Integrating Biophilic Strategies into the City of Winnipeg's Intensification Framework

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Master of City Planning
Capstone Report

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Abstract

As one of the most important sustainability strategies within contemporary urban planning practices, intensification should be supported by a strong environmental component. Integrating biophilic strategies into intensification practices is fundamental to push urban growth to a sustainable direction. This research analyses Winnipeg's intensification policy framework to identify opportunities for the incorporation of biophilic strategies or nature-based solutions. With *OurWinnipeg 2045* and *Complete Communities 2.0* at their approval phase, the City of Winnipeg was about to implement a new intensification goal. Half of the city's subsequent 25-year growth was to be directed towards mature neighbourhoods through intensification strategies.

The research contributes to the understanding of nature as an essential requirement to ensure a high quality of life for the residents and visitors of intensified urban areas. Through plan content analysis, the research reviews Winnipeg's intensification framework for biophilic strategies or opportunities for their integration. In doing so, Edmonton's main policy documents and on-going intensification process are analysed for best practice. The city of Edmonton was selected as a reference for the research due to its membership within the *Biophilic Cities Network* and its comparable status to Winnipeg as a winter city. This report includes ten key recommendations for Winnipeg’s policy framework.

Key words: biophilia, nature-based solutions, intensification, sustainability, Winnipeg, Edmonton, policy framework.

Acknowledgements

I would like to express my gratitude to everyone involved in the development of this capstone project. To my committee Dr. David van Vliet, Dr. Rae Bridgman, and Jason Syvixay for providing me with their knowledge, patience, guidance, and support throughout the research process. Thank you to Dr. van Vliet for being an inspiring supervisor and professor, for sharing your knowledge and your experience, and for supporting me in the process of getting to know the city of Winnipeg and discovering some of its most interesting spots.

To the Faculty of Graduate Studies, the Faculty of Architecture, and the Department of City Planning, thank you for selecting me to be part of this program and giving me the opportunity to study in Canada and to learn about the planning profession. To Dr. Richard Milgrom, thank you for your support and for all those meetings guiding me through the process of coming to Winnipeg during a time of pandemic chaos. To the selection committee and donors of the G. Clarence Elliot Fellowship, thank you for believing in me and helping to finance my studies.

To my classmates, thank you for your support and your friendship. We chose a very challenging time to embark on this adventure, but together we found our way through it. To my family and friends, thank you for love, patience, and faith on me. I would not have been able to achieve this success without your unconditional support.

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List of Acronyms

Acronym	Meaning
BCM	Big City Move
BCN	Biophilic Cities Network
CC 2.0	Complete Communities 2.0
CCA	Climate Change Adaptation
CPR	Capital Planning Region
DOE	Department of Environment
ECP	Edmonton City Plan
ES	Ecosystem Service
GHG	Greenhouse Gas
GIS	Geographic Information Systems
IISD	International Institute for Sustainable Development
IUCN	International Union for the Conservation of Nature
LID	Low Impact Development
MNAI	Municipal Natural Assets Initiative
N4C	Nature4Cities
NbS	Nature-based Solutions
OW 2045	OurWinnipeg 2045
SDGs	Sustainable Development Goals
UGS	Urban Green Spaces
UHII	Urban Heat Island Initiative
UN	United Nations
WMR	Winnipeg Metropolitan Region

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1. Introduction

With 55% of the world's population living in cities, it is fundamental to work in transforming urban areas to become more sustainable and resilient in the face of climate change (ICLEI—Local Governments for Sustainability, 2014; Ritchie & Roser, 2019). A variety of movements and nature-focused networks have emerged around the world over the last two decades with the purpose of encouraging strategic and compact urban growth, while protecting the environment and enhancing community's vitality (Maryland Department of Planning, n.d.). As members of these networks, many cities are following a common mandate to improve municipal planning policy and practice with sustainability at their core. Biophilic strategies emerge within this sustainability core as a resource to integrate nature into cities "as an element of a meaningful urban life" (Biophilic Cities Network, 2022). The implementation of green roof policy requirements, the development of bird friendly design guidelines, and the increase of urban tree canopy coverage; offer just a few examples of the diverse range of biophilic strategies that can be incorporated to enhance the presence of nature in high-density urban areas (Asadzadeh & Yousefi Ahmadchali, 2018; Beatley, 2017; Biophilic Cities Network, 2022).

The City of Winnipeg is at a crucial moment in its history to integrate biophilia into its future planning directions. At the time of this research, the City of Winnipeg was in the process of updating its planning policy framework to guide growth, development, and land use within the city over the subsequent 25 years. The purpose of this research is to analyse Winnipeg's policy framework to identify opportunities for the incorporation of biophilic strategies, particularly regarding the intensification area of the policy.

1.1 Research Problem

The City of Winnipeg is aiming to achieve 50% of the city's next 25-year growth through intensification strategies within its new planning policy framework. However, shaping an environmentally sustainable compact urban form is not just about the increase of density. Development needs to be guided to "the right place, at the right time, and in the right form" to

fit local conditions (Berke & Conroy, 2000, p.11). Therefore, integrating biophilic strategies into intensification practices is fundamental to push growth to a sustainable direction. While accommodating compact growth in serviced areas has the potential to minimize the impact on the use of resources, it also involves the risk of losing green spaces in contested urban areas and decreasing the quality of life of its residents. This report argues that the City of Winnipeg could incorporate biophilic strategies to address the challenges brought by intensification within its new policy framework.

1.2 Research Questions

1. What are the main benefits of biophilic strategies for intensified urban areas and what are the most common challenges to their implementation?
2. What environmental policies in *OurWinnipeg 2045* (draft) and *Complete Communities 2.0* (draft) could help promote the transformation of Winnipeg into a biophilic city?
3. What environmental policies does Edmonton, being part of a Nature-focused Network, have to inform Winnipeg's intensification framework?

1.3 Context

The context of this research is developed around three main factors: the pressure to increase housing supply as a result of the Canadian housing crisis; the governance changes around the Winnipeg Metropolitan Region and its influence over the city of Winnipeg; and the federal commitment to invest in nature-based solutions and support their implementation at the local scale. Each of the three are next addressed.

First, population growth in combination with a low housing supply has resulted in a housing crisis across Canada over the last several decades (Froese, 2021). "According to the Conference Board of Canada, the City of Winnipeg is expected to grow by approximately 160,700 people between 2020 and 2040, or about 8,200 people annually"(City of Winnipeg, 2021a, p.12). Based on these population projections, Winnipeg would need to provide approximately 82,000 new dwellings or 3,900 new units annually (City of Winnipeg, 2021b).

There is a need to increase residential supply in Winnipeg and the City is taking an intensification approach to address this issue. However, the pressure to increase density could result in the risk of neglecting environmental considerations, to address an urgent demand on supply.

Second, along with other 17 rural municipalities, cities, and towns, the City of Winnipeg is a member of the Winnipeg Metropolitan Region (WMR), whose vision is to promote regional cooperation, enhance community development opportunities, and manage resources effectively (Winnipeg Metropolitan Region, 2021). The WMR is currently in the process of being established as the Capital Planning Region (CPR) under Bill 37 (Province of Manitoba, 2020). As part of this mandate, the WMR is also in the process of adopting a regional development plan to direct growth and set common targets for its member municipalities. The establishment of this new governance body and its development policy document could have a great impact on the way density targets and natural assets management practices are implemented within the city of Winnipeg.

In 2017, the WMR joined the Municipal Natural Assets Initiative (MNAI), participating in the 2020 Acceleration project. This project's purpose is to help 30 Canadian local governments determine how to deliver services in a cost-effective and resilient way utilizing their natural assets (e.g., wetlands, forests, and streams). The outcome of the project consists of a tailored natural asset inventory, a dashboard to support decision making, and a roadmap on next steps to improve natural assets management (MNAI, 2022). By integrating nature as an alternative to engineered solutions into the servicing infrastructure of the city, natural asset management is identified as a biophilic strategy. The WMR is taking a step in the right direction by joining the MNAI. As a WMR's member, the City of Winnipeg could connect to other cities within this initiative and advance their capacity by joining additional nature-focused networks.

Third, federal support is fundamental to the implementation of biophilic strategies since it can promote policy enforcement and represents a significant source of funding. According to

Nature Canada (2021), Prime Minister Trudeau has committed to support Nature-based Climate Solutions by: investing $3 billion over the next 10 years to plant two billion trees and initiate regional and urban forest plans; investing $630 million over 10 years to reduce GHG emissions and protect biodiversity; expanding protected areas to 30% of Canada's land, water, and ocean by 2030; and launching a new Natural Infrastructure Fund (Nature Canada, 2021).

1.4 Research Contributions

Incorporating environmental strategies into Winnipeg's intensification policies is becoming an urgent matter as the City is implementing an intensification goal within its new development plan without more integrated and strong sustainability considerations. The Plan Approval Phase of *OurWinnipeg 2045* and its secondary plan companion – *Complete Communities 2.0* – is underway. Both planning documents would benefit from a series of explicit sustainable planning design recommendations since adopting an environmental approach is an essential component to the *complete communities* overarching concept. Recommended strategies will be provided in the form of policy directions to improve Winnipeg's policy framework. This research is expected to be of interest to an audience comprised of local decision-makers, planners, and developers.

1.5 Overview

This report is divided into six main sections: 1. Introduction, 2. Methodology, 3. Literature Review, 4. Results, 5. Analysis, and 6. Recommendations & Conclusions. Section 1. Introduction, provides a brief description of the research, presents the research questions, the context around the topic and the contributions to the planning practice. Section 2. Methodology, presents the methods used to develop the analysis and the main research limitations. Section 3. Literature Review, describes the main components around the concepts of intensification and biophilic strategies in order to set a comprehensive analysis framework for the policy review. Section 4. Results, describes the findings of the content analysis of two high-level local policy documents from the City of Edmonton and two from the City of Winnipeg. Section 5. Analysis, highlights the main outcomes from the analysis and connects them to the main

findings from the literature review. Finally, Section 6. Recommendations & Conclusions, answers the research questions, provides a series of recommendations, and discusses directions for future research.

2. Methodology

This section discusses the methods used to answer the research questions, as well as the criteria and limitations associated with each method.

2.1 Literature Review

A literature review was conducted to answer the first research question: What are the main benefits of biophilic strategies for intensified urban areas and what are the most common challenges to their implementation? Document types reviewed included academic articles, institutional reports, and media publications. These were analysed to understand the complexity of intensification and biophilic concepts, as well as the relationship between them. This part of the research was also fundamental for identifying key themes that would help to shape the framework for the following policy review.

2.2 Content Analysis: A Policy Review

This part of the research involved reviewing the main planning documents of the City of Winnipeg as they reflect municipal priorities by providing direction on growth, development, and land use. The review of these documents helped to answer the second research question: What environmental policies in *OurWinnipeg 2045* (draft) and *Complete Communities 2.0* (draft) could help promote the transformation of Winnipeg into a biophilic city?

In addition, the city of Edmonton was selected as a policy reference for this study, based on its membership in the *Biophilic Cities Network* and its similarities to Winnipeg regarding geographical location, population size, and climatic conditions. By adding Edmonton's policy framework to the review, this method addressed the third research question: What environmental policies does Edmonton, being part of a Nature-focused Network, have to inform Winnipeg's intensification strategies?

Figure 1. Policy Review Steps Diagram

Figure 1 provides an overview of the five main steps followed to develop the policy review. The first step was to select a sample of key policy documents for each city. Since the focus of this research is on documents at their plan approval phase for the City of Winnipeg, only recent plans (adopted between 2011 and 2022) were included to ensure contemporary practice. Documents included in this content analysis are outlined in Table 1.

Table 1. Policy Review - Municipal Policy Documents

City	Policy Document	Year	Pages
Edmonton	*Edmonton City Plan*	2020	182
	Infill Roadmap	2018	40
Winnipeg	*OurWinnipeg 2045*	In Review	48
	Complete Communities 2.0	In Review	180

The second step was to identify those policies related to intensification practices and environmental sustainability. Policies were chosen according to their reference to the intensification and environmental topics and their potential to accommodate biophilic strategies or nature-based solutions (NbS). (See Appendices A and B for tables including the complete selection of policies.) The third and fourth steps were defined following Berke & Conroy's (2000) method for evaluating environmental policies in local plans. Their method was adapted to the needs of the current research with the purpose of identifying policy priorities and policy strength. The third step consisted of classifying the selected policies into categories and a set of sub-categories for each, identified as key themes from the literature review.

Table 2. Policy Classification

Category	Sub-Category	Example of related Elements
Intensification	Location	Nodes, corridors, networks, open spaces
	Connectivity	Walkability, access, transportation
	Design	Compact design, mixed uses, public realm, amenities, housing diversity
	Procedures	Stakeholders, timeframes, budget, indicators, targets
Biophilia / NbS	Natural Assets and Low Impact Development	Air, land, and water protection, servicing infrastructure, rain gardens, bioswales
	Urban Green Spaces	Open spaces, parks, greenways, community gardens, urban agriculture
	Tree Canopy	Street trees, private and public trees
	Building Elements	Green walls, balcony gardens, green roofs
	Biodiversity	Butterfly gardens, bird friendly design
	Procedures	Governance, trade-offs, partnerships, regional approach, social programs, education, indicators, targets

Table 2 shows the organization of categories and sub-categories, as well as examples of related elements for each. The sub-categories for the Intensification category were defined based on the four areas of action from the Normative Principles of Smart Growth in Table 4 from Section Defining Intensification. For the category of Biophilia/NbS, sub-categories were drawn from key themes identified in different areas of the literature review. In this step, two high-level documents were used from each city based on the hierarchy diagrams from Figure 7 and Figure 13 in Section 4. Results. From the City of Edmonton, the selected documents were the *Edmonton City Plan* and the *Infill Roadmap*, while from the City of Winnipeg the selected documents were *OurWinnipeg 2045 (draft)* and *Complete Communities 2.0. (draft).*

The fourth step was to analyse policy strength for each sub-category, based on the permissive or mandatory language of the selected policies. Table 3 shows the key words considered for each type of policy language adapted from Berke & Conroy (2000).

Table 3. Policy Language Criteria. [Source: Adapted from Berke & Conroy, 2000]

Policy Language	Key Words
Suggested	Encourage, consider, intend, should, promote, support, facilitate, strive, pursue
Required	Shall, will, require, must, ensure, achieve, establish, prioritize, demonstrate, enable, conserve, provide

Finally, the fifth step consisted of scrutinizing the selected documents and their filtered policies from three different perspectives as suggested by Cardno's (2018) suggested analysis of policy content.

1. **Policy purpose analysis.** Identify words or phrases referring to the purpose of the policy**,** the values guiding the policy, and the local or national strategic and quality issues (Cardno, 2018).
2. **Policy construction analysis.** Identify sections, words or phrases providing evidence of the way in which the policy is constructed, the component elements of the policy, and the way in which stakeholders participated in development (Cardno, 2018).
3. **Practice implementation and impact.** Identify words or phrases that relate to its implementation to comment on its overall impact, strengths and positive aspects, and concerns and negative aspects (Cardno, 2018).

2.3 Limitations

The majority of the limitations identified during the research related to the short timeframe and the restricted length expected for a capstone project. The first limitation was regarding the scope of the study. From a geographical perspective, while the literature review covers a variety of sub-topics with examples from different countries, the content analysis is limited to Canadian practices. Originally, I intended to include three case studies from different countries to provide a more comprehensive view of policy frameworks around the world. However, due to the short timeframe and the long and detailed nature of the selected policy documents, the policy review was limited to the case of Edmonton. The scope was also limited to analyse in detail only high-level policy documents, while each city has a long list of subsidiary plans that could merit review.

This study is also limited to local government documents only. Reviewing federal and provincial policies could provide a better understanding of the regulatory framework and possible impacts on partnerships and funding resources (e.g., grants). In addition, the methodology could benefit from interviews with different types of stakeholders (i.e., public, and private sectors). This would help to better understand policy implementation processes, challenges, and outcomes.

The second limitation was biased selectivity. The selection and classification of policies into categories and sub-categories required some degree of flexibility to interpret the purpose of the policy. This flexibility can be subjective and relates to the lack of detail in some of the selected documents. High-level documents usually rely on supporting documents, which in the case of Winnipeg, have not even been developed yet. In addition, the purpose of the policy classification is to analyse which topics are being addressed more often in order to identify local priorities. However, some policies could cover two or three topics at the same time, which is not being reflected in the numbers.

The third identified limitation was related to biophilia being an emerging concept. For this reason, some degree of difficulty was expected in the process of identify policies referring to biophilia or nature-based solutions. This situation required of the identification and interpretation of compatible key words or concepts that could set the framework for future implementation. In addition, as an emerging topic under experimentation, there is extensive information on examples and potential benefits of biophilic strategies, but not enough documentation to analyse long-term results or implementation lessons.

3. Literature Review

The purpose of this literature review is to analyse the main elements around the concepts of biophilic strategies, to better understand the benefits and the importance of their integration into Winnipeg's intensification framework. While the densification of urban areas is generally perceived as a principle for sustainable growth management, achieving livable communities and environmental quality requires additional efforts (Dumitru, 2021; Tappert et al., 2018).

To explain the complexity behind the relationship of intensification and biophilia – the two key topics in this research – the literature review is organized in three main sections. The first section defines intensification, its impacts at the local level, and its relation to environmental sustainability. The second section defines the concepts and relation between biophilic cities and Nature-based Solutions (NbS). This section covers diverse aspects of the biophilic approach such as: impacts, design and implementation standards, legal mechanisms within the policy framework, challenges and barriers, and relevant Nature-focused organizations. The third part of this review of the literature concludes by providing a list of precedents that incorporate the previous elements and identify possible implementation paths.

3.1 Intensification

This section of the literature review defines the concept of intensification, identifies its impacts at the local level, and reflects on the environmental perspective of its application.

3.1.1 Defining Intensification

In the 1950s, Canada identified the need to increase or intensify residential densities to control the costs of urban sprawl. By the 1990s, this need increased along with the demands for more affordable housing and the interest to operate in a more environmentally sustainable way. As part of the intensification ideology, emerged the Smart Growth planning movement, based on the idea of achieving more compact and dense developments, centralized in existing and mature neighbourhoods (Han et al., 2020).

In his book "Urban Sustainability through Smart Growth", Dierwechter (2017) defines smart growth as "a planning theory of practice that calls for shifting new development away from low-density residential and commercial sprawl into well-serviced cities and suburbs using tools as containment, mixed-use, transit and stronger regional coordination" (p. 27). As an urban studies scholar from the University of Washington, Tacoma, Yonn Dierwechter advocates for the importance of making urban growth smarter and more ecologically sustainable. His book argues how an influential factor to this matter is the impact of regional policies on urban-scale processes related to local sustainability goals.

As shown in Table 4, Dierwechter (2017) proposes a set of principles to direct smart growth as a normative planning theory. Normative principles are organized into four focus of action categories shaping the urban form and "bringing the city back in" (p.29). As it will be analysed later in this literature review, smart growth principles are compatible with the objectives of biophilic cities and nature-based solutions.

Table 4. Normative Principles of Smart Growth. [Source: Adapted from Dierwechter, 2017, p.30]

Focus of Action	Normative Principles
Location	• Preserve open space, farmland, natural beauty, and critical environmental areas • Strengthen and direct development towards existing communities
Connectivity	• Create walkable neighbourhoods • Provide a variety of transportation choices
Design	• Take advantage of compact building design • Mix land uses • Foster distinctive, attractive communities with a strong sense of place • Create a range of housing opportunities and choices
Procedures	• Make development decisions predictable, fair, and cost effective • Encourage community and stakeholder collaboration in development decisions

3.1.2 Impact at the local level

Intensification policies are developed and implemented predominantly at the local level. "Local governments have embraced the compact city as the desirable urban form that facilitates sustainable urban development" (Tappert et al., 2018, p.75). Compact development promotes an efficient reorganization of urban space that optimizes the utilization of land and resources and

generates a series of economic, environmental, and social benefits in the long term (Dierwechter, 2017; Han et al., 2020; Tappert et al., 2018).

From the economic perspective, "...intensification in built up areas maximizes existing infrastructure and reduces the need to spend tax dollars building and maintaining new infrastructure to support urban development at the edges of our cities. Intensification in developed areas also supports public transit and maintains residential densities that are needed to support businesses and schools"(RIENS, 2017, p.ii). From an environmental perspective, Canada's low-density, auto-dependent cities represent a non-efficient development model that intensifies the consumption of fossil fuels and rises global warming concerns (Han et al., 2020).

Nevertheless, the literature also suggests that there can be risks to implementing intensification policies (Han et al., 2020; Tappert et al., 2018). Some of these risks can include "...traffic congestion, local air pollution, increased energy demand, overcrowding linked to poor health, increased poverty and crime, and the bad neighbor effect, as well as the loss of urban green or open space to development projects..." (Tappert et al., 2018, p.70).

In the Winnipeg context, intensification has already been introduced in the past as a main strategy for previous development plans since 1993. *Plan Winnipeg 2010* identified the need for higher density development and a compact urban form. In a similar way, *Plan Winnipeg 2020* also looked for the centralization of development in downtown to control peripheral growth. Then the *2016 Residential Infill Strategy* was created identifying the need to develop *Residential Infill Guidelines*, which have been under development since 2017. However, they only apply to small scale infill development (e.g., single family homes, duplexes, triplexes, fourplexes, and small-scale apartments)(City of Winnipeg, 2021a). The guidelines project is a good step within the development of Winnipeg's intensification framework, but it does not cover higher density areas highlighted in OW 2045 and CC2.0 as the focus areas for intensification strategies (e.g., downtown, corridors, transit stations). Even though residential

intensification been promoted in the past, these efforts have not been effective at achieving a significant impact (Han et al., 2020).

3.1.3 Is intensification environmentally sustainable?

Urban sustainability is identified as one of the main challenges around the world as the need to respond to climate change effects and to an accelerated urban population growth becomes more urgent. As noted in the previous section, intensification is currently perceived by many local governments as one of the best sustainability planning approaches for urban development, and as a connecting bridge between urban planning practices and climate action (Dierwechter, 2017).

Nevertheless, even though intensification is suggested as a sustainable planning theory, it is not environmentally sustainable by default. Some authors criticize intensification practices for prioritizing spatial densification and for turning green and open urban spaces into real estate development projects. Even European cities showing an increase of urban green spaces over the last ten years, show low per capita green space in intensified areas. Unfortunately, the demand for available land creates an intensification paradigm as green areas are one of the most important assets for achieving high-quality densification and livable compact cities. Without a proper directive, the densification of urban areas can lead to a loss of green space, environmental degradation, and a decrease in the quality of life within the impacted neighbourhoods (Tappert et al., 2018; UrbanShift, 2021). Therefore, there is a global search for new urban green space (UGS) types characterized by flexible forms and hybrid functions (Tappert et al., 2018).

The integration of biophilic strategies or nature-based solutions (NbS) as complement to intensification practices can provide a solution to the loss of greenspaces and a compromised quality of life. Redevelopment activities within intensification practices provide an opportunity to update urban infrastructure capable to deal with climate change challenges through the implementation of nature (Frantzeskaki, 2019). Nature-based solutions should not be considered as an option or a luxurious upgrade but as a necessary tool for the development of

resilient communities. In the article "Seven lessons for planning nature-based solutions in cities", Frantzeskaki (2019) highlights the need to translate NbS into planning policies. By analysing fifteen European cases, the authors provide feasible paths for the implementation of NbS in urban environments.

As the focus of this research is concerning the policy area, it is important to understand some of the key agreements which currently set and unify sustainability policy goals around the world. The *2030 Agenda for Sustainable Development* was adopted by all United Nations Member States in 2015, providing the *17 Sustainable Development Goals* (SDGs) that have become a guide for many cities (UN Department of Economic and Social Affairs, n.d.). As it will be discussed in further detail in the following sections, the UN SDGs are the basis setting the principles around the two main planning policy documents in the city of Winnipeg (i.e., *OurWinnipeg2045* and *Complete Communities 2.0*).

3.2 Biophilic Cities and Nature-Based Solutions

This section of the literature review defines the characteristics of a biophilic city, identifies biophilic strategies and their potential outcomes, provides precedents from biophilic design patterns, identifies legal mechanisms in the policy area, highlights main implementation challenges, and provides a list of international nature-focused networks.

3.2.1 Defining a Biophilic City

Biophilic cities can be defined as outdoor and resilient cities where residents can live and work while engaging with green and blue nature from the start to the end of the day. Biophilic cities look for an equitable and adequate access to nature, aiming to provide an immersive natural experience at any time of the year (Beatley, 2017). In consequence, biophilic urbanism looks to integrate green elements to the built environment, which can be achieved through a variety of ways. According to Beatley (2017), "every action, project, and policy intended to integrate nature into cities – from urban tree planting, to green rooftops and wall, to edible landscaping

and gardens – will help a city to become more resilient" (p.47). In compact cities, opportunities for the integration of green elements are usually found in the vertical realm (see Figure 2).

Figure 2. Newton Suite in Singapore. High-rise residential development incorporating exterior green walls, communal sky-rise gardens, and vertical greenery. [Source: Newman, 2014, p. 58]

The concept of nature-based solutions (NbS) has also emerged over the last decades sharing objectives compatible to biophilic cities. NbS are "solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions" (Dumitru, 2021, p.6). NbS look to generate benefits for both human well-being and biodiversity by restoring ecological flows in cities (Frantzeskaki, 2019; IUCN, 2020; Tappert et al., 2018).

The *International Union for Conservation of Nature* (IUCN, 2020) explains how the fundamentals of NbS are based on traditional practices such as forest landscape restoration, integrated water resource management, ecosystem-based adaptation and mitigation, and

ecosystem-based disaster risk reduction. As it can be observed, each of the previous NbS match within Beatley's (2017) description of biophilic cities' characteristics. Therefore, both concepts will be considered to have the same purpose within the framework of the current research.

3.2.2 Strategies and Outcomes

Biophilic design and NbS are integrated solutions to the complex urban challenges of climate change, such as disaster risk, biodiversity loss, water scarcity, bad quality of air, drought, aging infrastructure, and bad quality of life (Beatley, 2017; Dumitru, 2021; Frantzeskaki, 2019; UrbanShift, 2021). According to Browning et al. (2014), "increased natural air flow can help prevent sick building syndrome; daylighting can cut energy costs in terms of heating and cooling; and increased vegetation can reduce particulate matter in the air, reduce urban heat island effect, improve air infiltration rates and reduce perceived levels of noise pollution" (p.19). In addition, studies report that NbS have the potential to provide 30% of the cost-effective mitigation needed by 2030 to stabilise warming to below 2°C (IUCN, 2020). Identifying the potential outcomes of biophilic strategies and NbS is important to planners and policy makers as they inform best practices for urban planning (W. D. Browning et al., 2014).

NbS provide cities with opportunities to address complex and multi-scale problems. There is a diverse range of strategies that can be implemented in urban areas depending on the context and specific problem a city or region is aiming to address (Dierwechter, 2017; UrbanShift, 2021). Table 5 presents some of the most common NbS categorized around five of the most urgent urban problems according to UrbanShift (2021).

Table 5. NbS categorized by problem. Table extracted from UrbanShift Webinar. [Source: UrbanShift, 2021]

Problem	Extreme heat	Inland flooding	Coastal flooding and storm surges	Drought	Wildfires
NbS Category	Street trees Cool surfaces	River-catchment management Nature-based sustainable urban drainage solutions (SUDS)	Coastal nature-based barriers Coastal artificial barriers Flood and storm resilient buildings	Water-conservation behavior programs Water-system efficiency	Development planning Preventive forestry management

The creation of uban green spaces (UGS) is identified as an essential strategy to ensure a high quality of life within densified urban areas as they provide a variety of benefits for the natural ecosystem, the residents, and the city's economy. Table 6 provides an overview of some of the main benefits of UGS from three different perspectives (Dumitru, 2021; Tappert et al., 2018). Nevertheless, enhancing and restoring natural qualities and green spaces within intensive urban zones can be a challenge (Beatley, 2017). According to Gochman (2015), a strategic way to incorporate nature into densified and contested urban settings, is through biophilic urban acupuncture (e.g., green walls, rooftop gardens, bird and wildlife-friendly building designs, balcony gardens). Over time, biophilic interventions should create a web-like structure of connected threads and nodes throughout the city (W. D. Browning et al., 2014; Gochman, 2015).

