GROWING THE NETWORK:
CULTIVATING ALTERNATIVE FOOD SYSTEMS IN THE PRAIRIE CITY

by

Ellen Penner

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CONTENTS

ABSTRACT

The province of Alberta faces considerable challenges to food security due to urban expansion into agricultural land, loss of landscape identity, and deficits in fruit and vegetable production. While inefficient global transport results in significant loss of agri-food goods, lack of regional transport and support infrastructure creates substantial barriers for small farmers. This thesis aims to support local industry and provide alternatives to wasteful global networks by developing hybrid transport-agricultural systems at a regional, neighbourhood, and building scale.

This project uses historical patterns of prairie settlement and ecological urbanist ideals of multi-functional infrastructures and environmental capacities to develop an agrarian approach to urban expansion in the city of Calgary. At the terminus station of a future public transit line, an agricultural-innovation centre is designed for a rapidly emerging community, incorporating growing, innovation, transit, and community in order to cultivate productive and cultural connections to agricultural landscapes within the urban realm.

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To Hamza. Your support, encouragement, and strength has been immeasurable as I have explored my architectural ambitions. It means more than I could ever fully express to have had you with me on this adventure.

CHAPTER 1: INTRODUCTION

This thesis is about food – where it comes from, how we get it, and what we are missing. It is a fundamental human necessity, yet many people are completely removed from the processes that bring it to our tables. Modern cities have left agriculture out of the equation, but continuously consume fertile lands in order to grow the urban system. Food is imported into the city from ambiguous, distant landscapes, appearing in supermarkets in a seemingly infinite supply.

These issues are evaluated in the Western Canadian city of Calgary. Although this city was founded on agrarian and ranching ideologies, its modern form experiences the highest percentage of urban growth into agricultural lands in the country. It has been experiencing rapid growth since it was first incorporated as a city over a hundred years ago, undergoing constant development in the urban periphery as the population increases. However, a series of conditions, including lack of geographical boundaries, large scale infrastructure projects, and a historical connection to agrarian identity make it a particularly interesting environment to study the merging of agricultural and suburban landscapes.

The project proposes to nurture a local food system at the level of the region, the neighbourhood, and the building, while focusing on developing networks between these scales. These elements are manifested in an agricultural innovation centre at the terminus location of a future public transit project, connected through both agriculture and transportation to the community, the city, and the overall prairie landscape. By introducing agricultural development into current city growth frameworks, an ecologically focused method of urban expansion is proposed alongside an alternative network to global food systems.

Global Food Systems

Worldwide, the agricultural industry faces significant challenges due to growing populations and increased urbanization. The world population, currently 7.6 billion people, is projected to reach 9.73 billion by 2050. With this increase in population comes the requisite increase in food production – agricultural demand in 2050 will require a 50% increase in food, feed, and biofuels from 2012 levels (FAO 2017, 46). Aggravating these agricultural deficits is the inefficient transportation of goods; one-third of the roughly four billion tonnes of food that is produced is lost or wasted along the food chain (FAO 2017, 112). This product loss in the food system takes place at a variety of levels, from harvest, to processing, to distribution, to consumption. These global food chains are long, relying on many actors to carry out the various stages within the agricultural industry. The longer the chain, the higher chance of food loss within the system.

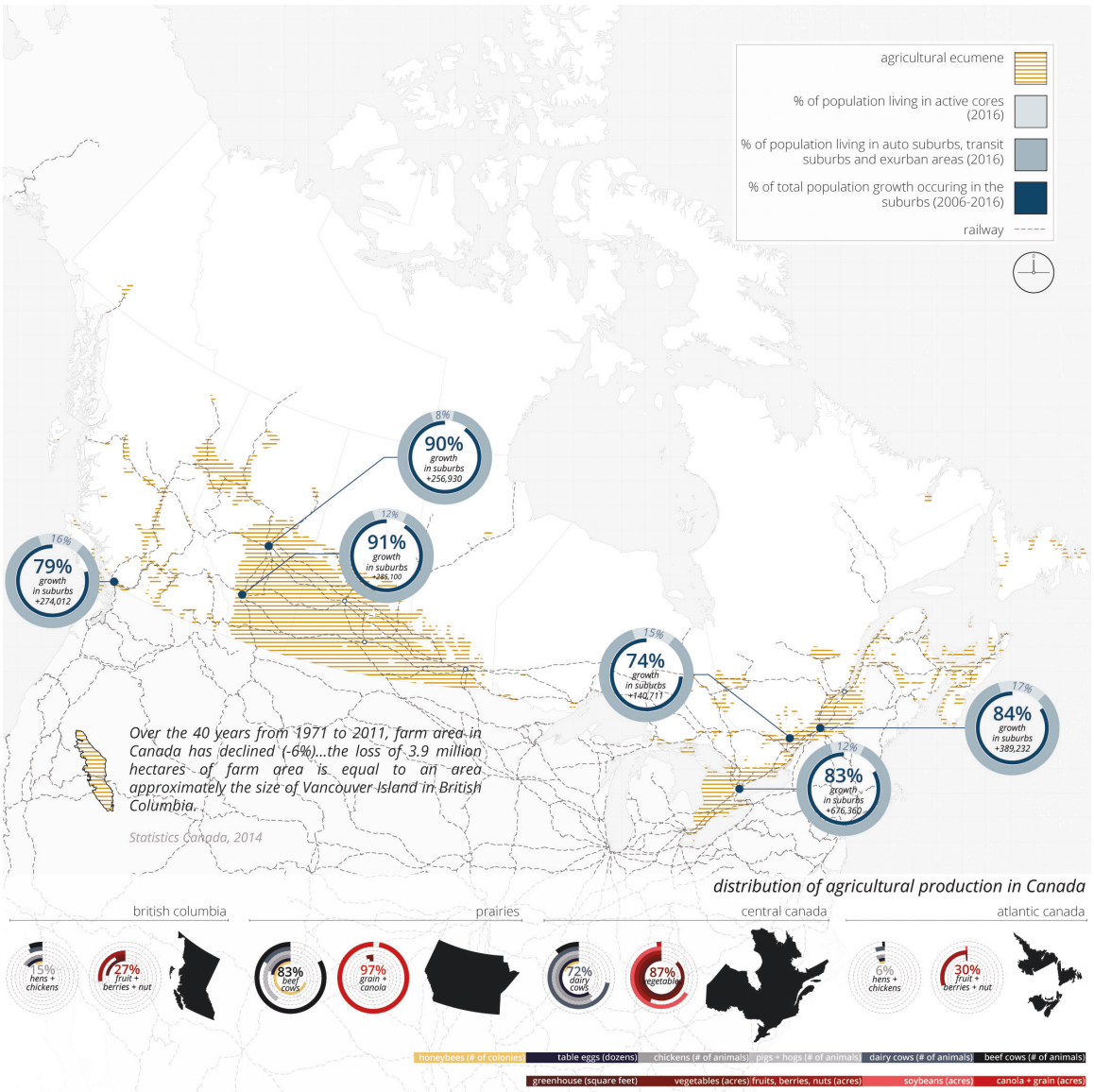
This issue of global food loss is further exacerbated by the increased urbanization of the world population. In the 1980's over 60% of the world lived in rural areas; today, more than 54% of the world is urban, and by 2050 over 66% of the population may be living in urban areas (FAO 2017, 14). Not only does this urban growth require larger imports of food from distant sites of production, but it also contributes to the scarcity of natural resources for agriculture as the growing city overtakes fertile, productive lands. It is these very cities that account for most of the demand for high-value foods such as fruits and vegetables and dairy products (FAO 2017, 140).

Urban Consumption of Agricultural Lands in Canada

City growth in Canada is overwhelmingly suburban. Despite the increased attention to infill projects and the development of

brownfield sites within the urban core, over two-thirds of the national population live in the suburbs, and five times as much population growth is seen on the periphery of metropolitan regions (Gordon, Hendricks and Willms 2017, 4). As shown on page four, the percentage of suburban population growth in the six major metropolitan areas in Canada ranges from 74% (Ottawa) to 91% (Calgary), with less than 18% of the city population living in active urban cores (Gordon, Hendricks and Willms 2017, 5). The expanding city boundaries occurring from this pattern of growth results in the loss of important productive and natural land; in North America, 365 acres of open land and 46 acres of farmland is lost to urban sprawl hourly (Gilham 2002, 75). In Canada, between the years 1971 and 2011, farm area decreased by 9.6 million acres – an area roughly equal to the size of Vancouver Island in British Columbia (Statistics Canada 2014). The horizontal expansion of cities creates a significant strain on Canadian farmland, decreasing the nation's ability to produce its own food and increasing its reliance on global food systems.

Each region in Canada provides an important contribution to the national diet, with the majority of vegetable and fruit production occurring in the coastal and Great Lake regions, and the majority of beef cattle and grain contributions arising from the Prairie provinces (see page four). These regional agri-food contributions are integral to the national food system, and provided over 70% of the food bought by Canadians in 2010. The country is particularly self-sufficient in meat, dairy, and breads and cereals, to which the Prairie provinces make significant contributions (Statistics Canada 2014, 10). However, this self-sufficiency within the country is threatened by the continued loss of agricultural land to urban settlement. As the city becomes more and more disconnected from the farmland it



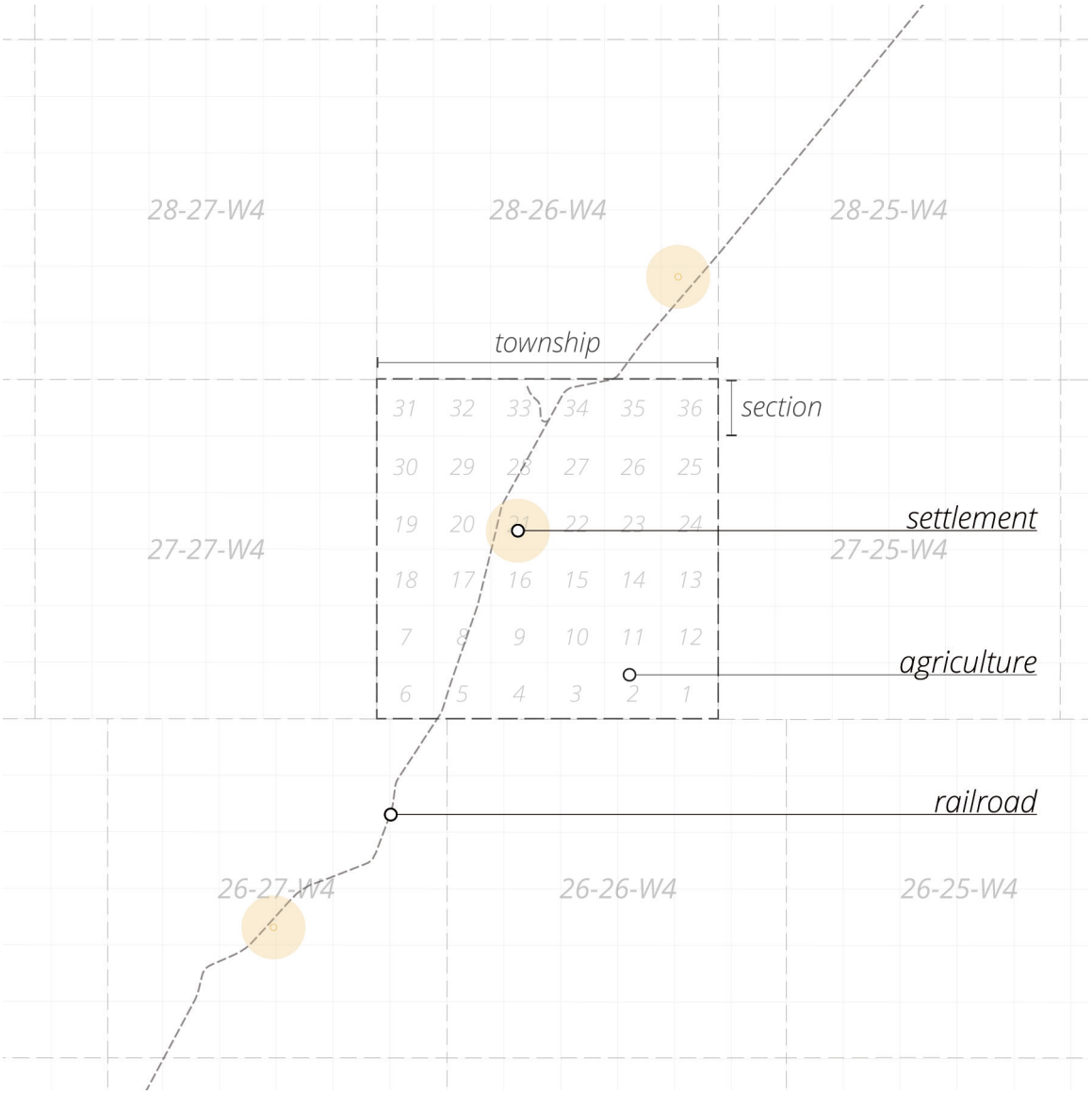
Canadian metropolitan growth into agricultural ecumene, highlighting suburban growth and major regions of agricultural production (Statistics Canada 2017c; Statistics Canada 2018; Natural Resources Canada; Gordon, Hendricks and Willms 2017.).

rests within, it becomes reliant on food that is produced further and further away. Canada's top five agriculture, forestry, fishing, and hunting good import partners include the United States, Mexico, Colombia, Guatemala, and China, primarily relying on the US for 53% of all imported goods (Statistics Canada, 2017b). Despite the vast amount of resources, energy, and logistical requirements for the manufacture and transport of food from these distant countries, the effort required to feed the city is largely hidden from consumers (Steel 2008, 65-67).

The threat to active farmland is made worse by the urban physical and psychological disassociation from productive and natural landscapes. This separation from the rural landscape has resulted in problematic attitudes towards resource use, design values, energy, nature, and technology (Hough 1984, 241). As Hough notes in *Out of Place*,

> [t]he perceptual distinction between what is urban and what is rural is a nostalgic view held by city dwellers who, seeking rural quiet or cheap real estate, are themselves the cause of its disappearance. (Hough 1990, 2)

Rather than an important productive and ecological resource, the rural environment is valued only for its recreational use and settlement capacity (Hough 1984, 206). It has become prospective real estate, rather than a productive, symbiotic extension of cities (Hough 1990, 88). This is particularly true in the Prairie provinces of Canada, where a seemingly endless supply of open land for city expansion is undervalued and overlooked as a fundamental agricultural resource.



The three primary drivers of Canadian western settlement, including the agricultural patterning of the Dominion Land Survey, the railroad stretching across the country, and the regular interval of settlements along the rail.

Historical Patterns of Western Settlement

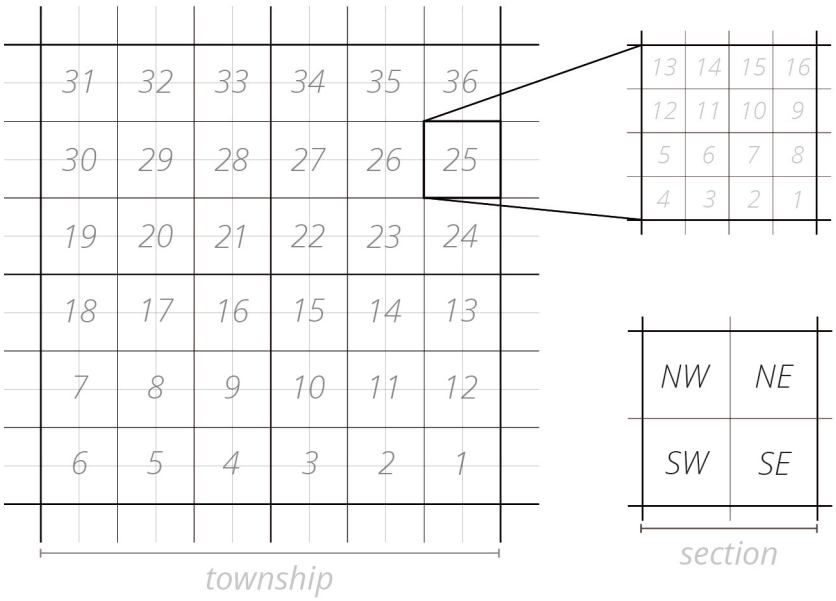
Although current agricultural lands are largely disassociated from the urban environment they support, farmland and settlement patterns in the West were once one and the same. With the colonization of the prairie provinces in the late 1800's, the landscape underwent a massive transformation as a result of three key elements. These major drivers of western expansion were the implementation of the Dominion Land Survey (DLS), the development of a national railway system, and the pattern of settlement arising from the rail and the survey system. By analyzing these historical drivers of growth, a framework for the future of agricultural activities within urban settlements for prairie cities will be explored.

Dominion Land Survey

The DLS in Canada closely followed the Public Land Survey in the United States; ironically, it was implemented in response to the threat of American northern expansion. Since its conception in 1871, this system resulted in the rapid subdivision of roughly 178 million acres across Canada (Olsson, Rogers and Ballantyne October 2010, 19-20). It became the framework for immigration and colonial settlement into the prairies, resulting in the allocation of resources, movement of people, and physical patterning of the land within the distinctive checkered grid.

The DLS is composed of a hierarchical grid system that allowed for the rapid organization of land. This includes 6-mile by 6-mile "Townships" which are divided into 1-mile by 1-mile (640 acre) "Sections", which can be further subdivided into quarter-sections (160 acres) and quarter-quarter sections or legal subdivisions (40 acres) (see page 8). It is defined by Township lines (running east-west), Range lines (running north-south),

and Meridians, resulting in the parcel naming conventions such as “Township 29, Range 24, west of the Fourth Meridian” or “29-24-W4”. At each additional level of division, the parcel naming convention expands, resulting in Quadrant-Section-Township-Range-Meridian (SE-18-29-24-W4) or Legal Subdivision-Section-Township-Range-Meridian (2-18-29-24-W4).



