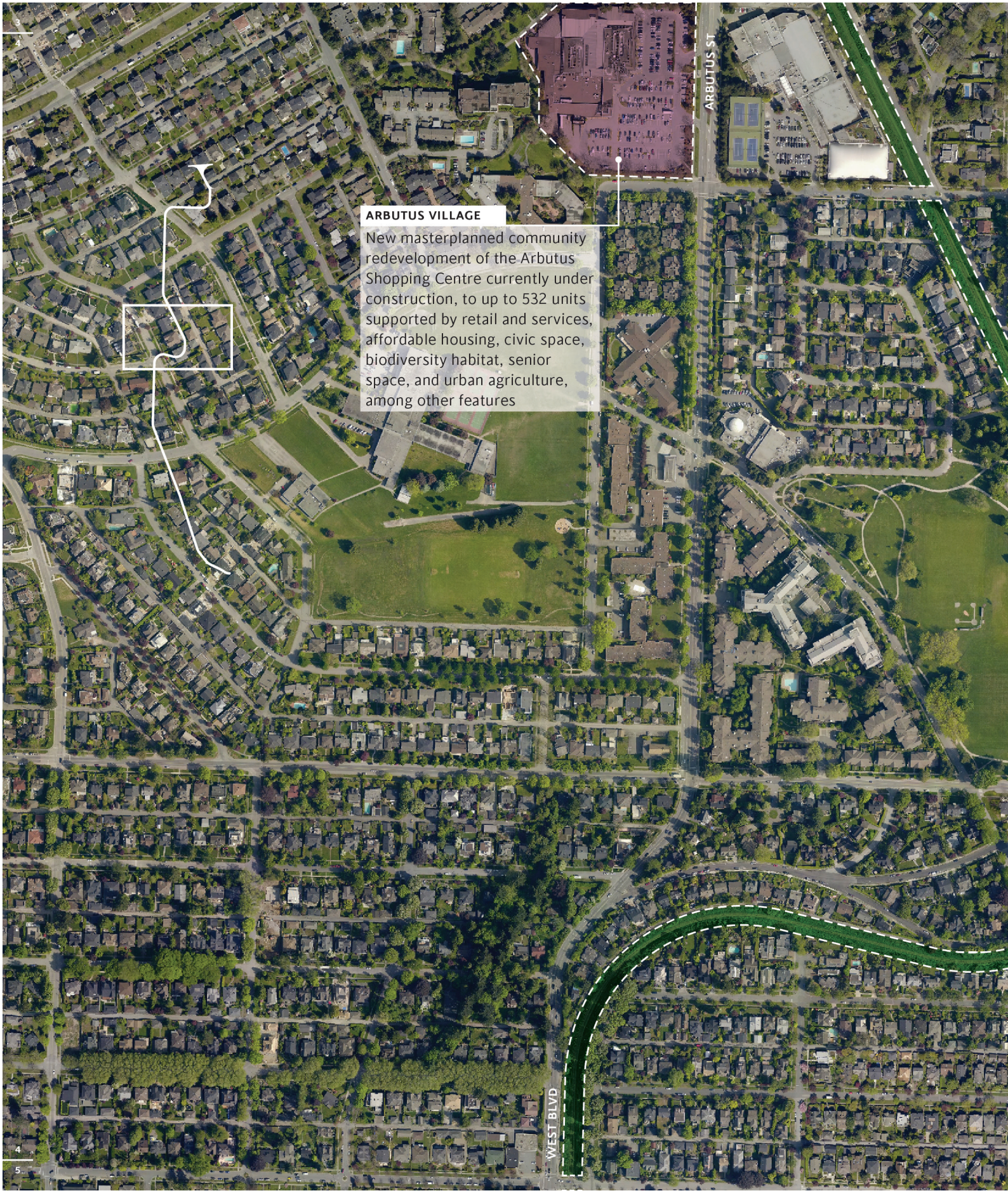
SCALE 1:5,000 0 25 50 100 200 400 m
BURRARD ST BRIDGE
BURRARD ST
GRANVILLE ST BRIDGE
SNAUQ VILLAGE SITE
Area of former Kitsilano Indian Reserve reclaimed by Squamish FN and earmarked for high density, mixed-use development
MOLSON BREWERY
Site of future mixed-use development by Concord Pacific
ARBUTUS CORRIDOR
Northern terminus of the site

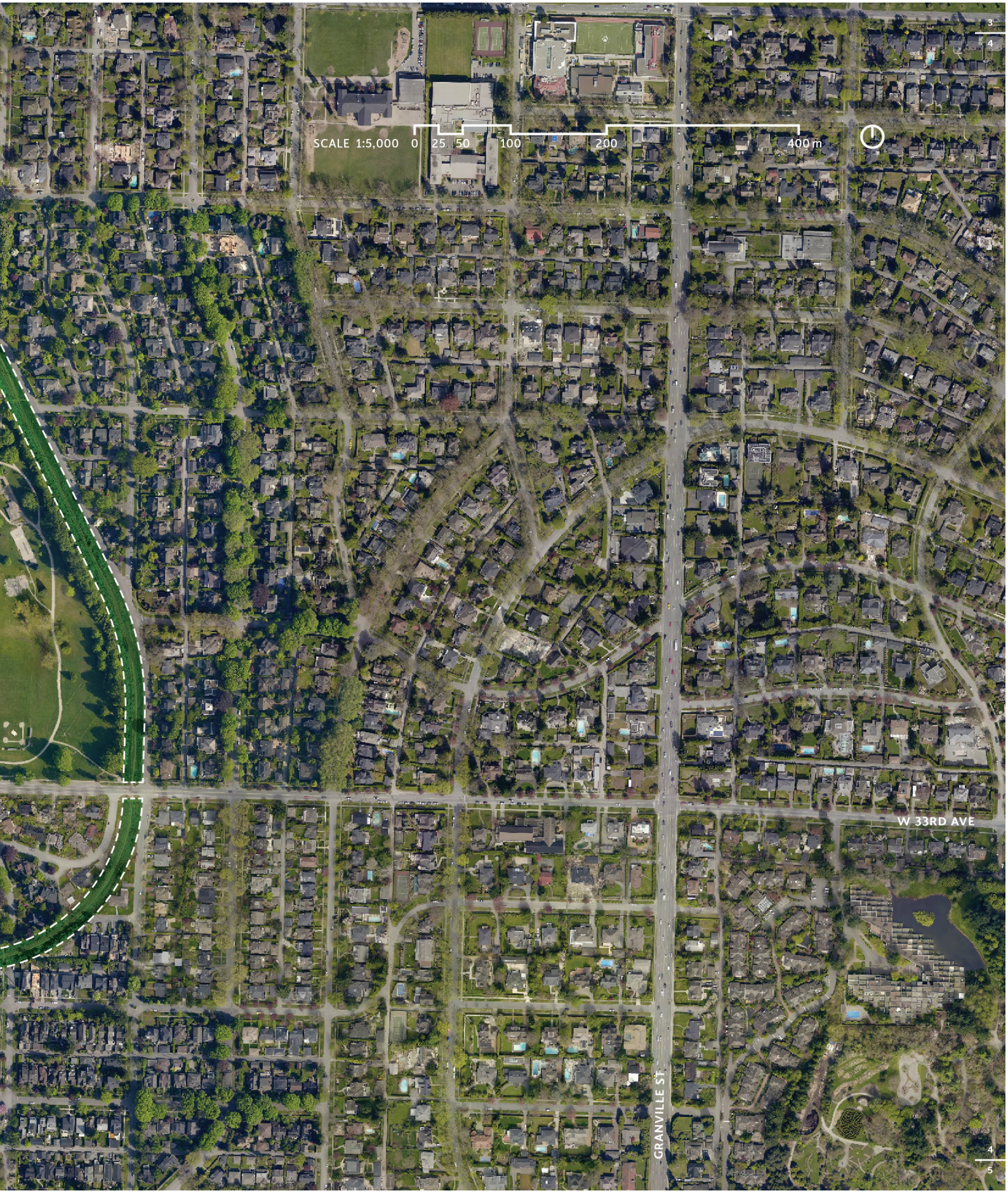

W 4TH AVE
W BROADWAY
W 12TH AVE
ARBUTUS ST
W 10TH + MAPLE
New 7-storey condominium development currently under construction


6TH + FIR PARK
New municipal park opened 2014
SCALE 1:5,000
0 25 50 100 200 400 m
BURRARD ST
GRANVILLE ST


W 16TH AVE
KING EDWARD AVE
ARBUTUS ST

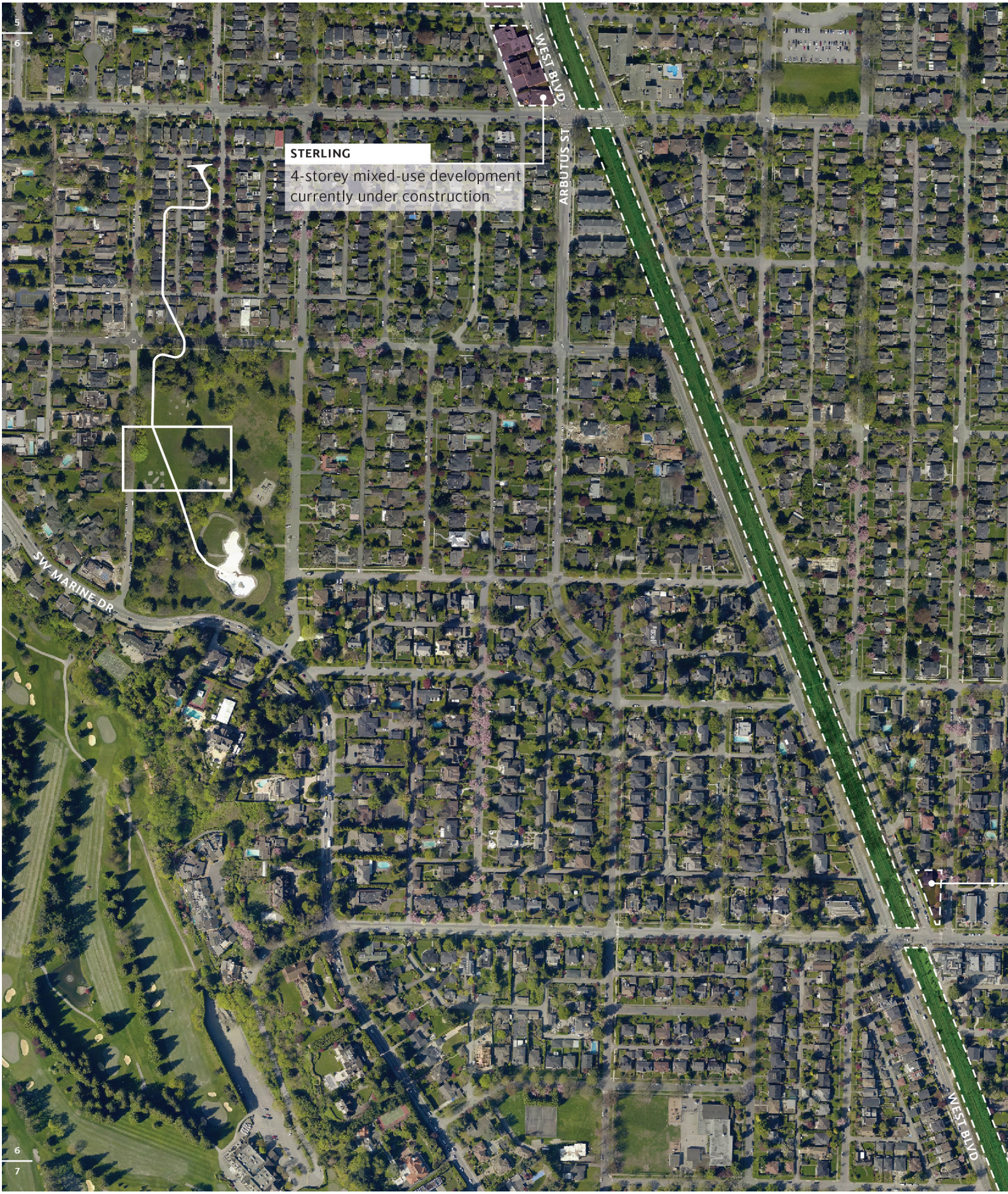

SCALE 1:5,000 0 25 50 100 200 400m
GRANVILLE ST

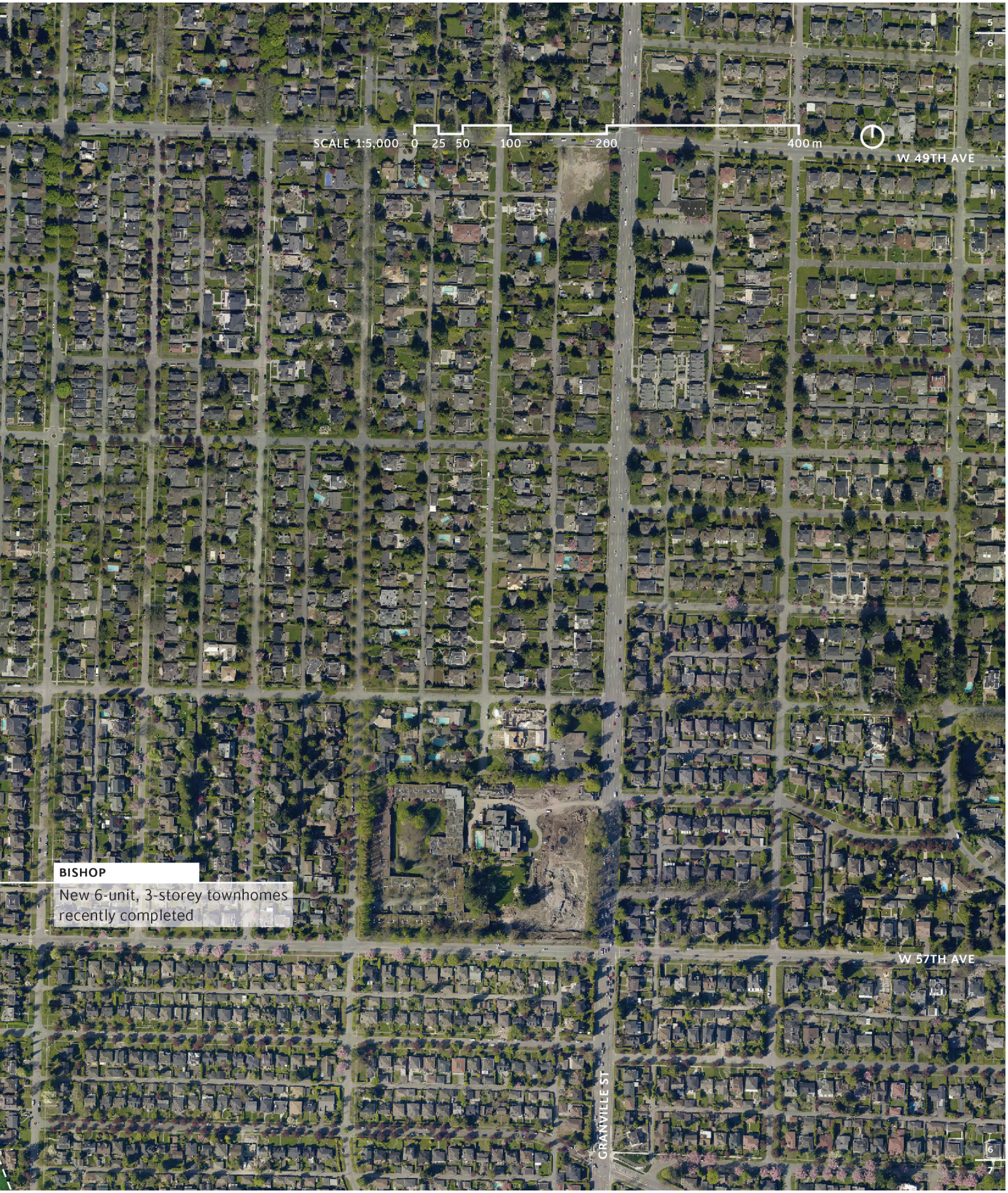

ARBUTUS ST
ARBUTUS VILLAGE
New masterplanned community redevelopment of the Arbutus Shopping Centre currently under construction, to up to 532 units supported by retail and services, affordable housing, civic space, biodiversity habitat, senior space, and urban agriculture, among other features
WEST BLVD


SCALE 1:5,000 0 25 50 100 200 400 m
W 33RD AVE
GRANVILLE ST

THE KIRKLAND
New 5-storey condominium and mixed-use development planned
MCKINNON
5-storey mixed-use development currently under construction
WEST BLVD

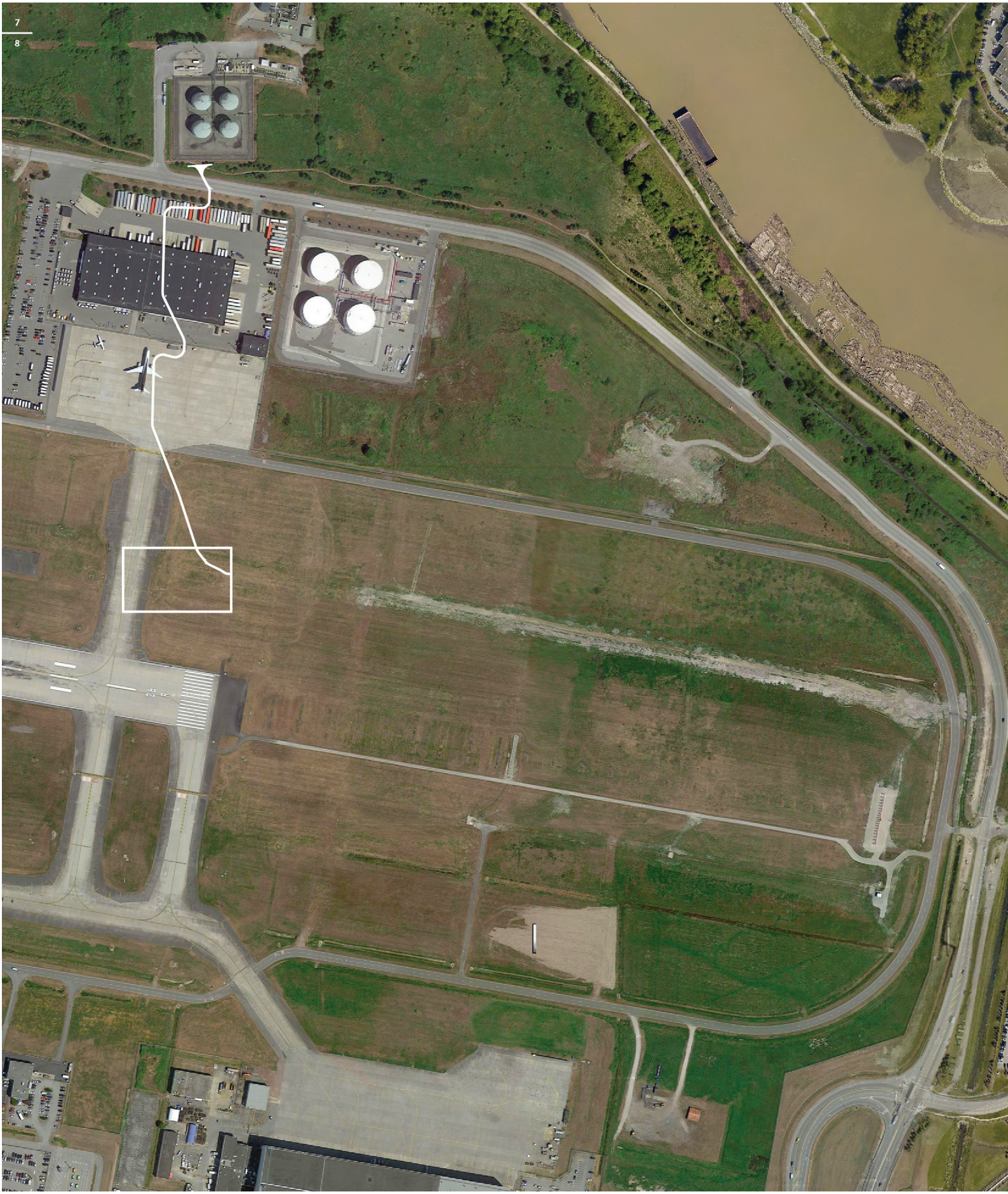
W 37TH AVE
SCALE 1:5,000 0 25 50 100 200 400 m
W 41ST AVE
GRANVILLE ST


STERLING
4-storey mixed-use development
currently under construction
WEST BLVD
ARBUTUS ST
SW MARINE DR
WEST BLVD


SCALE 1:5,000 0 25 50 100 200 400 m
W 49TH AVE
BISHOP
New 6-unit, 3-storey townhomes recently completed
W 57TH AVE
GRANVILLE ST

6
7
SW MARINE DR
WEST BLVD
7
8

SCALE 1:5,000 0 25 50 100 200 400 m
W 64TH AVE
GRANVILLE AT 70TH
New high density mixed-use development with retail, town homes, and two condominum towers recently completed
W 70TH AVE
GRANVILLE ST


7
8

ARBUTUS CORRIDOR
Southern terminus of corridor right-of-way purchased by the city in 2016
W 75TH AVE R.O.W.
Unused right-of-way for W 75th Ave adjacent to site
MARPOLE MIDDEN
Purchased by the Musqueam, this site occupying part of the historic Marpole Midden and village site is planned for archeological restoration and an interpretive/ceremonial park
ARBUTUS CORRIDOR
Southern terminus of the site, with potential for future extension along continuing rail lines and possible connection to Richmond via bridge
GRANVILLE ST
SW MARINE DR
ARTHUR LAING BRIDGE
SCALE 1:5,000 0 25 50 100 200 400 m

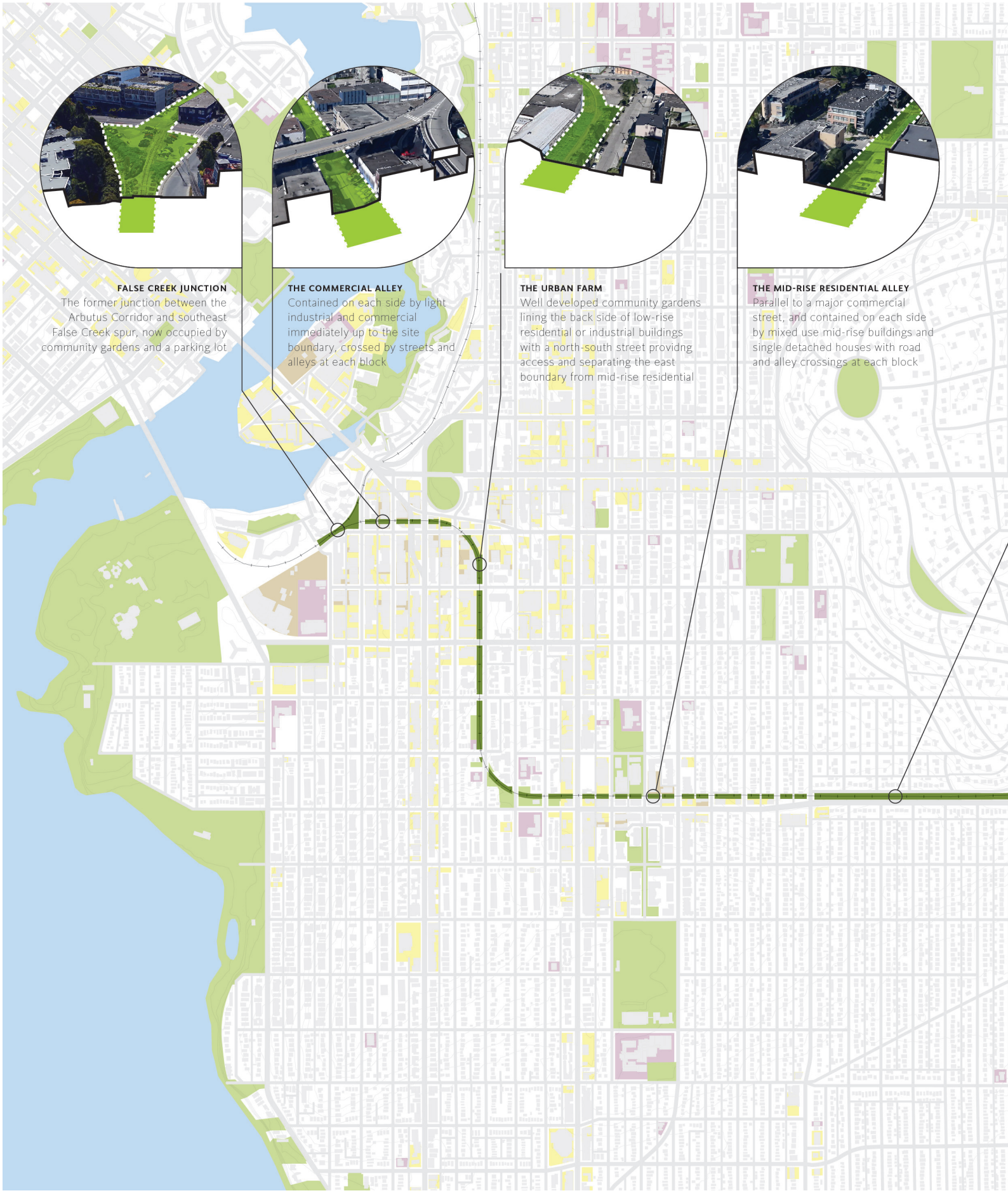
Existing Typologies

As would be expected of any corridor that spans such a length through a city, the Arbutus Corridor transects a diverse range of neighbourhoods as well as a rich tapestry of natural and built layers within the urban fabric. While every location along the corridor is unique, it is easier to understand and study it as a series of representative typologies that reflect the character of the built form over a length of the line.

In total, there are eleven such typologies that represent the majority of conditions along the corridor. While many of these typologies represent a variety of alignments within suburban neighbourhoods characterized by single-detached residences, the line also crosses through several civic centres and areas of increased density, activity, and variety of built form and land use.

This section offers an analysis of each of these typologies. While a key plan demonstrates the linear extent of the corridor that each typology covers, a written description of the characteristics and perspectival cross-section of existing conditions demonstrate the detailed components and make-up of the typology. While the general character will inform the design intervention, the cross-section illustrates the context, limits and constraints within which the proposal will exist.

FIGURE 3-3 *(next page) Varying typologies of the Arbutus Corridor.*

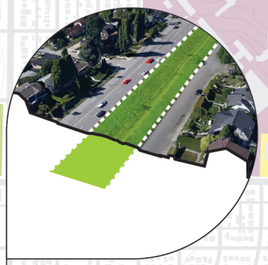


FALSE CREEK JUNCTION
The former junction between the Arbutus Corridor and southeast False Creek spur, now occupied by community gardens and a parking lot

THE COMMERCIAL ALLEY
Contained on each side by light industrial and commercial immediately up to the site boundary, crossed by streets and alleys at each block

THE URBAN FARM
Well developed community gardens lining the back side of low-rise residential or industrial buildings with a north-south street providng access and separating the east boundary from mid-rise residential

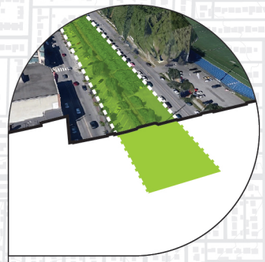
THE MID-RISE RESIDENTIAL ALLEY
Parallel to a major commercial street, and contained on each side by mixed use mid-rise buildings and single detached houses with road and alley crossings at each block



THE OPEN LAWN
An exposed grass corridor flanked on each side by roads and suburban neighbourhoods

THE PARK EXTENSION
Immediately attached to adjacent parks and open space

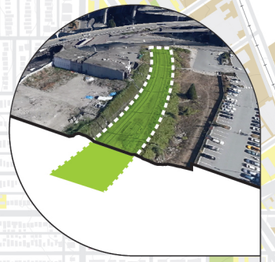
THE TUNNEL WITH A VIEW
Narrow and stepped to negotiate the steep topography and flanked with access limiting residential on each side



THE TOWN CENTRE
Parking lots that serve the Kerrisdale neighbourhood commercial and civic facilities encroach upon the corridor

THE GENEROUS BOULEVARD
A wide lawn flankd on each side by tree lined streets and mixed residential and retail zoning

THE BACKYARD EXTENSION
Flanked by houses on one side and a quiet residential street on the other, and often lined with community gardens



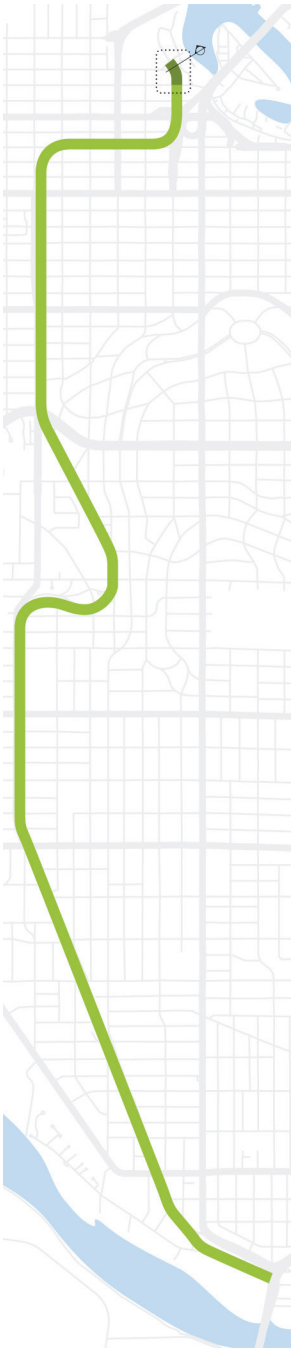
THE TRANSIT YARD
The end of the line, running below an embankment on the north side and adjacent to an unused municipal right-of-way and transit maintenance yards to the south

LEGEND
- Arbutus Corridor
- Parks + Green Space
- Commercial
- Institutional + Cultural
- Industrial

SCALE 1:15,000

0 100 200 500 1000 m

W 1ST AVE
W 2ND AVE
FIR ST



FALSE CREEK JUNCTION

Located at the northern terminus of the corridor, this section extends between W 1st Avenue and W 2nd Avenue on the east side of Fir Street. Here the line emerges from the commercial alley to the immediate south and takes on a more accessible and pedestrian oriented nature with condominiums along the banks of False Creek backing onto the line on its eastern side, and mixed use commercial and residential to the west. The northern half of this section is home to the Urban Acres community garden.