Table 6. Green Spaces Contributions. [Source: Tappert et al., 2018]

Urban Ecosystem	Urban Residents	Economic Value
Air purification, water and climate regulation, carbon storage, biodiversity, habitat for wildlife	Recreation, social interaction, community building, health benefits, subjective wellbeing, aesthetics	Increases the quality of landscapes: location, scenic setting, livability, recreational value, image, level of identification, cultural heritage

Terrapin Bright Green, a recognized design and planning firm in NYC, investigated the attendance of residents to green pocket areas across NYC. The research concluded that the most important aspects impacting the frequency of use of UGS are convenience and quality. Many

cities are starting to recognize these factors within their urban planning goals and development plans. For example, in 2015, Minneapolis was ranked as the #1 in the U.S. because of its park system's accessibility, large median park size, and high-quality facilities (Gochman, 2015). In addition, website platforms such as *ParkScore*, have emerged to analyse park systems through an index that measures access, investment, amenities, acreage, and equity (The Trust for Public Land, 2021).

In addition, urban green spaces have the potential to accommodate activities that promote community building and food security, such as urban gardening. UGS provide space for food production and social interaction while increasing urban biodiversity and micro-climatic conditions. New forms of urban gardening are emerging with the purpose of greening dense urban cores within the limited space of the compact city, such as fruit trees in public spaces, allotment gardens, balcony gardens, and community gardens (Tappert et al., 2018). Table 7 shows the main characteristics commonly found in new gardening spaces and practices within urban areas. According to *The Canadian City Parks Report: Centring Equity & Resilience*, in 2021, 49 community gardens/urban farms were officially established in the city of Winnipeg. In contrast, the city of Edmonton identified 104 community gardens, "including 29 pop-up community gardens created in 2020 as part of the city's COVID-19 response" (Stark et al., 2021).

Table 7. Urban Gardening characteristics. [Source: Tappert et al., 2018]

New Urban Gardening Characteristics
1. Small plots in urban areas
2. Located on public or private land (vacant space, brownfields future construction sites, existing green/open spaces, existing but structurally changed allotment garden sites, front yards under grass, parks)
3. Highly accessible to the public
4. Multifunctional land use (integrating other uses of space such as cultural, educational, or social practices)
5. Allocated without rent or for a small fee
6. Used by the surrounding neighbourhood
7. Temporary in nature
8. Involving cooperation between public and civic actors

Biophilic strategies and nature-based approaches can be complex and require the holistic integration of a variety of actors and disciplines working together at multiple scales (Dierwechter, 2017). The transformation to a biophilic city is a gradual process that can benefit from the development of punctual "green infrastructure elements to kick-start urban resilience" (Frantzeskaki, 2019, p.109) starting at the neighbourhood scale (see Figure 3). Pilot projects allow for flexible collaborative governance structures that promote the engagement of different stakeholders. The participation and input from a variety of stakeholders is fundamental to build trust during the development process of local policies oriented towards NbS (Dierwechter, 2017; Frantzeskaki, 2019).

Figure 3. 'Dream day' workshop with citizens to create a sense of ownership for the new Green Corridor in Sint Andries, Antwerp. [Source: URBACT, 2018, p. 28]

Demonstration community projects can be "a core strategy for municipal capacity building and advancing policy development for sustainable urban development and improved practice" (van Vliet, 2001, p.1). Van Vliet's research about the case study of Egebjerggård in Denmark, shows an example of how a proactive municipal organization can achieve the diffusion of improved practices through pilot and demonstration projects. This type of

experimental projects can be a catalyst of change that could better inform the adoption of formalized sustainability policies in the future. In addition, the author highlights the 'cost of change' as an important limiting factor to the implementation of sustainability changes. Therefore, the importance of developing pilot projects to demonstrate the potential to reduce perceived costs and increase the perceived benefits. Comparative performance data plays an important role in this strategy, as it helps to build awareness by making the achieved improvements evident to the public (van Vliet, 2001).

3.2.3 Setting Design Patterns and Implementation Standards

Biophilic design strategies for the integration of natural systems with urban systems differ depending on the characteristics (e.g., political climate, zoning, geography, land availability, density) of the place (Browning et al., 2014). Different organizations have considered necessary to develop a framework that provides a common language to understand, standardize, implement, and measure nature-based solutions around the world. This section of the literature review provides a brief overview of two biophilic frameworks with different approaches: the *14 Patterns of Biophilic Design* by Terrapin Bright Green (Browning et al., 2014) and the *IUCN Global Standard for NbS* by the International Union for the Conservation of Nature (IUCN, 2020).

The *14 Patterns of Biophilic Design* intends to articulate the relationships between nature, science, and the built environment by creating a design guide that incorporates patterns identified over 500 biophilic-related publications (Browning et al., 2014). The authors provide a list of flexible and adaptive patterns that can be applied for interior and exterior environments, and across a variety of scales that range from buildings to streetscapes, and to urban and regional planning. Heather Dubbeldam, principal of Dubbeldam Architecture + Design, also talks about the critical role biophilic design has played to promote health and wellbeing during COVID-19 pandemic times. In her article, *The importance of Biophilic Design* (2021), Dubbeldam describes

biophilic design as a "human-centred approach to design, integrating natural principles to support the physiological well-being of building occupants" (p.2).

Browning et al. (2014) and Dubbeldam (2021) agree on the organization of biophilic strategies into three main categories: *Nature in the Space*, *Natural Analogues*, and *Nature of the Space*. Table 8 describes each of the 14 biophilic design patterns proposed by Terraping Bright Green and structures them into the previously mentioned categories. The first category, *Nature in the Space*, addresses the direct presence of nature in a place (e.g., potted plants, butterfly gardens, water features, green walls, etc.). The second category, *Natural Analogues*, addresses indirect representations of nature (e.g., materials and patterns of nature manifested as ornamentation, furniture, etc.). The third category, *Nature of the Space*, addresses spatial configurations in nature and experiential qualities of the space.

Table 8. 14 Patterns of Biophilic Design by Terrapin Bright Green. [Source: Browning et al., 2014]

Nature in the Space
1. Visual Connection with Nature. A view to elements of nature, living systems, and natural processes
2. Nonvisual Connection with Nature. Auditory, haptic, olfactory, or gustatory stimuli that engender a deliberate and positive reference to nature, living systems, or natural processes
3. Nonrhythmic Sensory Stimuli. Stochastic and ephemeral connections with nature that may be analyzed statistically but may not be predicted precisely
4. Thermal & Airflow Variability. Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments
5. Presence of Water. A condition that enhances the experience of a place through the seeing, hearing, or touching of water
6. Dynamic and Diffuse Light. Leveraging varying intensities of light and shadow that change over time to create conditions that occur in nature
7. Connection with Natural Systems. Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem
Natural Analogues
8. Biomorphic Forms and Patterns. Symbolic references to contoured, patterned, textured, or numerical arrangements that persist in nature
9. Material Connection with Nature. Material and elements from nature that, through minimal processing, reflect the local ecology or geology to create a distinct sense of place
10. Complexity and Order. Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature
Nature of the Space
11. Prospect. An unimpeded view over a distance for surveillance and planning

12. Refuge. A place for withdrawal, from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead
13. Mystery. The promise of more information achieved through partially obscured views or other sensory devices that entice the individual to travel deeper into the environment
14. Risk/Peril. An identifiable threat coupled with a reliable safeguard

The second framework is the *IUCN Global Standard for NbS* (IUCN, 2020), which provides a practical approach to mainstream the implementation of NbS oriented projects (Dumitru, 2021). The IUCN (2020) envisions "that national governments, city and local governments, planners, businesses, donors, financial institutions including development banks and non-profit organisations will be primary users of the Standard" (p.3). Figure 4 organizes the 8 criteria of the IUCN Standard, translating the NbS concept into clear targeted actions. Table 9 provides a description and a set of indicators for each criterion.

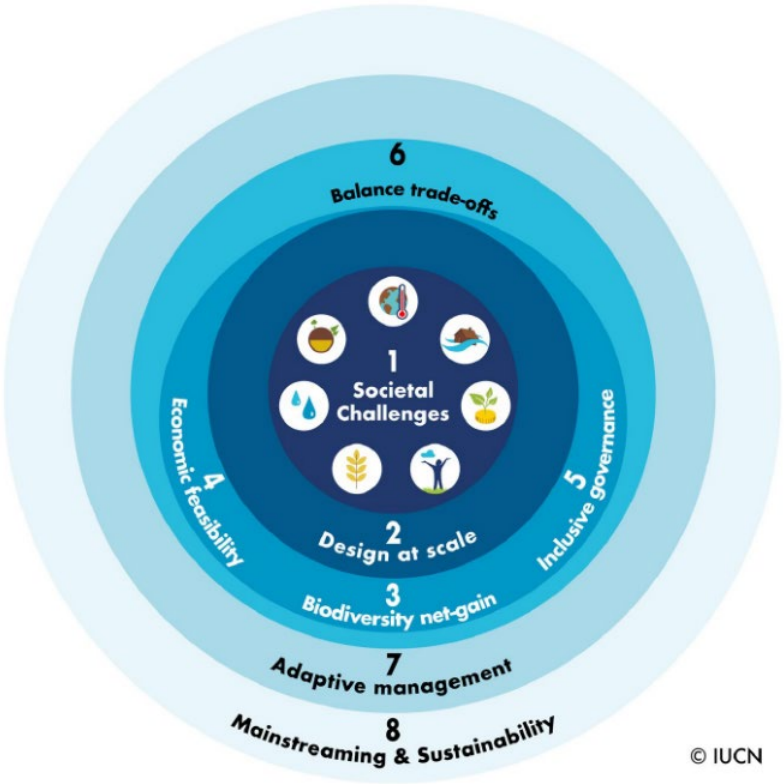

Figure 4. The 8 interconnected Criteria that make up the IUCN Global Standard for NbS. [Source: IUCN, 2020, p. 3]

Table 9. Criteria Table from IUCN Global Standard for NbS. [Source: IUCN, 2020]

CRITERIA	INDICATORS
1. NbS effectively address societal challenges. This criterion focuses on identifying the societal challenge to which the NbS is a response (e.g., climate change adaptation, disaster risk reduction, ecosystem degradation and biodiversity loss, food security, etc.) (p.6).	1.1 The most pressing societal challenge(s) for rights-holders and beneficiaries are prioritised 1.2 The societal challenge(s) addressed are clearly understood and documented 1.3 Human well-being outcomes arising from the NbS are identified, benchmarked and periodically assessed
2. Design of NbS is informed by scale. This criterion encourages NbS designs that recognise the complexity and uncertainty in dynamic land/seascapes. Scale applies to biophysical, geographic, economic systems, policy frameworks and cultural perspectives (p. 8)	2.1 The design of the NbS recognises and responds to interactions between the economy, society and ecosystems 2.2 The design of the NbS is integrated with other complementary interventions and seeks synergies across sectors 2.3 The design of the NbS incorporates risk identification and risk management beyond the intervention site
3. NbS result in a net gain to biodiversity and ecosystem integrity. NbS design and implementation must avoid undermining the integrity of the system and instead, enhance the functionality and connectivity of the ecosystem (p. 10).	3.1 The NbS actions directly respond to evidence-based assessment of the current state of the ecosystem and prevailing drivers of degradation and loss 3.2 Clear and measurable biodiversity conservation outcomes are identified, benchmarked and periodically assessed 3.3 Monitoring includes periodic assessments of unintended adverse consequences on nature arising from the NbS 3.4 Opportunities to enhance ecosystem integrity and connectivity are identified and incorporated into the NbS strategy
4. NbS are economically viable. This criterion requires consideration to the economic viability of the intervention, at the design and implementation stage. Long-term gains must be balanced agains short-term costs. If economic feasibility is inadequate the NbS is in risk of being a short-term project (p.12).	4.1 The direct and indirect benefits and costs associated with the NbS, who pays and who benefits, are identified and documented 4.2 A cost-effectiveness study is provided to support the choice of NbS including the likely impact of any relevant regulations and subsidies 4.3 The effectiveness of the NbS design is justified against available alternative solutions, considering any associated externalities 4.4 NbS design considers a portfolio of resourcing options such as market-based, public sector, voluntary commitments and actions to support regulatory compliance
5. NbS are based on inclusive, transparent, and empowering governance processes. This criterion requires to address the concerns of a variety of stakeholders. Good governance arrangements should be proven. NbS must adhere to and align	5.1 A defined and fully agreed upon feedback and grievance resolution mechanism is available to all stakeholders before an NbS intervention is initiated 5.2 Participation is based on mutual respect and equality, regardless of gender, age or social status, and upholds the right of Indigenous Peoples to Free, Prior and Informed Consent (FPIC)

CRITERIA	INDICATORS
with the prevailing legal and regulatory provisions (p.14).	5.3 Stakeholders who are directly and indirectly affected by the NbS have been identified and involved in all processes of the NbS intervention 5.4 Decision-making processes document and respond to the rights and interests of all participating and affected stakeholders 5.5 Where the scale of the NbS extends beyond jurisdictional boundaries, mechanisms are established to enable joint decision making of the stakeholders in the affected jurisdictions
6. NbS equitably balance trade-offs between achievement of their primary goal(s) and the continued provision of multiple benefits. This criterion requires to acknowledge trade-offs and to follow transparent and inclusive processes to balance and manage them over time and space (p.16).	6.1 The potential costs and benefits of associated trade-offs of the NbS intervention are explicitly acknowledged and inform safeguards and any appropriate corrective actions 6.2 The rights, usage of and access to land and resources, along with the responsibilities of different stakeholders, are acknowledged and respected 6.3 The established safeguards are periodically reviewed to ensure that mutually agreed trade-off limits are respected and do not destabilise the entire NbS
7. NbS are managed adaptively, based on evidence. This criterion requires implementation plans to include provisions to enable adaptive management as a response to uncertainty and to harness ecosystem resilience. Adaptive management is evidence-based through regular monitoring and evaluation, drawing on scientific understanding and indigenous, traditional, and local knowledge (p.18).	7.1 A NbS strategy is established and used as a basis for regular monitoring and evaluation of the intervention 7.2 A monitoring and evaluation plan is developed and implemented throughout the intervention lifecycle 7.3 A framework for iterative learning that enables adaptive management is applied throughout the intervention lifecycle
8. NbS are sustainable and mainstreamed within an appropriate jurisdictional context. This criterion requires interventions to be designed and managed considering long-term sustainability, and considering alignment with sectoral, national and other policy frameworks (p.20).	8.1 The NbS design, implementation and lessons learnt are shared to trigger transformative change 8.2 The NbS informs and enhances facilitating policy and regulation frameworks to support its uptake and mainstreaming 8.3 Where relevant, the NbS contributes to national and global targets for human well-being, climate change, biodiversity and human rights, including the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)

Both biophilic design patterns and NbS standard's criteria inform the development of a framework for monitoring and evaluation of efficacy, which can be supported by biophysical,

socio-economic and sustainability indicators. The evaluation of nature-based approaches is essential for policymakers, stakeholders, and decision-makers, as it can help to create business cases that promote and justify the allocation of public resources and private investment (W. D. Browning et al., 2014; Dumitru, 2021).

3.2.4 Legal Mechanisms in the Policy Framework

New laws should be designed to protect natural resources, but also to integrate nature into our lives as part of municipal and local directives (Brown, 2016). Strategic legal approaches are necessary for the successful implementation of biophilic design and NbS into the policy framework. As noted in previous sections, local governments have a primary role in the incorporation of ecosystem-based adaptation and sustainability into development plans, policies, and infrastructure investment strategies (Wamsler et al., 2014). *Biophilic Laws: Planning for cities with nature* (Brown, 2016), provides a comprehensive set of legal mechanisms that are currently used as policy tools to promote urban biophilic strategies at the local level in different cities around the world. Table 10 organizes these mechanisms into four main categories and provides a set of flexible tools and examples that could be adapted to the Winnipeg context.

Table 10. Biophilic Legal Mechanisms. [Source: Brown, 2016]

Legal Mechanisms & Policy Framework	
A. Land Use Controls - Influence the design of new development projects on a site-by-site basis - Usually implemented through zoning schemes	**Overlay Zoning** -An additional layer of regulation intended to supplement the standards set forth in an existing zone. -Specific regulatory focus that targets the boundaries of natural systems instead of artificial property boundaries. -Helpful tool for cities as it doesn't need a revision of underlaying zoning to address a new focus on biophilic planning. -It adds an extra layer of planning while maintaining current land use designations.
	Performance Zoning -Flexible mechanisms for achieving developer's desired outcomes using limited resources (e.g., targeting the volume of stormwater runoff or maintaining a certain percentage of tree coverage)
	Open Space Zoning -Tool used to create more green areas by requiring a percentage of new land developments to be dedicated for open space (as an overlay zone or as a primary use)

	-Usually aimed to create parks and common areas for outdoor activities. It can also encourage native wildlife habitat along corridors throughout the city.
	Development Impact Fees & Taxes -Related to the scope of new development to fund biophilic improvements in the city. -Biophilic categories of development fees can be linked to the cost of new development with the loss of wildlife habitat or other green infrastructure elements.
B. Land Use Incentives - Promote biophilic planning on a volunteer basis, it is more promising to encourage biophilic design. - Cities do not tend to prioritize funding for this matter, it is better to emphasize legal mechanisms where governments and private actors work together to increase nature.	**Incentive Zoning** -It grants increased development rights to promote a desired biophilic outcome. -Helpful in premium development areas as it reduces zoning restrictions in exchange for targeted green elements. For example, a density bonus to increase density in exchange for including green roofs in new development.
	Tax Credits & Breaks -Granting tax breaks to private entities and individuals that implement biophilic planning efforts. -It shares the cost between private and public actors. -Conservation easement programs. -It can be used to encourage maintaining open space for public use.
	Development Agreements -Tailored to site-specific development. -Agreement within the City and the developer at the front end of the development process. Developers may include biophilic elements in their projects in exchange for approval to compensate impact and infrastructure costs generated by the development.
	Recognition -Recognizing investment in nature to create ownership of biophilic improvements. -It can develop standards that can guide individual planning efforts and target desired outcomes. -Cities can also receive recognition for creating more abundant and accessible nature in their communities (e.g., Bird City Wisconsin).
	Technical Assistance / BMPs -Cities can provide expertise support to incentivise residents to improve their community's natural setting.
C. Information Collecting & Sharing	-Understand baseline conditions and the availability of resources. -Understand opportunities and prioritize funding. -Information collection and sharing is the core of many codes and it is usually tied with other legal efforts (e.g., overlay zones require investigating and mapping areas).
D. Property Purchase & Accessibility - Taxes and fees can also be used to acquire and maintain public amenities.	**Transferrable Development Rights** -Cities can create markets for the exchange of development rights to concentrate development and enhance biophilic elements in specific areas (e.g., New York City's TDRs for the High Line). -Promising in urban areas where development opportunities are limited.
	Purchase of Limited Property Rights -Acquisition can occur through tax breaks or the purchase of rights, easements provide opportunities for flexibility.

- Development agreements provide a way for developers to dedicate land towards biophilic improvements.	-Used to direct development away from prioritized development resources. -Private purchasers can work with local governments to purchase development rights.

3.2.5 Challenges and Barriers

Addressing the main challenges and barriers for the implementation of biophilic design and nature-based solutions (NbS) is an important step for their incorporation into the policy framework. Challenges and barriers have been identified from the literature and organized into six main categories:

1. **Limited knowledge.** NbS as a planning approach are relatively recent and need to be integrated into national, regional, and local policies. The potential of nature-based solutions and the technical knowledge to implement them is not widely understood yet in comparison to standard models of grey infrastructure and urbanisation processes. Most of the existing case studies on NbS focus on the understanding of benefits and not on the implications for policy, planning and governance (Dumitru, 2021; Frantzeskaki, 2019; Wamsler et al., 2014).
2. **Collaborative approach.** NbS require an integrated approach that incorporates governance (across departments), design (multiple disciplines), and implementation (public engagement and inclusion) considerations (Frantzeskaki, 2019).
3. **Integrated climate change approach**. Environmental planning and climate planning should work in an integrated way, but they are usually implemented separately as they follow different policy agendas, timeframes, and funding sources (Wamsler et al., 2014).
4. **Ecosystems and people's needs are in constant change.** It is impossible to predict future human-nature interactions and to ensure exact outcomes over a long period of time. For example, diurnal and seasonal cycles have an impact on the efficacy of biophilic patterns. Secondary and seasonal strategies are needed to balance desired responses all year round (Browning et al., 2014).

5. **Data comparison is complex.** Nature-based interventions will never be the same, they are contextual and differ depending on several factors (e.g., culture, climate, demographics, landscape, character, geography, etc.), which affect the accurate comparison of impacts and efficacy (Browning et al., 2014).

6. **Limited budget.** NbS and biophilic design projects are difficult to implement alone with limited resources, requiring from strong public-private partnerships to support them. Create a business case to justify costs and attract resources from private investments, banks, and public grants. To develop a strong business case, it is necessary to learn how to identify partners, visualize nature as capital, and measure monetary benefits. Nevertheless, economic values to the outcomes of biophilic design are not easy to define. In *The Economics of Biophilia: Why designing with nature in mind makes financial sense* (2012), Browning et al. discusses some of the main economic benefits of implementing biophilic strategies in urban areas and provides specific examples of potential economic savings in cities like New York and Cleveland (see Table 11).

Table 11. Economic benefits of Biophilic Strategies. [Source: Adapted from Browning et al., 2012, p. 23]

Economic Benefits of Biophilic Strategies	
Benefit	**Example**
Daylight reduces student absenteeism	NYC. Providing adequate daylight to students could re-engage $297 million in wasted taxpayer dollars and save $248 million in lost parental wages from missed school.
Biophilic work environments increase office workers' productivity	NYC. Integrating nature into work environments could result in over $470 million in recouped productivity value.
Biophilic landscapes reduce crime	NYC. Biophilic landscapes throughout the city could save $1.7 billion in incarceration costs.
Real Estate values increase	Cleveland. Property value increases averaging 127% for homes with lakefront properties.

3.2.6 The Biophilic Cities Network and other Nature-focused Organizations

Nature-focused organizations have a major role in the transformation of cities into biophilic cities since they promote the creation of partnerships and data sharing. This section of the literature review provides an overview of some of the main nature-focused organizations around

the world and focuses on the Biophilic Cities Network as one of the most relevant organizations for the purpose of the current research.

Biophilic Cities Network (BCN)

The *Biophilic Cities Network* project was started at the Virginia School of Architecture in 2011 by Professor Tim Beatley, aiming to improve the abundance and accessibility of nature in cities (Biophilic Cities Network, 2022; Brown, 2016).

In order to become a partner of the network, cities are required to select a minimum of 5 municipal indicators by which biophilic qualities can be assessed and progress can be evaluated over time. Indicators are distributed within the following categories: (1) Natural conditions, qualities, and infrastructure; (2) Biophilic engagement, participation, activities, and knowledge; (3) Biophilic institutions, planning, and governance; and (4) Human health/well-being indicators (Biophilic Cities Network, 2015). The *BCN* currently consists of 25 members from which only Edmonton and Toronto are Canadian cities.

Edmonton, Canada

Edmonton joined the BCN in 2016. Some of the key features of biophilic planning and design in Edmonton include:

- Biodiversity focus through the development of wildlife passages. The *River Valley Parks* network links urban parks along the North Saskatchewan River and the 27 connecting ravines through the heart of the city. This network is currently considered the largest urban park system across Canada (Biophilic Cities Network, 2022).
- The *Breathe: Green Network Strategy* was developed with the purpose to ensure that as the city grows, each neighbourhood will be supported by a network of open space for the next 30 years. This strategy encourages the connection and integration of open space at the site, neighbourhood, city and regional levels (Biophilic Cities Network, 2022).

- *Natural Connections Strategic Plan* is Edmonton's plan for the protection, management and restoration of local natural areas and biodiversity, while promoting communit engagement (Biophilic Cities Network, 2022).
- The *Edmonton City Plan* incorporates biophilic strategies through its Big City Move "Greener as We Grow". This area of the plan addresses the challenges of protecting and enhancing land, air, water and biodiversity resources (Biophilic Cities Network, 2022).
- The *WinterCity Strategy* provides guidance on how to address main winter challenges and encourages Edmonton's residents to reclaim the outdoors all year round (Biophilic Cities Network, 2022).

Toronto, Canada

Toronto joined the BCN in 2020. Some of the key features of biophilic planning and design in Toronto include:

- Toronto was the first city in North America to develop Bird-Friendly Development Guidelines. The purpose of this guideline is to make buildings less dangerous to birds and to support the adoption of the Toronto Green Roof bylaw (Biophilic Cities Network, 2022).
- Tree canopy coverage target increase to 40% of the city's total area through investment in public tree programs and tree planting on private land. The protection of natural areas is promoted through forest management, restoration, control of invasive species and practices prescribed for prairie and savannah habitats (Biophilic Cities Network, 2022).
- The *Toronto Green Standard* sets sustainable design requirements for new developments, including the enforcement of bird-friendly design guidelines to protect and enhance biodiversity (Biophilic Cities Network, 2022).
- The Toronto Green Roof Bylaw was adopted in 2009 and has achieved the creation of 640 green roofs since then (Biophilic Cities Network, 2022). In addition, the City has promoted the integration of urban agriculture (UA) amenities in new condominium developments.

This progress has been possible through the integration of UA in local bylaws and removing policy restrictions preventing food production on rooftops or certain land uses (Huang & Viswanathan, 2016).

Other Nature-focused Projects & Organizations

Understanding the work of nature-focused projects and organizations and their potential to create alliances is a fundamental step towards the implementation of biophilic or nature-based initiatives into the policy framework. This section of the literature review provides an overview of some of the most important nature-focused projects and organizations around the world.

- **CLEVER Cities:** This project aims to improve local knowledge of nature-based solutions, contribute data to EU policymaking, and promote and enable NbS in urban planning around the globe (CLEVER Cities, 2020; Dumitru, 2021).
- **GREEN SURGE:** This project has the purpose to design strategies that integrate green and grey approaches, connect green areas, and involve citizens in sustainable urban planning (Dumitru, 2021; University of Copenhagen, 2017).
- **Nature4Cities:** This project aims to balance economic, environmental, and societal benefits and costs by creating a reference platform for NBS. N4C provides technical guidance, methods, and tools for urban planning. The project promotes the collaboration between citizens, researchers, policymakers, and industry leaders. (Dumitru, 2021; Nature4Cities, n.d.)
- **URBAN GreenUP:** This project aims to enhance urban sustainability through the use of NbS in the renaturing of Urban Plans. Some of the main goals of the project include the mitigation of climate change effects, as well as the improvement of air quality and water management (Dumitru, 2021; Urban Green Up, 2020).
- **UrbanShift:** This organization supports cities around the world to adopt integrated approaches to urban development and looking to achieve a zero-carbon future. UrbanShift

provides on-the-ground investments to participating cities to address multiple urban issues by implementing pilot projects covering diverse focus areas including green infrastructure (UrbanShift, 2022).

- **C40 Cities:** This global network aims to protect communities from the risks of climate change by focusing on the design and performance measurement of policies at the local level. The *C40 Cities* network created the *Urban Nature Declaration* to engage signatory cities to follow one or both pathways on green quality coverage and equitable spatial distribution as shown in Figure 5 (C40 Cities, 2021; UrbanShift, 2021).