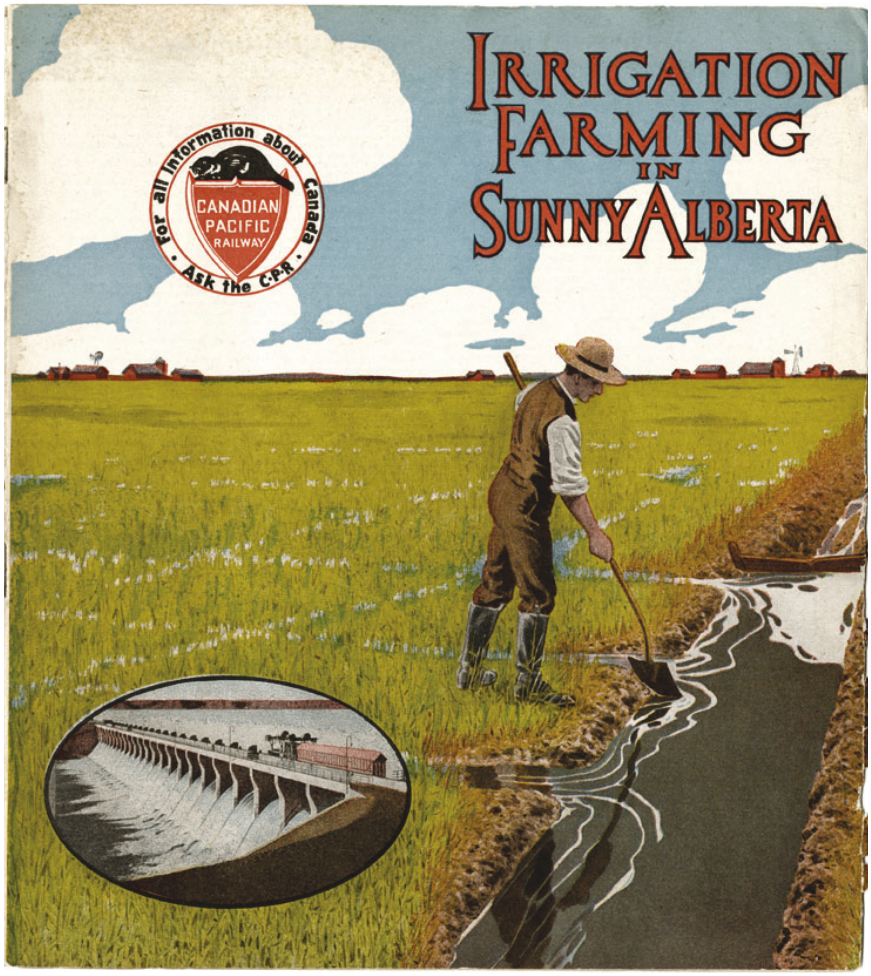
Hierarchical organization of the Dominion Land Survey.

This system of division directly related to the agricultural ambitions of the Canadian Government. By paying an administration fee, eligible settlers were given a quarter section of land; immigrants with farming backgrounds were specifically sought out to settle the prairies (Yarhi and Regehr 2006). However, the government was not the only force encouraging the agrarian development of the western provinces.

Railroad Expansion

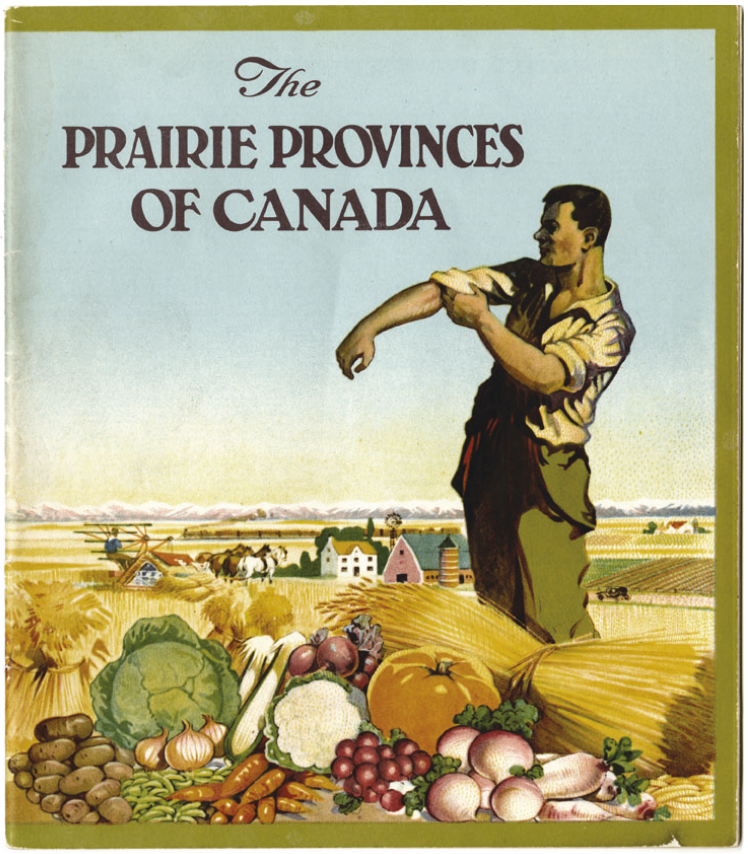
The Canadian Pacific Railway (CPR) was incorporated in 1881 and was formed to provide a physical link across Canada *A Mari Usque Ad Mare* (from sea to sea). By 1883 the CPR had stretched through southern Alberta, and by November 1885 the last spike of the rail line was driven in Craigellachie, BC. In partnership with

the Canadian Government, the CPR began actively recruiting immigrants and settlers from Europe and eastern Canada to settle these newly accessible lands (Canadian Pacific Railway 2019).

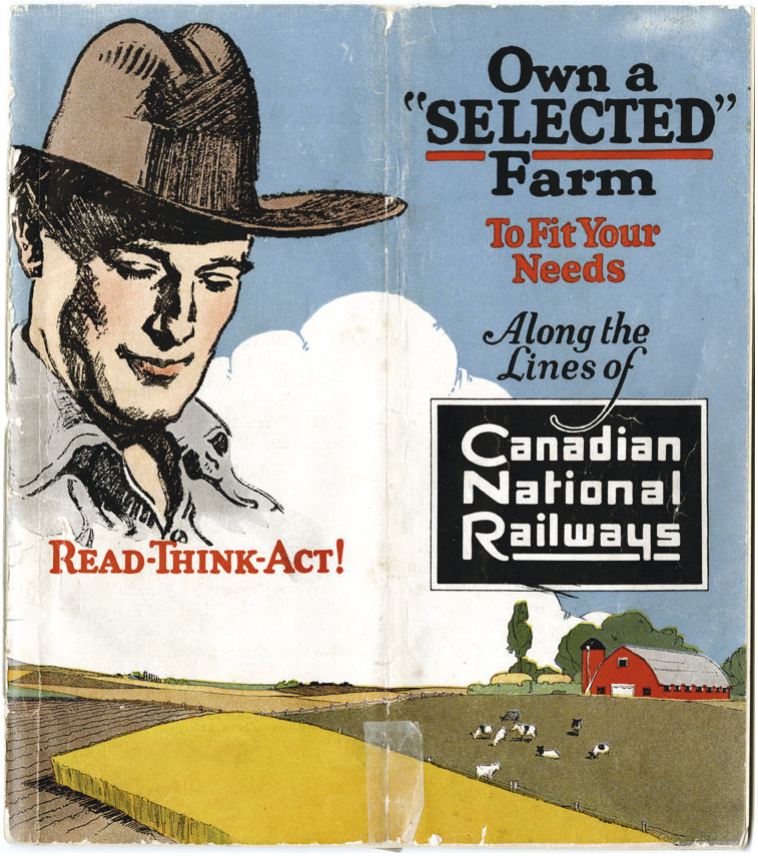


CPR immigration pamphlet extolling the benefits of irrigated farms in southern Alberta. The rail company had spent a significant investment in an irrigation strategy for the semi-arid Palliser Triangle ("Irrigation farming in sunny Alberta" 1921)

Model farms, railway gardens, and "ready-made" farms were all established by the CPR to attract farmers to the prairies. The company also constructed a massive irrigation infrastructure in southern Alberta, transforming semi-arid lands into desirable agricultural plots (Lam 2009). With expansion and settlement goals that clearly aligned with the Canadian Government, the CPR worked with the government to create immigration pamphlets centered around agrarianism in the West.



"The Prairie Provinces of Canada" immigration pamphlet, emphasizing the fertility of the land and railway connections ("The Prairie Provinces of Canada" 1925).



Immigration pamphlet from the Canadian National Railways showcasing "selected" farms ("Own a 'selected' farm to fit your needs" 1919?).

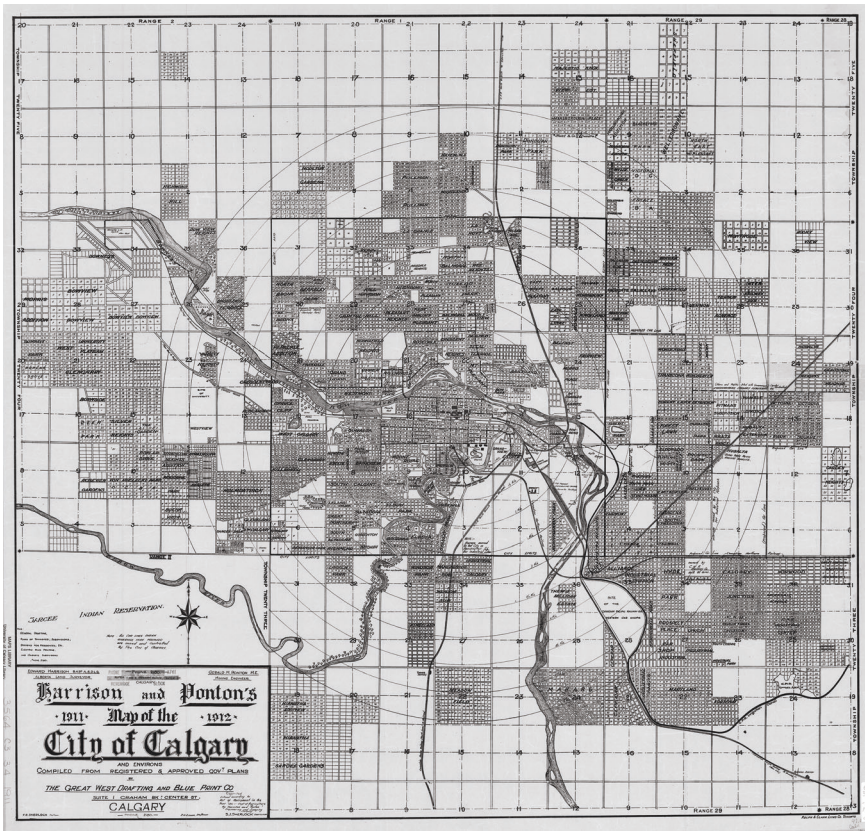
Settlement Patterns

In addition to forming the cultural patterns of the west, the CPR was also instrumental in forming the organization of settlements across the Prairies. The construction of grain elevators along the rail line, occurring as early as 1881, was encouraged and incentivized by the rail companies. The CPR developed policies outlining the establishment of elevators at regular intervals of seven to ten miles along the tracks, which related to the distance farmers could travel to transport their grain. (Vervoort 2006, 186-187). These elevators came to signal the locations of towns, acting as a symbol of inhabitation and an indicator of social and economic prosperity in the region (Vervoort 2006, 198).

A series of elevators along the railroad tracks in Vulcan, Alberta (Oliver 1928).

The combination of railway construction and the land survey also structured the division of land among individual farms. The *Dominions Land Act* of 1872 developed homesteading policies that granted land patents for a quarter section (160 acre)

parcel, under the condition that settlers would build a habitable residence, clear the land for farming, and cultivate a certain area annually (Yarhi and Regehr 2006). The rail companies worked within this framework to attract settlers to the region, with the CPR constructing ready-made farms to encourage agricultural economies to develop in the West. These farms included a house, barn, shed, fences, and 50 acres of ploughed and sowed land, and were grouped into rural colonies to create an agrarian vision for the West (Lam 2009, 5).



Harrison and Ponton's map of the city of Calgary and environs compiled from registered and approved government documents (Harrison 1912).

The early form of Prairie towns were also structured by the grid and the rail companies. Cities like Calgary were initially chosen for their strategic locations along train routes, and the grid of the DLS structured the grid of the city blocks laid out by the rail companies (Sandalack and Nicolai 2006, 7-8). This early city form will be explored in greater depth in Chapter 3.

It is important to note that the DLS, railroad system, and settlement patterns were a systematic approach to European colonization of the West. While these primary drivers of growth prevented the northern expansion of the United States and enabled the development of a vibrant farming culture in the Prairies, they also shaped the marginalization and displacement of First Nations in Canada. Although this thesis is primarily concerned with the agricultural systems that enabled mass expansion into the West, it acknowledges (but does not address) that these systems overtook the traditional territorial lands of many First Nations groups in the Prairies and British Columbia.

Thesis Statement

By evaluating historical methods of growth in the prairies (with an emphasis on the connection between agriculture and rail transportation networks) this thesis seeks to develop an alternative to the existing method of peri-urban expansion in the prairie province of Alberta. These alternative patterns of growth would begin to support regional food systems, acknowledge the value of prime agricultural lands, and cultivate a regional identity tied to productive landscapes. In order to create a structure for urban expansion, the requisite infrastructures must be developed to support these. By merging agricultural activities and modern public transit rail infrastructures within suburban developments, a framework for hybrid agrarian-urban growth in the prairie city seeks to mitigate the issues inherent in modern agriculture and urbanisation systems.

CHAPTER 2: AGRICULTURE, IDENTITY, AND CITY FORM

> The old symbiotic relationship between city and farmland has been replaced by an industrialised agriculture that has no direct connections with the city. Land that once produced crops and livestock is now more valuable as real estate...the countryside immediately surrounding the city, known as the urban shadow, is the object of land speculation and sporadic development, defying planning solutions and perpetuating an unproductive landscape. (Hough 1984, 14)

As previously mentioned, suburban development is the primary method of city growth in Canada. This type of urban form has been extensively criticized, particularly for its lack of identity. The built structures of these developments are disassociated from its environment, resulting in placelessness and a lack of regional character. However, the land it overtakes – the "urban shadow" – is a landscape rich with identity. Structures of agriculture are inherently connected to the landscape, strongly associated with the regional character of the place. By introducing agricultural structures and activities into the urban realm, an agrarian identity could be cultivated to foster a protectionist attitude towards farmland, reinforcing its cultural value as well as its productive value.

To explore how agriculture could be introduced into the modern Canadian city, historical models of urban growth were evaluated. Decentralist and centralist models of city form were explored, noting their provisions for agriculture and their connection to transport infrastructures. As a response to the failings of these 20th century organizational schemes, the ecological urbanist approach that recognizes the capacities of the land and the importance of multifunctional urban infrastructure was analyzed. By reconnecting urban systems to the land and recognizing the limitations and capacities of the physical environment, settlement patterns can once again be developed

to exist within a specific place. Instead of occurring within a perceptual vacuum afforded to cities by the globalization of resources, thoughtful city expansion can begin to recognize the agricultural and physical limits of its regional environment.

Agricultural Structures of Identity

> A place may not have a spectacular landscape, or great architecture, or even a long history. The markers, reference points, boundaries, and other symbols of everyday experience may be unseen or not understood by outsiders. But for those that live there these things are what give a place its meaning and relevance. (Hough 1990, 18)

Agricultural infrastructures are some of the most recognizable structures in the landscape, acting as a physical manifestation of the food system it operates within. They become a symbol of regional identity; windmills become a representation of the Netherlands, grain elevators of the North American Prairies. These structures reflect the technology, economics, and social organization operating within any given agricultural network. However, many of these symbols become obsolete with the urbanization of the population and the globalization of the food network. They become monuments to a lost identity, rather than active characters in the flow of everyday life.

Pre-Industrial food production manifested in the presence of the commons for livestock grazing, windmills to drain overly saturated lands and for the processing of crops, canals for crop irrigation, and many other regionally specific agricultural structures. City growth was limited by food transportation and production capacity, as expressed in the Isolated State model of city and agriculture (Steel 2008, 71). With the Industrial Revolution and global colonization of resources, new agricultural structures arose. In North America, the train system connected fertile stretches of land, preceding settlement and providing a framework for agricultural operations to develop in previously

un-colonised lands. Grain elevators, bursting from the ground along the train tracks, became an active symbol of the agricultural identity (Vervoort 2006, 183). These physical structures, along with the physical organization of land through the DLS in Canada (and the Jeffersonian Grid in the United States) created a strong regional character for the prairie landscape.

A Canadian Government Elevator that opened in Saskatoon in 1914. Under the Canada Grain Act, similar elevators were built in Port Arthur, Moose Jaw, Vancouver, and Calgary ("Canadian Government Elevator" 1920).

The Canadian Government Pavilion for the 1937 Paris Exposition, based on concrete grain elevators (Cowell 1994 15).

However, with mass urbanization occurring in the second half of the 20th century, this prairie identity was lost to the city engine. The industrial environment of farmscapes held no connection to the urbanite, who had no recreational or

functional relationship to the land. Without a tie to the land, the connection to agricultural structures in the rural landscape was also lost. The flow of agricultural products, occurring through complex, behind-the-scenes machinations, was removed from the conscience of the urban population, causing a physical and sociological detachment from the fundamental human requirement of food.

This detachment from food production arising from industrialisation and urbanisation was keenly felt by many people within the urban environment. Throughout various points in history, grass roots agriculture arising from within the urban environment resulted in the formation of allotment gardens. With this self-help and self-governing urbanism, the right to the land was seen as a democratic right (Krasny 2014, 12-13). In industrial cities, gardening along railroad tracks, the urban fringe, factory gardens, railway gardens, and allotments all contributed to the identity of the “garden colonist” or “farm

A garden run by the Calgary Vacant Lots Gardening Club, that had connections to Victory Gardens, the City Beautiful Movement, and food self-sufficiency efforts (“Gardening on a vacant lot, Calgary, Alberta” 1920).

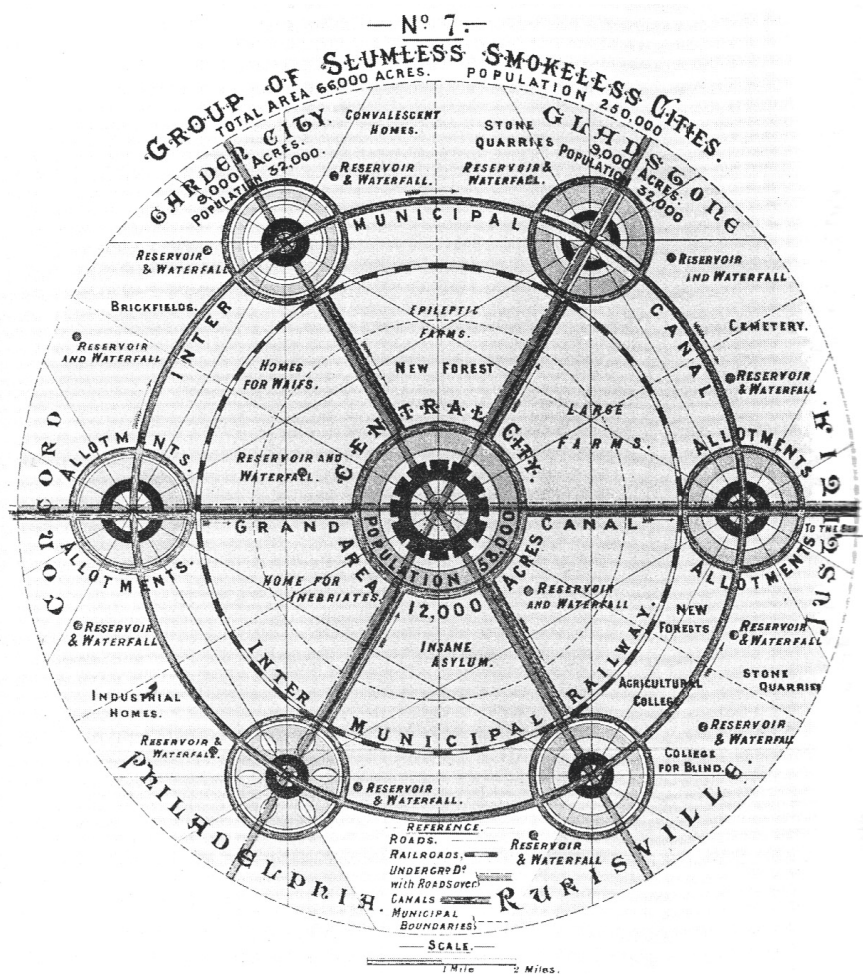
citizen" (Krasny 2014, 13-14). In times of scarcity and uncertainty, gardens were used within the city to provide resilience and sustenance to the population (Krasny 2014, 17). Although these bottom-up approaches are some the more successful and evocative examples of agricultural activity within the city, historical top-down frameworks for urban development have also sought to reintegrate an agricultural identity within the urban fabric.

