Urban Sustainability and Resilience in Kelowna:

Challenges and Opportunities

IGS 585 Knowledge Mobilization and Sustainability Policy

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1. Executive Summary

Being the fastest growing city in British Columbia, and the fifth fastest growing metropolitan area in Canada (Statistics Canada 2021a), the City of Kelowna is experiencing several challenges in adapting this rapid development for a sustainable and resilient present and future. This study has identified six major challenges associated achieving economic, environmental, and social sustainability and resilience in Kelowna: i) lack of accessible and reliable transportation systems often justified by a lack of demand ii) lack of urban development and liveability, iii) suburban sprawl, iv) lack of availability and affordability of housing, v) lack of urban vitality and social cohesion, vi) greenhouse gas (GHG) emissions. In the latter part, this study has proposed solutions for these challenges with an overarching goal towards promoting walkable neighbourhoods to ensure sustainability and resilience in the City of Kelowna.

Currently urban infrastructure for transport in Kelowna is centred around cars. Therefore, suggestions to improve public transit are shut down with the criticism that there is not enough demand to justify their costs. This lack of demand can be addressed through zoning related to the transportation system. By enacting zoning requirements that encourage walkability and transit use and disincentivize reliance on personal vehicles, such a demand can be created. Another problem of Kelowna's is the lack of more concentrated urban development and the increase in suburban sprawl, resulting in an ever-increasing use of cars and a decrease in urban liveability (this encompasses features that make a neighbourhood liveable, emphasizing the health and wellbeing of the community members). Further, as the population of the city expands rapidly, housing availability and affordability has become one of biggest challenges faced by residents of Kelowna. In recent years, Kelowna has gained the reputation of being one of the most unaffordable cities in Canada. The current design of public

infrastructure and green spaces in the city also lacks features that significantly promote urban vitality and social cohesion, and this also serves to reduce the urban liveability score of the city. Moreover, the existing housing and transportation systems are the greatest sources of GHG emissions in Kelowna. This, in the context of climate change, is very detrimental to the long-term sustainability and resiliency of Kelowna.

This study focuses on the importance of walkable neighbourhoods in addressing Kelowna's sustainability and resilience challenges. Walkability is a quantitative and qualitative assessment of how appealing or uninviting a neighbourhood is to pedestrians and the connectivity they have to the overall city. Walkable neighbourhoods are becoming increasingly important in towns and cities, and the link between walkability and neighbourhood social liveliness has been shown to be significant. When discussing the solution of creating healthy walkable neighborhoods in Kelowna, the Urban Liveability Index is proposed as a metric to assess where the city of Kelowna is in the present day as well as to create policies and steps towards long-term future goals to improve the city's sustainability and resilience.

To restrict suburban sprawl and increase housing supply, there should be densification and more development in the core areas through up-zoning strategies combined with a land value tax. Recognizing that market incentives for affordable housing have limited effect in the present highly concentrated housing market, as well as the principle of housing as a right, social and supportive housing plans are recommended as an area of focus. The policies of eliminating minimum parking requirement and supporting more mixed-use zones can also promote walkable neighbourhoods. Suggestions for the design and management of green and social infrastructures in Kelowna emphasize inclusion of people from all age groups, races, ethnicity, and incomes to increase social cohesion and ensure urban vitality in Kelowna. Lastly, strategies

to reduce GHG emissions should be considered for every development and future plan, especially considering the climate projections models for Kelowna.

The proposed solutions are a combination of short-term and long-term solutions, as well as solutions at both the policy and implementation levels and phases. With these proposed solutions, certain barriers – such as budget deficit, political and cultural opposition from community members, lack of integration among different levels of governments, and lack of knowledge mobilization and community engagement – need to also be acknowledged.

2. Introduction

2.1 Overview of the City of Kelowna

The City of Kelowna, located in the Okanagan Valley, is the third largest metropolitan area and seventh largest city in British Columbia (Statistics Canada 2021b). Kelowna has an area of approximately 212 km^2 while the census metropolitan area encompasses around 2905 km^2 (Statistics Canada 2019). The city's population is 144,576 as of 2021 with the density around 680 people per km^2 (Statistics Canada 2022). Kelowna's neighbouring communities are the City of West Kelowna to the west, Lake Country and Vernon to the North, Penticton and Summerland to the south, and Peachland to the southwest (Figure 1).

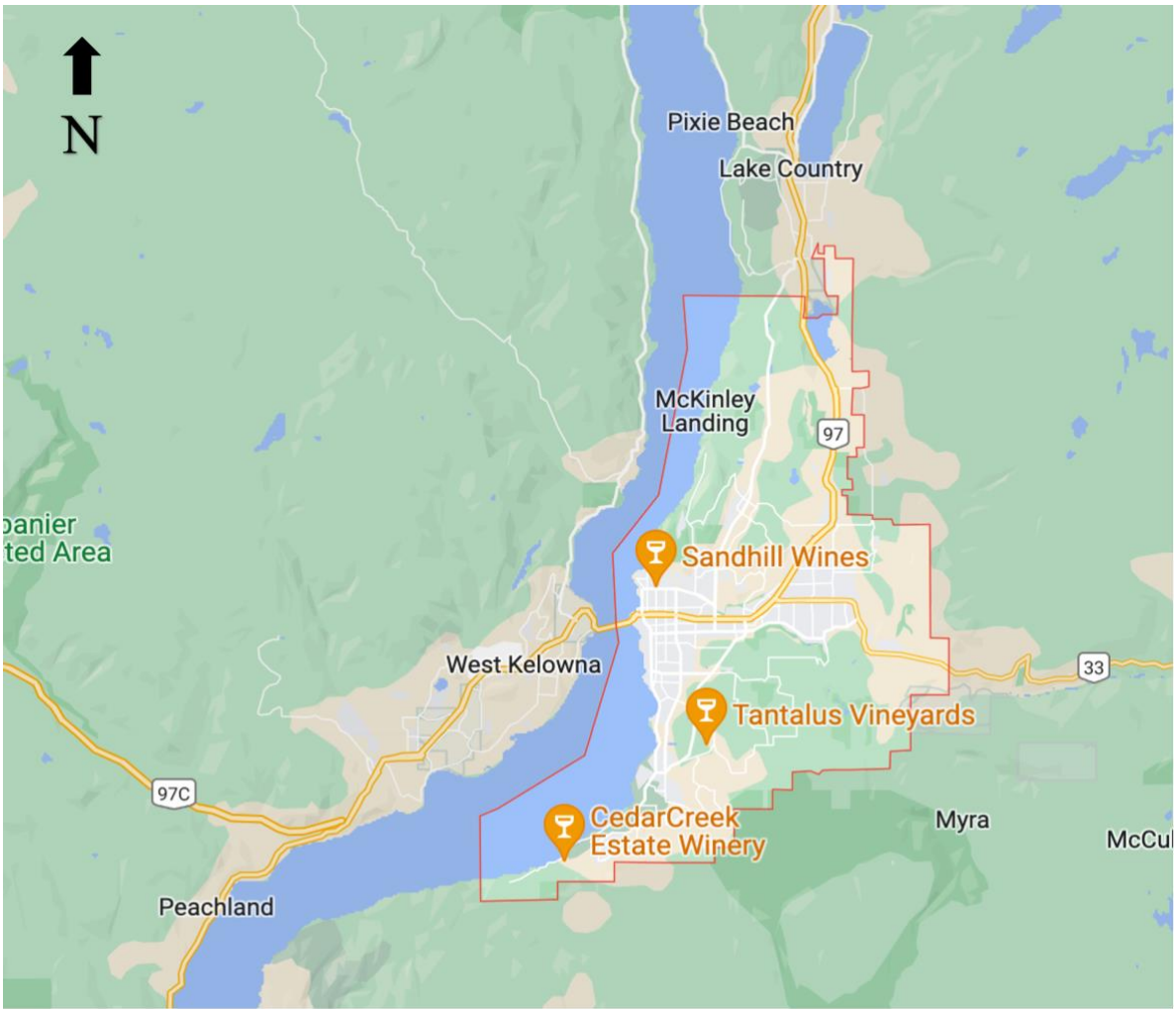


Figure 1: Location map of City of Kelowna (Source: Google Maps)

History

The Indigenous Syilx Okanagan people are the first known residents of the Okanagan region, though the exact dates of first settlement are unknown or predicted to be around 9000 years ago (Ewonus et al. 2004). White settler came to the area during the latter half of the 19th century and settler population grew considerably during the 1870s. By the 1890s they had commercially established several fruit orchards and agricultural enterprises (Ormsby 1935). The city officially became a municipal corporation on May 4, 1905, with a population of just 600. Until 1925, Kelowna relied on transportation over the Okanagan Lake. Subsequently, the Canadian Pacific Railway was extended to Kelowna (Surtees n.d.). Between 2005 and 2008, a new five lane bridge was constructed over the Okanagan Lake to replace the previous three-lane one (Ryan 2008).

Geography

The City of Kelowna is midway along the shores of the Okanagan Lake. It is part of the Interior Plateau of British Columbia with a string of lakes which were created by glaciation. Due to the presence of nutrients and minerals left by mountain river erosion and flooding, this region has fertile lands that are suitable for a successful agricultural economy (Tourism Kelowna 2022). There are three mountain ranges surrounding the Okanagan region: the Columbia mountains to the east, the Cascade Mountains to the south-west, and the Coastal Mountains to the west (Tourism Kelowna 2022).

Economy

The City of Kelowna is the largest tourism-oriented city in the Okanagan Valley. Most of the population are directly employed in the service industry and since 2016, tourism in greater Kelowna amounted to a $1 billion per year industry. The population of Kelowna are engaged in work in the following industries: healthcare and social assistance (17.1%), retail

trade (12.9%), manufacturing (12%), construction (10.7%), and education services (7.4%) (Kotler 2020). This city is very popular for different summer activities like water sports, golf, biking, and hiking, as well as winter activities such as skiing and snowboarding (InterVISTAS Consulting Inc. 2017). Other prominent economy sectors are the wine industry and the fruit industry due to the favourable climate and soil fertility of the region; these sectors have received international recognition. It is often compared to Napa Valley, California due to its climate and vineyard-filled scenery. Kelowna has also been often used as a filming location, as well as a market trial location for testing new products or any pilot/start-up projects (Way Back Machine 2008).

Demography

Kelowna is currently the fastest growing city in the province and the fifth fastest growing metropolitan area in Canada with a growth rate of 1.8%, which can be contrasted with the national average of 1.4%. This growth is mostly due to internal migration. Kelowna has a comparatively older population structure to the rest of Canada with an average age of 41.1 years, whereas the Canadian average is 37.6 years. Of the total population only 4.8% are under 5 years old, compared with 5.6% for all of Canada. Around 65.32% of the population are in the working age group (15 to 64 years), and the other 21.31% are in the younger population, which will be a part of the labour force in less than 2 decades. On the other hand, a major portion of population will retire within this time considering the aging population in Kelowna. Around 6.2% people are from a visible minority – South Asian (1.8%), Chinese (1.2%), Japanese (0.8%), Southeast Asian (0.6%), Black (0.5%), Filipino (0.4%), and Latin American (0.4%) and about 3.4% people are from Aboriginal groups or Indigenous groups (Statistics Canada 2021a).

Land Use and Transportation Network

There are numerous zones in Kelowna shown by the zoning bylaws, which demarcate the land use as well as the form, siting, height, and density of all development. The zones are – agricultural, rural residential, urban residential, multiple unit residential, hillside residential, commercial, industrial, public, and institutional, health district, and comprehensive development. In the Official Community Plan, City of Kelowna's growth was discussed for different land use types and zones such as urban centres, the core area, gateway areas, suburban neighbourhoods, and rural lands (City of Kelowna 2022; Figure 2).

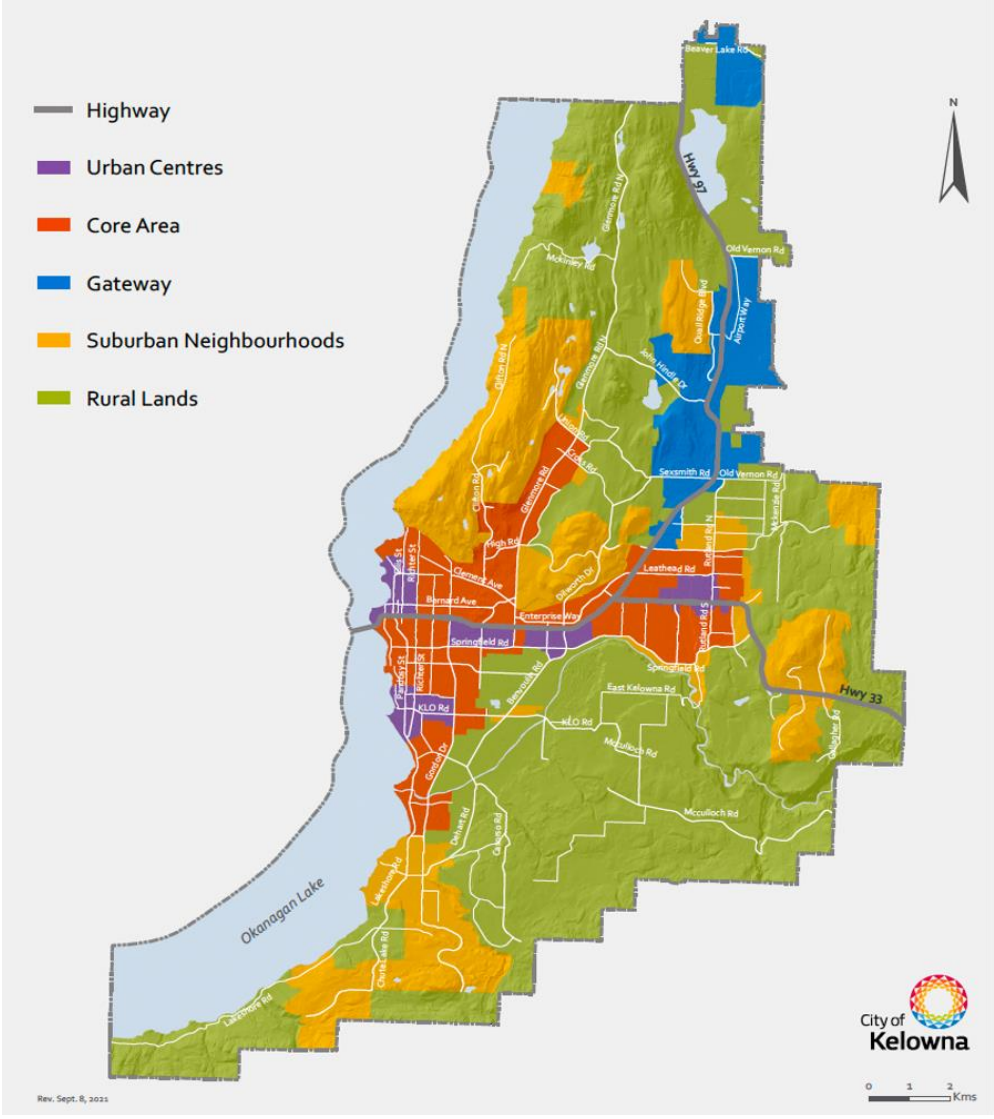


Figure 2: Growth strategy districts in Kelowna (City of Kelowna 2022)

Due to the low-density car-oriented development in Kelowna, it has experienced severe suburban sprawl. It has the highest car dependency rate in Canada and has the second highest per capita road transportation carbon footprint in British Columbia. Road transportation is responsible for more than 65% of total GHG emissions from the city (Tripathi n.d.). There are two highways in Kelowna – Highway 97 and Highway 33 – and for air travel, it has an international airport, which is one of the busiest airports in Canada with regular flights to other large cities in Canada and some cities in the USA.

2.2 Objectives of the Study

The objective of this study is to identify, examine, and discuss potential solutions to the major challenges to ensuring sustainable and resilient urban development in Kelowna. This study has identified six major challenges associated with the housing and transportation systems in Kelowna. The identified challenges are – i) lack of accessible and reliable transportation systems due to low demand ii) lack of urban development and liveability, iii) suburban sprawl, iv) lack of availability and affordability of housing, v) lack of urban vitality and social cohesion, vi) greenhouse gas (GHG) emissions. In the latter part of the paper, we propose solutions for these challenges with an overarching goal of promoting walkable neighbourhoods to ensure sustainability and resilience in urban infrastructure for housing and transportation in the City of Kelowna.

3. Definition of Key Terms

3.1 Urban Vitality

Urban vitality is defined as the quality of areas in cities that can attract a diverse range of people for a variety of activities across different time schedules (Mouratidis and Poortinga 2020). Lynch (1984) also defined it as the capacity of cities to satisfy people's "vital functions and biological necessities”.

3.2 Urban Liveability

Urban liveability is defined as the quality of urban areas that are "safe, attractive, socially cohesive and inclusive, and environmentally sustainable; with affordable and diverse housing linked by convenient public transport, walking and cycling infrastructure to employment, education, public open space, local shops, health and community services, and leisure and cultural opportunities" (Higgs et al. 2019).

3.3 Walkability and Walkable Neighbourhood

According to the Transportation Demand Management Encyclopaedia, "W*alkability* reflects overall walking conditions in an area. Walkability considers the quality of pedestrian facilities, roadway conditions, land use patterns, community support, security, and comfort for walking. Walkability can be evaluated at various scales. At a site scale, walkability is affected by the quality of pathways, building accessways and related facilities. At a street or neighbourhood level, it is affected by the existence of sidewalks and crosswalks, and roadway conditions (road widths, traffic volumes and speeds). At the community level it is also affected by land use accessibility, such as the relative location of common destinations and the quality of connections between them" (Victoria Transport Policy Institute 2019).

3.4 Affordable Housing

Affordable housing is defined as units of housing that cost "less than 30% of a household's before-tax income. Many people think the term "affordable housing" refers only to rental housing that is subsidized by the government. It is a very broad term that can include housing provided by the private, public, and non-profit sectors. It also includes all forms of housing tenure: rental, ownership, and co-operative ownership, as well as temporary and permanent housing" (Canada Mortgage and Housing Corporation 2018).

3.5 Sustainable Development

Sustainable development is the "[d]evelopment that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Field et al. 2012).

3.6 Resilience

Resilience is most commonly defined as "[t]he ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration or improvement of its essential basic structures and functions" (Field et al. 2012).

3.7 Transformative Resilience

Transformative resilience is defined as the "capacity to transform the stability landscape itself in order to become a different kind of system, to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable" (Folke et al. 2010).

3.8 Active Transformation

Active transformation is defined as the "deliberate initiation of a phased introduction of one or more new state variables (a new way of making a living) at lower scales, while maintaining the resilience of the system at higher scales as transformational change proceeds" (Folke et al. 2010).

4. Challenges, Current Initiatives, and Opportunities

4.1 Zoning for Walkability: Minimum Parking Requirements and Mixed-used Zoning

The suggestions to improve public transit – whether expanding bus routes, building biking infrastructure, or investing in emerging technologies like electric scooters and car-sharing – are often shut down with the criticism that there is not enough demand to justify their costs. This demand, however, can be created through policy and planning. The upcoming zoning bylaws of Kelowna are a great opportunity to create policies that increase demand for public transit and indirectly lead to a more reliable transit system.

4.1.1 Minimum Parking Requirements

Current Challenges

Minimum parking requirements, even though they are universal in North American urban planning, have varied and numerous negative consequences. Of these, three are of note in our discussion of walkability in Kelowna. The first concerns the substantial contribution of this policy to the problem of infrastructure deficit which afflicts many North American cities, including Kelowna. According to the 10-Year Capital Plan, the City of Kelowna is forecasted to have $388 million in infrastructure deficit by 2030 (City of Kelowna 2021). A substantial portion of this deficit is due to car-centred maintenance and development costs such as the building and maintenance of roads. These costs could be reduced through transitioning away from cars, which removing parking requirements will indirectly contribute to. There is also, however, a hidden cost that directly concerns parking. Minimum parking requirements are often calculated for each land use zone by considering the peak use of businesses which creates an excess of parking areas in most circumstances. While this makes parking free for nearly all trips by community members, it does not mean that parking is cost-free for the city or business. The cost of paving and maintenance may be considered negligible, but parking lots consume

substantial land area located in desirable areas of this city. This land use results in lost potential revenue for businesses which translates to higher prices for the customers. Most importantly, it also constitutes lost potential tax revenue for the municipality as the lots could have theoretically been new businesses in dense and desirable areas. As the cost of parking is intrinsically linked with land value, it is not possible to calculate a standard global parking cost. However, many municipalities include these costs in their planning considerations. Donald Shoup, in his seminal 1999 paper, mentions the examples of parking costs of Palo Alto, California, which amounts to $17,848 per parking space, and of Beverly Hills, California, which could climb as high as $32,400 per lot (Shoup 1999). Parking cost calculations cannot be found for Kelowna, but considering the high value of the city, it can be assumed that they would be considerable.