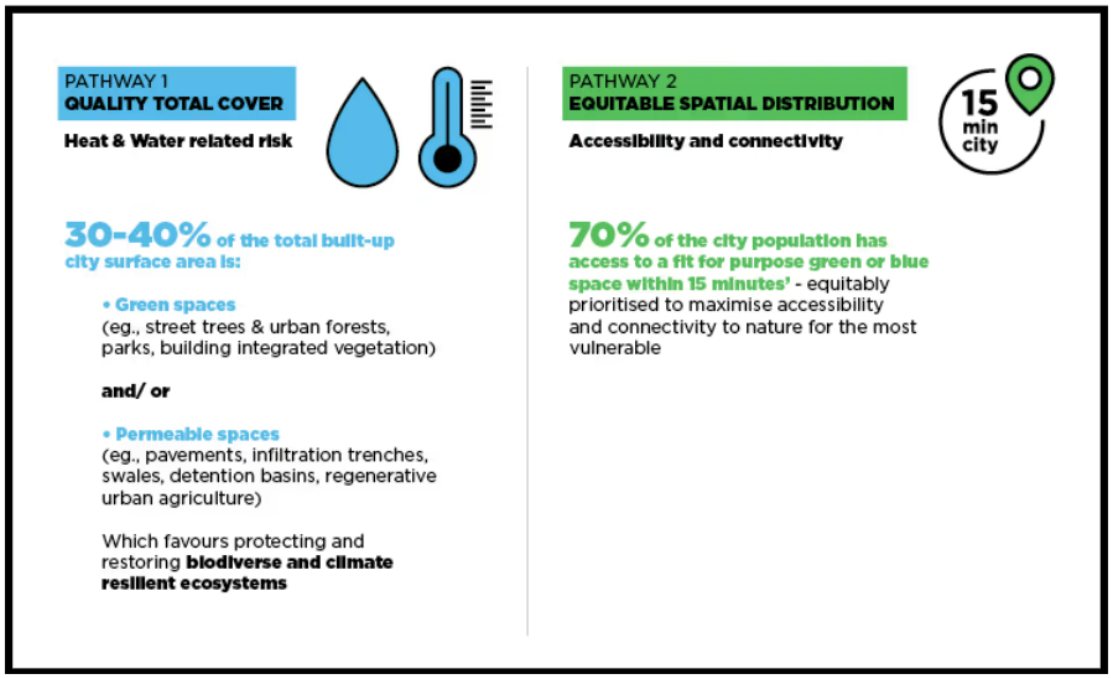

Figure 5. C40 Urban Nature Declaration Pathways. [Source: UrbanShift, 2021]

3.3 Precedents Overview

- **Portland, Oregon, USA:** The City developed a green streets policy initiative and a series of policy tools to support it. Some of the main supporting tools include a watershed management plan, a stormwater management manual, a city building eco-roof policy, and a green street inventory sheet. In addition, the City has been investing in the incorporation of

public spaces along the river such as floating walkways and waterfront parks to connect citizens to the river's natural system(Beatley, 2017, p.95)

- **Chicago, Illinois, USA:** The City has the goal to give visibility of green city thinking. One of the main strategies to achieve this goal is the retrofitting of the City Hall with a 20,000 sq. ft. green rooftop that incorporates more than 20,000 native plants. This project is a demonstration of the city's Green Roof Program which aims to address Chicago's urban heat island problem. In addition, in 2003, Chicago hosted U.S.A's First Annual Greening Rooftops for Sustainable Communities Conference, Awards and Trade Show, with the purpose to show the value of demonstration projects such and the one in the City Hall. The City Hall's green rooftop, along with a group of other pilot and demonstration projects, were funded with the support of a private multimillion-dollar agreement (Conroy & Beatley, 2007).

- **Singapore:** The City developed a Green Plan to direct investment to the transformation of Singapore into a "City in a Garden". With a population doubling to more than 5 million people in the last 25 years, the City looked to address densification problems by incorporating biophilia in the form of access to park space and vertical gardens. Green coverage (i.e., natural areas and rooftops) has increased from one-third to one half the city's area (B. Browning et al., 2012)

- **Malmö, Sweden:** The Municipality of Malmö has been implementing strategies to integrate ecosystem-based adaptation into municipal structures over the last two decades. These strategies include the development of planning tools (e.g., green factor as a requirement supported by guidelines) to address the loss of green space in new development projects and the creation of pilot projects on ecosystem-based adaptation (Wamsler et al., 2014). The Environment Department started the "BiodiverCity" project to develop solutions promoting biodiversity, such as roadside trees, green roofs, and mobile plant systems. In addition, the "Living Malmö" project was launched in 2014 to advance knowledge on how

to materialize the vision of a green and dense city. The Municipality created a multi-disciplinary working group with the task to analyse hazard risks and develop adaptation measures (Wamsler et al., 2014). Table 12 summarizes the main activities developed by the Municipality of Malmö to mainstream climate change adaptation and ecosystem service planning.

Table 12. Mainstreaming activities for ES planning in Malmö, Sweden. [Source: Wamsler et al., 2014]

Mainstreaming activities related to Climate Change Adaptation (CCA) and ecosystem service (ES) planning in Malmö, Sweden
1. Temporary working groups were established to collaborate in drafting policy documents related to Ecosystem Services
2. Establishment of a special working group with staff from different departments with the aim of addressing the implementation of CCA related projects
3. Different departments work together in order to plan for new municipal developments that integrate EbA measures
4. International networks are used to support local spatial planning of ES
5. Single departments have incorporated ES terminology into Comprehensive Plans
6. Crucial steps for addressing CCA were codified in policy documents to inform strategic planning
7. Departments responsible for ES or spatial planning have or are developing a tool to compensate for the loss of ecosystem services in Detail Plans
8. Civil servants developed an extensive list of ecological criteria to systematically evaluate and minimize potential impacts on ecosystem services in new Detail Plans
9. In order to translate EbA-related measures included in the Comprehensive Plan into Detail Plans, civil servants have developed informal working procedures since formal guidelines do not exist
10. The City Council promoted a series of ES seminars and provided funding for projects related to ES planning
11. The City Council endorsed participation in an international city network and projects related to ES planning

- **Izmir, Izmir, Turkey:** The City of Izmir has been introducing nature-based solutions with the purpose to improve quality of life and climate change resilience. In partnership with URBAN GreenUP (see section The Biophilic Cities Network and other Nature-focused Organizations), the City has created an ecological corridor (41,000 m2) with the objective of reducing carbon emissions, reducing the urban heat island effect, increasing biodiversity; providing green areas for the public, strengthening the stream's connection with the sea, and creating permeable surfaces to reduce flooding risks (Urban Green Up, 2020). This green

corridor (see Figure 6), hosts carbon absorbing plants, 1,150 trees and 250,000 bushes, along with ten pollinator houses for biodiversity enhancement (Urban Green Up, 2020).

Figure 6. Ecological Corridor in Izmir, Turkey. [Source: Urban Green Up, 2020]

3.4 Summary

The literature review has provided an overview of the main concepts and ideas around the two key topics in this research:

1. Intensification: definition, local impacts, and relation to environmental sustainability.
2. Biophilia: biophilic cities, nature-based solutions, and their potential impacts; biophilic design and implementation standards; legal mechanisms, challenges, and barriers; main nature-focused organizations; and precedents.

The literature has shown the importance of supporting intensification practices with biophilic strategies to address the main environmental challenges faced in densified urban areas. By identifying the main concepts and ideas around intensification and biophilia, the literature review has provided a theoretical framework to support the content analysis conducted in this research, as well as to inform key recommendations at the end of this report.

4. Results

This section provides the results from the content analysis divided into two parts, the first one for the City of Edmonton, as a reference for best practice, and the second one for the City of Winnipeg. Each part identifies the main characteristics from each document to understand Cardno's (2018) perspectives on purpose, construction, and implementation, as well as the results from the policy classification and the policy strength analysis. Results are summarized in this section, but tables providing the complete set of analysed policies from each document are included in the Appendices section at the end of the report.

4.1 Edmonton

The City of Edmonton is required to create and adopt a municipal development plan that aligns with regional and provincial regulations while embedding local priorities (Province of Alberta, 2021). Figure 7 provides an overview of Edmonton's overall planning tool hierarchy, showing *The City Plan* as a high-level document almost at the top (City of Edmonton, 2019). *The City Plan* was selected as the analysis focus for the current research since it provides an overview of the role of environmental policies within the City's planning priorities. In addition, the *Infill Roadmap* was also selected for analysis being the main implementation tool that translates intensification policies within *The City Plan* into enforceable actions.

4.1.1 Edmonton City Plan

The City Plan has the purpose to support the city's growth by providing strategic direction in environmental planning, social planning, and economic development (City of Edmonton, 2020b). The document is structured around a set of Big City Moves (BCMs) and associated targets. From these BCMs, "Greener as We Grow" stands out as the most strongly related to biophilic strategies, having the purpose to protect and enhance land, air, water, and biodiversity. Main targets for this BCM include planting a minimum of 2 million new urban tress, achieving a total community-wide carbon budget of 135 megatonnes, and a achieving a net-person

greenhouse gas emission of zero (see Table 13). In addition, the other relevant BCM, to the current study is "A Rebuildable City", which sets a target of 600,000 additional residents in the redeveloping area, with 50% of net new units being incorporated through infill city wide.

The plan proposes to shape the city through a planning and design approach comprised of interconnected networks: the district network (i.e., compact, and mixed-use development), the nodes and corridors network (i.e., areas of density concentration within districts), the green and blue network (i.e., parks, water bodies, greenways, and urban trees), and the non-residential opportunities network. This interconnected urban structure identifies the City Centre, Major Nodes, Local Nodes, Primary Corridors, and Secondary Corridors as the main elements to accommodate intensification. In addition, the plan describes the dynamics within the Green and Blue Network. As shown in Figure 8, the network is structured by a set of green elements interconnected throughout the urban core, including habitat greenways, urban greenways, major recreation parks, and major ecological connections.

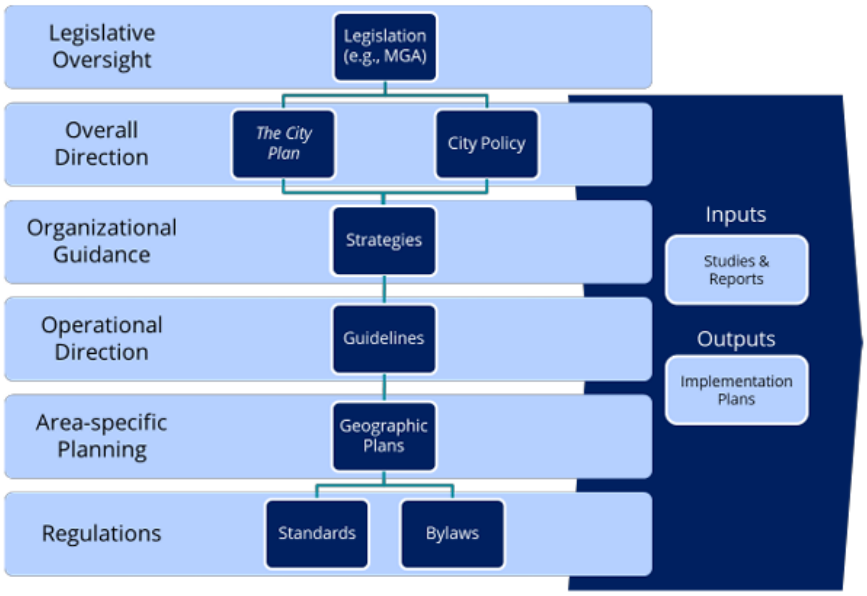

Figure 7. Edmonton's Overall Tool Hierarchy. [Source: City Planning Framework, p. 27]

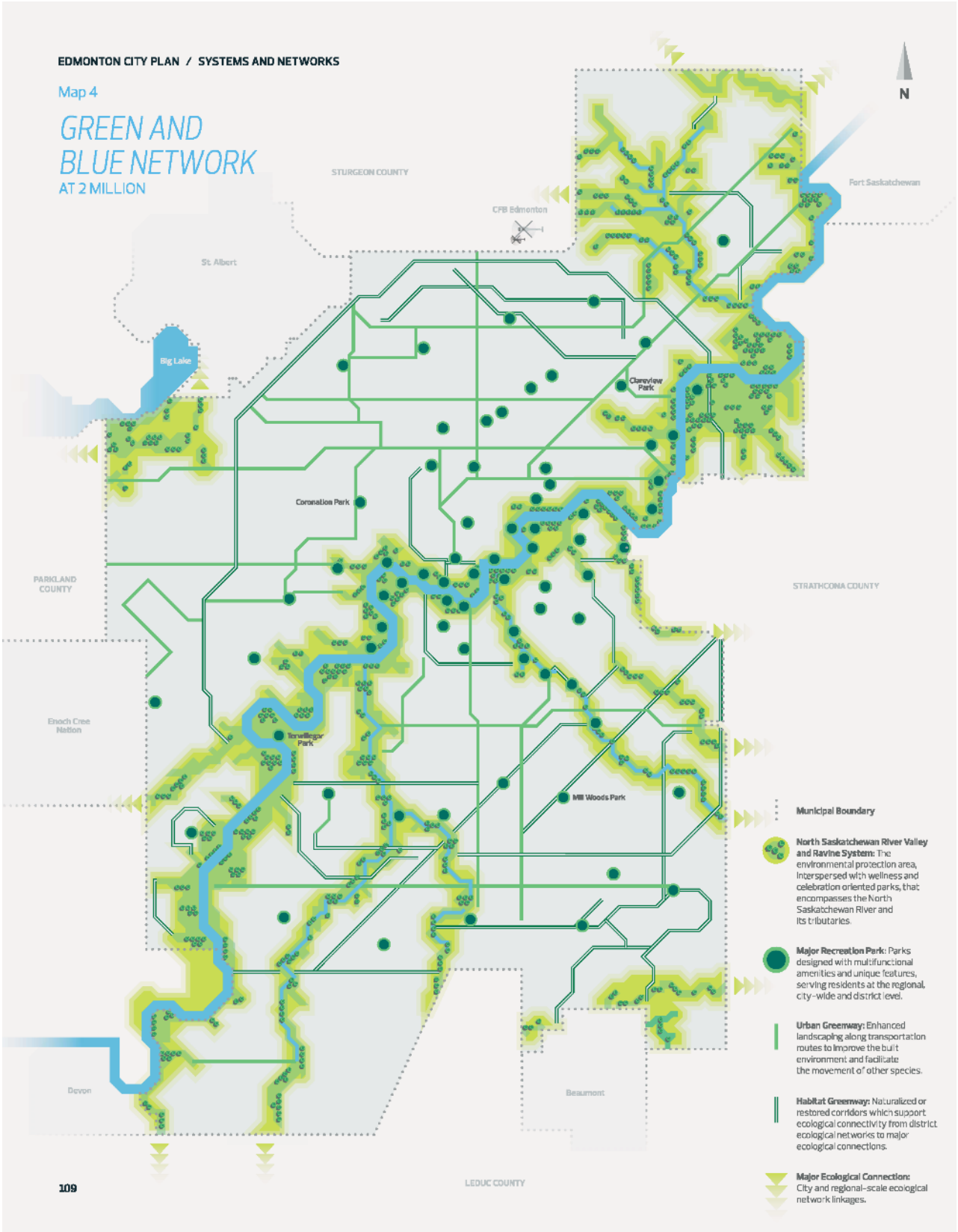

Figure 8. Green and Blue Network Map. [Source: Edmonton City Plan, p. 109]

Another section of *The City Plan*, relevant to the current research is the "Managing Growth" section, which focuses on the logistics of phasing growth areas over time. According to *The City Plan* (2020), Edmonton's population is expected to grow from one to two million residents, and this growth is being sequenced into increments of 250,000 residents in redeveloping, developing and future growth areas over the next 45 years. The plan proposes three interconnected growth-enabling elements: a growth management framework, development pattern areas, and phasing and activation strategies. "The number of residential dwelling units in Edmonton is expected to grow to 840,000 city-wide. approximately 340,000 (40%) will be low density residential, 280,000 (34%) will be medium density, and 220,000 (26%) dwelling units will be high density..." (City of Edmonton, 2020, p.136). Figure 9 provides a map from *The City Plan,* showing the first phase of anticipated growth that covers a population increase from 1 to 1.25 million people. As it can be observed, the map identifies optimal areas for residential infill and provides an approximation of the range of residential dwellings expected for each development pattern area. While only one map is being showed for exemplification purposes in this report, the plan includes a set of eight maps proposing different anticipated growth scenarios and their corresponding activation approaches.

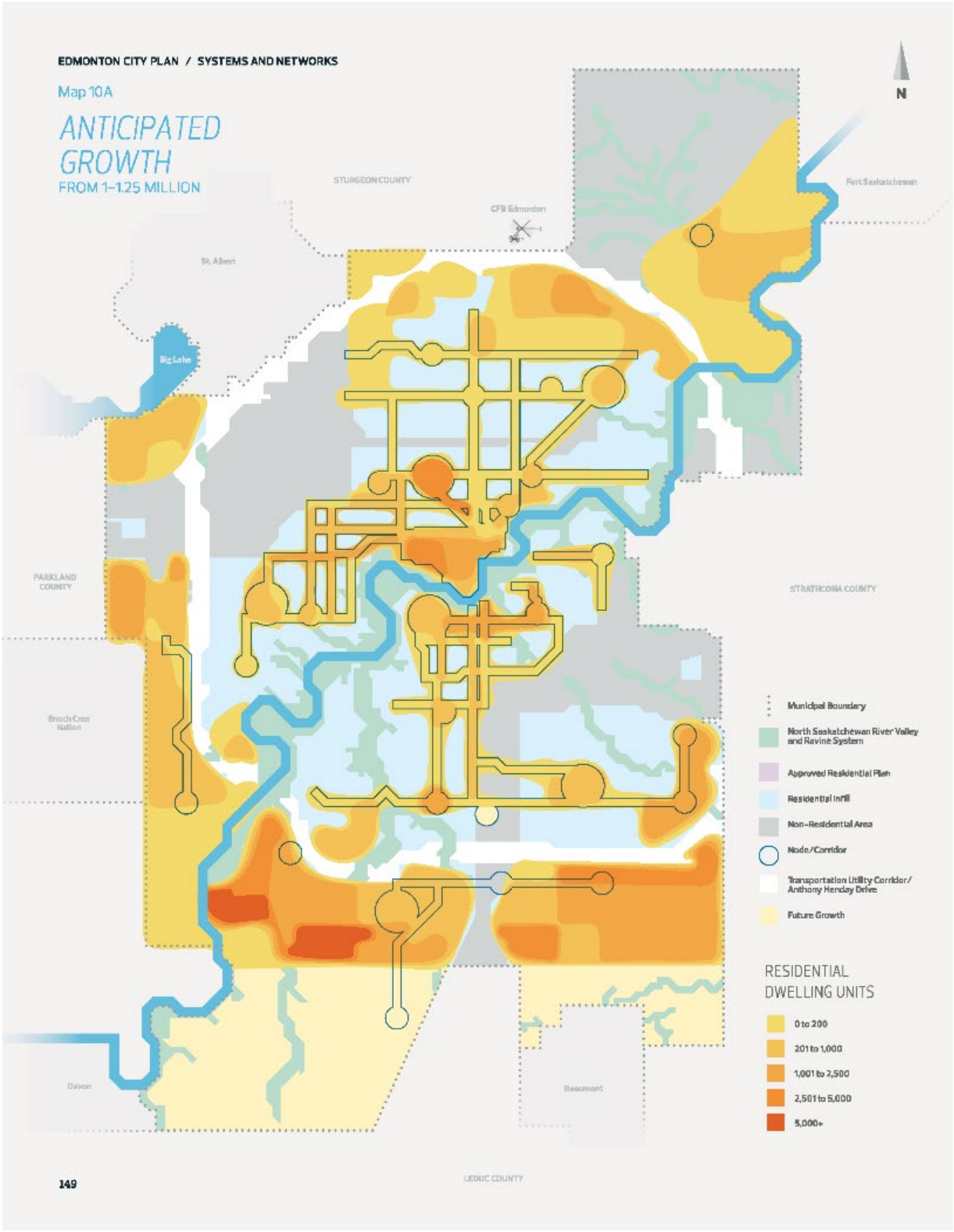

Figure 9. Anticipated Growth Map – 1 to 1.25 million Population. [Source: Edmonton City Plan p. 149]

Regarding implementation directions, the plan includes a table of implementation tools to achieve the desired growth patterns and identifies the following four levers of change: policy; partnerships and advocacy; incentives, pricing, and subsidies; and infrastructure investment. With the purpose of tracking progress, the document provides a set of indicators, targets, and strategic measures for each of the five BCMs. Table 13 summarizes the targets and strategic measures outlined for "Greener as We Grow" and "A Rebuildable City" as the most relevant BCMs to the current research.

Table 13. Edmonton's Targets and Strategic Measures. [Source: Edmonton City Plan]

Big City Move	Targets	Strategic Measures
Greener as We Grow	• Achieve total communitywide carbon budget of 135 megatonnes • Two million new urban trees planted • Net per-person green house emissions are Zero	Urban Forest, recycled solid waste, greenhouse gas emissions generated by City assets, areas designated for natural protection, green area (hectares) per 100,000 population, greenhouse gas emissions generated by the community
A Rebuildable City	• 50% of new units added through infill city wide • 600k additional residents will be welcomed into the redeveloping areas	Infill growth in nodes and corridors relative to Growth Management Framework, Infill growth in districts relative to Growth Management Framework, Housing growth distribution in developing, redeveloping and future growth areas, District population growth, Developing, redeveloping and future growth area population change, Capital Infrastructure Investments by District

In relation to structure, policies are presented as outcomes, intentions, and directions. From this structure, a total of 33 directions and 60 strategies were selected due to their relevance to the topics of intensification and biophilia. Table 14 and Figure 10 summarize the results from the policy classification and policy strength analysis. An overview of the number of policies related to each of the identified sub-categories is provided to identify local priorities, along with a percentage identifying "suggested" or "required" policy language.

As shown in Figure 10, the Urban Green Spaces (UGS) sub-category can be considered a priority representing 41% of the policies within the biophilic category; while Tree Canopy and Buildings Elements are embedded as specific strategies within the other directions and do not have their own set of policies as standing sub-categories by their own. Table 14 shows that policy language for the biophilic-related directions is mostly "suggested" (64%), except for the Natural Assets and Low Impact Development sub-category, in which 57% of the directions are outlined as a requirement. For Intensification policies, Design (46%) and Connectivity (27%) are identified as priorities, having a similar policy strength pattern with 61% of the policies being suggestions. See Appendix A – Edmonton Policy Review for access to a table that compiles all the analysed policies from the *Edmonton City Plan*.

Table 14. Policy Classification and Strength Analysis of the Edmonton City Plan

Edmonton City Plan							
Directions							Strategies
Category	Sub-Category	Total	Language				Total
			Suggested	%	Required	%	
Biophilic / NbS	Procedures	5	3	*60%*	2	*40%*	10
	Natural Assets and Low Impact Dev	7	3	*43%*	4	*57%*	12
	Urban Green Spaces	9	7	*78%*	2	*22%*	14
	Tree Canopy	0	0	-	0	-	2
	Building Elements	0	0	-	0	-	1
	Biodiversity	1	1	*100 %*	0	*0%*	1
	Total	22	14	*64%*	8	*36%*	40
Intensification	Location	1	0	*0%*	1	*100%*	2
	Connectivity	3	1	*33%*	2	*67%*	5
	Design	5	4	*80%*	1	*20%*	8
	Procedures	2	1	*50%*	1	*50%*	5
	Total	11	6	*55%*	5	*45%*	20
Total	**Total**	**33**	**20**	***61%***	**13**	***39%***	**60**

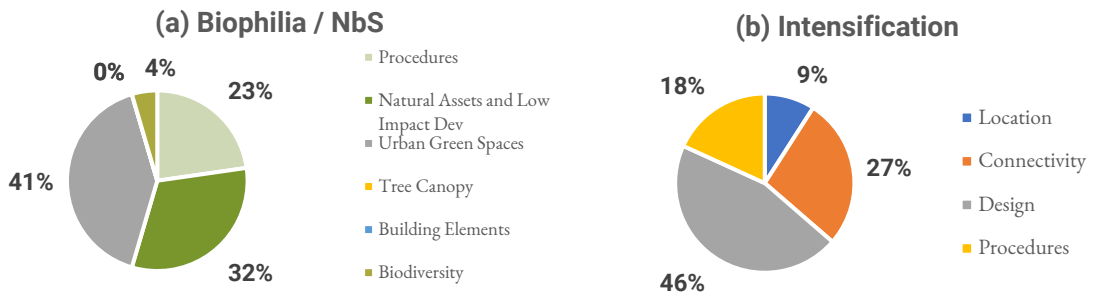

Figure 10. Distribution of sub-categories for (a) Biophilic and (b) Intensification Policies in the Edmonton City Plan

4.1.2 Infill Roadmap 2018

The *Infill Roadmap* was created in 2014 and updated in 2018 as a support tool to enable intensification strategies outlined in the *Edmonton City Plan*. The roadmap document addresses the challenge of providing diverse housing while ensuring a balanced growth management approach regarding fiscal and ecological constrains (City of Edmonton, 2018a). While the previous *Infill Roadmap* included 53 actions, the new document is simplified into 25 strategic actions towards infill development. The document identifies and addresses three main issues related to infill: improving affordability, improving construction timelines, and lowering construction bylaw infractions. To address these issues, the 25 actions relate to reducing costs, creating a diverse housing mix, supporting laneway housing, aligning city investment with infill, and providing clarity on the infill process.

As a first step to update the *Infill Roadmap 2014*, the City of Edmonton conducted public engagement exercises from which a set of priorities was drawn. The following list identifies the main engagement themes outlined in the *Infill Roadmap 2018* that provide an opportunity for the integration of biophilic strategies or NbS:

- Protect and promote public amenity spaces.
- Promote developments that support community building.
- Support sustainable building design and practices.
- Clarity on development regulations.
- Implement greater design controls to encourage high quality design.
- Promote the creation of neighbourhood level plans.

- Undertake more education and communication campaigns about the infill rules and benefits.
- Enforce good construction practices and penalize non-compliance.
- Address concerns related to mental health and urban isolation.
- Address increased pressure on public open spaces due to additional density to support infill and consider options for onsite stormwater management.
- Explore unique taxation tools and use city-led investments to promote infill.
- Undertake proactive infrastructure and service improvements to support infill.

In relation to implementation strategies, the City of Edmonton created a multidisciplinary Infill Working Group (i.e., staff members from every department within the City) with the purpose of providing comprehensive input on actions related to different areas of expertise. The document provides a clear timeline to ensure working teams, resources and funding are coordinated and allocated effectively. In addition, the document sets monitoring expectations throughout the implementation process.

For the classification of policies, actions were subdivided only into intensification sub-categories to identify priorities within the Infill Roadmap. Table 15 and Figure 11, summarize the results of this analysis. As it can be observed, 72% of the infill actions are focused on design directions as a priority for this tool, and 24% of the action provide guidance on implementation procedures. See Appendix A – Edmonton Policy Review for access to a complete table that compiles all the analysed actions from the *Infill Roadmap 2018*.

Table 15. Classification of Actions for the category of Intensification

Infill Roadmap Actions		
Sub-Category	**Total**	**%**
Location	1	4%
Connectivity	0	0%
Design	18	72%
Procedures	6	24%
Total	**25**	**100%**

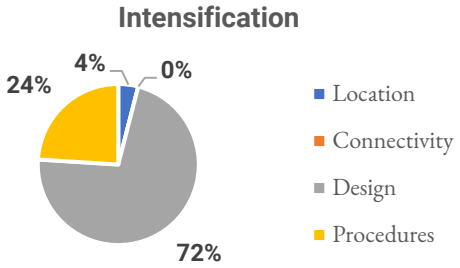

Figure 11. Sub-categories distribution for Intensification Policies in the Infill Roadmap

4.1.3 Other Documents

This section of the findings provides a brief overview of additional planning documents within Edmonton's planning framework being relevant for the analysis of the implementation of green practices in the city.

BREATHE: Green Network Strategy: High-level document with the purpose of establishing a framework for the assessment of open spaces around the themes of wellness, ecology, and celebration (see Figure 12) (O2 Planning + Design Inc., 2016).

Figure 12. Breathe Themes + Functions for Public Places [Source: Downtown Public Places Plan, p. 108]

Breathe provides information on implementation resources for each of the outlined themes, including key external stakeholders / organizations; relevant plans and policies (federal, provincial, and local); relevant projects and programs underway; relevant funding streams and mechanisms; and best practices and trends. In addition, there is a *Procedures and Standards Guide* in development for this document, which will include more detailed aspects of open space

planning, design, and management, such as acquisition, site configuration and street frontage (O2 Planning + Design Inc., 2016).

Downtown Public Places Plan (DPPP): The DPPP provides strategies for improving Downtown public places and has the purpose to create a greener and healthier environment through a connected network of high-quality public places (City of Edmonton, 2020a). The document is structured around eight guiding principles: Safe + Inclusive, Public Access + Connectivity, Linked to the River, Vibrant + Livable, Sense of Community, Green + Sustainable, Celebration, and Cohesive Public Realm. There are two main green components from this document (i.e., Linked to the River & Green + Sustainable) that take part in the integration of the Green and Blue Network (Figure 8) to the downtown's development of public places. Table 12, from the *Breathe: Green Network Strategy,* is introduced in the DPPP as well since it is considered as part of the design framework for downtown's public places. This interconnection of green goals within the two documents is of high relevance to the purposes of the current research since downtown is identified as an optimal location for the concentration of density within the urban structure.

Mature Neighbourhood Overlay: This is a policy tool with the purpose to regulate residential development, such as infill, within Edmonton's mature residential neighbourhoods. The document considers the surrounding development context and looks to maintain a pedestrian-oriented design of the streetscape. Development regulations within this tool include setbacks, heights, platform structures, dwelling type considerations, and vehicular access. These regulations include special areas requiring a pedestrian walkway system that incorporates green elements (e.g., treed landscaped boulevard separating the sidewalk from the street) (City of Edmonton, 2018b).