At the corner of W 2nd Avenue and Fir Street, the corridor flares out where the former False Creek rail line connects from the east. For the 2010 Winter Olympic Games, Vancouver upgraded the False Creek Line and operated an LRT system between the Canada Line Skytrain Olympic Village Station and the Anderson Street access to Granville Island. While a Starbucks retail outlet now occupies a single parcel of the formerly intact rail corridor at the corner of Anderson Street and W 2nd Avenue, there is still potential to reconnect the False Creek line to the Arbutus Corridor in the future.

FIGURE 3-4A *(opposite) 1:1,000 Orthophoto plan detail of Fir Street between W 1st Avenue and W 2nd Avenue.*

FIGURE 3-4B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-4C *(next page) 1:200 Existing conditions section cut through Fir Street looking north towards W 1st Avenue.*

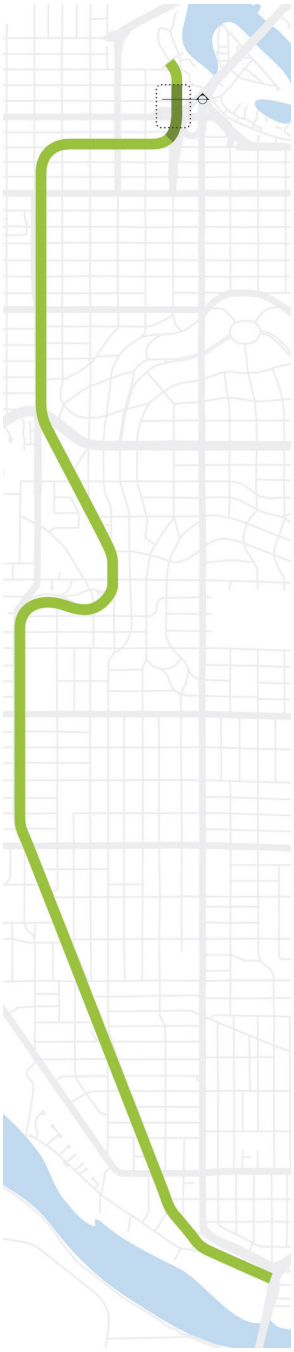
5 Storey Residential with
Mixed Use Ground Floor

Sidewalk
2.7 m

Fir Street
9 m

Sidewalk
1.4 m
Rail Corridor
7.5 m
False Creek Spur
7 m
4 Storey Residential
'Street' Width
27.6 m

W 2ND AVE
W 3RD AVE
GRANVILLE ST BRIDGE OFF-RAMP
W 4TH AVE
FIR ST



THE COMMERCIAL ALLEY

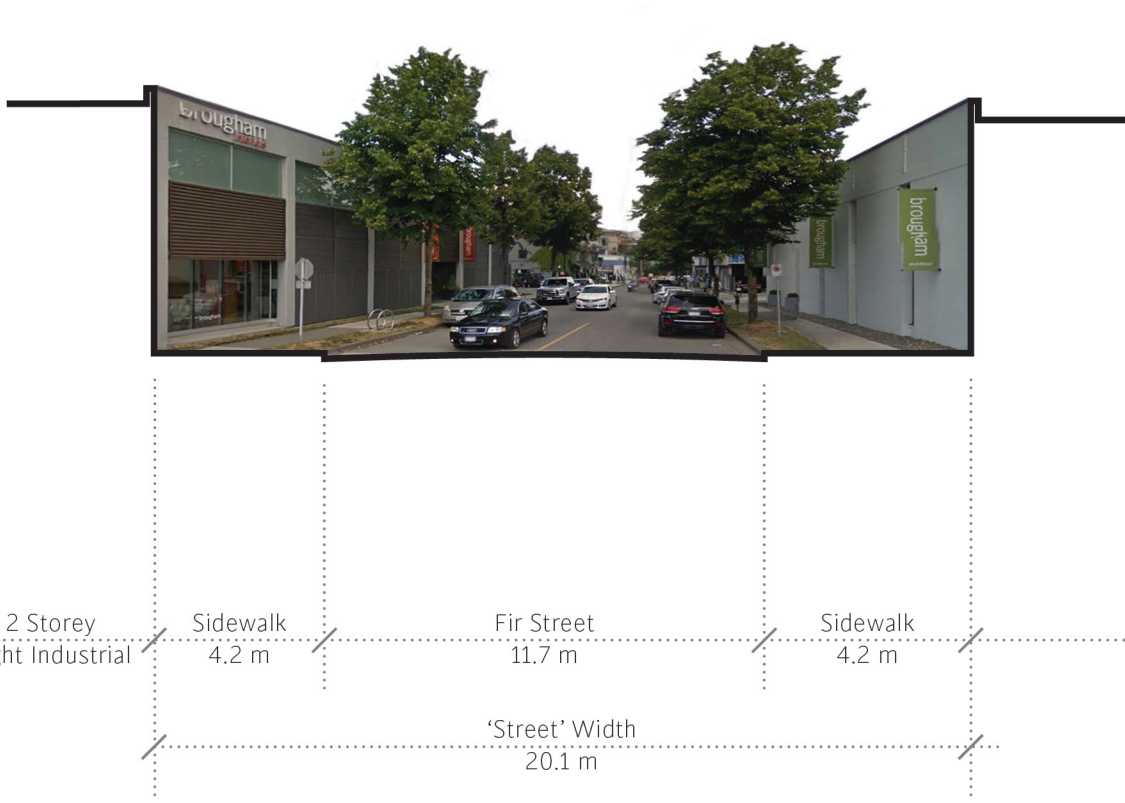
Between W 2nd Avenue and W 5th Avenue, the line steps back from Fir Street and cuts an alleyway through the commercial buildings of the neighbourhood. With no street presence other than crossings, this section of the corridor has largely been taken over by adjacent businesses for vehicle parking.

At only 16 m in width, the corridor is tightly walled in on both sides by single and double storey commercial buidings, with the exception of the Waterfall Building by renowned architect Arthur Erickson, which sits on the corridor's eastern flank along the south side of W 2nd Avenue.

FIGURE 3-5A *(opposite) 1:1,000 Orthophoto plan detail of Fir Street between W 2nd Avenue and W 5th Avenue.*

FIGURE 3-5B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-5C *(next page) 1:200 Existing conditions section cut through Fir Street looking north from W 3rd Avenue.*

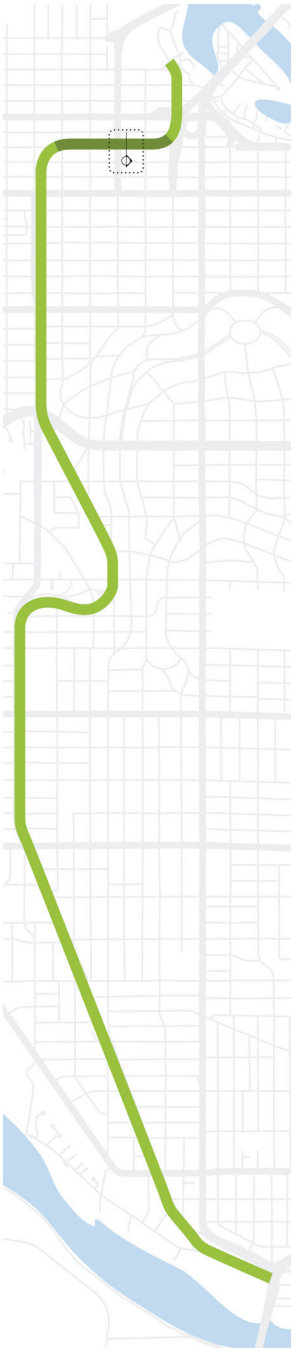

brougham
brougham
brougham
2 Storey
Light Industrial
Sidewalk
4.2 m
Fir Street
11.7 m
Sidewalk
4.2 m
'Street' Width
20.1 m

2 Storey Light Industrial
15.3 m

Rail Corridor
15.3 m

1 Storey
Light Industrial

W 6TH AVE
W 7TH AVE
BURRARD ST
PINE ST



THE URBAN FARM

The east-west oriented span of the corridor along W 6th Avenue between Fir Street and Maple Street in Kitsilano is the highest density residential neighbourhood on the line. North of the line and east of Burrard Street is a mix of commercial.

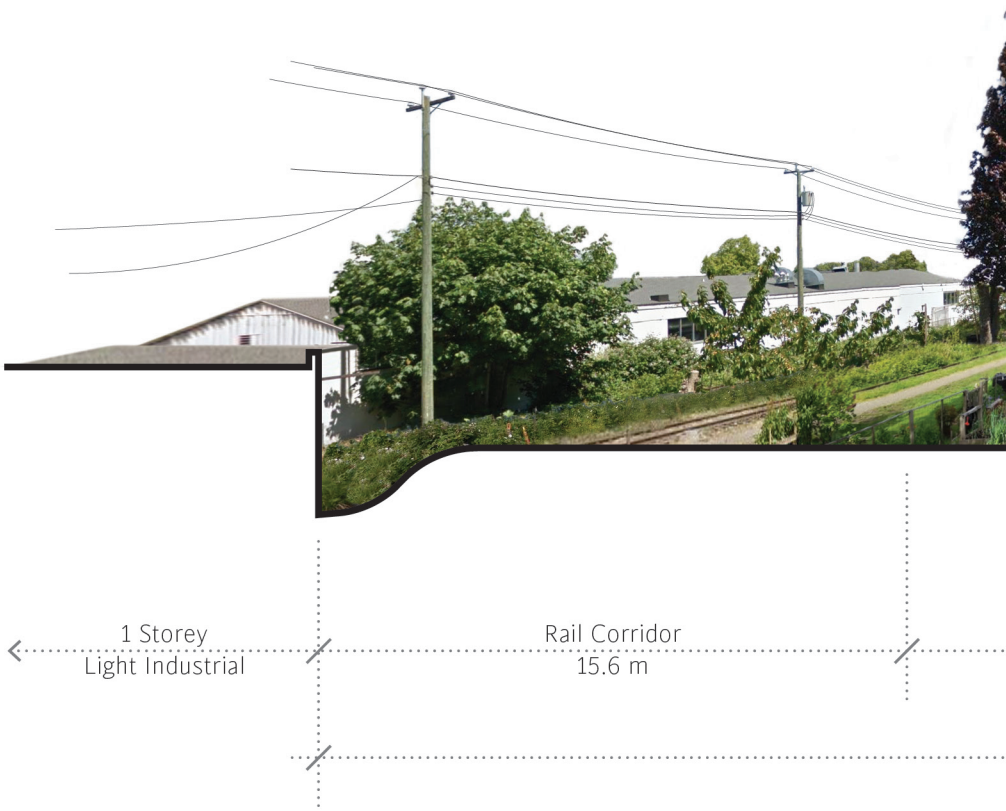
With excellent southern solar exposure and high local demand for garden space, this section contains one of the largest and busiest blocks of community gardens along the corridor. W 6th Avenue, while a quiet side street, is heavily used for parking by residents and for its close proximity to businesses along both W 4th Avenue and Burrard Street. The eastern end of this segment at Fir Street is also less than one block from multiple bus connections to Downtown Vancouver across the Granville Street Bridge.

In 2014, the City of Vancouver completed construction of a new park at the corner of W 6th Avenue and Fir Street. The new park contains play areas, open lawn and seating, and a community orchard with perennial plants and trees.

FIGURE 3-6A *(opposite) 1:1,000 Orthophoto plan detail of W 6th Avenue between Burrard Street and Pine Street.*

FIGURE 3-6B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-6C *(next page) 1:200 Existing conditions section cut through W 6th Avenue looking east towards Pine Street.*


1 Storey
Light Industrial
Rail Corridor
15.6 m

Community Gardens 7.5 m

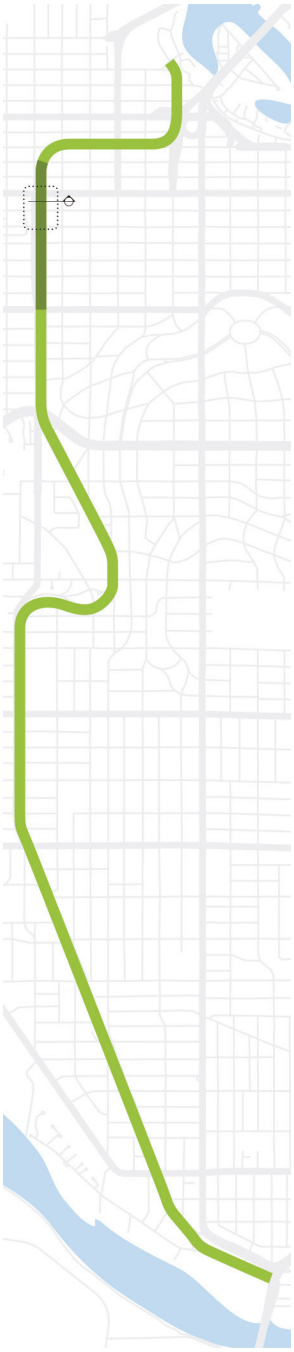
W 6th Avenue 10.0 m

Sidewalk 3.2 m

Midrise Residential

'Street' Width 36.3 m

W BROADWAY
W 10TH AVE
ARBUTUS ST
W 11TH AVE



THE MID-RISE RESIDENTIAL ALLEY

From the intersection of W Broadway and Arbutus Street south to W 16th Avenue, the corridor is stepped back to form an alleyway behind businesses and mixed use buildings which front the east side of Arbutus Street. With Broadway being one of the busiest commercial corridors in the city, the intersection at Arbutus serves as a major node for both transportation and commerce along the line, and continues to be the centre of increased densification and renewal. Many of the older low-rise commercial units along this section of the corridor have been replaced by mixed-use mid-rise developments over the last decade, as well as some mixed-use high-rises in the last few years. This trend is expected to continue with the redevelopment of the few remaining single detached residential and low-rise commercial buildings on this stretch.

With Broadway laying claim to North America's busiest bus route, plans are underway to extend the Millenium Line Skytrain from its current terminus at VCC-Clark Station to the UBC Point Grey Campus through a tunnel under Broadway. Arbutus Street marks the last station proposed in the first phase of this extension.

From W Broadway to W 37th Avenue, Arbutus Street grows from its predominantly 2 lane alignment into a 4 lane arterial road. While it is indeed a busier collector route, city traffic counts during peak hours reach a maximum of roughly 1,150 vehicles per hour. With the theoretical maximum saturation flow rate of 1,900 vehicles per lane per hour, this section of Arbutus Street is significantly over-designed for actual demand. With improved transit as well as rapidly evolving vehicle automation, a two lane street with turning lanes is sufficient to handle current and future traffic growth. This gives the opportunity to reclaim some of the paved surface for other uses.

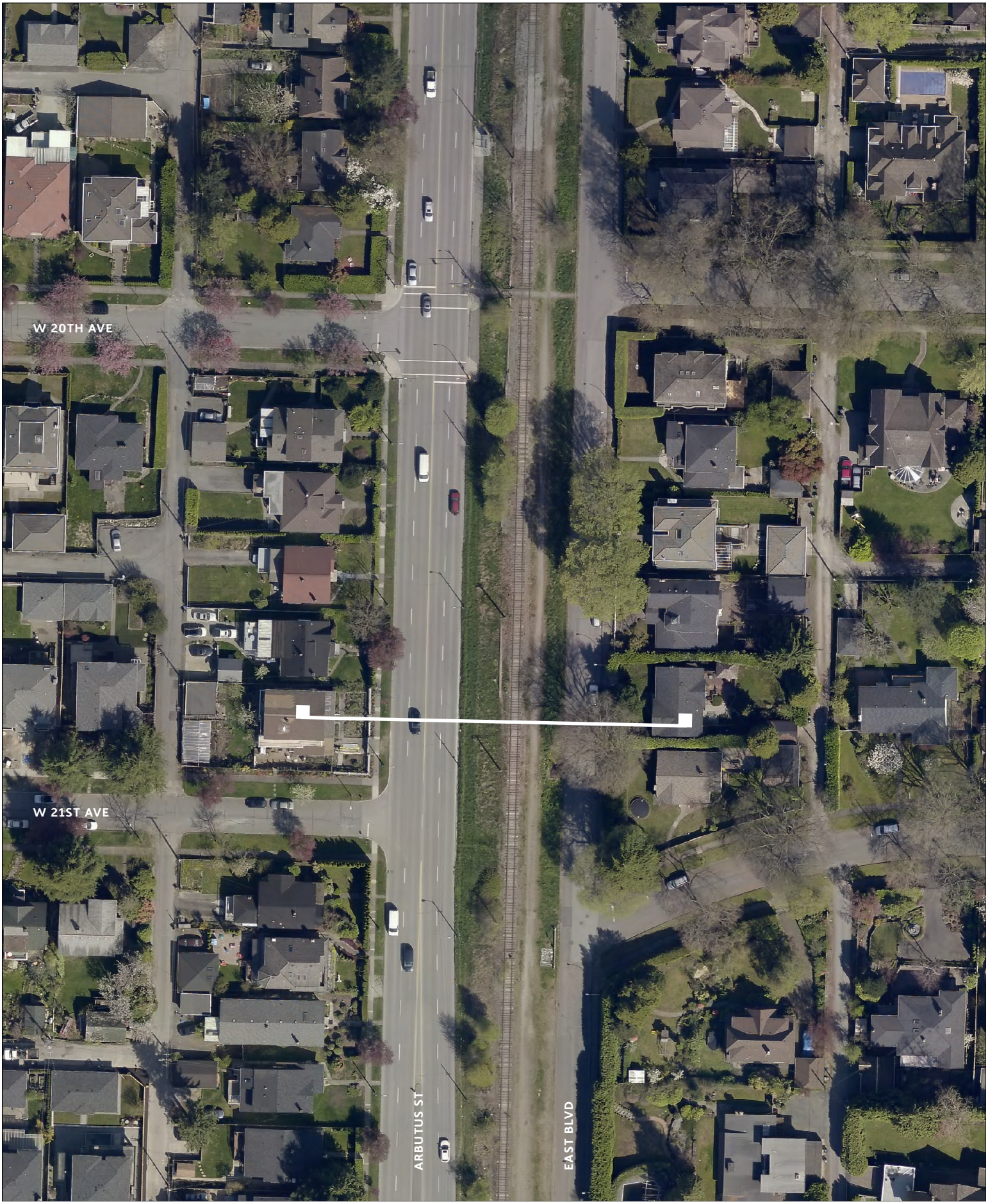
FIGURE 3-7A *(opposite) 1:1,000 Orthophoto plan detail of Arbutus Street between W Broadway and W 11th Avenue.*

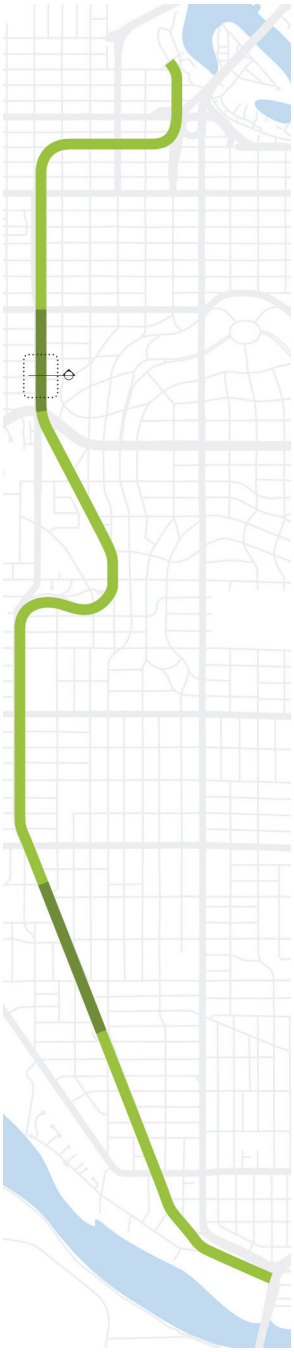
FIGURE 3-7B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-7C *(next page) 1:200 Existing conditions section cut through Arbutus Street looking north towards W Broadway.*

2 Storey
Commercial
Sidewalk
3.6 m
Arbutus Street
12.7 m
Sidewalk
3.8 m
1 Storey Commercial
22.9 m
Street Width
20.1 m

Rail Corridor
15.3 m
Plaza
Varies
6 Storey Residential with
Mixed Use Ground Floor


W 20TH AVE
W 21ST AVE
ARBUTUS ST
EAST BLVD



THE OPEN LAWN

Between W 16th Avenue and W King Edward Avenue, the corridor takes on the form of a treeless, grassy boulevard between two streets. To the west, Arbutus Street is a busy 4-lane arterial route, while to the east, East Boulevard is a quiet residential access street. Both streets are lined with single detached residential houses that face the corridor and are serviced by laneways in the back.

Unlike previous sections of line where each cross street had a crossing, this section is unbroken, forcing vehicle, cycle and pedestrian traffic to the either W 16th Avenue of W King Edward Avenue to cross the corridor. This section of the line also serves as a neighbourhood divider, with the luxury estate properties of Shaughnessy occupying the high ground to the east and more typical 'Vancouver Special' neighbourhoods to the west.

To the south, the corridor takes on a similar typology between W 51st Avenue and W 61st Avenue. Here, West Boulevard is a busy two-lane collector route on the west side of the corridor, while East Boulevard maintains its role as quiet residential street (East Boulevard is discontinuous between W 57th Avenue and W 60th Avenue, where single detached homes back onto the corridor's eastern flank).

From W 51st Avenue to W 57th Avenue, as well as at the corner of W 60th Avenue, the east side of the corridor houses mostly continuous community garden plots.

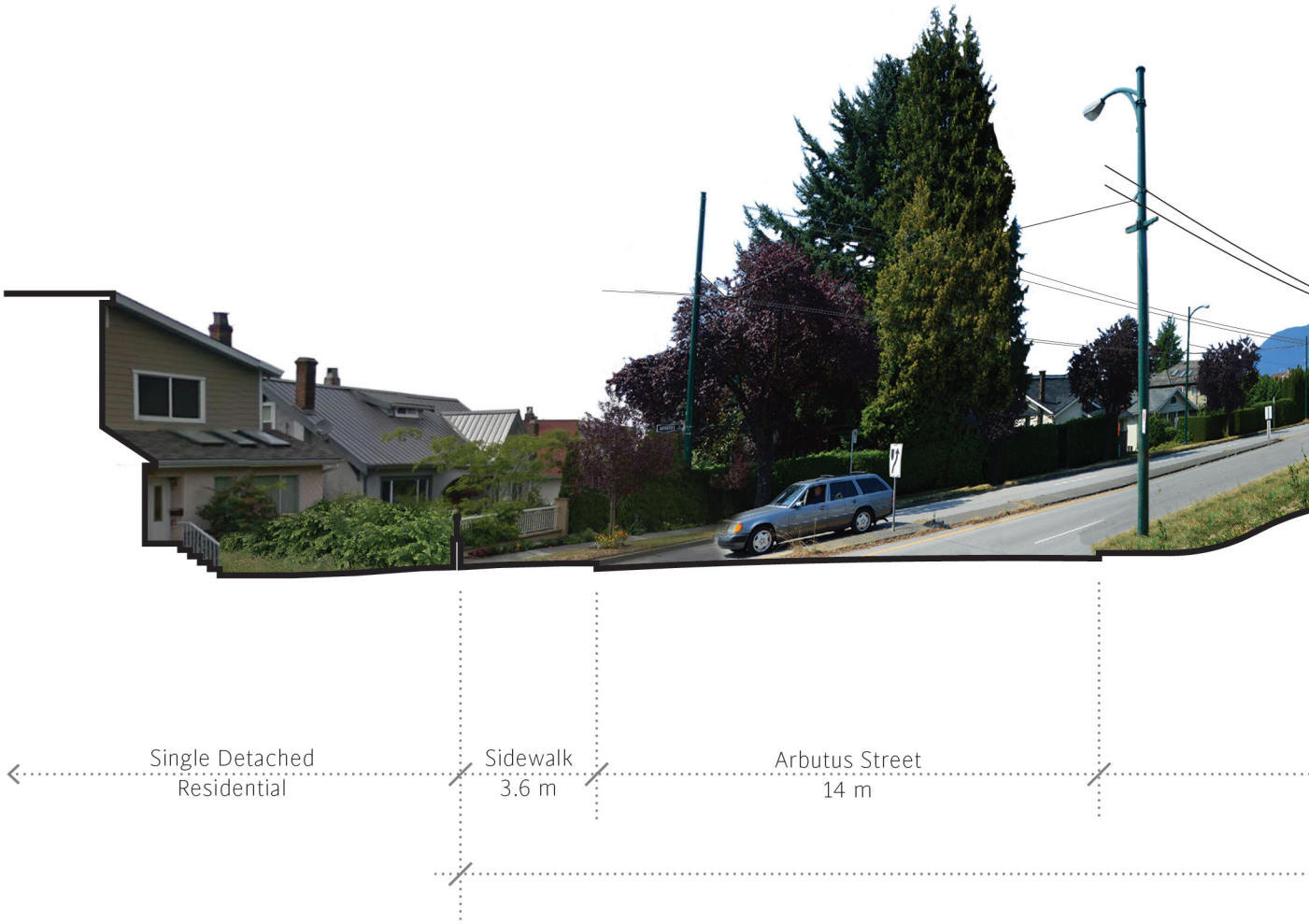
While there are few road crossings in this section, pedestrian and bicycle crossings are frequent.

As discussed in the previous section, the four lane alignment of Arbutus Street between W Broadway and W 37th Ave, which includes the northern section of this typology, is over-designed for vehicle traffic. There is opportunity to reclaim a significant portion of the paved space in the redesign of this segment.

FIGURE 3-8A *(opposite) 1:1,000 Orthophoto plan detail of Arbutus Street between W 20th Avenue and W 21st Avenue.*

FIGURE 3-8B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-8C *(next page) 1:200 Existing conditions section cut through Arbutus Street looking north from near W 21st Avenue.*


Single Detached
Residential
Sidewalk
3.6 m
Arbutus Street
14 m

Rail Corridor
21.5 m

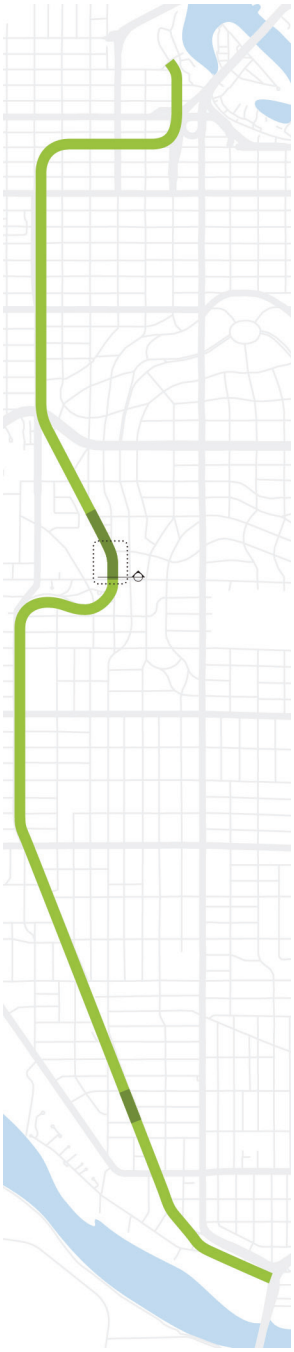
East Boulevard
7.9 m

Sidewalk
2.4 m

Single Detached
Residential

'Street' Width
49.4 m

W 32ND AVE
W 33RD AVE
QUILCHENA CRES
PINE CRES



THE PARK EXTENSION

From W 29th Avenue to W 33rd Avenue, the corridor runs along the eastern edge of Quilchena Park. While the corridor is elevationally at the high end of the park, it is physically and visually diconnected by trees and bushes along the entire length. Along this stretch, the corridor parallels Maple Crescent and Pine Crescent along its eastern edge, quiet residential collector streets at the edge of single detached residential neighbourhoods.