The economic inefficiency of this system relates to the second detrimental effect of parking requirements. Had policies regarding parking leaned towards a laissez-faire position – even though this should not be the goal as the European cases show that political intervention is beneficial if it is against car-centeredness – businesses and developers could have determined the fair market price for parking so that they could reduce their lots and dedicate them to new business ventures They could, therefore, leave enough parking lots so that an acceptable number of customers – who might have been dissuaded, or prevented by disabilities from coming to a site without parking – can still join but with a higher price. This new scarcity would also allow the municipality to charge for on-street parking which is justifiable since the taxpayer is paying for the road on which cars can park. It is important to note that abolishing minimum parking requirements does not mean abolishing parking. All businesses would still have parking spots simply because they recognize some customers will need them. It is only that the cost of parking can be more accurately determined.

The final issue relates to the adverse effects of parking lots on walkability and pedestrian experience. Not only do parking lots themselves lack any consideration for pedestrian use – as there are no pathways, pedestrian signs, or designated spaces; they also negatively affect the walkability of surrounding sidewalks. Open space lots decrease density by creating unnecessary distance between buildings that would increase walking time. They also render walking less stimulating and pleasant because they prevent the presence of store windows and shop fronts adjacent to the sidewalk which is one of the key indexes of walkability.

Current Strategies and Initiatives

Minimum parking requirements emerged in local policies during the first half of the twentieth century to accommodate the rise in car ownership. While such requirements are now common in the municipal bylaws of North American cities for every type of land use, urban developers have increasingly come to realise the detrimental effects of such practices on the cities and their sustainable growth. In Europe, which was on track to become as car centric as North America in the 1950s and 1960s, this push against minimum parking was initiated sooner and with more conviction to turn from vehicular accommodation to regulation (Kodransky and Herman 2011). Today, minimum parking requirements are not only practically extinct in European cities, but many places have maximum parking policies that require new development to be accessible by public transit for a minimum number of users.

Kelowna, however, is not set to meet this trend in any capacity since the zoning bylaws draft does not reveal any changes in parking requirements compared to the previous bylaw. The only course of action for reducing parking is a policy known as Payment in Lieu of Parking that allows new developments in urban centres to have reduced parking in exchange for paying a substantial fee of more than $33,000 per spot to the city (City of Kelowna 2019a). This is not

the incentive required to reduce parking in the city, but it shows the high cost of parking lots in Kelowna. The establishment of parkades and alternative parking areas as well as the monetization of on-street parking in Downtown and Pandosy area is a step in the right direction for the city and should be expanded to include the entire municipality.

4.1.2 Mixed-Use Zoning

Current Challenges

The current zoning proposals for the urban centres and core areas in downtown aim to create density and prevent sprawl in Kelowna. However, they are designed with the same suburban mindset and criteria and would, therefore, inevitably become undesirable places to live, further failing to create the intended sustainable way of living because such a suburban framework is not translatable to urban living. Whereas limited use of residential streets, peace and quiet, and travelling from the periphery to the centre for any business or commercial activity are the desired features of any suburb, they are diametrically opposed to what is considered sustainable urban design. Residents in dense areas feel safer with a lot of foot traffic in their neighbourhood, they prefer activity and vitality over quiet, and they do not want to travel long distances for everyday business or shopping (Tu and Lin 2008). These fundamental differences show that in contrast to suburbs where a clear division between residential and business zones is desirable, in dense urban areas, such distinction is not necessary but rather detrimental.

Another design obstacle in the OCP and Transportation Master Plan is the city's incorporation of the language of Transit-Oriented Development (ToD) which holds that new developments should only be allowed along the existing transit route (City of Kelowna 2022). The justification for this is that there is no demand to rationalize building new transit routes, hence, by building business and large buildings along transit routes, the users of those areas

will be able to use transit. This rhetoric is misleading because the city's existing transit is not reliable enough to warrant this approach and so, this way of thinking means the city is, in effect, not implementing ToD methods, but rather, is engaging in Road Oriented Development.

Current Strategies and Initiatives

In the Official Community Plan and the draft of the Zoning Bylaws, mixed-use zones are rare and only dedicated to developments that have occurred or were initiated prior to the OCP. Mixed-use areas in the city will increase liveability, walkability, and desirable density while decreasing travel distances and helping address the infrastructure deficit. The assistance of permitting business development along transit corridors coupled with the lack of transit expansion means that business zoning will be highly concentrated while residential zoning will be expanded to the periphery. This rigid distinction of the uses means that mixed-use areas will not be present in any shape or form based on current policies in Kelowna (City of Kelowna 2022).

4.2 Urban Liveability and Suburban Sprawl

4.2.1 Urban Liveability

Current Challenges

A major challenge for Kelowna is the lack of urban development, which is also in conjunction with suburban sprawl; as neighbourhoods sprawl past the permanent growth boundaries of the city there is less development within the urban centres. This is important to address since in creating a sustainable city the aim is to create a more complete and compact community that can sustain itself through mixed use building and multiple, fuel-efficient transportation options. The future of Kelowna as a compact and vibrant city is displayed in the "Urban Centres Roadmap" with the goals that the city associates with the urban centres to create these communities (City of Kelowna 2016a). Urban development and vibrancy are also

associated with the idea of urban liveability. It is, therefore, important to understand what urban liveability is and how to increase it. Urban liveability is defined as "safe, attractive, socially cohesive and inclusive, and environmentally sustainable; with affordable and diverse housing linked by convenient public transport, walking and cycling infrastructure to employment, education, public open space, local shops, health and community services, and leisure and cultural opportunities" (Higgs et al. 2019). This definition emphasizes the health and wellbeing of the community members which is important when addressing the community resilience of the city.

The city of Kelowna is lacking in many features of urban liveability within the defined urban centres, and this has resulted in an overreliance on cars as transportation as well as a lack of connectivity within the neighbourhoods. With an increase in urban liveability the neighbourhoods would have everything for a person's everyday needs, or it would connect through public transportation, walking and biking infrastructure to another neighbourhood that has it (Higgs et al. 2019). This aligns with the idea of connectivity, as a healthy walkable neighbourhood where the five urban centres are linked by high density of connections creating a network, would translate to an increase in urban liveability. Increasing urban liveability will also mean addressing the zoning that the city has to increase mixed-use zoning, which is important since a "mixed-use new urbanist development produced 22% fewer emissions than an adjacent development of large single-family homes" (Senbel et al. 2014) hence reducing the greenhouse gas emissions of the city.

Current Strategies and Initiatives

The city of Kelowna has been addressing their urban development with initiatives that are mainly targeted at increasing the amount and diversity of the development in the Downtown area. This has largely been accomplished by the Revitalization Tax Exemption Program

(Bylaw 9561) that targets three separate tax incentive areas two of which are downtown and one in the Rutland urban centre. In addition, under Bylaw No. 10515, development costs are lower by 29% in the downtown area, acting as an incentive for development (Rodriguez 2020). Another method that has helped to increase the downtown development is the greater detail that the Civic Precinct Plan, which is focused on the downtown, has as compared to the OCP since it targets specific streets and building with purposeful driven objectives. An example of such an objective would be the redevelopment of the existing Museum site at Queensway/Ellis as affordable housing (City of Kelowna 2021).

The future focus of the city is to achieve a higher density of residents and jobs per hectare within the urban centres to create primary hubs of activity. There are a few specific plans for Urban Centres such as the Capri-Landmark Plan and the Civic Precinct Plan. The Capri-Landmark Plan has a focus on increasing urban liveability with goals to increase housing, mixed use development, improve sustainable transportation, and develop the natural assets of the region (City of Kelowna 2019b). Within this plan, there are objectives the city has for public-use, land use, and transportation providing detail that was missing from the OCP. The city also has a multi-stage improvement plan for development, implementing higher priorities first to allow for a gradual development and integration of the policies in the area. Having a plan such as the Capri-Landmark Plan not only gives an overarching plan for this area but also allows for future zoning to be much easier and for assessing if development plans align with the goals of the city as a whole (City of Kelowna 2019b). In general, in the OCP the future projections defined are that 73% of the city's growth will be in the Urban Centres and the Core Area, with 48% of that within the Urban Centres specifically (City of Kelowna 2021).

While there are long-term goals to increase urban development in the city laid out in the OCP, the language around how these goals will be achieved is quite vague. There has been

a great deal of focus on the Downtown Core through the Civic Precinct Plan with some additional focus on the Capri-Landmark and a program in Rutland. There is a need for more urban centre plans that provide incentives for development within them. Additionally, according to the Urban Centres Roadmap the urban centres are all at varied stages of development, with Midtown in early, Capri-Landmark between early and middle, Rutland in development, and South Pandosy and Downtown in mature. This demonstrates that urban liveability is lacking within the city of Kelowna and needs to be addressed to create a city that is compact and resilient.

4.2.2 Suburban Sprawl

Current Challenges

A major challenge to a resilient and sustainable future for Kelowna is suburban sprawl. The city of Kelowna has in the past been ranked as the eighth most sprawling city within Canada (Bourne 2019). Suburban sprawl can be defined as "a particular form of urban growth characterized by low densities, segregated land uses, the presence of dysfunctional, unused spaces left over after development, and automobile dominated landscapes" (Bourne 2019). In Kelowna there has been a transition of growth within the city to an increase in growth in the outer suburban areas with a decline in the inner-city suburbs (Bourne 2019), that is defined as the Core Area within the OCP, thus also reducing the walkability of the city (City of Kelowna 2021).

The city of Kelowna is further impeded from a sustainable and resilient future due, in part, to the cost of infrastructure maintenance for suburban neighbourhoods. Within the OCP it is defined as a long-term challenge, especially as "the costs to maintain infrastructure in suburban areas are considerably higher than the tax revenue collected in these areas" (City of Kelowna 2021). Suburban sprawl is a problem for sustainability because "cities consume in

transport and housing between 60–80% of energy production worldwide … and account for a roughly equal share of global CO2 emissions" (Conticelli et al. 2017) and this is further fuelled by the additional pressure of the sprawl of neighbourhoods. As there is lack of reliable public transportation in suburban neighbourhoods and the primary transportation for these areas are cars, the GHG emissions are much higher than in a dense walkable neighbourhood. In addition, the single detached residential dwelling that is popular within suburban neighbourhoods has the highest embodied emissions per dwelling "due to their large size, lack of shared walls, and because their operation emissions are greater than those for dwellings located closer to the urban centre" (Senbel et al. 2014).

Current Strategies and Initiatives

There has been some natural progression of the city towards increasing urban densification, resulting in less suburban sprawl. This is demonstrated in the OCP documents where the 2030 OCP had 49% of growth within the city core whereas the 2040 OCP has 67% of growth within the city core (Rodriguez 2020). In addition, the focus of the city has been on multi-family and mixed-use development for the core area and urban centres, accommodating growth in the urban centres to help in preventing sprawl.

Current initiatives within the city to decrease the suburban sprawl within Kelowna are targeting increasing infill housing within already created neighbourhoods. Infill housing is defined by the city as the addition of new housing units to existing neighbourhoods. Currently, infill housing is completed under the RU7 zone which permits two to four units depending upon the size of the lots, allowing either the redevelopment of the entire plot or the construction of additional units on the plot. Incentivization for infilling has been through the past Infill Challenge of 2016 as well as the current 2022 Infill Challenge. The 2016 Infill Challenge was a contest for architectural firms to submit infill housing plans to win. If a developer or owner

uses the winning plans for their development, it results in the reward of reduced development permit processing times (City of Kelowna 2016b). While the city of Kelowna has provided some rewards with the use of the infilling challenge winner plans, it also relies mostly on intensification within neighbourhoods to occur passively due to market demand (City of Kelowna 2021).

Future plans and policies of the city of Kelowna for suburban sprawl are outlined in the OCP and are focused on ground-oriented densification within the Core Area and higher development grouped near the transit supportive corridors (City of Kelowna 2021). In addition, there is a current Infill Challenge occurring to find infill housing that "works to enhance affordability, diversity, resiliency, inclusivity, and liveability" (City of Kelowna 2016b). It is uncertain what type of incentive the current infill challenge will have for developers to increase urban densification.

While suburban sprawl is addressed within the OCP and even with the progress towards intensifying development within existing neighbourhoods, the approach is passive and provides little incentive and diversity of infill options. The OCP has great objectives outlining what the city would like to see pertaining to the creation of a sustainable city with a restriction on suburban sprawl. While the articulation of these goals is important, the plan to achieve them is still vague. There is a need for more context specific action as well as penalties for sprawl outside of the permanent growth boundary. In addition, it would be useful to have more growth concentrated within the city to address the extra cost of infrastructure.

4.3 Housing: Availability and Affordability

Current Challenges

Housing diversity and affordability is an essential aspect of a healthy, liveable city. Housing affordability stress is defined by the City of Kelowna in their "Healthy Housing

Strategy" report as the proportion of households that spend 30 % or more of their household income on housing costs (City of Kelowna 2018a). The City of Kelowna also provides a more holistic and expansive definition of what a healthy housing system consists of. This involves the combined characteristics of not only affordability, but also quality, community, and location (City of Kelowna 2018a).

With Kelowna's population on a rapid growth curve, housing affordability has become one of the most perceptible and pressing challenges faced by the city's residents. In recent years, Kelowna has gained the reputation of being one of the most unaffordable cities in Canada (Munro 2022). In the span of roughly three decades, the number of households spending 30 % or more of their income on housing has increased from 11 % in 1991 to 28 % in 2018. Data suggests, however, that the cause of the city's housing affordability crisis is not necessarily the inability of developers to keep up with the city's growing population since, between 2011 and 2016, new housing production actually exceeded the city's population growth by 29 % (City of Kelowna 2018a). Therefore, the problem does not lie so much in the lack of housing development but rather the types of housing that are available.

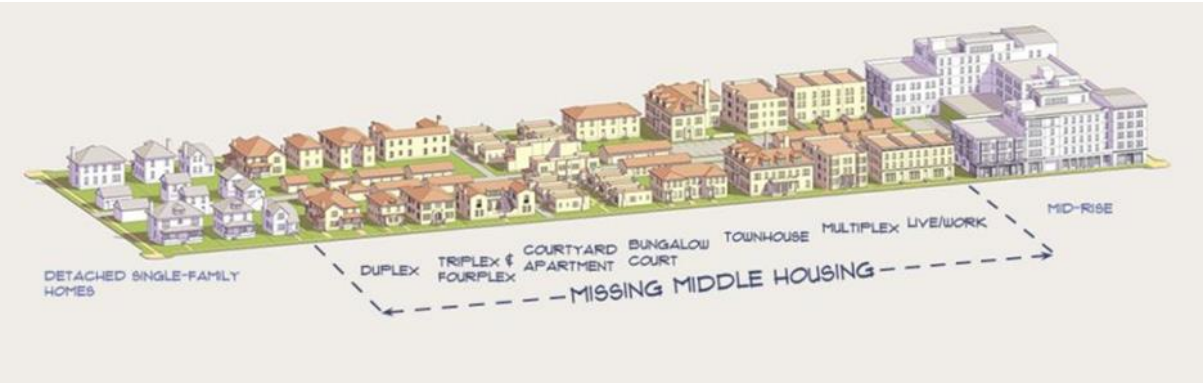


Figure 3: Missing Middle Housing (City of Kelowna 2018a)

Traditionally, the dominant form of housing in Kelowna has been single-family detached homes built on large lots of land. As the city's population and demand for housing

grows, however, this lack of housing diversity is creating a crunch in affordable housing options that account for the living requirements and financial constraints of diverse residents such as students, low-to-middle income families, ageing populations, single working professionals, etc. As represented in Figure 3, there is a missing middle in housing diversity between single detached homes and high-rise apartments (which together make up 70 % of housing) – this missing sector encompasses the medium to higher density duplexes, triplexes and fourplexes, courtyard apartments, bungalow courts, townhouses, multiplexes, live/work, and mid-rise apartments (City of Kelowna 2018a).

The biggest emerging gap in the housing market has been identified as the lack of affordable rental housing. As compared to owners, among whom 6,900 households or 19% spend more than 30% of their income on housing costs, among tenant households, 8,000 or 47% spend above 30% of their income on rent (City of Kelowna 2018a). As housing prices rise, owning a house is becoming more of a distant dream for many low-and-middle income households and rental housing is often the short or even long-term housing solution for many. Moreover, certain growing sections of the city's population, such as students, are almost exclusively in the rental market. Consequently, there has been a steep rise in the past decade in the demand for rental housing – whereas between 2005 and 2010 only 32% of new households in Kelowna were renter households, this number has increased to 73% between 2011 and 2016 (City of Kelowna 2018a). This surge in demand has not been met sufficiently on the supply end and the city's rental market has shown a growing trend of low vacancy rates and price hikes.

Currently, the rental supply is dominated by the secondary rental market of carriage homes, secondary suites, and rented homes. The stock of primary rentals – long-term, dedicated, and purpose-built rental complexes and apartments – is still quite limited. The

supply of secondary suite rentals is not, however, stable as it can fluctuate depending on the priorities of individual owners (City of Kelowna 2018a). With Kelowna being a popular summer tourist destination, these secondary suites are often used for short-term vacation rentals (such as Airbnb) which can put additional stress on the long-term rental market. Although city regulations limit these short-term rentals to commercial areas and rooms in principal homes, rather than secondary suites, there are many short-term rental units that are not in alignment with these city bylaws (City of Kelowna 2018a).

According to Kelowna's "Rental Housing Inventory", the city has a total of 8,090 purpose-built rental units. Of these, 82% of these are market rentals, while only 18% are subsidised rentals (City of Kelowna 2019c). Most of these buildings were built in the decade between 1980 and 1990 with a significant slow-down in the subsequent three decades. This trajectory is in the context of changes in policy at the federal level, as the federal government began a "process of divestment and retrenchment in terms of housing investment" in the early 1990s (City of Kelowna 2019c). Whereas the federal government had earlier played an important role in funding social housing as well as providing tax incentives for private developers of rental housing, this was greatly cut back in subsequent years (City of Kelowna 2019c).

For vulnerable groups and low-income families, the resulting crunch in rental housing, low vacancy rates, and price hikes has created a particularly stressful and precarious environment in Kelowna. Housing affordability is one of the top factors contributing to people losing housing in the city and having to be homeless or in temporary shelters. The number of days on average that people are finding themselves without a house has also been increasing year by year. For instance, from 2016 to 2018, the average grew from 192 to 241 and by 2020, this number was 267 (Zeilinski 2020).

The features and design of the existing stock of rental housing in the city also do not adequately meet the needs and requirements of all population sections. Of the existing rentals, a majority are 1- or 2-bedroom units with a very limited stock of 3-bedroom family-oriented rental units (City of Kelowna 2019c). The "Rental Housing Inventory" also notes the importance of rental housing design that accounts for accessibility to people of different ages and abilities. This is particularly important considering the changing age demographic of the city with the projected estimate of 25 % of the population being senior citizens (65+) by the year 2040. However, survey results indicate that most rental property owners/managers have not completed any accessibility upgrades in the last ten years and do not plan to do so for the foreseeable future (City of Kelowna 2019c). As most of the buildings in the rental market are over 40 years old, they will also need several other capital upgrades and retrofitting for better energy efficiency.

While most rental housing units are located in the core areas of town which are near transit routes, there are key developments in the rental market that have not been planned for ease of walkability and transit. This is more the case with market rentals than government subsidised rentals – 25 percent of market rentals lie outside the core area as opposed to 16 percent of subsidised rentals (City of Kelowna 2019b). A case study of this is the development at Academy Way, which is advertised as addressing the need for purpose-built student rental housing as Kelowna grows increasingly into a university city. Even though it is located near a village centre (the University of British Columbia Okanagan campus) it is completely disconnected from the rest of the city, any major shopping centres, and other important facilities. This gives its residents a distinct spatial disadvantage, as to manage even basic day to day activities requires its residents to travel long distances. There is not yet a robust enough public transit system in place connecting to this development. The walk to the closest bus stop connecting to the rest of the city is 15–20-minutes in hilly terrain. In short, it is very

inconvenient to live here without a car. Owning a car, however, also greatly increases living costs for students and not all can afford it.

With this overview of the current conditions, it is evident that there is a need for intervention in all four aspects of the housing system in Kelowna – affordability, quality, location, and community.

Current Strategies and Initiatives

The City of Kelowna has been trying to tackle the problem of housing affordability in a variety of ways. To address the "missing middle" of housing, there has been an effort to up-zone areas of the city to encourage diverse and denser forms of housing, thus also aligning with the goal to limit suburban sprawl. In 2017, the new sensitive infilling RU7 zone was introduced to allow up to 4 units on a plot of land (City of Kelowna 2013) with the maximum height of 8 m or 2 storeys for residential buildings (City of Kelowna 2013). However, even in core areas RU7 zones are limited as much of the zoning in Kelowna remains quite exclusionary, since it is restricted to low-rise, low-density buildings. Single detached homes lots - the RU1 to RU3 zones – are still the most found ones. Urban planner Adam Wilson, however, points to the downside of RU7 zoning in Kelowna:

> RU7 lots were created throughout Kelowna to address the issue of the "missing middle" housing; however, it can be argued the city inadvertently worsened the affordability of those properties. Properties that were previously home to one small house have been either redeveloped as fourplexes, where each unit sells for more than the previous home under the old zoning, or remain with small homes, which now sell for a much higher price due to the possibility of converting them into fourplexes in the future. (Wilson 2022).