Low Impact Development – Best Management Practices Guide: This document was developed to provide guidance on the implementation of low impact development best management practices (LID-BMPs). The guide presents an overview of LID-BMPs and design

directions to integrate LID-BMPs into land development, redevelopment, or retrofit projects. This document can be used as a tool to support environmental goals and green strategies within the *Edmonton City Plan* and the *Infill Roadmap*. Chapter 2 identifies federal, provincial, and municipal legal documents that have an impact on the implementation of LID. Chapter 5 provides an overview of seven compatible LID features to the Edmonton context. Chapter 6 provides LID design processes and identifies cold weather adaptations recommended for Edmonton's conditions. Some of the main LID strategies presented include bioretention/rain gardens, bioswales, green roofs, permeable pavements, box planters, naturalized drainage ways, and rainwater harvesting for re-use. Each of these strategies are supported by a set of descriptions, applications, design considerations, operation, and maintenance directions. Overall, the document is not considered a standard but a source of high-level information about LID-BMPs to orient LID development (City of Edmonton, 2014).

4.2 Winnipeg

The City of Winnipeg's policy framework is required to be aligned with provincial regulations, while portraying local planning priorities (Province of Manitoba, 2021). Figure 13 provides an overview of the authority of plans guiding the City of Winnipeg's activities. At the top of the hierarchy is *OurWinnipeg* (OW) as the development plan for the city and subject to provincial approval. In addition, as previously addressed in section 1.3, the City's development plan must also align with the future regional regulations once the regional plan is approved by the province and adopted by the Capital Planning Region (CPR). The next level is *Complete Communities (CC)* as the main secondary plan, which must conform to OW but is only subject to local approval. *OurWinnipeg 2045* (OW2045) and *Complete Communities 2.0* (CC 2.0) were selected as central documents for analysis in this report. Both documents are currently in their draft version and provide a vision of the direction the City is intending to take to shape Winnipeg's growth over the next 25 years.

It must be acknowledged that this study is not intending to make a direct comparison of the content of these two documents with those selected from the City of Edmonton. Instead, the

purpose of the study is to analyse Edmonton's intensification framework to identify how biophilic strategies are reflected or incorporated within its policy documents. After identifying the city of Edmonton as a partner of the Biophilic Cities Network, the current research assumes Edmonton can provide best practice on green strategies, meriting consideration for informing improved practices in Winnipeg. Therefore, even though *Complete Communities 2.0* is not an equivalent to Edmonton's *Infill Roadmap 2018*, it is OW2045's companion document and provides the necessary details to understand its direction.

Figure 13. Authority of plans guiding City of Winnipeg activities. [Source: OurWinnipeg 2045 (Draft), p. 5]

4.2.1 OurWinnipeg 2045 (draft)

OurWinnipeg 2045 (draft) (OW2045) is the development plan for the city of Winnipeg. The plan has the purpose "to guide the physical, social, environmental, and economic objectives and sustainable land uses and development of the city" (City of Winnipeg, 2021b, p.5). OW2045 updates the urban structure map, providing a framework to organize and prioritize growth (see Figure 14).

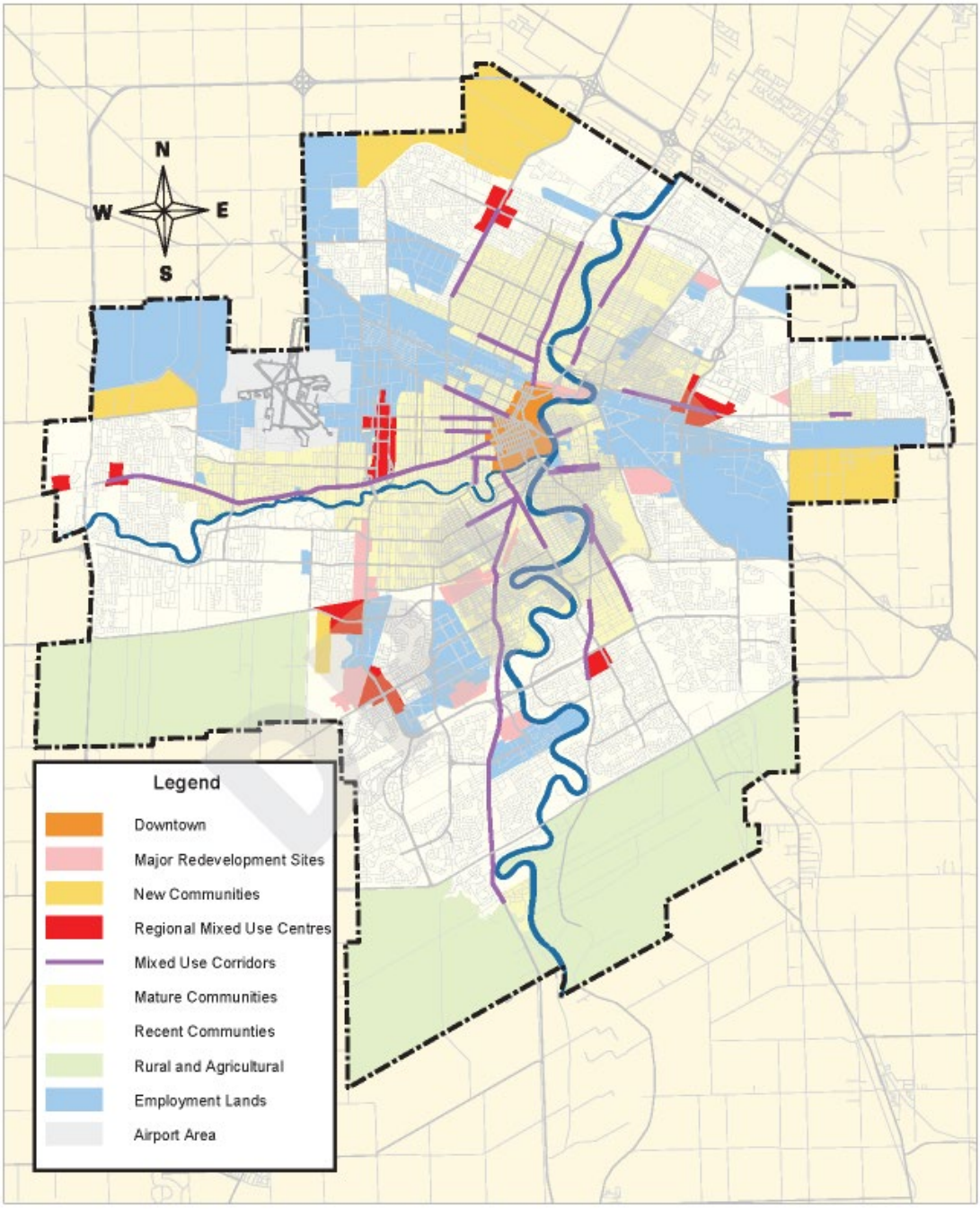

Figure 14. Map of Urban Structure. [Source: OurWinnipeg 2045 (Draft), p. 7]

OW2045's vision is framed by the 17 United Nations Sustainable Development Goals (SDGs), which are allocated to six interconnected sustainable development goals structuring the document's policies (see Figure 15). These SDGs constitute a set of internationally recognized standards for community development.

Figure 15. Goals for Winnipeg localized from the United Nations 2030 Agenda for Sustainable Development. [Source: OurWinnipeg 2045 (Draft), p. 13]

"Environmental Resilience" (ER) is the most relevant goal within the plan for the purpose of the current study. "This goal encompasses all aspects of natural resource preservation, renewal, enhancement, and reuse. It requires respect for the essential role that nature plays in the enrichment of urban quality of life, seeks to minimize the most harmful impact of climate change, and is ultimately focused on sustaining life" (City of Winnipeg, 2021b, p.14). Some of its essential components include: providing equitable access to potable water and urban sanitation; eliminating sources of pollution; supporting biodiversity and ecosystem health by enhancing connectivity of green spaces and parks, as well as protecting ecologically significant natural areas and wetlands; enhancing the capacity of the urban forest and urban agriculture; and assessing and preparing for climate change risks. In addition, the ER goal acknowledges the City's responsibility for "establishing more climate-resilient infrastructure [...] taking a leadership role in regulating the retrofitting of existing buildings [...] as well as to communicate

environmental impacts associated with services and regulations, and to increase public awareness of the roles and opportunities to promote environmental resilience" (City of Winnipeg, 2021b, p.15).

The "City Building" (CB) goal is the second most relevant section for the purpose of the current study as it relates to intensification practices. Policies in this section look for a balance between "growing out and growing up", introducing denser forms of urban housing, mix of land uses, and sustainable transportation. The CB goal has the objective to build a city of 'complete communities', which could provide benefits related to the minimization of environmental impacts, adaptability to climate change, and resilience to natural hazards (City of Winnipeg, 2021b, p.31)

The OW2045 plan is organized into goals, objectives, and policies. Table 16 and Figure 16 summarize the results of the conducted policy classification and strength analysis for OW2045. A total of 48 policies were selected for this analysis because of their relevance to biophilia and intensification. As shown in Figure 16, the Implementation Procedures sub-category can be considered as a priority representing 40% of the policies within the biophilic category along with Urban Green Spaces (UGS) with a 34%; while Tree Canopy, Buildings Elements, and Biodiversity have only one or nonspecific policies within the plan. Table 16 shows policy language for the biophilic-related directions is mostly "required" (53%), except for the Natural Assets and Low Impact Development sub-category, in which 67% of the directions are outlined as a suggestion. For intensification-related policies, Location (33%) and Implementation Procedures (33%) are identified as priorities, having a contrasting policy strength pattern, in comparison to biophilic-related policies, with 72% of the policies being suggestions. See *Appendix B – Winnipeg Policy Review* for access to a table that compiles all the analysed policies from *OurWinnipeg 2045 (Draft)*.

Table 16. Policy Classification and Strength Analysis of OurWinnipeg 2045 (Draft)

Policies						
Category	**Sub-Category**	**Total**	**Language**			
			Suggested	**%**	**Required**	**%**
Biophilic / NbS	Procedures	12	6	50%	6	50%
	Natural Assets and Low Impact Dev	6	4	67%	2	33%
	Urban Green Spaces	10	4	40%	6	60%
	Tree Canopy	1	0	0%	1	100%
	Building Elements	1	0	0%	1	100%
	Biodiversity	0	0	NA	0	NA
	Total	30	14	47%	16	53%
Intensification	Location	6	5	83%	1	17%
	Connectivity	1	1	100%	0	0%
	Design	5	4	80%	1	20%
	Procedures	6	3	50%	3	50%
	Total	18	13	72%	5	28%
Total	**Total**	**48**	**27**	**56%**	**21**	**44%**

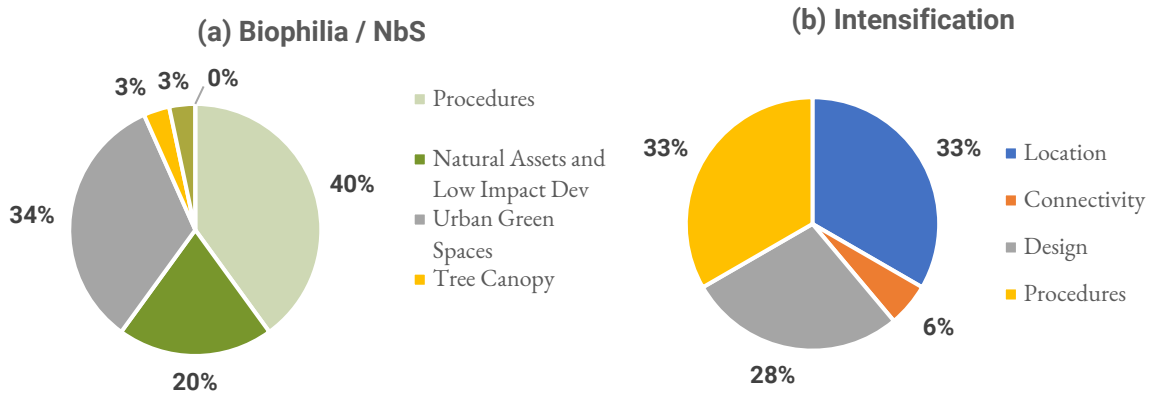

Figure 16. Distribution of sub-categories for (a) Biophilic and (b) Intensification Policies in OW 2045 (Draft)

OurWinnipeg 2045 (draft) identifies two main elements for its implementation: i) key indicators to recognize data and trends, identify issues, and measure progress in alignment with established goals, objectives, and priorities; and ii) the development of a *Strategic Priorities Action Plan (SPAP)*.

First, in relation to key indicators, the plan refers to an existing community indicator system called *Peg* (mypeg.ca), which directly aligns with the United Nations SDGs. The plan

intends to build on the 60 sustainability indicators in *Peg* to better provide refined goals and to measure policy impact by aligning *Peg's* indicators with the directions of the six SDGs in *OW2045*. Figure 17 provides a portion of a table included in *Winnipeg and the SDGs: A Voluntary Local Review of Progress 2021*, showing the alignment between *Peg* themes, the UN SDGs, and the OW2045 goals (MyPeg, 2022). Second, the *Strategic Priorities Action Plan* (SPAP) will provide implementation guidance to local departments to develop budgets, service plans, and partnership plans. However, this strategic plan is still under development and OW2045 does not include clear targets or ready-to-use indicators to apply once the SPAP is adopted.

Peg Indicator	Peg Theme(s)	SDG(s)	OurWinnipeg 2045 Goals (includes indirectly relevant indicators)
Quality of Life	Social Vitality & Governance	All SDGs	
Sense of Belonging	Social Vitality & Governance	16 PEACE, JUSTICE AND STRONG INSTITUTIONS	

Figure 17. Peg, SDGs, and OurWinnipeg 2045 Alignment. [Source: Winnipeg and the SDGs: A Voluntary Local Review of Progress 2021, p. 90]

4.2.2 Complete Communities 2.0 (draft)

Complete Communities 2.0 (draft) (CC 2.0) is *OurWinnipeg 2045's (draft)* secondary plan companion, providing more detailed directions for each of its six policy areas. Figure 18 is a diagram from CC 2.0, illustrating a feedback loop between the vision of the plan for building complete communities and the outcomes obtained when this vision is achieved (City of Winnipeg, 2021b, p.8). CC 2.0 introduces an urban structure that creates a framework for the city's future physical growth and development. This secondary plan sets an intensification target with the purpose to prioritize infrastructure and planning in places that best support complete communities' principles, to identify a residential growth target, and to create a policy framework

for accommodating infill development within established neighbourhoods (City of Winnipeg, 2021a, p.6).

Figure 18. Relationship between Complete Communities 2.0 and the OurWinnipeg 2045 sustainability goals. [Source: Complete Communities 2.0 (Draft), p. 8]

CC 2.0 defines the concept of 'complete communities' as "places that both offer and support a variety of lifestyle choices, providing opportunities for people of all ages and abilities to live, work, shop, learn and play in close proximity to one another" (City of Winnipeg, 2021a, p.10). The document identifies that moving toward the construction of complete communities is also a strategy to meet sustainability goals, such as better air quality, resource efficiency, waste management, climate change mitigation and resilience to natural disasters (City of Winnipeg, 2021a).

CC 2.0's vision is based on seven principles, from which the most relevant principle to the current research is: "Complete Communities builds on existing assets, including natural heritage features (rivers, urban forests, and parks), [...] built form (mature neighbourhoods and downtown), and community focal points (facilities, open spaces, and main streets)" (City of

Winnipeg, 2021a, p.9). This set of principles structures the plan's policies in seven sections: Growth and Servicing, Transformative Areas, Established Neighbourhoods, Additional Areas, Special Districts, Urban Structure Supports, and Implementation. Each section consists of an introduction, a vision (inspirational statement), and a group of goals (direction) and policies (guidelines).

Table 17 and Figure 19 summarize the results of the policy classification and strength analysis conducted for CC2.0 *(draft)*. A total of 48 goals and 126 policies were selected for the analysis, due to their relevance to the key topics of biophilia and intensification. As shown in Figure 19, the Urban Green Spaces (UGS) sub-category can be considered as a priority representing 56% of the policies within the biophilic category along with Natural Assets and Low Impact Development with a 22%; while similar to *OW2045*, Tree Canopy, Buildings Elements, and Biodiversity have only two or nonspecific goals within the plan, but are embedded as policies within the other goals. Table 17 shows that, with half of the policies being "required" and the other half been "suggested", policy language is not a determinant for the strength of the document. For intensification-related policies, Design (33%) and Implementation Procedures (33%) are identified as priorities, having a similar policy strength pattern to the one from biophilic-related policies. See *Appendix B – Winnipeg Policy Review* for access to a table that compiles all the analysed policies from *Complete Communities 2.0 (draft)*.

Table 17. Policy Classification and Strength of Complete Communities 2.0 (Draft)

Complete Communities 2.0							
Goals							Policies
Category	Sub-Category	Total	Language				Total
			Suggested	%	Required	%	
Biophilic / NbS	Procedures	2	2	100%	0	0%	14
	Natural Assets and Low Impact Dev	4	1	25%	3	75%	6
	Urban Green Spaces	10	4	40%	6	60%	29
	Tree Canopy	2	2	100%	0	0%	8
	Building Elements	0	0	NA	0	NA	4
	Biodiversity	0	0	NA	0	NA	2
	Total	18	9	50%	9	50%	63

Intensification	Location	5	3	60%	2	40%	9
	Connectivity	5	1	20%	4	80%	8
	Design	10	7	70%	3	30%	21
	Procedures	10	6	60%	4	40%	25
	Total	30	17	57%	13	43%	63
Total	**Total**	**48**	**26**	**54%**	**22**	**46%**	**126**

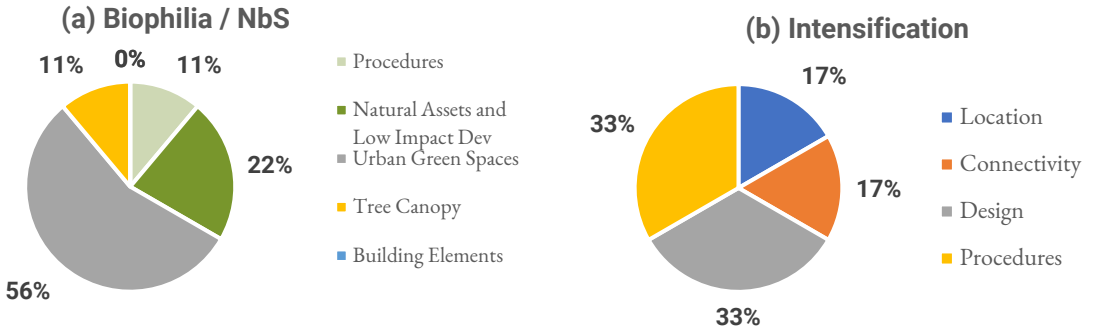

Figure 19. Distribution of sub-categories for (a) Biophilic and (b) Intensification Policies in CC 2.0 (Draft)

The "General Growth" section introduces a residential intensification target as a central piece of the document: "...consistent with Winnipeg's Climate Change Action Plan, the intensification target states that a minimum of 50% of all new dwelling units be accommodated in the existing built-up area of the city" (City of Winnipeg, 2021a, p.18). According to *CC 2.0 (draft)*, infill will be a key strategy for this approach since it will help to reduce the city's environmental footprint by supporting sustainable transportation and preserving greenfield land, while minimizing the need for additional infrastructure (City of Winnipeg, 2021a).

CC 2.0 (draft) identifies Transformative Areas (i.e., downtown, corridors) and Established Neighbourhoods (i.e., mature communities) as the areas providing the best opportunity for growth within the new Urban Structure (see Figure 14). Downtown, is identified as one of the main areas requiring investment in physical and green infrastructure. Corridors, provide the best opportunity for mixed-use intensification outside of Downtown as they have the best transit service and are based around vital nodes with access to goods and services. Intensification of Mature Communities within Established Neighbourhoods (see Figure

14) will also play a key part within the growth strategy as they provide well-connected sidewalk networks and a variety of residential densities (City of Winnipeg, 2021b).

Major Open Spaces (see Figure 20) are also identified within the plan as typically attractive areas for development; therefore, the plan incorporates a development requirement for a higher level of review to underlie any pressures to impact these lands. *CC 2.0 (draft)* looks to protect these areas by enhancing the connectivity of green spaces while supporting biodiversity and natural systems. The plan provides a set of policies to set out a multi-step process, in case any major open space is approved for development, with the purpose of protecting important natural features and habitats within it. In addition, the plan briefly touches on regional collaboration with partners in the Capital Planning Region (CPR) by acknowledging there is a regional plan in progress (City of Winnipeg, 2021b).

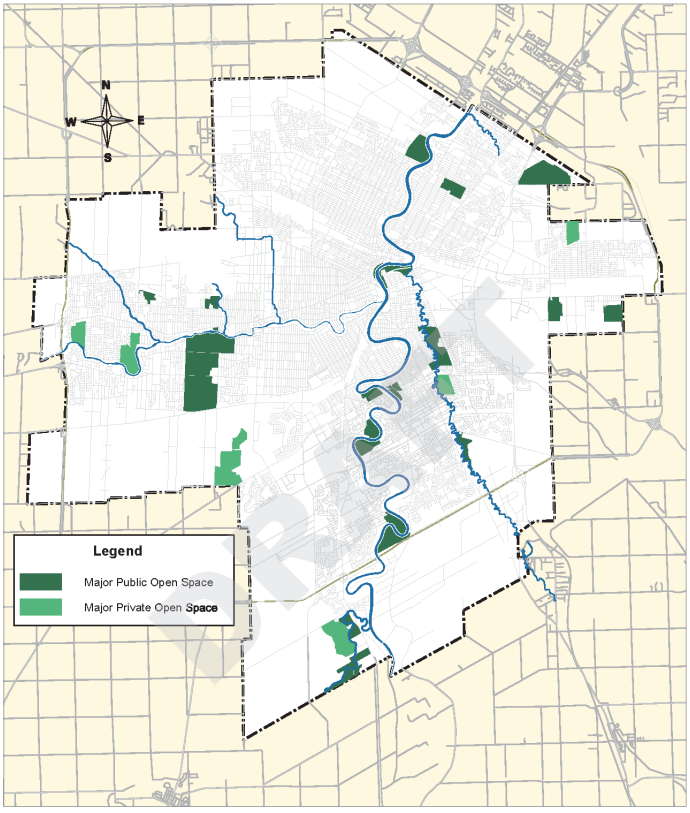

Figure 20. Map of Major Open Spaces. [Source: Complete Communities 2.0 (Draft), p. 120]

In relation to implementation strategies, CC 2.0 (draft), is designed to work with a series of supporting planning documents. Table 18 provides a list of completed documents and documents under development to guide the implementation of OW2045 and CC 2.0. As previously noted, the future *Strategic Priorities Action Plan* will identify short-term actions to approach goals within both OW2045 and CC 2.0. (City of Winnipeg, 2021b).

Table 18. Supporting documents to Complete Communities 2.0. [Source: Complete Communities 2.0 (Draft)]

Completed Documents	Documents Underway
• Winnipeg's Climate Action Plan • Winnipeg Climate Resilience Strategy • State of the Infrastructure Report • Infrastructure Master Plan • Pedestrian and Cycling Strategies • Transit Oriented Development Handbook • Ecologically Significant Natural Lands Strategy • Go to the Waterfront Plan	• Residential Infill Strategy • Parks Strategic Plan • Recreation Strategic Plan • Comprehensive Urban Forestry Strategy • Climate Resiliency and Adaptation Strategy

4.2.3 Other documents

This section provides an overview of additional documents within Winnipeg's planning framework considered relevant for the analysis of the integration of green practices in the city's path to intensification.

***A Sustainable Winnipeg*:** This document is one of the four *OurWinnipeg's* (2011) direction strategies. *A Sustainable Winnipeg* envisions a 25-year sustainability strategy that supports the three interdependent elements of sustainability: environmental, economic, and social. The document provides short-term sustainability actions, integrating commitments related to Green Standards for City Buildings, a Green Workplace Initiative, and a Green Living Public Education and Awareness Campaign, among others (City of Winnipeg, 2011).

***Made-in-Manitoba Climate and Green Plan*:** This document provides a strategic framework that sets a vision for Manitoba to become "Canada's cleanest, greenest, and most climate resilient province" by building upon its previous investments in clean hydroelectricity. This plan is complemented by *The Conservation and Climate Fund*, made available to support

projects related to climate change adaptation and environmental protection (Province of Manitoba, 2017).

***Winnipeg's Climate Action Plan*:** This Plan addresses climate change challenges by establishing targets for greenhouse gas (GHG) emissions reductions and providing recommendations for new and previous policies and programs. Targets established within this document aim to reduce GHGs emissions by 20% by 2030 and by 80% by 2050 (2011 baseline) (City of Winnipeg, 2018).

In addition, there are other documents that could inform the current research providing additional perspectives such as the regional draft *Plan20-50*, the *Manitoba's Road to Resilience 2021*, the *Provincial Environment Act*, the *Climate and Green Plan Implementation Act*, as well as the new plan for Winnipeg's Downtown which is currently under development.

4.3 Summary

The results from the content analysis method have provided an overview of the main policy documents from the City of Edmonton and the City of Winnipeg. Policies from these documents were selected for analysis based on their relation to intensification and biophilia as the key topics in this research. Results are summarized for each city:

City of Edmonton

- Policy classification: The Urban Green Spaces sub-category was identified as a priority within biophilic-related policies in the *City Plan*. The Design sub-category was identified as a priority within intensification-related policies in the City Plan and in the *Infill Roadmap 2018* as well.
- Policy Strength: Most of the selected policies from the *City Plan* showed a "suggested" language.
- Relevant Observations: Big City Moves with specific targets and strategic measures ("Greener as We Grow" and "A Rebuildable City"); interconnected networks (district network, nodes

and corridors network, green and blue network, and non-residential opportunities network); the Managing Growth section informs about the logistics of phasing growth over time.

City of Winnipeg

- Policy Classification: The Procedures sub-category was identified as a priority within biophilic-related policies in OW2045, while Urban Green Spaces in CC 2.0. The Location sub-category was identified as a priority within intensification-related policies in OW2045, while Design and Implementation procedures were the most relevant in CC 2.0.
- Policy Strength: Most of the selected policies from both OW2045 and CC 2.0 showed a "suggested" language.
- Relevant Observations: Vision and goals framed by the 17 United Nations Sustainability Development Goals (SDGs); alignment with indicators from the Peg system, which is also based on the UN SDGs; "Environmental Resilience" and "City Building" identified as the more relevant goals for the purpose of the current research; new urban structure map identifying specific community and corridor types as optimal locations for intensification.

5. Analysis

The analysis section is structured following Cardno's (2018) guiding questions and analysis perspectives on policy purpose, policy construction, and policy implementation. As described in section 2.2, in the article "Policy Document Analysis: A Practical Educational Leadership Tool and a Qualitative Research Method", Cardno (2018) provides a guided policy document analysis framework. This method is adapted to the current research by using its three main analysis perspectives to organise and analyse the results presented in section 4. Each subsection below, compares the results from the policy review and connects them to concepts and precedents from the literature review to answer the research questions outlined in the introduction of this document.

5.1 Policy Purpose

The results from the conducted content analysis showed that environmental planning is embedded within the vision and purpose of both the *Edmonton City Plan* (2020) and *OurWinnipeg 2045* (2021).

For the *Edmonton City Plan*, the analysis identified environmental planning as part of one of its five Big City Moves (i.e., "Greener as We Grow") and not as a secondary element. In addition, results from the policy classification analysis identified Urban Green Spaces (UGS) as a priority element for the plan. These policy findings are supported by Edmonton's actions on biodiversity (e.g., wildlife passages) as a member of the *Biophilic Cities Network*. As noted in the literature review, Edmonton established the vision of creating a park system that works as an ecological network linking the city's forests and making them accessible to its residents. As part of this vision, Edmonton has protected and enhanced the River Valley (i.e., parks, trails, and facilities), which is already the largest urban park in Canada (Biophilic Cities Network, 2022). Even when the results from the policy strength analysis showed that the majority (78%) of the policies related to UGS were presented just as suggestions instead of requirements, Edmonton

has been able to enforce its policies and advance in its green vision. This success might be related to the strong commitment of Edmonton's City Council to invest in the development of a comprehensive set of enforceable policy tools and to engage the city to international partnerships, elevating its expectations.