Though the park itself features two sports fields with overlapping ball diamonds, a Hellenic Garden, and some playgrounds, much of the park is underutilized slope with open grass lawn. Maps of Vancouver's buried streams suggest the headwaters of MacDonald Creek may reach as far as Quilchena Park.

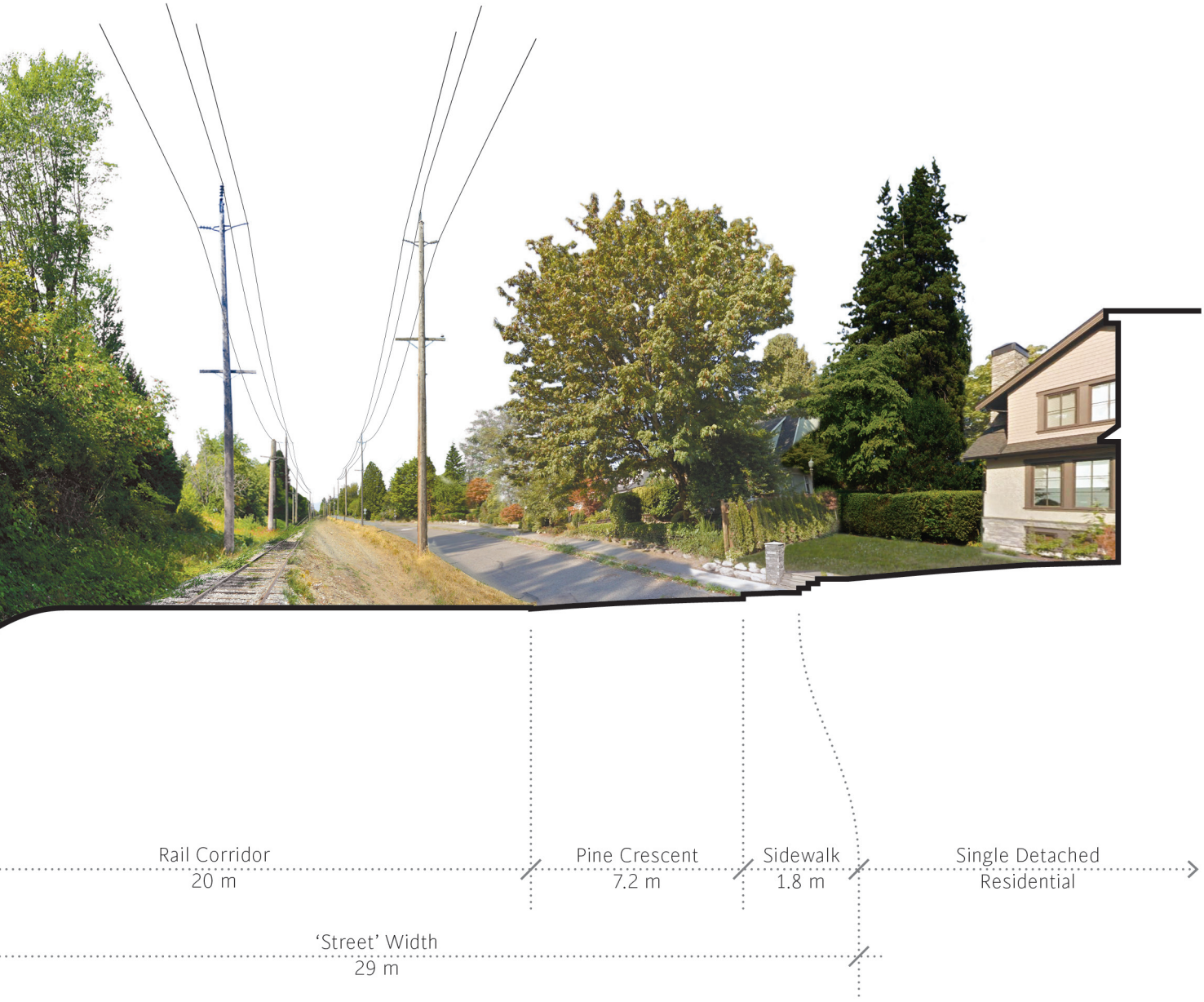
Farther south, Riverview Park abuts the western edge of the corridor in much the same fashion while East Boulevard and some community gardens line its eastern side. Like Quilchena Park, Riverview Park contains a small playground, though the rest of the park is open grass lawn with some patches of trees, and is wholly underutilized space both in terms of ecology and community amenity.

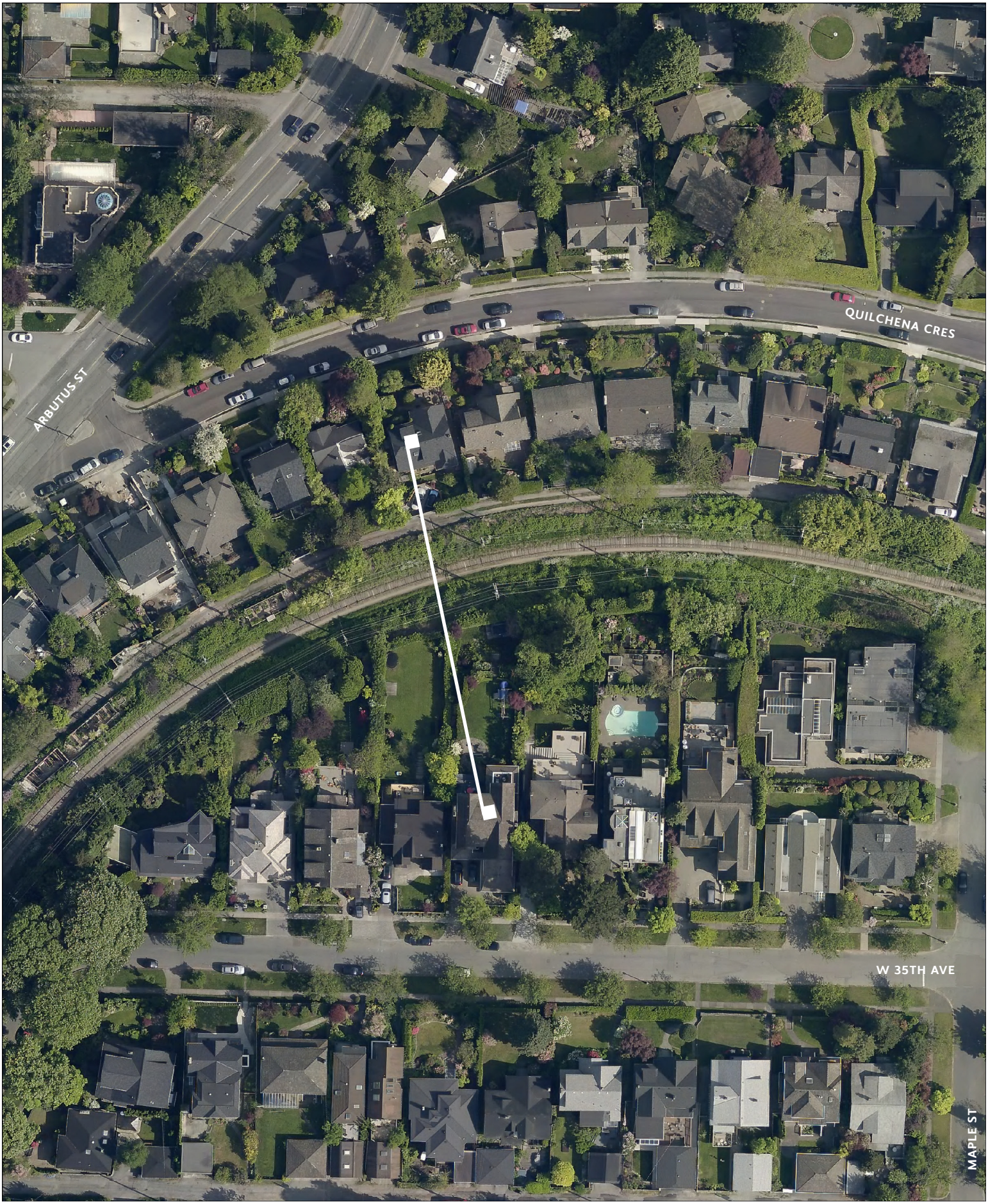
FIGURE 3-9A *(opposite) 1:1,000 Orthophoto plan detail of Pine Crescent between W 32nd Avenue and W 33rd Avenue.*

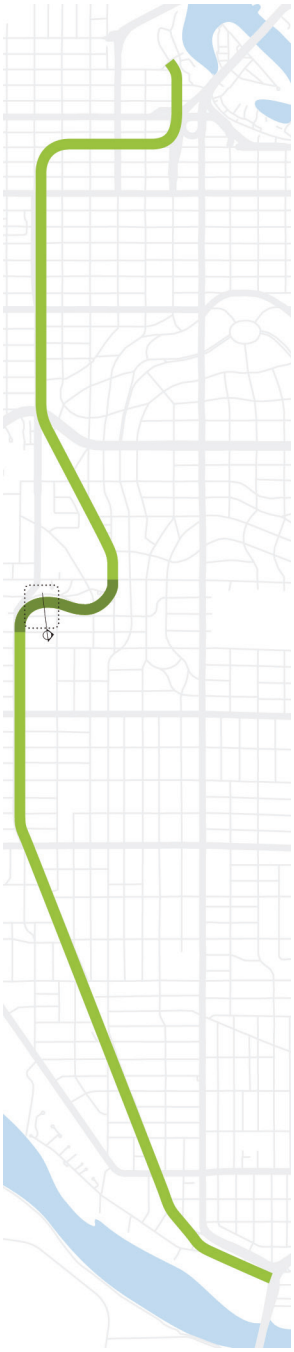
FIGURE 3-9B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-9C *(next page) 1:200 Existing conditions section cut through Pine Crescent looking north from near W 33rd Avenue.*

Quilchena Park


Rail Corridor
20 m
Pine Crescent
7.2 m
Sidewalk
1.8 m
Single Detached
Residential
'Street' Width
29 m


QUILCHENA CRES
ARBUTUS ST
W 35TH AVE
MAPLE ST



THE TUNNEL WITH A VIEW

From W 33rd Avenue to W 37th Avenue, the corridor winds in an S-shape as it gains elevation. Traversing the steep slope between the ridge to the south and the valley of buried MacDonald Creek headwaters to the north, the corridor here is quiet and separated from any streets, with only a residential laneway providing adjacent vehicle access below. Because of the steep slope across the section, this segment of the corridor enjoys an open view over the houses below towards the city and mountains to the north, though several houses on the slope above look down over the corridor as well.

The edges of the corridor here are defined by emabankments and retaining walls, mostly overgrown with extensive Himalayan Blackberry bushes and Japanese Knotweed, both of which are extremely invasive and offer little to local ecology.

Other than access from both ends of this segment, a pedestrian stairway and path connects Cypress Street across the corridor.

FIGURE 3-10A *(opposite) 1:1,000 Orthophoto plan detail of Arbutus Corridor between Quilchena Crescent and W 35th Avenue.*

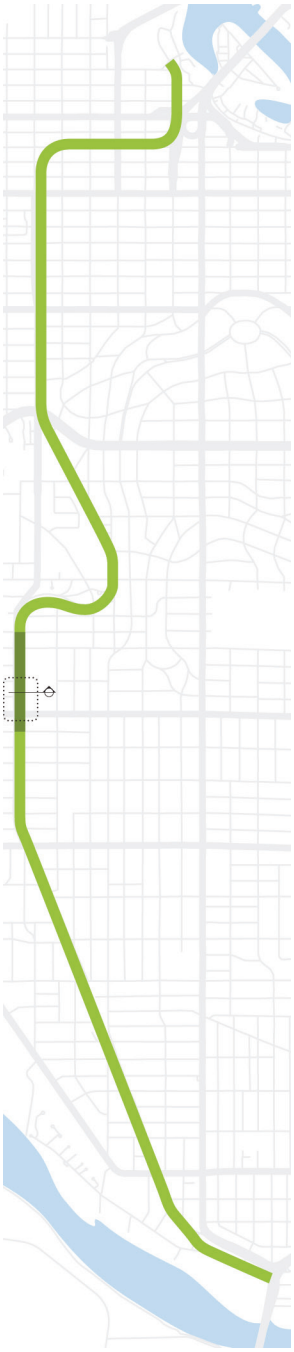
FIGURE 3-10B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-10C *(next page) 1:200 Existing conditions section cut through Arbutus Corridor looking east.*

Single Detached
Residential
Laneway
3.5 m
Rail Corridor
20.5 m
'Street' Width
24 m

Single Detached
Residential

W 39TH AVE
W 40TH AVE
W 41ST AVE
WEST BLVD
EAST BLVD



THE TOWN CENTRE

Kerrisdale Village is centred around the intersection of W 41st Avenue and West Boulevard, with shops and services lining both streets for several blocks. Running parallel to the busy two-lane West Boulevard main street, quieter East Boulevard sandwiches the Arbutus Corridor as a narrow green strip through the middle of the town centre.

Between W 37th Avenue and W 41st Avenue, West Boulevard is lined by two- to four-storey commercial buildings to the west, while parking lots intrude upon the corridor on the east. East Boulevard is essentially only used for street parking and access to additional parking lots serving the high school sports field and a community arena to the east.

With the focus on parking and driving, pavement takes up the majority of space while accessible and useable greenspace is actually quite limited.

FIGURE 3-11A *(opposite) 1:1,000 Orthophoto plan detail of West Boulevard between W 39th Avenue and W 41st Avenue.*

FIGURE 3-11B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-11C *(next page) 1:200 Existing conditions section cut through West Boulevard looking north from near W 42nd Avenue.*

2–4 Storey Commercial | Sidewalk 3.3 m | West Boulevard 13.2 m | Parking 10.5 m | Rail Corridor 9.2 m

'Street' Width 60.9 m

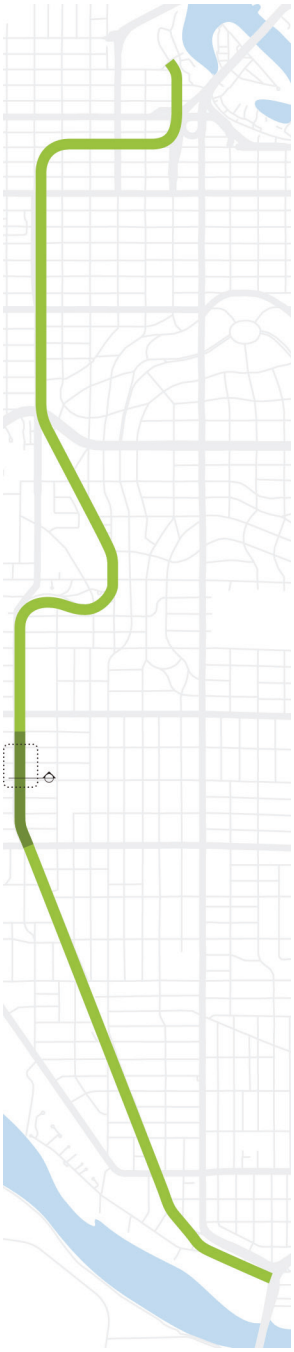
Parking
10.3 m

East Boulevard
9.1 m

Sidewalk
5.3 m

Point Grey Secondary School
Sports Field + Parking

W 43RD AVE
W 44TH AVE
W 45TH AVE
WEST BLVD
EAST BLVD



THE GENEROUS BOULEVARD

From W 41st Avenue south to W 49th Avenue, the corridor continues to be confined between West and East Boulevards. Unlike north of W 41st Avenue, and save for one small parking lot between W 41st and W 42nd Avenues, however, the corridor here is wide and unimpeded by vehicle infrastructure. West Boulevard is the main collector street, lined mostly with one- to two- storey commercial buildings and some newer four-storey mixed-use buildings. East Boulevard is a quieter access route serving mostly three-storey residential apartments with multi-storey commercial buildings between W 41st and W 42nd Avenues.

Wide and grassy, the corridor is lined by a variety of mature street trees which provide generous shade in summer months and shelter sidewalks along both boulevards. Throughout this stretch, only W 45th Avenue is continuous and crosses the corridor, though pedestrian crossing is easy at all points due to the open and grassy nature of the space.

Between W 42nd Avenue and W 43rd Avenue, West Boulevard is also home to a branch of the Vancouver Public Library and the Kerrisdale Community Centre.

FIGURE 3-12A *(opposite) 1:1,000 Orthophoto plan detail of West Boulevard between W 43rd Avenue and W 45th Avenue.*

FIGURE 3-12B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-12C *(next page) 1:200 Existing conditions section cut through West Boulevard looking north from W 45th Avenue.*

1–4 Storey
Commercial + Mixed Use

Sidewalk
2.0 m

West Boulevard
13.7 m

Sidewalk
1.6 m

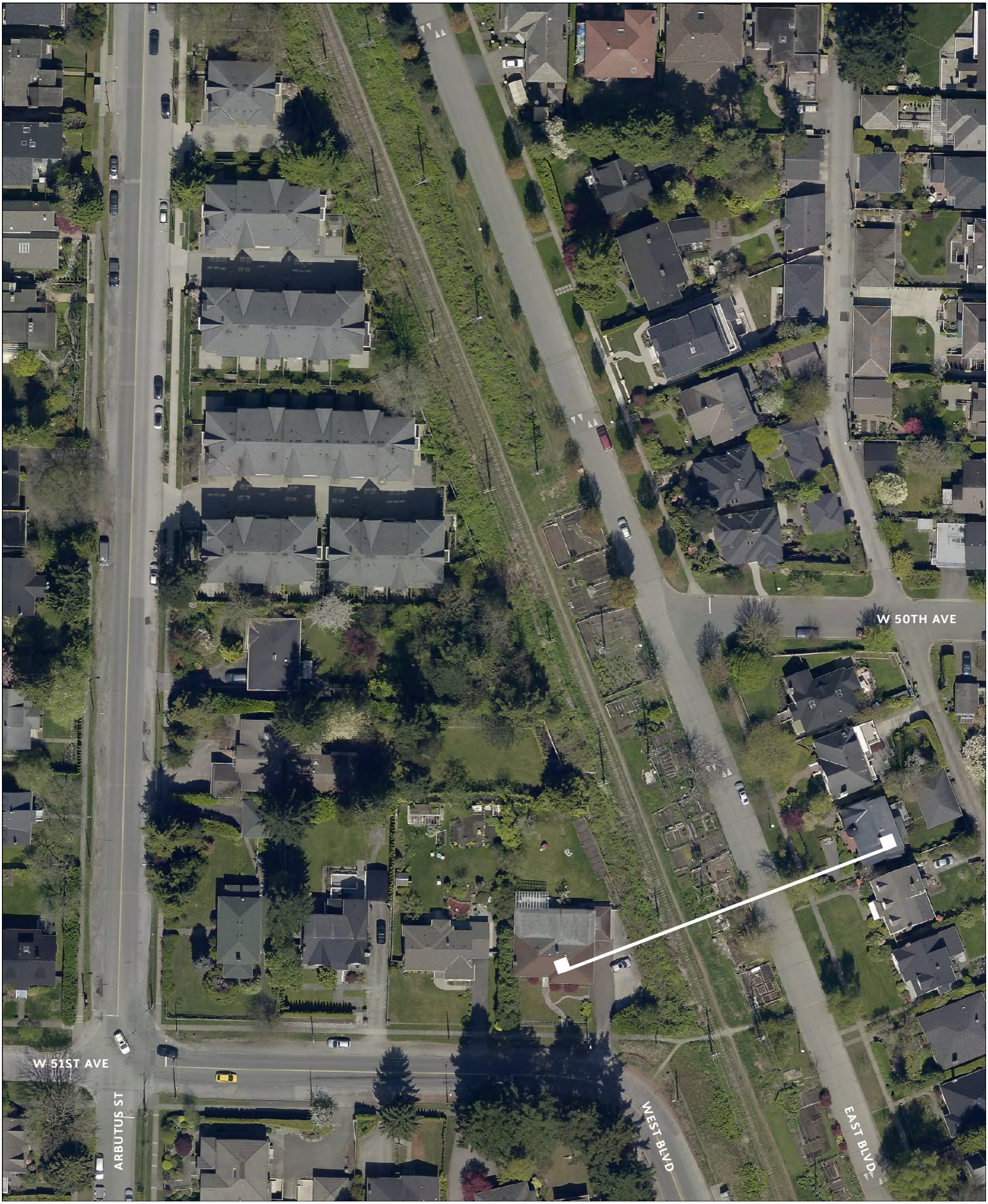
Rail Corridor
28 m

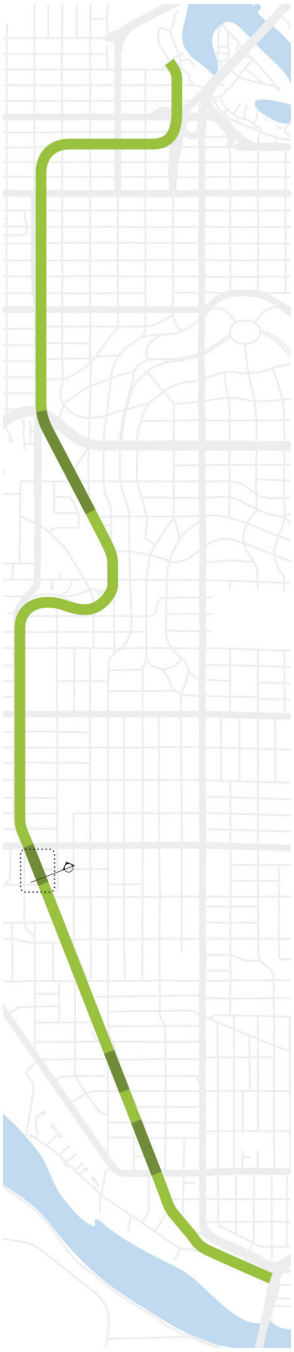
'Street' Width
59 m

East Boulevard
11 m

Sidewalk
2.7 m

2-3 Storey
Residential


W 50TH AVE
W 51ST AVE
ARBUTUS ST
WEST BLVD
EAST BLVD



THE BACKYARD EXTENSION

For multiple shorter segments of the line, the corridor is mostly lined by a quiet residential street on one side and backs onto either residential yards or rear laneways to the other.

From W King Edward Street to W 29th Avenue, the corridor abuts Maple Cresent to the east. Between W King Edward Avenue and Nanton Avenue, the west side of the corridor lies adjacent to the Arbutus Club private sports facility, as well as an electrical substation. For much of this block, the corridor is visually and physically separated from the street by tall cedar hedges that line the curb. South of Nanton Avenue, the corridor is open to Maple Crescent, and backs onto a residential laneway on the west, though it is separated by Himalayan Blackberry bushes and trees.

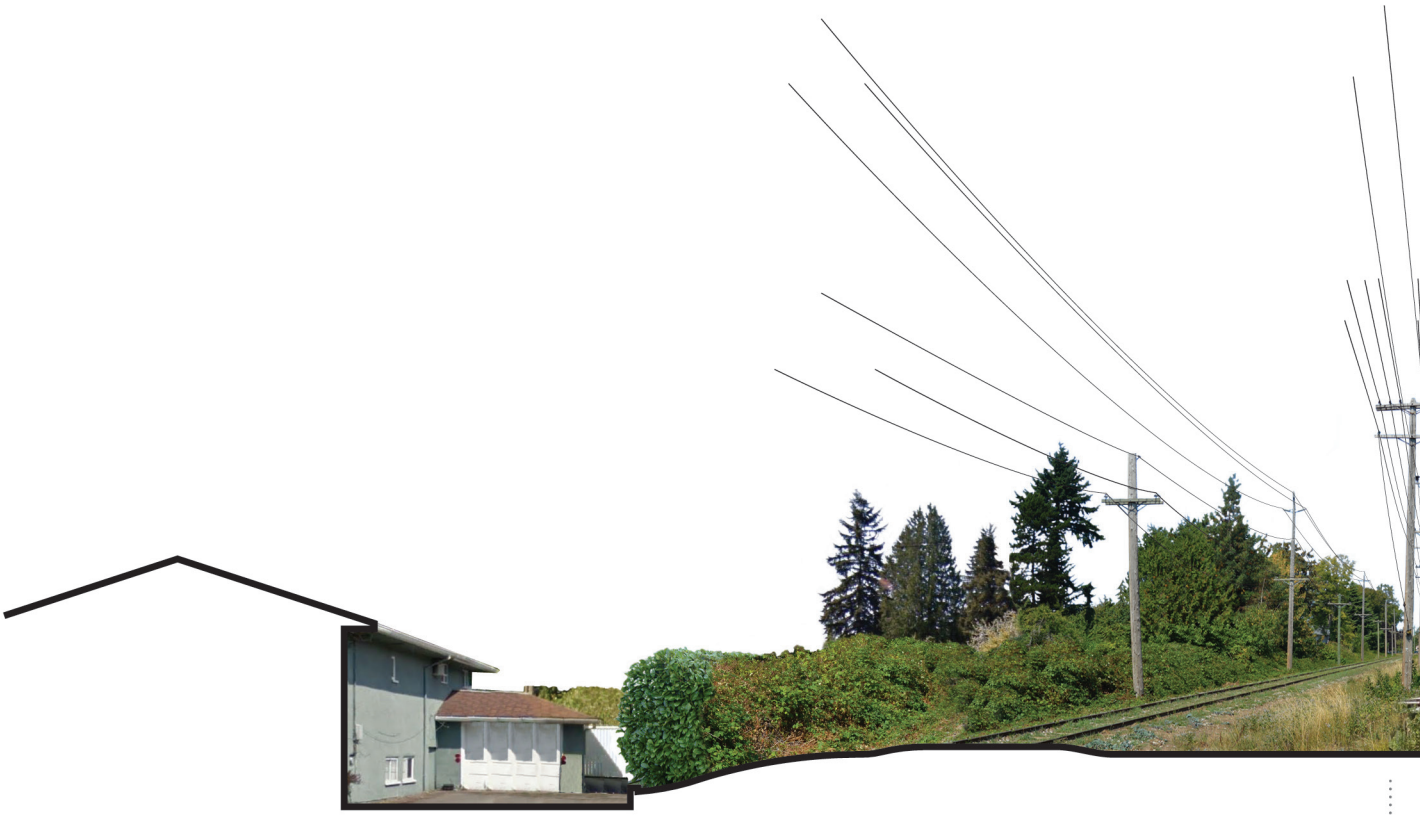
From W 49th Avenue to W 51st Avenue and W 61st Avenue to W 64th Avenue, the corridor backs onto a variety of single detached homes and three-storey apartments, separated by a mix of hedges, trees and blackberry. East Boulevard is a residential collector street here, running along the east edge of the corridor, but with blocks running east west so no houses front towards the corridor.

Between W 66th Avenue to SW Marine Drive, the corridor once again runs along East Boulevard and backs onto residential laneways.

FIGURE 3-13A *(opposite) 1:1,000 Orthophoto plan detail of East Boulevard between W 49th Avenue and W 51st Avenue.*

FIGURE 3-13B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-13C *(next page) 1:200 Existing conditions section cut through East Boulevard looking north from near W 51st Avenue.*



Single Detached
Residential

Rail Corridor
20.1 m

'Street' Width
39.1 m

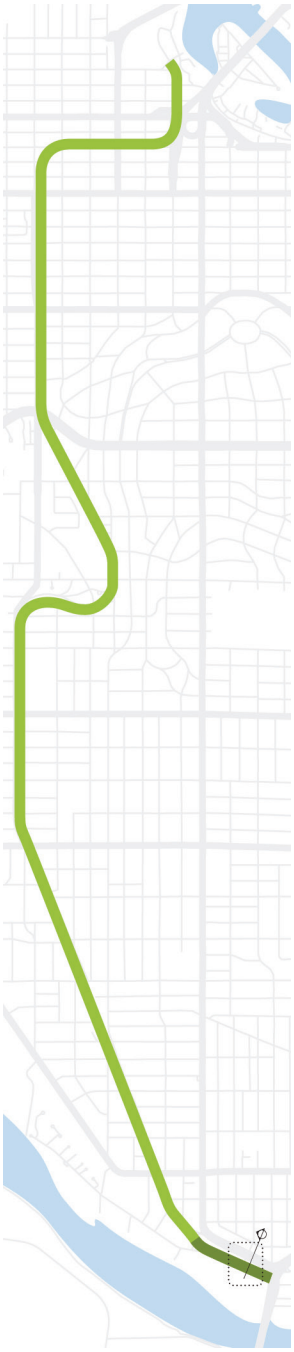
Community Gardens 6.3 m

East Boulevard 7.6 m

Sidewalk 5.1 m

Single Detached Residential

SW MARINE DR
MONTCALM ST



THE TRANSIT YARD

Stretching from Milton Street to Hudson Street under the Arthur Laing Bridge, this section marks the southern terminus of the corridor near the Fraser River.