Food Production and City Growth Models

> Urban systems are increasingly becoming the locus of consumption and engines of economic growth in a globalized world, which everyday sees more people flowing from rural areas to cities. This movement contributes to separate humans from nature and eventually for us to lose the sense of the limits to growth, which is inherent to ecosystems, the basis for the natural world sustainability. (Ferrao and Fernandez 2013, 3)

Agricultural production within the urban environment has long been a part of human settlement patterns. As globalization and urbanization began to catalyze growth following the Industrial Revolution, cities became more reliant on expansive food networks to feed their populations. Rather than a connected relationship to the land, urban form became more and more disconnected, and the symbiosis between settlement and agriculture was lost. As noted by Carolyn Steel in *Hungry City*, critics wary of agricultural modernisation and rapid urban growth described the city as a "wen": parasites that consumed without regard and offered nothing in return (Steel 2008, 28-29). Produce was imported from distant countries, instead of fruits and vegetables being grown as close as possible to the Pre-Industrial city in order to minimize transport bruising and to benefit from wastes provided by the town (Steel 2008, 69). Late 19th century and early 20th century urban models have sought to remedy the disconnection of the urban environment and agricultural production, to varying extents.

Formalized models of urban growth that provide provisions for agriculture within settlement patterns can first be explored through decentralist city concepts. Since the late 19th century, designers have sought alternatives to the compact cities arising from the Industrial Revolution. Ebenezer Howard, with his Garden City proposals, described a new settlement pattern of interconnected cities (Social Cities) where agriculture, recreational space, and low density living harmoniously coexisted within the English countryside. The Garden Cities were walkable cities with a central recreational park space that was within 550m of every dwelling unit (Howard 1945, 53-54). A green belt defined boundaries as a way to alleviate the impacts of city expansion into the countryside, and agricultural



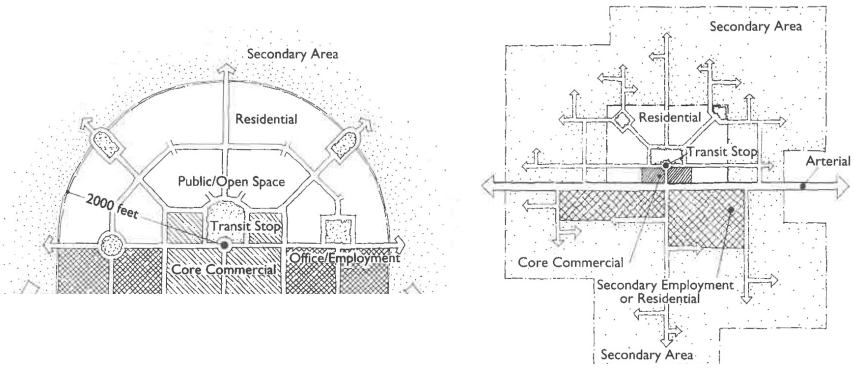
Ebenezer Howard's "Social City" diagram showing an interconnected system of garden cities (Howard 1945).

production at the periphery was connected to the city through a regional railroad. Farmers would benefit from the proximity to urban inhabitants due to shorter transportation distances, which would allow for greater diversity of food production on agricultural lands (Howard 1945). However, traditional greenbelt models prohibit all development, can increase reliance on private transportation, and potentially contribute to a shortage of affordable housing (Amati and Taylor 2010, 144).

In the early 20th century, Frank Lloyd Wright developed a disurbanist, decentralist model of settlement with Broadacre City. Wright's American "city" emphasized automobile transportation, agrarian living, and the importance of the individual, all rigorously structured by the Jeffersonian grid (Wright 1932). It focused on meaningful proximal relationships between work, family, food, and civil life (Waldheim, Landscape as Urbanism: A General Theory 2016, 136). Settlement was designed around the car, where walkability was sacrificed for the benefit of 60mph transportation. Although a primary marketplace within a 10 mile radius of every dwelling was proposed, small scale markets on every one acre lot created an emphasis on living off the land and agrarian ideals. Arguing that there is little need for centralisation as a result of modern technology, Wright believed land ownership and individual dwelling units was a way to express individuality (Wright 1932, 27). Despite this emphasis on individuality, the homogeneity seen in modern suburban forms (which hold similar ideals to the Broadacre model) does little to express the characteristics of the individual, nor the regional identity of the settlement. Furthermore, this model did not take into account the vast amount of resources required to service a spread out society.

Responding to the very spread of settlement that Wright

proposed in Broadacre, centralist models within the New Urbanist movement proposed “smart growth” to counteract wastefulness in new city developments. Although this term has many different definitions depending on the project utilizing it, it can be loosely described as a development method that reduces resource requirements and seeks to avoid damage to the community and environment (Filion 2003, 52; Gilham 2002, 158). Within the city, it calls for compact, mixed-use neighbourhoods with moderate densities that emphasize walking, mixed-use developments, and transit (Gilham 2002, 181). These Transit Oriented Developments (TODs) operate within a regional framework, rather than the scale of a single community (Gilham 2002, 182). Although there are many similar principles to Garden Cities (i.e. urban growth boundaries, central park space, walkability), TODs lack the consideration of productive land within the city framework. Open spaces incorporated within communities are largely seen as a recreational resource, and the lack of agricultural production within the settlement results in the urban realm being completely reliant on separate and distinct food sources. Although Calthorpe advocates for the use of natural features for resource protection and public access, “nature” in this sense is still fundamentally seen as a playground for the urban inhabitants, rather than a symbiotic extension of city form (Calthorpe 1993, 72).

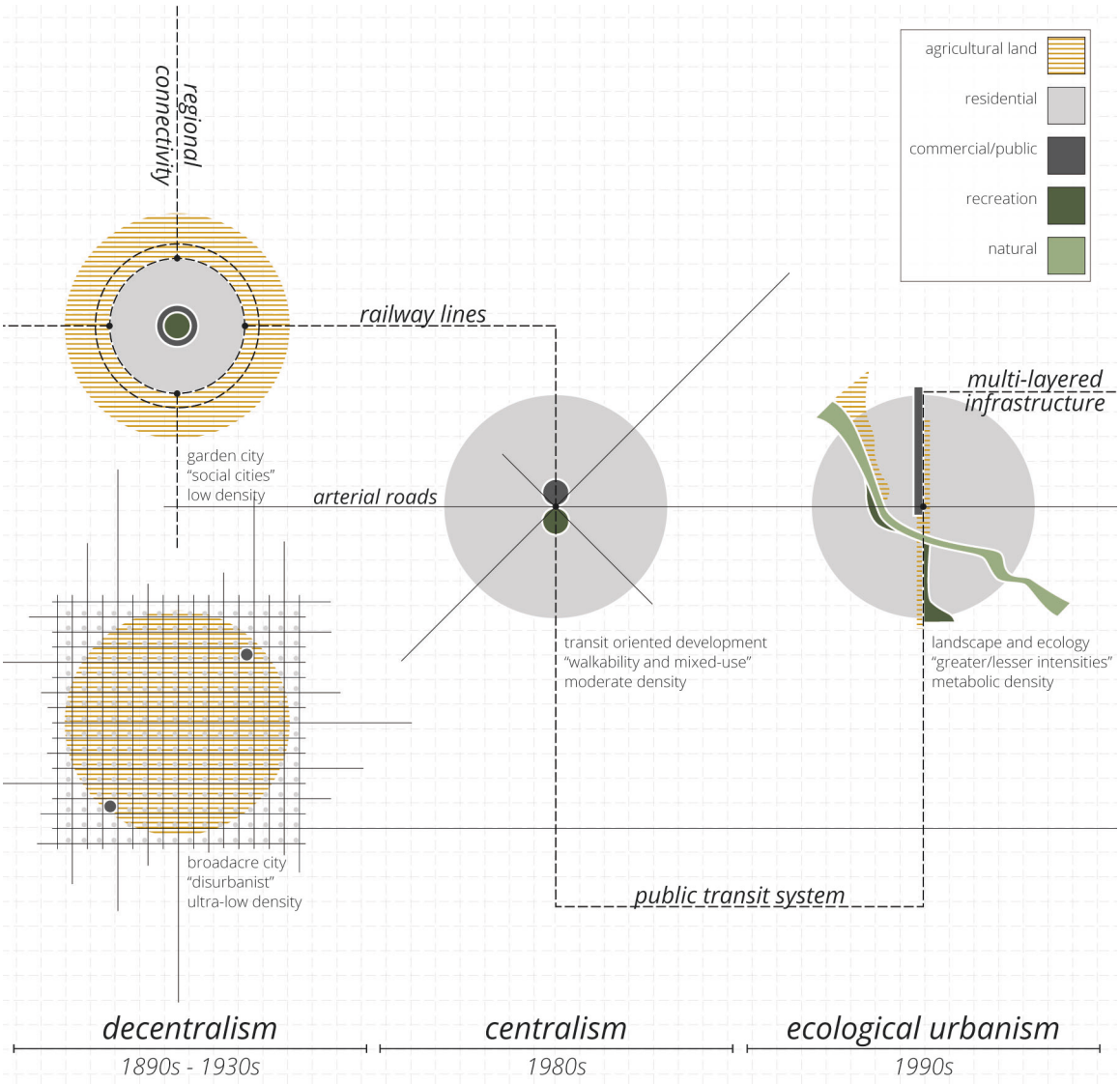


Centralist, transit oriented development models for urban growth, showing the importance of connections between pedestrian networks and arterial transit lines (Calthorpe 1993).

Mixed Intensities and Hybrid Approaches

As a result of the failings of centralist and decentralist models of urban growth, ecological urbanism and landscape urbanism begin to focus on the ecological capacity of the land in relation to human settlement. Ecological urbanism evaluates settlement based on the specific value and capability of the land it rests within, focusing on balancing supply and demand and reinforcing self-sufficiency, rather than relying on a singular model to respond to certain issues related to density and overcrowding (Garden Cities) or automotive reliance and low density (TODs) (Hagan 2015, 48). Here, green space is viewed as both metabolic and recreational, a multi-layered infrastructure within settlement patterns that allows for complex relationships between various city systems (Hagan 2015, 39). Multifunctional systems create an integrated approach to infrastructure, including transport, waste, food supply, energy production, and recreational areas (Hagan 2015, 15 and 42).

Alternative forms of urban models that encompass ecological urbanism can be seen in projects like Andrea Branzi's Agronica, where the city is seen as a continuous system of relational forces and flows, as opposed to a collection of objects (Waldheim 2016, 132). Agronica provides a structure for complex self-organization alongside linear top-down approaches to planning (Ilieva 2016). A relationship between energy and agricultural production is established, as well as new modalities of post-Fordist industry (Waldheim, Weak Work: Andrea Branzi's "Weak Metropolis" and the Projective Potential of an "Ecological Urbanism" 2016, 115). These ideas are further explored in the New Athens Charter, where Branzi describes the term "weak urbanism" in reference to hybrid territories. These threshold areas between the city and the countryside are half urban and half agricultural; they are



Urban models and agricultural production, with transport infrastructures highlighted.

productive, horizontal, and allow for flexible and discontinuous housing (Branzi 2016).

Another project that seeks to create new models for agricultural systems and settlement are the AgroParks by the Dutch Innovation Network. These hypothetical complexes cluster agriculture (livestock, crops, horticulture) with other activities, creating all-encompassing sites of production that allow for the greatest possible environmental benefits. By clustering agricultural activities, these projects seek to close nutrient cycles, reduce transport requirements, save the countryside, bridge the gap between producer and consumer, and generate economic and social benefits. Through an integrated approach to agricultural production, an innovation system would be used to resolve many of the problems inherent in current food production methods (InnovationNetwork; Stuk Producties 2005).

New urban models should focus on varying intensities of activities within the system, multifunctional infrastructures, and ecological capacities of the region. Through the use of these models to foster a landscape-based regional identity and knowledge of place, as well as new structures that support agricultural activities and act as symbols of identity, alternative city infrastructures may be able to address current issues facing the periphery of many Canadian cities. However, these models and infrastructures must be aware of the existing agricultural and urban systems that they will become part of.

Edited image of stooks and grain elevators near Fort Saskatchewan, Alberta (McDermid Studio 1927).

CHAPTER 3: ALBERTA AGRICULTURE

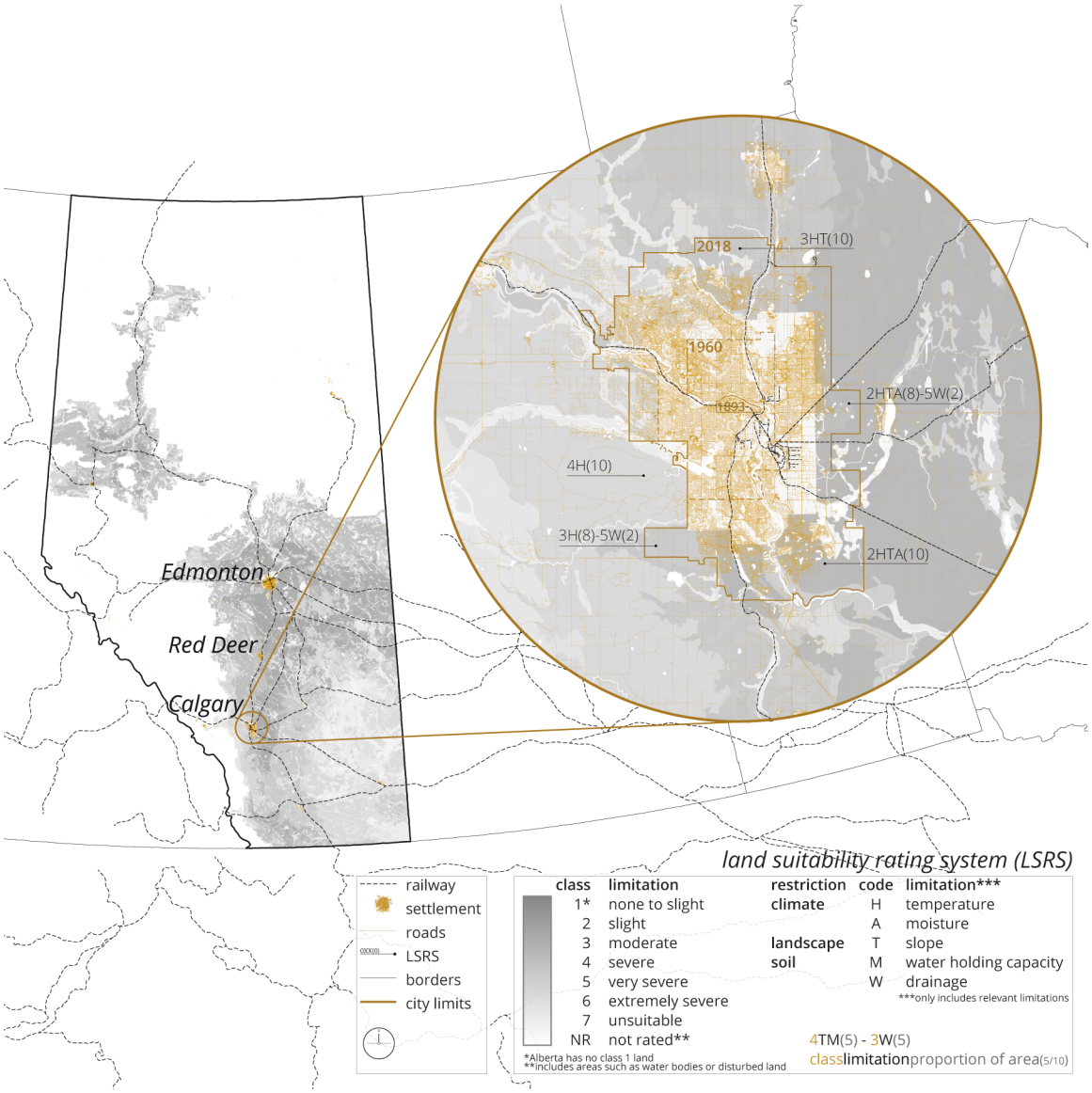
In the prairie cities of Western Canada, a clear separation exists between the city and countryside. Driving along the high-speed freeway one passes by a regular patchwork of wheat, barley, canola, and pea fields, the grid of crops stretching out to meet the edge of the expansive sky. From a distance, the city comes into view. As vast as the fields stretching in all directions, a mass of urbanity stretches across the horizon. It approaches like a wall, the threshold from the rural to the urban a jarring change in the landscape. What was farmland as recently as five years ago is now an expanding, winding cluster of vinyl siding, asphalt paving, and colossal box stores striving to feed the growing urban hunger. The production from the countryside that fed the city and depended on the return of wastes to enrich the soil has disappeared; the pre-industrial symbiosis between land and settlement has been lost.

To understand where opportunities exist for integrating food production and urban form and re-creating a symbiosis between the two, the current agricultural industry in Alberta must be explored. Issues relating to loss of land, environmental impacts, and changing farm demographics are studied in order to understand what is required to ensure the continued growth of the farming industry. Existing provincial food networks were analyzed, exposing deficits in production that endanger local food security. Finally, by exploring the barriers to growth that cause these deficits and finding existing organizations in the Prairies seeking to overcome those barriers, opportunities arise for alternative agricultural activities and labour supply within an agrarian-urban context.

Challenges within the Farming Industry

One of the major challenges facing the Albertan agricultural industry is loss of prime agricultural lands. The Prairies contained 63% of Canada's farm area in 2006, but also experienced a population increase of 56% between 1971 and 2006 (Statistics Canada 2009, 25). This growth is seen most in Alberta where, since 1984, the cities of Edmonton, Red Deer, and Calgary have almost doubled the amount of land within their city limits (Stan and Sanchez-Azofeifa 2017, 361). In Calgary "214 km^2 of arable land and 154 km^2 of natural and semi-natural land were lost to settled area" between 1971 and 2011 (Statistics Canada 2016, 69). This transfer of land area from rural to urban paralleled a shift in population; in 1931, 51.3% of Alberta's population lived on a farm, but in 2011 this number decreased to just 3.6% (Begam and Adilu 2017, 2). This migration of rural populations into urban areas over the past century, in addition to population growth and immigration, has resulted in the annexation of agricultural lands into the city domain.