The findings from the policy classification analysis also showed Low Impact Development (LID) as one of the main priorities within the *Edmonton City Plan*. LID strategies are also supported by the *Infill Roadmap 2018*, identifying opportunities for their application in Action 2 – Review Infrastructure Capacity – and enabling them as a potential tool in Action 12 – Reduce barrier to use of Low Impact Development. In addition, Action 12 refers to an additional implementation tool, the *Low Impact Development Best Management Practices Design Guide.* As it can be observed, the City of Edmonton has created a strong regulatory policy framework that supports green strategies through its development plan; enables it through secondary documents such as the LID guide or the *Breathe: Green Network Strategy*, which both provide information on implementation tools, technical guidance, precedents, and possible sources of funding; and promotes it and make it accountable through international partnerships, particularly the *Biophilic Cities Network*.

In relation to the incorporation of green or biophilic features to buildings (e.g., green balconies, walls, and roofs), the results of the content analysis showed that neither of the two cities approach this sub-category in a direct way within their development plans. This omission might be related to development plans being high-level documents intended to provide guidance to shape growth and urban form, more than direction over specific building elements. However, intensification policies addressing building design set the stage for best practice and can provide an opportunity for the integration of biophilic features through additional tools, such as neighbourhood overlays or secondary bylaws (Brown, 2016). As noted in the literature review, the incorporation of biophilic features into buildings potentially play a significant ecological role in high-density areas since they can compensate for the lack of open green spaces in the compact city model (Tappert et al., 2018). Examples of cities that have incorporated biophilic features in

the built environment in a successful way include Singapore, which achieved a green coverage of half of its total area due to the creation of green rooftops (Browning et al., 2012); and Toronto, with over 640 new green roofs, resulting from its *Toronto Green Roof Bylaw* (Biophilic Cities Network, 2022).

As reported in Section 4. Results, the *Infill Roadmap 2018* was developed as a tool to support and enable Edmonton's previous intensification goals. The document has the purpose to address three main issues related to infill: improving affordability, improving construction timelines, and lowering construction bylaw infractions. To address these issues, the 25 proposed actions relate to approaching emerging needs, reducing costs, creating a diverse housing mix, supporting laneway housing, aligning city investment with infill, and providing clarity on the infill process (City of Edmonton, 2018a). Developing similar implementation tools would be essential for the City of Winnipeg while introducing its intensification goals within its new policy framework. As noted in the literature review, Winnipeg has already tried to incorporate intensification practices in the past without achieving a significant impact (Han et al., 2020). In addition, the *Infill Roadmap 2018*, has advanced a step forward by acknowledging the increased development pressure on urban green spaces due to the additional density, and the need to consider alternative options for onsite stormwater management to support it (City of Edmonton, 2018a, p.30). The loss of green spaces and the need to increase servicing infrastructure capacity, are also identified within the literature review as some of the main risks of intensification (Tappert et al., 2018). Identifying these intensification challenges as priorities to address, creates a bridge for the incorporation of biophilic strategies and NbS into infill practices within Edmonton's intensification framework.

In addition, as biophilic strategies and NbS are selected and designed based on the conditions of a specific place, Edmonton also sets a precedent for seasonal adaptation by the development of its *WinterCity Strategy*. OW2045 acknowledges the importance of planning for winter conditions and identifies Edmonton as a reference of successful winter planning.

Edmonton's *WinterCity Strategy* and *Winter Design Guidelines* aim to enable the use of outdoor spaces in the winter months (City of Edmonton, 2017).

On the other hand, Winnipeg incorporates environmental planning within the purpose and the structure of its two main planning policy documents by framing its vision around the 17 United Nations Sustainable Development Goals (SDGs). SDGs form part of an international framework and reflect Canada's commitment to sustainability. As shown in Section 4. Results, "Environmental Resilience" is the OW2045's goal that provides the best opportunities for the integration of biophilic strategies; supporting the "City Building" goal, which promotes compact building and promotes intensification (City of Winnipeg, 2021c). From the policy classification analysis, it could be observed that OW2045 is focused in providing high-level implementation procedures (e.g., identifying optimal locations), more than specific policy content. This could be related to the introduction of a new urban structure to the policy framework (see Figure 14), and to the fact that OW2045 is a considerably short document (48 pages) relying on several secondary documents for its effective direction and implementation.

UGS was also identified as a priority topic within biophilic-related policies in OW2045 and CC 2.0. However, as showed in the Major Open Spaces map from CC 2.0 (see Figure 20), there are very few major open spaces within the Downtown nor within the Mature communities' boundaries. This finding confirms the importance of incorporating biophilic urban acupuncture throughout the urban core as suggested by Browning et al. (2014) & Gochman (2015) from the literature review.

5.2 Policy Construction

The *Edmonton City Plan* (ECP) and *OurWinnipeg 2045* (OW2045*)* have a very contrasting document structure. The ECP is organized by guiding values, and policy statements are based on outcomes, intentions, and directions; while *OW2045* is organized into goals, objectives, and policies. Therefore, it was not possible to conduct a direct comparison on the policy strength of both documents with such a significant difference in policy structure. For OW2045, each goal

provides an initial set of objectives, which are not directly linked to specific directions; while for the ECP each direction responds to an intention and each intention to a specific outcome. Table 19 proposes an equivalence between both documents' structure for reference purposes.

Table 19. Document Structure comparison between the Edmonton City Plan and OurWinnipeg 2045 (Draft)

Edmonton City Plan	OurWinnipeg 2045
1.0 Outcomes: guiding values and desired experiences.	Goals: provide brief, clear, statement of outcomes to be achieved.
1.1 Intentions: statements of what needs to be accomplished: support, promote, or ensure	Objectives: provide key building blocks to achieve the goals, that can be measured over time.
1.1.1 Directions: specific course of action at a city-wide or district level	Policies: provide high-level direction that is structured in a consistent "what, for whom and why" format, to provide clarity about policy intent.

The results from the policy strength analysis for biophilic and intensification-related policies were similar for both documents. The ECP showed a 39% of policies in the form of requirements and OW2045 a 44%. Neither of the documents showed a high level of enforceability; however, they differ in their organization, clarity, accountability, and implementation strategies. It was more difficult to define the strength of policies within *OW2045* since its language was unclear and required a higher level of flexibility for its interpretation. Having an unclear language decreases policy strength and, therefore, its enforceability.

ECP provides clear direction and specific strategies to implement its vision. In contrast, OW2045 is a significantly shorter document with high-level policies that have the purpose of aligning to other strategic documents and do not provide clear guidance on *where*, *when*, or *how* to be applied. For example, Edmonton is structured around Big City Moves (BCMs), such as "Greener as We Grow", which is focused on protecting Edmonton's land, air, water, and biodiversity. In order to support this BCM, the ECP incorporates the Green and Blue Network map (Figure 8) with specific elements to be protected an enhanced. At the same time, this network is interconnected to the district network and the nodes and corridors network. In contrast, OW2045 provides vague directions on how to approach its "Environmental Resilience" goal and refers to CC 2.0 for further details. In addition, CC 2.0 only provides a

Major Open Spaces map (Figure 20) and an additional policy subsection on parks, but it can be observed that there is not much interaction between these green elements and the areas with major intensification opportunities. Major Open Spaces in CC 2.0 are isolated areas, and while the plan promotes their protection, they are not a main element within the urban structure and there is no analysis on their relationship to the proposed density increase within Downtown, Corridors, and Mature Communities. As noted in the literature review, corridors could also be approached as "ecological corridors". Turkey provides an interesting precedent on how an ecological corridor has the potential to reduce the urban heat island effect, increase biodiversity, promote community building, increase water permeability, and reduce flooding risks (see section 3.3) (Urban Green Up, 2020). Even though both Edmonton and Winnipeg are integrating an urban structure with components to shape and prioritize growth areas, Edmonton goes a step forward by integrating a green network throughout the urban core.

However, it is important to acknowledge that even though CC 2.0 does not provide a clear connection between intensification and green elements, it does provide opportunities for their integration and maintenance over time. For example, policies within "Goal 8: Prioritize pedestrian comfort, convenience, and amenities Downtown" (City of Winnipeg, 2021b)within the Downtown section of the document, provide opportunities for the implementation of biophilic strategies. "Amenities within the public realm" could incorporate sub-categories such as urban green spaces and tree canopy, which at the same time could promote biodiversity in an indirect way.

According to Cardno (2018), alignment to regulatory requirements is another important element to consider when analysing policy construction. There is a lack of on-the-ground biophilic-related regulations in both cities' policy framework. As shown in the literature review, cities like Toronto are incorporating biophilia and NbS into its policy documents not only as suggestions, but as regulatory requirements. Toronto developed *Bird-Friendly Development Guidelines*, a *Green Roof Bylaw*, and a *Green Standard* as requirements for most of the new development applications. In addition, the *Toronto Green Standard* is required for new private

and city-owned development, not just for city-owned buildings as previously proposed in *A Sustainable Winnipeg* (Biophilic Cities Network, 2022; City of Winnipeg, 2011).

5.3 Policy Implementation

In relation to policy implementation, Edmonton's policy documents showed strengths that Winnipeg could recognize as opportunities for improvement. The first strength was the implementation of an incremental approach. An example of an incremental approach can be observed in the way in which Edmonton introduced its first *Infill Roadmap* in 2014 to help people get familiar with infill practices. In 2018, Edmonton updated the roadmap including simplified and more focused directions and supported it with a stronger set of intensification targets in the new 2020 *Edmonton City Plan*. Incremental policy implementation is fundamental to change the perception of residents, developers, and decision-makers regarding the importance of new and controversial topics such as intensification and biophilic strategies. As shown in the literature review, demonstration projects and pilot programmes can help to introduce environmental planning into new places, shape popular thinking, and pave the way for future regulatory requirements (Conroy & Beatley, 2007; van Vliet, 2001). Introducing biophilia into Winnipeg's policy framework and practice standards will be a process of raising expectations and creating accountability.

The second implementation strength identified from Edmonton is its strong governance framework. As previously noted in the policy purpose analysis, Edmonton has created a strong regulatory policy framework that supports biophilic strategies through its development plan, enables it through secondary documents, and keeps it accountable through international partnerships. In addition, Edmonton's local policy framework is also bound to a comprehensive and coordinated regional framework that reinforces local directions (Edmonton Metropolitan Region Board, 2017). The importance of a strong regional framework as a complement to compact growth management is supported by Dierwechter (2017) in the literature review. However, even though Winnipeg has been working in partnership with the Winnipeg

Metropolitan Region (WMR) for decades, its regional regulatory framework and *Plan20-50* (draft) are still in process. The Capital Planning Region board has yet to be established to approve and adopt its new regional plan. Once this process is completed, member municipalities will have a total of three years to implement regional requirements into their local plans. Winnipeg will still have to wait some years to experience the results of this new regional framework (Province of Manitoba, 2020).

The third implementation strength identified within Edmonton's policy framework is in relation to metrics and policy tools for the implementation of intensification and biophilic strategies. As shown in Table 13, the ECP provides specific targets (e.g., 2 million new urban trees) and strategic measures for its "Greener as We Grow" Big City Move (BCM) and developed implementation documents such as the *Infill Roadmap 2018*, the *Breathe*: *Green Network Strategy*, and the *Low Impact Development Best Management Practices Design Guide*. Edmonton also uses some of the legal mechanisms identified in the literature review as land use controls such as overlay zoning (e.g., the *Mature Neighbourhood Overlay*) (Brown, 2016). In addition, the *Infill Roadmap 2018* looks for the creation of an optimal infill map in Action 11 (see Appendix A – Edmonton Policy Review). This infill map is proposed to be publicly available and has the purpose to help identify optimal infill development locations based on neighbourhood level indicators; to compile development activity trends and available infrastructure capacity; to monitor and address construction issues, and to include changing construction practices and declining tree canopies (City of Edmonton, 2018a, p.19).

In a similar way, Winnipeg's policy framework provides a set of indicators and actions for implementation. However, Winnipeg's expectations and performance measures are not clear. As previously acknowledged, OW2045 shows a strength by incorporating the *UN Sustainable Development Goals* and the *Peg* system within its preliminary community indicators. However, they do not indicate specific enough direction as they only provide an arrow indicating desired trend instead of a measurable goal. CC 2.0 also aims to facilitate policy implementation by providing an implementation table that incorporates actions, priorities, partners, level of effort

and impacts. However, priorities are indicated as *low*, *medium*, and *high*, instead of providing measurable timeframes. The "Environmental Resilience" goal would be benefited from specific green space targets that set an amount of ideal green spaces per capita or a green coverage % of total areas. It would be important to identify how much land should be designated as green open space or green infrastructure to respond to the proposed population growth and intensification measures and where would this land be obtained from.

Keeping annual tracking of key green indicators (e.g., acres of parks, forests, major open spaces, and green infrastructure) within the *Peg* system could be a first step in the process. As noted in the literature review, different guidelines or "rules of thumb" to set urban forestry targets have been recently developed to address the demand for Urban Green Spaces (UGS) during the Covid-19 pandemic. The "3-30-300 Rule" proposes targets including that every citizen should be able to see at least 3 trees from their home, that at least 30% of tree canopy coverage should be achieved in every neighbourhood, and that each household should be 300 metres from the nearest park or green space (Konijnendijk, 2021).

The City of Edmonton also provides examples of best practices to challenges identified within the literature review in relation to the implementation of intensification and biophilic practices such as limited knowledge, the need for a collaborative approach, and a limited budget (Browning et al., 2012). An example of a collaborative approach is the Infill Working Group established by the City of Edmonton to integrate the expertise of different local government departments to approach infill development (City of Edmonton, 2018a). An example of how to address a limited budget is Edmonton's membership within the *Biophilic Cities Network* (Biophilic Cities Network, 2022). As noted by Browning et al. (2012), strong public-private partnerships are essential to attract private investment.

CC 2.0 indicates that "...by-laws are only as valuable as their implementation"(City of Winnipeg, 2021b). Nevertheless, it can be appreciated, that even though the environmental perspective is started to be incorporated as one of the main overarching principles in the new

Winnipeg's policy documents, its implementation framework is still weak as it is formed by high-level policies that fully rely on future secondary documents to support its direction. *A Sustainable Winnipeg* matched *OurWinnipeg (2011)* expectations in the past, but it is now outdated and does not respond to the new OW2045's intensification goals. In addition, it is not clear if the proposed documents that will support the "Environmental Resilience" goal within the new plan will be developed as enforceable requirements (e.g., regulatory bylaws), or just as suggested guidelines lacking enforceability, interdepartmental coordination, and budget directions. Overall, in relation to the coordination of intensification and biophilic strategies, Winnipeg is still more than 10 years behind other Canadian cities such as Edmonton and Toronto.

5.4 Summary

The results of the research were analysed using Cardno's (2018) policy analysis perspectives on purpose, construction, and implementation. Overall, coherence was identified among Edmonton's policy purpose, construction, and implementation actions. The analysis has shown how the identified policy priorities (i.e., UGS and biodiversity) led to the creation of a set of supporting guiding documents. Documents such as the *Infill Roadmap 2018* and *Breathe: Green Network Strategy*, have performed as tools to implement intensification and biophilic strategies across interconnected city networks. Through and integrated and incremental planning approach, Edmonton has been working to achieve biophilic goals - identified in the literature review - as a member of the Biophilic Cities Network.

In contrast, the analysis has shown Winnipeg is behind Edmonton regarding the incorporation of biophilic and intensification strategies. With OW2045 and CC 2.0 at their approval stage, Winnipeg's intensification framework appears to be on its way to be detailed. However, the incorporation of biophilic strategies into this framework has not been identified as a priority. Even though environmental policies are shown as part of the purpose and goals of Winnipeg's policy documents; the "Environmental Resilience" goal is not being fully interconnected to intensification strategies and key locations within the urban structure (e.g.,

mature communities, corridors, transit stations). Considering the implementation perspective, Winnipeg is going in the right direction by referencing its indicators to Peg and the UN Sustainability Development Goals. As noted in the literature review, settings common indicators is an efficient strategy to promote data sharing and identify best practice within international partnerships. The City of Winnipeg is in a strategic moment to strengthen its intensification framework with biophilia and join Nature-focused networks to support it.

This analysis has provided an overview of the current Winnipeg status in relation to the presence of environmental policies within Winnipeg's new policy framework. By identifying policy strengths and weaknesses from both Edmonton and Winnipeg, the analysis section has provided best practice and opportunity areas to inform key recommendations for Winnipeg's policy framework.

6. Recommendations & Conclusions

This section of the document compiles the main findings of the study and connects them to the initial research questions, provides a set of recommendations to integrate into the new Winnipeg's intensification framework, sets directions for further research, and concludes with a reflection on final thoughts.

6.1 Addressing the Research Questions

Each of the research questions outlined in the introduction were addressed with findings from the literature review (section 3) and the content analysis method (section 4).

Q1. What are the main benefits of biophilic strategies to intensified urban areas and what are the most common challenges to their implementation?

This question was answered through a comprehensive literature review on the main concepts and ideas around intensification and biophilia as the two key topics in this research. Biophilic strategies can help to address some of the main challenges of intensification, including the loss of urban green spaces, environmental degradation, and the risk of decreasing the quality of life of residents within impacted urban areas. According to the literature, some of the main benefits of biophilic strategies to intensified urban area include improving air quality, and water and climate regulation; protecting and enhancing biodiversity; providing recreational spaces that promote health, social interaction, and community building (Tappert et al., 2018; UrbanShift, 2021). In addition, Nature-based Solutions (NbS) represent an alternative to traditional engineering approaches to urban problems. NbS provide opportunities to address complex and multi-scale issues such as extreme heat, inland flooding, coastal flooding and storm surges, drought, and wildfires (Dierwechter, 2017; UrbanShift, 2021).

As described in section 3.2.5, some of the most common challenges to the implementation of biophilic strategies and NbS include:

- Regulatory barriers because of the lack of knowledge on potential outcomes of biophilia/Nbs and the lack of technical expertise in comparison to standard infrastructure models (Dumitru, 2021; Frantzeskaki, 2019; Wamsler et al., 2014).
- The complexity to achieve a collaborative approach that integrates a variety of government levels, jurisdictions, disciplines, and implementation techniques (Frantzeskaki, 2019).
- The uncertainty of changes in natural and social environments (Browning et al., 2014).
- The complexity to set targets, measure results, and compare data (Browning et al., 2014).
- A limited budget to implement and sustain nature-based projects in the long term, strong public-private partnerships are required (Browning et al., 2014).

Q2. What environmental policies in *OurWinnipeg 2045* (draft) and *Complete Communities 2.0* (draft) could help promote the transformation of Winnipeg into a biophilic city?

The content analysis on *OurWinnipeg 2045* (draft) and *Complete Communities 2.0* (draft) provided insight on how the City of Winnipeg is integrating environmental planning into its new policy framework. See Appendix B – Winnipeg Policy Review for access to tables including all the environmental-related policies identified in OW2045 and CC 2.0.

As noted in section 5.1, it was possible to identify that environmental planning is embedded within the purpose and the structure of both OW2045 and CC 2.0., however, additional efforts are needed for its development and implementation. Winnipeg's new development plan is framed by the UN Sustainable Development Goals, which are simplified into 6 main goals structuring OW2045. "Environmental Resilience" (ER) was identified as the main goal incorporating environmental policy directives into the plan. ER acknowledges the importance of nature in urbanized areas and includes aspects related to "natural preservation, renewal, enhancement, and reuse" (City of Winnipeg, 2021b, p.14). Addressing pollution, enhancing biodiversity, promoting urban agriculture, and mitigating climate change, are some of the most important topics covered under the objectives of this goal.

However, there is not a strong connection between the environmental policies in ER and the intensification policies in the "City Building" (CB) goal. More clarity is needed on the way

the environmental objectives within ER can be applied throughout the urban structure and how this goal could address the potential challenges of intensification in these specific areas. To start the path to becoming a biophilic city, Winnipeg still needs to prioritize its environmental sustainability efforts by investing more resources on environmental planning and implementation strategies.

Q3. What environmental policies does Edmonton, being part of a nature focused Network, have to inform Winnipeg's intensification framework?

The content analysis on the *Edmonton City Plan (ECP)* and the *Infill Roadmap 2018* provided insight on how the City of Edmonton has integrated biophilic strategies within its policy framework. See Appendix A – Edmonton Policy Review for access to tables including all the environmental-related policies identified in the *Edmonton City Plan* and the *Infill Roadmap 2018.*

Through a coordinated and incremental approach, the City of Edmonton interconnects green strategies across the city's different networks within the *City Plan*. Section 4.1.1 in this report identifies "Greener as We Grow" as the Big City Move (BCM) promoting the integration of environmental policies and setting specific targets in the ECP. This BCM includes strategic measures related to the enhancement of the urban forest, the control of greenhouse gas emissions, the enhancement of natural resources and biodiversity, and the protection of designated natural areas, among other measures. The plan connects these strategic measures through its green and blue network map, which identifies the location of the following green elements across the urban structure: parks, waterways and water bodies, greenways, and urban trees. Most of the environmental policies related to the targets and strategic measures outlined in this BCM can be found in the *5.0 Preserve* policy area of the ECP.

In addition, the City of Edmonton enables the implementation of its environmental policies through the development of secondary documents that provide guidance on intensification and biophilic-related strategies (e.g., *Infill Roadmap* and *Breathe: Green Network Strategy*). Edmonton maintains these efforts accountable and updated to international

environmental trends through its membership and commitments to a Nature-focused Network (i.e., Biophilic Cities Network).

The findings obtained from these research questions have informed and shaped a series of key recommendations for Winnipeg's intensification framework provided in the subsection below.

6.2 Recommendations for Winnipeg's Policy Framework

The analysis of the findings from the literature review and the content analysis on Edmonton's and Winnipeg's policy framework, have led to a set of ten key recommendations for integrating biophilic strategies and NbS into Winnipeg's intensification framework.

1. **Map Natural Assets and Create a Green Infrastructure Network Across the City**

Complete Communities 2.0 (CC2.0) identifies major open spaces across the city. Incorporate other types of available green infrastructure into this map and analyse their impact ratio to identify strategic areas lacking access to urban green spaces (UGS). From the identified UGS, consider which of them are publicly accessible and define their quality to better understand their impact. Based on the biophilic urban acupuncture strategy suggested by Gochman (2015), identify specific types of biophilic strategies (e.g., parks, greenways, green roofs, sidewalk gardens) that could adapt to the characteristics (e.g., size, geography, availability of land) of the areas lacking UGS. Identify ways to connect these nodes to create a green network that promotes biodiversity throughout the urban core. Edmonton's Green and Blue Network from the *Edmonton City Plan* (2020) provides a reference of this type of strategy. Creating a natural assets map for the city of Winnipeg would extend and improve the work started by the Winnipeg Metropolitan Region (WMR) on natural assets management (see section 1.3).

In addition, consider the environmental justice perspective. Define who benefits from green infrastructure across the network and who is lacking access. Design and create green spaces to address the needs of disadvantaged social groups in the inner city (European Environment Agency, 2022).

2. **Design Seasonal and Contextual Biophilic Strategies**

As noted in the literature review, addressing the impacts of seasonal changes is one of the main challenges for the implementation of biophilic strategies (Browning et al., 2014). As a winter city, Winnipeg experiences extreme and contrasting temperatures throughout the year. Developing biophilic strategies that respond to seasonal cycles and control desired responses all year round is essential to obtain successful outcomes from biophilic strategies and NbS (Browning et al., 2014).

3. **Support Intensification Policies through a Strong Regional Approach**

Promote a closer relationship and a stronger commitment to new regional policies (i.e., Draft Plan20-50, see section 1.3) to support local intensification strategies (Han et al., 2020). Align objectives and indicators to facilitate data sharing and the achievement of common goals.

4. **Integrate Biophilic Strategies within Risk Management and Resilience Programmes**

Biophilic strategies and NbS can be integrated into Risk Management and Resilience programmes as they have the potential to address a variety of complex urban problems (e.g., flooding, drought, extreme heat, wildfires) (Dierwechter, 2017; UrbanShift, 2021). For example, urban green spaces have played an important role for wellness and mental health throughout the COVID-19 pandemic (Dubbeldam, 2021). In 2021, Edmonton created 29 new pop-up community gardens as part of its efforts to address issues resulted from the pandemic (Stark et al., 2021).

5. **Develop Clear and Comprehensive Implementation Tools**

Create local reports and specific guidelines to inform citizens, government departments, and developers about the benefits of biophilic strategies and feasible ways to implement them. Similar to Edmonton's *Breathe: Green Network Strategy* (2016), include Winnipeg-based strategies and implementations resources regarding relevant bylaws, partnerships, and funding. Make sure guidelines are flexible and avoid creating unintended barriers (Huang & Viswanathan, 2016).

Roadmaps, guidelines, and similar documents are essential to support high-level policies from the development plan. OW 2045 and CC 2.0 refer to a set of documents to be developed with the purpose of providing more detail and clarity to their directions. The City of Winnipeg should analyse best practice on implementation procedures from other cities around the world to inform the development of these new documents and ensure environmental sustainability as a main component within their structure. Providing consistency and connecting strategies across this new set of documents is fundamental to achieve an efficient allocation of resources and promote interdepartmental and interjurisdictional partnerships (e.g., WMR, Province of Manitoba).

6. Develop Indicators, Monitor Progress, and Evaluate Results Regularly

Context-based indicators can help to motivate citizens and elected officials to support environmental policies and NbS-oriented projects (Conroy & Beatley, 2007; IUCN, 2020). For example, the U.S. national *ParkScore* Index and Ranking has helped to understand better the status of greenspaces for each city and how they compare across the country (The Trust for Public Land, 2021). *The Canadian City Parks Report: Centring Equity & Resilience* (2021), is a first step to this purpose. However, this type of metric could be developed at the local level to identify current conditions and needs of UGS at the neighbourhood level.

In OW2045, the "Environmental Resilience" goal could be improved through measurable UGS targets that set an amount of ideal green space area per capita or a green coverage percentage as suggested in the new *3-30-300 Rule for Urban Forestry and Greener Cities* (Konijnendijk, 2021). Identifying how much land should be designated as green open space or green infrastructure, would help to address the environmental impacts of the projected population growth and proposed density increase. Keeping annual tracking of key green indicators (e.g., acres of parks, forests, major open spaces, and green infrastructure) within the Peg system (MyPeg, 2022) could be a first step in this process.

7. Create Public Demonstration Projects and Pilot Programmes

Public demonstration projects and pilot programmes are identified as helpful implementation tools for cities where sustainability is not easily accepted (Conroy & Beatley, 2007). Demonstration projects have the purpose to set a reference for future wider implementation and pilot programmes represent a test of feasibility. The success of this type of projects relies on measuring the cost of change and comparing performance data to make benefits evident to the public (van Vliet, 2001). Start with small interventions at the neighbourhood scale and allow for the engagement of different stakeholders to build trust and promote future collaboration (Dierwechter, 2017; Frantzeskaki, 2019).

8. Promote Education, Community programmes, and Awareness-raising Activities

Promote environmental education and support community-based programmes to raise awareness on the benefits of biophilia and get public support for the implementation of environmental policies. For example, in Malmö, Sweden, politicians have promoted awareness-raising activities and a constant dialog with ecologists, to mainstream sustainability-oriented projects (Wamsler et al., 2014).

9. Join Nature-Focused Networks and Create Partnerships

Joining Nature-focused Networks and promoting public-private partnerships is a way to address the challenges of a limited knowledge (Dumitru, 2021; Frantzeskaki, 2019; Wamsler et al., 2014) and a small budget (Browning et al., 2012). Nature-focused Networks can provide access to best practice, technical support, and funding resources. The City of Winnipeg would benefit from joining international networks such as *Cities WithNature*, *C40 Cities,* and the *Biophilic Cities Network* (see Section 3.2.6). Other Canadian cities such as Edmonton, Surrey, and Montreal are already partners with *Cities WithNature* (ICLEI, n.d.).

Consider alignment with other jurisdictional sustainability agendas as partnerships can be created with other government levels and provide additional resources for the development of NbS-oriented projects. In addition, partnerships with Indigenous communities can provide

knowledge to define best practice, as suggested in the Criterion 8 from the *IUCN Global Standard for NbS* (2020).