This is a known problem with up-zoning policies as in the short-term, they often lead to high property prices because of market speculation without a significant increase in supply of additional units of affordable housing (Saunders 2019). This is something that has not been fully factored into Kelowna's up-zoning strategy.

The BC government has a program for rental supplements to low-income households who cannot afford the market rental rates. This does not, however, address the root problem of housing affordability and can only be seen as a short-term measure to help people tide over the market crisis. The most important long-term strategy is to address the gap in the supply of affordable housing. The City of Kelowna addresses this gap with two main incentives to encourage the increase in the supply of more long-term, stable, and affordable purpose-built rental housing. The first is the Rental Housing Grant Program which off-sets development cost charges for purpose-built rentals. The second is the Rental Housing Tax Exemption incentive which provides eligible projects relief from a portion of the municipal property tax (City of Kelowna 2019b). Another minor incentive is the reduction of minimum parking requirements by 20 percent within urban centres and 10 percent outside of urban centres, as long as development is sub-zoned as Residential Rental Tenure (City of Kelowna 2008).

A major limitation of market incentives in addressing housing affordability is the nature of local housing markets, which have become "highly concentrated" in the last decade with a few large developers in control of housing production (Cosman and Quintero 2021). The housing market does not, therefore, function as a perfectly competitive market. While a competitive market would respond to market incentives by increasing supply and bringing down the prices of goods, developers in the housing market have too much power over supply and can wait for prices to be high before bringing in additional units. At the federal level, Canada's $73.4 billion Affordable Housing plan is still funnelling most of this money into such

market incentives that facilitate private developers in constructing more housing, often on already existing projects. This does not guarantee an increase in supply of affordable housing and instead serves to simply increase the profits made by the private developers (Punwasi 2021).

In the past 5-7 years, due to the overwhelming and urgent need for more affordable rental housing supply, there has been more activity in the construction of subsidised housing (City of Kelowna 2019b). In 2019/2020, the Province of British Columbia came out with a 30-point plan for affordable housing in BC with an investment of 6.6 billion dollars over ten years, with a major portion of this fund going into BC Housing projects that will fill the market gap in "homes for growing families and seniors, housing options for women and children fleeing violence, individuals experiencing or at risk of homelessness and housing for Indigenous Peoples" (City of Kelowna 2019b). Through an affordable housing partnership between the City of Kelowna and BC Housing (whereby the city provides zero cost property to BC housing for developing affordable housing), a goal of 300 units of supportive housing in purpose-built rental buildings, was reached in 2021 (Rodriguez 2021). These actions support the Housing first principle adopted in the city's "Journey Home Strategy" which aims to guarantee housing for groups vulnerable to chronic houselessness (City of Kelowna 2018b).

There is still, however, a long way to go in providing sufficient affordable housing. This is hindered by the fact that land acquisition for affordable housing projects has not been a very systematic or well-funded effort in Kelowna. While the City has a Housing Opportunities Reserve Fund set up for this purpose it is much too limited in its resources to enable the City to be an effective partner in provincial and federal affordable housing projects (City of Kelowna 2018a).

4.4 Urban Vitality: Social Cohesion and Public Space

Current Challenges

To understand the current challenge of social isolation and, therefore, social resilience within Kelowna, we need to understand the characteristics of successful urban cities. A great number of empirical studies have been done over the past two decades to investigate the relationship between the built environment and a variety of social and health outcomes. In the study of sustainability in cities, not surprisingly, we often encounter the term “urban vitality” and its relationship with walkability. In the field of urban planning, Jacobs (1992) believed that the theory of urban vitality is closely related to the fields and concepts of built environment, social interaction, public space design, transportation, urban forms, and walkability among other things.

Urban vitality has a wide range of meanings as a socially constructed concept. Kevin Lynch defined urban vitality as the capacity of cities to satisfy people's "vital functions and biological necessities” (1984). Further, urban vitality is also the raw power and energy within a city (Landry 2000). Paul Maas described vitality as “the synergy arising from a ‘variety’ of somewhat ‘unique’ commercial and entertainment opportunities, and a dense socially heterogeneous pedestrian population” (1984). By focusing on the connection between urban design and urban vitality, Montgomery defined it as intensive and diversified human activity characterized by "many and different comings and goings, meetings, and transactions" (1998).

Despite the lack of complete agreement on the definition and metrics of urban vitality, scholars argue that the built environment – which includes land use patterns, urban design, and transportation networks – is a crucial determinant of urban vitality (Frank and Engelke 2001; Handy et al. 2002). To create urban vitality from the viewpoint of human activity, urban form, and urban image, Montgomery offered 12 urban design principles, among which development

intensity, mixed use, and movement were key (1998). In comparison, Jacobs (1992) highlighted four characteristics that encourage street life and vitality: population concentration, small blocks, mixed uses, and buildings of varying ages. She also argued for the importance of neighbourhood parks and sidewalks in successful cities. This connects directly with the idea of walkable neighbourhoods.

Social isolation is a major concern in Kelowna, as it is in many other cities throughout the world (Kelowna Capital News 2021). The social isolation of urban residents is a growing problem that can diminish the social resilience of the city. It appears that city parks, as hubs of social activity, have significant potential in this respect. Thus, bringing neighbours back to neighbourhoods through "increasing social and public connectedness in these parks" can be both a challenge and an opportunity for Kelowna.

To investigate the function and significance of neighbourhood parks in enhancing urban vitality, first, a clear definition of them and their differences with other urban parks must be understood. The city of Kelowna classified the parks in this city in six Groups: City-Wide Parks, Recreation Parks, Natural Area Parks, Linear Parks, Community Parks, and Neighbourhood Parks (City of Kelowna 2018d). Only neighbourhood and community parks have service zones that are specified on a neighbourhood level. Community Parks feature higher intensity recreation uses such as multi-recreational courts (i.e., tennis, basketball, hockey, lacrosse), sports fields with minimal bookings, and infrastructure to meet vehicle, transit, cycling and pedestrian needs. They may also include playgrounds, open spaces for unstructured activities and other uses typical of a neighbourhood park.

Neighbourhood Parks are centrally located within a neighbourhood and typically serve 2,000 residents within one kilometre or a five-minute walk to the park. They may include playgrounds, non-bookable recreation spaces, trails, picnic areas, and passive recreational

space for children, families, seniors, and others to enjoy. Neighbourhood and community parks are the most generalised sort of city park we have; thus, they expose certain general principles about park behaviour more clearly than specialty parks (Jacobs 1992). According to Malek et al. (2012), a neighbourhood park is a site where varied requirements are addressed without having to drive a great distance, offering basic recreational amenities for all users, and is generally placed in the core of a development. These parks provide both active and passive recreation by providing a local park function as well as facilities for a diverse group of individuals. However, in this context, neighbourhood park refers to parks that are located inside a community neighbourhood housing area and provide leisure and recreational opportunities for the local and immediate populations.

Neighbourhood parks, as one of the significant built environments in modern cities, play a considerable role in improving social cohesion and urban vitality. These green spaces, along with other types of urban parks (known as “nodes of activities") and green corridors, form a socio-environmental network (Figure 4). These green networks make inner-city neighbourhoods more liveable as they offer opportunities for recreation and exercise to at-risk and low-income children, youth, and families who might not be able to afford them elsewhere. They also provide places in neighbourhoods where people can experience a sense of community. Research shows that residents of neighbourhoods with greenery in common spaces are more likely to enjoy stronger social ties than those who live surrounded by barren concrete (Gies 2006). In addition, Gies (2006) supports the widely held belief that community involvement in neighbourhood parks is correlated with an increase in “social capital”. That is, when people work together toward shared goals, such as working in a community garden, creating a park from a vacant lot, or doing social activities, they get to know, trust, look out for, and feel invested in each other and in their neighbourhood. This sense of community,

willingness to work together, and intervene for the common good when trouble arises, is also known as social resilience.

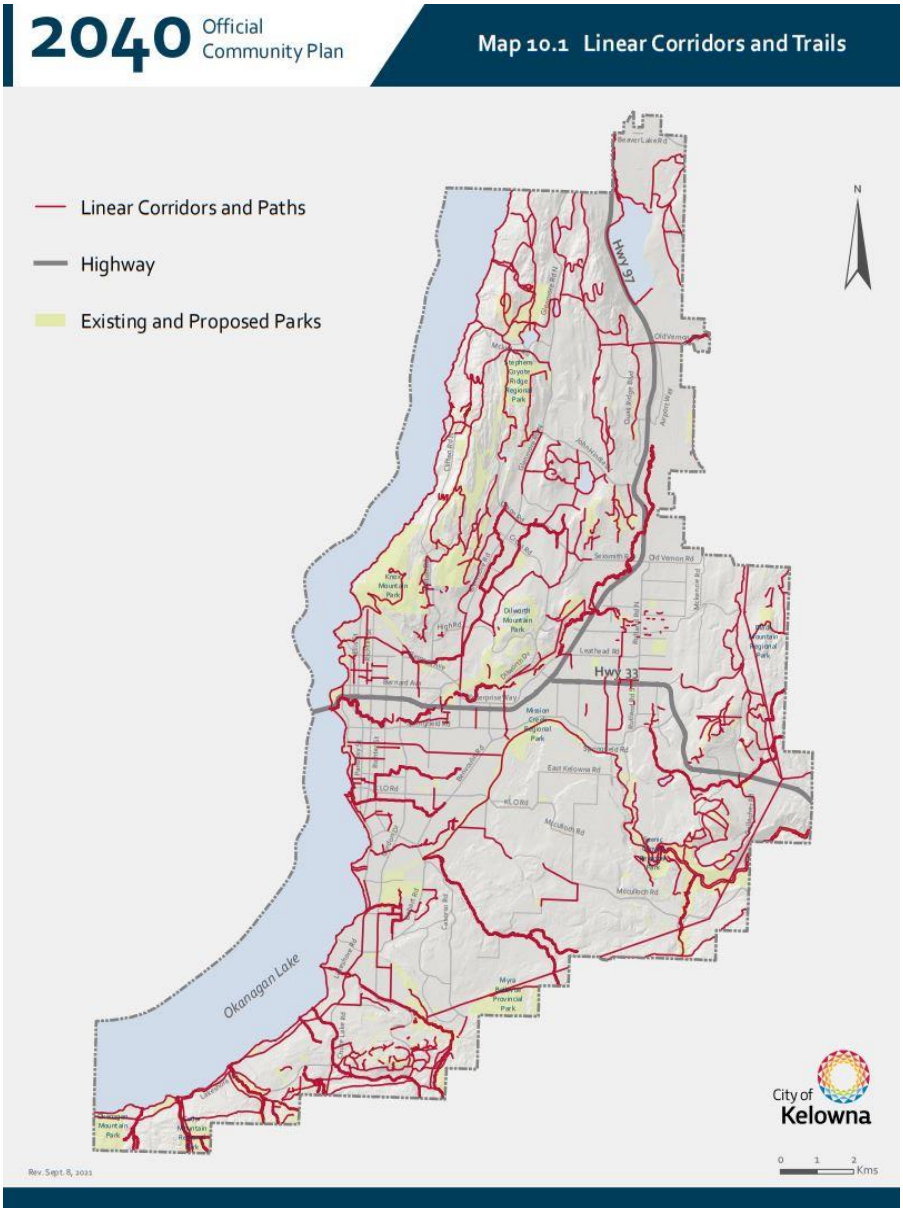


Figure 4: Parks and Green Corridors of Kelowna (City of Kelowna 2022)

The multi-functionality of green spaces has been frequently emphasized in terms of recreation, social interaction, aesthetics, cultural heritage, and ecological services (Haaland and Bosch 2015). Green spaces in cities provide opportunities for restoration, physical activity, social interaction, and community involvement. Access to green space has been a fundamental

topic of green space research, in its relation to improving human well-being and health. The significance of the role of urban parks in creating social connectedness has been repeatedly mentioned and acknowledged in the "Official Community Plan" of Kelowna. While the parks and public buildings in Kelowna, like those in other Canadian cities, are of the best grade in terms of construction quality and techniques. It seems that the main root of the challenges of this city in the field of neighbourhood parks is more related to the field of management and planning.

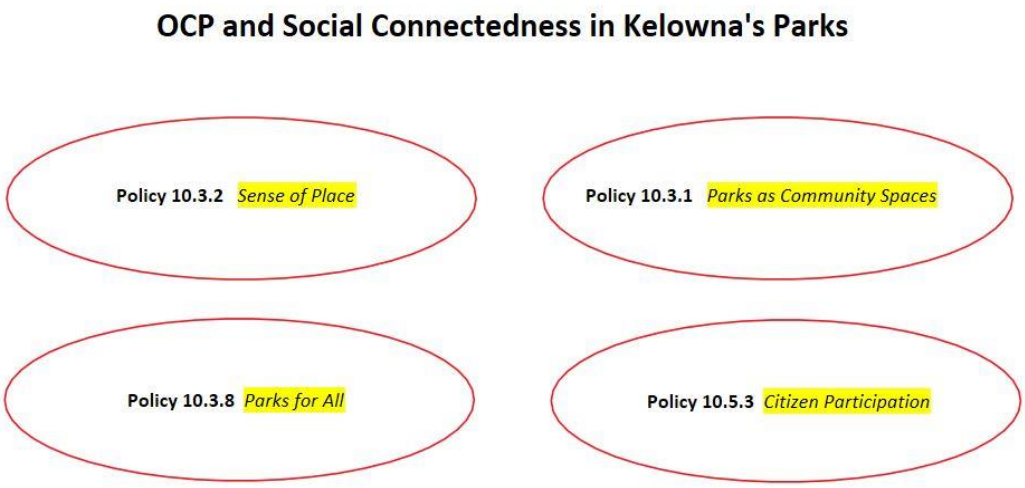


Figure 5: Some policies of the OCP on social connectedness in Kelowna's parks (City of Kelowna 2022)

Current Strategies and Initiatives

One of the projects that the city of Kelowna has done for the assessment and improvement of urban green spaces is the "Community for All, Parks and Buildings Assessment" (City of Kelowna 2018d). This is an Action Plan that was adopted by Council in December 2016, during the first phase of the City of Kelowna's Healthy City Strategy. The plan outlines areas for

policy, planning, and programmer adaptation to respond to the community's developing requirements as well as actions for creating healthier individuals of all ages and abilities by allowing them to be more active and involved within Kelowna's community. Action items were developed with the goal of making Kelowna a city that is healthy, safe, active, and welcoming to elderly, children, and people of all abilities. The proposal resulted in two City-led actions: 1) an "All Ages and Abilities Parks Assessment" and 2) an "All Ages and Abilities Municipal Buildings Assessment". This was dubbed the "Community for All Ages, Parks, and Buildings Assessment".

The Parks and Buildings Assessment is thought to provide a tool to measure the City of Kelowna's success in providing park and building amenities for those of all ages and abilities. It also provides staff with a framework to use when planning infrastructure improvements and serves as an inventory of various features within the city's parks and buildings. This planning project strives to provide strong linkages to the community through partnership development to help achieve long-term goals and targets of Kelowna being a community for all ages. This assessment incorporated the needs of Kelowna's residents across their lifespan. Planning for the entire lifespan provides the greatest community benefit. The following objectives were incorporated into the design of the assessment methodology and evaluation criteria: 1) Design a built environment which respects the needs of young and old, and those with diverse abilities to stay physically active, mentally well, and socially connected and 2) Provide reasons for people to visit, stay, and feel comfortable and safe in City owned parks and buildings. The intent of the report was not to inspect every detail of a park or building and determine whether it met a particular code or guideline, but instead to measure how the site may be underserving users of all ages and abilities, and how it may be going above and beyond. In this way, they have provided several checklists in the following categories:

i. Vehicular Access – includes transit locations, parking areas, and access to the park.
ii. Paths of Travel – includes surface material, width, slope, ramps, drainage, and obstructions.
iii. Site Furniture – includes benches, shelters, picnic tables, trash cans, and drinking fountains.
iv. Signage and Wayfinding – includes site maps, tactile signage, signage dimensions, and colour contrast.
v. Park Amenities – includes playgrounds, beach access and washrooms.
vi. Social Connectedness – includes cleanliness, safety and comfort, opportunities for interaction and park design for Crime Prevention Through Environmental Design (CPTED).

As can be seen in Appendix A, despite the inaccuracies and lack of transparency, the overall trajectory of this project is positive and forward moving. The development of this program, over time, certainly has the potential to considerably enhance existing policies and, as a result, the quality of urban green areas.

Another initiative is "The Partners in Parks program" that may be recognized as a noteworthy achievement in the city of Kelowna. This program is planned to “strengthen neighbourhoods through partnerships with community groups that want to refresh and enhance local parks throughout Kelowna” (City of Kelowna 2016c). “The Partners in Parks” program matches contributions from community groups for park funding and has proven successful in providing positive improvements to parks and the community. Through the program in past years, local groups have achieved projects like establishing an outdoor skating rink in Crawford and a giant chess set, ping pong tables, and chairs in Stuart Park.

Figure 6: Giant chess set, Stuart Park, Kelowna, BC (Photo: Kelownanow.ca)

However, considering the above-mentioned initiatives and programs, the question remains: why, despite the development of projects, policies, and guidelines such as "Community for All, Parks and Buildings Assessment", "Official Community Plan (OCP)" and "The Partners in Parks program", are most of the parks in Kelowna still fraught with challenges and problems? These parks still cannot meet the needs of their local users in terms of social, recreational, and other related dimensions. According to the assessment of the City of Kelowna (City of Kelowna 2018d), more than half of the parks of this city lack the necessary criteria to strengthen social connections. For example, about 63% of these parks do not have nodes of activity such as sports fields or equipment for all groups.

Projects like the "Partners in Parks" state their goals as "Fostering a shared sense of park stewardship within the community", "Leveraging community groups' resources, interests and passion", and "Increasing community pride and involvement of residents in parks".

However, in practice, their emphasis is more on spontaneous and voluntary activities to complete the park maintenance such as “planting, weeding, removing litter and invasive plants, and spreading mulch” (City of Kelowna 2016c). However, increasing social cohesion in local spaces such as neighbourhood parks cannot be done through the mere provision of funds. At least in the initial phases, they require managerial incentives and support from municipalities and local organizations to establish such needed activities for residents.

An example of a project that has had an undesirable outcome is the “Rowcliffe Park Redevelopment”. It is claimed that during this project, Rowcliffe Park has transformed from a pile of dirt into one of the city’s nicest parks (KelownaNow 2022). The project has had three phases of development at a cost of over 1.4 dollars. The first phase of work on Rowcliffe Park, including the playground, sidewalks, stairs, and landscaping, was completed in 2018. The second phase included a community garden, open grass field, additional walkways, and a redeveloped off-leash dog park while the final phase comprised of landscaping, curb and gutter work, and a new plaza at the corner of Rowcliffe Avenue and Richter Street and the project was finished in 2020. However, considering the checklists in the “Community for All, Parks and Buildings” assessment, the following weaknesses and shortcomings can be seen in this park:

i. The park does not have a unique landmark.
ii. There is not a good mix of sun and shade in the walking and seating areas of the park.
iii. There is no drinking fountain.
iv. Fragrant types of plants are not provided at bench locations.
v. There are no gathering places and seating areas are not positioned to provide opportunities for interaction/conversation (group sitting areas, benches facing one another, etc).

vi. There are not moveable seats and/or tables in the park to promote flexible use of the space.

vii. There are not any tactile garden features provided (textured maps, touchable art, Braille signage).

viii. There are no ‘nodes of activation’ in the park (e.g., food concession, sport rental, ‘Busk Stop’ for performers, sports fields, stage).

ix. There are not locations available to provide refuge, de-stressing, or quiet contemplation.

x. Activities are not available for a variety of ages.

xi. The park design does not create opportunities for different ages to connect (e.g., displays or artwork with multi-age appeal or game opportunities).