Immediately adjacent to the southern edge of the corridor through this section is an unutilized right-of-way for 75th Avenue, which currently stops at Milton Street to the west. South of that, the segment is bordered by a large Imperial Parking lot, and the Vancouver Transit Centre, which serves as a garage for most of the diesel and electric trolley buses that operate in the city.

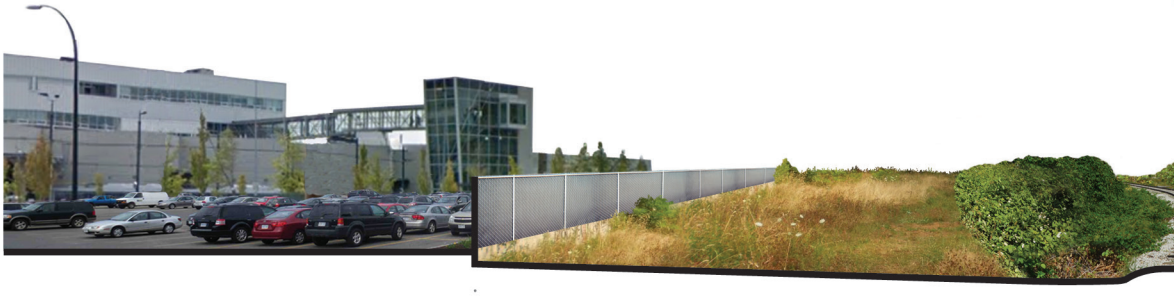
The north edge of the corridor through this section is bounded by retaining walls and embankment, on top of which sit a strip mall, theatre, and other commercial units. The embankment is also the site of the historic Musqueam Marpole Village Site, and the presence of a midden and ancient burial remains sparked conflict between developers and Musqueam First Nation when permits were issued for the construction of a condominium in 2011. The Musqueam Band has since purchased the property and plans to restore the site.

While this marks the end of the the rail property that has been acquired by the city, the rail line continues along the original New Westminster and Steveston interurban routes from this point forward.

FIGURE 3-14A *(opposite) 1:1,000 Orthophoto plan detail of Arbutus Corridor and the W 75th Avenue right-of-way between SW Marine Drive and the Vancouver Transit Centre.*

FIGURE 3-14B *Key plan showing where plan detail is taken and where similar typology exists along the corridor.*

FIGURE 3-14C *(next page) 1:200 Existing conditions section cut through the corridor and the W 75th Avenue right-of-way looking northwest from near Montcalm Street.*



Vancouver Transit Centre,
Parking, and Industrial

75th Avenue Right-of-way
20.5 m

Rail Corridor
20.1 m

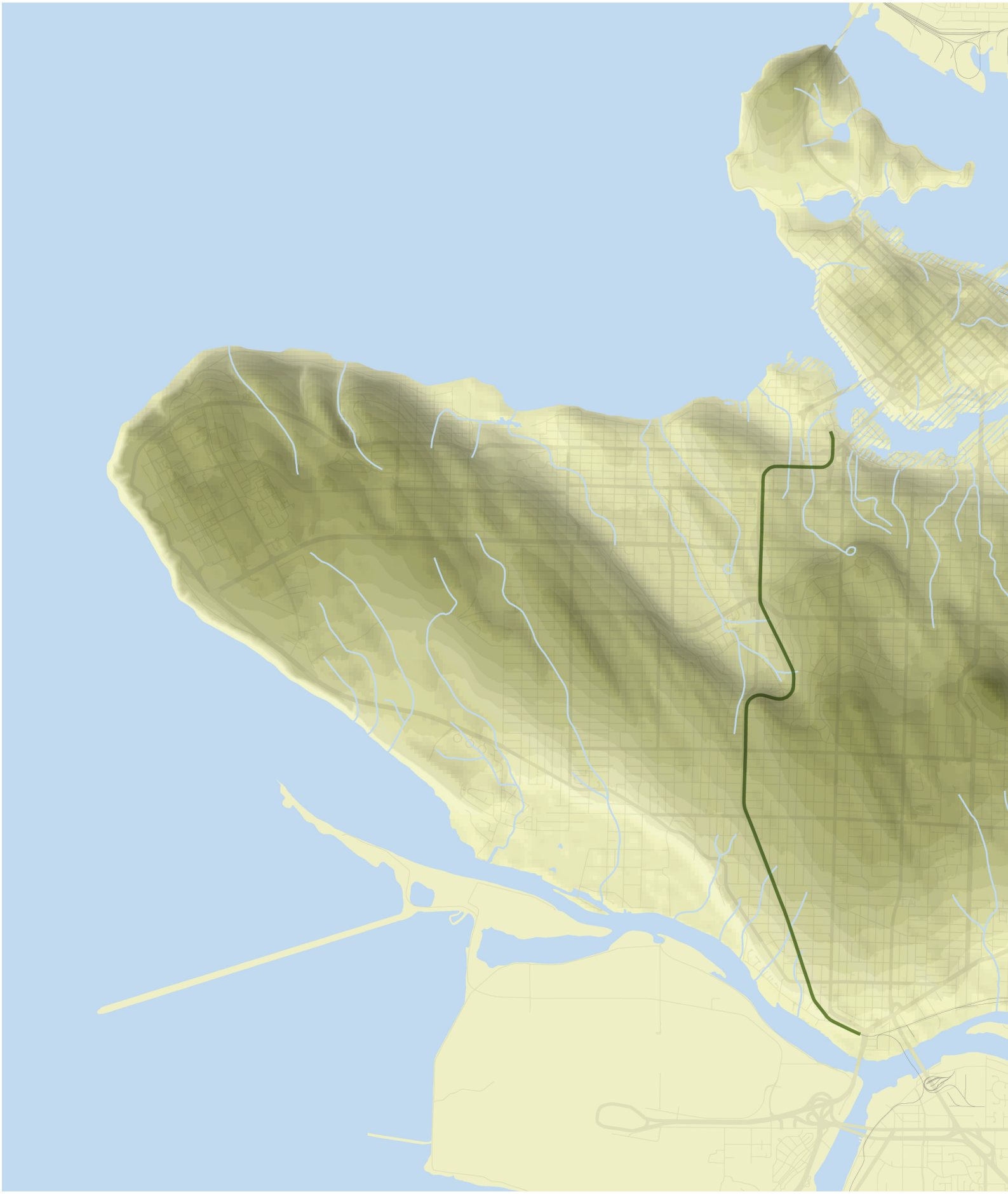
1 Storey Commercial

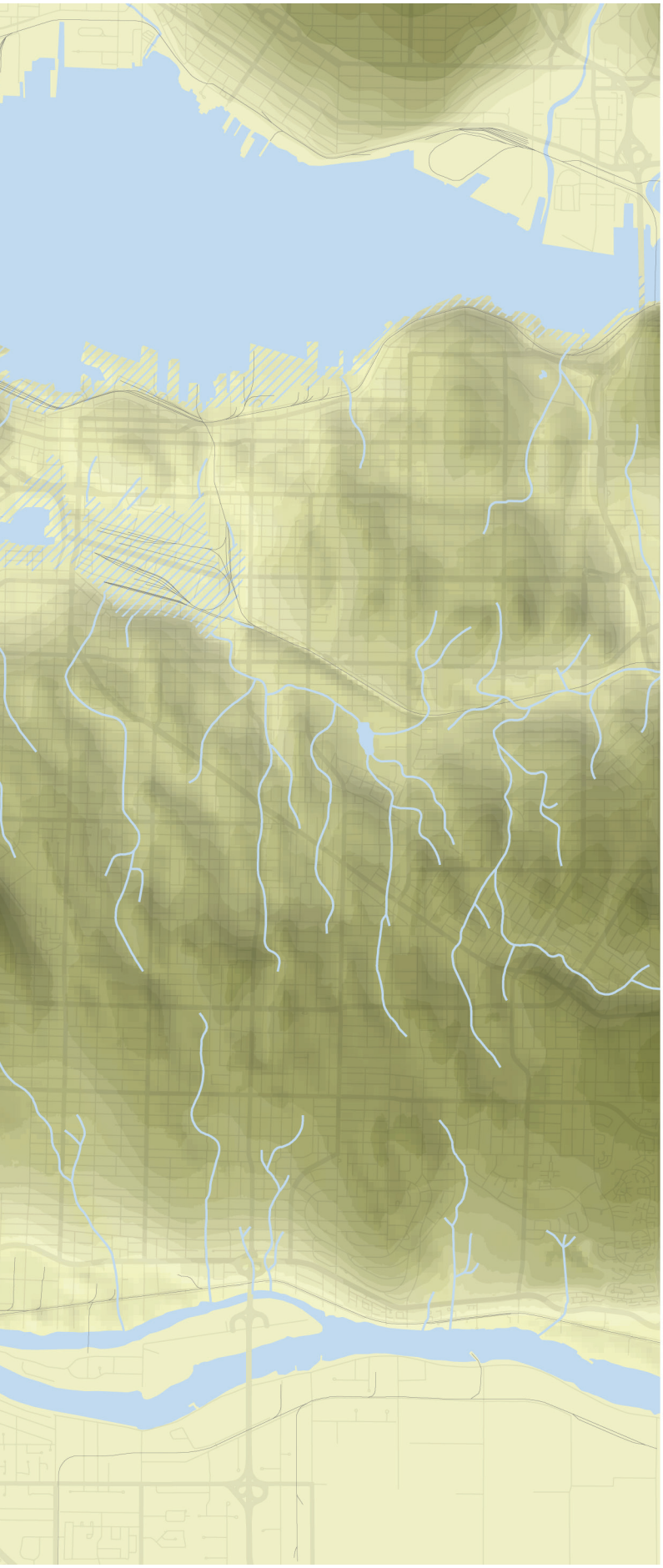
Full Corridor Width
40.6 m

Analyzing the Urban Geography

While the previous section analyzed the spatial typologies that characterize the corridor at the scale of a city block, it is also important to understand the corridor as a continuous element within the larger scale of the city. The maps within this section illustrate the corridor within the context of the city, pulling out specific layers of the urban fabric to show how the corridor is affected by and affects the city around it.

These maps act in addition to the figures from section 1.2 to provide an understanding of the social, ecological, and infrastructural context in which the corridor exists. Together they inform the design response in part four.



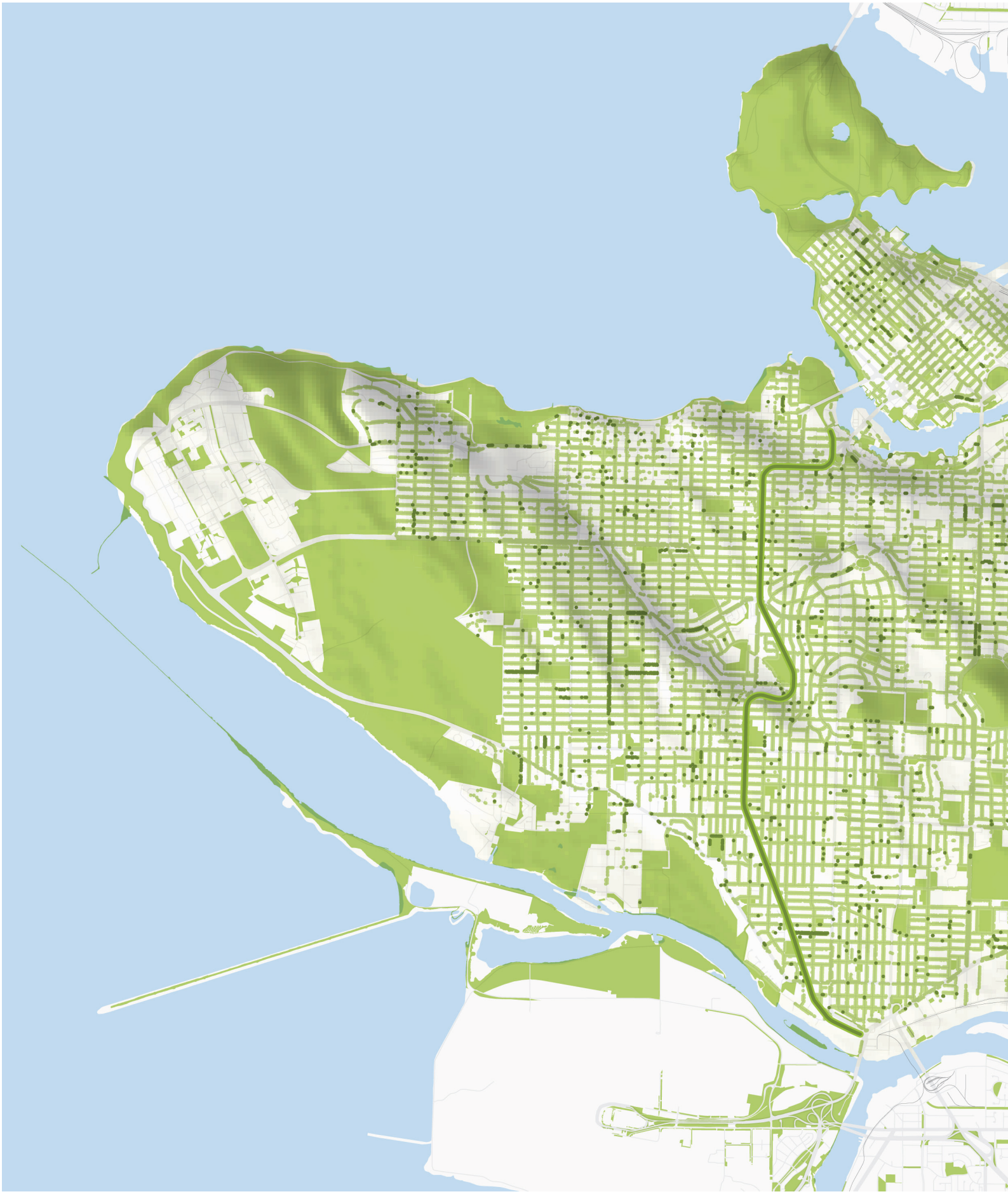


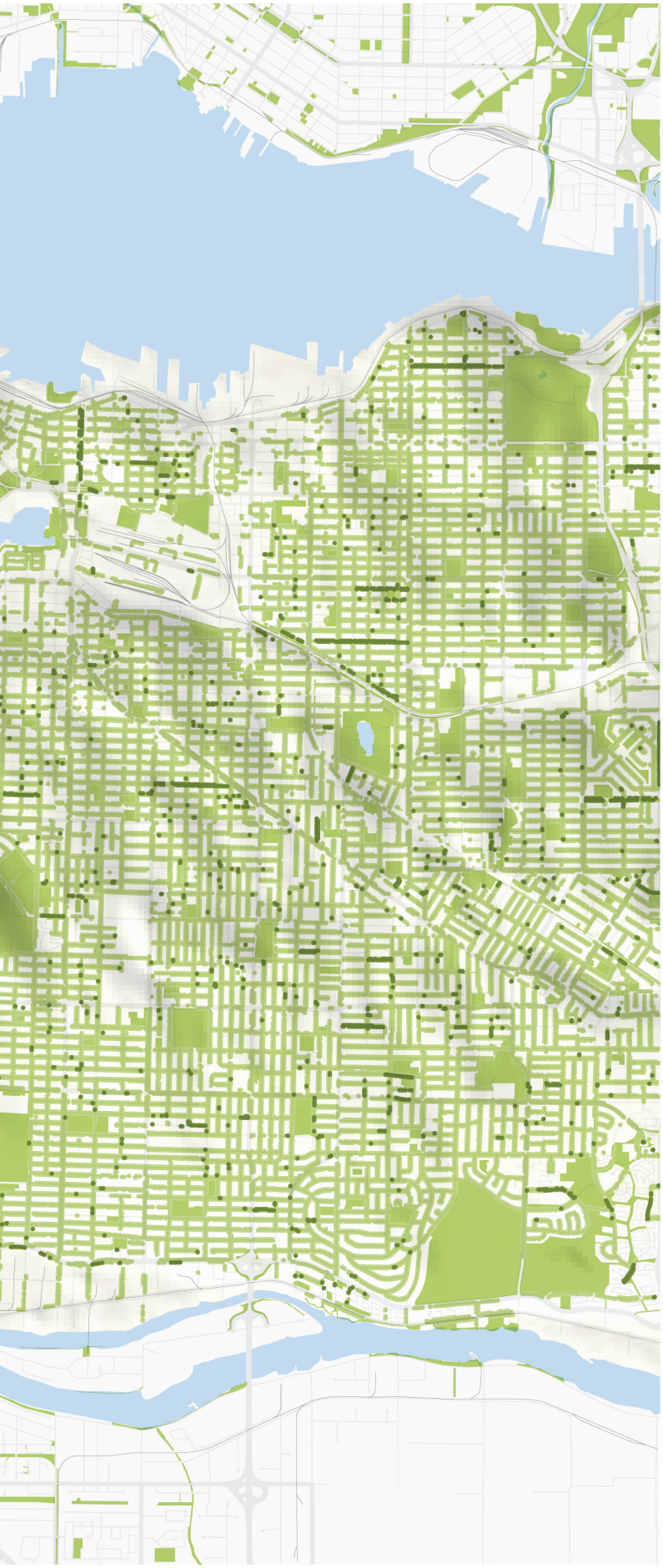
GEOGRAPHY OF THE CITY AND THE CORRIDOR

With its origins as a rail line, the Arbutus Corridor carefully follows the landscape to weave the shortest path between False Creek and the Fraser River while minimizing the slope at any one point. As such, the corridor offers a relatively flat route through some otherwise hilly areas in the city, making it ideal for both cyclists and modern transit options.

Of course, streams also follow, and indeed form, the landscape as well. While most of Vancouver's streams were buried in decades past, some efforts have been made to restore them where possible. However, as the corridor crosses only the headwaters of a few small streams perpendicularly, it's likely not an ideal intervention to be made unless there is the potential to continue daylighting the stream beyond the narrow boundary of the corridor.

FIGURE 3-15 *Geography of the city and the corridor.*





STREET TREES, PARKS + GREEN SPACE

Vancouver is blessed with many parks that were set aside during it's formative years. Additionally, the city boasts an extensive coverage of street trees. According to MIT's Treepedia, which ranks major cities by the percentage of google street view images covered by tree canopy, the city has 25.9% coverage, tying it for third globally with Sydney even though the city's population density outperforms all the leaders except Singapore in the number one spot.

While the city's tree coverage is beautiful, a closer look at species reveals most of the street trees are non-native. As such, their value as habitat and food for birds and animals, climate change adaptability, and generally as a reservoir of regionally appropriate biodiversity is not easily determined.

In order to increase ecological resilience, trees and other vegetation should be planted according to existing, regionally native biogeoclimatic groupings that are likely to perform well now and into the future as they adapt and transition with environmental changes. Redeveloping the Arbutus Corridor is a perfect opportunity to remove invasive species and replace them with more beneficial and resilient plant communities.

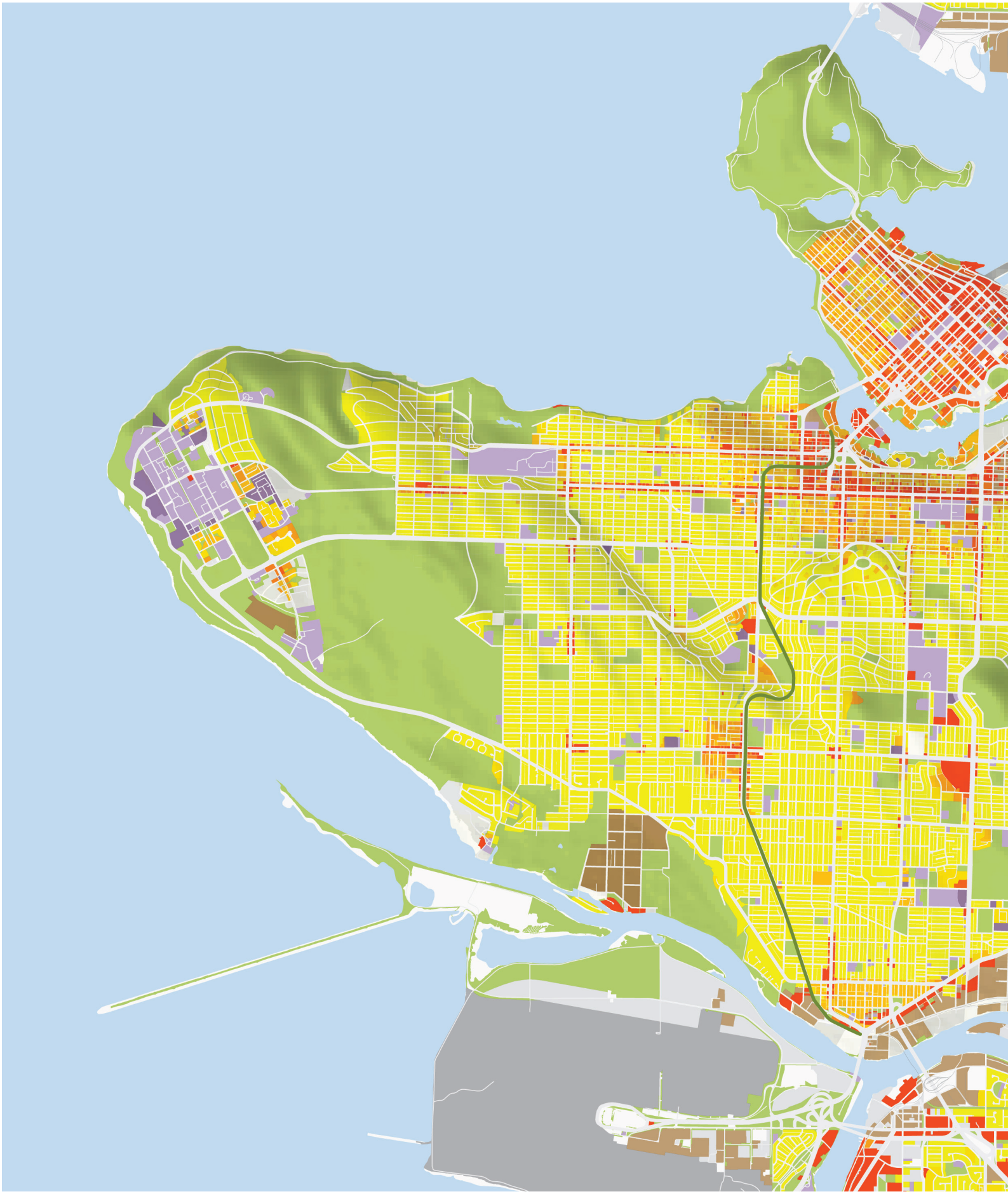
FIGURE 3-16 *Street trees, parks and green space.*

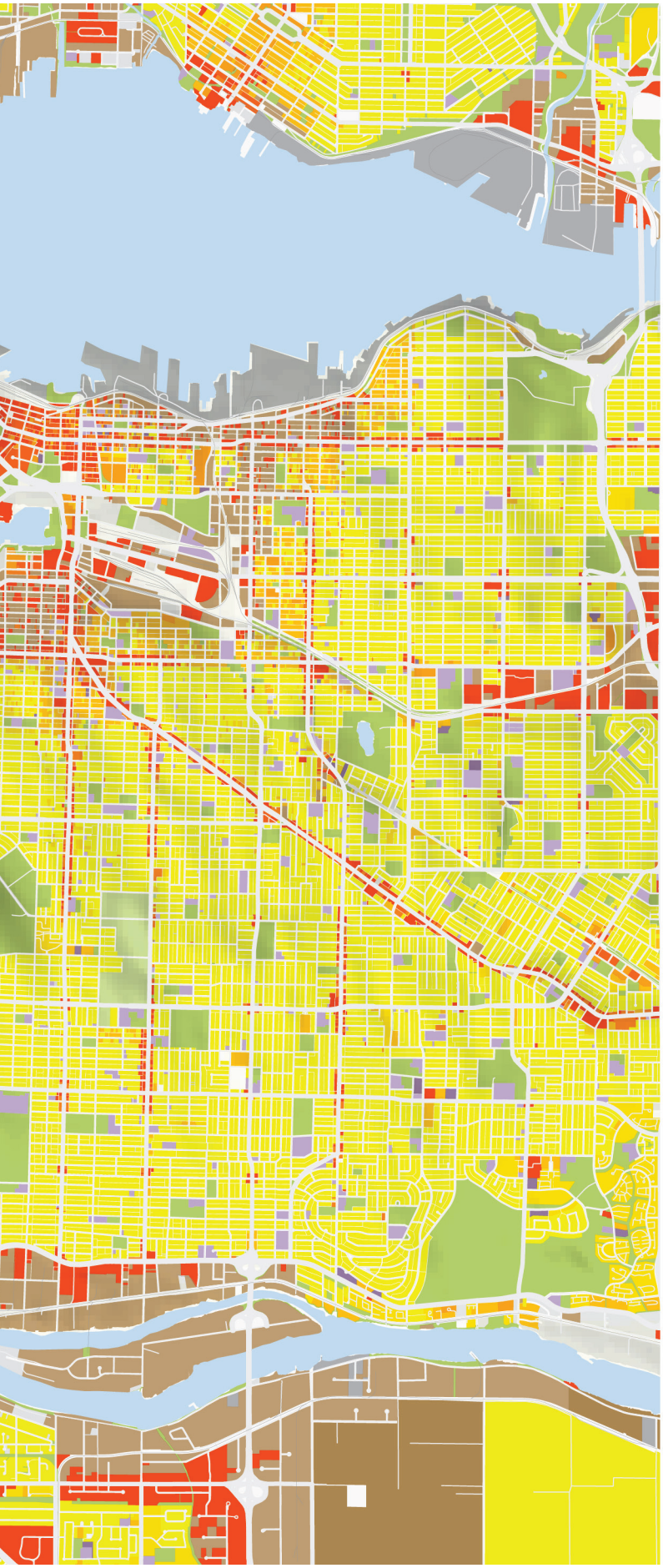
PARKS + GREEN SPACE

- Arbutus Corridor Greenway
- Parks
- Street Trees - Native
- Street Trees - Non-native

SCALE 1:60,000

0 500 1000 2000 4000 m



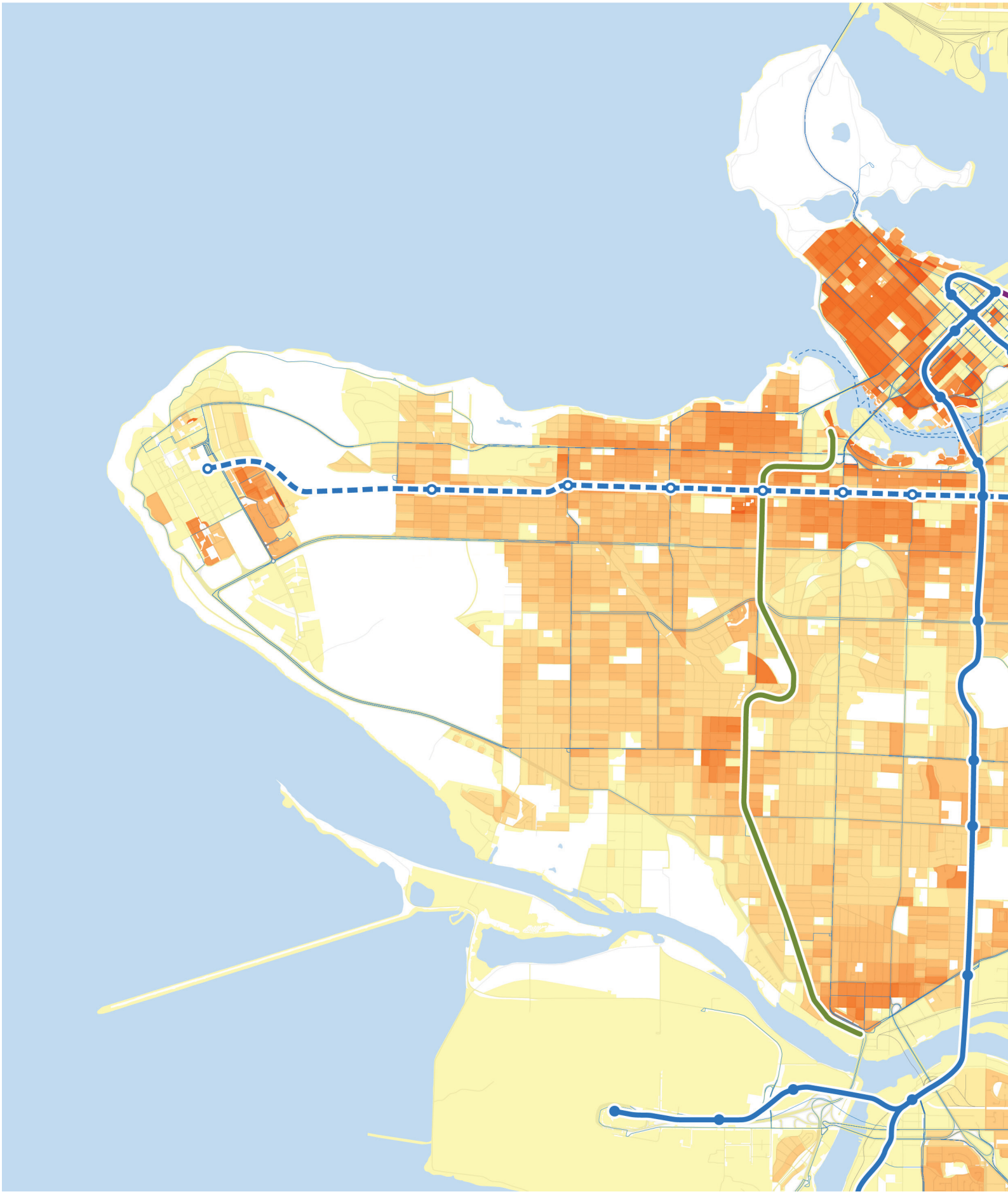


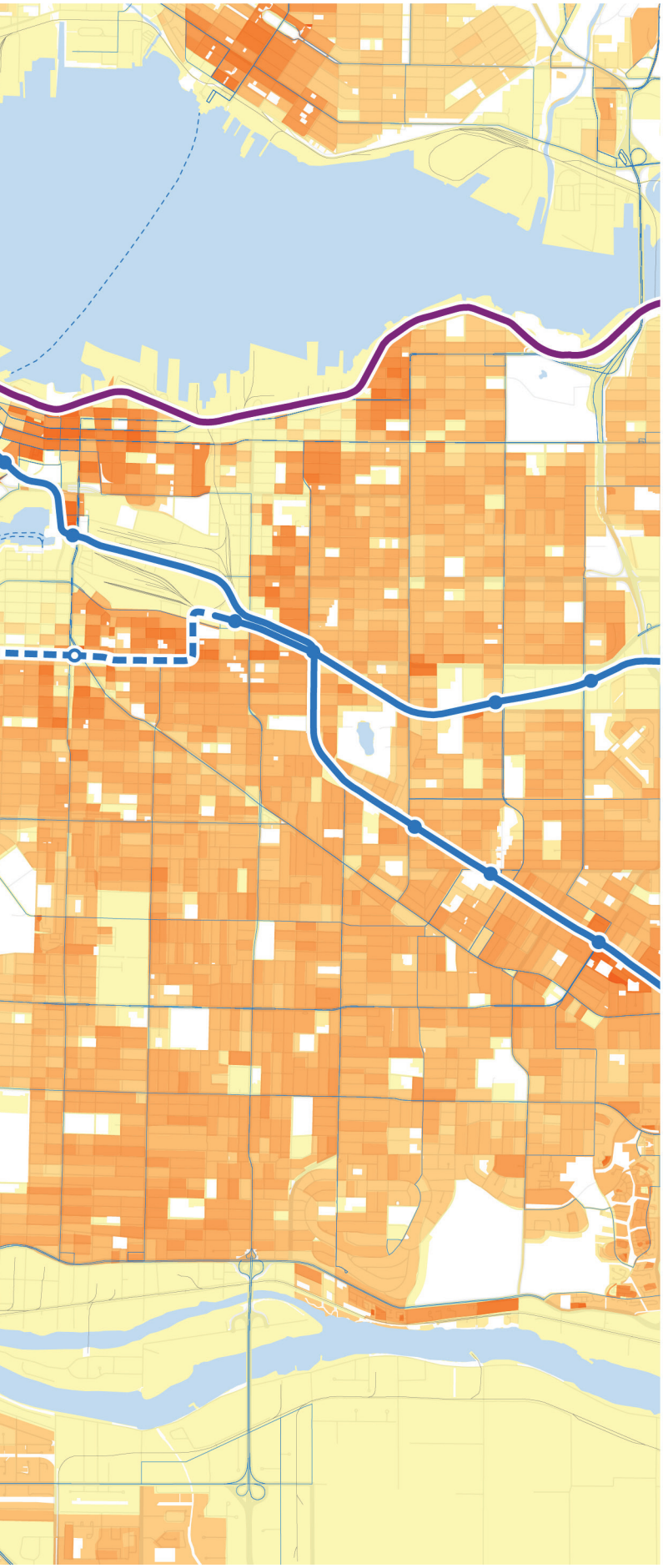
LAND USE ALONG THE CORRIDOR

While zoning plans provide a rough idea of land use, some zones allow a variety of uses other than their primary intent. The actual land use provides a more accurate picture of how properties are being utilized.