10. Develop Legal Mechanisms to Increase Enforceability of Environmental Policies

Different legal mechanisms were identified in section 3.2.4 to enforce or incentivise biophilic strategies within policy frameworks. A zoning overlay (land use control) could be added as an extra layer in the future to incorporate different biophilic strategies into specific mature neighbourhoods as a first step of an incremental approach (Brown, 2016). This type of overlay can be incorporated after a demonstration project is finalized and provides positive cost-benefit evidence. Edmonton's *Mature Neighbourhood Overlay* is an example of the application of this mechanism within an intensification framework. This precedent shows how regulations for special areas can include the requirement of pedestrian walkway systems that incorporate green elements such as treed landscaped boulevards (City of Edmonton, 2018b). Another option is Performance and Open Space Zoning, which could be incorporated as a requirement for large-scale development applications to ensure a certain percentage of tree coverage or green areas as proposed in the new *3-30-300 Rule for Urban Forestry and Greener Cities* (Brown, 2016; Konijnendijk, 2021).

6.3 Directions for Further Research

A variety of topic directions were identified as an opportunity for further research throughout the process of this study. Developing further knowledge on these topics and making connections to the results of this report, would improve the provided recommendations and address some of the main limitations of this research. The six following research directions could be developed by planning students interested in the integration of biophilic strategies into intensification practices. Funding could be provided by the CIP/ICU Planning Student Fund through scholarships and bursaries such as the *General Fund* and the *Climate Change Action Scholarship* (Canadian Institute of Planners, 2022).

- **Regional Planning**. The literature review identified the need for a strong regional planning approach to support local intensification policies to achieve sustainable growth patterns (Han et al., 2020, p.2). The City should work closely with the WMR to develop more detailed intensification targets for each of the policy tiers identified in *Draft Plan20-50*. Research on regional planning could also be developed in collaboration with planners from the City and the WMR, sharing human and financial resources. Some of the expected benefits from this research include developing clearer local and regional density targets, facilitating public buy-in for intensification practices by showing a strong jurisdictional alliance, and allocating resources in a more efficient way.
- **Spatial Data Analysis / GIS Mapping.** GIS could be used as a tool to map the natural assets and green infrastructure network suggested in section 6.2. Mature neighbourhoods with the best characteristics for infill development could be identified to propose contextual recommendations at the neighbourhood level. It would be necessary to collect data bases with information regarding density, zoning, vacant lots, road and transit network, open spaces, and tree inventory. In addition, a 15-minute proximity analysis (e.g., walking distance ratios) could be conducted around urban green spaces. This mapping exercise could be developed by planning students taking GIS courses. Funding could also be available through ArcGIS mapping competitions launched each year by Esri. The expected benefit of this exercise would be to take a step forward from a theoretical to a more practical approach that the City could use as a guide to prioritise the allocation of resources.
- **Indigenous Planning**. Research on Indigenous planning could provide best practice on the protection and management of natural assets. This information would expand the literature review and improve key recommendations provided in this report. Planning students taking Indigenous Planning courses (e.g., Indigenous Studio) could undertake this research. Engagement and consultation with Indigenous communities would benefit the results of the research and promote social inclusion.
- **Environmental Justice.** Further research about the economic impacts on the areas surrounding the implementation of biophilic strategies would provide an environmental

justice perspective to the current research. Properties in areas with more green space tend to increase their value and result in neighbourhood gentrification (European Environment Agency, 2022). Research is needed to analyse the equity gap and the inequities within parks and public spaces across neighbourhoods with different income levels in densified areas (Stark et al., 2021). This research could be undertaken in collaboration with the City's Sustainability department and the department of Planning, Property & Development. Benefits expected from this research would include the development of economic strategies to support local businesses and residents living in impacted neighbourhoods, and the identification of green spaces in low-income neighbourhoods in critical improvement needs.

- **International Policy Documents.** As described in section 2.3 Limitations, only one Canadian city was selected for the analysis of environmental policies in this research due to the lack of time. The current research could be improved through the incorporation of a more extensive policy review that includes local policy documents from other countries. A content analysis on European policy documents would make a great addition to this research as many cities identified in section 3.3 Precedents Overview are European. Planning students taking Planning Theory courses or developing major research projects (e.g., Capstone Project) could undertake this research.
- **Biophilic Regulatory Tools.** Further research on biophilic regulation is needed to improve this report. Section 3.2.4 provides a brief overview of some of the most important legal mechanisms for the implementation of biophilic strategies. However, the report would benefit from exploring the extent and authority for biophilic regulatory tools and their consequences. European precedents could provide helpful documentation on experienced benefits and impacts since they have been implementing biophilic strategies for a longer period of time in comparison to North America. Planning students taking courses related to urban ecology and law could be interested in developing this research.

6.4 Conclusion

In conclusion, the research has shown the integration of biophilic strategies into the City of Winnipeg's intensification framework as fundamental to ensure a high quality of life for residents within intensified urban areas. While intensification can be considered a sustainable urban growth management approach, it jeopardises the availability of urban green spaces by adding development pressures to impacted neighbourhoods.

The research methods conducted for this study included a literature review on intensification and biophilia – the two key topics in this research – and a content analysis on the main policy documents from the City of Edmonton and the City of Winnipeg. After analysing the results from the content analysis, it was possible to identify best practice on biophilic strategies from the City of Edmonton and support them with the literature review as a theoretical framework. The combination of the findings from both methods resulted in a series of ten key recommendations for integrating biophilic strategies into the City of Winnipeg's policy framework.

As a next step, the recommendations provided could be improved through the development of GIS maps, identifying optimal locations for intensification development, and proposing biophilic strategies across Winnipeg's urban structure. The research suggests that a strong and comprehensive governance framework (integrating technical guidance, incentives, and enforceable environmental policies) is needed to address the future impacts of the new intensification framework. With a new set of policy documents still under development, the City of Winnipeg is at a crucial moment in its history. It has a clear opportunity to recognize and integrate the tenets associated with biophilia in its policies – policies that will guide its development and growth over the next 25 years.

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Appendices

Appendix A – Edmonton Policy Review

Edmonton City Plan

Biophilia/ NBS

No.	Policy	Page	Policy Language	Category	Sub-Category
1.1.1	Promote personal and community wellness and connection through inclusive and welcoming places.	43	suggested	Biophilic / NbS	Urban Green Spaces
1.1.1.2	Design new and retrofit existing open spaces networks to encompass wellness, celebration and ecology at the district level	43			Urban Green Spaces
1.2.1	Promote active communities through the design of diverse, welcoming and playful public places	45	suggested	Biophilic / NbS	Urban Green Spaces
1.2.1.3	Encourage and support the use of public space in formal and informal ways throughout the year.	45			Urban Green Spaces
1.3.1	Promote and celebrate the distinct communities that contribute to Edmonton, its quality of life and unique sense of place.	47	suggested	Biophilic / NbS	Urban Green Spaces
1.3.1.2	Provide opportunities for people to easily connect to and experience open space and features within districts.	47			Urban Green Spaces
1.3.1.5	Encourage high quality urban design that celebrates the unique physical pattern of the city's systems, networks and places.	47			Urban Green Spaces
1.3.2	Support Edmonton's identity as a winter city through its infrastructure, design, events and economy.	48	suggested	Biophilic / NbS	Urban Green Spaces
1.3.2.4	Improve and integrate winter city design through the development of buildings, the public realm and open spaces	48			Urban Green Spaces
1.4.1	Support Edmontonians' transition to a low carbon future in their daily lives.	49	suggested	Biophilic / NbS	Others
1.4.1.5	Provide supports for residents, organizations and businesses to reduce energy use and greenhouse gas emissions and adapt to climate change	49			Others
1.4.2	Ensure Edmonton's air, land and water are safe and clean.	49	required	Biophilic / NbS	Natural Assets
1.4.2.1	Protect, restore, maintain and enhance a system of conserved natural areas within a functioning and interconnected ecological network.	49			Natural Assets

No.	Policy	Page	Policy Language	Category	Sub-Category
1.4.2.2	Partner to effectively manage, monitor and communicate air, land and water quality to protect human and ecosystem health	49			Natural Assets
1.4.2.3	Expand and enhance a healthy and sustainable urban forest.	49			Tree Canopy/ Natural Assets / UGS
2.1.1	Ensure that publicly accessible spaces and facilities are designed and maintained for the year-round safety, security and comfort of all users.	51	required	Biophilic / NbS	Urban Green Spaces
2.1.1.1	Improve access to the North Saskatchewan River Valley and Ravine system.	51			Natural Assets / UGS
2.1.1.5	Develop and retrofit publicly accessible spaces and facilities to incorporate safe access for all Edmontonians.	51			Urban Green Spaces
2.1.2	Support the physical and mental health of Edmontonians by integrating housing, services, amenities and natural systems with active transportation networks.	52	suggested	Biophilic / NbS	Natural Assets / Low Impact Dev
2.1.2.3	Manage the impact of environmental stressors on people and natural systems including excessive noise, air and light pollution.	52			Natural Assets
2.1.2.4	Incorporate nature and natural systems into the built environment	52			Natural Assets / Low Impact Dev
2.1.3	Ensure that development occurs in an orderly and safe manner to protect public health and the environment.	53	required	Biophilic / NbS	Procedures
2.1.3.4	Participate in the planning of regional energy corridors in collaboration with regional partners, agencies and the Government of Alberta.	53			Procedures
2.2.2	Ensure affordable housing and local food options to support social equity and meet the needs of all Edmontonians.	55	required	Biophilic / NbS	Urban Green Spaces
2.2.2.4	Encourage an integrated local food economy through a range of activities and amenities including investment in value-added food processing, local distribution, consumption and disposal.	55			Urban Green Spaces
2.2.2.5	Facilitate local urban agricultural opportunities through education, supportive programming and regulation.	55			Urban Green Spaces
2.4.1	Support ecological function and energy efficiency of Edmonton's built environment.	60	suggested	Biophilic / NbS	Low Impact Dev

No.	Policy	Page	Policy Language	Category	Sub-Category
2.4.1.2	Conserve, restore and reconnect natural areas and ecological networks within the built environment for human and ecosystem health.	60			Low Impact Dev / Urban Green Spaces
2.4.1.3	Pursue emissions-neutral and net-positive infrastructure, buildings and neighbourhoods.	60			Low Impact Dev
2.4.2	Ensure public buildings and infrastructure are sustainable and resilient.	61	required	Biophilic / NbS	Low Impact Dev
2.4.2.1	Manage the impacts of climate change on City assets in the design, maintenance and retrofit of buildings and infrastructure.	61			Low Impact Dev
2.4.2.5	Manage parking and curbside space as a strategic public asset.	61			Urban Green Spaces
2.4.2.6	Prioritize and enable green infrastructure including low impact development solutions.	61			Low Impact Dev
2.4.2.7	Efficiently use public land and develop multifunctional and multipurpose facilities in new and redeveloping neighbourhoods	61			Building Elements
3.4.1	Support Edmontonians in building individual and community capacity to take action on climate change.	69	suggested	Biophilic / NbS	Procedures
3.4.1.1	Expand community relationships to build awareness of actions that residents and businesses can take on climate change.	69			Procedures
3.4.2	Support innovation and private investment in climate-resilient industries and businesses.	69	suggested	Biophilic / NbS	Procedures
3.4.2.4	Collaborate with regional partners to advocate for climate-resilient businesses.	69			Procedures
4.1.1	Support inviting and inclusive transportation options for Edmontonians of all ages, abilities and incomes.	71	suggested	Biophilic / NbS	Urban Green Spaces
4.1.1.4	Enhance street design through building and renewal to improve connectivity, amenity space and beauty	71			Urban Green Spaces / Tree Canopy
5.1.1	Ensure protection, enhancement and opportunities for access to open space and the river valley and ravine system.	78	required	Biophilic / NbS	Natural Assets
5.1.1.1	Provide opportunities for people to access, enjoy and connect to open space and the river valley and ravine system	78			Urban Green Spaces / Natural Assets
5.1.1.3	Expand and enhance Urban Greenways as part of the Green and Blue Network to improve the built and natural environments.	78			Urban Green Spaces

No.	Policy	Page	Policy Language	Category	Sub-Category
5.1.1.6	Acquire lands within the North Saskatchewan River Valley and Ravine System for natural areas protection, open space connectivity and use	78			Natural Assets / UGS
5.1.2	Promote the conservation and restoration of natural systems to improve ecological connectivity and reduce habitat fragmentation.	79	suggested	Biophilic / NbS	Biodiversity
5.1.2.1	Improve the quality and function of habitat greenways and ecological connections within the Green and Blue Network.	79			Natural Assets / UGS
5.1.2.2	Expand and diversify Edmonton's urban tree canopy and native vegetation.	79			Tree Canopy / Biodiversity
5.3.1	Support the conservation of agricultural land to reduce its loss and fragmentation and contribute to economic development and resilience of the food system.	81	suggested	Biophilic / NbS	Urban Green Spaces
5.3.1.1	Facilitate urban agricultural activities and protect agricultural operations through regulation, programming, land use and design.	81			Urban Green Spaces
5.3.1.2	Establish partnerships within the region to advocate for and support the development of a sustainable food system.	81			Procedures
5.3.1.3	Attract innovation and investment in urban agricultural intensification	81			Procedures
5.4.1	Ensure the safety and security of Edmonton's water supply, food systems, infrastructure and natural systems to support long-term resilience to flooding, droughts and extreme weather events.	83	required	Biophilic / NbS	Natural Assets / Low Impact Dev
5.4.1.1	Manage stormwater runoff and improve water quality through the design and development of the built environment.	83			Low Impact Dev
5.4.1.4	Adapt management practices in response to changes in native and invasive species.	83			Biodiversity
6.1.1	Promote city-building solutions with communities through prototyping, partnerships and piloting.	86	suggested	Biophilic / NbS	Procedures
6.1.1.4	Create opportunities for residents to explore and generate solutions through information sharing and open data.	86			Procedures
6.1.1.5	Expand programming and encourage flexible use of open spaces and public facilities year round.	86			Procedures
6.1.2	Promote community-based placemaking to retrofit and redevelop open spaces and public facilities.	87	suggested	Biophilic / NbS	Urban Green Spaces
6.1.2.1	Encourage community led park redevelopment through coordination, planning and design.	87			Urban Green Spaces

No.	Policy	Page	Policy Language	Category	Sub-Category
6.1.2.3	Consider commercial opportunities and amenities within limited areas of the Green and Blue Network	87			Procedures
6.4.1	Promote economic development opportunities to support energy transition.	91	suggested	Biophilic / NbS	Low Impact Dev
6.4.1.2	Partner with businesses and organizations testing and implementing new-to- Edmonton solutions and technologies that support increased climate resilience	91			Procedures / Low Impact Dev
6.4.2	Ensure Edmonton plans and implements climate change mitigation, adaptation and resilience.	91	required	Biophilic / NbS	Procedures
6.4.2.1	Align, implement and monitor climate change mitigation and adaptation planning to meet local, national, and international commitments	91			Procedures

Intensification

No.	Policy	Page	Policy Language	Category	Sub-Category
1.1.1	Promote personal and community wellness and connection through inclusive and welcoming places.	43	suggested	Intensification	Connectivity
1.1.1.4	Encourage healthy and active living by supporting community-focused recreational, leisure, social and cultural programs.	43			Connectivity
1.1.1.5	Develop, enable and animate community hubs for intergenerational gathering.	43			Connectivity
1.2.2	Ensure vibrant and inclusive communities where children, youth and families can live, learn and grow together.	46	required	Intensification	Design
1.2.2.4	Encourage medium and high density residential development that serves households above the average Edmonton household size.	46			Design
1.3.1	Promote and celebrate the distinct communities that contribute to Edmonton, its quality of life and unique sense of place.	47	suggested	Intensification	Design
1.3.1.1	Establish and invigorate districts where daily life, work and play intersect.	47			Design
2.2.1	Promote compact, mixed-use development within districts that supports equitable access to employment, education and amenities.	54	suggested	Intensification	Design / Location
2.2.1.1	Design and retrofit street layouts to facilitate intensification and ongoing adaptability.	54			Design
2.2.1.2	Improve local open space and public amenities to support density increases.	54			Design

No.	Policy	Page	Policy Language	Category	Sub-Category
2.2.1.4	Use full City authority in the provision of environmental reserve, municipal reserve, or municipal or school reserve, or cash-in-lieu in accordance with the Municipal Government Act.	54			Procedures
2.2.1.5	Facilitate housing and job growth and intensification within nodes and corridors.	54			Location
2.2.1.6	Enable ongoing residential infill to occur at a variety of scales, densities and designs within all parts of the residential area.	54			Design
2.2.3	Ensure that walkable and attractive mixed use development occurs at nodes and along corridors in a manner that is integrated with accessible mass transit.	56	required	Intensification	Location / connectivity
2.2.3.5	Prioritize the building, activation and maintenance of beautiful, comfortable public spaces at nodes and corridors.	56			Location
2.3.1	Promote opportunities to accommodate growth through the compact development of new and existing neighbourhoods.	57	suggested	Intensification	Design
2.3.1.2	Encourage residential and non-residential redevelopment that contributes to the livability and adaptability of districts.	57			Design
2.3.1.4	Strategically expand infrastructure capacity to enable future redevelopment and intensification in alignment with priority growth areas	57			Design
2.3.1.5	Sequence development and align infrastructure upgrades to leverage and optimize existing infrastructure.	57			Procedures
2.3.2	Ensure that growth is managed with regard to long term fiscal impacts and full lifecycle costs of infrastructure and services.	58	required	Intensification	Procedures
2.3.2.6	Require that all districts meet or exceed regional density targets as they develop and redevelop over time.	58			Procedures / Design
3.3.1	Support opportunities for local economic and community resilience through development, revitalization and renewal.	67	suggested	Intensification	Procedures
3.3.1.2	Align resources and partner with business improvement areas and similar groups to attract, retain and expand businesses	67			Procedures
4.2.1	Ensure that transportation investment supports urban intensification and diversification	73	required	Intensification	Connectivity
4.2.1.2	Plan and design active transportation and transit networks in support of nodes and corridors.	73			Connectivity

No.	Policy	Page	Policy Language	Category	Sub-Category
4.2.1.3	Adapt City operations, equipment and infrastructure to contribute to intensification	73			Procedures
4.2.2	Ensure a mobility system where people can move seamlessly from one travel option to another to conveniently fulfill their daily needs.	74	required	Intensification	Connectivity
4.2.2.1	Incorporate mobility hubs in select nodes.	74			Connectivity / Location
4.2.2.3	Integrate transit facilities with active transportation networks and include supportive amenities.	74			Connectivity
6.2.2	Promote a well connected, attractive and delightful city through beautiful architecture, animation and urban design excellence.	88	suggested	Intensification	Design
6.2.2.2	Incorporate a high standard of design for public and private development with an emphasis at nodes, corridors and city entrances.	88			Design / Location

Infill Roadmap 2018

	Action	Sub-Category
Knowledge	Action 1. Prioritize infill at key nodes and corridors	Location
	Where and what kinds of investments the City should make	
	Help the private development industry make decisions about where to invest	
	Action 2. Review infrastructure capacity	Design
	Review infrastructure capacity in Edmonton's older neighbourhoods and identify the infrastructure investments needed to support infill	
	Proactively assess that capacity for larger areas of Edmonton's older neighbourhoods	
	Capacity available for services such as stormwater, sewer, water, and transportation	
	Review of existing levels of service for quality, quantity, reliability, responsiveness, safety and cost	
	Take into consideration the preferred level of service that will be established	
	A later phase of this action could integrate work to reduce the demand on energy infrastructure through tactics like improving the efficiency of buildings	
	Action 3. Investigate opportunities for tiny homes	Design
	Action 4. Re-examine collective housing regulations	Design
Collaboration	Action 5. Partner to pilot innovative housing	Procedures
	Action 6. Improve housing affordability	Procedures
	Action 7. Address land assembly and mixed use	Design
	Challenges associated with land assembly and financing mixed-use developments	
	Potential tools - density bonusing	
	Action 8. Pilot alley enhancements	Design
	Improving alley livability that incentivises laneway housing development	

	Action	Sub-Category
	Placemaking features, additional lighting and alternative surface treatments	
	Idenitify where alley improvements may be best located	
Advocacy	Action 9. Better inform residents	Procedures
	Resources and education opportunities are available	
	Action 10. Incentivize accessible laneway homes	Design
	Action 11. Create optimal infill map	Procedures
	Create a publicly available map of optimal infill development locations for medium, high scale and mixed use developments based on best evidence and neighbourhood level indicators	
	Online dashboard and map that complies development activity trends, available infrastructure capacity, neighbourhood indicators and other evidence to identify the areas in Edmonton that are best suited for medium scale, high scale and mixed-use infill development	
	Action 12. Reduce barriers to use of Low Impact Development	Design
	Reduce barriers to the use of Low Impact Development practices for low and medium scale infill	
	Efforts to make better use of stormwater, to protect our rivers, and to reduce the impact of sudden weather events on our older neighbourhoods	
	The existing *Low Impact Development Best Management Practices Design Guide* is an abundant resource providing site developers with options to improve their on-site water management	
	Considerations would be made for both site developers and individual homeowners wanting to participate in creating more environmentally sustainable solutions for stormwater runoff	
	Changes to Zoning Bylaw regulations such as soil depth, landscaping requirements for permeable surfaces and lot grading solutions such as common swales	
Process	Action 13. Monitor and address construction issues	Design
	Monitor and make the necessary improvements to regulate how the City addresses emerging issues related to infill construction	
	Monitor issues related to infill development such as changing construction practices or declining tree canopies	
	Regulatory changes to help encourage good construction practices and mature tree protection	
	Action 14. Improve permitting process timelines and consistency	Procedures
	Action 15. Review, update or retire plans and policies	Procedures
	Develop a process to review and update or retire plans and policies that are not aligned with current policy and regulations	
	The policies and plans could be replaced with a modern and simplified infill policy framework	
	Action 16. Develop infrastructure cost sharing system	Design
	Action 17. Improve lot grading	Design
	Investigate new processes and mechanisms to improve lot grading in infill situations	
	Research into best practices, and innovative drainage techniques and enforcement	

	Action	Sub-Category
	Private drainage improvements, such as Low Impact Development strategies, allowing more intensive plantings as on-site stormwater management or implementing block-level stormwater management practices	
Rules	Action 18. Improve medium scale zones	Design
	Action 19. Simplify low scale zones	Design
	Action 20. Reduce parking requirements	Design
	Reduce barriers to infill caused by parking requirements as part of the Comprehensive Parking Review	
	Examining how parking requirements impact the cost of infill development	
	Ways to reduce the costs, such as tying parking requirements to a site's development context	
	Action 21. Increase opportunities for semi-detached housing	Design
	Action 22. Create opportunities for small apartment buildings	Design
	Action 23. Create opportunities for more suites on a property	Design
	Action 24. Remove zoning barriers for medium scale	Design
	Action 25. Integrate urban design into Zoning Bylaw	Design
	Integrate urban design regulations into the Zoning Bylaw through the Zoning Bylaw Renewal project	
	This may include regulations on building-street interfaces, building orientation, site layout and pedestrian Access	

Appendix B – Winnipeg Policy Review

OurWinnipeg 2045

No.	Policy	Page	Policy Language	Category	Sub-Category
1. Leadership and Good Governance					
1	Establish and implement priority actions through evidence-informed decision-making processes.	18	required	Biophilia / NBS	Procedures
3	Achieve community-responsive service delivery through an aligned, integrated, collaborative and results-oriented organizational culture.	18	required	Biophilia / NBS	Procedures
1.1	Organizational Alignment. All City policy implementation and enforcement tools must be aligned with the localized United Nations Sustainable Development Goals framework, consisting of Leadership and Good Governance; Environmental Resilience; Economic Prosperity, Good Health and Well-Being; Social Equity; and City Building contained in this Plan.	18	required	Biophilia / NBS	Procedures
1.3	Integrated Service Planning and Outcomes. Advance operational implementation plans that align with this Plan's sustainability goals through responsive, innovative and integrated government leadership.	18	Suggested	Biophilia / NBS	Procedures
1.9	Responsive Change Management. Monitor and evaluate municipal investment and divestment, activities, risk of action or inaction, and outcomes for effectiveness, through a relevant set of sustainability goal indicators, benchmarks and targets, and analysis of local and global community trends.	19	Suggested	Biophilia / NBS	Procedures
1.12	Integrated Regional Planning. Partner with Indigenous governments, community leaders and the Winnipeg Metropolitan Region as stakeholders in coordinating and investing in climate change mitigation and adaptation, regional economic competitiveness, and cost-sharing resiliency and adaptability. Areas of partnership should include policy areas such as land resource and watershed management, natural area and urban forest canopy conservation, housing choice, communications technology infrastructure, connectivity, and sustainable infrastructure development and maintenance.	19	required	Biophilia / NBS	Procedures

No.	Policy	Page	Policy Language	Category	Sub-Category
1.17	Neighbourhood Needs Assessment. Invest in neighbourhood revitalization and supportive land uses, without contributing to gentrification or the displacement of systemically disadvantaged people, by layering interdepartmental and community data to better understand socio-economic needs, gaps and resource pooling required for collaborative action.	20	Suggested	Intensification	Procedures
2.Environmental Resilience					
1	Prioritize the transition to a resilient, low-carbon future through demonstrated organizational and community leadership, and collaborative actions that mitigate and adapt to a changing climate.	21	Suggested	Biophilia / NBS	Low Impact Dev
2	Prioritize sustainable transportation as the mobility options of choice.	21	Suggested	Biophilia / NBS	Low Impact Dev
3	Promote low-carbon, energy-efficient buildings through low-energy design, construction and retrofitting.	21	Suggested	Biophilia / NBS	Building Elements
4	Minimize and divert waste from landfill.	21	Suggested	Biophilia / NBS	Low Impact Dev
5	Protect and value ecosystems as essential components to quality of life.	21	Suggested	Biophilia / NBS	Natural Assets
2.1	Climate Action Targets. Achieve an overall greenhouse gas emissions reduction target of 20 percent by 2030 and 80 percent by 2050, relative to 2011, through partnerships with the community, businesses, governments and Indigenous leadership.	22	required	Biophilia / NBS	Procedures
2.2	Climate Action Investment. Prioritize the economic benefits of sustainability and climate action in municipal decision-making processes, including the budget, investment planning and procurement processes.	22	required	Biophilia / NBS	Procedures
2.3	Climate Action Leadership. Demonstrate municipal environmental leadership through an integrated, proactive organizational culture that applies innovative practices, including piloting new initiatives and evaluating and sharing results to eliminate the use of fossil fuels and enhance climate resilience in the built and natural environment.	22	required	Biophilia / NBS	Procedures

No.	Policy	Page	Policy Language	Category	Sub-Category
2.4	Climate Resilient Growth. Facilitate compact, dense, complete and physically and virtually connected communities through integrated land use, transportation, and infrastructure planning, to achieve climate change mitigation and adaptation goals and objectives, and greenhouse gas emissions reduction targets.	22	Suggested	Intensification	Procedures
2.5	Climate Resilient Growth. Actively explore innovative approaches to city building, sustainable transportation and related infrastructure capacity enhancements that mitigate the impact of climate risk on infrastructure; leverage targeted densities as detailed in Complete Communities; and minimize conflict between different street functions and users.	22	Suggested	Biophilia / NBS	Low Impact Dev
2.6	Integrated Regional Planning. Enable a collaborative and integrated solution to transportation system connectivity and efficiency on a regional scale, in a manner that addresses infrastructure costs, promotes public health benefits, and reduces greenhouse gas emissions.	22	required	Biophilia / NBS	Procedures
2.7	Air Quality Conservation. Collaborate in community-wide efforts to achieve or exceed local air quality standards, including through the reduction of air pollution and greenhouse gas emissions.	22	Suggested	Biophilia / NBS	Natural Assets
2.12	Eliminate Fossil Fuel Dependence. Reduce greenhouse gas emissions from existing and new buildings, including municipally-owned buildings and facilities, and associated infrastructure, through the promotion of renewable energy sources; energy efficiency use and performance measures; and low-carbon construction, retrofit and demolition methods that maximize the lifecycle of buildings.	23	Suggested	Biophilia / NBS	Building Elements
2.14	Heritage Conservation. Identify, designate, and conserve heritage resources and districts that illustrate the broad range of heritage values, as defined in Complete Communities, while supporting efforts for carbon-neutral and energy-efficient buildings that reduce embodied carbon.	23	required	Biophilia / NBS	Natural Assets