Figure 7: The site of Rowcliffe Park before Redevelopment in 2017 (Source: Google Earth)

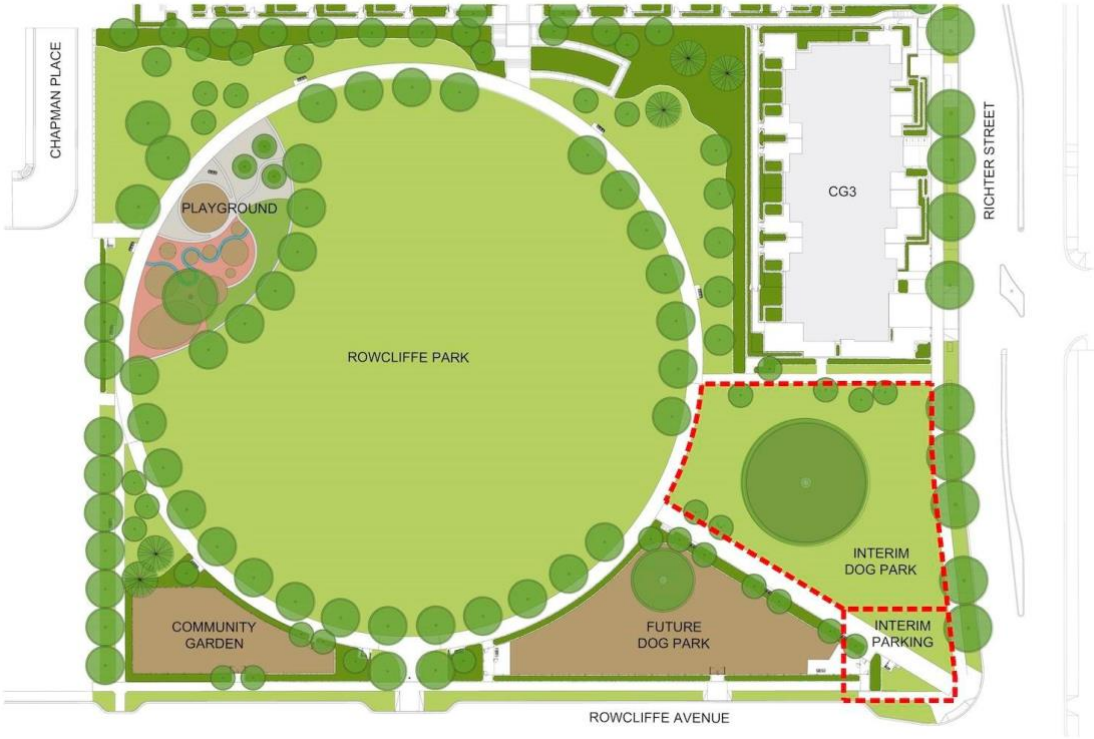


Figure 8: Master Plan of Rowcliffe Park (Source: Kelowna Cap News)

Figure 9: Rowcliffe Park after Rehabilitation (Source: Google Earth)

As mentioned previously, most of the problems with urban parks in Kelowna can be categorised and traced back to the planning and management processes. As Haaland and Bosch

(2015) said, Urban green space planning and management is a critical problem in the context of the cities, as these places give vital advantages to city people. These problems ultimately lead to the isolation of these spaces in cities decreasing the overall walkability of Kelowna. The inefficiency of these spaces in attracting users and satisfying the people not only leads to the lack of vitality of the city but due to lack of sense of belonging in citizens, can also lead to an increase in maintenance cost.

4.5 Green House Gas (GHG) Emissions

Current Challenges

As climate projection models are predicting hotter and drier summers with longer warm days, shorter and warmer winters, increased precipitation for all seasons except for the summer, and a change in growing seasons for the Okanagan region, reducing greenhouse gas (GHG) emissions is an important challenge for the city (Regional District of Central Okanagan [RDCO] 2020a). In Kelowna the two main sectors of GHG emissions are transportation, which is 55%, and buildings, with their current energy use at 36% (City of Kelowna 2018e).

Transportation and buildings are also responsible for 51% and 49% of the community energy expenditures respectively (City of Kelowna 2018e). To reduce the GHG emissions, the City of Kelowna prepared its Community Climate Action Plan (CCAP) and set different short term (4% reduction from 2007 by 2023) and long term (25% reduction from 2007 by 2033) targets, shown by the policies in the OCP. But achieving these targets and facilitating the IPCC 2030 target seems unrealistic with the current policies (City of Kelowna 2020; Figure 10). In 2017, the emissions increased by 6% (Moore 2019) and even the city could not assure the reduction per capita of GHG emissions with the current population. Considering the future population growth and growth in housing development and transportation and energy use, achieving these targets will be a challenge.

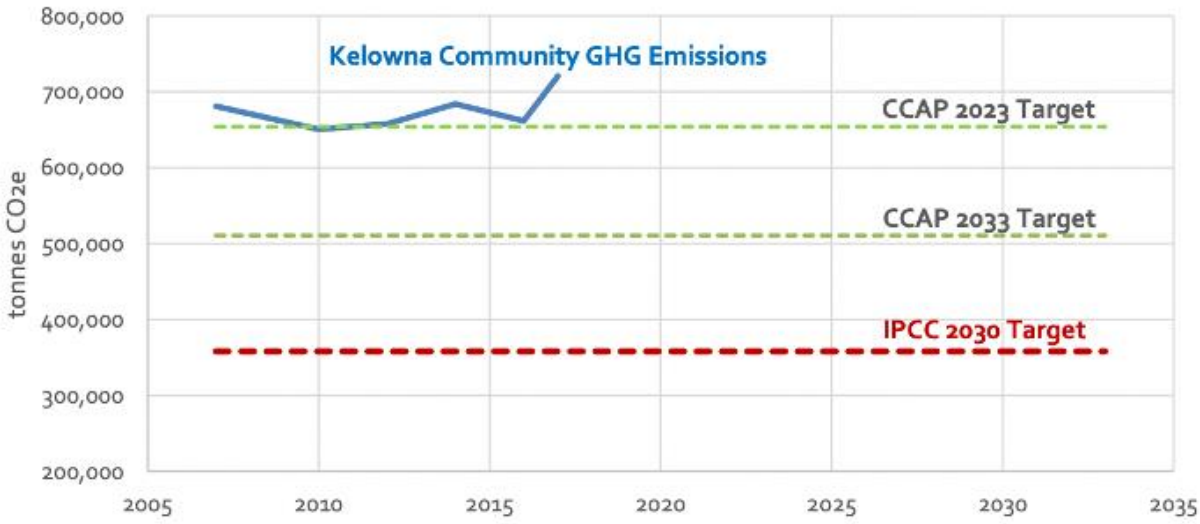


Figure 10: Status of GHG emissions in Kelowna with respect to the targets of CCAP and IPCC 2030 target (City of Kelowna 2020)

Current Strategies and Initiatives

There are some current initiatives taken under the Community Climate Action Plan in the City of Kelowna to reduce GHG emissions from transportation and buildings by introducing sustainable transportation options, energy efficient buildings, and lively urban centres. It was targeted that 72% emissions can be reduced from transportation and another 10% from buildings (City of Kelowna 2018e). Besides, the City of Kelowna has also formulated its Corporate Energy and GHG Emissions Plan to reduce GHG emissions from energy usage and to become a sustainable city. Among the current initiatives, development of the Pedestrian and Bicycle Master Plan and BC Transit's Transit Future Action Plan can be noted. There are also some specific community level and corporate level initiatives by the Regional District of Central Okanagan to reduce GHG emissions. The RDCO received Level 2 recognition in 2017 and 2018, and the City of Kelowna received Level 3 recognition in 2018 and 2019 by the Provincial Union of BC Municipalities Green Communities Committee Climate Action Recognition Program, for accelerating the progress to achieve climate action commitments. Community level initiatives are mainly related to waste management and

include curb side recycling and yard waste collection, incentives for backyard composters, food digesters and rain barrels, and fuel mitigation in regional parks. At the corporate level, there are some current initiatives for supporting alternative transportation methods (e.g., green vehicle/bicycle) and routes (e.g., rail trail connecting different neighbourhoods) (RDCO n.d.b.).

Though the targets of CCAP have not been met yet, there are some successful examples of GHG emission reduction in the City of Kelowna:

i. 8% and 10% reduction in average household natural gas and electricity usage between 2011 and 2015.
ii. 3.5% reduction in GHG emissions between 2007 and 2012.
iii. Provision of 280 km of bike lanes and 412 km of sidewalks to promote cycling and walking more.
iv. In 2016, 14% of residents either walked, cycled, or took transit to work.
v. 51% residents live within 400 meters of a transit stop.
vi. Introduction of hybrid vehicles.
vii. Energy-efficient police building and Glenmore Landfill Administration Building.
viii. LED streetlight retrofit project with 11,000 low-energy streetlights to reduce electricity usage by 62% (City of Kelowna 2018e; Peacock 2018; Seymour 2019).

Figure 11: Energy efficient Police Service Building in Kelowna (Source: Colliers Project Leaders)

Figure 12: Energy efficient Glenmore Landfill Administration Building (Source: Naturally Wood)

Green Vehicle and Equipment Policy

The RDCO has formulated the Green Vehicle and Equipment Policy in 2020 for all the vehicles and equipment owned and/or operated by the RDCO, to facilitate achieving the carbon neutrality target by alternative fuel usage, rightsizing equipment, and fleet size, and conducting life cycle assessments to evaluate their efficiency and return on investment (RDCO 2020b). The RDCO also prepared its implementation plan for 2021 to 2040 with some specific strategies as well as short-term and long-term targets (RDCO, n.d.a.). It has targeted to replace its light duty vehicles with zero-emission vehicles by 10%, 30% and 100% for 2025, 2030 and 2040 respectively (RDCO, n.d.a.).

Actions to Implement in CCAP

In the CCAP, there are some actions/targets to implement or achieve in the transportation and housing sector to reduce GHG emissions:

i. Expansion of pilot community bike share program.
ii. Development of community wide electric vehicle strategy with proper technology and infrastructure (e.g., charging stations).
iii. Updating zoning bylaw to restrict through traffic to ensure walkability.
iv. Improving city parking system to encourage using alternate transportation modes.
v. Investigating options for alternative fuels in the public fleet as well as a regional fuel tax.
vi. Increasing support for ridesharing and ride-hailing services.
vii. Usage of renewable energy for electricity and heat sources.
viii. Reuse of waste heat.
ix. Reduction of energy demand through community design, energy efficient buildings and technologies (City of Kelowna 2018e).

Energy Step Code

The BC Energy Step Code is an optional path facilitated by the BC Building Code and local governments are encouraged to use it by incentivizing new construction of energy efficient buildings (Energy Step Code 2018). The energy efficiency concept was added to the BC Building Code in 2008 and provided two options to the builders – a prescriptive or performance approach. Most of the builders are following the prescriptive approach and focusing on individual systems (i.e., windows, insulation, furnaces, lighting, water heaters, etc.) of a building to make it energy-efficient which, however, does not assure that the buildings are energy efficient as a system. But the performance approach is aligned with the BC Energy Step Code and ensures that the building will be energy efficient as a system by using energy software modelling and on-site airtightness testing during design and construction. There is a target to set the BC Energy Step Code as a minimum requirement in the BC Building Code by 2032 (Energy Step Code 2018). If the residential building project is funded by BC Housing, it must follow the third step of the BC Energy Step Code (Ministry of Attorney General 2022).

Figure 13: Five steps to achieve net-zero emission from Part 9 residential buildings (Energy Step Code 2018)

Figure 14: Four steps to achieve net-zero emission from Part 3 wood frame residential buildings (Energy Step Code 2018)

Retrofitting Existing Buildings

Retrofitting refers to changing the existing amenities/systems with some energy efficient amenities/systems. As 72% buildings in Kelowna were built before 2000, they can be retrofitted for energy saving. In the CCAP, it is stated that if 1% of existing houses can be retrofitted, 30% reduction in energy usage is achievable (City of Kelowna 2018e).

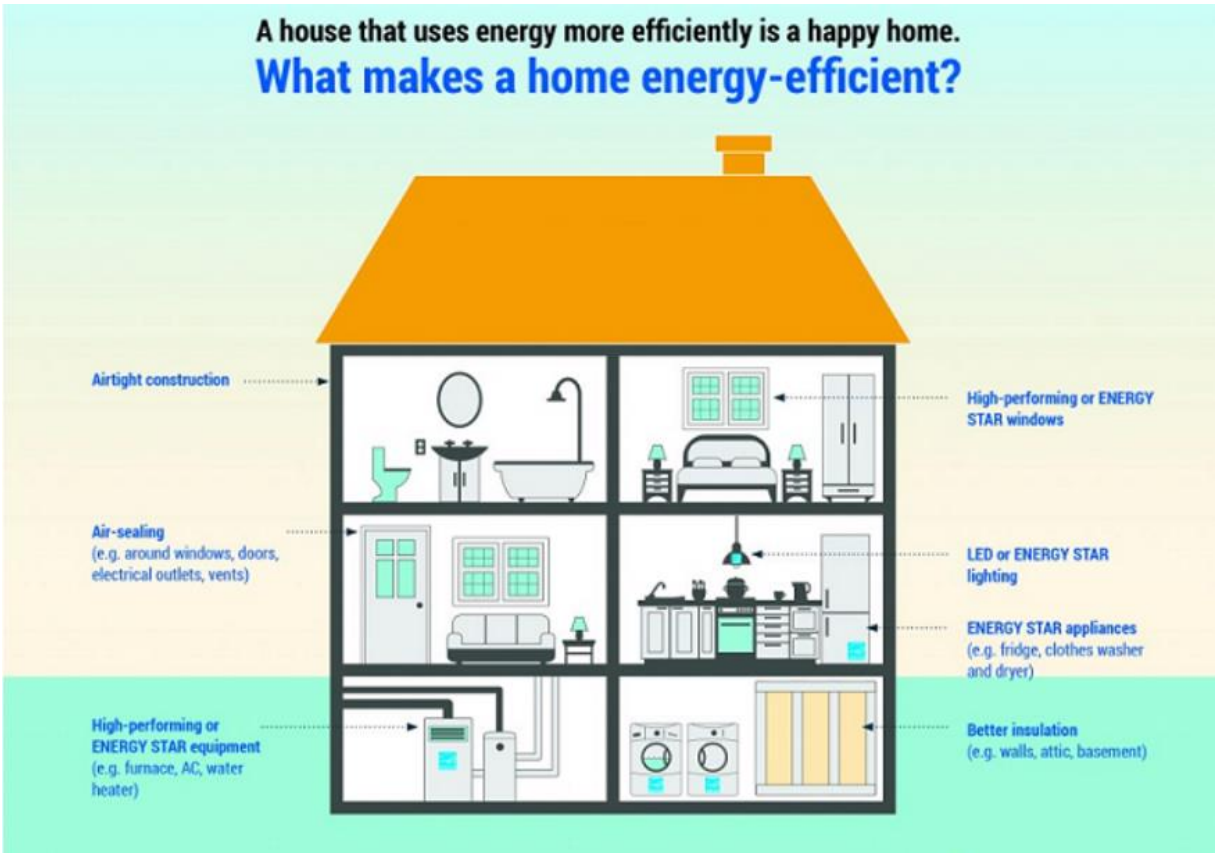


Figure 15: Retrofitting strategy for energy efficient buildings (Vickers 2019)

Affordable Energy Efficient Buildings

Recently, 122 affordable and energy-efficient rental units are being constructed in the National Society of Hope's Apple Valley in Kelowna (Ministry of Attorney General 2022). The nine-storey building is made of mass timber so that it has a lower carbon footprint. It will be an affordable option for low-income individuals, families, seniors, and disabled people. This building will follow the BC Energy Step Code by including various energy efficient features like central heat recovery ventilators, electric car charging stations, triple-glazed windows, central boiler system, etc. This project is a good example of public-private partnership among the Provincial and Federal governments, the City of Kelowna, and the National Society of Hope. It is a part of BC's 10-year housing plan worth of $7 billion and since 2017, the province

has funded around 1800 energy-efficient homes in Kelowna (Ministry of Attorney General, 2022).

Figure 16: New energy-efficient and affordable rental housing under construction in Kelowna (Source: ROV Consulting 2020)

While the current initiatives and future plans seem promising, there are still some gaps in ensuring sustainable and resilient housing and transportation systems. Firstly, there are a plethora of policies in place, but immediate actions and implementation of these policies are still not up to the mark. Moreover, the City of Kelowna does not have a Climate Adaptation Plan, which will facilitate the preparedness of the community for anticipated changes due to climate change impacts. Further, the city can also include more climate resilient options in its policies and implement them immediately to follow the path towards IPCC's zero-emission target.

5. Healthy and Walkable Neighbourhoods as a Sustainable and Resilient Solution

Walkability is a quantitative and qualitative assessment of how appealing or uninviting a neighbourhood is to pedestrians. Walkable neighbourhoods are becoming increasingly important in towns and cities, and the link between walkability and neighbourhood social liveliness is becoming obvious. Hess et al. (2014) stated built environments that promote and facilitate walking to stores, work, school, and amenities, are better places to live, have higher real estate values, promote healthier lifestyles, have lower greenhouse gas emission rates, and show higher levels of social cohesion. It is now widely recognized that immediate short-term and single-minded solutions alone are not sufficient to address a city complex and interrelated challenges. Walkability, as a more holistic approach, has received much attention over the last years, particularly in the three fields of urban design, public health, and transportation. Our proposed solutions offer a variety of short, medium, and long-term approaches to the City of Kelowna's sustainability and resilience problems. Together, however, they may be integrated towards the vision of creating vibrant, healthy, and walkable neighbourhoods in the city. Along with the framework of walkability, it is also necessary to mention that these solutions need to consider the environmental, cultural, and social context of Kelowna to be effective.

5.1 Urban Liveability Index

When discussing solutions to the resiliency and sustainability issues of Kelowna a metric is needed to assess where the city of Kelowna is in the present day as well as to measure the success of the future policies the city implements. Without a measuring tool, the city of Kelowna cannot improve their sustainability and resiliency and, therefore, cannot assess their overarching goals in the long term. Having a metric will allow the city of Kelowna to track

their progress in attaining the goal of becoming sustainable and resilient. To serve this purpose, we put forth the Urban Liveability Index, to assess the liveability of a city or neighbourhood.

The ULI was originally used in Melbourne, Australia, and was created because of interest from local policy makers around urban liveability and its connection with health-enhancing behaviours of residents. It can work in an interactive mapping application that can be used as a diagnostic tool to identify where interventions may enhance living conditions (Higgs et al. 2019). There have been similar metrics created elsewhere, such as Ewing and Clemente's measurement protocol which looks at imageability, visual enclosure, human scale, transparency, and complexity. In this context urban liveability is defined as a "safe, attractive, socially cohesive and inclusive, and environmentally sustainable; with affordable and diverse housing linked by convenient public transport, walking and cycling infrastructure to employment, education, public open space, local shops, health and community services, and leisure and cultural opportunities" (Higgs et al. 2019). Ewing and Clemente's measurement protocol was used in "a test in New York City [that] showed that [it] can be implemented in large-scale studies relating the built environment to social, psychological, and health outcomes" (Ewing and Clemente 2013). Researchers from Columbia University sampled 588 block faces in New York City to demonstrate its use on a large scale. This displays how the ULI or a metric like it can be applied to assess the entire city of Kelowna, as well as more specific areas such as the five urban centres.

For the Urban Liveability Index to measure urban liveability seven domains are considered: transport, social infrastructure, employment, walkability, housing, green infrastructure, and ambient environment. These domains connect with several of the sustainability and resiliency issues for Kelowna: affordable housing, suburban sprawl, urban development, greenhouse gases, transportation, and urban vitality. A specific problem that this

solution addresses in Kelowna is the lack of urban liveability, which is demonstrated by the focus the city of Kelowna has in the OCP on development within the five urban centres as well as the core area, as these are still lacking in sufficient density of residents and jobs. The ULI utilizes policy-relevant liveability indicators to create "an evidence-informed, policy-relevant tool that measures the distribution of urban liveability within cities" (Higgs et al. 2019) and these neighbourhoods will be assessed both individually and collectively. Increasing the urban liveability to create a healthy walkable neighbourhood will bring these five urban centres into a network of high-density connections.