As can be seen, the Arbutus Corridor travels through a few main land use zones, with single detached residences being the most prevalent. Beyond this, it's clear to see increased density and commercial use in Kitsilano, Kerrisdale, and Marpole. Some industrial use remains active at the south end of the line along the Fraser River.

FIGURE 3-17 *Current land use in Vancouver.*





TRANSIT AND POPULATION DENSITY

While Skytrain rapid transit currently connects Downtown Vancouver with regional centres, the dense population centres of Kitsilano, Kerrisdale, and Marpole—all situated along the Arbutus Corridor—are served by traditional bus transit only, and are poorly connected to other population centres and business areas.

With the Number 16 Arbutus bus route that closely follows the corridor being one of the busiest routes in the region, and the Canada Line Skytrain to Richmond growing to capacity faster than expected, providing a faster option to Vancouver's west side residents would help relieve both lines while encouraging increased transit use generally.

FIGURE 3-18 *Transit and population density in Vancouver.*

Arbutus Corridor

VANCOUVER TRANSIT NETWORK

- Existing Skytrain Rapid Transit
- Planned Skytrain Extension to UBC
- West Coast Express Commuter Rail
- Bus Routes
- Passenger Ferry

POPULATION/HECTARE

- 0-10
- 11-20
- 21-35
- 36-50
- 51-70
- 71-100
- 101-140
- 141-200
- 201-300
- 301-500
- 501-800
- ≥801

SCALE 1:60,000

0 500 1000 2000 4000 m

A VISION FOR THE ARBUTUS CORRIDOR

part four

VANCOUVER
pop. 648,000
KITSILANO
KERRISDALE
MARPOLE
VANCOUVER INTERNATIONAL AIRPORT
22.3M annual passengers
23,000 daily workforce
RICHMOND
pop. 218,000

Envisioning a Resilient Vancouver

In developing a design for the redevelopment of the Arbutus Corridor, attention has been given to the socio-economic and ecological-infrastructural opportunities for resilience that were discussed in part one, while responding to local conditions along the length of the corridor. The resultant proposal is a multi-prong strategy at a variety of scales.

At the large scale of the city, the corridor is reimagined first and foremost as a multi-modal transportation spine that connects Vancouver's western neighbourhoods to downtown Vancouver and Richmond. Prioritizing people over vehicles, the corridor features a separate pedestrian walkway and a continuous dedicated off-street bike path between Richmond and existing protected bike paths across the Burrard Street Bridge to downtown.

An LRT provides rapid and reliable transit to downtown, and connects with Richmond-Bridgeport Skytrain station in Richmond to connect with Vancouver International Airport and downtown Richmond. As an alternative north south rapid transit route between Richmond and downtown Vancouver, this line will absorb riders from west of the Canada Line Skytrain, helping alleviate crowding as that line approaches capacity.

The second priority at this scale is supporting ecological resilience along the line and throughout the city. To support this in broad strokes, the line becomes an ecological corridor woven through the previously described transportation infrastructure.

At this scale, it is also important to discuss the resilience of the urban fabric surrounding the corridor. While a master plan for the city, new zoning patterns, neighbourhood schemes or specific building plans to address housing availability and affordability is beyond the scope of this thesis, it is hoped for and intended for the city to cooperate with provincial and federal government on the extensive initiatives discussed in part one.

For the part of this thesis, the corridor is envisioned as an armature to support increasing urban density along its length through the organic, yet guided, redevelopment of suburban neighbourhoods into walkable communities with new Missing Middle housing options. With the redevelopment of the corridor making neighbourhoods along the line more desirable, some level of environmental gentrification is expected. However, it is hoped that regulatory tools, the lower density suburban nature of the communities, and increasing housing density is enough to help make housing in this area of the city more affordable and available to a more diverse demographic of residents.

FIGURE 4-1 *(opposite) City-scale design parti. The new greenway will serve as a multi-modal transportation spine, linking neighbourboods along the corridor with Downtown Vancouver, Richmond, and the Vancouver International Airport.*

FIGURE 4-2 *In Cities for People, urbanist Jan Gehl makes the case for people-friendly cities. Prioritizing people, cyclists, transit, and then vehicles in the design of urban spaces makes communities more desirable and resilient.*

At the medium scale of the corridor, a variety of site constraints and operational preferences influence the alignment of different components in different sections. In the north, the functional necessity to continue the LRT directly downtown causes it to diverge from the historical rail right-of-way to the Granville Street Bridge, leaving a stretch of the corridor without LRT but with increased opportunity for public space and vegetation.

Between W 6th Ave and W 16th Ave, the narrow width of the corridor makes tunneling the LRT the best option in order to accommodate the other components of the corridor, making the LRT a mixed profile at-grade/below-grade line. Through this section, it was also determined that the bike path is best aligned as a protected bike path alongside traffic to help mitigate conflict at arterial crossings.

At the south end of the corridor, an extension of the LRT over a new North Arm bridge crossing allows a terminus station to be located in the vacant lot next to Richmond-Bridgeport station, linking the two transit lines together conveniently. The bike path will also share this new bridge, connecting the Arbutus Corridor bike route to Richmond.

Where practical, the LRT is also designed to run via groundlevel switched contact system to eliminate the more traditional overhead catenary wire system. While more expensive, this system provides multiple benefits. First, clearing the poles and wires from the length of the corridor is much more aesthetically pleasing. Secondly,

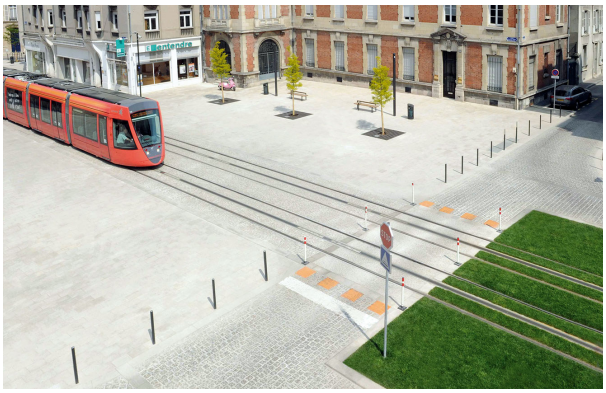


FIGURE 4-3 *Catenaryless LRT systems eliminate unsightly overhead wires and poles, and can easily transition between varied surfaces.*

FIGURE 4-4 *Enclosed bike parkades allow members to lock their bike securely and out of the weather at transit stops or other high traffic destinations.*

it also reduces conflict and clearance requirements for trees planted in the corridor. Finally, eliminating the overhead wires prevents the risk of trees and branches falling on and breaking the wires during storms, or potential icestorms from damaging the wires. For similar reasons, all of the utility lines that exist along the corridor currently have also been routed underground in the design proposal.

At this scale, it also becomes clear that the roadways adjacent to the corridor can be better redesigned. Between W Broadway and W 37th Avenue, Arbutus Street is overdesigned for vehicle traffic that does not exist. Between W 16th Ave and W King Edward Ave, and between W 37th Ave and W 49th Ave, East Boulevard is a redundant street with little purpose other than parking. Through these sections in particular, surplus road width was reclaimed as part of the corridor for increased greenspace. Throughout the rest of the corridor, any additional width beyond the minimum necessary was also reclaimed, providing extra greenspace along the edges. Curb bump-outs and improved crossings make roads safer for pedestrians and improve the walkability of the corridor.

Bike infrastructure is also an important feature at this scale. In order to support a growing bike culture, secure covered bike parkades with tool stations at LRT stops and ample bike racks along the corridor are important. Added Mobi Bike Share stations along the corridor would provide flexible bike solutions to all residents and visitors.

Ecological design interventions at this scale reflect the many environmental challenges and opportunities discussed in part one. The planting of native trees and Coastal Douglas Fir plant communities in particular is aimed to counteract the city-wide loss of tree canopy in recent decades, while increasing habitat for birds, insects, and small animals in the city. The increased tree coverage will also improve the microclimate along the corridor, help ameliorate local carbon emissions and improve air quality, and provide numerous mental and physical health benefits to the corridors' users.

Along with native tree coverage, native gardens planted with pollinator friendly species will help provide habitat and food for insects, birds, and small animals within the city. In turn, pollinators will help existing and expanded community gardens and fruit and nut trees along the corridor to be more productive.

Bioswales in curb bump-outs, medians, and alongside the bike path are included to help manage stormwater. In addition to increasing groundwater absorption and reducing flooding during extreme weather events, these wetland retention ponds help clean pollutants from surface runoff, reducing urban impacts on water resources.

Where possible, the LRT runs on tracks embedded in a vegetated blend made up of local native grass and flower species. This aims to further expand pollinator habitat, maximize pervious surface for water absorption, and also eliminate the likely impacts of invasive Chafer beetles if traditional turf grass was used.

FIGURE 4-5 *Curb bump-outs and raised crosswalks increase pedestrian safety at crossings, while also providing space for bioswales at the end of parking zones.*

FIGURE 4-6 *Pollinator gardens provide a safe haven for insects and habitat for birds.*

Along the length of the corridor, the pedestrian walkway will link a series of diverse public spaces that provide the community with a range of amenities. A non-exhaustive list of examples includes tree lined plazas with sitting areas, children's playgrounds, adult exercise parks, splash pads, public washrooms, grassy knolls and open grass yards, community gardens, art plazas, performance spaces, covered picnic tables, group gathering spaces, and enclosed off-leash dog parks.

At the small scale, several details communicate a local modern-vernacular architectural language of the corridor design, and also improve the user experience and safety. For the bike path, gently profiled curbs frame the asphalt roadway for added safety. While aesthetically pleasing, this design improves safety for cyclists by gently redirecting tires onto the road as you approach the edge. Throughout the corridor, crossings safety is improved for both cyclists and pedestrians by using raised crosswalks. While pedestrian crossings are marked with high visibility zebra stripes, bike crossings are painted green and lined with elephant's feet. Pedestrian crossing safety is further increased for the visually impaired using truncated domes at all curb letdowns.

Architecturally, a consistent visual language is used across the length of the corridor to maintain its continuity. A main palette of timber, corten steel, glass, and stone pavers, speaks to a west coast materiality and helps root the corridor in its location. LRT station canopies, for example, feature timber framed and glass roofs sitting on

FIGURE 4-7 *Playgrounds and plazas with splash pads are two examples of the diverse civic amenities that will be found along the length of the corridor.*

FIGURE 4-8 *Gently sloped curbs along the bike path define the edge and contain the roadbed while improving safety for cyclists who pedal too close.*

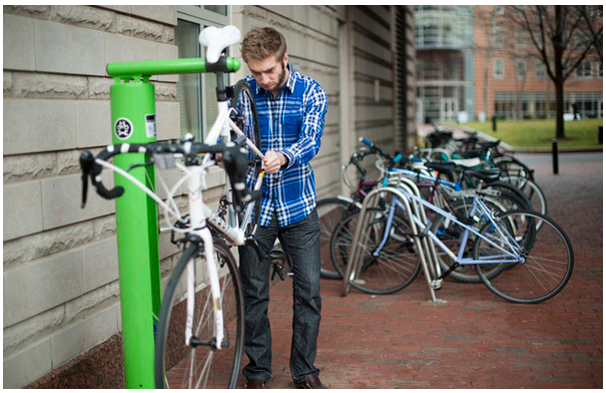


FIGURE 4-9 *Ample bike racks and bike repair stations along the corridor support cycling as an excellent option to get around the city.*

steel columns. Benches along the corridor are a combination of corten steel supports and heavy timber sections.

Design details also highlight the rail heritage of the corridor. Where the LRT dives underground, steel rails are embedded in the footpath along the corridor surface as a reminder of the corridor's history. North of W 5th Ave, after the LRT line diverts to the Granville Street Bridge, rails frame the edges of the bioswale that divides the bike path from the pedestrian plaza.

Taken altogether, the design strategy and elements described here and illustrated further in this section aim to implement the findings of part one. Through this design, the redevelopment of the Arbutus Corridor can help improve the long-term resilience of the city through which it winds.

Studying Options

With many components running down a narrow corridor, it is a challenge to fit all of the desired elements into the available space. Pedestrian paths, bike lanes, LRT track, civic amenities, ecological zones, infrastructure, and of course vehicle traffic and parking all compete for space along the corridor. This is particularly challenging between W 6th Avenue and W 16th Avenue, where the corridor is especially narrow. Here, the rail corridor runs just over fifteen metres wide from property line to property line, with adjacent buildings being built right up to or close to the boundary.

Through this section, the corridor is also offset from Arbutus Street, making crossings of perpendicular streets a challenge. While smaller neighbourhood streets are generally not of concern, and can be easily controlled with stop signs and lights, the three busy arterial routes of W Broadway, W 12th Avenue, and W 16th Avenue are more challenging. For these streets, a secondary controlled intersection for LRT, pedestrians, and cyclists would at the very least be difficult to coordinate with the main road intersections only fifteen metres away. More likely, introducing this complexity would cause traffic delays and potential conflict between vehicles and other users.

For this reason, a study of several alignments was carried out to help determine the ideal option in this section of the corridor. Ultimately, it was determined that a mixed profile for the LRT is the best solution, with the regularly at grade LRT line diving below grade through this section of the corridor.

At the north end of the corridor is a different challenge. To provide the best service for LRT users on the line, it is desirable for the LRT to directly connect downtown without transfers. In order to accomplish this, however, there are only a few plausible options, which are studied in this section.

Options studied include tunneling, using the Burrard Street Bridge, and terminating the line with a connection to the Southeast False Creek LRT line that was upgraded for the 2010 Winter Olympics, and which itself connects to the Canada Line Skytrain to downtown.

Based on traffic studies that show Granville Street Bridge to have significant extra capacity compared to other downtown bridges, as well as other factors, it was ultimately determined that the best option is to divert the LRT from the Arbutus Corridor at W 5th Avenue, through the Granville Loop transit hub, and over the Granville Street bridge to downtown.

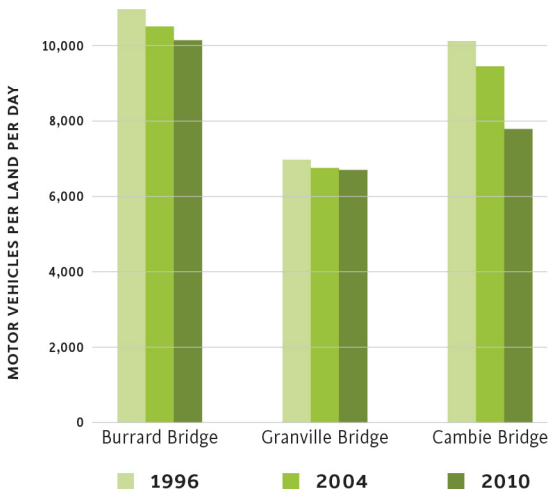


FIGURE 4-10 *Traffic capacity of downtown bridges. With four lanes in each direction and low per-lane traffic, removing two lanes from the Granville Street Bridge for LRT would provide a valuable new transit connection while having little impact on vehicle traffic.*

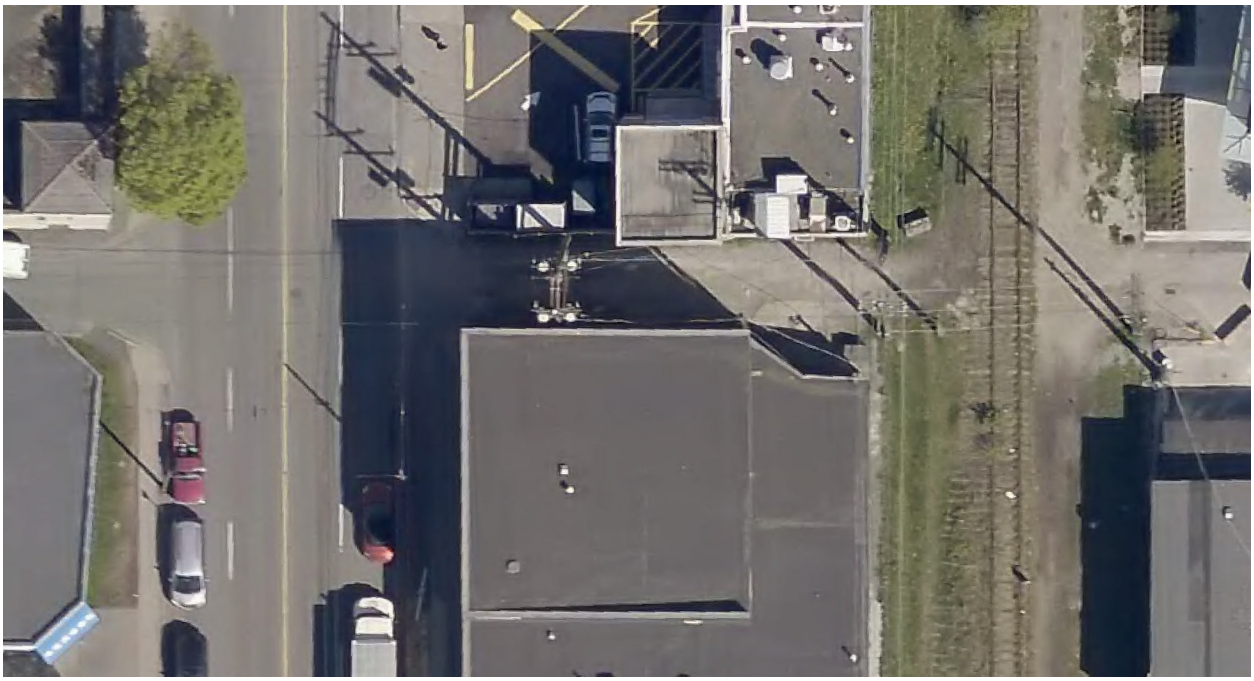


FIGURE 4-11 *Arbutus Street and the Arbutus Corridor between W Broadway and W 10th Ave, a typical cross-section between W 6th Ave and W 16th Ave. Scale 1:425.*

FIGURE 4-12 *Alignment Option 1 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 1

The most obvious option, placing the LRT and separated bike path in the corridor, while keeping Arbutus Street unaltered. Through pedestrian walkways can extend from the LRT station platforms. Alternatively, the extra space between tracks can be used for vegetation and bioswales, with LRT platforms accessible from cross street sidewalks and pedestrians relegated to existing sidewalks on Arbutus Street. This option is far from ideal, as it fails to capitalize on the potential for green space and new park amenity within the corridor, provides insufficient clearance to property lines, and misses the opportunity to improve the Arbutus Street road corridor. Crossing streets—particularly W Broadway, W 12th Ave, and W 16th Ave arterials—is a challenge to coordinate with traffic, and requires separate signaling in close proximity to other major intersections.

FIGURE 4-13 *Alignment Option 2 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 2

Similar to option 1, with LRT tracks separated to accommodate a centre platform alternative. Using a centre platform maximizes the flexibility of the space allotted for platforms and reduces risk of overflow during peak traffic. It also serves better as a through pedestrian walkway, or a single larger space for vegetation and bioswales between tracks. Unfortunately, the same weaknesses faced by option 1 apply to this option as well. This section of the corridor is simply to tight to fit LRT, bike paths, pedestrian paths, and vegetation, let alone other amenities or features.

FIGURE 4-14 *Alignment Option 3 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 3

Another alternative to option 1, this alignment tries to solve the property line clearance and walkway/LRT platform width challenges. In this option, the LRT track snakes through platforms that are staggered linearly on opposite sides of cross streets. By weaving the LRT tracks between station platforms, more space is available for platforms and for a greenery buffer zone around the bike path. Beyond this marginal improvement, this alignment still suffers from most of the same weaknesses as the previous two options.

FIGURE 4-15 *Alignment Option 4 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 4

This option proposes to raise the bike path in response to the lack of space demonstrated by previous alignments to fit all required amenities at grade within the corridor. The raised bike path serves to free up space on the ground for the LRT, platforms and pedestrian walkways, greenery, and allows for a clearance buffer along property lines. The bike path can also serve as a roof over the platforms and/or walkway, though it also has the option to meander horizontally along the length of the section to accommodate access ramps and possible connections to the podiums of adjacent buildings. Though this option allows cyclists to bypass arterial cross streets, access ramps would be at least 30m long and would therefor take up too much space and would be infrequent. The height of the raised platform is also out of scale with neighbouring single detached homes, and LRT signalling at cross streets is still a problem as well.

FIGURE 4-16 *Alignment Option 5 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 5

Since raising the bike path is not a viable option, this alignment proposes one direction of the LRT to travel within the Arbutus Street road corridor. This shift allows more room in the rail corridor for the bike paths, a pedestrian pathway, and some green space. However, the rail corridor is still fairly limited to these linear elements, and there is no remaining room for other civic park amenities which the neighbourhood could really benefit from. Additionally, this option removes one lane from Arbutus Street, but does little else to improve the road. Ultimately, it is still felt the corridor could be better utilized for dedicated place making, and there is more opportunity to improve Arbutus Street.

FIGURE 4-17 *Alignment Option 6 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 6

This option is the logical follow through of option 5, testing the complete removal of the LRT to the Arbutus Street road corridor. While this option frees up more space within the rail corridor, it completely removes both parking lanes from the commercial street. Though signaling of the LRT is easier to accommodate at the existing cross street intersections, these same cross strees are still a barrier to pedestrians and cyclists travelling in the new greenway. Without new signals, which would pose challenges being so close to the parallel Arbutus Street, both pedestrians and cyclists would have to divert to Arbutus Street to cross, breaking the flow and convenience of the corridor for these users.

FIGURE 4-18 *Alignment Option 7 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 7

Instead of moving the LRT to the Arbutus Street road corridor, this option proposes moving the bike path to Arbutus Street instead. In order to maintain separation from vehicle traffic, a one metre bioswale is introduced as a buffer. To make room for this, the south bound curb lane is converted into a narrower parking only lane, which also allows bulb-outs with bioswales at crossings to enhance pedestrian and ecological values. The LRT runs in separated tracks through the existing rail corridor, with a pedestrian path running between them and buffered by green space. Though the changes to Arbutus Street work well for pedestrians and cyclists while maintaining more than adequate vehicle capacity according to city traffic counts, the same previously discussed challenges with crossing exist for the LRT and pedestrian walkway. There is also limited room for other amenity within the corridor.

FIGURE 4-19 *Alignment Option 8 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 8

Similar to option 7, this alignment proposes a slight variation on the rail corridor design. In this option, the entire greenway becomes a shared street with embedded rail tracks, as is found in many European LRT and tram designs through plazas. Here, a the entire width of the corridor is paved with vegetated buffers along the property lines. When trams travel through, pedestrians move out of the way into the centre dedicated walkway where street trees and furnishings are located. A shared option like this might require a slower speed of operation for the LRT, but provides a more open plaza feeling for pedestrians. The same previous challenges at crossing exist for this alignment.

FIGURE 4-20 *Alignment Option 9 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 9

This is a slight variation on option 8, with the only change being the alignment of the LRT tracks in the centre of the shared pedestrian plaza. In this alignment, the street tree and furnishing zone is pushed to the sides, adjacent to the vegetated buffer zone/bioswales along the property lines. Between option 8 and 9, there is no clear preference. However, because of the ongoing challenges with crossing the major arterial roads of W Broadway, W 12th Ave, and W 16th Ave, both of these options are still not ideal, and a better solution that deals with these challenges would be preferred.

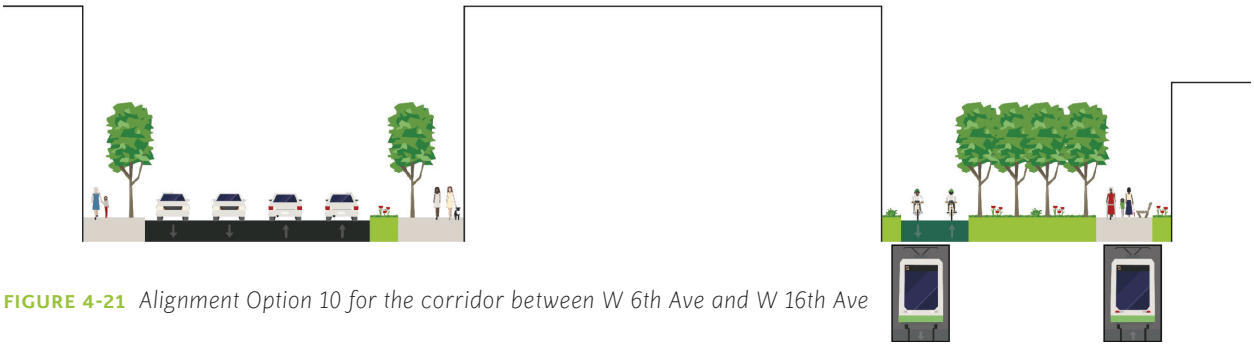


FIGURE 4-21 *Alignment Option 10 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 10

This option proposes diverting the LRT underground for this section of the corridor. With tunnel entrance ramps north of W Broadway and south of W 16th Ave, the LRT would bypass the three main arterial cross streets that posed a challenge to other options. Construction via cut and cover would be easy and cost effective with limited interference to local businesses and street traffic. Running the tracks separated allows for central platforms and fewer access points. Without the LRT at grade, substantial space is cleared up for bike and pedestrian paths and green space. In this option, the bike path runs through the corridor again, which poses a challenge at crossings, and limits space for park amenities in the corridor. A final option with the bike path along Arbutus Street would be preferred.