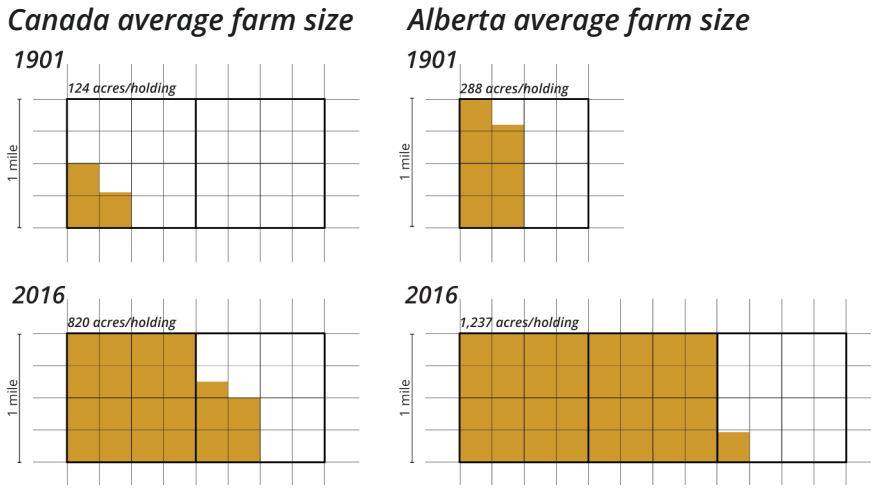
The agricultural realm faces more challenges than just urban appropriation of arable lands. Industrial agriculture relies on resource-intensive methods of production, and accounts for 8.6% of Canada's total greenhouse gas (GHG) emissions. Of these total GHG emissions, 56% were from nitrous oxide and 44% were from methane, resulting from livestock digestive processes, manure, fertilizers, and crop production (Statistics Canada 2009, 37). Nitrous oxide and methane are both stronger GHGs than carbon dioxide. Furthermore, agricultural practices also contribute to soil erosion and the destruction of natural habitats. Between 2011 and 2016, Alberta lost approximately 78,200 acres of land to non-agricultural usage, but gained 78,550 acres, resulting in a net increase of 350 acres for



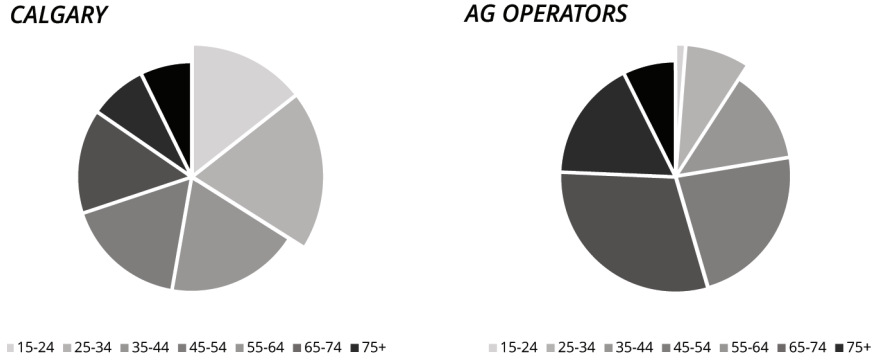
Metropolitan areas and agricultural land classifications in Alberta (Alberta Agriculture and Forestry; Geofabrik; Natural Resources Canada; Open Calgary).

agricultural activity (Begam and Adilu 2017, 4). This sheds light on a unique situation in the country, where Alberta agricultural lands encroach upon natural lands that are not necessarily the most fertile, resulting in fragmented natural areas that create challenges to diversity and danger to large fauna (Stan and Sanchez-Azofeifa 2017, 363).

In addition to the environmental cost of industrial agriculture, larger, increasingly mechanized equipment has been evolving in conjunction with increasing farm areas and a decreasing number of farming operations (Farm and Farm Operator Data, 2017). In 2016, the largest 10% of farms produced 70% of total provincial gross farm receipts in Alberta (Begam and Adilu 2017, 2). Furthermore, the average age of farm operators in the country increased to 55 years old, with only 9% of farm operators under the age of 35 (Farm and Farm Operator Data, 2017). This is a



Farm holding growth in Canada and Alberta, from 1901 to 2016 (Statistics Canada 2017a).



While the average age in Calgary is only 37.6 years old, the average Canadian farm operator is 55 years old (Statistics Canada 2017c; Statistics Canada 2018).

major issue for the agriculture industry in Canada, where the number of people entering the farming business will not be able to replace the number of older operators retiring in the next few decades.

Young workers in Canada face significant challenges to starting their own farming operations. Due to the high capital costs required to be competitive with larger scale operations, many farmers are unable to begin their own businesses. The investments in technical support, land, and infrastructure often require more funding than young entrepreneurs are able to access (Young Farmers: The future of agriculture 2010, 8). In addition to capital challenges, a lack of specialized education and the disconnect between citizens and farmers have been cited as barriers for young farmers (Young Farmers: The future of agriculture 2010, 13-15). This lack of education is a major concern considering that 80% of new farmers have no background in agriculture. Furthermore, these farmers are primarily operating small and medium scale organic farms, relying on direct marketing to distribute their products (A Food Policy for Canada 2017, 26-27). In Alberta, the lack of educational and infrastructural support for small farms significantly impacts the viability of these operations. Small fruit and vegetable farmers facing these challenges have called for the creation of local food hubs to provide support for farmers operating in this sector (St-Onge 2018).

To combat lack of education and high capital costs, and to ensure a viable agricultural sector, a series of recommendations have been made by the Canadian Standing Committee on Agriculture and Agri-Food. One such recommendation included introducing agricultural and food science education into schools to attract young farmers and encourage local food consumption. The

importance of local and regional agricultural research centers was also highlighted. This research and innovation connected to a specific place has been important for fruit producers in British Columbia and Nova Scotia, who have noticed a link between easy access to local facilities and their operational profitability (Young Farmers: The future of agriculture 2010, 24).

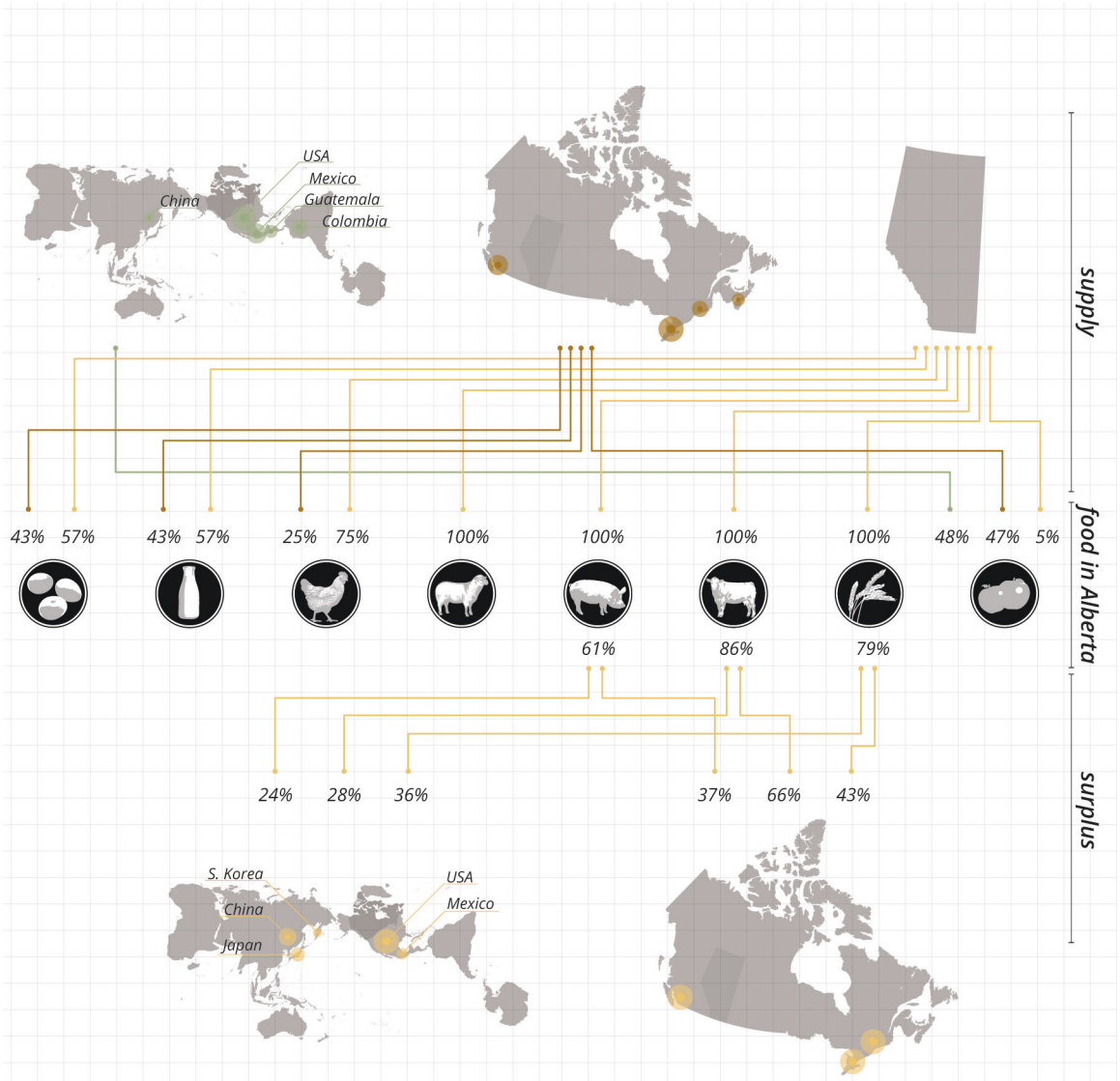
Food Networks

The Alberta agricultural sector is extremely reliant on world export markets, as there is an abundance of agricultural production in areas like wheat and beef cattle that cannot be absorbed by the population (Begam and Adilu 2017, 3). Despite this excess in certain sections of the industry, the importation of large amounts of agri-food goods is required to fulfill the nutrient requirements of the province. Deficits in the production of eggs, poultry, and dairy are a result of Canadian supply management systems, and are able to be supplemented by national production. Fruits and vegetables, however, require the import of both national and international goods (see page 32).

When considering new local agricultural networks in Alberta, the opportunities for production where there are currently deficits should be explored. Both traditional and non-traditional methods of fruit and vegetable production should be considered in order to create a viable industry within the province. To address current deficits in production, the barriers to growth and challenges to entry must be fully understood.

Barriers to Fruit and Vegetable Production

A recent report has identified eight major challenges to the fruit and vegetable industry in Alberta (Serecon Management



Supply and surplus within food networks in Alberta (Begam and Adilu; Pekalski 2018; Statistics Canada 2017c).

Consulting Inc. 2012, 36). Although climate is a major limiting factor, an entire suite of issues arising from the systemic structure of Canadian production are perhaps even more prevalent in the province. Categorically, these issues relate to global food markets, industry organization within the province, and consumer choices. It includes, but isn't limited to:

Import competition

Branding

Industry Organizational Structure

Innovation Support

Storage Capacity

Labour

Food Trends

By creating a framework that can address these major issues within the commercial fruit and vegetable industry, local production could begin to provide a feasible alternative to global imports. However, a certain amount of education and awareness must be fostered in order to address issues related to consumer choice and global market competition.

Opportunities for Local Food Systems

There are currently a number of agricultural organizations in the Prairies that are attempting to address the challenges faced by fruit and vegetable producers. In Manitoba, a grower-owned, not-for-profit supplier called Peak of the Market is an extremely successful example for vegetable producers (Serecon Management Consulting Inc. 2012, 25). A number of important factors have contributed to the viability of their model, including strong and innovative management and marketing capacity,

investment in temperature and humidity controlled storage facilities, and the effective collaboration of producers within a cooperative structure (Serecon Management Consulting Inc. 2012, 42). With facilities in both Winnipeg and Calgary, Peak of the Market has been able to support farmers in Manitoba and provide consumers throughout the Prairies with year-round access to produce (Serecon Management Consulting Inc. 2012, 25).

In Calgary, a small group of rural and urban farmers have also created a cooperative in order to provide support to local, small-scale producers. YYC Growers and Distributers operates within the city, distributing produce through seasonal farmers markets, community supported agriculture Harvest Boxes, and even through pop-up markets at light rail transit stations. They advocate for urban farming, local and organic production, and partnerships between rural and urban farmers in order to encourage food security in the city (YYC Growers and Distributers 2018). Although they have been very successful as local fruit and vegetable producers, they still only account for a small amount of the total produce required by Calgarians.

Pop-up market in a public transit station in Calgary (YYC Growers and Distributors 2018).

In order to expand on the models of Peak of the Market and YYC Growers and increase the amount of local production, additional organizations and infrastructures must be developed to ensure the food security of local inhabitants. Business support for individuals and farmer collectives in the form of marketing and logistics planning could provide competitive strategies to counter global food systems. Temperature and humidity controlled storage facilities could extend the shelf life of fresh produce and expand the distribution potential of local agri-food goods. Research facilities focusing on the innovation of regionally specific production could diminish the climatic limitations inherent in northern environments, while creating educational and training opportunities for young farmers entering the industry. Finally, the inclusion of community facilities in close proximity to agricultural activities could educate urban inhabitants and create an awareness of the agricultural cycle that is largely hidden from consumers. In order to understand how these agricultural support structures could insert themselves into the city form, the historical and modern patterns of growth in Calgary must be explored.

CHAPTER 4: CALGARY AS A SITE OF PRODUCTION

> The evolution of the city reflects the evolution of ideas and ideologies, and of changing theories and practices of urban design and planning. The values cultures place on the built landscape are reflected in the changing patterns of land ownership and land development, and consequently in the spatial qualities of the public realm. The city form is therefore a manifestation of societal values. (Sandalack and Nicolai 2006, 1)

In addition to larger systems of global food networks, western expansion, and provincial agricultural conditions, the specific form of the city of Calgary must be studied to propose alternative systems of local food production and urban growth. The history of city expansion is explored, focusing on transportation methods and key industries as drivers of built urban form and cultural ideologies. Modern public transportation infrastructure in Calgary is also studied. Finally, the advantages and disadvantages of suburban form are evaluated, highlighting the potential within this form of growth. By analyzing historical form alongside contemporary transit infrastructure and development patterns, opportunities for future neighbourhoods focusing on agriculture and transportation could begin to arise.

Sprouting from the Railway to Modernist Maturation

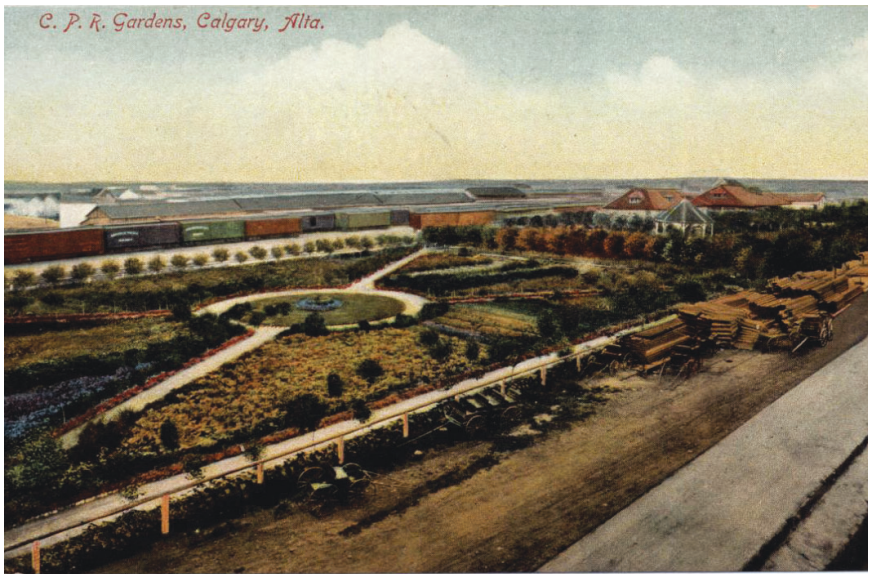
Calgary, like most western Canadian cities, is a relatively young settlement. Fort Calgary was established in 1875 at the confluence of the Bow and Elbow Rivers, where existing aboriginal trails along the river valley had been adopted by Europeans as colonisation expanded westward (Sandalack and Nicolai 2006, 5-6). By 1884, Calgary had been incorporated as a town – one year after the Canadian Pacific Railway had been completed in the area (Sandalack and Nicolai 2006, 6-7). The laying of the railway, paired with the Canada-wide DLS, shaped the settlement patterns across the region for the first phase of

the city's growth, before eventually giving way to the spatial and ideological self-determination afforded by automotive modes of transportation.

From the late 1800's to the mid 1900's, the railway acted as both the economic and cultural centre for the region. Early on, the city primarily functioned as a service and supply center for the agricultural activities surrounding the settlement. Through the opportunities provided by the rail system, the city's identity as a ranching settlement was solidified, where the cattle industry – from the stockyards, to slaughterhouses, to the open range – provided the most important economic contribution to the growing town (Sandalack and Nicolai 2006, 6-7). However, the CPR was not the only rail line responsible for city growth patterns. Streetcar lines sprouted from the city centre as tentacles of growth, driving the creation of neighbourhoods like Hillhurst and Rosedale. These neighbourhoods were organized according to the survey subdivision system, resulting in a highly permeable grid system that promoted walkability, while the streetcar line promoted the mixture of commercial, residential, and recreational along the street system (Sandalack and Nicolai 2006, 46-50).

Not only did the rail lines allow for the transport and expansion of people and industry, but they also became the social and cultural heart of the settlement (Sandalack and Nicolai 2006, 52). As the gateway to the city – and the region as a whole – the CPR railway station became the point of entry meant to appeal to the cultural values of settlers, where the high fertility of the vast prairie landscape was exemplified within the station gardens (Sandalack and Nicolai 2006, 8). Originally growing trees, shrubs, and flowers in formalized grounds, nurseries, and greenhouses, the gardens were re-established for food production during the

World Wars (Heritage Park Historical Village 2018). However, the cultural connection to the land that these station gardens exemplified was eventually decimated by parking lots and buildings, paralleling the economic and ideological transition from agricultural to oil-based industry.



Postcard of CPR station gardens in Calgary ("C.P.R gardens, Calgary, Alta., early 20th century").

Following the Second World War, Calgary became the Canadian headquarters of the international oil industry. From as early as 1914, oil extraction was an important economic driver of the Calgary region. This fueled a change in transportation preferences, and streetcar travel eventually gave way to automotive use, with automobile traffic disrupting streetcar schedules as early as 1920 (Sandalack and Nicolai 2006, 60). Gas powered buses were introduced in 1931, and by 1950 streetcars were phased out completely, giving way to a new era of development (Sandalack and Nicolai 2006, 60-85). By the mid-1970's Calgary had the most cars per capita in all of Canada (Sandalack and Nicolai 2006, 102). The development and economic patterns shifted from rail-dependence to automobility.