No.	Policy	Page	Policy Language	Category	Sub-Category
2.17	Regional Water Resource Management. Engage in comprehensive watershed planning and partnerships that protect people and property by addressing the long-term capacity of water-related systems and resources, including: potable water quality, flood protection, and storm and wastewater management.	23	Suggested	Biophilia / NBS	Natural Assets
2.19	Leverage Green Infrastructure. Value, protect and integrate green infrastructure solutions within the urban environment, to promote biodiversity and ecosystem integrity and mitigate servicing capacity constrains	23	Suggested	Biophilia / NBS	Low Impact Dev
2.2	Leverage Green Infrastructure. Conserve, manage and enhance parks and natural areas year-round, to support climate change adaptation and mitigation through the ecological functioning of natural systems. Work to improve access to play, social interaction, active living and connection of people with nature.	23	required	Biophilia / NBS	Urban Green Spaces
2.21	Leverage Green Infrastructure. Conserve and enhance the urban forest as a key contributor to good air quality, carbon sequestration, storm water management, efficient energy resource consumption, shade, improved health and well-being, and mitigation of and adaptation to the urban heat island effect.	23	required	Biophilia / NBS	Tree Canopy / UGS
2.22	Local Food Security. Enable sustainable, local, affordable, healthy agricultural food systems that include access to land, scalable production, processing, storage, distribution, preparation, consumption and disposal, to achieve food security and build community cohesion.	23	required	Biophilia / NBS	Urban Green Spaces
3. Economic Prosperity					
2	Advance strategic economic opportunities through a focus on innovation.	24	Suggested	Biophilia / NBS	Low Impact Dev
4	Make strategic use of community and regional assets to optimize local economic competitiveness.	24	Suggested	Biophilia / NBS	Natural Assets
3.2	Strategic Enterprise Supports. Incorporate municipal asset investment and divestment criteria into decision-making that promotes sustainable economic growth, through the evaluation of long-term economic impact and community return on investment.	24	Suggested	Biophilia / NBS	Procedures

No.	Policy	Page	Policy Language	Category	Sub-Category
3.4	Community Economic Development. Facilitate new, community-beneficial economic opportunities by leveraging municipal assets and operations to test innovative solutions including climate-friendly, share- or care-based community economic development through practical application and scalability of technology advancements.	24	Suggested	Biophilia / NBS	Procedures
3.6	Downtown Economic Investment. Prioritize the Downtown by leveraging private and public investments, including entrepreneurship, arts, entertainment, and tourism, that advance its status as an economic driver.	25	required	Intensification	Procedures
3.16	Optimize Facility Access. Maximize the use of existing municipal assets to promote recreation, community development, and social interaction, while optimizing equitable access, infrastructure reinvestments, service delivery methods and resource management.	26	Suggested	Intensification	Procedures
4. Good Health and Well-Being					
1	Enable access to basic needs for good physical and mental health.	27	Suggested	Biophilia / NBS	Urban Green Spaces
2	Support positive health outcomes through the built and natural environments.	27	Suggested	Biophilia / NBS	Urban Green Spaces
4.5	Healthy Food. Pursue access to locally-sourced, healthy food production and distribution as a fundamental component of community health, climate change mitigation and poverty reduction.	27	Suggested	Biophilia / NBS	Urban Green Spaces
4.7	Community Safety. Provide capacity to prepare, mitigate, assess risk, respond to and recover from the impacts of climate change, extreme weather, human or natural emergencies, disasters, and diseases, to promote community resilience within a changing hazard landscape.	27	required	Biophilia / NBS	Low Impact Dev
4.9	Inclusive Public Places. Provide and promote the amenities, and the design and maintenance standards, necessary to ensure accessible, safe and sanitary conditions in gathering spaces frequented by the public.	28	required	Biophilia / NBS	Urban Green Spaces

No.	Policy	Page	Policy Language	Category	Sub-Category
4.11	Equitable Service Access. Prioritize equitable access to recreation and parks systems, services, and infrastructure, in order to: enable active living; connect people and nature; create supportive environments; build community capacity; and achieve desired health outcomes, with a focus on children and youth.	28	required	Biophilia / NBS	Urban Green Spaces
4.12	Inclusive Public Places. Invest in inclusive pedestrian-oriented public amenities, and active transportation in prioritized development areas on Urban Mixed-Use Corridors and other priority routes, to promote year-round accessibility, physical activity and social interaction.	28	required	Biophilia / NBS	Urban Green Spaces
4.13	Inclusive Public Places. Integrate public art and green infrastructure into neighbourhood-scale public gathering spaces, to promote usability, beauty, pride, belonging and sense of place.	28	Suggested	Biophilia / NBS	Urban Green Spaces
6. City Building					
1	Responsibly plan, prioritize and accommodate growth in areas that best support Complete Communities principles, to achieve this Plan's sustainable development goals	31	Suggested	Intensification	Location
2	Integrate resilient land use, transportation and infrastructure planning, and investments.	31	Suggested	Biophilia / NBS	Low Impact Dev
3	Facilitate development opportunities that complete established communities, and plan new communities as complete and connected from the outset.	31	Suggested	Intensification	Location
6.1	Established Neighbourhoods. Designate Established Neighbourhoods within the Urban Structure, representing lands that will accommodate additional growth in a context-sensitive manner, while promoting the efficient use of land, cost-effective municipal servicing, enhanced housing choice and affordability, and conservation of green infrastructure and heritage resources and districts, as defined in Complete Communities.	32	Suggested	Intensification	Location
6.4	Urban Structure. Distinguish Urban Structure areas, based on their ability to accommodate growth and change through Transformative Areas and Established Neighbourhoods.	31	Suggested	Intensification	Location

No.	Policy	Page	Policy Language	Category	Sub-Category
6.5	Climate Resilient Growth. The intensification target adopted in Complete Communities must align with climate change mitigation and adaptation goals, objectives, and adopted greenhouse gas emissions reduction targets.	31	required	Intensification	Procedures
6.6	Intensification Target. Achieve the intensification target by making development in existing built-up areas easier and more desirable and predictable, as directed in Complete Communities.	32	required	Intensification	Procedures
6.8	Plan For and Accommodate Forecasted Growth. Provide for predictable development, through the timely delivery of City-funded growth-enabling and growth-supportive infrastructure, within the City's financial capacity.	32	required	Intensification	Design
6.9	Transformative Areas. Designate Downtown, Corridors, Mixed Use Centres, Major Redevelopment Sites and New Communities as Transformative Areas within the Urban Structure in Complete Communities, representing lands that provide the best opportunities to accommodate significant growth and change.	32	Suggested	Intensification	Location
6.11	Downtown Economic Investment. Support development that reflects the Downtown's designation as a Transformative Area and preeminent complete community, as detailed in Complete Communities.	32	Suggested	Intensification	Location
6.12	Downtown Economic Investment. Facilitate the intensification of Downtown commercial and office uses, innovation, and local enterprises that promote the Downtown as a primary location for economic activity.	32	Suggested	Intensification	Design
6.13	Downtown Economic Investment. Facilitate the intensification of Downtown residential development that supports the diversity of housing needs and builds on the character of existing Downtown districts and destinations.	32	Suggested	Intensification	Design

No.	Policy	Page	Policy Language	Category	Sub-Category
6.14	Corridors. Designate Corridors within the Urban Structure as targeted segments of the primary transit network that provide the best opportunity for mixed use intensification outside of the Downtown. Prioritize the creation and maintenance of vibrant pedestrian and transit-oriented places in Urban Mixed-Use Corridors, while encouraging the transition of Regional Mixed-Use Corridors towards this character over the longer term.	33	required	Intensification	Location
6.16	Complete Streets. Apply complete streets principles in the design, reconstruction, construction and operation of designated Urban Mixed-Use Corridors, and other areas of the city where appropriate, to enhance the safety and usability of a mixed transportation network based on a hierarchy of users which safeguards those most at risk of fatality and injury.	33	Suggested	Intensification	Design
6.17	Urban Mixed-Use Corridors. Prioritize the creation of a comfortable pedestrian environment and attractive public realm along Urban Mixed-Use Corridors through design guidelines and infrastructure investments.	33	Suggested	Intensification	Design
6.18	Transit-Oriented Development. Support Rapid Transit and other primary transit corridors with strategically located transit stations, that facilitate transit ridership through development intensification, a mix of complementary land uses, and a pedestrian and cycling-friendly environment consistent with transit-oriented development principles.	33	Suggested	Intensification	Connectivity
6.24	Reinvestment Areas. Identify Reinvestment Areas as representing a subset of Mature Communities that normally have a desirable character but would benefit from reinvestment through infill and redevelopment.	33	Suggested	Intensification	Location
6.27	Major Open Space. Designate Major Open Spaces within the Urban Structure, to represent areas of City-wide importance that have important natural habitat and provide for passive nature-oriented activities and a variety of active recreation areas, and conservation of natural features and habitats that promote this Plan's goals.	33	Suggested	Biophilia / NBS	Urban Green Spaces

No.	Policy	Page	Policy Language	Category	Sub-Category
6.35	Inclusive Public Places. Practice and enforce a high standard of urban design, that supports a sustainable quality of life and sense of place through the development of a safe, resilient, high-quality, high-functioning and pedestrian-oriented urban environment.	34	required	Biophilia / NBS	Urban Green Spaces
6.36	Inclusive Public Places. Leverage investment in public amenities in partnership with private investors, to create a safe, vibrant, and pedestrian-oriented public realm in areas prioritized for mixed-use development.	34	Suggested	Biophilia / NBS	Procedures
6.38	Compatible Growth. Protect green and built infrastructure from incompatible development that would compromise achievement of this Plan's goals.	34	Suggested	Biophilia / NBS	Urban Green Spaces
6.40	Brownfield Land. Collaborate with other levels of government and stakeholder partners in pursuit of the context-sensitive remediation and redevelopment of brownfield lands, in keeping with this Plan's goals.	34	Suggested	Biophilia / NBS	Procedures

Complete Communities 2.0

No.	Policy	Page	Policy Language	Category	Sub-Category
	GENERAL GROWTH				
1.0	Ensure forecasted growth is responsibly planned.	20	required	Intensification	Location
1.1.1	Recognize the Urban Structure as the guiding vision for the growth and development of the city. Within the Urban Structure, distinguish areas based on their ability to accommodate growth and change through Transformative Areas and Established Neighbourhoods.	20		Intensification	Location
1.1.6	Optimize existing infrastructure and services.	20		Intensification	Design
2.0	Encourage strategic intensification.	20	suggested	Intensification	Design
2.1	Aim for a minimum of 50% of all new dwelling units to be located in the existing built-up area.	20		Intensification	Location
2.2	To help measure achievement of the intensification target, use the following benchmarks for new dwelling units in the existing built-up area: • 20% of all new single-family and semi-detached dwellings	20		Intensification	Design

No.	Policy	Page	Policy Language	Category	Sub-Category
	• 50% of all new row houses				
	• 75% of all new apartment units				
2.3	Aim to establish a minimum of 350 new dwelling units per year in the Downtown each year until 2030, and 500 dwelling units per year after 2030	20		Intensification	Design
2.4	Work to achieve the intensification target by making development in the existing built-up area easier, more desirable, and more predictable through the use of the following approaches:	20		Intensification	Design
2.4.2	Leverage tools such as planning, infrastructure investment (including public realm improvements), and fiscal tools to enable growth where directed by this By-law.	20		Intensification	Design
2.4.3.2	Request that the Province of Manitoba change existing legislation to allow the City to enter into development agreements with developers via the development permit process.	20		Intensification	Procedures
2.4.3.3	Prioritize a review of the ability of existing water, wastewater, and land drainage infrastructure to support growth in the existing built-up area, where directed by this By-law.	20		Intensification	Design
3.0	Direct the highest residential and employment densities to areas that can provide the best transit service.	22	required	Intensification	Connectivity
3.1	Where compatible with surrounding land uses and subject to other applicable policies of this By-law, direct the highest multifamily residential densities to the areas that provide the best transit service.	22		Intensification	Connectivity
5.0	Monitor development trends on an ongoing basis.	28	suggested	Intensification	Procedures
5.1	Undertake updated long-run population and housing forecasts at least once every five years to serve as a common basis for all long-range planning activities undertaken by the City	28		Intensification	Procedures
5.2	Report annually to Council on:	28		Intensification	Procedures
	a. Residential development patterns and the City's progress towards achieving the intensification target;				
	b. Actions undertaken by the City in the previous year aimed at achieving the intensification target;				
	c. The supply of vacant serviced and planned greenfield land; and				
	d. Other contextual economic measures as appropriate.				

No.	Policy	Page	Policy Language	Category	Sub-Category
6.0	Use tools to enable residential, commercial, and office growth that best achieves Complete Communities principles.	29	suggested	Intensification	Location
6.1	Consider the following prioritization when using enabling tools to facilitate residential, commercial, and office development: 1.Downtown 2.Corridors (which may include properties within 200 metres of these Corridors) a.Priority Corridors (Map 5, Corridor Map) b.All other Corridors 3.Existing built-up area 4.Greenfield development in accordance with phasing plan	29		Intensification	Location
7.0	Leverage growth to promote climate change resiliency.	29	suggested	Intensification	Design
7.1	Promote sustainable building practices with a focus on net zero carbon and energy efficiency building standards.	29		Intensification	Design
7.2	Capitalize on opportunities to improve the quality and expand the quantity of the urban forest canopy to achieve an overall increase in canopy coverage and to reduce the urban heat island effect.	29		Biophilic / NbS	Tree Canopy
FINANCING GROWTH					
2.0	Strive for financially sustainable city infrastructure, capital assets, and services.	31	suggested	Int / NbS	Procedures
2.2	Categorize and prioritize capital projects based on their growth-enabling infrastructure or growth-supportive infrastructure status.	31		Int / NbS	Procedures
3.0	Ensure growth is fiscally sustainable.	32	required	Intensification	Procedures
3.1	Establish and implement financial tools to finance the City's share of land development costs.	32		Intensification	Procedures
3.4.2	Identify major growth-related capital works that require direct investment from the provincial and/or federal government.	32		Intensification	Procedures
3.4.3	Review funding formulas for grants and other contributions relating to growth.	32		Intensification	Procedures
SERVICING					
1.0	Ensure that the majority of new development in built up areas are supported by a full range of municipal services.	34	required	Biophilic / NbS	Low Impact Dev
1.2	Consider sustainable alternatives to a full range of municipal services where the following conditions are satisfied:	34		Biophilic / NbS	Low Impact Dev

No.	Policy	Page	Policy Language	Category	Sub-Category
	a. The applicant can demonstrate that the alternative provides a comparable level of service and safety in an environmentally-sound and economical manner; and				
	b. The alternative has been accepted as satisfactory by the Directors of Public Works, Water and Waste, and Planning, Property & Development.				
DOWNTOWN					
1.0	Ensure coordinated planning Downtown.	40	required	Intensification	Procedures
1.3	Identify nodes, corridors, and meeting places that complement Downtown's districts, destinations and clusters by serving as key gateways and meeting places, with a focus on pedestrian-oriented, active uses	40		Intensification	Location
1.7	Develop a Downtown plan that:	40		Intensification	Procedures
	a. Clearly articulates/defines a framework of districts, nodes, destinations, and corridors;				
	b. Defines a vision, parameters, and policies for future development and redevelopment, all modes of transportation, the transportation network, and urban design.				
1.8	Define appropriate targets and indicators for redevelopment and intensification in each district, which include:	41		Intensification	Procedures
	a. Targets related to Downtown urban canopy and Downtown greenspace;				
	b. District-specific residential growth targets to ensure defined Downtown districts attain population numbers that will enable these districts to maintain safety, achieve an enjoyable walking environment, and support and attract amenities; and				
	c. Indicators to measure success or show improvement in areas such as environmental responsibility, amount of greenspace, safety, economic activity etc.				
1.9	Review policies, regulations, and administrative processes, in consultation with key stakeholders, to ensure they are streamlined, enriched, and clarified to support Downtown businesses and development.	41		Intensification	Procedures
2.0	Reinforce downtown as the primary focus for economic activity through residential, commercial, and office intensification.	42	required	Intensification	Design

No.	Policy	Page	Policy Language	Category	Sub-Category
2.2	Facilitate the redevelopment of vacant or underutilized properties, such as surface parking lots, to support increased residential and mixed-use development, when servicing allows, to achieve a sustainable, inclusive and vibrant Downtown.	42		Intensification	Location
2.3	Invest in strategic transit and public realm improvements to facilitate and support residential and commercial growth in Downtown.	42		Intensification	Connectivity
2.5	Work with the Province and key stakeholders to establish building code equivalencies to facilitate the adaptive reuse of heritage buildings.	42		Intensification	Design
3.0	Ensure inclusive housing Downtown reflects the diversity of Winnipeg's population.	42	required	Intensification	Procedures
3.1	Continue to facilitate residential development and residential rehabilitation or reinvestment through strategic use of incentives (such as Tax Increment Financing) that advance affordable housing and address additional Downtown housing needs.	42		Intensification	Procedures
4.0	Ensure land use decisions reduce the impact of automobile use to enhance the pedestrian experience Downtown.	43	required	Biophilic / NbS	Urban Green Spaces
4.2	Establish surface parking licensing program and fees for Downtown standalone surface parking lots, to address landscaping and safety issues, encourage redevelopment and ensure surface parking lots are safe, high-quality, visually appealing, and functional, in accordance with the Downtown Parking Strategy.	43		Biophilic / NbS	Urban Green Spaces
5.0	Facilitate an amenity-rich, enjoyable, and beautiful urban environment that contributes to a high quality of life, to reflect Downtown's importance as the city's preeminent complete community.	43	suggested	Intensification	Design
5.1	Encourage development with uses and amenities that support the Downtown residential population.	43		Intensification	Design
5.3	Facilitate the provision of public and/or private neighbourhood-based amenities in Downtown districts such as public spaces, pedestrian improvements, streetscaping, and recreational amenities.	43		Intensification	Design
5.4	Ensure Crime Prevention Through Environmental Design (CPTED) principles are integrated into development to increase safety and perceptions of safety.	43		Biophilic / NbS	Urban Green Spaces
6.0	Ensure walking is a mode of preference, and that pedestrian comfort, convenience, and amenity	44	required	Intensification	Connectivity

No.	Policy	Page	Policy Language	Category	Sub-Category
	continue to be primary determinants of design decisions.				
6.1	Develop design guidelines for Downtown pedestrian facilities that consider the unique characteristics of each district	44		Intensification	Connectivity
6.3	Complement or enhance established or planned pedestrian routes and weather-protected walkway system in accordance with the Winnipeg Pedestrian and Cycling Strategies and the City of Winnipeg Accessibility Design Standard	44		Intensification	Connectivity
6.5	Enhance the connectivity between Downtown districts by improving pedestrian and cycling facilities in accordance with the Winnipeg Pedestrian and Cycling Strategies and supporting development and redevelopment along strategic routes.	44		Intensification	Connectivity
6.7	Ensure that urban design considerations such as scale, view lines, placemaking, and pedestrian comfort are considered in transportation planning Downtown.	44		Intensification	Design
7.0	Ensure the sustainability of the transportation network by encouraging mode shifts and transportation demand management.	45	required	Intensification	Connectivity
7.3	Support the growth of Winnipeg's pedestrian and cycling network in accordance with the Winnipeg Pedestrian and Cycling Strategies	45		Intensification	Connectivity
7.5	Ensure that the river system continues to be incorporated into the pedestrian network within, to, and from Downtown year-round, including river access points to the formal Riverwalk system as well as access points to winter river trails.	45		Biophilic / NbS	Natural Assets
8.0	Prioritize pedestrian comfort, convenience, and amenities Downtown.	46	required	Intensification	Design
8.9	Encourage the creation of a patio culture to enliven streets and draw people throughout the day	46		Intensification	Design
9.0	Take a leadership role in creating high-quality streets, parks, plazas, and buildings Downtown.	47	suggested	Biophilic / NbS	Urban Green Spaces
9.1	Encourage high-quality public and private buildings, spaces, and streetscapes Downtown that reinforce the unique character of each district.	47		Intensification	Design
9.2	Develop distinct public and private realm design parameters that reflect the development goals of each defined Downtown district.	47		Intensification	Design

No.	Policy	Page	Policy Language	Category	Sub-Category
9.5	Invest in high-quality Downtown public spaces that showcase Winnipeg's civic image and promote private sector investment.	47		Intensification	Procedures
9.6	Showcase exemplary urban design Downtown in City-led initiatives and projects involving City-owned land. Demonstrate energy data transparency and show leadership in green building design, including zero carbon buildings and high energy efficiency such as construction to PassiveHaus standard.	47		Biophilic / NbS	Building Eelements
9.7	Ensure that investment in public spaces Downtown supports year-round, people-oriented activity and integrates connections to other complementary amenities, destinations, and points of interest.	47		Biophilic / NbS	Urban Green Spaces
9.8	Improve the quality and expand the quantity of the urban canopy in both the public realm and on private property over the next five years to achieve an overall increase in the canopy coverage, to enhance pedestrian comfort, enjoyment, and to create a sense of place Downtown.	47		Biophilic / NbS	Tree Canopy
9.9	Add, adapt, and renew parks and public open spaces to meet the needs of the growing and changing Downtown population	47		Biophilic / NbS	Urban Green Spaces
9.10	Seek opportunities through property redevelopment and right-of way-changes to incorporate outdoor green space, plaza space and/or trees where appropriate	47		Biophilic / NbS	Urban Green Spaces
9.11	Use Crime Prevention through Environmental Design (CPTED) principles and the City of Winnipeg Accessibility Design Standard to create a safer, more welcoming, and more accessible public realm.	47		Biophilic / NbS	Urban Green Spaces
10.0	Enhance Downtown as Winnipeg's creative window to the world.	48	suggested	Intensification	Procedures
10.9	Collaborate with stakeholder partners to support the expansion of programming and events taking place in public Downtown venues in all seasons.	48		Intensification	Procedures
CORRIDORS					
1.0	Encourage strategic residential intensification on Corridors.	55	suggested	Intensification	Location
1.2	Where higher intensity commercial or residential uses are interrupted by lengths of low-density residential development along Corridors, higher intensity residential development should be directed towards established nodes.	55		Intensification	Location

No.	Policy	Page	Policy Language	Category	Sub-Category
2.0	Prioritize city investment through focused support of development on Priority Corridors.	55	required	Intensification	Location
2.1	Recognize Priority Corridors as the Corridors that provide the best opportunity to achieve Complete Communities objectives.	55		Intensification	Location
2.2	Consider the following tools to facilitate redevelopment on Priority Corridors: a. Investment in growth-enabling and growth-supportive infrastructure; b. Public realm improvements; c. Financial incentives for development; d. Local area planning; and e. Studying and increasing water, wastewater, and land drainage capacities.	55		Intensification	Procedures
3.0	Ensure Corridors provide a comfortable pedestrian environment and attractive public realm.	55	required	Biophilic / NbS	Urban Green Spaces
3.1	Ensure that development on Urban Mixed-Use Corridors is designed to prioritize a comfortable pedestrian environment and attractive public realm	55		Biophilic / NbS	Urban Green Spaces
3.1.4	Encouraging balconies and public spaces, such as plazas, patios, or other pedestrian amenities.	55		Biophilic / NbS	Urban Green Spaces
3.5	Design the public realm and right-of-way to promote improvements to the pedestrian and cycling environment, including pedestrian- and transit-oriented streetscaping enhancements.	56		Biophilic / NbS	Urban Green Spaces
3.10	Consider the use of tools such as local area planning, zoning, and design guidelines to further implement these design principles.	56		Biophilic / NbS	Procedures
5.0	Use Corridors to provide opportunities to accommodate other compatible land uses.	57	required	Intensification	Design
5.2	Encourage uses such as recreation and sport facilities, cultural facilities, institutions, and others that support concentrations of people and jobs at an appropriate scale.	57		Intensification	Design
6.0	Encourage the integration of land use and transportation.	58	suggested	Intensification	Design
6.1	Ensure the design and use of the public realm supports this By-law's vision for Corridors.	58		Intensification	Design
MAJOR REDEVELOPMENT SITES					
1.0	Promote Transit Oriented Development (TOD) to accommodate growth and change at stations along rapid transit corridors through integrated land use, transportation, and infrastructure planning.	61	suggested	Intensification	Design

No.	Policy	Page	Policy Language	Category	Sub-Category
1.1	Require that the development in Major Redevelopment Sites be guided by a front-end collaborative planning process culminating in a secondary plan.	77		Intensification	Procedures
1.2	Require that a secondary plan in respect of a Major Redevelopment Site provides for the following information, without limitation: a. Land use designations; b. Building details (e.g., density, sizes, heights, placements); c. Transition to adjacent areas and uses; d. External and internal mobility connections (e.g., streets, rear lanes, sidewalks, cycle paths, transit); e. Public realm improvements; f. Identification of current or proposed transit service g. Anticipated subdivisions; h. Parks and open space, including consideration of natural features and riverbanks, if applicable; i. Proposed community facilities; j. Servicing requirements, including green infrastructure qualities such as landscaping features and storm water management; and k. Phasing of development.	77		Intensification	Design
3.0	Design Major Redevelopment Sites as Complete Communities that embody principles of sustainability within a well-designed, walkable, and active transportation friendly environment.	78	suggested	Intensification	Design
3.5	Implement mitigation measures to minimize any negative impacts new development may have on neighbouring streets, parks, and properties	78		Intensification	Design
ESTABLISHED NEIGHBOURHOODS					
1.0	Encourage compatible residential development within Established Neighbourhoods to build more Complete Communities and align with the City's residential intensification target.	93	suggested	Intensification	Location
1.2	Increase the population within Established Neighbourhoods to contribute to the physical renewal and revitalization of older neighbourhoods.	93		Intensification	Location
1.4	Support opportunities for further residential intensification within approximately 400 metres of a rapid transit station, where appropriate and in accordance with the TOD Handbook	93		Intensification	Location

No.	Policy	Page	Policy Language	Category	Sub-Category
1.6	In the absence of a secondary plan guiding the local development of an Established Neighbourhood, intensification should be guided by a number of factors to ensure compatible development, including: a. Existing zoning of the property and adjacent properties; b. Characteristics of the immediately surrounding built form including building mass, height, lot coverage, setbacks, and layout; c. Surrounding uses and their characteristics including residential density and the intensity of commercial and other non-residential uses; d. Characteristics of the lot, including whether it is a corner lot, a larger lot than is typical for the neighbourhood, or the shape of the lot; e. Proximity to Downtown, Mixed Use Centres, Major Redevelopment Sites and Mixed-Use Corridors; f. The supporting street network (ex. local, collector, or arterial streets) and the street network's ability to support proposed development; g. The supporting transit, pedestrian, and active transportation network; and h. The supporting water, wastewater, and land drainage infrastructure and capacity to accommodate a proposed development or ability to make the required upgrades necessary to accommodate a proposed development.	93		Intensification	Design
2.0	Design new development in Established Neighbourhoods to a high standard of urban design and construction to ensure new development adds value to public and private urban spaces to create a sense of place and civic pride.	96	suggested	Biophilic / NbS	Urban Green Spaces
2.1	Single-family buildings should have setbacks that respect existing building alignments on a street. Setbacks should provide adequate space for tree growth and open space.	96		Biophilic / NbS	Tree Canopy
2.2	Encourage the location of commercial or mixed-use buildings at or near the front and corner side property lines to create a pedestrian orientation. Use setbacks to reinforce the public realm through landscaping and pedestrian amenities, such as entryways, patios, benches, and bicycle parking.	96		Biophilic / NbS	Urban Green Spaces

No.	Policy	Page	Policy Language	Category	Sub-Category
2.4	Encourage the use of high-quality, energy efficient, and durable exterior building façade materials. **Incorporate biophilic architecture**	96		Biophilic / NbS	Building Eelements
2.13	Taller buildings should use step backs and roof design to mitigate negative impacts on adjacent properties and provide a more comfortable pedestrian environment.	97		Biophilic / NbS	Building Eelements
2.21	Site design should take cues from the character of the neighbourhood or street and should mitigate the potential for land use conflict with adjacent properties that have different scales, densities and uses. Parking location (motor vehicle and bicycle), vehicular access, servicing elements, building placement and landscaping treatment will be important design elements to ensure context-sensitive design.	97		Biophilic / NbS	Building Eelements
4.0	Ensure neighbourhoods accommodate a range of commercial services and amenities within walking distance to meet daily needs.	98	required	Intensification	Connectivity
6.0	Ensure Neighbourhoods and communities are well served by parks, open spaces, and recreational facilities that contribute to sustainability, wellness, and active living.	100	required	Biophilic / NbS	Urban Green Spaces
6.1	Maintain and improve the quality of open spaces and community facilities in Established Neighbourhoods to ensure the current and future recreational needs of residents are met.	100		Biophilic / NbS	Urban Green Spaces
6.2	Provide a variety of park experiences and opportunities for active and passive enjoyment in all communities in Established Neighbourhoods.	100		Biophilic / NbS	Urban Green Spaces
6.3	The City should acquire lands where possible to add to the linear parkway network and riverbank areas.	100		Biophilic / NbS	Urban Green Spaces
6.4	Where significant intensification of housing occurs within a neighbourhood, ensure parks, open spaces, and community facilities respond to community needs through strategic investment	100		Biophilic / NbS	Urban Green Spaces
6.5	Encourage the expansion of the urban tree canopy on private and public property to improve the aesthetics of properties and streetscapes, assist in storm water management, provide shade, and improve the overall quality of life of our communities.	100		Biophilic / NbS	Tree Canopy