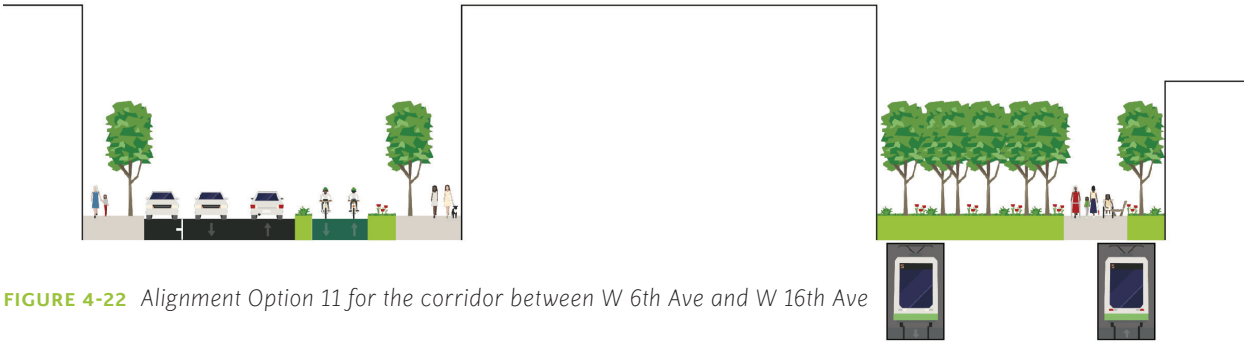


FIGURE 4-22 *Alignment Option 11 for the corridor between W 6th Ave and W 16th Ave*

W 6TH AVE TO W 16TH AVE ALIGNMENT - OPTION 11

The best from each of the previously studied options, this alignment diverts the LRT underground to maximize space on the surface for a pedestrian oriented greenway. Excess vehicle lanes on Arbutus are converted to protected bike paths and dedicated parallel parking, with increased vegetation and bioswales on both sides of the street as well as bump-outs for improved pedestrian safety. Moving the bike paths to Arbutus streamlines crossings with one intersection per arterial cross roads. This also provides more flexibility in the corridor for a wider variety of amenities and increased vegetation, while moving cycle traffic to where store frontages are more visible.

For all of these reasons, this is deemed to be the best alignment option for the corridor between W 6th Ave and W 16th Ave, and is the option proposed as a part of this thesis.

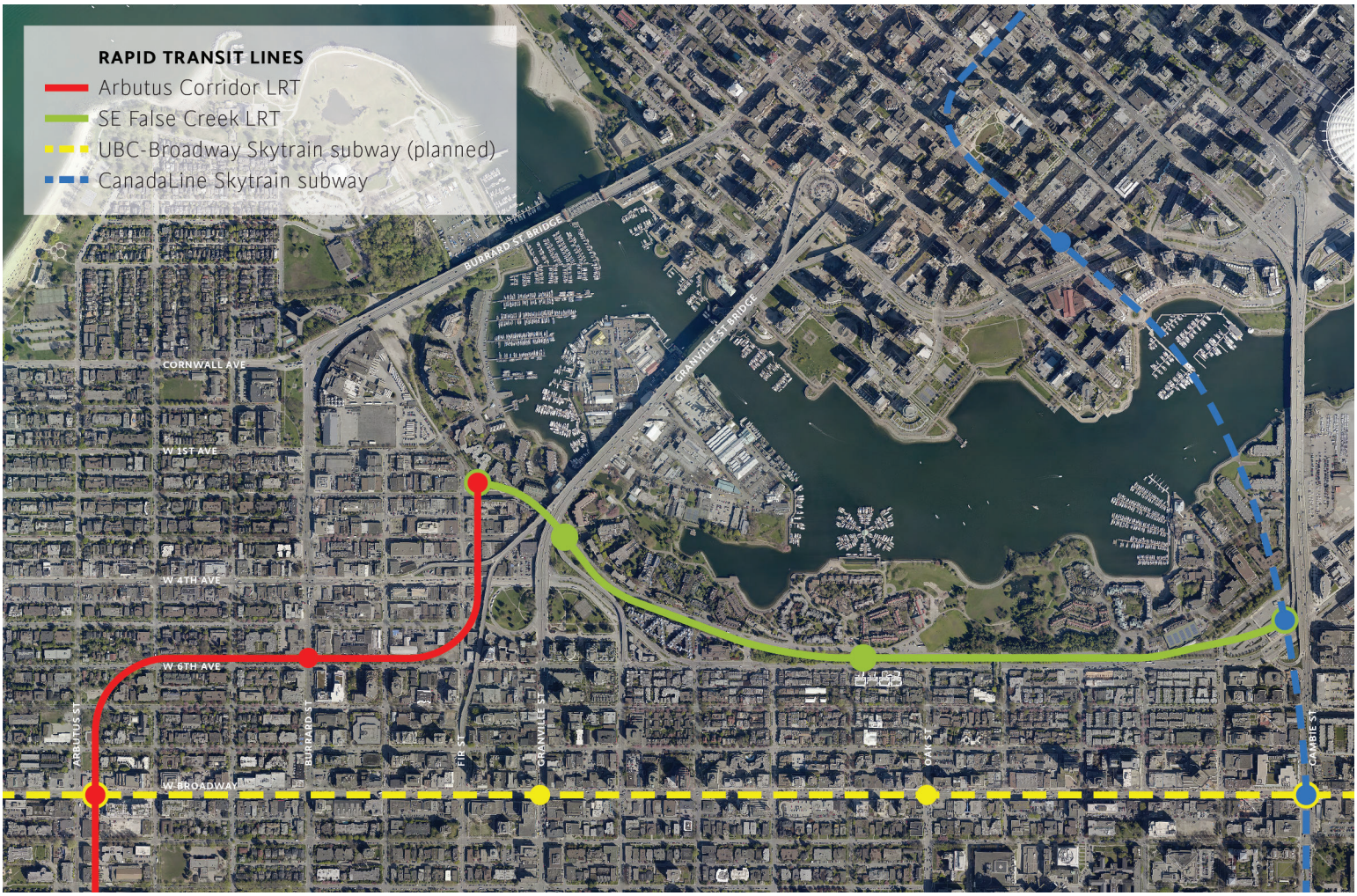


FIGURE 4-23 *Routing option 1 for the north end of the Arbutus LRT.*

NORTH END LRT ROUTING - OPTION 1

Perhaps the simplest and most expected option, this routing takes the Arbutus LRT along the corridor all the way to W 2nd Ave. To reach downtown, passengers would have to disembark and transfer to a bus or take the SE False Creek LRT—a currently unused single track LRT line used during the Vancouver 2010 Olympics that would be reactivated—to the Canada Line and transfer again. Alternatively, the Arbutus LRT could continue along the tracks of the SE False Creek line to the Canada Line station on Cambie Street to reduce transfers, though single track operation could prove a bottle neck, limiting service for the rest of the corridor. There may not be room to add an additional track on this stretch to remedy that problem.

While most likely the cheapest option to implement, it is slow and requires extra connections for riders attempting to reach downtown. Being completely within the Arbutus corridor property boundaries, except at road crossings, constructing this option would offer the fewest interuptions. However, low cost and construction ease are not the best metrics to plan a route. As speed, convenience, and reliability are commonly rated as the most desirable aspects of transit, another option with a direct connection to downtown is more desirable.

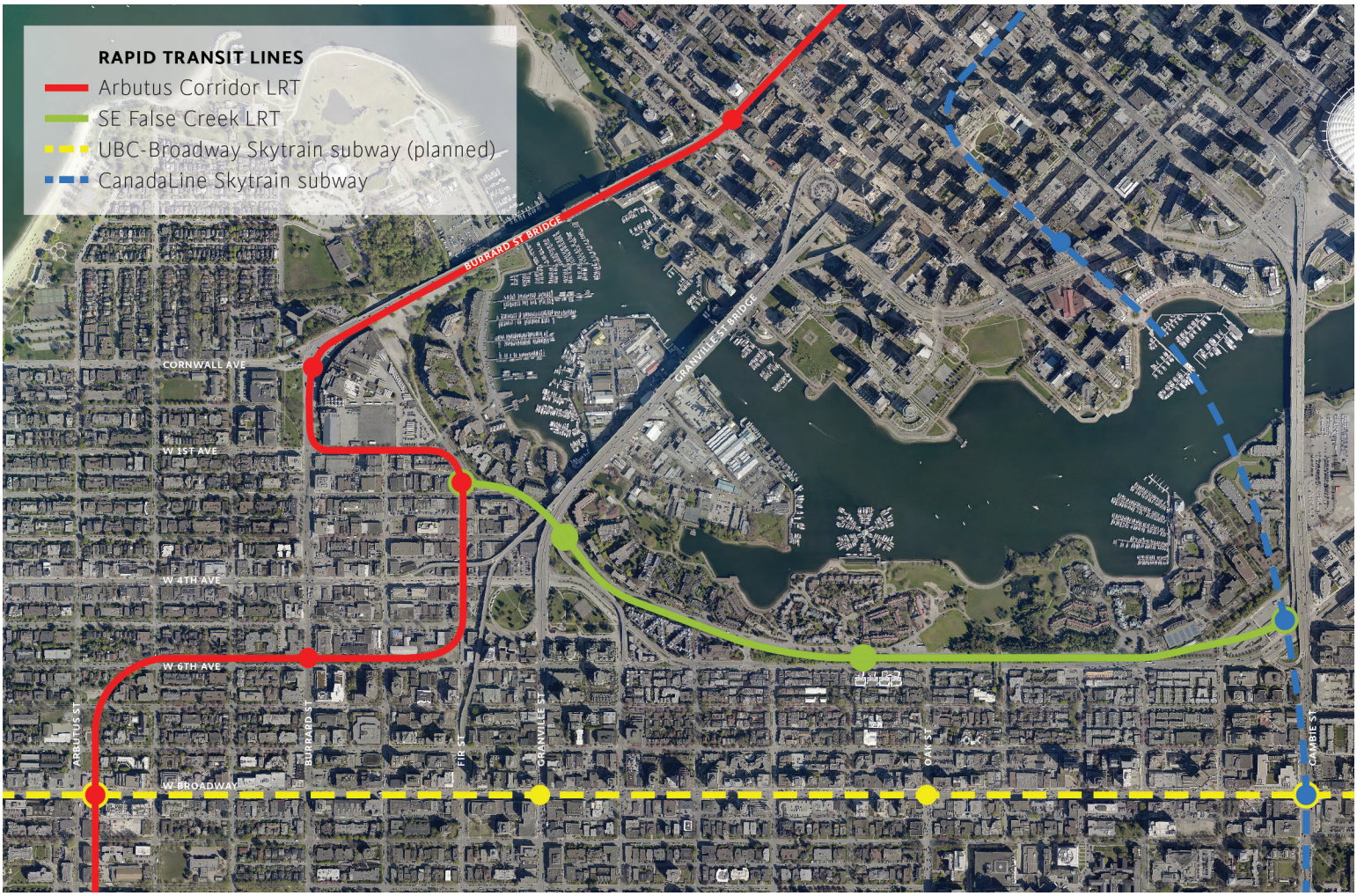


FIGURE 4-24 *Routing option 2 for the north end of the Arbutus LRT.*

NORTH END LRT ROUTING - OPTION 2

This option builds upon option 1, reimplementing the SE False Creek LRT and extending it to Fir Street, but continuing the Arbutus LRT over the Burrard Street Bridge to Downtown Vancouver. While this route would service the future mixed-use, high density developments at the former Molson Brewery and Squamish Kitsilano reserve sites well, the Burrard Street Bridge and Burrard Street corridor downtown have already lost driving and parking lanes to protected bike lanes, and capacity issues are already controversial. Running the LRT over this bridge would only be possible if the tracks ran in road lanes, whereby trains would be susceptible to traffic congestion and undermine the reliability and speed of the entire line.

Apart from the bridge crossing, this option also explores an alternative alignment of the Fir Street section which would also be possible for option 1. For this stretch, the LRT runs as a streetcar down Fir Street between W 6th Ave and W 1st Ave. The same issues with traffic are less of a problem as Fir is not arterial and does not experience significant vehicle traffic. This alignment, however, would free up significant space in the narrow corridor for pedestrians, cyclists, and green space.

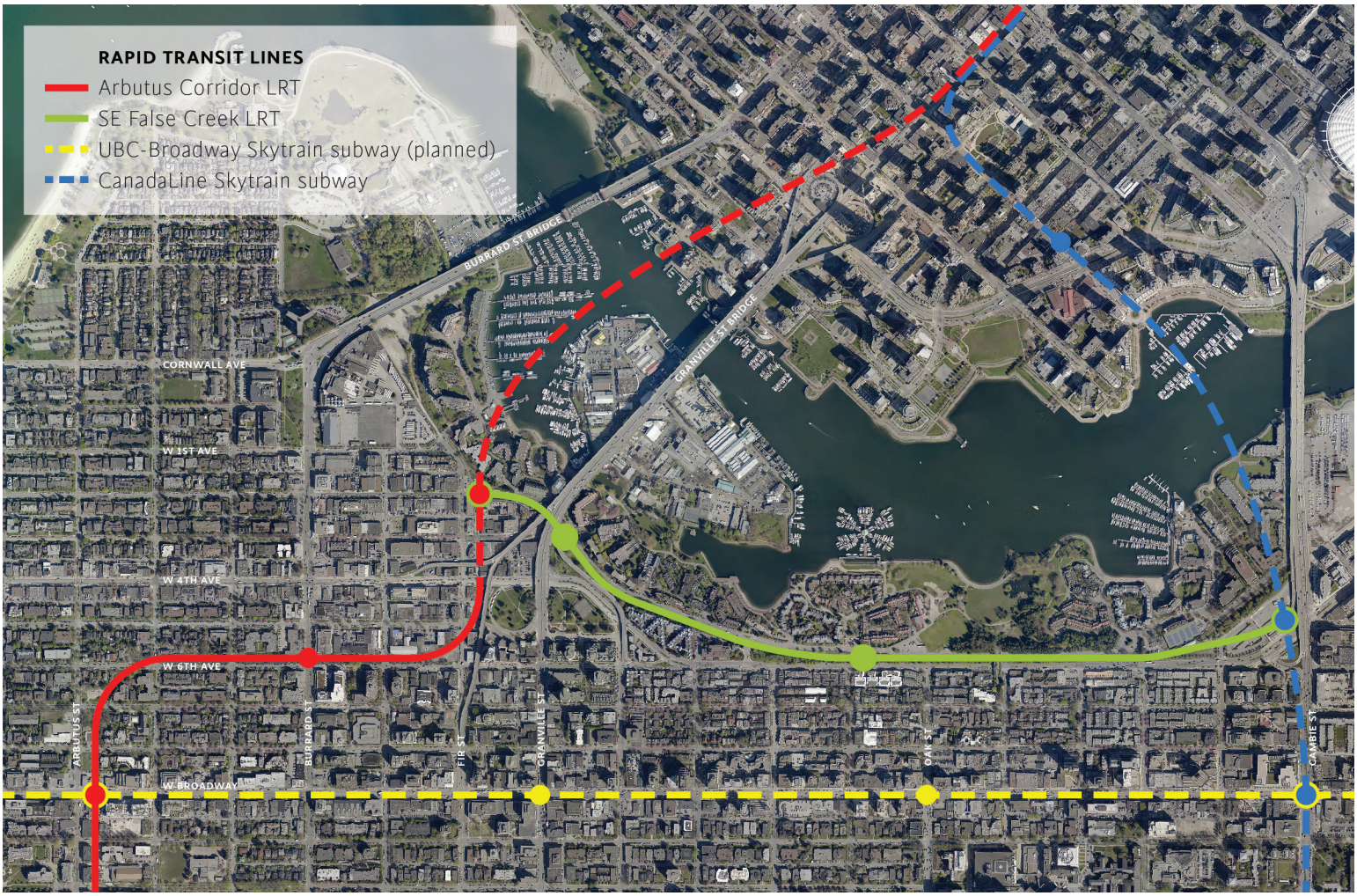


FIGURE 4-25 *Routing option 3 for the north end of the Arbutus LRT.*

NORTH END LRT ROUTING - OPTION 3

Option 3 is the most expensive explored. From W 5th Ave to W 4th Ave, the Arbutus LRT would descend below grade and continue via tunnel underneath False Creek to Downtown. This option leaves the Fir St section of the corridor free on the surface for pedestrian, cyclist, and green space amenities, and eliminates the challenges of crossing busy W 4th Ave at an offset to the Fir Street intersection. Additionally, a multi-use or bike path could descend beside the LRT to also bypass the crossing before returning to the surface. However, the exorbitant cost of tunnelling under False Creek is hard to justify against the other options, and the money could be better spent on other aspects of the corridor design.

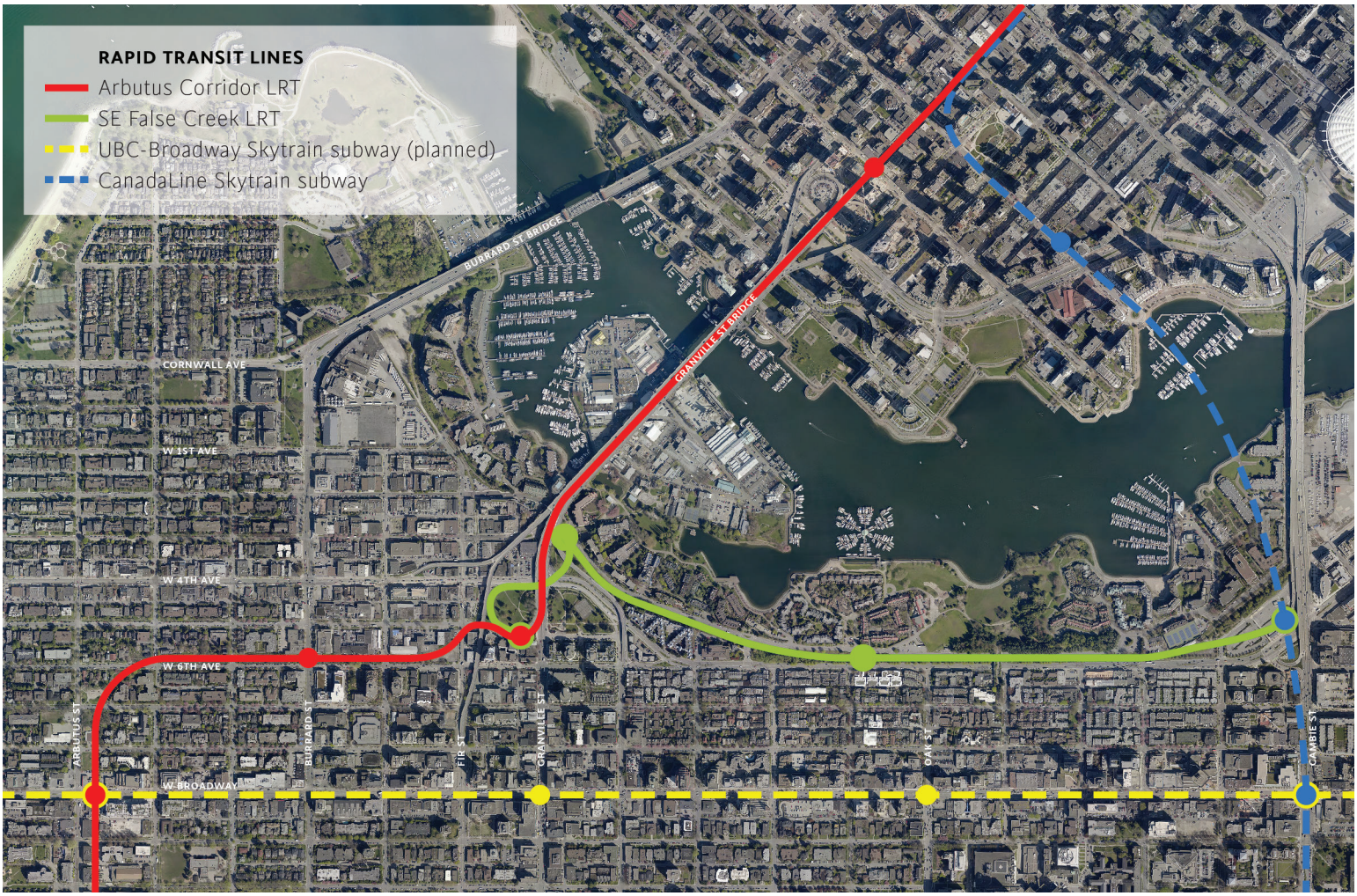


FIGURE 4-26 *Routing option 4 for the north end of the Arbutus LRT. Option 4 is the preferred route.*

NORTH END LRT ROUTING - OPTION 4

In this option, the Arbutus LRT skips the last stretch of the corridor and diverts over the eight lane Granville Street Bridge to Downtown Vancouver. The SE False Creek LRT is extended to connect with the line at Granville Loop, while the narrow stretch of the Arbutus Corridor between W 5th Ave and W 1st Ave remains free for pedestrians, cyclists, and green space.

This option is preferred for several reasons. First and foremost, studies show the Granville Street bridge has the highest capacity to demand ratio of the downtown bridges, and the city has already proposed replacing the centre two lanes with bike and pedestrian paths without significantly impacting vehicle traffic. Such a proposal could still be implemented on a raised platform above the LRT tracks. Additionally, the downtown section of Granville Street is already a main transit corridor, and this routing would connect the Arbutus LRT with many existing transit services.

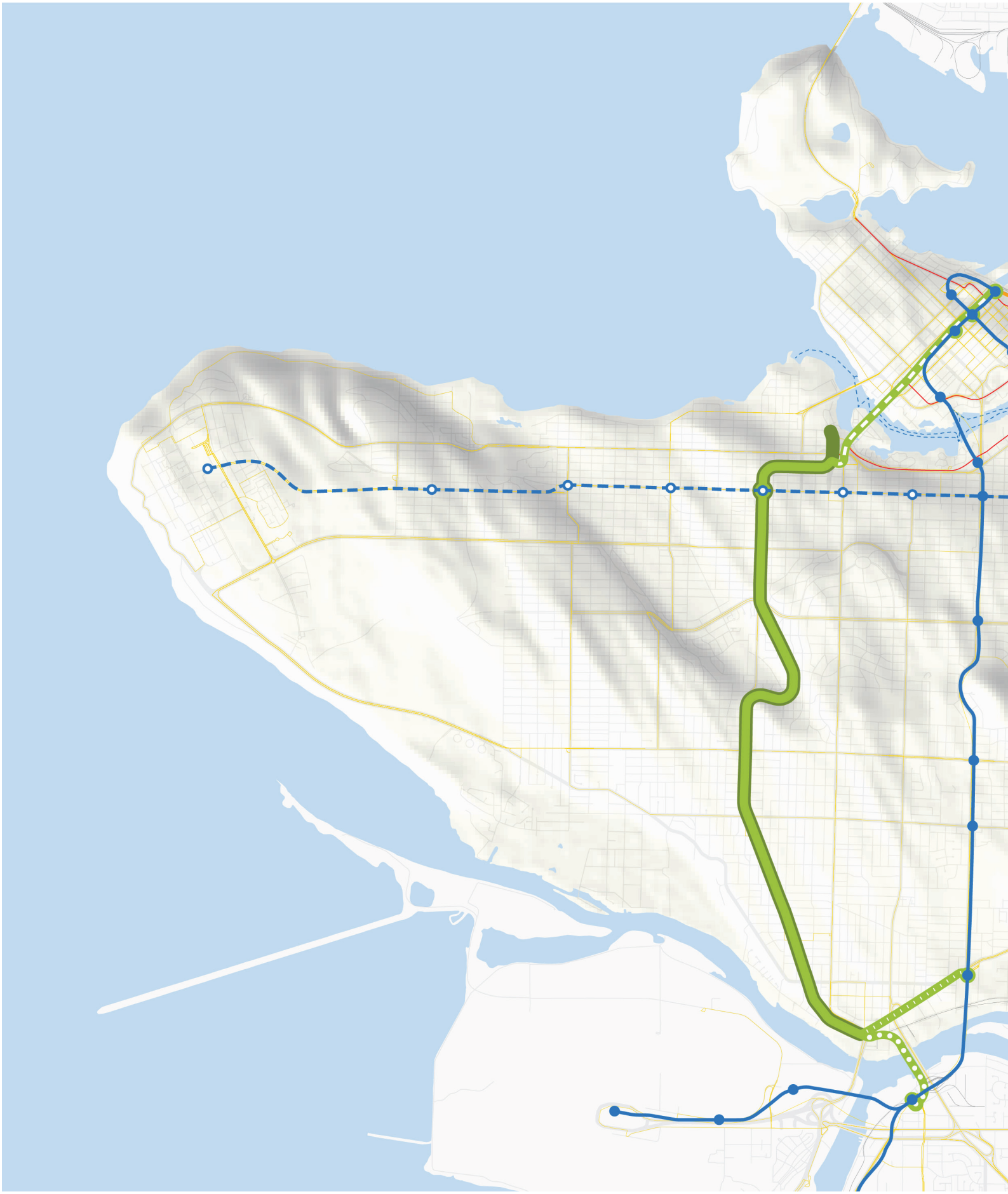
While part of Granville Street downtown is restricted to transit only, this option would benenfit from closing the entire downtown stretch to vehicle traffic, directing all bridge traffic to Seymour and Howe, and making Granville a dedicated transit and pedestrian strip. This would give the LRT freedom to move without being susceptible to traffic congestion.

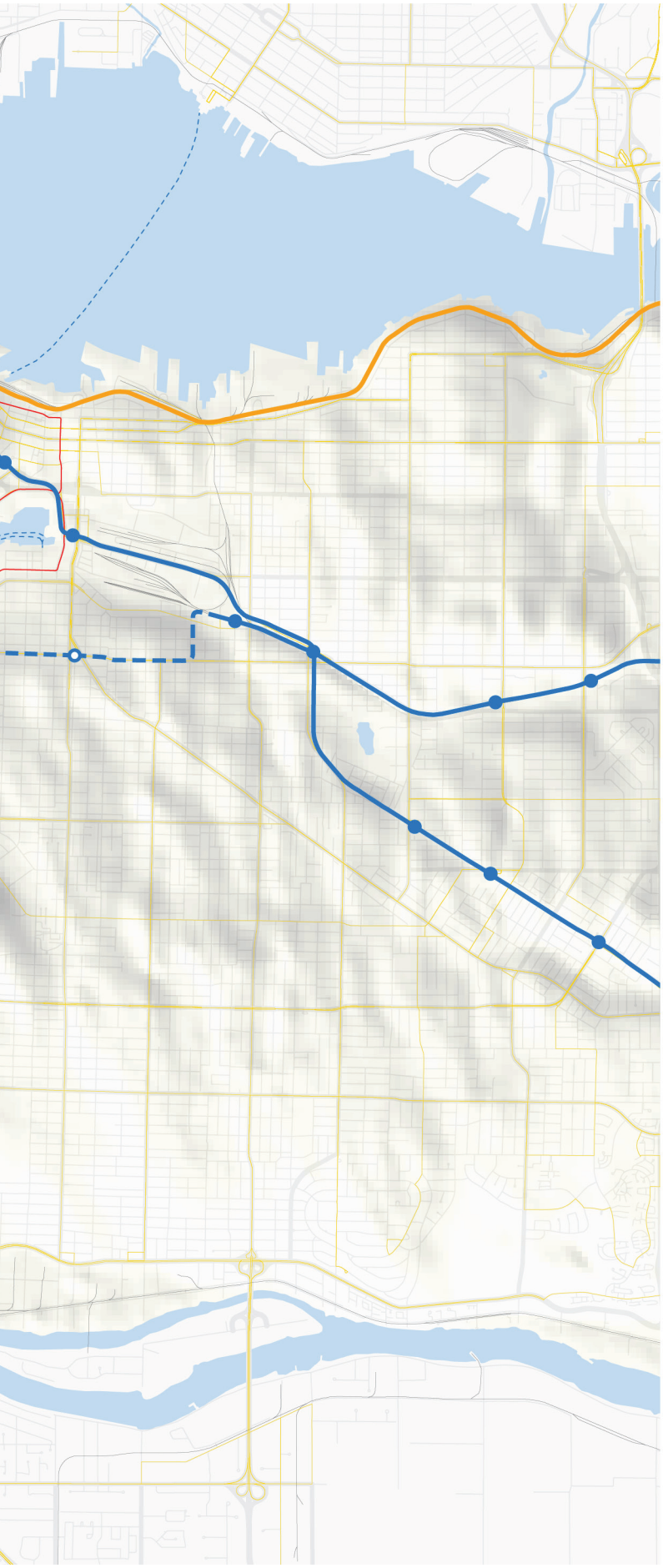
For the reasons outlined, this is deemed to be the best routing option for the Arbutus LRT, and is the option proposed as a part of this thesis.