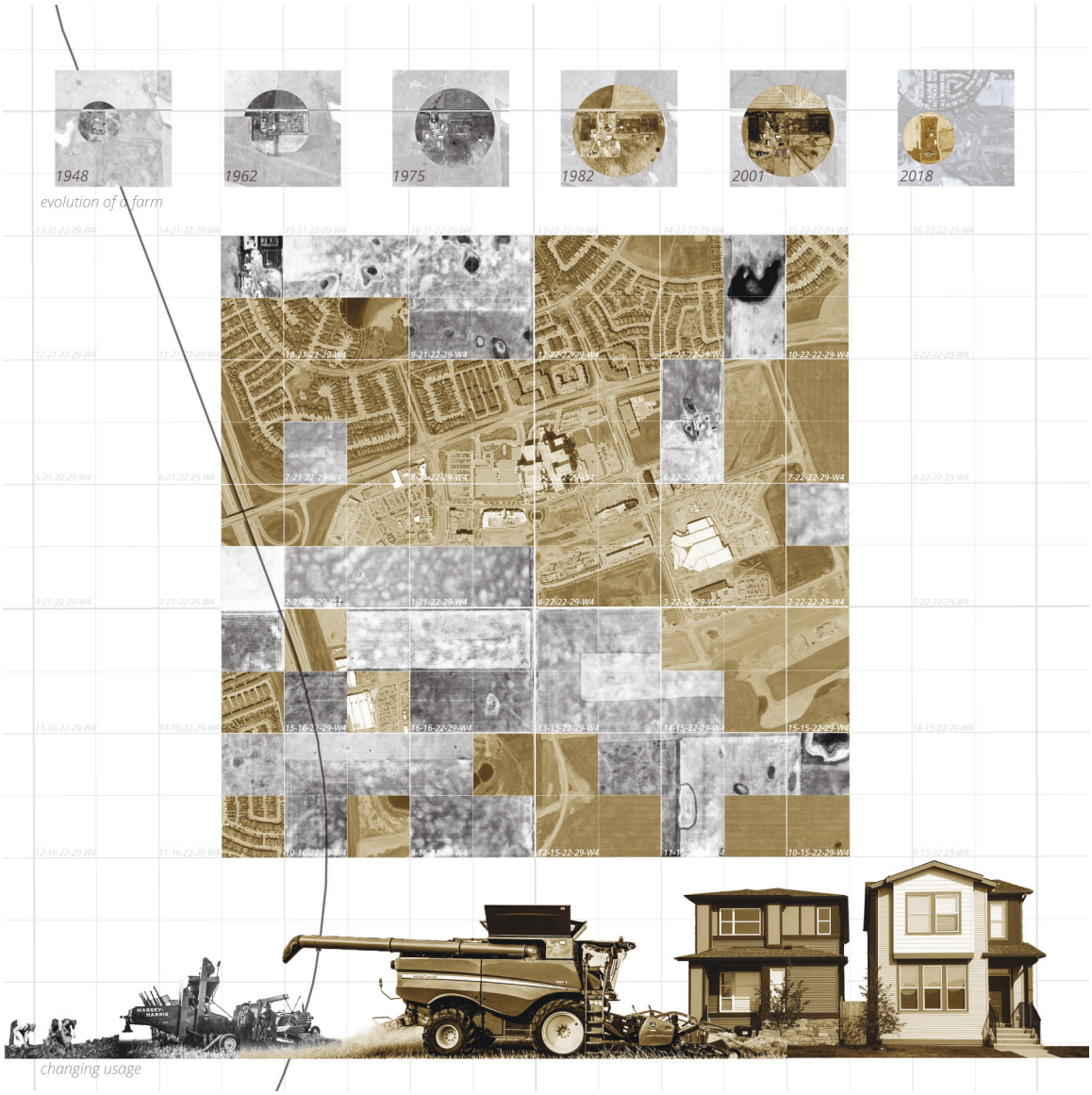
As opposed to the "unplanned" growth in the first half of the 19th century structured by the survey grid, the latter half focused on

the “orderly growth” of the city (Sandalack and Nicolai 2006, 79). Rigorous zoning, curvilinear street forms, and a focus on the suburban neighbourhood unit as the basic functional and spatial organizer of residential development resulted in a city largely dependent on automobile use. However, the rural hinterlands maintained their dependence on the rail and survey lines for the transport of agricultural goods and for its organizational structure. This spatial differentiation between the urban and rural environment was paralleled by an ideological one; following World War II, the Calgarian identity, while still tied to the West through its oil and ranching heritage, began to separate itself from its rural surroundings (Sandalack and Nicolai 2006, 102).

The influence of the car on Calgary’s growth has led to much of its current criticisms. However, new developments in the city seek to address issues related to urban sprawl, social disconnection, and automotive reliance. Although suburban developments are still one of the defining forms of growth in Calgary, much has been done in the past few decades to revitalize the city centre. Inner city neighbourhoods like East Village, the Beltline, and Marda Loop are sites of numerous infill projects that seek to redefine the city form. A new National Music Centre, Public Library, and many downtown refurbishment projects are re-cultivating a cultural centre in the heart of the city. Furthermore, connectivity between the city centre and outlying neighbourhoods is being reinforced through light rail transit (LRT) infrastructure. These all contribute to the city being recognized as the fourth “most liveable city” in the world in 2018 (The Economist 2018).

Light Rail Transit as a Driver of Growth

The current LRT infrastructure in Calgary is an incredibly important part of the city’s transportation strategy. The first LRT line opened in 1981; today it supports 285,000 passengers

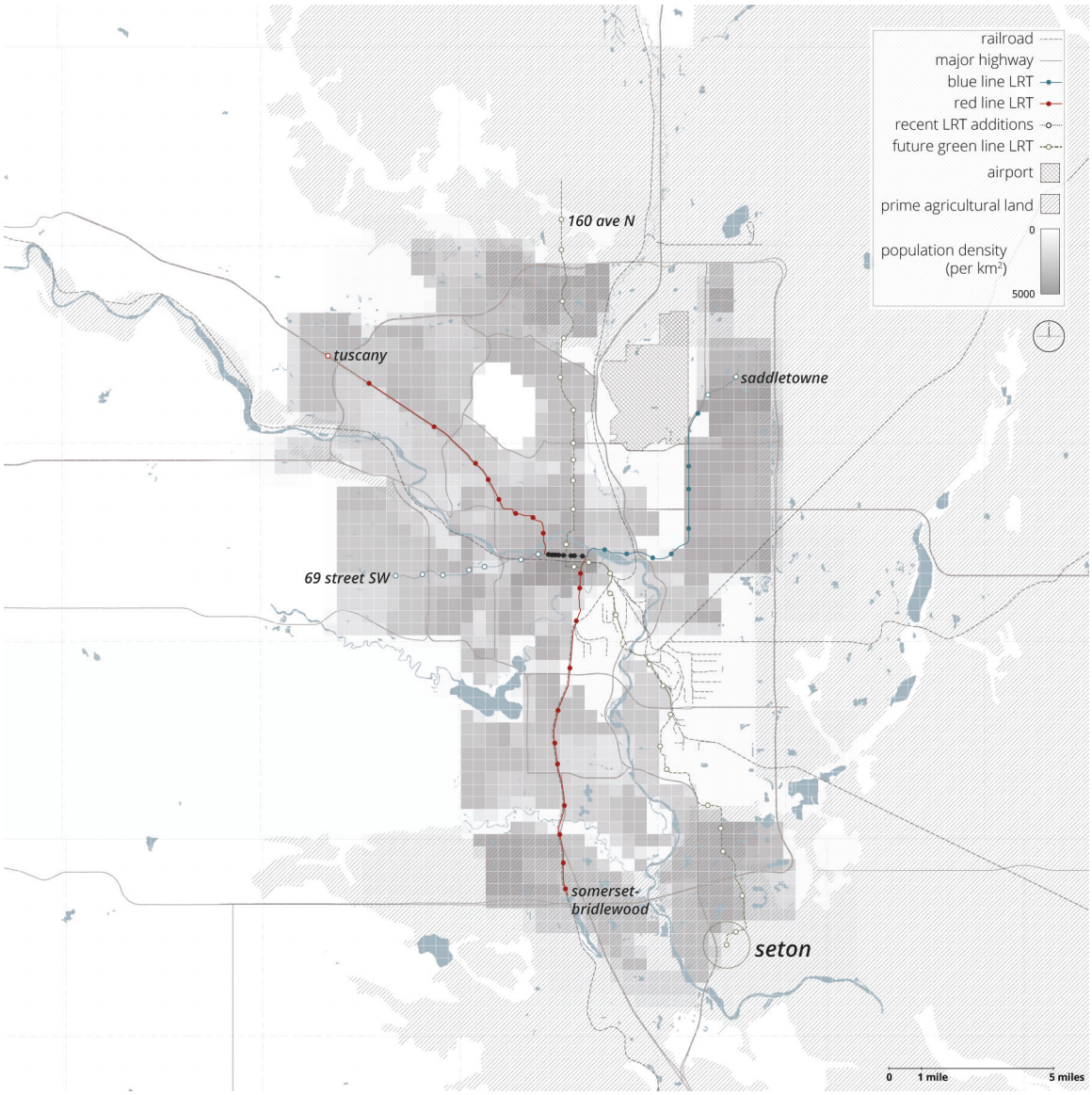


Changing landscapes on the city periphery, where modern suburban growth (gold) overtakes the historical (grey) agricultural activities and patterns of the land (City of Calgary).

on the average weekday (Green Line LRT Long Term Vision: 160 Avenue N to Seton 2017, 19). It has two railway lines. The Red Line has 20 stations stretching from the northwest to the south, and the Blue Line has 17 stations from the northeast to the west. Both of these lines connect suburban areas to the downtown core, providing transport from the greater Calgary Region to its economic centre (Green Line LRT Long Term Vision: 160 Avenue N to Seton 2017, 19). Since 2001, these lines have been expanding to service the ever-increasing population in the suburban areas of the city (see page 42).

Another LRT line, dubbed the Green Line, has also been proposed to provide public transport to the large number of Calgarians living outside the city core. The project is set to begin construction in 2020, and would provide a connection from the northernmost to the southeast edge of the city. When completed, it is estimated that it will support up to 240,000 trips per day along 28 stations (Green Line LRT Long Term Vision: 160 Avenue N to Seton 2017, 10).

A number of design considerations have been developed throughout the course of the Green Line project. Similar to the existing LRT lines, these trains will be powered by overhead electric lines, resulting in a non-emissive form of public transportation in the city. Currently 100 percent of the electricity used by the LRT trains is generated from renewable wind energy (Calgary Transit 2015). By continuing to use this system, the Green Line will provide an alternative to emissive automotive transportation. In addition to environmental concerns, this LRT line is utilizing low-floor light rail vehicles (LRVs) to will allow for greater flexibility in station design and contribute to the pedestrian experience. Platform heights of 300mm will allow for smaller stations and provide easier access to the train than the



Population distribution, major transportation infrastructures, and future LRT lines in Calgary, Alberta (Open Calgary; Alberta Agriculture and Forestry; National Resources Canada; Geofabrik).

current 900mm stations (Green Line LRT Long Term Vision: 160 Avenue N to Seton 2017, 37). Additionally, the Green Line will continue to employ the at-grade tracks used in the Red and Blue lines, which gives flexibility to pedestrians to cross the tracks at important intersections. However, it is not only the design of the stations that has been considered in the planning of the project. TOD strategies and zoning bylaws have also been developed to shape the form of urban development along the line.

At the future terminus locations of the Green Line, development has already begun to form around the anticipated LRT infrastructure. In the north, the community of Livingston has been planned around a commercial core serviced by the LRT. Roughly 1,300 acres of farmland will be taken over to establish this neighbourhood (Skapin 2016). In the southeast, Seton is being developed as an urban centre outside the downtown core. Overtaking 350 acres of active farmland, this development includes a hospital, recreational and educational facilities, and an office district, all to be serviced by the future LRT (Skapin 2016). These two developments land directly within prime agricultural land, encouraging asphalt, concrete, and monocultural lawns to overtake the productive areas surrounding the city.

Suburban Potential

The disadvantages of urban sprawl are well-documented and extensive, highlighting the higher consumption of water, energy, and natural resources, as well as the higher production of pollution and waste in the suburbs as compared to inner city neighbourhoods (Kelbaugh 2015, 1). One of the major contributors to these issues is the dispersal of activities, resulting in increased reliance on automobile travel (Young, Tanguay and Lachapelle 2016, 26). Day-to-day life exists as a series of nodes of activity and isolated events, rather than a continuous

progression, resulting in social and perceptual issues (Hough 1990, 92). This heavy reliance on automobile transportation create a myriad of social and public health issues, and is one of the major contributors to air pollution (Frumkin 2002, 202-208).

Despite these issues that are created by suburban expansion, there are also many reasons for its continued existence in the Calgary Metropolitan Area. Not only does the land on the city periphery allow for more affordable residential and economic

Adjacency between farmland and suburban developments in Calgary (2018).

opportunities than the city centre, it also contributes to the sustained growth of the metropolitan region (White 2018). Infill developments may be unable to account for the necessary growth in the region, and so new growth areas are considered in order to reinforce the city's role as the cultural and economic centre of the region (Calthorpe 1993, 32). Furthermore, the

densification of existing neighbourhoods can increase the pressure on existing infrastructure and services, as well as the expenditures and maintenance on those existing structures (Hagan 2015, 70).

Although the suburbs have the ability to contribute to the city's continued growth, they are also areas that face the greatest issues with identity and placelessness. As previously mentioned, the suburbs – and cities in general – are areas of high energy and resource consumption. These one-way energy systems are accepted and encouraged in return for complete freedom of choice (Hough 1990, 93). These systems create a situation where resources and opportunities are seen as "limitless". However, this very lack of limitation contributes to the lack of suburban identity, which no longer operates within societal and environmental boundaries (Hough 1990, 58). Finally, the high volume of unbuilt and open spaces in the suburban environment further contributes to the lack of identity, where ecological diversity of the region is replaced by monotonous horticulture that has no recognition of place (Hough 1990, 90).

However, these weaknesses in the environmental and social identity of the suburbs are also its greatest opportunity. The suburbs have more open space than inner city neighbourhoods, which may contribute to the potential of the performative landscape, including latent energy saving capacities and metabolic processes (Hagan 2015, 71). Rather than a one-way consumption engine closed off from its environment, these areas would be able to create an ecological balance between settlement, countryside, and natural features. Peripheral areas have the potential to become hybrid sites where mixed intensities of settlement and ecosystem (or in this case, agriculture) can coexist. Furthermore, the new infrastructural requirements

of growth on the periphery could begin to act as a catalyst for alternative, multi-functional uses. Rather than operating on a single mode of action, these transit and resource infrastructures could begin to encourage performative and productive functions on open spaces within the suburban network (Corner, Landscape Urbanism 2014). Rather than the dualistic, opposing conditions of city and countryside, a symbiosis between the two would cultivate an ecological relationship between settlement and land (Corner, Terra Fluxus 2014, 308).

By looking at the history of urban form, LRT infrastructure as a driver of growth, and the potential of suburban neighbourhoods, possibilities for the integration of agricultural

Suburban growth adjacent to active farmland in Calgary (2018).

and urban settlement begin to arise in Calgary. Historical patterns of city growth formed by the DLS and the railways has resulted in some of the most desirable neighbourhoods in the city, whereas the curvilinear forms driven by automotive transport have created disconnected and placeless urban environments. By re-introducing elements of the grid and connectivity through rail into the current system of suburban growth, an alternative model of development for the prairie city could begin to form. Through the combination of non-emissive transportation systems like the LRT, the open spaces inherent

in suburban growth, and the high quality of agricultural land new developments overtake, peripheral neighbourhoods in the city of Calgary have the potential to become ideal sites for developing hybrid agricultural-urban forms.

CHAPTER 5: CULTIVATING THE AGRARIAN -URBAN NETWORK

This thesis seeks to develop a framework for hybrid agrarian-urban growth in the prairie province of Alberta, using the city of Calgary as a test site. This framework is formed as a response to the historical patterns of settlement in the west, the existing conditions of the agricultural industry, and the current mode of city growth in the province. By responding to these contexts, and applying theories of ecological urbanism, continuous productive urban landscapes, and systems thinking, a regionally specific method of design for an agrarian-urban model is proposed. It explores the pixelation of landscape and programs, visual and physical networks, and the hybridization of program and space as a process for design and analysis. Finally, a multi-scalar application of the network is explored, considering the region, the neighbourhood, and the building, and providing a space for key agricultural activities within a model of alternative urban growth.

Pixelation

The survey systems in North America have resulted in a very distinct patterning/pixelation of the landscape. This mass ordering system and its physical implications have caught the interest of architects throughout the 20th and 21st century. Frank Lloyd Wright designed Broadacre City within the ordering of the Jeffersonian Grid; James Corner's *Taking Measure across the American Landscape* creates a catalogue of the various conditions that occur within the land survey. More recently, Rem Koolhaas and OMA have turned their focus to the countryside, noting that:

> The countryside is becoming a colossal back-of-house, organized with relentless Cartesian rigour. That system,

> not always pleasant, is proliferating on an unprecedented scale. The resulting transformation is radical and ubiquitous. (Koolhaas 2014)

"Ubiquitous" pixelation of the southern Alberta landscape (Google Earth 2019).

The implementation of the survey grid in North America is arguably the largest example of the mass design of landscape in the world. Its success in terms of execution and design is largely dependent on the hierarchical ordering of the system, where the multi-scalar application of the grid resulted in a high degree of flexibility within the seemingly rigid framework. As noted be Donella Meadows in *Systems Thinking*, the arrangement of complex systems and subsystems within a hierarchy is a key characteristic of a system that works well (Meadows 2009, 82). Similar to Branzi's framework for Agronica, a hierarchical systems approach emphasizes the balance between top-down and bottom-up approaches, where centrally controlled coordination occurs in tandem with autonomous self-organization (Meadows 2009, 85). In developing a regional infrastructure that is supported by localized architectural frameworks, a system for a new agriculture organizational network could be developed to address food security concerns in the Calgary region. This

network could begin to provide an alternative to the industrial food system that is pervasive and unrelenting in its control of regional and global food patterns.

In addition to a hierarchical framework, self-organization and resilience are key characteristics of successful systems (Meadows 2009, 76-79). Within an alternative, localised agri-food network, resilience can be encouraged physically through redundancy and repetition. In this way, the current DLS system for the agricultural organization of land is extremely successful. Similarly, Calgary's early growth – indicative of some of the most desirable and successful neighbourhoods in the city – was formed by the repetitive ordering of the street grid, which allowed for a high degree of permeability and choice of route (Sandalack and Nicolai 2006, 1). A new infrastructural organizational network could embrace the functional capabilities of these early ordering systems in order to allow for the self-organisation of subsystems (i.e. agricultural production, distribution, and innovation operations) within an agrarian infrastructure.