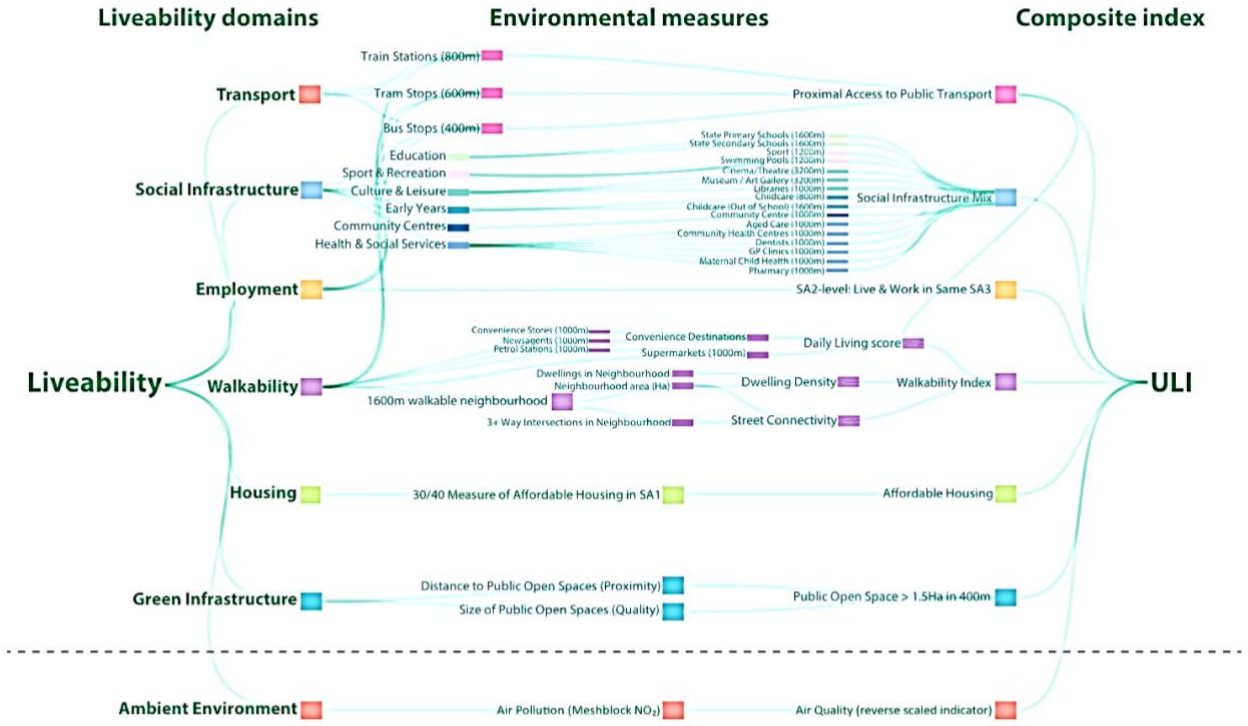
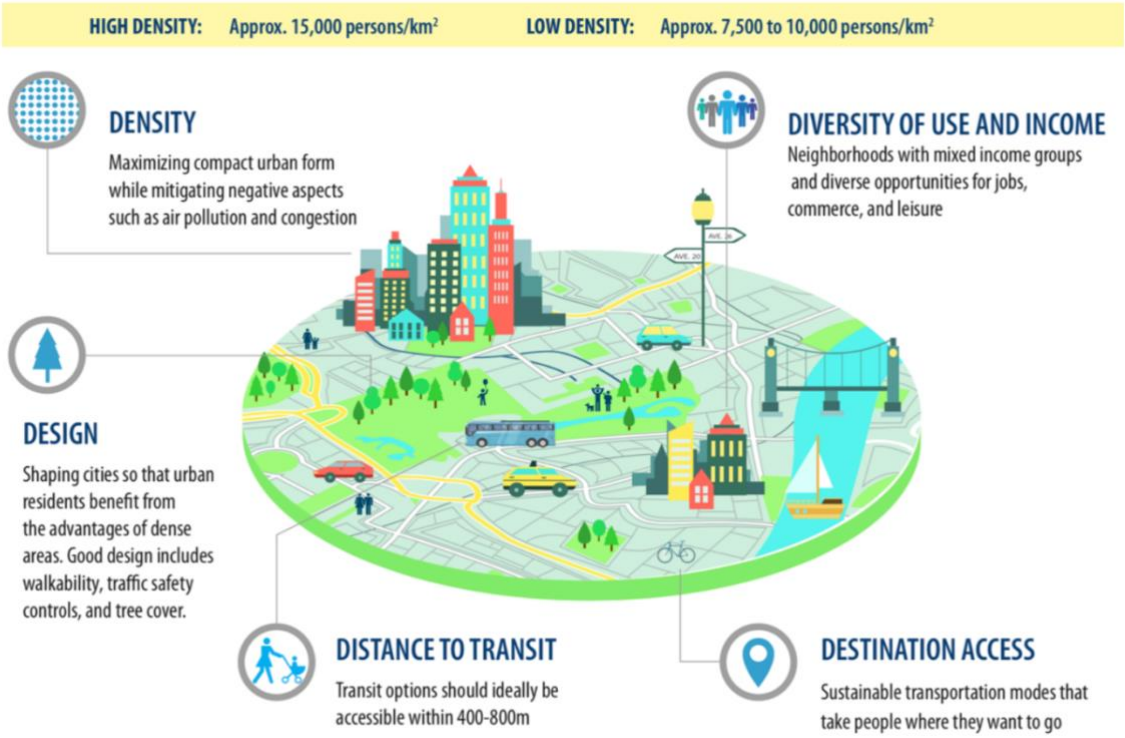


Fig. 1 Liveability domains and indicators as conceptualised in the Urban Liveability Index. A conceptual flow diagram of our process, from the concept of liveability (left) considered through key domains, neighbourhood measures which are ultimately combined in the ULI (right). The inclusion of an air quality indicator (below dashed line) in the liveability model was evaluated as a sensitivity analysis

Figure 17: Urban Liveability Index (Higgs et al. 2019)

While this tool can be used to assess the urban liveability of the city and its urban centres it can also allow an insight into sustainable transportation; a higher ULI score relates to higher levels of sustainable transportation such as walking, biking, and public transit and

lower levels of auto-mobile transportation (Higgs et al. 2019). Comparing the highest ULI score to the lowest ULI score there is a prediction of double to triple the incidence. It can be used to display how the design of the environment relates to the health, social, and economic outcomes of the population therefore investigating what the cumulative effects of integrated urban planning are (Higgs et al. 2019). These align with the idea of connectivity, where a walkable neighbourhood has everything for a person's everyday needs or connects, through public transportation, walking and biking infrastructure, to another neighbourhood that has it. This also addresses the infrastructure deficit of the city since a more compact neighbourhood does not need to create new infrastructure that will be an additional strain on the city's budget to maintain.



Source: UN Environment 2018. Sustainable Urban Infrastructure Transitions in the ASEAN Region: A Resource Perspective.

Figure 18: Sustainable Urban Infrastructure (Source: UN Environment 2018)

The ULI can be used to assess present conditions and implemented in the long term to create steps and goals towards achieving a more liveable and vibrant city environment. Higgs

et al. (2019) outlines the equation to calculate the ULI as well as the standards for the indicators that fall under the seven previously discussed domains that are used in the calculation. For instance, walkability is the combination of three indicators: dwelling density (dwellings per hectare), daily living score, and the number of three-way connections (Higgs et al. 2019). To account for variability, the equation subtracts a penalty, which is the variability of sub-indicators versus the average of all indicators at the same address. The data for this information can be taken from the census, a program like ArcGIS, and targeted surveys. Using a metric as described is useful for the city since they focus on the health and wellbeing of humans, specifically addressing how the built environment relates to the health, social, and economic outcomes of the population (Higgs et al. 2019). These will allow for a more active identification of the urban development that the city of Kelowna seeks, and it will address spatial inequalities within the city as well as the urban liveability that the city needs to improve on to address the resiliency and sustainability issues it has.

5.2 Zoning and Regulating Development

5.2.1 Densification within the Core Area – Up-zoning and Transition Zones

As previously discussed, there is a missing middle of housing in Kelowna and a lack of widespread rapid-transit networks (Bourne 2019). Kelowna's existing policy on up zoning needs to be expanded upon to effectively increase the stock of diverse and affordable housing as well as limit suburban sprawl. To free up more land for densification eliminating exclusionary zoning for single detached homes should also be considered. Another medium-term to long-term solution for the problem of suburban sprawl and an aid to increasing urban development within Kelowna is to "provide incremental densification over larger-pockets of suburban areas" (Bourne 2019). The case study by Bourne (2019) which looks at studies of zoning policies in Seattle and Portland provides a model of soft densification that is woven

within neighbourhoods, maintaining the character of these neighbourhoods while also increasing density. With medium density housing, this also addresses the gap between single family dwellings and apartment buildings (Bourne 2019). The city of Kelowna needs a combination of different types of densifications to address the missing middle housing and reduce the suburban sprawl it is well known for.

Currently, the city of Kelowna has a combination of hard densification, where wide-ranging urban renewal projects are created with major developers and replace individual houses with collective housing, offices or shopping centres, and soft densification, which is "characterized by progressive densification of low-rise single-family neighbourhoods through successive subdivision of the land into smaller plots" (Conticelli et al. 2017). In the downtown area a flexible policy of hard densification, which is described as "using regulatory tools produced by municipalities, such as lifting of minimum plot-size restrictions, revocation of instruments for the regulation of building density, easing of building height restrictions, as guidelines for the approval or rejection of applications for building permits", is sometimes utilized (Conticelli et al. 2017). This could be further combined with a flexible policy of soft densification through a proposed change of the current RU7 infill zones to MRU7 and MRU7 Transition (MRU7T) zones.

This solution has a strategic focus on the inner-city suburb since these zones are characterized by more affordable, diverse housing and lack a high percentage of cul-de-sacs. These areas are better connected due to a lack of cul-de-sacs, their proximity to downtown and consequently, their proximity to more jobs and transit routes. They also have more civic assets such as parks and schools (Steuteville 2016). The MRU7T zone can serve to transition from more urban areas such as the urban centres and transit corridors to more suburban areas. It has 65 dwellings per gross hectare, up to three storeys, and one unit per 150 m^2 of lot area, allowing

for a higher density (Bourne 2019). The MRU7 zone is less urban with a lower density of 40 dwellings per gross hectare, two storeys or less, and one unit per 250 m^2 of lot area. In addition, the MRU7 zone has been adjusted to accommodate five to six dwellings. This is more than the RU7 zone used in Kelowna and can be particularly relevant for the city's context, as it has some larger lots. For both, incentives are provided to retain existing building and permit rear-lot infill. Rear-lot infills are also permitted for neighbourhoods that already allow secondary suites and accessory dwelling units (Bourne 2019).

These new potential zones consider the smart growth mindset of meeting the demand for housing, while using new policies and practices that reduce poorly planned neighbourhoods that do not support community liveability (Lee and Leigh 2005). There can be a great deal of opposition to densification due to the "not in my backyard" sentiment of many residents. These zones will be more contextually sensitive, weaving in more harmoniously with pre-existing development and will, therefore, face less political opposition (Bourne 2019). In addition, since these are smaller and softer densification zones they will be more commonly developed by smaller developers, encouraging less concentration of the housing market and more accessibility for homeowners.

This densification solution is context specific to Kelowna, but it must be done carefully to keep green spaces in place to provide ecosystem services (Grêt-Regamey et al. 2020). Fostering ecosystem services in cities involves decreasing the surface to volume ratio of buildings, but also depends on the types of vegetation and the amount of concrete in the neighbourhood. Having an open midrise neighbourhood can support regulating services such as microclimate regulation, water flow regulation, and air pollution control which are especially important with the increase in temperature and fires in Kelowna (Grêt-Regamey et

al. 2020). Furthermore, the promotion of a higher density neighbourhood is proven to produce fewer emissions than a neighbourhood of large single-family homes (Senbel et al. 2014).

5.2.2 Land Value Tax

Policies directed at up-zoning and densification can often lead to high property prices without a real increase in additional units of housing. These should, therefore, be combined with a land value tax which can be implemented to prevent speculation and encourage actual densification in up-zoned areas. As opposed to Property Tax which charges the same rate of tax for land as well as structures, Land Value Tax charges a higher rate of tax on land than it does on built structures, sometimes doing away with tax on structures altogether. This encourages more development of houses, as the tax difference is not very high and can be split between multiple households on densely built plots of land. Another benefit is that it also allows some of the additional land value to potentially feed back into the local community through the construction of public amenities, improvements to the public transit, as well as affordable or subsidized housing (Schuetz 2020).

5.3 Social and Supportive Housing

Market-based incentives and policies encouraging up-zoning and densification have limited effect on increasing the supply of affordable housing. Moreover, housing is one of the basic rights of people and cannot be treated as just a commodity. There should, therefore, be a stronger focus on social and supportive housing in Kelowna's Housing Affordability strategy. A push for government owned and operated social housing will not only ensure an increased supply of housing, but also enable the government to direct resources towards the development of the right kind of supply to meet the requirements of diverse low-income and vulnerable groups. Supportive housing, with on-site amenities and services, is the most holistic strategy

to rehabilitate people facing chronic houselessness and will, in the long run, ensure a stronger, more cohesive, just, and equitable community.

Gaps in housing diversity and quality which, have not been addressed by market rentals so far, can also be brought into greater focus through government planned housing. While 1- and 2-bedroom suites have so far dominated the market rentals, social housing plans can ensure an increase in supply of family-oriented housing. Additionally, there should be a greater emphasis on designing social housing to meet accessibility/universal design standards, ensuring that the needs of people of different ages and abilities are met. Regular assessment and capital upgrades in areas such as energy efficiency should be incorporated as part of the management and maintenance plan for social and supportive housing. This will ensure that the living costs for residents will stay minimal while maintaining a higher quality of life. Even assessing the limited number of existing government subsidized rental housing displays that they fare much better in comparison with market rentals in respect to meeting energy efficiency requirements, accessibility/universal design standards, as well as providing for diverse households – single working professionals, students, ageing populations, as well as families (City of Kelowna 2019b).

In Singapore, the best-known example of a successful public housing system, 81% of residents live in public housing (Hirschmann 2021). Examples from Singapore show how government owned housing can also integrate concepts of walkability and green space into design (Lambert 2020). With more mixed-use neighbourhoods and integrated design of social housing, parks, shopping areas, key jobs and services, the car-dependency and overall costs of living will be reduced greatly for residents to enhance the overall quality of life and vibrancy of the city.

As of 2015, however, only 7% of housing was subsidised or supportive housing in Kelowna (City of Kelowna 2018c). To be able to achieve anything near what a city like Singapore has done will require much more comprehensive planning and involvement by the government in housing. The local municipal government of Kelowna cannot do this alone and will require a much stronger funding mechanism for social housing, with greater alignment and collaboration in policy and action across the municipal, provincial, and federal levels of government.

5.4 Pedestrian Friendly Design and Policy

5.4.1 Removal of Minimum Parking Requirements

To work towards the goal of a healthy walkable neighbourhood, urban infrastructure design needs to be more pedestrian friendly and less in service of a car-centric community. The current bylaws around minimum parking requirements go in the exact opposite direction, as they require all infrastructure to be designed for the convenience of cars rather than pedestrians. The solution of complete removal of minimum parking bylaws is unrealistic at this time due to the current car-dependency of the community and the fact that this action should go hand in hand with the expansion of a reliable transit network. However, it should be a medium-term goal for the city to incrementally progress towards. This would include eliminating requirements in select areas, such as downtown, which have existing and acceptable levels of transit connectivity, as well as reducing requirements in other areas that offer some mode of public transit such as, for example, businesses along Highway 97. In areas where the minimum parking requirement does not change, it is still important to introduce cosmetic and design requirements, that are geared to pedestrians, in the bylaws.

These requirements, of course, would not address the economic levers that would incentivize walking and using transit, but it is important to understand that aesthetic, symbolic,

and design factors also create behavioural change. The cosmetic requirements could include building parking lots in the back of the building with the pedestrian entrance opening to the street, incentivizing multi-story parkades instead of open lots, requiring garages to be built in the back, requiring signs to be small and human scale, and generally considering the priority of pedestrian experience over the drivers' experience. Such changes would have the subconscious effect of making alternative transit viable for the people who drive instead of the current design implications which convey the message of "this place is not meant for you" to pedestrians.

As a long-term goal, and alongside development of a better and more reliable public transit system, minimum parking requirements can be eliminated. In the United States, cities are gradually shifting towards removing minimum parking requirements, with less than 20 cities having completely removed parking bylaws. The city of Edmonton, in 2020, became the first Canadian city to eliminate minimum parking requirements; Toronto and High River, Alberta, have since followed suit (Strong Towns 2015).

5.4.2 Mixed Use Zoning

Another proposal towards more walkable neighbourhoods is that a significant majority of zoning distinctions in urban areas should be changed to mixed-use zones. There are three ways to implement mixed-use areas: vertical mixed-use buildings, horizontal mixed-use blocks, and holistic mixed-use neighbourhoods (Blackson 2013). Vertical mixed-use refers to a single building that includes several uses such as residential, business, commercial, office, or recreational uses. These types are often seen as buildings that have a shop front on the ground floor with residential units on above stories.

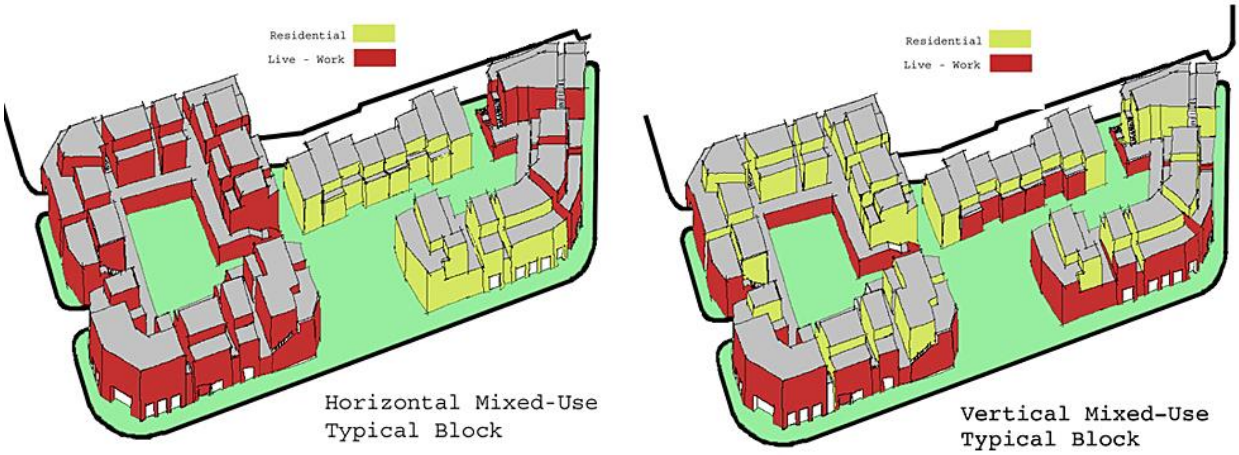


Figure 19: Example of horizontal and vertical mixed-use blocks (Blackson 2013)

Horizontal mixed-use blocks are blocks that interspace buildings with multiple uses, such as having a business building in the middle of several residential ones (Blackson 2013). The third method of having a holistic mixed-use neighbourhood is a mixture of the previous two and the most desirable option. This method envisions the neighbourhood as an interconnected and self-sufficient system in which all uses are connected organically and seamlessly both within individual buildings and within neighbourhood blocks.

By allowing mixed-use zoning, new businesses in neighbourhoods can sustain themselves through their local customer base, who would be able to walk to those business ventures while simultaneously, creating a demand for other people from different areas to come and experience these walkable and lively neighbourhoods. And because these neighbourhoods are pedestrian-friendly and are designed to discourage personal vehicles, this will translate into a demand for public transit. Therefore, allowing the city to move towards Development-oriented Transit (DoT) or in simpler words: “build it and they will come.”

5.5 Public Space and Walkable Areas to Promote Urban Vitality and Social Cohesion

Well-designed and easily accessible public and green spaces are an essential feature of healthy walkable neighbourhoods and can help shift the mindset of people from desiring large single detached homes and a car-centric suburban lifestyle to appreciating and contributing to more vibrant, public transit oriented, and pedestrian friendly urban communities. For Kelowna to move towards a form of densification that is attractive to its residents, it is important to design and manage public and green spaces in a way that promotes urban vitality and the health, well-being, and social cohesion of the community.

5.5.1 Local Management for Local Parks

Parks play an important role in providing venues for social activity in urban areas but tend to be underutilized. Since parks and their facilities by themselves are not sufficient to attract users, many sit unused or underused, even after recent renovations. On-site marketing and supervised activities by local managers are among the top two park features that encourage greater use of parks for social events, public engagement, and physical activity. Marketing efforts are likely to be especially important in low-income neighbourhoods.

Investments to encourage social involvement and local activities will not be made without the support of local park managers. Neighbourhood parks are financed on the local level, and local park managers are best positioned to understand the needs of their local populations. In this way, on-site marketing, and supervised activities under the local park managers, such as daily and weekly physical activities in groups, relaxation gatherings, yoga and dance outdoor classes, are some of the best local activities which can be organized for neighbourhood parks.

Figure 20: Weekly farmer markets in Mission, BC (Source: Mission City Record)

5.5.2 Providing Diverse Facilities for Activities and Engagement of Different Groups

Public parks may also play an essential role in encouraging physical exercise. They provide areas for people to walk or jog, and many feature facilities for sports, exercise, and other strenuous activities. Parks are also frequently used for reasons other than physical activity (Gobster 2002). They are great places for people to socialize with their friends and neighbours. Attracting people to do not only sports, but also other activities in the park, can ultimately lead to greater social interaction and solidarity.

Zhang et al. (2021) claimed the construction of Community Sport Parks (CSPs) and residents' subjective well-being (SWB) have a positive link. They argued that residents' SWB is greater in regions with CSPs, indicating that it enhances residents' subjective well-being. As a result, throughout the planning, construction, and transformation of the community, the ratio of sports facilities and associated exercise facilities should be explicitly established to fulfil the

exercise demands of the community's members and increase the residents' subjective well-being.

Furthermore, the variety of amenities available in neighbourhood parks has a favourable impact on the well-being of residents. Under the premise of assuring acceptable planning, the space value of these parks should be thoroughly investigated to make maximum use of the park's site. Simultaneously, the planning and construction of parks should not pursue a vast area blindly and should thoroughly evaluate the arrangement of the park facilities. This will ensure that land is used efficiently to achieve high-quality park building targets.