The Corridor Reimagined

This section aims to illustrate the proposed design interventions along the corridor at a variety of scales. Based on the objectives and principles previously outlined, the design attempts to bring the corridor towards an armature for resilience in the city.

At the city scale, this is laid out as a transportation network plan to varying levels of detail. At the site scale, new design sections, plans, and vignettes illustrate the proposed interventions while highlighting a shift in priority away from the 20th century vehicular city towards a people oriented future and a resilient vision for the city.





LRT AS THE BACKBONE OF MULTI-MODAL, WALKABLE NEIGHBOURHOODS

A new LRT will reimagine the historic Sockeye Special interurban, providing a fast and reliable transit option between Downtown Vancouver and Richmond. The line will replace the No. 16 bus, the 5th busiest route in the region, serving the dense neighbourhoods of Kerrisdale and Marpole while supporting increasing density along the corridor.

At the north end, the line will take over the centre two lanes of the underutilized Granville Street Bridge, allowing non-stop, direct service to downtown Skytrain and bus connections.

The new LRT will also connect with the future UBC Skytrain Extension where it crosses the corridor at the corner of Broadway and Arbutus, connecting the line to the busiest commercial area of the city.

In the south, two extensions will connect the corridor with the Canada Line Skytrain at Marine Drive and Bridgeport Stations, linking the corridor to Richmond, and providing a new bridge shared with cyclists along a continuous Richmond to Downtown Vancouver off-road bike path.

FIGURE 4-27 *Light Rail Transit will form the backbone of multi-modal and walkable communities along the corridor.*

DESIGN PROPOSAL
- Arbutus Corridor
- Arbutus Greenway LRT/Streetcar Hybrid System
- Downtown Vancouver Extension over Granville Bridge
- Richmond-Bridgeport Extension over new bridge
- Marine Drive-Marpole Extension

VANCOUVER TRANSIT NETWORK
- Existing Skytrain Rapid Transit
- Planned Skytrain Extension to UBC
- West Coast Express Commuter Rail
- Bus Routes
- Proposed Renewal of Historic Downtown Streetcar Lines
- Passenger Ferry

SCALE 1:60,000

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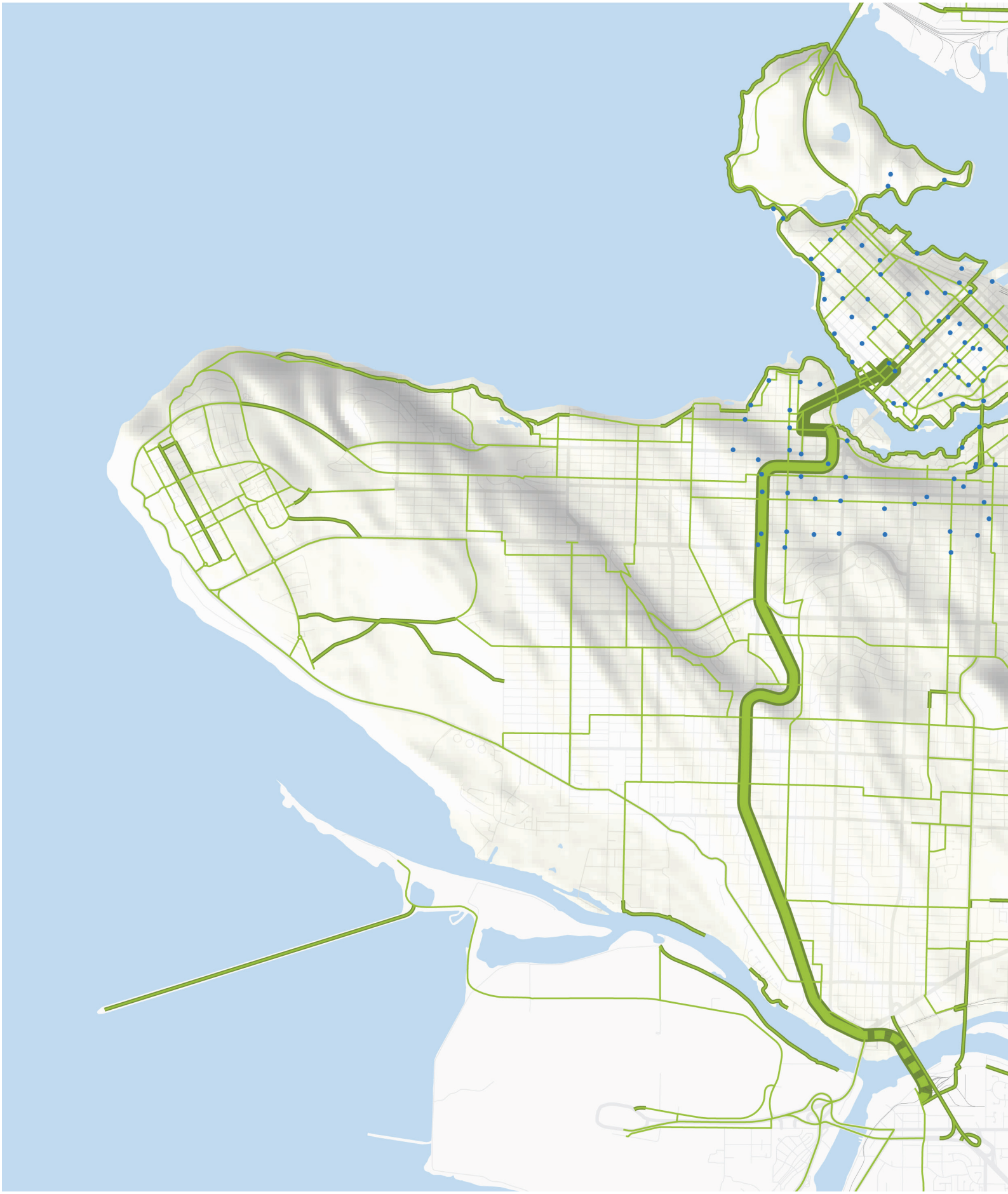

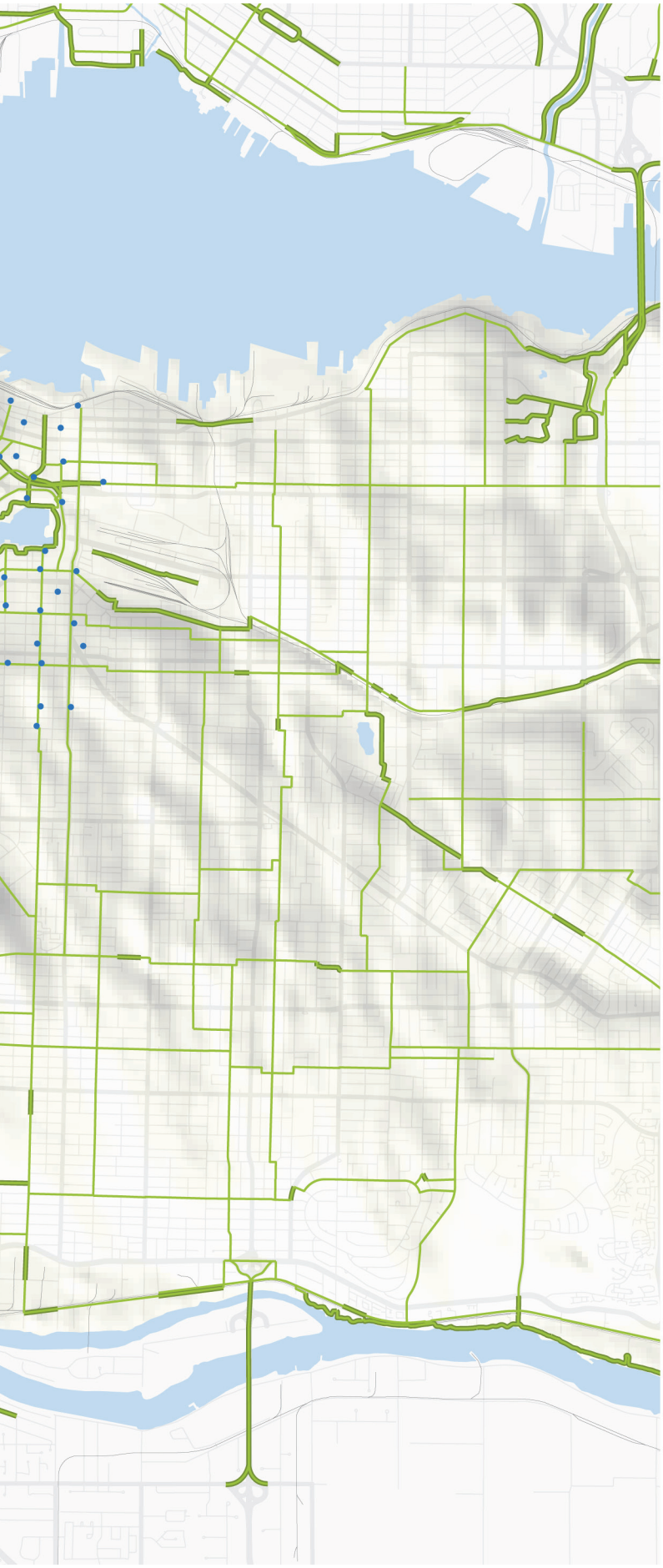

AN OFF-ROAD BICYCLE HIGHWAY FROM RICHMOND TO DOWNTOWN VANCOUVER

A new off-road dedicated cycling path along the gentle grade of the Arbutus Corridor will provide the fastest, easiest, safest, and most enjoyable north-south route for cyclists in the city, replacing shared road bike routes as the default route in its vicinity.

The new route will connect with existing protected bike lanes around False Creek and over the Burrard Street Bridge to Downtown in the north, while the shared LRT/Cycle bridge will connect with bike routes in Richmond at Bridgeport Skytrain Station. The rapidly growing city south of Vancouver will be only 40 minutes away by bicycle. Save for a short few hundred meters of on-street bike path near Lost Lagoon, the route will also connect Richmond all the way to North Vancouver exclusively by protected and off-street bike paths on a route that will take the average cyclist approximately 75 minutes.

FIGURE 4-28 *A new bicycle highway from Richmond to Downtown Vancouver will provide safe new infrastructure for a rapidly growing modal share across the city, and an armature for an expanding bike share system.*

DESIGN PROPOSAL

- Arbutus Corridor
- New North Arm LRT/Bicycle Bridge to Richmond
- Downtown Vancouver to Richmond Off-Street Cycle Path

EXISTING BICYCLE ROUTE NETWORK

- Mobi Bike Share Stations
- Protected Bike Lanes and Off-Street Paths

- On-Street Bike Lanes *(with signs and/or pavement markings)*

SCALE 1:60,000 4 km = 16 min = 50 min

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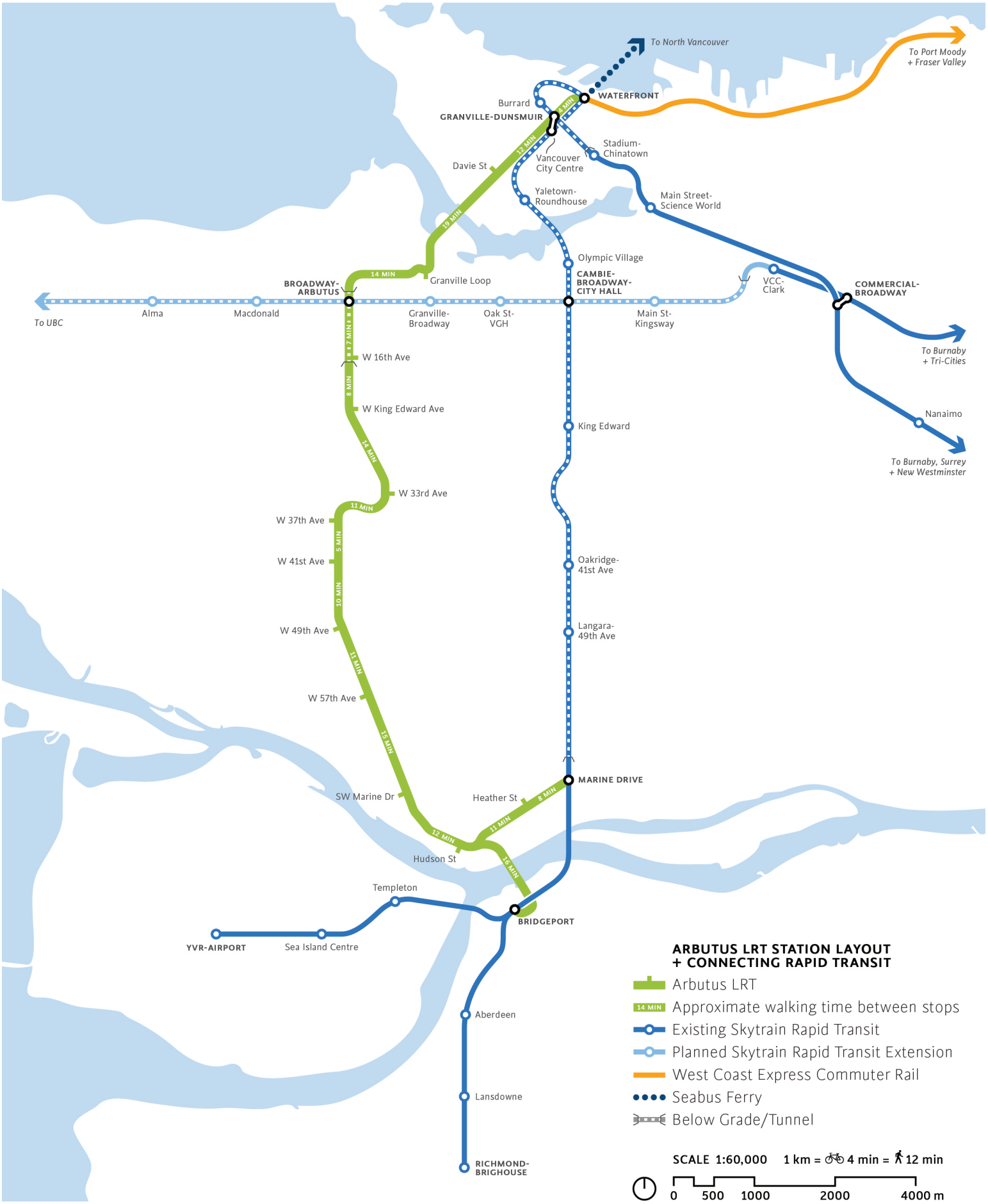

To North Vancouver
To Port Moody + Fraser Valley
WATERFRONT
Burrard
GRANVILLE-DUNSMUIR
3 MIN
12 MIN
19 MIN
Davie St
Vancouver City Centre
Stadium-Chinatown
Yaletown-Roundhouse
Main Street-Science World
Olympic Village
CAMBIE-BROADWAY-CITY HALL
14 MIN
Granville Loop
BROADWAY-ARBUTUS
To UBC
Alma
Macdonald
Granville-Broadway
Oak St-VGH
Main St-Kingsway
VCC-Clark
COMMERCIAL-BROADWAY
To Burnaby + Tri-Cities
Nanaimo
To Burnaby, Surrey + New Westminster
7 MIN
W 16th Ave
8 MIN
W King Edward Ave
King Edward
14 MIN
W 33rd Ave
11 MIN
W 37th Ave
5 MIN
W 41st Ave
Oakridge-41st Ave
10 MIN
W 49th Ave
Langara-49th Ave
11 MIN
W 57th Ave
15 MIN
MARINE DRIVE
SW Marine Dr
Heather St
8 MIN
11 MIN
12 MIN
Hudson St
16 MIN
Templeton
BRIDGEPORT
YVR-AIRPORT
Sea Island Centre
Aberdeen
Lansdowne
RICHMOND-BRIGHOUSE
ARBUTUS LRT STATION LAYOUT + CONNECTING RAPID TRANSIT
Arbutus LRT
14 MIN Approximate walking time between stops
Existing Skytrain Rapid Transit
Planned Skytrain Rapid Transit Extension
West Coast Express Commuter Rail
Seabus Ferry
Below Grade/Tunnel
SCALE 1:60,000 1 km = 4 min = 12 min
0 500 1000 2000 4000 m

LAYING OUT THE LRT

For most of the route the new LRT line will run at grade, parallel to roadways and the new bike path. This is by far the most economically feasible option, which is a major concern when multiple regional transit initiatives are competing for scarce government funding. Running at grade also makes the line more flexible. Stops can easily be added or removed with little cost, or platforms lengthened to accommodate longer trains. There is also ample room to run the line at grade for most of the corridor. This is especially true where roadway narrowing is proposed in response to shifting transportation technology and to shift priority from vehicle traffic to alternative modes.

Between W 6th Ave and W 16th Ave, the LRT will run below grade. Through this stretch, the corridor narrows to 15.4 m and there is insufficient room for both a bike path and LRT, let alone a pedestrian path or other services. Burying the LRT provides space for a greenway to continue through a zone of high-density residential where park space is in demand. It also allows the LRT to bypass three of the busiest east-west arterial roads that cross the corridor: W Broadway, W 12th Ave, and W 16th Ave.

In identifying potential stops for a new light rail transit system, it becomes a challenge to balance speed and accessibility. Both affect system uptake and user satisfaction, but each acts directly counter the other. Closer stop spacing improves accessibility and convenience, but increases the total trip time by reducing the average train speed as more time is spent stopping and at reduced speed. On the other hand, increasing stop spacing maximizes the amount of time trains can travel at design speed, while also reducing time lost at stops. The ideal solution is a compromise between accessibility and speed.

Vancouver's Skytrain system, for example, was designed in favour of speed over accessibility. Stations are spaced an average 1.5 km apart, and grade-separated trains are able to reach their maximum speed of 80 km/h and achieve an average trip speed of 45 km/h including stops.[1] In user satisfaction surveys along the Canada Line route, users overwhelmingly valued the rapid trip speed, while inconvenient routes and access was lower on the list of concerns.[2]

In Toronto, the new Eglinton Crosstown LRT will have stops spaced an average of 760 m apart. With a fully dedicated corridor and signal priority, the estimated average trip speed will be 28 km/h.[3] This falls closer in line with the 800-1000 m stop spacing transit planner Jarret Walker suggests is ideal for rapid transit such as LRT. Below this, and the system slows down to more of a street-car or bus service level than rapid transit, and spacing of approximately 400 m works well and is commonplace.[4]

Based on this information, the LRT stops shown represent a best guess to maximize trip speed while maintaining satisfactory coverage. At an average spacing of 850 m (920 m including the long bridge spans across False Creek and the Fraser River), stops are located mostly at arterial cross streets. Ultimately, however, such decisions are best made by transit experts based on user data as well as community consultation. The stops chosen here serve as a schematic design proposal of likely locations.

FIGURE 4-29 *(opposite) LRT stops will be spaced to serve major cross streets and maximize access while maintaining swift end to end service.*

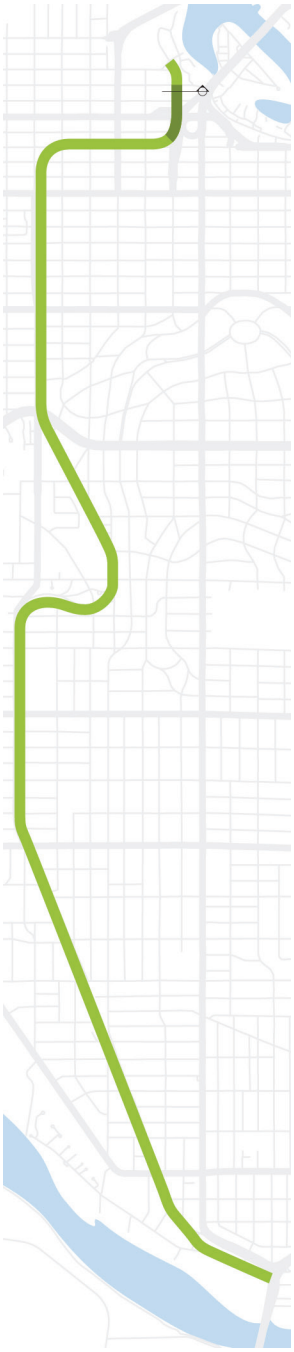
ENDNOTES

1 "Skytrain (Vancouver)," *Wikipedia*, accessed September 1, 2017, https://en.wikipedia.org/wiki/SkyTrain_(Vancouver).

2 NRG Research Group, *Satisfaction with Canada Line and Connecting Buses : Wave 2*, March 10, 2011, https://www.translinklistens.ca/MediaServer/documents/Satisfaction%20with%20Canada%20Line%20and%20Connecting%20Buses%20Wave%202%20March%202011.pdf, 4.

3 "What is the Crosstown?," *Eglinton Crosstown*, accessed September 15, 2017, http://www.thecrosstown.ca/the-project.

4 Jarret Walker, "Basics: The Spacing of Stops and Stations," *Human Transit*, November 5, 2010, http://humantransit.org/2010/11/san-francisco-a-rational-stop-spacing-plan.html.



FIR STREET LINEAR PLAZA

This stretch of the corridor, currently used mostly as a gravel parking lot for adjacent automotive businesses, will become a linear pedestrian plaza and bikeway. Though this neighbourhood has the highest population density the most diversity of businesses and organizations along the corridor, inviting and useful public space is in short supply and would be highly beneficial.

The design focuses on the rail corridor proper, with little intervention to Fir Street which runs adjacent, separated by a single parcel. The off-street bike path runs along the west side of the plaza, while the east side consists of a generous pedestrian path. Both are divided by a bioswale into which all storm water is directed, and which is framed by inset rails to reference the history of the corridor since the LRT does not travel through this section The pedestrian path is populated with native shade trees, ample seating, and pollinator gardens.

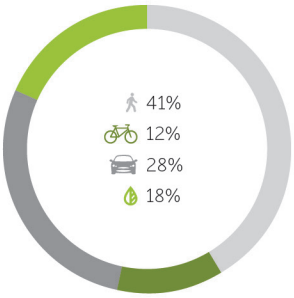
Flanked mostly by the blank walls of commercial buildings, the plaza provides an ideal space a variety of art installations, small music events, and even as simply a nice space to eat lunch for employees of local businesses.

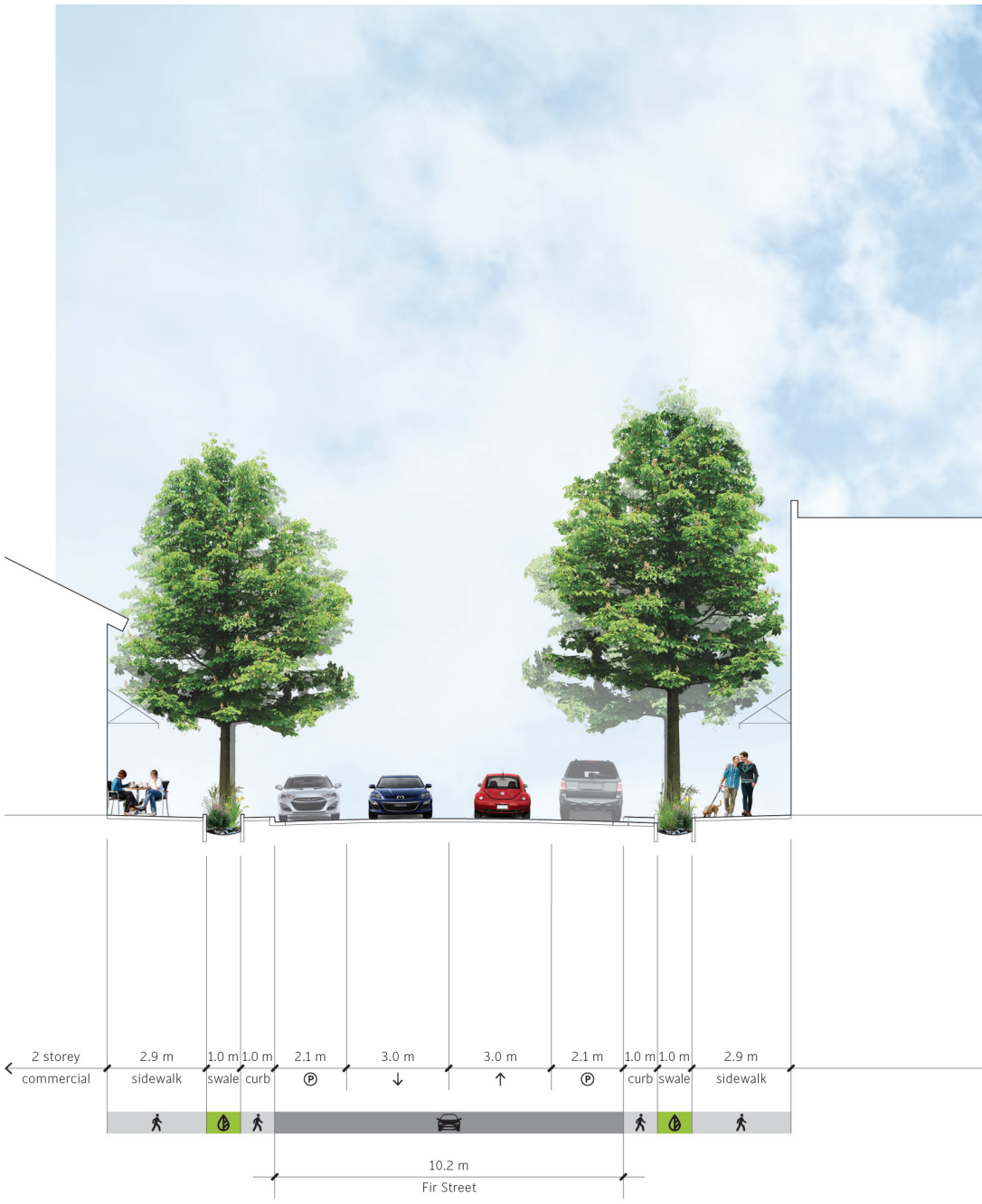
Fir Street is narrowed slightly, providing 3 m driving lanes flanked on each side by a 2.1 m parking zone. The reclaimed space is added as a curb zone to allow new bioswales in place of the existing grass strips between mature street trees.

FIGURE 4-30A *Key plan showing where the design section is taken and where similar typology exists along the corridor.*

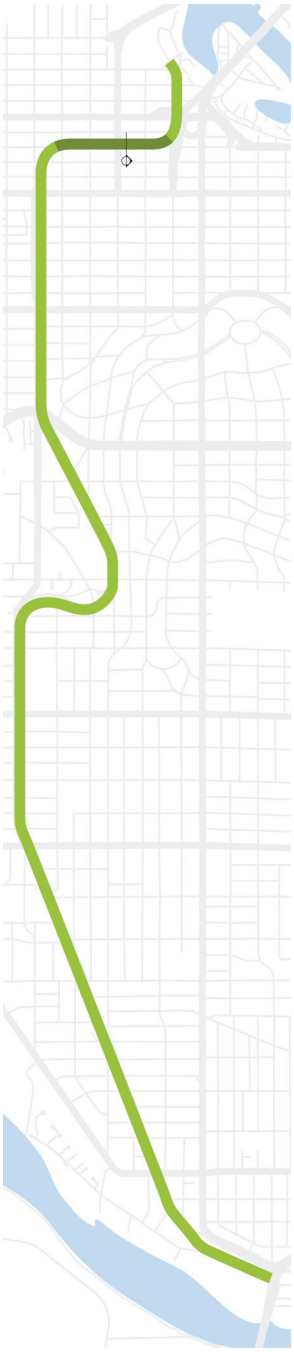
FIGURE 4-30B *(next page) 1:200 Design section looking north towards W 2nd Ave along Fir St.*

SECTION 1 - FIR STREET @ W 2ND AVE





15.2 m
2 storey commercial
1.0 m
buffer
2.2 m
2.2 m
1.7 m
bioswale
varies
pavers
varies
pollinator garden
2-4 storey
mixed use
4.4 m
bike path
8.9 m
pedestrian plaza



W 6TH AVE GARDENS

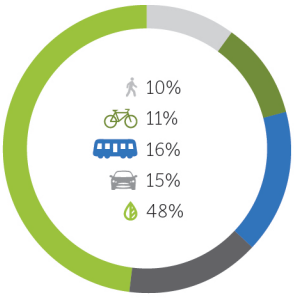
The design approach to this stretch of the corridor is to enhance existing features while inserting both LRT and an off-street bike path. To accommodate these amenities, the road is reduced to single direction traffic with parking on the south side only, serving the houses and condos along that side of the street.

With the road reduction, a new sidewalk and bioswale are possible on the north side of the road. Along the north edge of the corridor, a pollinator garden buffer zone flanks the off-street bike path. The LRT runs adjacent to the bike path, with 1 m vegetated buffer zones on each side for safety. The remaining space between the LRT and sidewalk allows for a slightly enlarged community garden zone, which remains in it's existing place.