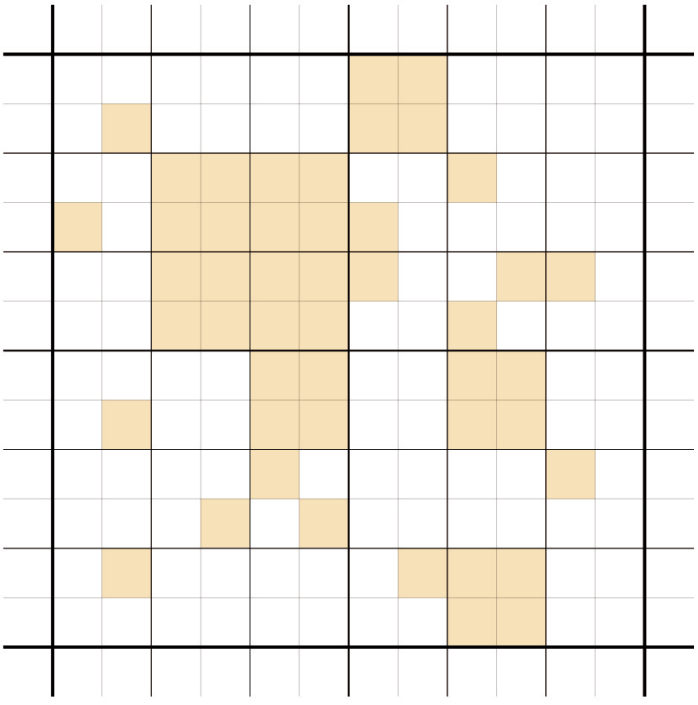


Diagram of a hierarchical pixelation based off the DLS.

This thesis seeks to re-implement the pattern of the grid as a method of reintroducing agricultural activities into the city. As an ordering system, the DLS creates a distinctive pixelation across the agricultural landscape and has been hugely successful in structuring the rural activities of the past century. By thinking about the city through agricultural form and the units of agricultural measure (acres, sections), new possibilities arise for the physical, social, and productive form of the city.

Networks

To connect these pixelated landscapes and programs, continuous networks will be introduced into the project. This includes physical networks required for production and distribution, as well as sociological and cultural networks that are necessary for community interaction and agricultural innovation. Similar to the historical railway system that drove growth in the west, modern LRT systems should not only create a connection for people, but also for agricultural goods and information. The flow of information, nutrients, and people through the project will establish a series of multi-layered networks within the hybrid suburban-agricultural landscape.

In *Continuous Productive Urban Landscapes* (CPULs), the importance of a constant connection to green elements within the urban realm is emphasized. Viljoen and Bohn call for the linking of existing open spaces in the inner city with the surrounding rural area (Viljoen and Bohn 2005, 11). They also advocate for various types of agricultural and green structures within the regional landscape, connected through pedestrian, cyclist, and engine-less pathways (Viljoen and Bohn 2005, 11-12). The result will be environmentally, sociologically, and economically productive green infrastructures connecting the urban and rural environments (Viljoen and Bohn 2005, 15).

Michael Hough also speaks to continuous landscape systems in order to establish a regional identity tied to landscape. In areas with an absence of architectural styles, landscape can become an expression of the regional context (Hough 1990, 115). In Calgary, the city is not only devoid of strong architectural styles, but it also lacks a deep connection to the landscape it rests within. As Hough notes in *Out of Place*, regional identity is based on limitations; yet Calgary is a city without limits (Hough 1990, 34). The "endless" prairies create the perception of unlimited land resources for the city, the never-ending construction on the edge implies infinite housing stock, and the globalised food market provides a bottomless supply of food for the city.

However, rural areas in the region are strongly connected to the prairie identity, where crop and livestock farming are defined by the limitations of the land. Agricultural structures and networks articulate this regional identity, where grain elevators, grain bins, livestock corals, and the very pattern of the land create a strong visual, physical, and psychological identity. Yet this identity is not stable. Changing demographics, modes of operation, and world market forces all effect the rural structure of identity. Indeed,

> "the essential character of a landscape is revealed through a combination of natural forces, generations of cultural history,

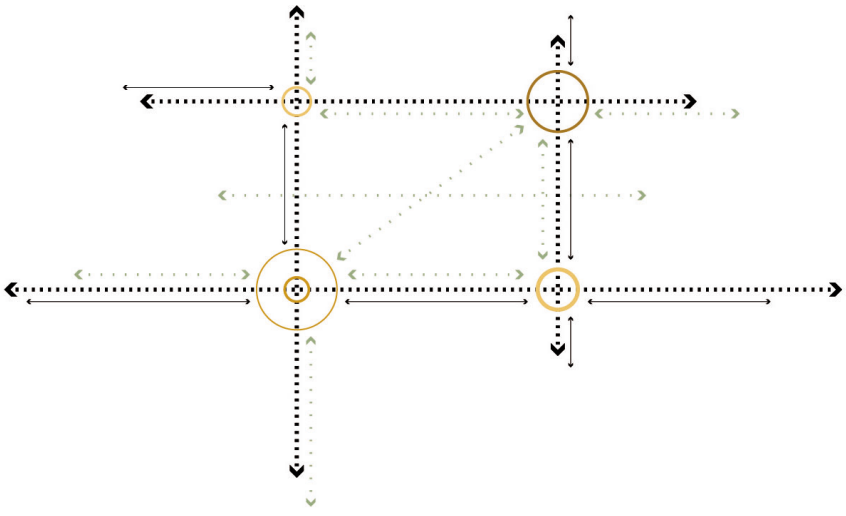


Diagram of interconnected networks.

> and changing farming technology that occur both in the context of unorganized development and within a larger political framework. Changing times create changing landscapes" (Hough 1990, 49).

With these changing landscapes comes changing identities.

Hybridity

As these changes in cultural identities and the built environment occur, the conventional dichotomies between the urban and the rural could dissolve, and an integration of the two could begin to shape new landscapes and policies (Hough 1990, 146). This creates an opportunity to allow for landscape identities that are no longer distinct and separate, but rather shared by the two environments. The modern suburban areas that are rigorously zoned and separate from the countryside could instead be areas that allow for mixed programs and spaces. Through this new hybrid urban-rural zone, an awareness of place will be enhanced through an interaction with the land in everyday life. Through this interaction, attitudes and experiences of a place can be changed, and the meaning and significance given to the hitherto ordinary and undervalued productive and natural landscapes in the peri-urban prairie environment will begin to provide a basis for regional design and identity (Hough 1990, 190-191).

In addition to agricultural-urban zones of hybridity, infrastructures and buildings could also begin to shape city form. Just as ecological urbanist theories advocate for multi-functional infrastructures in city systems, this project calls for a transit infrastructure that is more than just a vessel for people. By combining agricultural and transport infrastructure in the urban environment, a direct link between city inhabitants and their source of food is created. These areas of intersection between

differing activities could then become areas of opportunity for the formation of new hybrid activities, identities, and ideologies.

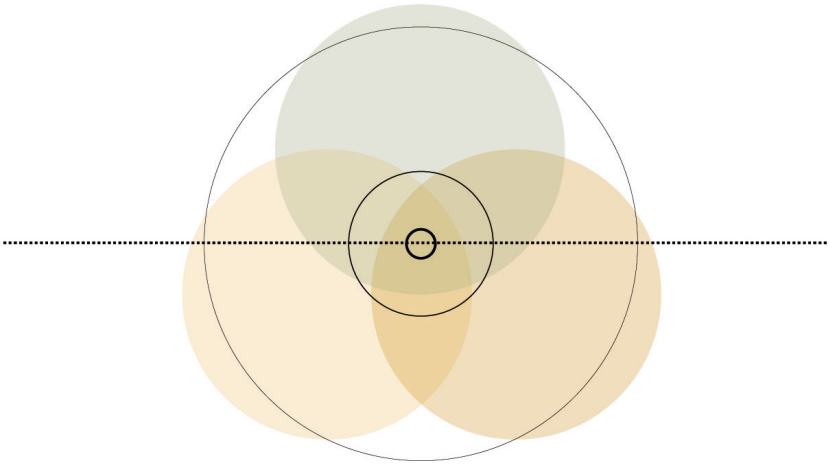
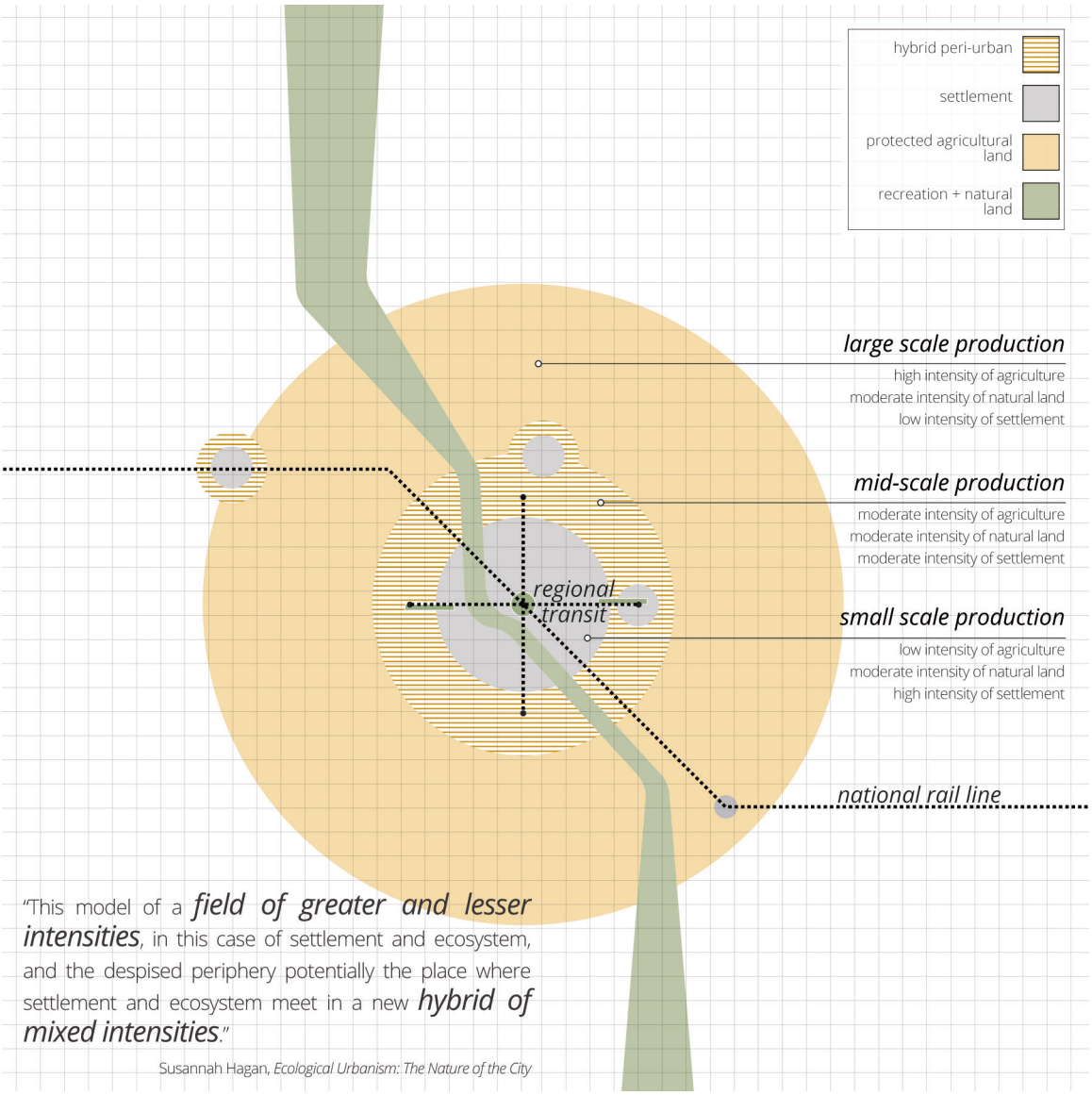


Diagram of the hybridization of multiple programs and conditions within a site.

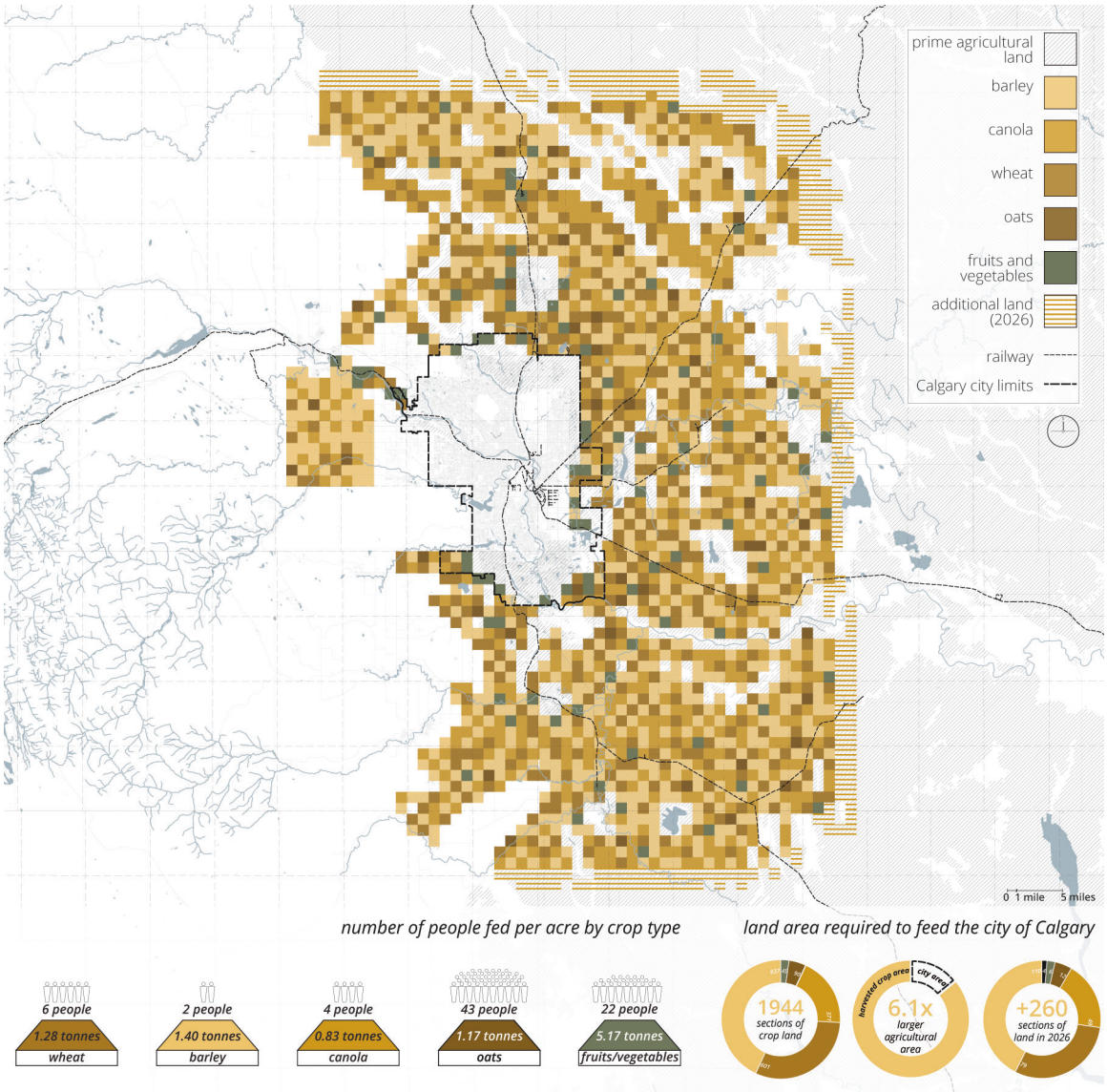
Multi-Scalar Interventions

To begin the design of the agricultural network for Calgary, a regional model for urban expansion that is connected through rail lines is proposed in order to understand the growth of the city occurring alongside agricultural preservation. This model includes a protected farming area where a high intensity of agricultural production occurs in order to feed the high intensity of settlement occurring within the city. Between these zones, a hybrid settlement and farming area that acknowledges the need for city expansion while also preserving prime agricultural land is proposed as a key feature of local agrarian networks in the city. These zones of varying intensities would all be connected through rail systems envisioned as a multi-layered infrastructure system able to support the flow of people, dispersal of knowledge, as well as the production and distribution of food within the city (see page 55).

To apply this model, the Section survey parcel is used as a measure to determine the agricultural area required to feed the city of Calgary. This results in an area six times larger

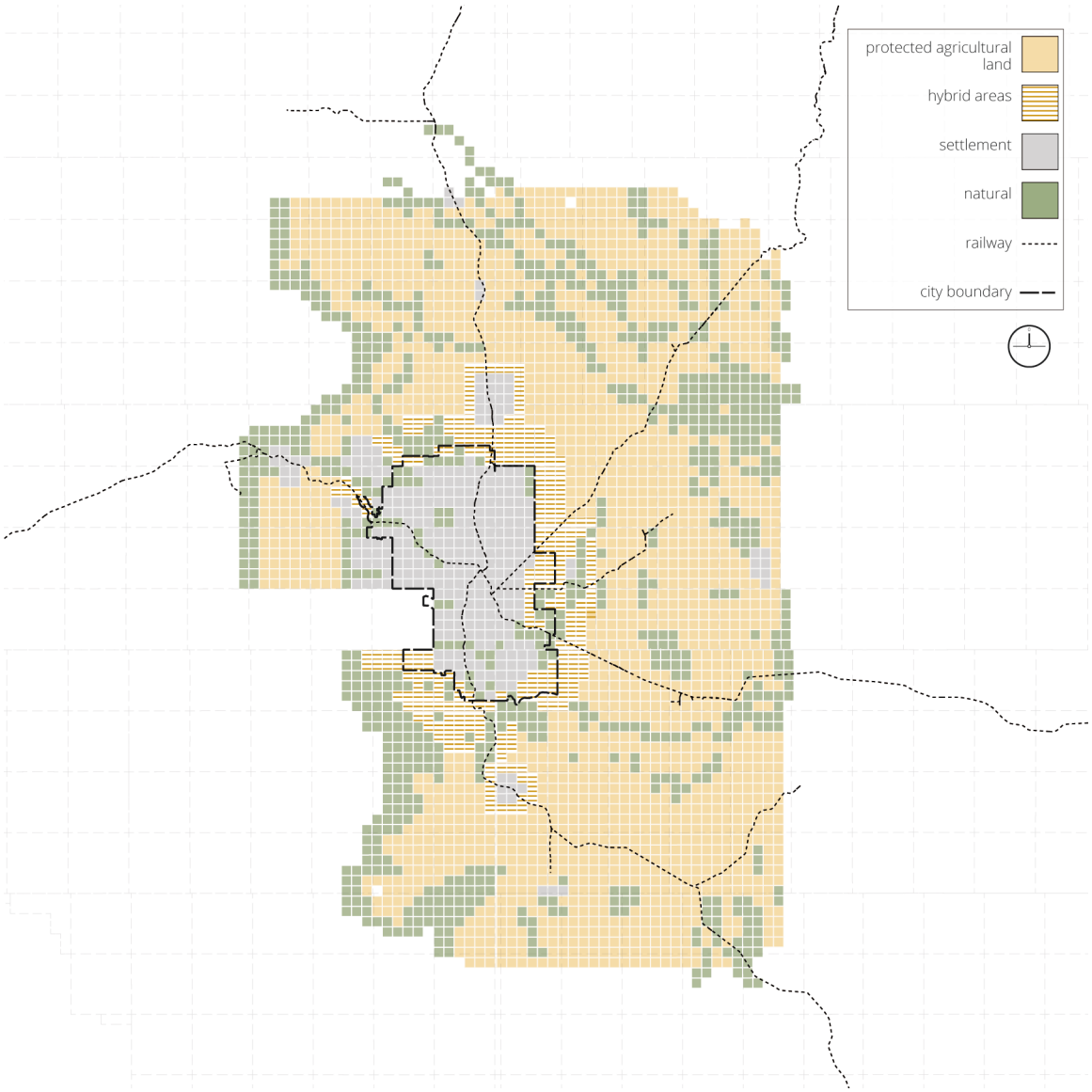


Regional growth model developed through a range of agricultural-settlement intensities.