There are numerous differences in how parks are used among different racial, ethnic, gender, income, and age groups (Cohen and Leuschner 2019). These different characteristics should be considered while building and rehabilitating parks. For instance, the elderly's comfort and accessibility should be properly considered in the design of parks. Cohen et al. (2007) believed seniors visit parks at a lower rate than other age groups; nonetheless, the existence of adequate amenities for seniors in the park related to a larger number of older people observed in the park. This shows that special programmes or incentives may be required for the elderly to frequently utilize park facilities.

Simultaneously, distinct activity zones with diverse roles should be split during park planning and construction to satisfy the needs of different groups. Roads, for example, should be softened, and safety should be ensured. A sufficient, safe distance should be maintained between the location of vigorous exercise and the location of activity frequented by the elderly.

Figure 21: Group activities (chess clubs in Tabriz, Iran)

5.6 Energy Efficient Housing and Clean Energy Transportation for Reducing GHG Emissions

A compact walkable community with a diversified and efficient transportation system which uses renewable energy will be beneficial in the long term to achieve a zero-emission target and build a sustainable and resilient community (City of Kelowna 2020). Following are some of the sustainable options to adapt for energy efficient housing and clean energy-based transportation systems in the City of Kelowna.

5.6.1 Sustainable and Zero-emission Hydrail

Hydrail (Hydrogen Rail) is an innovative idea, proposed by Dr. Gordon Lovegrove of the University of British Columbia Okanagan, to use hydrogen fuel systems with an electric battery system to promote a more sustainable and energy efficient transportation system in the City of Kelowna. The project is a long-term solution that is a collaboration between Dr.

Lovegrove's Sustainable Transport Safety (STS) Lab and regional and international experts. This would provide convenient communication and transit networks among different cities of the Okanagan Valley (i.e., Osoyoos, Penticton, Vernon, Kamloops). It would not only improve mobility and accessibility in the valley but also reduce GHG emissions drastically. Along with the efficient transportation network, it will also encourage new hydrogen fuel-based industries in the valley (Sustainable Communities, n.d.). The hydrogen fuelled rail has been used elsewhere and is a very popular concept in European countries and China. Some examples of hydrogen fuelled rails that are being operated in Germany, Scotland, the United Kingdom, and China are in Figure 22.

Ballard Hydrogen Fuel Cell Tram, Foshan, Guangdong Province, China (Howe 2021)

A prototype of Hydrail by Alstom company in Germany (Pinkstone 2019)

The world's first "zero-emission" train in Berlin (Peters 2016)

Hydrogen powered train in Scotland (Keith 2021)

HydroFLEX in the UK (Billington 2020)

Hydrogen fuelled train in Austria (Frangoul 2020)

Figure 22: Examples of hydrogen fuelled rails around the world

5.6.2 Energy Efficient Public Housing

Though there are some initiatives for constructing energy efficient buildings in the City of Kelowna, it should be practised more. More energy efficient public or social housing should be built to tackle the challenge of lack of affordable housing and reduce GHG emissions from the built environment in this city. There are some examples of zero carbon or energy efficient public housing and community examples around the world which can guide how the City of Kelowna implements this short and long-term solution.

42,000-home eco smart city in Singapore (Holland 2021)

UK's first major zero-carbon community – BedZED in South London (Bioregional n.d.)

Energy efficient social housing in Norwich (Wainwright 2019)

A proposed net zero development in Ann Arbor, Michigan (Margolies 2021)

Figure 23: Some examples of energy efficient social housing around the world

5.6.3 Clean Energy based Public Transport

Another short to medium-term solution is clean energy based public transit, which is the single-most effective and important way to reduce car dependency and GHG emissions from private vehicles. The main target should be to make public transit more energy efficient. Using electric and/or solar powered public buses is one of the most efficient ways to reduce carbon emissions from the transportation system. Electric or solar powered buses are already in use in Singapore, Australia, UK, Denmark, and Netherlands, among other places and this can be followed in the City of Kelowna too.

Electric public buses in Denmark (Taylor 2021)

Electric public buses in Netherlands (Cities Today 2021)

Solar powered public buses in Singapore (Land Transport Guru 2021)

Solar powered public buses in the UK (Land Transport Guru 2021)

Figure 24: Some examples of energy efficient public transport system around the world

5.6.4 Community Climate Adaptation Plan

The city of Kelowna has its Community Climate Action Plan, but it is still missing its Community Climate Adaptation Plan, which will guide its citizens to adapt with the adverse effects of climate change. It is very important for this to be created and implemented to mitigate climate change impacts as it is important for the community to also be prepared for the unforeseen in the short- and long-term future. Some regions of Canada have already prepared their community climate adaptation plan, like the Waterloo region (Regional Municipality of Waterloo 2019), Campbell River community (City of Campbell River 2020), and City of Red Deer of Alberta (City of Red Deer 2014). These can be used to guide the creation of such plan for Kelowna.

6. Conclusions and Limitations

6.1 Limitations

Sustainability is fundamentally a concept defined in relation to complex and interrelated systems. Hence, any report on sustainability challenges and solutions will inevitably be incomplete, because the high number of factors and arenas for intervention as well as their complicated influences upon each other, makes a fully comprehensive and detailed study impossible. Therefore, we have limited the scope of this study to the notions of walkability and urban sustainability, choosing to focus on a limited number of issues varying across scales of measurement, policy, planning, and perspective.

Lack of data limits some forays of this report, namely, in terms of greenhouse gas emissions and the urban liveability index. Detailed data for GHG emissions from each section such as housing, transportation, industry, waste, etc. is difficult to attain and so, this report limits quantitative assessments of the efficacy and priority of each suggestion. Similarly, although the ULI is a quantitative metric, because of the lack of data for measurement, this

report refrains from calculating the ULI for each section and only offers the metric for future uses.

This report also aims to primarily offer suggestions that are actionable and within the financial, jurisdictional, and political confines of the City of Kelowna. Therefore, most of the topics are approached with limited short-term interventions. However, this report also notes areas where long-term planning or collaboration with provincial and federal governments could prove useful but refrains from detailed exploration of such instances. The local solutions are also limited by the considerations of budget deficit and potential political opposition from some sections of the community. In addition, our groups' perspective is limited by our position in society and our inherent bias, and we acknowledge that a limitation in this report is that there is very little discussion about the Indigenous peoples of this land. Involving the Syilx Nation in the future discussion around solutions to sustainability and resiliency for the city of Kelowna is a must to create a future that we can all participate in.

6.2 Conclusions

Walkability, as a network concept that is expansive from the neighbourhood levels to the metropolitan scales, is linked to aspects of safety, infrastructure and built environment, local culture, policy, public transit, green space, affordable housing, mental/physical/emotional health, accessibility, and inclusivity. It includes principles that advocate for diverse needs of different generations and various demographics. This concept means advocating for options for individuals with reduced mobility and for accessible and affordable public transit systems in cities. Consequently, Kelowna, which is known as Canada's car capital, has a long and arduous road ahead of it to meet acceptable walkability criteria. Disentangling ourselves, as individuals and communities, from the car-centric paradigms that have dominated many of our

societies for decades, and moving toward sustainable resilient cities, requires a lot of work and collective effort.

Another criterion that should be emphasized is liveability in cities. Urban liveability is an important concept in a city that wants to restrict suburban sprawl and increase urban development in a sustainable manner. Therefore, the focus of the city must be on creating a neighbourhood that incorporates the elements of walkability. The people and the officials of Kelowna need to look at what they want the future of the city to be and start implementing the solutions that will allow it to become sustainable and resilient as a city. A city that is neither sustainable nor resilient will not exist for long in this uncertain future of climate change. It is recognized that not all these solutions are currently feasible, but to improve the future of Kelowna they must be considered, and the city needs to work in the direction of a walkable neighbourhood.

For the City of Kelowna to be a truly liveable and stress-free environment for its residents, affordable housing for all is a must. Planned social and supportive housing is proposed as the most comprehensive way forward to address the varied needs of diverse populations as well as integrate housing design with the broader vision of walkable neighbourhoods.

Furthermore, the draft of the zoning bylaws currently under consideration by the City of Kelowna can address walkability through two policy decisions of limiting and reducing minimum parking requirements and introducing mixed-use zoning. While the benefits of these suggestions are well known within the literature, they have not entered the City of Kelowna's policy discussions. This report offers a case for their value and a potential incremental pathway for their implementation, they will address challenges that the city has declared.

It is essential to mention that cities and their parks have an impact on one another. Urban green spaces are frequently considered as independent and self-referential objects and components of urban design, with little consideration given to how they could interact with their surroundings and the larger urban context. Banchiero et al. (2020) believe that unlike a naive determinism of "green-oriented" urban development – to encourage interventions which are effective in attaining wider policy and planning goals – the spatial, functional, and social characteristics of the urban context surrounding urban green spaces must be taken into consideration. Therefore, one of the ways to restore vitality to cities is to reconsider the relationship between parks and the urban context.

As the City of Kelowna and Regional District of Central Okanagan have already acknowledged the importance of energy efficient housing and clean energy transportation system in their policies and strategies, and have different short-term and long-term goals, we believe it is the right time to implement them quickly so that this city can contribute significantly to achieve the IPCC zero carbon target. It is admirable that the City of Kelowna is now thinking of updating their climate action plan to include both mitigation and adaptation strategies, which will guide community members to cope with the adverse effects of climate change and create resiliency in the community. Utilizing the solutions mentioned in this report for reducing GHG emissions, the City of Kelowna will hopefully be able to reduce carbon emissions for its transportation and housing systems.

Walkability is a concept that has connected all our solutions that address the challenges of a sustainable and resilient Kelowna, and it has been through our many perspectives that we could find this concept. Working in an interdisciplinary environment, it has been a wonderful ride for us to investigate sustainability and its challenges in Kelowna, put these solutions to paper, and create something from the shared knowledge we acquired in this course for

advocating for a truly sustainable, mobile, and healthy community in Kelowna. Our proposed solutions have been developed to address the challenges of Kelowna with the intention of contributing to the current collective efforts.

7. Reflections

7.1 Individual Reflections

Morgan King

During this course the idea that sustainability connects to many facets of life has become quite apparent to me, especially with the display of these connections through the course. For example, I have always spouted the expression that sustainability is of three pillars: economic, social, and environmental; but it was the perspectives from the guest speakers, the papers that I read, and the ideas from my classmates that showed these linkages. In the past, I would have thought that if I had a fantastic solution to a problem, and that if this solution was implemented properly that I would solve the problem easily, but with the many components to sustainability this is not the case. Looking at the viability of solutions for Kelowna's many sustainability and resiliency issues there are several barriers that we came up against over and over. These are barriers that I have acknowledged in the past but with naivety, I thought that once people realized fully what the problem was and the solution that they would get onboard with the idea. Whereas with this course I have realized that this is not the case and that sometimes people need to be cajoled, incentivized, or deterred to make the solution happen. Therefore, it is looking at all the components of sustainability and having the interdisciplinary team with the expertise to do so that can allow sustainability and resiliency solutions to move forward. Since we need to recognize all the effects and how they can be countered or worked around to create comprehensive viable solutions.

Reflecting on the multiple facets of sustainability, as well as the sustainability and resiliency issues and solutions with regards to the city of Kelowna I have wondered throughout this course: Can a city ever be sustainable? Something that has come up multiple times throughout the course is the growth mindset that can be found within all the documents created by the city of Kelowna. The policies and the "Official Community Plan" all discuss and leave room for more growth in population and/or development, and this is interesting since at first we discussed how the city should stop or limit this growth. This changed due to the guest speakers' presentation and our research into the city of Kelowna because we realized that the city does not have the jurisdiction to stop the growth and is prohibited from doing so. Since, the city of Kelowna cannot prohibit people or corporations from moving here this can increase other problems such as the geographical limitations of the city due to the mountains and lake. Therefore, it was after taking this growth into consideration that we could find solutions that had the city channelling the growth in a direction that was viable and useful in the long term.

Another thing that I learned in this class is that different perspectives are a vital piece of any worthwhile research, especially regarding sustainability. Since any subject that I want to learn about or any knowledge I want to mobilize is affected by people of various backgrounds, therefore I must listen to and recognize the differences in my perspective and others to become a better researcher. I can only hope that by listening to all the guest speakers and reflecting upon the perspectives and knowledge that they brought with them and connecting it to my past and my present research, I will improve as a researcher overall. Recognizing the value of connecting with people who do not always agree with you is a vital life lesson that has been further impressed upon me in this course.

While this course could cause me to focus only on the problems of Kelowna such as how many members of the community are not interested in sustainability and resiliency it has

done the opposite for me. The course has shown me with the guest speakers, the documents that the city has created, and the community engagement by the city how many people care about this place and the people in it. With this, I can see a city that I would like to be a part of, and while Kelowna has many things to address, I believe it is worth the effort.

Jannatul Ferdous

I was very excited that this year for IGS 585, we worked on the city of Kelowna. During this course, I learned a lot about this city, which was a great experience for me being a newcomer to this region. Moreover, the multidisciplinary backgrounds of my classmates, groupmates and instructors were the most interesting part of this course. Diversity of our group members' backgrounds and their willingness to engage across disciplines were very helpful for this project. The wide array of guest speakers – academicians, researchers, private and public consultants, representatives from Westbank First Nations, city councillor, etc. has broadened my perspective of sustainability and resilience. Working on the housing and transportation systems was very enjoyable as my background is urban and regional planning.

The most astonishing thing I came across during this course was that the difficulties in the path of sustainability and resilience are very similar for developed and developing countries. My previous conception was that being a developing country, we face a wide range of barriers, starting from budget deficit to social and political opposition from citizens. The scenario is kind of the same in developed countries, at least in Kelowna. During my undergrad, while learning about different policies and plans in my country, I always wondered how rich our policies were. But unfortunately, we lagged in the implementation phase due to the financial crisis or other priorities of the central government to please the citizens. It is very appealing that all the policies and by laws of the city of Kelowna considered the future growth or at least acknowledged the future growth. At the policy level, I do not have that much

criticism but in my opinion, some policies are too generic. Specific strategies and implementation plans are still missing to be considered as adequate.

While working on the solutions of the sustainability and resilience challenges in the city of Kelowna, we found that all these issues are interlinked, and it is very tough to treat them separately and provide individual solutions. One of the main things to consider is the three pillars of sustainability - social, economic, and environmental, and while proposing any solutions, we must maintain the balance among the pillars, and we must ensure that the solutions should not have any cascading effects. Some solutions seem perfect in the short term, but it can have long-lasting or unalterable effects in the long run. I remember a presentation of Dr. Kasun Hewage from School of Engineering at University of British Columbia, Okanagan in a symposium, where he was talking about the importance of life cycle assessment for the new innovative zero emission and clear energy ideas/technologies. Being a researcher in the field of life cycle assessment, I found the presentation very captivating, and I strongly agree that while proposing any new innovative ideas, we should keep in mind that the solution can have adverse impacts in any stage of its life cycle. We only consider the economic budget or some short-term environmental impacts, which does not reflect the wholesome picture.

Another thing is worth mentioning that nowadays we are more concerned about either the environment or the economic part of sustainability. In my opinion, researchers and academicians are more involved in the environmental sector, whereas other consultants or decision-makers are very concerned about the economic pillar. The social pillar is being neglected in most of the cases. During this course, I realised that social, cultural, and political orientation of community members, human behaviour, in a word the social pillar of sustainability is very important to be considered. I think our project would be a more realistic and successful one if we could incorporate some primary data like interviews of community

people while working on the solutions. In that case, I remember one of my undergrad sessional courses where we followed the Participatory Rural Appraisal (PRA) techniques to identify a framework for community based solid waste management system ensuring active participation from community members. After all, we are working for the betterment of the community. Neglecting their views and perspectives, it won't be fruitful to propose anything for the sustainability and resilience of the community.

Chhavi Mathur

This project challenged me to think and work outside my discipline alongside students who came from very different disciplinary perspectives, training in methodologies, and work styles. While none of us were experts on sustainability and resilience issues in cities, these different perspectives contributed to many useful insights and diverse ways of identifying and approaching the challenges faced by the city of Kelowna.

A lot of the problems we were looking at were interrelated and very complex – transit, mobility, social cohesion, housing, carbon emissions, etc. One of the things I learnt from many of the presentations we had from a variety of government, corporate, academic, and community actors involved with the city, was that there is no silver bullet solution to these problems. What looks like a solution for a part of a problem can cause further problems in other areas. I found this during my research as well when looking at the issue of housing affordability. The catchphrase of "densification" seemed to be the most discussed solution everywhere, but going deeper into it, I found that it was not a comprehensive solution by itself and could, counterintuitively, even cause a spike in housing prices.

I found the experience of researching an area I was also living in particularly enriching, as it made the concepts, we were looking at much less abstract and very relatable to my living experience of the city, while also allowing me to bring a critical lens to things I would otherwise

discuss only in passing with friends. I feel like our group composition – all of us students, most of us from outside of Canada or at least outside of Kelowna, who also mostly walk or use the bus in this very car-centric and suburban town-growing-into-city – also allowed us to bring a fresh perspective to addressing the cities challenges and made us more observant of certain urban design aspects in the city which contributed to these challenges.

As a group, we eventually arrived at the concept of walkability to frame our project and what I liked about this was that it brought a more holistic perspective to addressing the environmental, social, as well as economic aspects of sustainability and resilience challenges and looked at the city as an interconnected system or ecology. The main difficulty with applying the walkability concept to Kelowna is that it would require a paradigm shift in the culture of the city and its planning. Certain pathways of car-centric development have already been shaped by the existing infrastructure of the city and have also set in to the cultural and behavioural norms and practices of its residents. Shifting from that seems like such an enormous task, it seems almost impossible or not worth the effort. It is easier doing something that is already acceptable within the existing system, even if they only temporarily fix a problem in a fragmented and surface level manner.

I think, however, that it is important to be more optimistic than that. Even being able to see that there are alternatives is crucial in opening the possibility for transformation. In the face of climate change, systems at different levels will need to change in order to be able to sustain what is most valuable to us – our communities and the material environments we depend on. Local level change at the level of a neighbourhood or a city, even as it is linked to more provincial, national, or global structures, is a key part of this. Addressing local-scale challenges can be an important site for rethinking and re-imagining our communities and their social, governmental, and economic structures.

Jalal Sarrami

My previous experiences in horticultural science and Environmental design have allowed me to gain valuable skills in these fields and have prepared me to be familiar with the concept of sustainability on the level of Horticulture and landscape architecture. However, I found myself constantly looking for ways to improve my relevant knowledge and find opportunities to enhance my awareness of sustainability. Coming to this realization, when I started my study at Digital Arts and Humanities (DAHU) Program, I began searching for courses that are related to this concept. This is my answer to classmates and peers who wonder why, despite my DAHU program, I chose and attend sustainability courses such as IGS 584 (Sustainability Theme Seminar) and IGS 585 (Knowledge Mobilization and Sustainability Policy). During these courses, I have learned that various disciplines, as well as different scales within the same discipline, have diverse interpretations of the idea of sustainability. This can exacerbate the complexity of this multifaceted concept.

Sustainable horticulture is a relatively recent phrase in the English language, and the area is still considered "infancy". As a result, the phrase is ephemeral and difficult to define. However, even though sustainable horticulture has the potential to be much more than small-scale farming, organic vegetables, and locally grown ornamentals, it seems that most aspects of sustainability in horticulture, at least at the production level, are related to the dimensions of the field and micro-climates and related factors within the borders of the farmlands and orchards. The larger the orchards, the more complicated their sustainability challenges.

I believe that the issues of sustainability in landscape design appear to be a bit more complex than in horticulture since we deal with humans and society more in landscape architecture. However, Although, unlike horticulture, sustainability in landscape architecture is linked to human and social aspects, practically all characteristics of sustainability in this field

are reflected within the scale of the site and its environs. A small garden's irrigation system is far easier to plan and construct than a park on a local or urban scale.

When it comes to cities, the subject of sustainability becomes far more difficult and problematic, because on the one hand we are dealing with provincial and federal laws and decisions, and on the other hand the human dimensions and users' needs in a city are far more complex. Environmental deterioration, traffic congestion, poor urban infrastructure, and a lack of essential services like water supply, sanitation, and waste management are already problems in many cities. Cities' environmental footprints are concerning, since they may jeopardize the natural resources needed to maintain economic development and poverty reduction rates. A city like Kelowna, without considering these complexities, can not walk the path of sustainability. The smallest activity in this city's little neighborhood can be impacted by circumstances inside and outside the metropolis. As Jane Jacobs (1992) said: "Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody".

Yazdan Gordanpour

I had never experienced a course with such a practical and problem-centred focus. It was very helpful to see how the theoretical discussions of interdisciplinarity apply to "real-world" situations. The variety of disciplines in the class both in students and guest speakers, and the multitude of approaches, frameworks, and intervention fronts truly speak to the complexity and scope of sustainability and environmental issues. I have always been intellectually aware of how systems are complex, difficult to predict, and how changes in one area have unforeseen effects on other areas, but only after having taken this course, I can say that I have a concrete understanding of such multi-faceted endeavours.