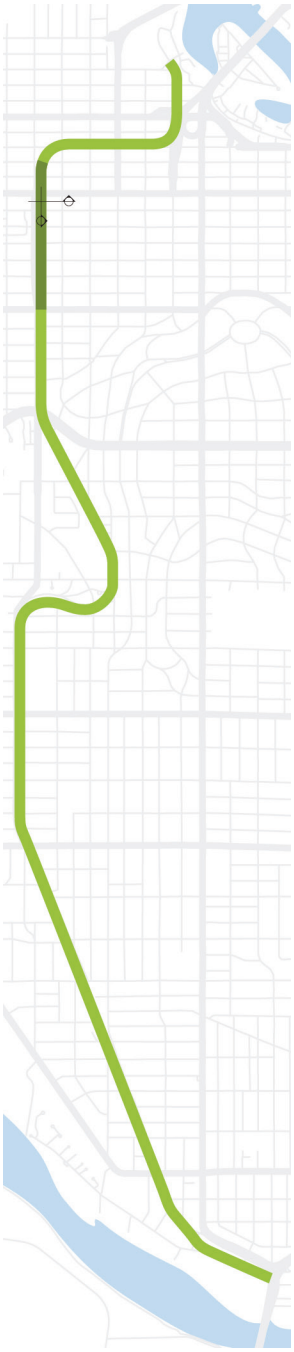
FIGURE 4-31A *Key plan showing where the design section is taken and where similar typology exists along the corridor.*

FIGURE 4-31B *(next page) 1:200 Design section looking east from Burrard St. along W 6th Ave.*

SECTION 2 - W 6TH AVE @ BURRARD ST



2.15 m
sidewalk
1.5 m
bioswale
3.65 m
2.1 m
1.4 m
trees
1.8 m
sidewalk
2.3 m
grass buffer
midrise residential, townhouses
+ single detached homes
5.75 m
W 6th Ave
one-way street



BROADWAY-ARBUTUS CROSSING

W Broadway is one of the busiest arterial routes in the city, and home to the second largest economic corridor in the province after Downtown Vancouver. A Planned extension of the Millenium Line Skytrain along Broadway to UBC will only encourage this growth, and a planned station at Arbutus makes this intersection an important crossing of two major transportation routes.

With the LRT running underground due to space constraints between W Broadway and W 16th Ave and to avoid three busy cross roads in that stretch, the design of this section is a below-grade station with pedestrian paths and bike parking/bike share space at grade. Between the station and W 16th Ave, the pedestrian path continues through a variety of park and green space amenities, while cyclists use a separated bike path along the east side of Arbutus St.

For the station design, a centre platform was chosen to maximize flexibility and reduce access stairs, escalators, and elevators. The station was kept open to above, with a series of columns supporting a basket weave space frame canopy. Made from laminated, sinusoidally-curved douglas fir planks with stainless steel struts and cable cross-tensioners, the structure showcases British Columbian ingenuity in wood construction. Simultaneously, the structure is an abstract reference to the basket nets traditionally used by local first nations to catch Sockeye salmon, for which the old interurban line was named.

To allow for longer trams, the station extends between W Broadway and W 10th Ave, which is the local east-west bike route. A bridge spans over the station at midpoint to allow vehicle access to the laneway as well as elevator access to the station platform halfway between the two station entrance streets.

FIGURE 4-32A *Key plan showing where the design section is taken and where similar typology exists along the corridor.*

FIGURE 4-32B *(next page) 1:200 Design section looking north towards W Broadway along Arbutus St.*

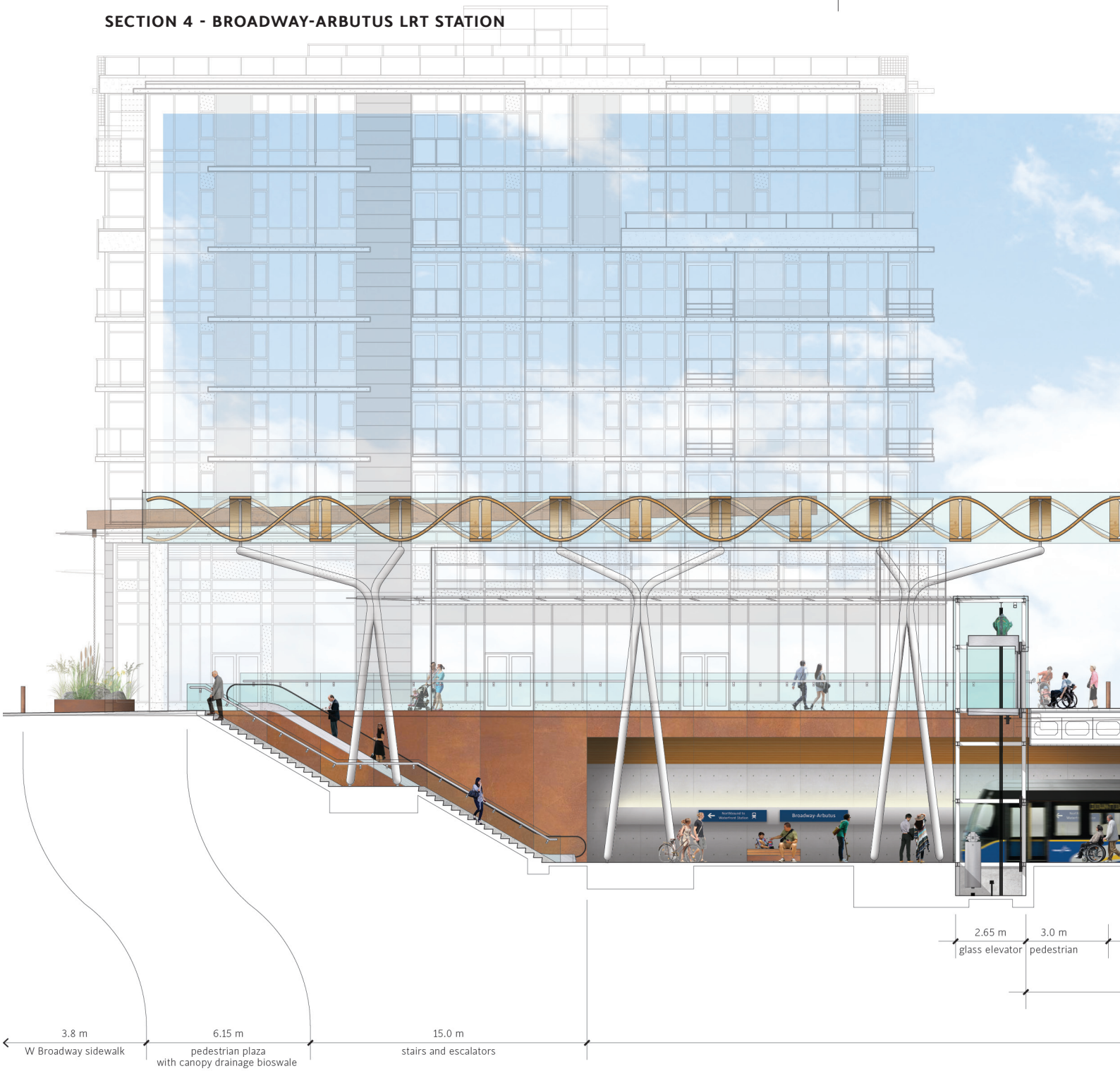
FIGURE 4-32C *(two pages ahead) 1:200 Transverse design section of Broadway-Arbutus LRT station.*

SECTION 3 - ARBUTUS ST @ W BROADWAY

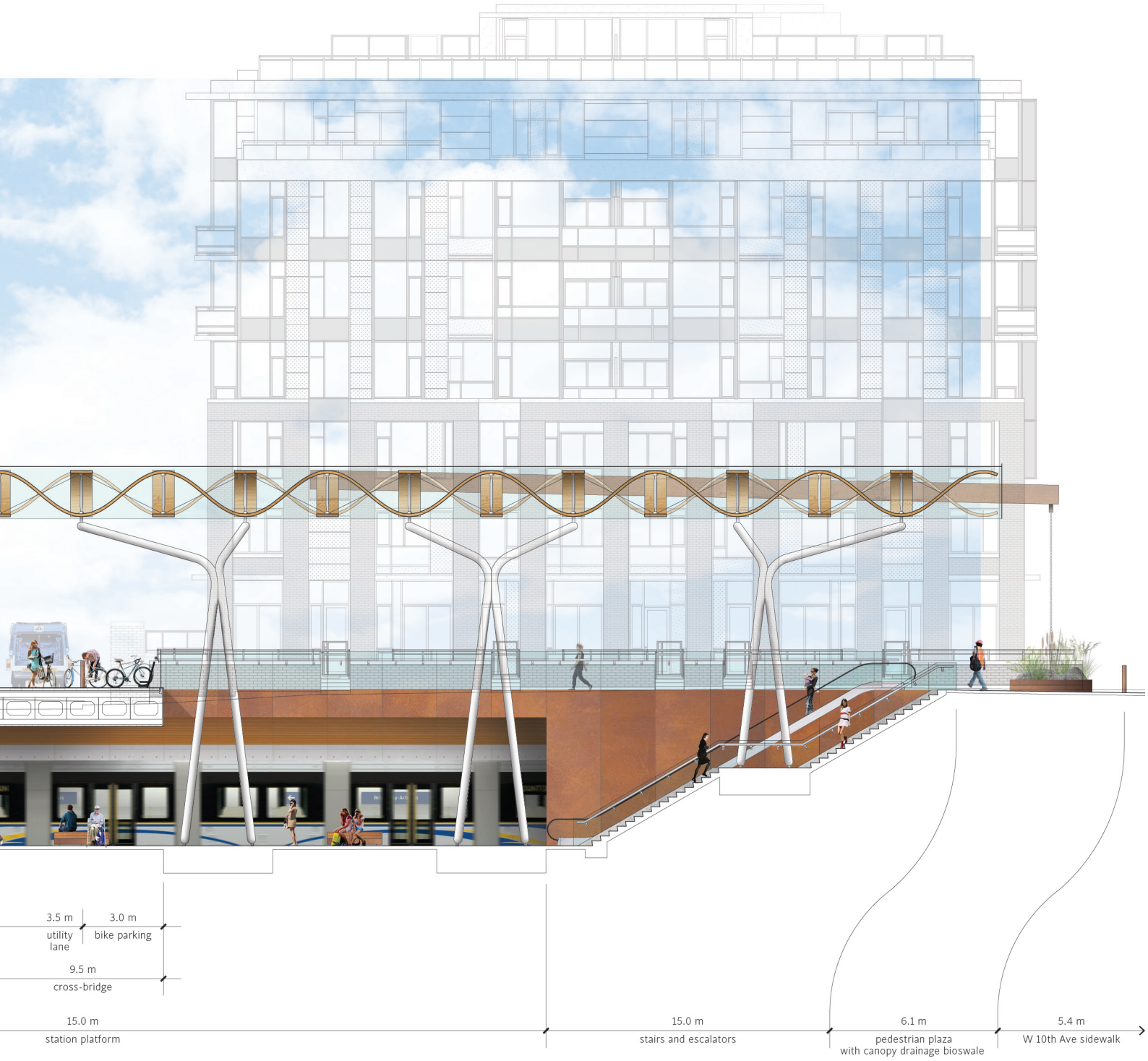
4.2 m
bike share dock
+ bike parking
1.4 m
escalator
2.0 m
stairs
1.4 m
escalator
4.2 m
pedestrian walkway
6-7 storey midrise residential
with mixed use ground floor
3.1 m
7.8 m
station platform
3.1 m
14.0 m
LRT - below ground station

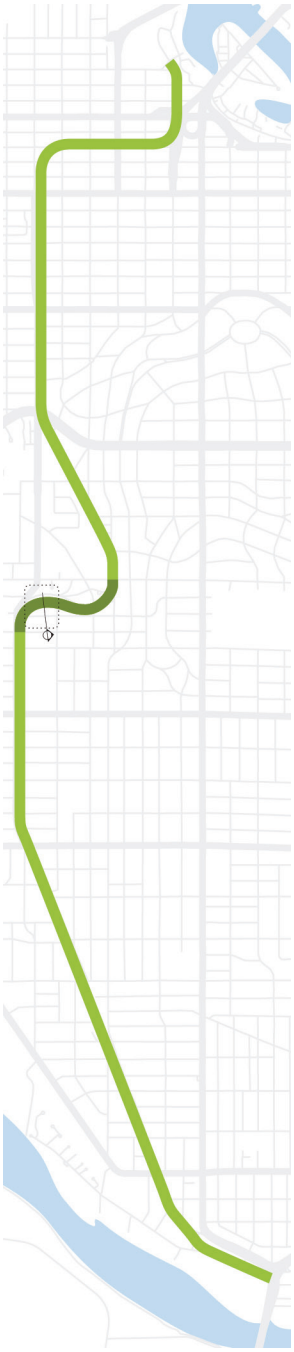
SECTION 4

SECTION 4 - BROADWAY-ARBUTUS LRT STATION



SECTION 3


3.5 m
utility lane
3.0 m
bike parking
9.5 m
cross-bridge
15.0 m
station platform
15.0 m
stairs and escalators
6.1 m
pedestrian plaza with canopy drainage bioswale
5.4 m
W 10th Ave sidewalk



THE TUNNEL WITH A VIEW

This section of the Arbutus Corridor offers incredible views of the city and the North Shore mountains beyond. Sandwiched on each side by residential properties and a service road to the north, the corridor here is confined to its legal property boundaries. Because of this, there is little room for extra program beyond the LRT, bike path, and a pedestrian walkway. As such, the design strategy for this section of the corridor aimed to align each of these components for maximum view of all users, while also permitting as much space as possible for ecosystem components.

To this end, the design builds out the full width of the corridor using a retaining wall on the south side of the service lane. This wall holds back a pedestrian promenade, to take advantage of the views over the houses downgrade. At the back edge of the pedestrian walkway, a cobblestone strip makes up the furnishing zone where seating, trees, and bike racks are located.

Immediately behind this zone is the bike path, two metres in width each way. The bike path slopes gently forward, with rainwater runoff draining into the cobblestone tree strip. Uphill of the bike path is the LRT, supported on an open frame system which spans over an expanded bioswale garden zone.

The order of each of these elements was very intentional, and places the slowest modes to the front edge of the viewing platform. Pedestrians, who naturally want to move forward towards a view when possible, are free to wander at their own pace and stop to enjoy the view wherever they wish. Faster traffic does not distract or block the view, or cause collision conflicts. Cycling straddles the boundary between a sight-seeing mode of transit and one for getting to a destination. For cyclists who wish to stop, they are able to do this, while others can continue on quickly without getting in the way. Pulling the LRT back and onto raised concrete fins allows the LRT to disappear into the background. Here, the tram will float over the bioswale and vegetation, maximizing the view for transit users while allowing additional ecological value.

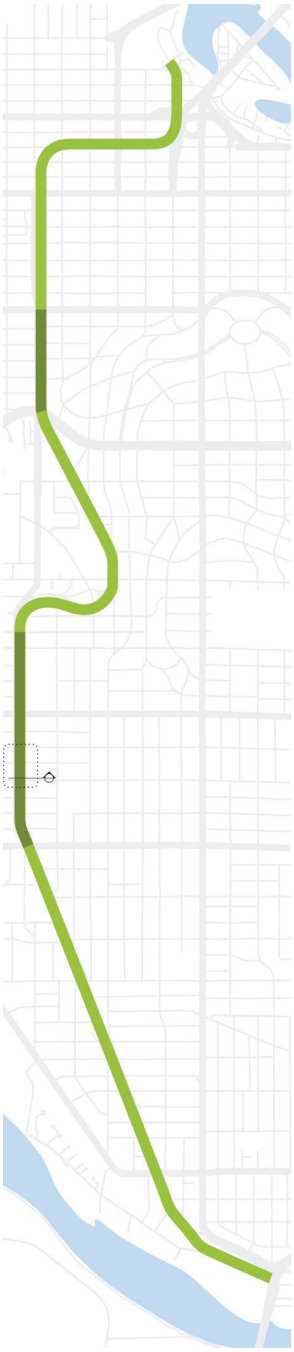
FIGURE 4-33A *Key plan showing where the design section is taken and where similar typology exists along the corridor.*

FIGURE 4-33B *(next page) 1:200 Design section looking east near W 35th Ave at Maple St*

SECTION 5 - W 35TH AVE @ MAPLE ST

vegetated
hill side

single-detached
residential



THE CIVIC BOULEVARD

The civic boulevard is a general design response in three of the corridor's typological zones: the Open Lawn, the Town Centre, and the Generous Boulevard. While each of these typologies have their differences, they all have the same underlying structure of a narrow corridor flanked on both sides by roads. In all cases, the western road is an arterial route, while East Boulevard is a quiet neighbourhood distribution road. Used mostly for parking, East Boulevard is redundant with the parallel arterial road only metres away on the western side of the corridor.

The design strategy for the Civic Boulevard is to reclaim the space occupied by the redundant road. What this space becomes is a wide pedestrian walkway running parallel to the LRT. The LRT tracks are embedded in cobblestone to differentiate the surface, allow additional water absorption, and also for aesthetics.

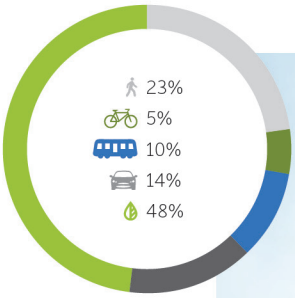
The arterial road—Arbutus Street in the north and West Boulevard in the south—is also wider than it needs to be. For the north section, Arbutus Street is reduced to two lanes plus parallel parking, down from four overly wide lanes. West Boulevard is already only two lanes plus parking, though is much wider than it needs to be for this. In both cases, the road width is reduced to the minimum. Narrowing the street naturally reduces vehicle traffic speed, making it safer for pedestrians. With the reclaimed space, the west sidewalk is expanded to support businesses. A three metre bike path takes up the remainder, separated from traffic by a healthy one-and-a-half metre bioswale.

In the middle of the boulevard is a large zone left free for a variety of programs that will vary over the length of the corridor, depending on what is most needed in the neighbourhood. Examples include playgrounds, outdoor adult exercise gyms, fenced off-leash dog parks, grassy fields, community gardens, food forests, native tree and plant zones and pollinator gardens, and plazas for art, performance, and other uses such as mobile farm markets.

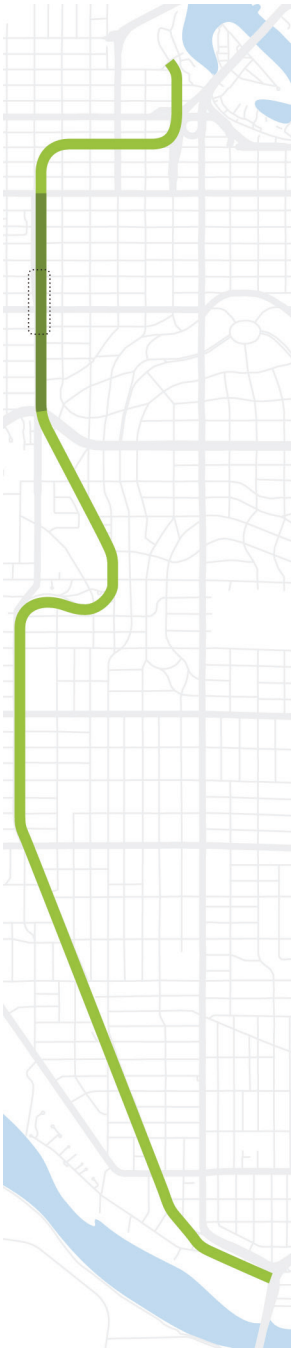
FIGURE 4-34A *Key plan showing where the design section is taken and where similar typology exists along the corridor.*

FIGURE 4-34B *(next page) 1:200 Design section looking north from W 45th Ave along W Boulevard*

SECTION 6 - W BOULEVARD @ W 45TH AVE



26.8 m
varied civic and ecosystem programs
3.0 m
sidewalk
3.05 m
3.05 m
5.5 m
sidewalk
3-4 storey residential
+ mixed-use
6.1 m
LRT - cobble embedded



W 16TH + ARBUTUS TRANSITION

The intersection of W 16th Ave and Arbutus St pose particular challenges and opportunities. W 16th Ave was the original southern boundary of the city, and Arbutus St follows different grids north and south of this line. In the 1950's or 60's, this misalignment was 'fixed' by curving Arbutus St over two and half blocks between W 14th Ave and W 17th Ave. To accommodate this new alignment, parcels adjacent to Arbutus were cut up into segments too small for buildings, and have only been used for parking ever since. In 2015, the slice of parking on the west side of Arbutus was redeveloped along with the mid-rise redevelopment of the Ridge Theatre complex. The proposed plan was an unimaginative concrete plaza, and though it was strongly opposed by local residents, this is what ended up being built. Complete today, the plaza is unused and feels exposed to traffic.

City traffic counts for the intersection during peak hours also peg vehicle usage well under what could be accommodated by single lanes in each direction. The intersection and particularly Arbutus St are over designed for cars while offering little for people. What's more, East Boulevard runs only 20 m parallel to Arbutus from W 16th Ave to W King Edward Ave (W 25th Ave). Used only as parking to serve residences along the boulevard, this street is redundant and only serves to frame the rail corridor within a sea of pavement.

The design proposal on the following pages aims to reconsolidate the land that was fragmented by realigning Arbutus St, and reclaim redundant space from vehicles for people and ecological services. While the focus is on the transition between differing typologies north and south of W 16th Ave, the proposal also serves to illustrate the similarly continuing treatment beyond the extents of the plan in each direction along Arbutus St.

FIGURE 4-35A *Key plan showing where the design plan is taken and where similar typology exists along the corridor.*

FIGURE 4-35B *(opposite) NTS Plan view of existing conditions at W 16th Ave. + Arbutus St.*

FIGURE 4-35C *(next page) 1:500 Design plan of the W 16th Ave. + Arbutus St. intersection.*

W 14TH AVE
W 15TH AVE
ARBUTUS ST
20
18
13
10
3
12
7
18
19
6
14
14
12
11
12
14
W 14TH AVE
W 15TH AVE

PLAN 1:
W 16TH AVE + ARBUTUS ST DESIGN PROPOSAL

As a major transition between two typologies of the corridor, the crossing at W 16th Ave is a key node along the line. The intersection has been realigned using a turbo roundabout and roadways narrowed to single lane with parking and reduced width crossings to prioritize space for people instead of cars. E Boulevard has become a pedestrian corridor and extended front lawn of park and socio-ecological amenity for properties along the street. The LRT, running underground from W 8th Ave to W 16th Ave, reemerges via ramp to run at grade south of this point. A new playground and off-leash dog park remedy the lack of these amenities in the vicinity.

DESIGN PROPOSAL KEY ELEMENTS

1. Turbo roundabout intersection and realignment of Arbutus St north approach (*Safer, more efficient traffic management, and consolidates city land to create new park*)
2. Pedestrian pathway and green space to replace E Boulevard (*Intersecting streets terminated with cul-de-sacs*)
3. LRT W 16th Ave Station entrance
4. LRT underground to surface ramp
5. Off-street bike path (*Typical along corridor*)
6. Protected street-side bike path (*W 15th Ave through W 8th Ave*)
7. North-south cyclist + pedestrian tunnel to bypass roundabout
8. Bike share station
9. Secure, enclosed bike parkade
10. Realignment of laneway to facilitate service vehicles
11. Reduced traffic lanes with dedicated parking
12. Narrowed pedestrian and cyclist crossings
13. Pedestrian greenway path with ‘rail-trail’
14. Bioswale gardens for stormwater management
15. Pollinator gardens
16. Community allotment gardens
17. Public fruit tree orchard
18. Naturalized habitat zones for birds and small animals
19. Playground + splash park (*grassy knolls offer seating and space for play while providing visual and acoustic separation from traffic*)
20. Fenced off-leash dog park

SCALE 1:500

0 5 10 20 40 m

FIGURE 4-36 *An example of the corridor between W 2nd Ave and W 5th Ave. The bioswale separating the bike path and pedestrian plaza collects stormwater runoff for slow absorption into the water table.*

FIGURE 4-37 *The Arbutus Corridor becomes a multi-modal linear park through the city.*

FIGURE 4-38 *Walking through a Coastal Douglas Fir habitat zone near W 16th Ave station. While this forest will take many years to reach this level of maturity, planning and planting now for long term ecological resilience will pay dividends, and can also create amazing spaces in the city.*

Conclusion

The first time I left Vancouver was when I moved to Halifax to begin my studies in architecture. Returning home after eight months away, I could see the city was changing very quickly. Then, as with each subsequent time I have returned after being away, it seemed as if the city had hit warp speed with the enormous number of new developments.

At its root, this thesis is an exploration of that change. In particular, this thesis explores the dynamic changes the Arbutus Corridor has seen over the last hundred years. No one could have predicted when the rail tracks of the Sockeye Special were first laid down they would one day fall out of use and set in motion the potential to rethink a large area of Vancouver.

When I began this thesis, the Arbutus Corridor had fallen out of the city's collective memory. Every few years it would bubble up into the collective consciousness before quickly fading away again. Only those who walked its worn dirt path or tended a garden along its length thought about it with any regular occurrence. Yet very rapidly after I started my thesis, the city purchased the rail corridor property, organized community consultations and design charettes, and is now working quickly towards a design of its own.

A lot of the questions I have asked throughout this thesis, I believe, are central to asking what kind of city Vancouver is becoming, and what kind of place we wish it to become. While it is natural for cities to change and grow over time, I was concerned that the questions I felt were most important would not be asked: How will climate change affect the city I love? How do changes within the city affect the natural beauty and ecological integrity of its surroundings? How will the affordability crisis affect my ability as a young professional to live, work, and potentially raise a family in the city in which I grew up? How can architecture and urban design play a meaningful and positive role in shaping a more resilient future for the city? And finally, rather than being driven by narrow economic constraints, how can an urban project help redefine the economic parameters that challenge the healthy development of the city?

Guiding this urban exploration has been another question: What are the urban and architectural decisions necessary to allow a community to be resilient?

Reflecting on these questions now, I realize this thesis is not just about reimagining the Arbutus Corridor, but also reimagining the idea of home. A constantly changing city is not necessarily a bad thing, but when these changes undermine the very people and communities who make the city a remarkable place, they threaten the heart and soul of the city. In a sense, this thesis was my attempt to protect what I love about Vancouver: the diversity of people and ideas, the incredible landscape and the rich ecology it supports, and the hopefulness and promise of a vibrant future that is embodied within the progressive spirit of the city.

While this thesis is site specific, it nonetheless offers lessons in building resilience for other locations. Whether gripped by the rapid pressure of development or building community resilience against climate change, there are themes and strategies that can be shared.

In starting this thesis, I was aware it was an ambitious undertaking. Not only is the site large in scale, but my intended goal of using the corridor to catalyze transformative change in the surrounding city is a complex problem with

almost endless scope. Limiting this scope was the hardest challenge, as I discovered resilience reaches into every aspect of the city and every field of study.

In part one, I felt a thorough discussion of the affordability crisis in the city was necessary, even if the solutions are mostly regulatory and require significant political leadership. Affordability is crucial to the economic stability of the city, and any attempt to build greater social resilience must address it.

In this regard, I strongly believe a shift in development to walkable Missing Middle neighbourhoods that respect existing urban character has an important role to play if the growth of cities is to become more inclusive. Neighbourhoods such as these can provide the necessary range of housing options to support a diversity of residents, including young adults.

As a society, we often tell our children they are the future. But what does the future hold for Vancouver if the children who grow up here cannot afford to live in the city as young adults? The long-term resilience of the city relies upon the energy, ambition, and creativity of its younger generations.

Resilience is not a simple programmatic element found in design textbooks. Resilience is an outcome of design decisions that deeply value inclusiveness and strive to bring wellbeing to current and future generations. With this in mind, this thesis is an exploration of and investigation into the kinds of urban conditions and decisions that overtime have the potential to remake Vancouver in service of all who wish to live there.

The proposed redesign of the Arbutus Corridor is a response to this investigation. The design is a carefully crafted intervention that works within a multitude of varying urban conditions along the length of the corridor. Reclaiming the city for its inhabitants, the design prioritizes people over vehicles. Where there is opportunity to expand the corridor beyond existing property lines and repurpose excessive vehicle infrastructure such as parking and road space, it was generally taken. This space is then transformed into healthy urban environments for the benefit of all residents and visitors alike, with transit and cycling infrastructure, civic amenities, and robust ecosystem services. My goal with this transition was not only to support contemporary changes to urban mobility and healthier lifestyles, but also to help accelerate their development and use.

The thesis imagines the Arbutus Corridor as a string of beads woven through the fabric of the city. Tying neigbourhoods of the city together are the linear ribbons of Light Rail Transit, off-street bike paths and expanded pedestrian paths. Supporting and growing from these transit and pedestrian enhancements are a series of ecological and civic amenity nodes. Representing a diversity of services and supports, each of these nodes is specifically tailored to maximize the capacity of the Arbutus Corridor for building vibrant communities supported by a healthy environment.

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