No.	Policy	Page	Policy Language	Category	Sub-Category
6.6	Ensure a variety of public spaces, facilities, parks, and other community amenities are provided in Established Neighbourhoods to support well-being, inclusiveness, and the social fabric of a community.	100		Biophilic / NbS	Urban Green Spaces
6.7	Improve the quality and increase the coverage of the urban tree canopy in Established Neighbourhoods by 10% over the next five years.	100		Biophilic / NbS	Tree Canopy
7.0	Strategically encourage and guide growth within Established Neighbourhoods through the use of secondary plans.	100	suggested	Intensification	Procedures
7.1	Support amendments to existing secondary plans that further the vision, goals and policies of this By-law	100		Intensification	Procedures
7.2	Consider the creation of secondary plans in Established Neighbourhoods when the City determines an area is a strategic location for growth and that more detailed direction is needed for matters beyond the general framework provided by the policies contained within this By-law.	100		Intensification	Procedures
8.0	Facilitate the redevelopment of Established Neighbourhoods that contributes to the further development of walkable, bikeable and transit-oriented communities in accordance with city pedestrian and cycling strategies.	101	suggested	Intensification	Connectivity
8.2	Public investments in the public realm should improve the quality of the pedestrian network and fill in gaps. Particular focus should be given to improving access to high frequency transit, schools, libraries, recreational facilities, and other commercial amenities.	101		Intensification	Connectivity
8.6	Bicycle parking facilities should be integrated into new commercial, multi-family residential and mixed-use development. Bicycle parking facilities should be designed to provide, safe, secure, four season use	101		Intensification	Connectivity
REINVESTMENT AREAS					
2.0	Build on partnerships and channel local knowledge into renewal efforts.	103	suggested	Intensification	Procedures
2.1	Collaborate with community renewal organizations, school boards, and other relevant partners to identify community needs and support revitalization efforts	102		Intensification	Procedures
3.0	Promote land use and design elements to help revitalize Reinvestment Areas.	103	suggested	Biophilic / NbS	Design

No.	Policy	Page	Policy Language	Category	Sub-Category
3.3	Encourage the restoration, re-use, and retention of existing buildings that are economically adaptable for re-use	103		Biophilic / NbS	Design
3.4	Prioritize opportunities for public space and streetscape improvements, while incorporating universally accessible design, age-friendly design, and CPTED principles	103		Biophilic / NbS	Design
4.0	Identify sufficient resources needed to achieve revitalization efforts.	103	suggested	Intensification	Procedures
4.1	Employ tools to increase the impact of interventions in Reinvestment Areas which could include, tax increment financing, community benefit districts, or other similar tools	103		Intensification	Procedures
MAJOR OPEN SPACES					
1.0	Designate and retain lands identified as Major Public Open Space for recreational uses and the preservation of natural habitat.	121	required	Biophilic / NbS	Natural Assets
1.1	Require a Complete Communities 2.0 amendment to re-designate Major Public Open Space to another use.	121		Biophilic / NbS	Procedures
1.3	Re-designating or repurposing areas that are comprised of less than two acres of Major Public Open Space may be processed without requiring a Complete Communities 2.0 amendment, or necessitating a formal secondary plan process, but must be accompanied by a report containing all the requirements outlined in Policy 2.2 of this section	121		Biophilic / NbS	Procedures
2.0	Ensure any redevelopment of Major Private Open Space is well planned and conserves natural features and habitats.	121	required	Biophilic / NbS	Urban Green Spaces
2.2	Require that a secondary plan shall be submitted in respect of Major Open Spaces that provides for the following information, at a minimum:	121		Biophilic / NbS	Procedures
	a. Land use;				
	b. A natural features and habitats inventory coupled with a preliminary natural area and tree preservation report, as outlined in Policy 2.3 of this section;				
	c. Existing provisions on-site and in adjacent neighbourhoods for parks and open space;				
	d. Building details (e.g., density, sizes, heights, and placements);				
	e. Transition to adjacent areas;				
	f. External and internal mobility connections (e.g., streets, sidewalks, cycle paths, transit routes and infrastructure);				

No.	Policy	Page	Policy Language	Category	Sub-Category
	g. Public realm improvements;				
	h. Identification of proposed or current transit service;				
	i. Potential or anticipated subdivisions;				
	j. Proposed community facilities;				
	k. Servicing requirements, including green infrastructure qualities such as landscaping and stormwater manage-ment; and				
	l. Anticipated phasing of development.				
2.3	Require the preparation and submission of a natural area and tree protection report as a component of development applications in a Major Open Spaces which includes:	122		Biophilic / NbS	Procedures
	a. Details of the existing native habitat and tree species, including location, size and condition;				
	b. Details of any associated significant vegetation worthy of protection in accordance with the Ecologically Signif icant Land Strategy or Comprehensive Urban Forestry Strategy;				
	c. Recommendations for natural area and tree protection or preservation;				
	d. A description of tree preservation and protection measures (before, during and after construction) for all trees that are to be preserved on-site;				
	e. Details of all natural area and/or trees proposed for removal;				
	f. Details of tree pruning (crown and roots), as applicable;				
	g. Appraised value of City-owned natural habitat and trees affected by the application. This valuation will be conducted by the City of Winnipeg Urban Forestry Branch in accordance with the City of Winnipeg Tree Removal Guidelines; and				
	h. A schedule for site inspection and status reporting to the City by qualified arborists throughout construction.				
2.4	Require that any redevelopment recognize the diversity and connectivity of natural features and that long-term ecological function and biodiversity of natural features and habitats should be maintained, restored, or, where possible, improved.	122		Biophilic / NbS	Biodiversity

No.	Policy	Page	Policy Language	Category	Sub-Category
2.5	For Public Major Open Space lands, priority areas to be retained for public use and enjoyment will not be governed by any pre-determined limit but shall be maintained as needed to fulfill the following requirements: a. Valued natural features and habitats, as determined through the natural area and tree preservation report; and b. Additional parks and open spaces lands as necessary to: i. Buffer the existing natural areas; ii. Provide connectivity between natural areas; iii. Further protect lands subject to flooding, erosion or bank instability; and iv. Facilitate pathway provision in flood-proof areas and on alignments that don't disturb natural vegetation or significant trees.	122		Biophilic / NbS	Urban Green Spaces
3.0	Promote and encourage the protection and responsible management of trees in Major Open Spaces.	122	suggested	Biophilic / NbS	Tree Canopy
3.1	Develop policies to project significant trees or groupings of trees within Major Open Spaces.	122		Biophilic / NbS	Tree Canopy
CAPITAL REGION					
1.0	Build on recent efforts to work collaboratively as a region.	129	suggested	Intensification	Procedures
1.1	Work collaboratively with regional partners on regional planning initiatives.	129		Intensification	Procedures
2.1	Work with the Winnipeg Metropolitan Region on actionable items derived from the Regional Action Plan	129		Intensification	Procedures
2.3	Coordinate with regional partners and the Province of Manitoba to enhance and maintain a regional transportation network in the Capital Region	129		Intensification	Procedures
2.4	Work with the Winnipeg Metropolitan Region on compiling and monitoring environmental, social, and economic indicators in ongoing planning processes	129		Intensification	Procedures
STRATEGIC INFRASTRUCTURE AND RESOURCES					
9.0	Manage development along riverbanks and within flood prone lands recognizing the value of protecting these lands and the natural limitations and risks associated with building in these areas.	140	suggested	Biophilic / NbS	Natural Assets
9.2	Regulate development in proximity to waterways in order to protect built assets from flooding and natural riverbank processes, with consideration for building lifecycle	140		Biophilic / NbS	Natural Assets

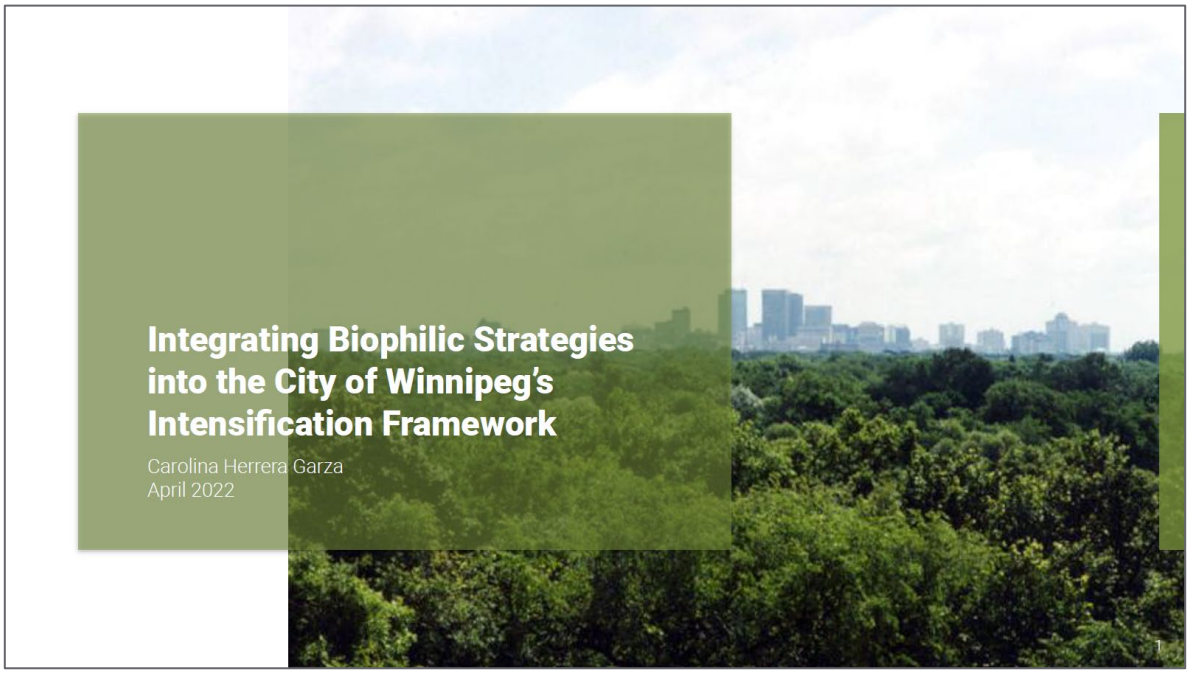
No.	Policy	Page	Policy Language	Category	Sub-Category
9.3	Encourage the preservation of riverbank lands through naturalization, and by establishing and maintaining appropriate riparian vegetation	140		Biophilic / NbS	Natural Assets
PARKS AND RECREATION					
1.0	Ensure land designated for public parks, recreation facilities and supporting open space is sufficient to provide all Winnipeggers ample, year-round opportunities for physical recreation, leisure, play, sport, natural experiences, and active transportation.	142	required	Biophilic / NbS	Urban Green Spaces
1.3	Plan the recreation and park systems from a city-wide perspective, giving consideration to the differing areas of the Urban Structure, and their respective unique character, configuration, and need	142		Biophilic / NbS	Urban Green Spaces
1.4	Create and designate spaces that increase walking and cycling opportunities and promote active mobility and pedestrian connectivity.	142		Biophilic / NbS	Urban Green Spaces
2.0	Ensure land and facilities designated for recreation services, parks, and open space can be developed to serve our changing population's physical and social needs.	142	required	Biophilic / NbS	Urban Green Spaces
2.2	Ensure the high-quality design of park sites, recreation facilities and their amenities that: a. Are interconnected across neighbourhoods and communities; b. Facilitate public access to, movement along, and views of public amenities such as other parks or trails, recre-ation facilities, historic and natural features, other public spaces and other interesting focal points; and c. Encourage year-round activity while accommodating and celebrating Winnipeg as a winter city.	142		Biophilic / NbS	Urban Green Spaces
3.0	Reduce physical, geographic, social, financial and environmental barriers to accessing parks and recreation spaces and natural areas.	143	suggested	Biophilic / NbS	Procedures
3.2	Mitigate the impact of physical barriers, such as busy streets, lack of public transit options, and unsafe pedestrian crossings, when planning the allocation, layout and pedestrian connections to park sites and recreations facilities.	143		Biophilic / NbS	Urban Green Spaces
3.3	Ensure community and regional parks and facilities can be serviced by all modes of transportation.	143		Biophilic / NbS	Urban Green Spaces

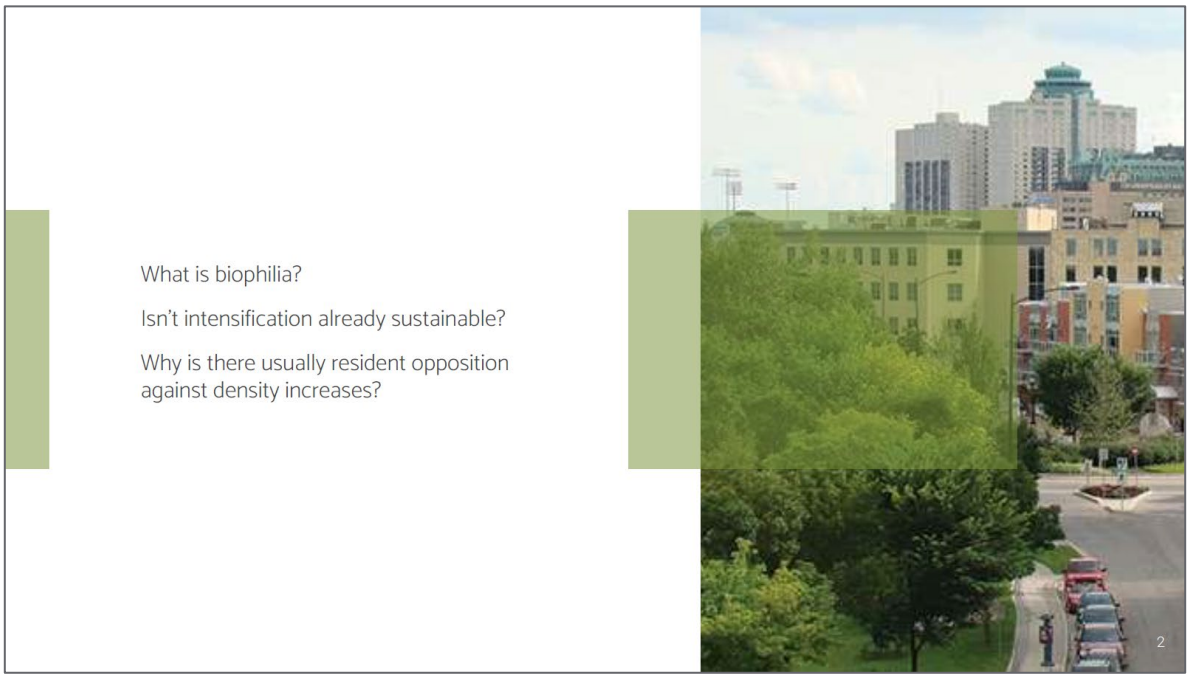
No.	Policy	Page	Policy Language	Category	Sub-Category
4.0	Protect, preserve, and enhance natural areas and historical features to increase opportunities for human interaction with nature and facilitate reflection on our city's cultural past.	143	required	Biophilic / NbS	Natural Assets
4.1	Identify, protect, enhance and restore natural and cultural resources recognized as having historical, ecological, or aesthetic value by incorporating them into the park system.	143		Biophilic / NbS	Natural Assets
4.2	Ensure the design of recreation facilities, parks, and open spaces utilizes climate-sensitive design principles, does not harm archeological and historic resources, and supports other features that further the goals of OurWinnipeg and the Climate Action Plan.	144		Biophilic / NbS	Urban Green Spaces
4.3	Design and manage open space and park areas for their highest environmental and ecological performance:	144		Biophilic / NbS	Urban Green Spaces
4.3.1	Integrate interdisciplinary natural resource goals with planned park, recreation and infrastructure improvements to reduce costs and maximize public benefit.	144		Biophilic / NbS	Urban Green Spaces
4.3.2	Demonstrate a commitment to biodiversity and ecological integrity through planning, regulation, and collaboration.	144		Biophilic / NbS	Biodiversity
4.3.3	Demonstrate the benefits of both natural and restored environments as contributors to quality of life.	144		Biophilic / NbS	Procedures
4.4	Preserve and enhance natural environments by ensuring their harmonious integration into urban development.	144		Biophilic / NbS	Urban Green Spaces
4.4.1	Maintain our "ribbons of green" (riverbanks, urbans street trees, greenways and green corridors) and provide a well-managed urban forest that contributes to air quality, water quality, and high environmental and aesthetic standards.	144		Biophilic / NbS	Urban Green Spaces
4.4.2	Balance the competing needs of development and preservation by establishing requirements for minimum natural area provisions	144		Biophilic / NbS	Procedures
4.4.3	Seek opportunities to educate and instill environmental and cultural values through modeled best practices and strategic passive interpretive opportunities	144		Biophilic / NbS	Procedures
4.5	Establish stronger policy statements within secondary plans to ensure the protection of natural areas	144		Biophilic / NbS	Procedures

No.	Policy	Page	Policy Language	Category	Sub-Category
4.6	Collaborate with environmental and stewardship organizations on shared best practices and implementation strategies	144		Biophilic / NbS	Procedures
5.0	Increase the sustainability of recreation systems and of the lifespan of their infrastructure.	144	suggested	Biophilic / NbS	Procedures
5.5	Recognize the role parks and recreation facilities have in supporting economic development, and tourism	144		Biophilic / NbS	Procedures
5.5.1	Promote parks and recreation facilities as a draw for new developments – by providing both formal and informal neighbourhood focal points and community gathering spaces;	144		Biophilic / NbS	Procedures
5.5.2	Celebrate parks and open spaces as the backdrop to the City's urban image			Biophilic / NbS	Procedures
HOUSING					
3.0	Establish partnerships with the private, not-for-profit and government sectors to provide affordable housing throughout the city, with a particular focus on locations near a variety of transportation options.	147	required	Intensification	Procedures
3.1	Maintain a collaborative approach with outside partners, providing incentives and facilitating processes in order to increase Winnipeg's supply of affordable housing.	147		Intensification	Procedures
3.5	Continue to support investment in neighbourhoods of need through the Housing Revitalization Investment Reserve	147		Intensification	Procedures
URBAN DESIGN					
1.0	Enhance Winnipeg as an exceptional and distinct city through design.	149	suggested	Biophilic / NbS	Urban Green Spaces
1.2	Promote design that responds to the site and local area context in a way that enhances and improves it; especially to significant buildings, landscapes, cultural heritage, and heritage districts, such as the Exchange District	149		Biophilic / NbS	Urban Green Spaces
1.3	Recognize, use, conserve and enhance heritage resources, including districts, buildings, landscapes, and cultural heritage.	149		Biophilic / NbS	Natural Assets
2.0	Promote the design of Winnipeg as a city of vibrant and exciting places.	149	suggested	Biophilic / NbS	Urban Green Spaces
2.2	Incorporate pedestrian amenities such as pedestrian lighting, street trees, and site furniture when undertaking city street rehabilitation or reconstruction in the Downtown and BIZ areas	149		Biophilic / NbS	Urban Green Spaces

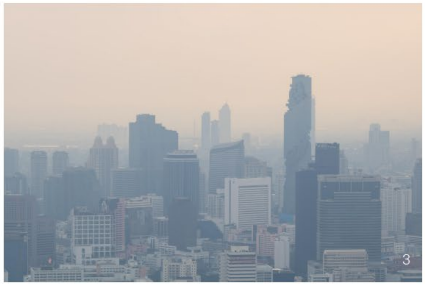
No.	Policy	Page	Policy Language	Category	Sub-Category
2.3	Support Urban Corridors as complete streets by creating guidelines to improve the quality of development and streetscaping on these important community connectors	149		Biophilic / NbS	Urban Green Spaces
4.0	Promote high-quality urban design.	152	suggested	Biophilic / NbS	Tree Canopy
4.6	Strengthen requirements for new developments and additions to existing buildings to retain mature trees, replace lost trees, and plant new trees if none were there originally	152		Biophilic / NbS	Tree Canopy
4.7	Ensure a healthy planting environment in the right-of-way by increasing growing space for street trees where opportunities exist	152		Biophilic / NbS	Tree Canopy
4.8	Use planning tools to implement urban design objectives, which include, but are not limited to: a. Secondary plans; b. Area or category specific design guidelines; c. Zoning By-laws; d. Design review; e. Plan approval; and f. Other tools, as appropriate.	152		Biophilic / NbS	Procedures

Appendix C – Presentation





INCREASING DENSITY CAN LOOK LIKE...



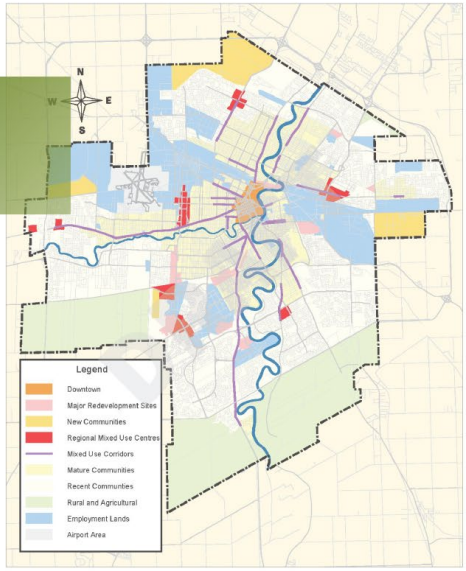
SCENARIO A

air pollution, traffic congestion, loss of green spaces, heat island effect...

SCENARIO B

tree planting and garden beds, permeable surfaces, alternative transportation, active ground level, comfortable micro-environments...

TABLE OF CONTENTS



RESEARCH QUESTIONS

1. What are the main **benefits** of biophilic strategies for intensified urban areas and what are the most common **challenges** to their implementation?

RM - Literature Review

2. What **environmental policies** in *OurWinnipeg 2045* and *Complete Communities 2.0* could help promote the transformation of **Winnipeg** into a biophilic city?

RM - Content Analysis

3. What **environmental policies** does **Edmonton**, being part of a Nature-focused Network, have to inform Winnipeg's intensification framework?

RM - Content Analysis

01

Canadian Housing Crisis - Development Pressure

02

The Winnipeg Metropolitan Region and (draft) *Plan20-50*

03

Federal Sustainability Commitments - Funding Support

03 METHODOLOGY: LITERATURE REVIEW

Intensification
Definition, impacts, sustainability component

Biophilic Cities
Definition, impacts, strategies, design patterns

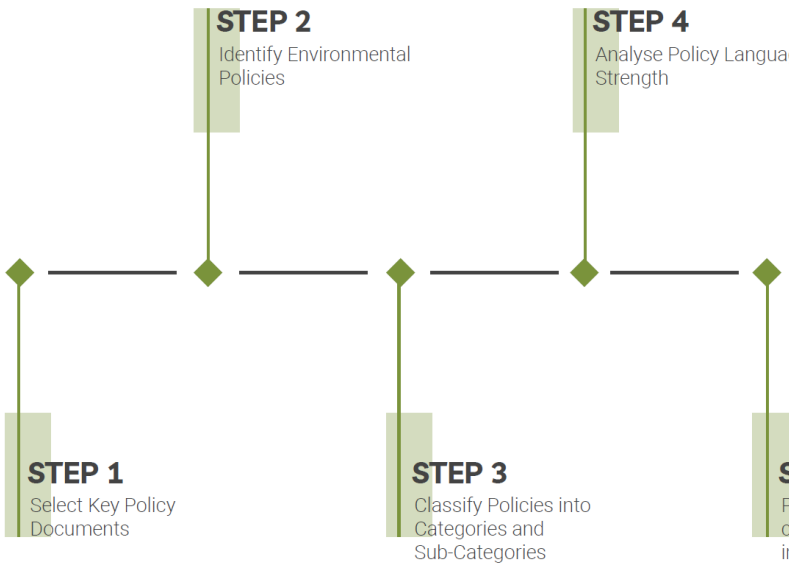
Challenges
Regulatory barriers, limited budget, integrated approach, difficulty to measure results

Legal Mechanisms
Regulations and incentives

Nature-Focused Networks
Biophilic Cities Network, Nature4Cities, UrbanGreenUP, C40 Cities

Precedents
Portland, Chicago, Singapore, Malmö, Izmir

03 METHODOLOGY: CONTENT ANALYSIS



03 METHODOLOGY: CONTENT ANALYSIS

City	Policy Document	Year	Pages
Edmonton	*Edmonton City Plan*	2020	182
	Infill Roadmap	2018	40
Winnipeg	*OurWinnipeg 2045*	In Review	48
	Complete Communities 2.0	In Review	180

03 METHODOLOGY: CONTENT ANALYSIS

Category	Sub-Category	Examples of Related Elements
Intensification	Location	Nodes, corridors, networks, open spaces
	Connectivity	Walkability, access, transportation
	Design	Compact design, mixed uses, public realm, amenities, housing diversity
	Procedures	Stakeholders, timeframes, budget, indicators, targets
Biophilia / Nature-based Solution	Natural Assets & Low Impact Development	Air, land, and water protection, servicing infrastructure, rain gardens, bioswales
	Urban Green Spaces	Open spaces, parks, greenways, community gardens, urban agriculture
	Tree Canopy	Street trees, private and public trees
	Building Elements	Green walls, balcony gardens, green roofs
	Biodiversity	Butterfly gardens, pollinator corridors, bird friendly design
	Procedures	Governance, trade-offs, partnerships, regional approach, social programs, education, indicators, targets

WINNIPEG

- *OurWinnipeg 2045 (draft)*
  - Intensification - Location (33%)
  - Biophilia - Implementation (40%)
- *Complete Communities 2.0 (draft)*
  - Intensification - Design (33%) and Implementation (33%)
  - Biophilia - Urban Green Spaces (56%)
- 54% of the selected policies from both OW2045 and CC 2.0 were “suggested”
- Vision - 17 United Nations Sustainable Development Goals
- Peg System indicators
- Goals: “Environmental Resilience” and “City Building”
- Mature communities and corridors optimal locations for intensification

04 RESULTS & ANALYSIS

EDMONTON

- *Edmonton City Plan*
  - Intensification - Design (46%)
  - Biophilia - Urban Green Spaces (41%)
- Infill Roadmap 2018
  - Design (72%)
- 64% of the selected policies were “suggested”
- Big City Moves: “Greener as We Grow” and “A Rebuildable City”
  - specific targets and strategic measures
- Interconnected networks (district network, nodes and corridors network, green and blue network, and non-residential opportunities network)
- Managing Growth - Logistics of phasing growth over time

ADDRESSING THE RESEARCH QUESTIONS

1. What are the main benefits of biophilic strategies for intensified urban areas and what are the most common challenges to their implementation?
   - Benefits: air quality, climate regulation, biodiversity, recreation, multi-scale urban issues
   - Challenges: regulatory barriers, complex integrated approach, uncertainty of changes, complexity to measure results, limited budget
2. What environmental policies in *OurWinnipeg 2045* (draft) and *Complete Communities 2.0* (draft) could help promote the transformation of Winnipeg into a biophilic city?
   - UN Sustainable Development Goals
   - "Environmental Resilience" Goal
   - Peg System Indicators
3. What environmental policies does Edmonton, being part of a Nature-focused Network, have to inform Winnipeg's intensification framework?
   - "Greener as We Grow" Goal
   - Interconnected Networks
   - Partnerships and Accountability

05 CONCLUSIONS

KEY RECOMMENDATIONS

1. Map Natural Assets and Create a Green Infrastructure Network across Mature Communities.
2. Design Seasonal and Contextual Biophilic Strategies.
3. Support Intensification Policies through a Strong Regional Approach.
4. Integrate Biophilic Strategies within Risk Management and Resilience Programmes.
5. Develop Clear and Comprehensive Implementation Tools.
6. Develop Indicators, Monitor Progress, and Evaluate Results Regularly.
7. Create Public Demonstration Projects and Pilot Programmes.
8. Promote Education, Community Programmes, and Awareness-raising Activities.
9. Join Nature-focused Networks and Create Partnerships.
10. Develop Legal Mechanisms to Increase Enforceability of Environmental Policies.

05 CONCLUSIONS

DIRECTIONS FOR FURTHER RESEARCH

- Regional Planning
- GIS Mapping
- Environmental Justice (gentrification)
- International Policy Documents
- Indigenous Planning

THANK YOU

Does anyone have any questions?

5

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