One of my main takeaways from this course relates to the importance and power of local politics. We are always more interested in national and global politics, but I now realise how much influence municipalities and local councils have on the lives of normal people and how, in turn, it is so easier to bring change through local politics which has immediate results. On the other hand, because local politics is easier to change but has less scrutiny from the majority of people, its processes might appear to be haphazard – only depending on the decisions of under-budget staff and not necessarily well-informed council members. I am still ambivalent about whether this decentralisation is beneficial since it can be inefficient in tackling large-scale problems, but it is also very suited for answering to local needs. Nevertheless, this course made me think a lot about how we can encourage engagement with local politics for those who do not always pay attention to the proceedings of the council.

This course also made me, as a humanist, reconsider the role of various disciplines in problem-centred discussions. We have often heard the grievances of humanities scholars that they are not given a seat at the table when multi-disciplinary teams are tackling an issue but my experience in this class was that the solution of just having humanities scholars in the discussion is not satisfactory. Such multidisciplinary taskforces are never created on a non-disciplinary foundation, rather, they always bring implicit disciplinary assumptions that shape the problem itself. Sustainability itself, as a term, is rooted in certain assumptions of capital growth that might not be welcome in some disciplines. Hence, disciplines are not created equal when it comes to real-world issues. Economics for example is often seen as a "first among equals" in tackling such problems (and not just because John is an economist!) But the humanities as disciplines fundamentally concerned with meaning rather than solutions simply operate on a different layer. I often struggled to understand how my "knowledge" can be "mobilised" when that knowledge is never explicitly about solutions.

As a final remark, I would add that the experience of working on a place I live in and having personal stakes in the study and the course was a peculiar mixture of excitement and despair. I was constantly aware of how I can – however to a small degree – change my immediate surroundings and the ways these efforts have been successful – for example, the water board. This created a thrill I had never experienced in scholarship. On the other hand, being aware of both how difficult that process can be and also the ways the system is built to resist certain kinds of change – for example, those that might decrease land values or the suburban ways of living – was incredibly frustrating. I guess this is how it feels to work on things that so obviously matter!

7.2 Reflection on Reflections

Morgan King

Reading over everyone's reflections made me realize how much we have learned and completed over this semester together. Like Jannatul, I agree with how important the social aspect of sustainability is and how it is often neglected when people are considering solutions. Her idea of incorporating primary data, like interviews, is something that I think is worthwhile. Discussing these solutions and ideas with the local community would inform us on what is realistic and what is wishful thinking. Having someone such as Jannatul on our team who is very practical minded with an urban planning background has been incredibly useful. She has made sure that with all our solutions that we discuss that the implementation and the materials used also aid in the reduction of GHGs which is an overarching goal.

In addition, reflecting on what Chhavi has said, that popular solutions are not always comprehensive, has been very important during this research. Without the clarity brought in by our fresh perspectives I believe we would have gone for just the simple implementable solutions. While these solutions are important, as densification is needed, they will not address

the root of the problem if the framework it is in is inaccurate. Having Chhavi on our team has been so interesting, the perspective of someone who has been using their own experiences of finding housing, to verify the information that we had collected, has been great to have.

Jalal's perspective has been so unique, it influenced how I was thinking about the research that I was focusing on for this project. His discussion of urban vitality with the focus on green infrastructure, due to his background in urban design, really emphasized how important it is that we look at solutions that make Kelowna a city that people are really excited to live in. In his reflection he discusses how scale is an important aspect of sustainability and the increasing complexity of it, I believe this is reflected in our paper since we needed to narrow down our topic to be able to write about it in any detail. There are so many pieces in Kelowna that come together to make a complex sustainability or resiliency issue, and this is reflected in the idea that we came to of walkability.

I am in agreement with Yazdan in that I fully realize how important local politics can be, with the implementation of policies the environment in which you live can change so drastically and rapidly. This also causes me to be frightened and excited, I am always a little scared of causing harm to the environment to the extreme, but I also recognize that it is the larger processes that we assess in this project that are the larger culprit and hopefully we can change them. Having Yazdan as part of our team has been quite interesting, as he points out he is a humanist therefore he has a contrasting perspective to mine which has added to our research. I know Yazdan said that he struggled with the mobilization of knowledge as a solution, but I think in the end this was an additional strength to our team. He looked at the knowledge and what it informed, and this allowed us to bring forth practical solutions that might be overlooked since they were not the most talked about solutions.

Overall, having differing perspectives that came from different disciplines and brought an array of subjects to focus on resulted in a stronger report. While combining our knowledge and opinions into one document was difficult it was also so interesting to learn about what everybody thought was a worthwhile topic. This resulted in me learning so much more about what makes a city healthy, sustainable, and resilient especially in the real-world context.

Jannatul Ferdous

I really enjoyed reading the reflections of my groupmates, how everyone connected their background experience and discipline with this project and course and emphasised on the new learnings. It was great to have these people from diversified backgrounds to work in a practical and problem-oriented topic, so that we were able to incorporate everyone's knowledge and insights to find out the solutions for the multifaceted challenges in the City of Kelowna to achieve sustainability and resiliency.

I found the thought of Morgan very interesting - "can a city ever be sustainable?". I don't think a 100% sustainable city is a realistic concept, but we can achieve sustainability to a greater extent that will at least provide a minimum benchmark for the inhabitants. Now the biggest question is what is considered as a minimum benchmark. Here comes the importance of social, cultural, and political orientation of the people. It is for sure that most of the great solutions do not work just because of the ignorance of community people or due to the knowledge gap. Another thing to notice from Morgan's reflection is that she talked about limiting or stopping the growth for achieving sustainability. But I don't think stopping or limiting growth is the right or realistic path, as growth is a natural thing. All we can do is predict the growth and plan accordingly.

Chhavi's insight about the housing problem in Kelowna resonates with my sufferings too. As a newcomer and being an international student without any credit or relative references

here, it is a nightmare to find a decent place here. Let's not talk about the rent. When I personally think about the affordability problem, I cannot think of any solution with the current setting. To solve this problem, we need a major change in policy and implementation systems, and a paradigm shift in society's point of view and lifestyle. I agree with Chhavi that being an outsider, we had different and fresh perspectives for the housing and transportation problems of Kelowna, and our diversified academic backgrounds have a profound impact on that. I admire that being a literature student how well Chhavi worked for the housing issues in Kelowna and came up with diversified and innovative ideas.

Jalal connected his background knowledge and motivation with this course very interestingly. I found the concept of sustainable horticulture very captivating. I would love to know what the parameters are to assess the sustainability of horticulture and landscape. Jalal emphasised on the complex systems associated with a city's sustainability, and undoubtedly the interlinkages between systems and priorities are the most important thing to consider while working for the sustainability and resiliency.

I strongly agree with Yazdan about the culture and influence of local politics. A plan/solution can sound great at the central government level but can be failed just because of local politics. It was very interesting to have a humanist perspective in our group. I agree that humanists are kind of neglected for multidisciplinary projects, but I am also confident that this will change very soon or is already changing. People from technical backgrounds now acknowledge the importance of the humanist view.

Overall, working in a multidisciplinary group project was a great learning for me. Though I had some experience working in a multidisciplinary group consisting of planners, engineers, and architects before, this is the first time I had a group with this level of diversity.

I strongly believe that there is no other way than multidisciplinary and/or interdisciplinary research to solve current sustainability and resiliency issues.

Chhavi Mathur

Working with my group members has been an enriching experience and I have learnt a lot from their different perspectives. Reading over everyone's reflections has only reinforced this feeling and I am glad to have this opportunity to learn from their insightful questions, comments, and takeaways.

Morgan's observation that knowledge and good ideas aren't enough to solve problems is very pertinent. People's minds and behaviours do not usually change through logical reasoning alone and this is what makes working in sustainability, which is so tied to social and human behaviour, so challenging. I also found Morgan's question about the growth mindset and the possibility of a sustainable city very thought-provoking. An economics perspective, which Yazdan pointed out is often dominant, often works from the assumption of growth. However, I do think it doesn't have to be like that – my own interest in having a career in sustainability might have been cemented in my 11th grade economics class (high school) which was taught by an ex-Marxist, Buddhist, Environmentalist teacher and it was from him that I first heard a critique of the growth mindset. Capitalism itself is not a monolith, but there are also many perspectives in economics that are outside of or sideways to capitalism, even if they are not very dominant.

I really appreciate Jannatul's suggestion about drawing on primary data and interviews to bring in the views and perspectives of community members. I have been recently having some really enriching conversations with my landlady about rent, real estate, zoning regulations, and planning in the city and have been grateful that, due to this project, I am not completely ignorant on these subjects! Ethnographic research can be very challenging, not least

because of ethics considerations, but also because it requires a different kind of flexibility and adaptability of research. But I feel like everyday citizen perspectives were the main aspect that was lacking in our research and would have been very valuable to include.

I love Jalal's enthusiasm to learn and grow by taking courses outside of his program requirements. He always brought a very fresh and unique perspective to the issues we were engaging with, drawing on his background in horticulture and landscape architecture. I've always been fascinated by the way in which design, environment and human behaviour intersect and I learnt a lot from Jalal's contributions to ideas for improving park design in Kelowna. I also liked that a lot of his suggestions were very practical, concrete, and implementable steps.

Yazdan also offered an interesting perspective bringing in his skills in reading literature to reading urban design and its more subtle and implicit messaging and assumptions. Yazdan and I have a similar disciplinary background in the humanities, and I have also shared similar questions and doubts about how my knowledge could be mobilised or how it could have a practical value in the world. Yazdan rightly points out that the humanist perspective works on a different level. What I like most about a humanities approach is that it is not only analytical but can also be quite playful. This may not seem very relevant in the context of solving serious problems like sustainability. But I think it is actually very important to our way forward in generating creative and seriously playful (I'm pretty sure I must be badly quoting someone here) conversations that can enable us to step out of or, at least revisit afresh, our set ways of thinking and acting in the world.

Jalal Sarrami

The most enticing aspect of this project, in my opinion, is that everyone in my group enjoys the interdisciplinary atmosphere of this course and its final project. Learning about other

areas and their approaches seems to appeal to all of us. We also believe that multidisciplinary techniques should be used to address sustainability and resilience issues. At the same time, we all recognize that there are several difficulties and roadblocks in the way of sustainability that will not be simply overcome.

It should be stated that although multidisciplinary approaches might sound useful for sustainability challenges, they are difficult to apply in these cases. It is simply because, as Chhavi said, there is no simple and seemingly magical solution to these complicated problems. All these issues are interconnected, making it difficult to tackle them independently and give specific remedies. On the other hand, one of the cornerstones of sustainability and resilience is "society and humans," which compounds the problem, and unfortunately, is being ignored by both industrialized and developing nations.

Moreover, for sustainable challenges, we should follow realistic and practical approaches. For example, as Jannatul stated in her reflection essay, it is important to acknowledge that we cannot stop growth in our cities, we can just direct it toward sustainable ways. In this regard, it is very important to avoid generalizations in the formulation of laws and policies. Moreover, using creative community engagement methods and incorporating some primary data like interviews for engaging people and stakeholders seems to be very helpful.

All things considered, by reading all our reflections, I realized that we all believe that we should be optimistic about the future of our cities. Sustainability is a way of travel, not a destination. One of the main cultural barriers to sustainability road might be focusing on either short-term solutions or long-term ones. There are many opinions about the benefits and drawbacks of both short and long-term ideas. But despite the different views, in much of our cases both are needed.

Yazdan Gordanpour

Reading all the reflections has reinforced the understanding I had throughout the course that issues such as sustainability can invoke very different experiences for different people. This variety of ways to approach issues of such scale is precisely what makes interdisciplinarity so important. Seeing how everyone's background and home disciplines shape the way they have understood this course and what highlights they remember, makes me grateful for having had the opportunity to engage in a practical way with the problems of sustainability and resilience.

I fully agree with Morgan's observation that this course made us truly grasp the complexity of the challenges that we had previously only had a shallow understanding of. Her remark that growth is a pre-existing assumption of the city and the question of if growth and sustainability are commensurable is a foundational topic of discussion that more practice-oriented disciplines might miss as we in the class many times noted that we cannot stop growth. This, however, reminds me of William Rees' recent talk at the Roger W. Gale conference in which he argued we cannot keep ignoring the issues of growth and population and that sustainability is really an illusion. This makes me think about the politics of knowledge mobilization as such a stance will destroy any prospect of practical change.

Jannatul's argument that social sustainability is an often ignored but very important component of the issue is absolutely true. Her observation about the similarities of sustainability issues in the developed and developing world is very interesting and something I had not previously considered. While I completely agree that sustainability is a global challenge and every city and country is tackling this issue in generally similar ways, I think it is also important to note that local and regional differences, although subtle, are important to consider. This is precisely what we encountered many times in this course; that many solutions

that have worked elsewhere and seemingly can be adopted in Kelowna, will not work because of the political, cultural, and historical differences that come into play.

Chhavi perfectly captures the complexity and the interrelatedness of sustainability issues. I also concur with her point that the high number of students who were new to Kelowna offered an important "outsider perspective." This is something I noticed too; that many people who have mostly experienced living in North America fail to realize that many things they take for granted as fundamental facts of life can easily be another way as they are in other places. This is the most pernicious obstacle to walkability in my opinion.

Jalal's experience in landscape design and the points he raises about sustainability in urban greenery and parks are very fascinating to me. Urban parks in Kelowna have often been ignored due to the notion that the Okanagan is already within nature, and you can easily find yourself in nature in any direction you go. However, this stance is itself rooted in car-centeredness and sprawl as someone who lives in a dense area without a car might not be able to easily leave the bounds of the city. Hence, a new attention to urban parks is necessary and Jalal's remarks perfectly address this need.

References

Banchiero, F., Ivan, B., Valeria, S., and Giuseppe, A.T. 2020. “Neighbourhood Park Vitality Potential: From Jane Jacobs’s Theory to Evaluation Model.” Sustainability 12 (15): 5881. https://doi.org/10.3390/su12155881

Billington, J. 2020. “HydroFLEX: UK’s first-ever hydrogen-powered train begins mainline trial”. October 2, 2020. https://www.electrichybridvehicletechnology.com/news/electrification-strategies/hydroflex-uks-first-ever-hydrogen-powered-train-begins-mainline-trial.html

Bioregional. n.d. “BedZED - the UK's first major zero-carbon community”. Accessed March 27, 2022. https://www.bioregional.com/projects-and-services/case-studies/bedzed-the-uks-first-large-scale-eco-village

Blackson, H. 2013. “Don’t Get Mixed Up on Mixed-Use.” Placeshakers and Newsmakers. http://www.placemakers.com/2013/04/04/mixed-up-on-mixed-use/

Bourne, C. 2019. “Toward Incremental Density in Inner-Ring Suburbs: Overcoming Political Opposition Through Context Sensitive Design”. Course-Based Graduate Degree Paper. McGill University.

Canada Mortgage and Housing Corporation. 2018. “About-Affordable-Housing-in-Canada,” March 31, 2018. https://www.cmhc-schl.gc.ca/en/professionals/industry-innovation-and-leadership/industry-expertise/affordable-housing/about-affordable-housing/affordable-housing-in-canada

Cities Today. 2021. “Electric buses fuel zero-emission transport at Amsterdam’s Schiphol Airport”. February 23, 2021. https://cities-today.com/industry/electric-buses-zero-emission-transport-amsterdams-schiphol-airport/

City of Campbell River. 2020. “Campbell River Community Climate Adaptation Plan”. 2020. https://www.campbellriver.ca/docs/default-source/default-document-library/cr-ccap_final.pdf?sfvrsn=f7db6908_0

City of Kelowna. 2008. “Bylaw No. 8000, Section 8. Zoning – Parking and Loading”. kelowna.ca. https://apps.kelowna.ca/CityPage/Docs/PDFs/Bylaws/Zoning%20Bylaw%20No.%208000/Section%2008%20-%20Parking%20and%20Loading.pdf?v=10B232D19C65F0B0485C8B6C02677993

City of Kelowna. 2013. “Bylaw No. 8000, Section 13. Zoning – Urban Residential Zones”. kelowna.ca. https://apps.kelowna.ca/CityPage/Docs/PDFs/Bylaws/Zoning%20Bylaw%20No.%208000/Section%2013%20-%20Urban%20Residential%20Zones.pdf?v=D4584FBBF49CAD35B630BE9DE90AD8C0

City of Kelowna. 2016a. “Urban Centres Roadmap”. kelowna.ca. https://www.kelowna.ca/sites/files/1/docs/urban_centres_roadmap_final_report.pdf

City of Kelowna. 2016b. “Infill Housing and RU7 Zone.” kelowna.ca. https://www.kelowna.ca/homes-building/property-development/infill-housing-and-ru7-zone

City of Kelowna. 2016c. “Partners in Parks.”. City of Kelowna. kelowna.ca. https://www.kelowna.ca/city-hall/city-funding/partners-parks

City of Kelowna. 2018a. “Healthy Housing Strategy”. Kelowna.ca. https://www.kelowna.ca/sites/files/1/docs/logos/healthy_housing_strategy_final_reduced_size.pdf

City of Kelowna. 2018b. "Journey Home Strategy: Community Report". Kelowna.ca. https://www.journeyhome.ca/wp-content/uploads/2019/04/journey_home_community_report_web_version-_reduced.pdf

City of Kelowna. 2018c. “Facts in Focus – Population and Housing in Kelowna”. Kelowna.ca. https://www.kelowna.ca/sites/files/1/docs/related/ff-population_and_housing.pdf

City of Kelowna. 2018d. “Parks and Buildings Assessment Report.” Kelowna.ca. https://www.kelowna.ca/sites/files/1/docs/community/Planning/2018_attachment_b_parks_and_buildings_assessment_report.pdf

City of Kelowna. 2018e. “Our Kelowna as We Take Action - Kelowna’s Community Climate Action Plan”. kelowna.ca. https://www.kelowna.ca/sites/files/1/docs/related/community_climate_action_plan_june_2018_final.pdf

City of Kelowna. 2019a. “Bylaw No. 8125. Payment in Lieu of Parking”. kelowna.ca. https://apps.kelowna.ca/CityPage/Docs/PDFs/Bylaws/Payment%20in%20Lieu%20of%20Parking%20Bylaw%20No.%208125.pdf

City of Kelowna. 2019b. “Capri-Landmark Urban Centre Plan.” kelowna.ca. https://www.kelowna.ca/sites/files/1/docs/related/capri-landmark_urban_centre_plan_2019-03.pdf

City of Kelowna. 2019c. “Rental Housing Inventory”. kelowna.ca. https://kelownapublishing.escribemeetings.com/filestream.ashx?DocumentId=24010

City of Kelowna. 2020. “Report to Council”. June 15, 2020. kelowna.ca. https://kelownapublishing.escribemeetings.com/filestream.ashx?DocumentId=27801

City of Kelowna. 2021. “City of Kelowna’s 10-Year Capital Plan.” http://viewer.zmags.com/publication/7bb1bbad#/7bb1bbad/1

City of Kelowna. 2022. “Bylaw No. 12300, 2040 Official Community Plan”. 10 January 2022. https://www.kelowna.ca/our-community/planning-projects/2040-official-community-plan

City of Red Deer. 2014. “Climate Change Adaptation Plan – City of Red Deer”. March 3, 2014. https://www.prairiesrac.com/wp-content/uploads/2018/07/Planning-for-Climate-Change-Mitigation-and-Adaptation-Red-Deer-Alberta.pdf

Cohen, D.A., and Leuschner, K.J. 2019. “How Can Neighborhood Parks Be Used to Increase Physical Activity?” Rand Health Quarterly 8 (3). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6557046/

Cohen, D.A., McKenzie, T.L., Sehgal, A., Williamson, S., Golinelli, D., and Lurie, N. 2007. “Contribution of Public Parks to Physical Activity.” American Journal of Public Health 97 (3): 509. https://doi.org/10.2105/AJPH.2005.072447

Conticelli, E., Proli, S., and Tondelli, S. 2017. “Integrating Energy Efficiency and Urban Densification Policies: Two Italian Case Studies.” Energy and Buildings 155 (November): 308–23. https://doi.org/10.1016/j.enbuild.2017.09.036

Cosman, J., and Quintero, L. 2021. “Fewer Players, Fewer Homes: Concentration and the New Dynamics of Housing Supply.” SSRN Electronic Journal, May 17, 2021. https://doi.org/10.2139/ssrn.3303984

Energy Step Code. 2018. “How the BC Energy Step Code works”. December 31, 2018. https://energystepcode.ca/how-it-works/

Ewing, R., and Clemente, O. 2013. “Introduction” In Measuring Urban Design: Metrics for Livable Places, edited by Reid Ewing, Otto Clemente, Kathryn M. Neckerman, Marnie Purciel-Hill, James W. Quinn, and Andrew Rundle, 1–23. Washington, DC: Island Press/Center for Resource Economics. https://doi.org/10.5822/978-1-61091-209-9_1

Ewonus, G., Ewonus, P., & Baker, J. 2004. "Chapter 8: Ancient Peoples of the Okanagan". In John D. Greenough, Murray A. Roed (eds.). Okanagan Geology. Kelowna Geology Committee. pp. 67–78. ISBN 0-9699795-2-5.