Agricultural footprint of Calgary based on land suitability and crop yields (Begam and Adilu 2017; Altalis; Alberta Agriculture and Forestry; National Resources Canada; Open Calgary).

than the current extents of the city. By laying this agricultural footprint along prime agricultural lands, a regional model that preferentially protects the best farmland in the region is established. Future city growth is also applied, including both settlement and agricultural areas. This area forms the agricultural settlement zone, and is situated along the periphery of the current city limits. It is in this suburban area of hybridity that the project is situated.



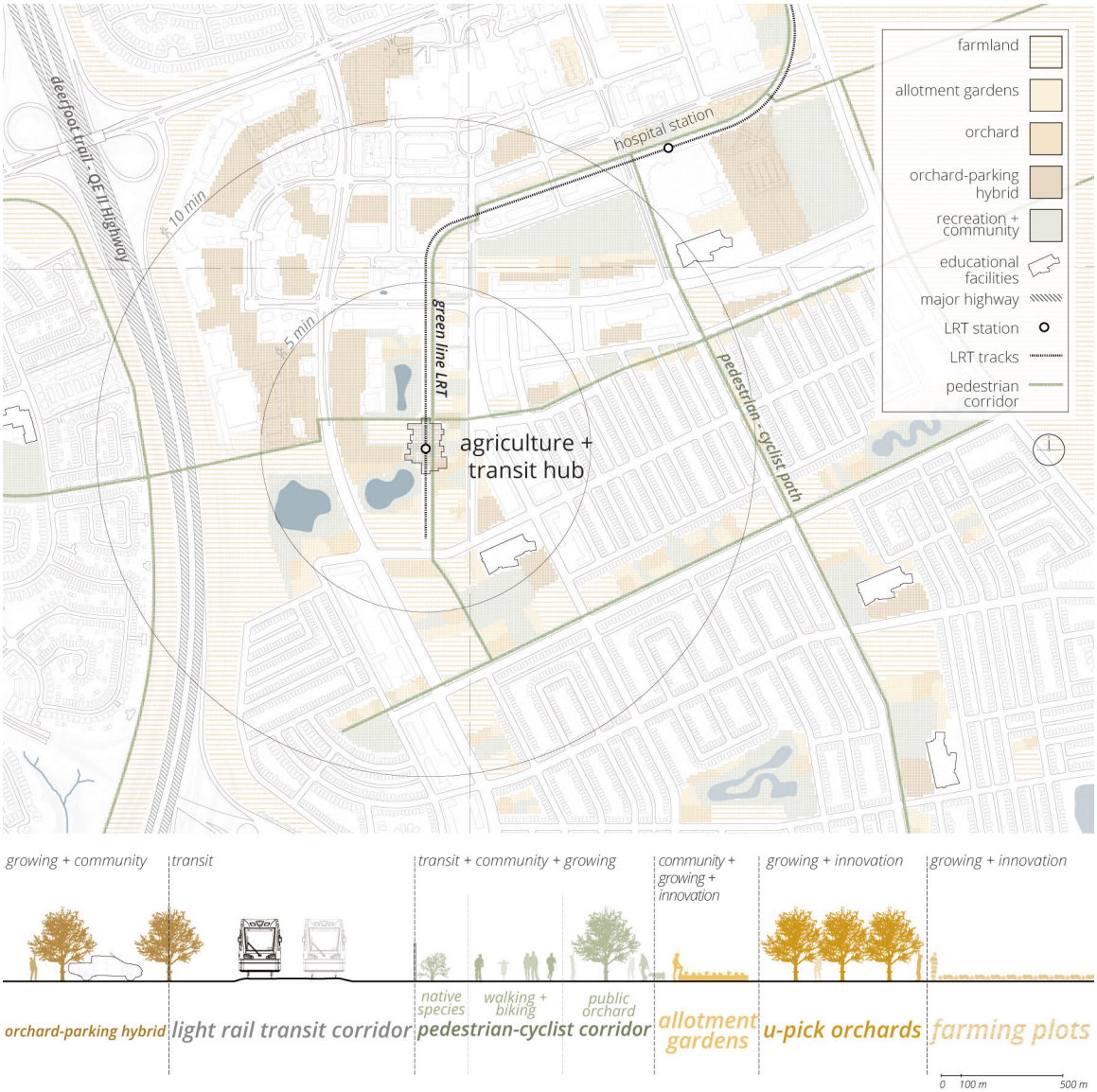
Applied regional growth model for Calgary (Altalis; National Resources Canada; Open Calgary).

Site Selection

This agricultural hub is proposed for the emerging community of Seton in southeast Calgary. This site was chosen as a result of its connection to the future Green Line LRT, its fast-paced development, and the high quality of farmland that the development will overtake. It has been under construction since the early 2000's, and when it is fully built, it will take over 350 acres of active farmland and make room for roughly 17,000 people (Green Line LRT Long Term Vision: 160 Avenue N to

Future development at the southern end of the Green Line in Seton (Altalis; Geofabrik; Open Calgary).

Seton 2016). This site is functionally separated into mid-rise and single-family homes, recreational and educational facilities, an office district, and a shopping district comprised of large box stores.



Proposed strategy for the community of Seton, where agricultural and transit corridors act as a connective tissue through the neighbourhood.

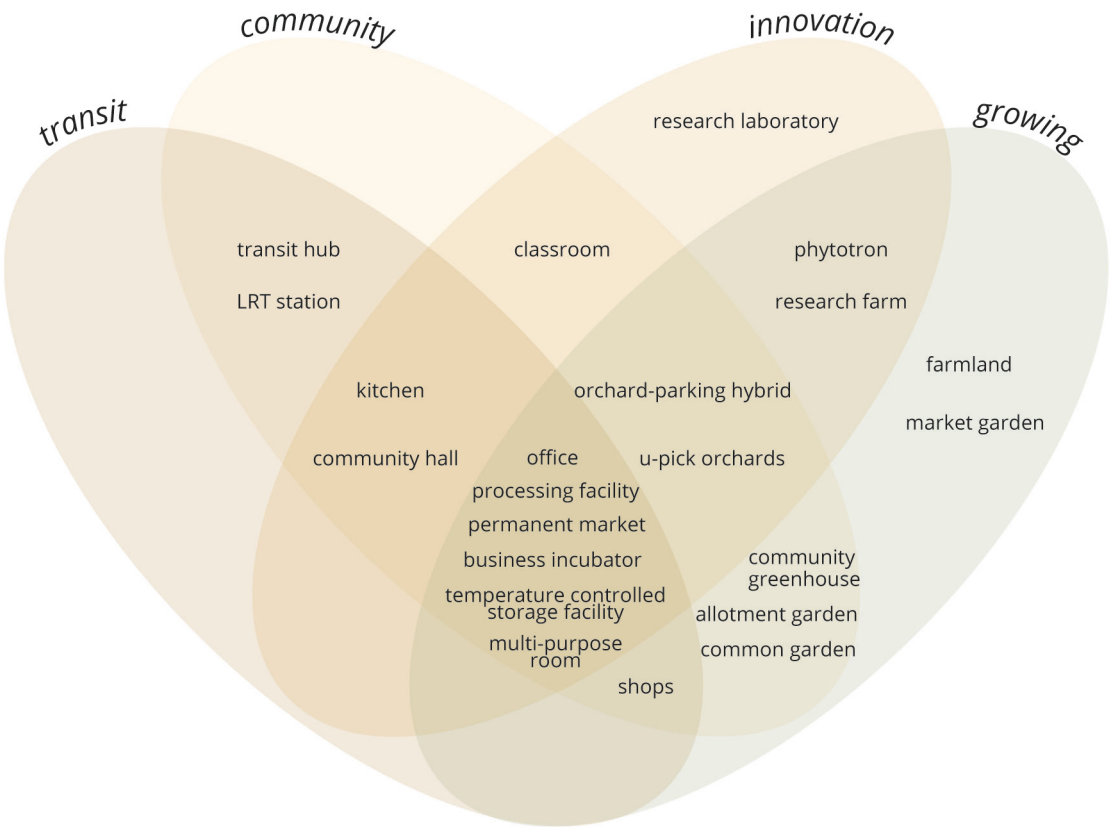
Proposed Neighbourhood Strategy

This project proposes to connect these zoned areas through a connective system of growing. Major transit networks stretch into the community, including the major Queen Elizabeth II highway and the proposed Green Line LRT. Along these transit lines agricultural zones are implemented, connecting train stations, educational facilities, and recreational areas. These agricultural swaths become a system of production

as well as transportation, with hybrid orchard parking areas, LRT corridors, and pedestrian-cyclist paths. These areas of movement are described as “the commons”, where people pass through native species, pollinators, permacultural gardens, and cultivated areas. These commons are a system that connect a variety of agricultural and garden types that stretch through the community.

The train station itself is seen as a site of growing, connected to a continuous agricultural system stretching through the neighbourhood. This growing network is linked with transit networks, with a major highway passing beside the development, a new LRT at the core, and pedestrian and cyclist paths creating a connective corridor through the agricultural lands. The cross section of these growing swaths shows hybrid parking-orchard areas, an LRT corridor, a pedestrian-cyclist-growing network, and a variety of garden types that form the basic patterning of the land.

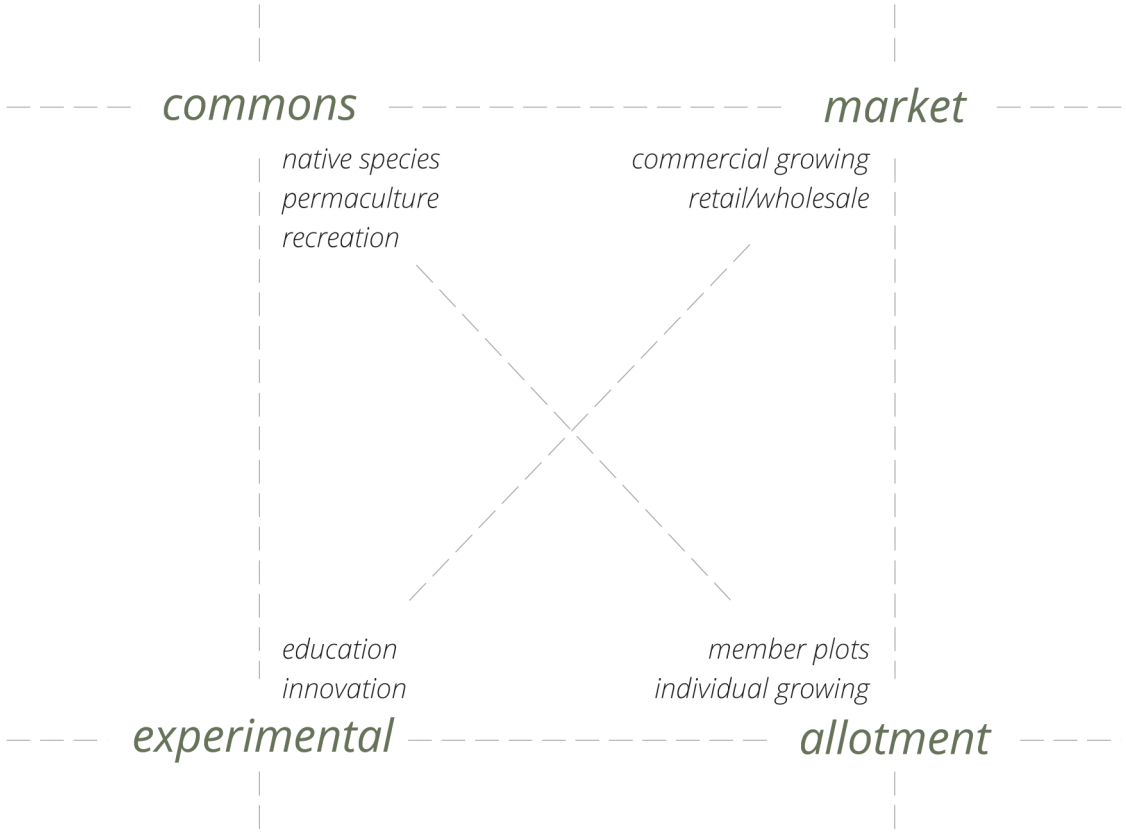
Visualization of the pedestrian-cyclist corridor, with productive elements available to anyone within the community.



The overlap of programs in the project based on four key groupings of production, innovation, distribution, and community.

Activities within the Agricultural Network

Four main programmatic areas have been identified as key elements within the project. Primarily, the project is centered around growing, where the cultivation of local foods occurs within urban communities. It includes transit to encourage distribution of goods and connection between city neighbourhoods. Gathering, education, and participation nurtures the creation of community centered around agriculture, and innovation at multiple levels provides support for the farmers in the sector. Each of these programs come together and intersect in order to create opportunities for shared programming and the exchange of knowledge and ideas.



Garden types in the project.

Growing

Gardens, greenhouses, and orchards create a local food network for fruits and vegetables in the neighbourhood. These elements are organized into four key garden types, including the commons, market production, experimental growing, and allotment plots. The commons are open growing swaths that allow for everyone to participate in the cultivation of produce, and also provide spaces for recreation. Market gardens would operate at a variety of scales, ranging from acre or sub-acre farms, to individual plots, to indoor growing shelves. Experimental gardens would also occur at multiple scales, providing opportunities for controlled research environments, educational growing beds, or high-tech growing practices. Finally, individuals or groups within the community would be able to rent out small growing plots within the allotment gardens.

Community

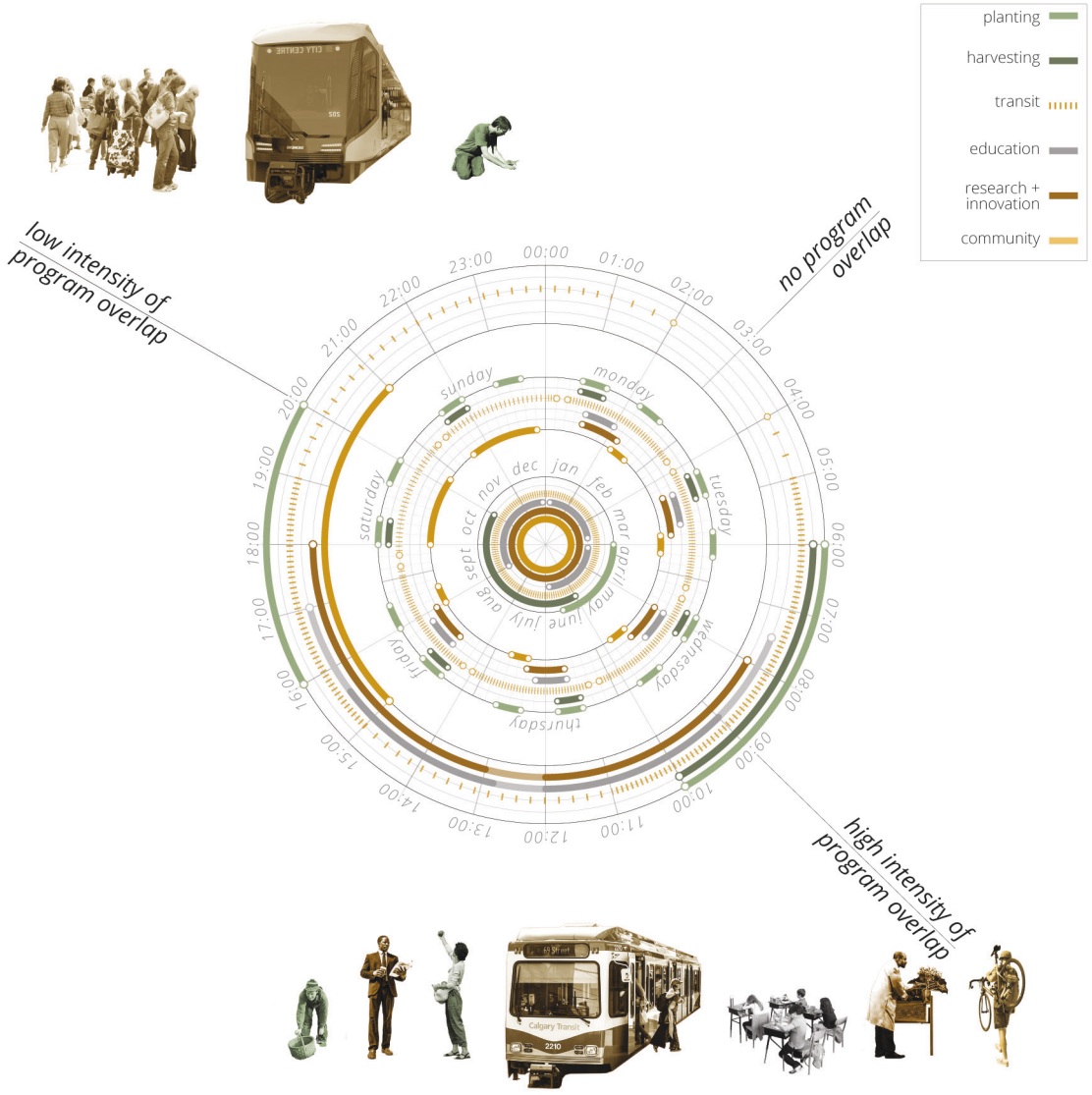
In order to connect people to growing and create a culture around farming, areas for community gathering are fundamental to the project. By combining functions of civic life with growing activities, not just the farmers, but all members of the community would be able to experience cultivation in their day-to-day life. In this way, agricultural-transit networks would also become networks of identity, tying inhabitants to each other and the land they exist within.