Field, C.B., Dahe, Q., Stocker, T.F., and Barros, V. eds. 2012. “Glossary of Terms.” In Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Special Report of the Intergovernmental Panel on Climate Change, 555–64. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781139177245.014

Folke, C., Carpenter, S.R., Walker, B., Scheffer, M., Chapin, T., and Rockström, J. 2010. “Resilience thinking: integrating resilience, adaptability and transformability. Ecology and Society 15(4): 20. http://www.ecologyandsociety.org/vol15/iss4/art20/

Frangoul, A. 2020. “In Austria, a hydrogen train is set to travel on challenging alpine routes”. September 14, 2020. https://www.cnbc.com/2020/09/14/in-austria-a-hydrogen-train-is-set-to-travel-on-challenging-routes-.html

Frank, L.D., and Engelke, P.O. 2001. “The built environment and human activity patterns: exploring the impacts of urban form on public health”. J. Plan. Lit. 16, 202–218.

Gies, E. 2006. The Health Benefits of Parks. The Trust for Public Land. San Fransisco, CA.

Gobster, P. 2002. “Managing urban parks for a racially and ethnically diverse clientele”. Leisure Sci.; 24:143–159.

Grêt-Regamey, A., Galleguillos-Torres, M., Dissegna, A., and Weibel, B. 2020. “How urban densification influences ecosystem services—a comparison between a temperate and a tropical city”. Environmental Research Letters 15: 075001. https://doi.org/10.1088/1748-9326/ab7acf

Haaland, C., and Bosch, C.K. 2015. “Challenges and Strategies for Urban Green-Space Planning in Cities Undergoing Densification: A Review.” Urban Forestry & Urban Greening 14 (4): 760–71. https://doi.org/10.1016/j.ufug.2015.07.009

Handy, S.L., Boarnet, M.G., Ewing, R., Killingsworth, R.E., 2002. “How the built environment affects physical activity: Views from urban planning”. Am. J. Prev. Med. 23, 64–73

Hess, P.M., Farrow, J., University of Toronto, and Cities Centre. 2014. “Walkability in Toronto’s High-Rise Neighbourhoods: Final Report”. https://www.deslibris.ca/ID/240134

Higgs, C., Badland, H., Simons, K., Knibbs, L.D., and Giles-Corti, B. 2019. “The Urban Liveability Index: Developing a Policy-Relevant Urban Liveability Composite Measure and Evaluating Associations with Transport Mode Choice.” International Journal of Health Geographics 18 (1): 14. https://doi.org/10.1186/s12942-019-0178-8

Hirschmann, R. 2021. “Singapore: Population Living in Public Housing 2020.” Statista. August 25, 2021. https://www.statista.com/statistics/966747/population-living-in-public-housing-singapore/

Holland, O. 2021. “Singapore is building a 42,000-home eco 'smart' city”. February 1, 2021. https://www.cnn.com/style/article/singapore-tengah-eco-town/index.html

Howe, T. 2021. “Hydrogen Trains: The Railroad Revolution of the 21st Century”. May 13, 2021. https://blog.ballard.com/hydrogen-train

InterVISTAS Consulting Inc. 2017. “Economic Impact of Tourism in Kelowna and the Greater Kelowna Area, B.C.”. March 2, 2017. https://res.cloudinary.com/simpleview/image/upload/v1/clients/kelowna/Economic_Impact_of_Tourism_in_Kelowna_2016_033f81a1-fd41-4429-b99f-22d942d92660.pdf

Jacobs, J. 1992. The Death and Life of Great American Cities. Vintage Books ed. New York: Vintage Books.

KelownaNow. 2022. “The Final Phase of Construction on Rowcliffe Park Begins next Week.” KelownaNow. Accessed March 26, 2022. https://www.kelownanow.com/watercooler/news/news/Kelowna/The_final_phase_of_construction_on_Rowcliffe_Park_begins_next_week

Keith, L. 2021. “Scotland's first hydrogen-powered train will run by the end of 2021”. January 12, 2021. https://www.lonelyplanet.com/articles/first-hydrogen-powered-train-scotland

Kelowna Capital News. 2021. “Social connections.” March 25, 2021. https://www.kelownacapnews.com/news/seeking-a-friend-for-the-pandemic-lonely-souls-find-socially-distanced-connections/

Kodransky, M., and Hermann, G. 2021. “Europe’s Parking U-Turn: From Accommodation to Regulation.” Institute for Transportation and Development Policy. https://thepep.unece.org/sites/default/files/2017-06/EuropesParkingUTurn_ENG.pdf

Kotler, D. 2020. “Kelowna Economy: Top Industries, Biggest Employers, & Business Opportunities”. December 14, 2020. https://www.kelownahomes.ca/blog/kelowna-economy.html

Lambert, R. 2020. “Singapore a City in a Garden – A Model for Creating an Integrated Urban Green Walking Network”. October 8, 2020. https://naturalwalkingcities.com/singapore-a-city-in-a-garden-a-model-for-creating-an-integrated-urban-green-walking-network/

Land Transport Guru. 2021. “Solar panels installed on Go-Ahead buses”. March 30, 2021. https://landtransportguru.net/solar-panels-go-ahead-buses/

Landry, C. 2000. “Urban Vitality: A New Source Of Urban Competitiveness”. Prince Claus Fund Journal. ARCHIS issue 'Urban Vitality / Urban Heroes’ December 2000

Lee, S., and Leigh, N.G. 2005. “The Role of Inner Ring Suburbs in Metropolitan Smart Growth Strategies.” Journal of Planning Literature 19 (3): 330–46. https://doi.org/10.1177/0885412204271878

Lynch, K. 1984. “Good City Form”. MIT Press, Cambridge, MA.

Maas, P., 1984. “Toward the Theory of Urban Vitality”. Department and Community and Urban Planning. University of British Columbia, Vancouver. Maas, S., Attard, M., Caruana, M.A., 2020. Assessing spatial and social dimensions of shared bicycle use in a Southern European island context: the case of Las Palmas de Gran Canaria. Transp. Res. Part A: Policy Pract. 140, 81–97.

Malek, N.A., Mariapan, M., and Shariff, M.K.M. 2012. “The Making of a Quality Neighbourhood Park: A Path Model Approach.” Procedia - Social and Behavioral Sciences 49: 202–14. https://doi.org/10.1016/j.sbspro.2012.07.019

Margolies, J. 2021. “Net zero houses: The homes that produce as much energy as they consume”. November 24, 2021. https://www.irishtimes.com/life-and-style/homes-and-property/net-zero-houses-the-homes-that-produce-as-much-energy-as-they-consume-1.4736333

Ministry of Attorney General. 2022. “New affordable, energy-efficient homes coming to Kelowna”. January 28, 2022. https://news.gov.bc.ca/releases/2022AG0010-000129

Montgomery, J., 1998. “Making a city: urbanity, vitality and urban design”. J. Urban Des. 3, 93–116.

Moore, W. 2019. “City emitting more GHG”. November 24, 2019. https://www.castanet.net/news/Kelowna/271082/Kelowna-is-emitting-more-GHG-not-less-than-in-2007

Mouratidis, K., and Poortinga, W. 2020. “Built Environment, Urban Vitality and Social Cohesion: Do Vibrant Neighborhoods Foster Strong Communities?”. Landscape and

Urban Planning 204 (December): 103951. https://doi.org/10.1016/j.landurbplan.2020.103951

Munro, R. 2022. “Kelowna Is One of the Most Unaffordable Cities in Canada and Looking for Ways to Change.” Infotel.ca, January 8, 2022. https://infotel.ca/inhome/kelowna-is-one-of-the-most-unaffordable-cities-in-canada-and-looking-for-ways-to-change/it88188

Ormsby, M.A. 1935. "Fruit Marketing in the Okanagan Valley of British Columbia". Agricultural History, 9(2), 80–97. https://doi.org/10.2307/3739660

Peacock, A. 2018. “Kelowna falls far short on plan to cut emissions”. June 18, 2018. https://www.kelownadailycourier.ca/news/article_84f2086c-737a-11e8-8b67-eb88559e0c0b.html

Peters, G. 2016. “Hydrogen fuel cells vs batteries: how to power the trains of tomorrow”. December 12, 2016. https://www.railway-technology.com/features/featurehydrogen-fuel-cells-vs-batteries-how-to-power-the-trains-of-tomorrow-5692017/

Pinkstone, J. 2019. “The birth of the 21st-century steam train: Locomotives powered by hydrogen fuel cells that only produce water vapour will be operational in less than two years”. January 7, 2019. https://www.dailymail.co.uk/sciencetech/article-6564527/The-birth-21st-century-steam-train.html

Punwasi, S. 2021. “Canada Is Spending $ 73 Billion on Affordable Housing and It Will Push Prices Higher,” August 11, 2021. https://betterdwelling.com/canada-is-spending-73-billion-on-affordable-housing-and-it-will-push-prices-higher/

Regional District of Central Okanagan (RDCO). 2020a. “Climate Projections for the Okanagan Region”. February, 2020.

https://www.rdco.com/en/environment/resources/Documents/2020---OK_Climate_Projections_Report_Final.pdf

Regional District of Central Okanagan (RDCO). 2020b. “Green Vehicle and Equipment Policy”. December 7, 2020. https://www.rdco.com/en/your-government/resources/Documents/2020---Green_Vehicle_and_Equipment_Policy.pdf

Regional District of Central Okanagan (RDCO). n.d.a. “Green Vehicle and Equipment Policy Implementation Plan 2021-2040”. Accessed March 24, 2022. https://www.rdco.com/en/environment/resources/Documents/RDCO-Green-Vehicle-and-Equipment-Policy-Implementation-Plan-2021-2040.pdf

Regional District of Central Okanagan (RDCO). n.d.b. “Climate Action”. Accessed March 24, 2022. https://www.rdco.com/en/environment/climate-action.aspx

Regional Municipality of Waterloo. 2019. “Community Climate Adaptation Plan for Waterloo Region”. 2019. https://www.regionofwaterloo.ca/en/living-here/resources/Environment/Community-Climate-Adaptation-Plan---Full-ACCESS.pdf

Rodriguez, M. 2020. “Kelowna Council Struggles with Creating New Parks to Balance Growing City.” Kelowna Capital News, March 10, 2020, sec. News. https://www.proquest.com/docview/2375953401/citation/817E03D5D348410DPQ/1

Rodriguez, M. 2021. “300 Supportive Homes: Journey Home Society Celebrates Kelowna Milestone.” Summerland Review, March 9, 2021. https://www.summerlandreview.com/news/300-supportive-homes-journey-home-society-celebrates-kelowna-milestone/

Ryan, D. 2008. "Opening of William R. Bennett Bridge in Kelowna". https://www.newspapers.com/clip/28631702/opening-of-william-r-bennett-bridge-in/

Saunders, P. 2019. “Maybe Upzoning Doesn’t (Always) Lead To Lower Home Prices.” Forbes, February 22, 2019. https://www.forbes.com/sites/petesaunders1/2019/02/22/maybe-upzoning-doesnt-always-lead-to-lower-home-prices/

Schuetz, J. 2020. “To Improve Housing Affordability, We Need Better Alignment of Zoning, Taxes, and Subsidies.” Brookings.edu, January 7, 2020. https://www.brookings.edu/policy2020/bigideas/to-improve-housing-affordability-we-need-better-alignment-of-zoning-taxes-and-subsidies/

Senbel, M., Giratalla, W., Zhang, K., and Kissinger, M. 2014. “Compact Development without Transit: Life-Cycle GHG Emissions from Four Variations of Residential Density in Vancouver.” Environment and Planning A: Economy and Space 46 (5): 1226–43. https://doi.org/10.1068/a46203

Seymour, R. 2019. “City of Kelowna continues work to reduce carbon footprint”. May 28, 2019. https://www.kelownadailycourier.ca/news/article_b271be06-81cd-11e9-a2fa-477c719fafd5.html

Shoup, D. 1999. “The Trouble with Minimum Parking Requirements.” Victoria Transport Policy Institute. 1999. https://www.vtpi.org/shoup.pdf

Statistics Canada. 2019. “Focus on Geography Series, 2016 Census”. June 19, 2019. https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-csd-eng.cfm?GC=5935010&GK=CSD&LANG=Eng&TOPIC=1

Statistics Canada. 2021a. “Census Profile, 2016 Census”. October 27, 2021. https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=POPC&Code1=0403&Geo2=PR&Code2=48&Data=Count&SearchText=Kelowna&SearchType=Begins&SearchPR=01&B1=All&TABID=1

Statistics Canada. 2021b. “Population and Dwelling Count Highlight Tables, 2011 Census”. July 25, 2021. https://www12.statcan.gc.ca/census-recensement/2011/dp-pd/hlt-fst/pd-pl/Table-Tableau.cfm?LANG=Eng&T=201&S=3&O=D&RPP=150

Statistics Canada. 2022. “Census Profile, 2021 Census of Population”. February 9, 2022. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E

Steuteville, R. 2016. “Postwar Neighborhoods Are Key to Suburban Revitalization.” Build a Better Burb. November 1, 2016. http://buildabetterburb.org/postwar-neighborhoods-key-suburban-revitalization/

Strong Towns. 2015. “A Map of Cities That Got Rid of Parking Minimums.” Accessed April 15, 2022. https://www.strongtowns.org/journal/2015/11/18/a-map-of-cities-that-got-rid-of-parking-minimums

Surtees, U. n.d. "A Pictorial History of Kelowna BC". Accessed April 6, 2022. https://www.kelownabc.com/kelowna/

Sustainable Communities. n.d. “Hydrail: Hydrogen Fueled Electric Rail”. Accessed March 27, 2022. https://sustainablecommunities.ok.ubc.ca/research/hydrail-hydrogen-fueled-electric-rail/

Taylor, K. 2021. “Denmark leads EU on deployment of zero-emission buses: report”. January 15, 2021. https://www.euractiv.com/section/electric-cars/news/denmark-leads-eu-on-deployment-of-zero-emission-buses-report/

Tourism Kelowna. 2022. “Geography”. https://www.tourismkelowna.com/plan/about-kelowna/geography/

Tripathi, M. n.d. “TAC Sustainable Urban Transportation Award Submission”. Accessed April 9, 2022. http://conf.tac-atc.ca/english/annualconference/tac2012/docs/session23/tripathi.pdf

Tu, K., and Lin, L. 2008. "Evaluative Structure of Perceived Residential Environment Quality in High-Density and Mixed-use Urban Settings: An Exploratory Study on Taipei City." Landscape and Urban Planning 87 (3): 157-171.

Vickers, B. 2019. “Kelowna discussing options for a community energy retrofit strategy”. December 2, 2019. https://www.iheartradio.ca/am-1150/news/kelowna-discussing-options-for-a-community-energy-retrofit-strategy-1.10303920

Victoria Transport Policy Institute. 2019. “Walkability Improvements: Strategies to Make Walking Convenient, Safe and Pleasant.” TDM Encyclopedia. September 6, 2019. https://www.vtpi.org/tdm/tdm92.htm

Wainwright, O. 2019. “I've seen the future and it's Norwich: the energy-saving, social housing revolution”. July 16, 2019. https://www.theguardian.com/artanddesign/2019/jul/16/norwich-goldsmith-street-social-housing-green-design

Way Back Machine. 2008. “New Screening Technology Piloted at Kelowna International Airport”. June 19, 2008. https://web.archive.org/web/20111001081321/http://www.catsa-acsta.gc.ca/PressRelease.aspx?id=43&pname=PressReleases_CommuniquesPresse&pr=6&yr=2008&lang=en

Wilson, A. 2022. “Despite Council Comments, Kelowna Can Do More for Housing - Wilson on Water Street.” Castanet, January 14, 2022. https://www.castanet.net/news/Wilson-on-Water-Street/356924/Despite-council-comments-Kelowna-can-do-more-for-housing

Zeilinski, J. 2020. “Those Experiencing Homelessness in Kelowna Increases from 2018.” Kelowna Capital News, July 17, 2020. https://www.kelownacapnews.com/news/those-experiencing-homelessness-in-kelowna-increases-from-2018/

Zhang, Z., Wang, M., Xu, Z., Ye, Y., Chen, S., Pan, Y., and Chen, J. 2021. “The Influence of Community Sports Parks on Residents’ Subjective Well-Being: A Case Study of Zhuhai City, China.” Habitat International 117 (November): 102439. https://doi.org/10.1016/j.habitatint.2021.102439

Appendices

Appendix A: Checklist of Social Connectedness in the project of "Community for All, Parks and Buildings Assessment Report, April 2018" (City of Kelowna 2018d)

SOCIAL CONNECTEDNESS

-	Reasons to Visit	.
199	Are 'nodes of activation' present in the park? (E.g. food concession, sport rental, 'Busk Stop' for performers, sports fields, stage)	
200	Does the park offer opportunities for performance (e.g. 'Parks Alive!')	
201	Does the park hold community festivals or other events? (City-Wide Parks)	
202	Is a central plaza or square present?	
203	Does the park displays any unique Landmarks? (Bear statue, etc.)	
204	Is there a wide promenade in the park (3.0m or wider)? (City-Wide Parks)	
205	If a promenade exists, are there seating opportunities along it?	

-	Reasons to Stay	.
206	Are seating areas positioned to provide opportunities for interaction/conversation? (group sitting areas, benches facing one another, etc.)	
207	Are there moveable seats and/or tables in the park?	
208	Is there a good mix of sun and shade opportunities?	
209	Is there well-maintained greenspace to allow for picnicking and passive recreation?	
210	Are there any tactile garden features provided (textured maps, touchable art, Braille signage)?	
211	Are fragrant types of plants provided at bench locations?	

212	Are there decorative flower beds with yellow, orange or red spectrums?	
213	Are there locations available to provide refuge, de-stressing or quiet contemplation?	
214	Does the park design create opportunities for young and old to connect (e.g. displays or artwork with multi-age appeal or game opportunities)?	
-	**Safety and Comfort**	.
215	Are gathering places located in open areas with good visibility to and from the rest of the park?	
216	Is distance and isolation overcome through improved communications and design efficiencies (i.e. emergency telephones, pedestrian path connections, no dead ends, no hiding places)?	
217	Is a safe needle disposal unit provided?	
218	Does at least on full side of the park is open up to a road?	

Appendix B: Team Profile

Morgan King

Morgan is a first year MSc student in Interdisciplinary Graduate Studies in the Sustainability Theme at UBCO. She completed her Bachelor of Science in Chemistry and Anthropology at the University of Victoria which set her on the path of interdisciplinarity. She is researching the sustainability and resiliency of the Okanagan wine industry focusing on adaptative strategies that prompt resiliency in the face of climatic conditions such as extreme heat and drought. This research is shaped by firsthand experience having worked in the beverage industry at a winery and a cidery.

Jannatul Ferdous

Jannatul Ferdous is a first year Ph.D. student in the Interdisciplinary Graduate Studies - Sustainability program in the University of British Columbia, Okanagan Campus. She is from Bangladesh. She is working on the sustainability of pulse processing industries in Canada to promote plant-based protein as a healthy and environment-friendly diet. Her research combined life cycle assessment, techno-economic analysis, process simulation and optimization to

identify the most suitable pathways to extract protein from pulses. Jannatul's perspective and contribution to this project is shaped by her background experience of being an urban and regional planner and an environmentalist researcher.

Chhavi Mathur

Chhavi is a first-year MA student in IGS - Sustainability at the University of British Columbia, Okanagan. She completed a BA in English with a minor in Environmental Studies from Ashoka University in India. In her Master's thesis, which is tentatively titled, "Picturing Paradise: An Ecocritical Study of Literature in the Okanagan", she is looking at the shifting perceptions and imagination of the Okanagan in literature and its entanglement with material history of the landscape. Chhavi has never really lived for an extended period in a city/town before this.

Jalal Sarrami

Jalal is a first-year master's student in Digital Arts & Humanities/IGS. He completed a BSc degree in Horticultural Science as well as an MSc degree in Environmental Design. His first master's thesis was on low-water-use landscaping (Xeriscape) in Iran. In his second Master's degree in Dahu, he is working on "horticultural techniques in Persian Gardens," with an emphasis on water systems.

Yazdan Gordanpour

Yazdan is a first year Ph.D. student in IGS - Sustainability. With a background in English, he is now working at the intersection of environmental and energy humanities. His dissertation, tentatively titled "Okanagan Petro cultures," will examine how petroleum has influenced and shaped the culture of the Okanagan through history. Yazdan previously worked as a technical writer and translator at an urban design firm in Tehran. He incorporated both his professional

experience and his academic training in close reading and explication of the municipal documents in his contributions to this project.