Innovation

The creation of an innovation network within the agrarian-urban framework is intended to provide much-needed support to the fruit and vegetable industry in Alberta. Research facilities would provide local farmers with regionally specific agricultural information. Educational spaces would foster an interest in growing in both children and adults. Industry support spaces would allow for farmers, both small and large scale, to process, store, and market their goods.

Transit

By connecting activities of innovation, community, and growing to transit, the networks created within individual neighbourhoods would be able to expand throughout the city. The transport of produce along the light rail line would minimize issues related to distribution, creating a direct connection between sites of growing and their markets. In addition to the transport of goods, the flow of people in and out of agrarian neighbourhoods would provide opportunities for the supply of labour and the exchange of knowledge.



Overlap of schedules for various programmatic activities taking place within the project.

Program Overlap and Intensities

Within the project, multiple programs come together to support the agricultural activities in Seton. Each activity has a unique schedule that results in the activation of the building throughout the day, creating periods of high and low intensity depending on the hour, day, and month. For instance, at nine in the morning on a weekday, a high intensity of activity would be taking place. Planting and harvesting is best done early in the morning; trains

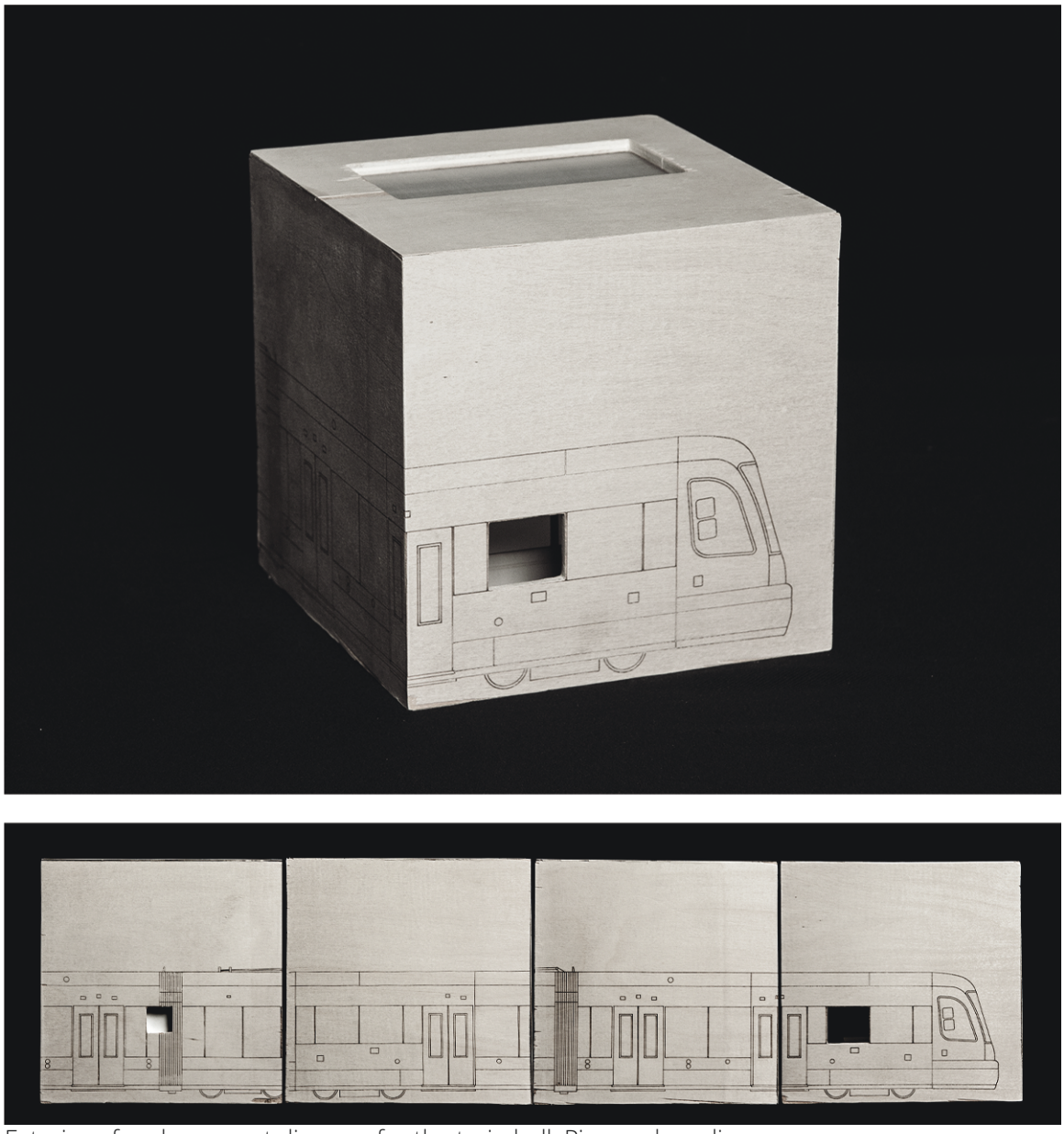
reach the station every three to seven minutes during rush hour, administrative staff and researchers would be getting to work, and children would be starting school, coming to the agricultural centre as a part of a curriculum about food and production.

Alternatively, on a weekend in the evening, the trains only run every 10 to 15 minutes and there is less traffic from workers and transit users, leaving plenty of room for community activities to take place. This could include anything that a suburban-agrarian neighbourhood would need, from agricultural workshops, to farmers markets, to banquets, to gardening, to arts and crafts classes. The temporal overlap of various activities in the project are supported by a built environment that seeks to create opportunities for new interactions between growing, transportation, and community life.

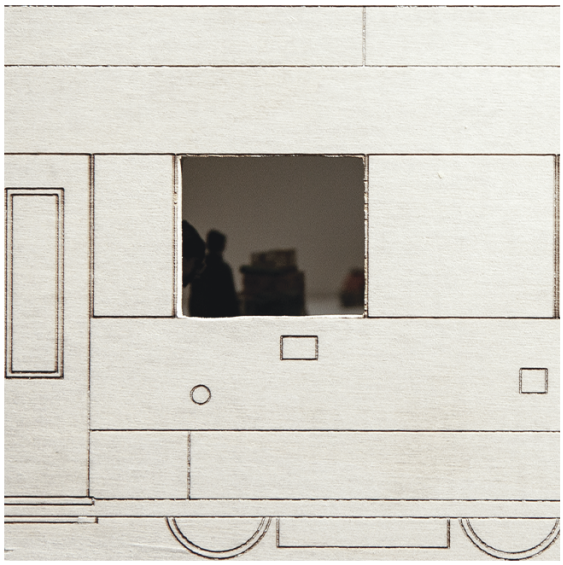
CHAPTER 6: DESIGN OF AN AGRICULTURAL TRANSIT CENTRE

In order to foster a local fruit and vegetable network and mitigate urban expansion into agricultural land, this project proposes the merging of agricultural and transportation infrastructures in order to develop a local food system. Similar to how the national rail line stations once had a policy of gardens attached to train stations to emphasize the fertility of the land and foster an agrarian culture, this project pairs the LRT with production of fruits and vegetables to re-invigorate an identity for the city focused around food. The result is an agricultural innovation centre and transit hub that activates the community it sits within as well as the city as a whole.

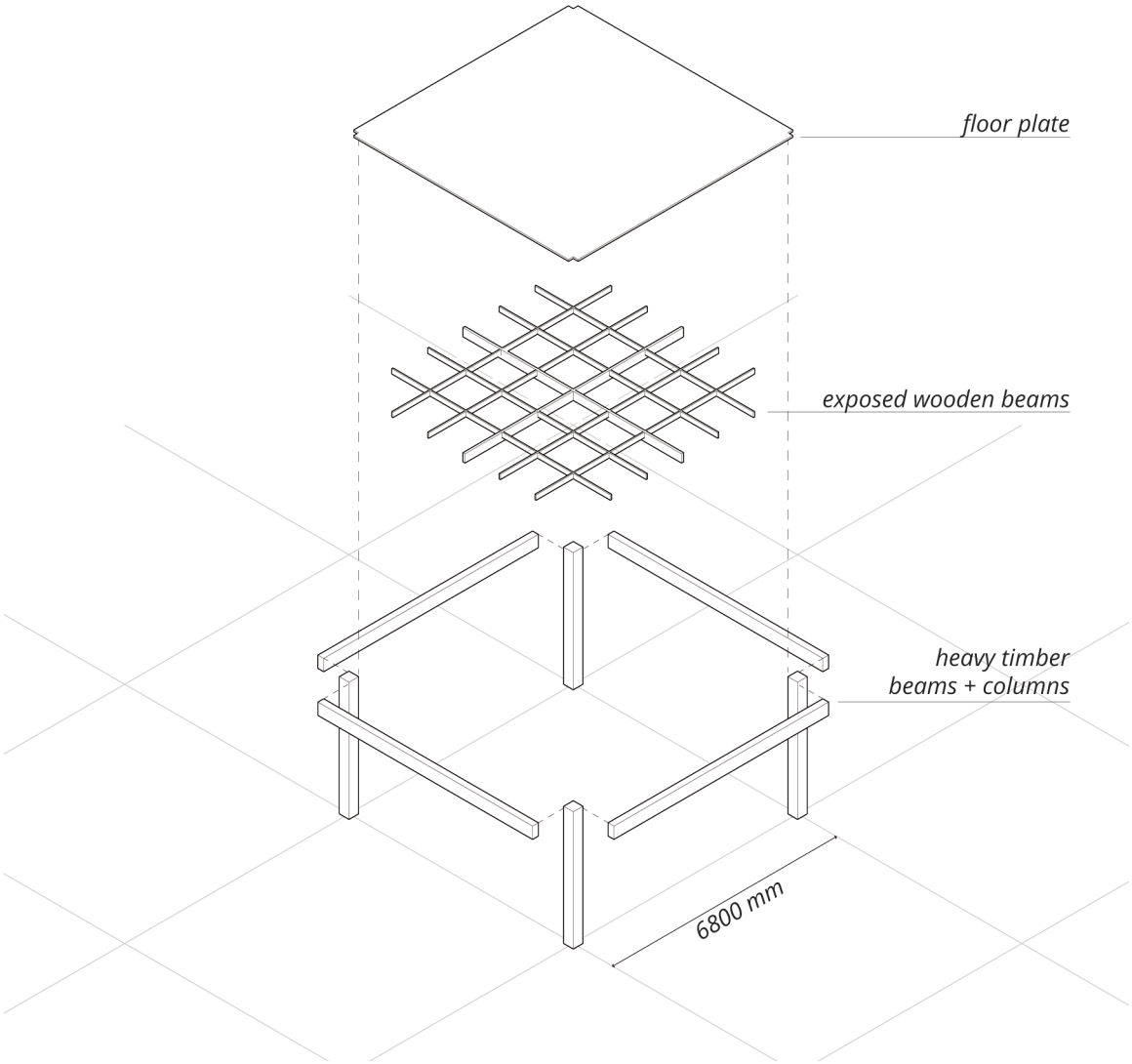
Early conceptual image of a project that would support agriculture and transit in the suburbs of Calgary.



Exterior of early concept diorama for the train hall. Pine and acrylic.



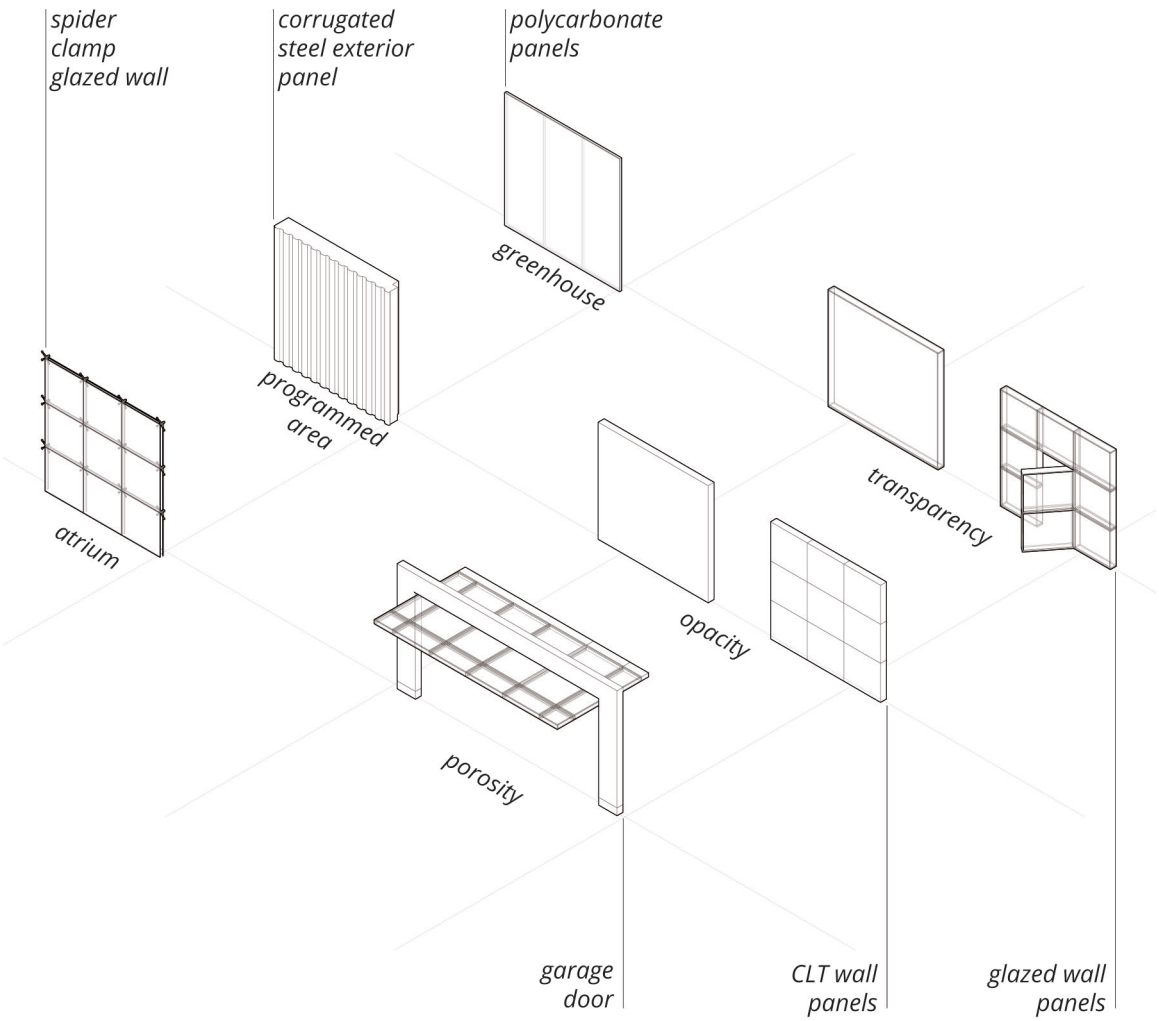
Interior views of early concept diorama for the train hall. Pine, card, and acrylic.



Heavy timber building structure.

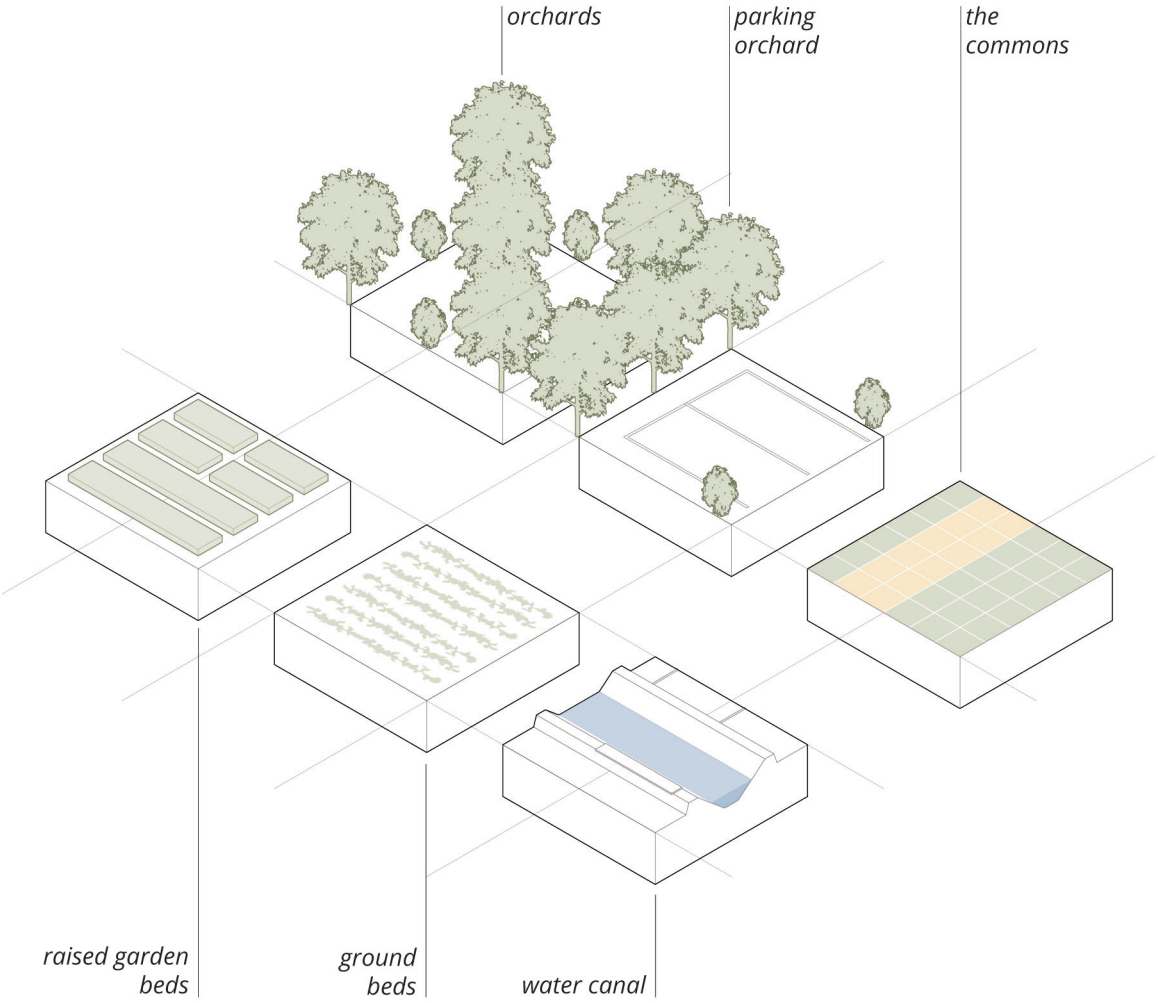
Building Parcels

Using pixelation as an architectural and organizational strategy, the project was developed using a series of parcels that formed the agricultural transit center. These parcels are all organized within a grid of 6.8 meters. From this grid, a structural system was developed using heavy timber components. Exposed wooden beams create a repetitive structure that mimics the hierarchical organization of the land survey, pointing to the agricultural roots of the project.



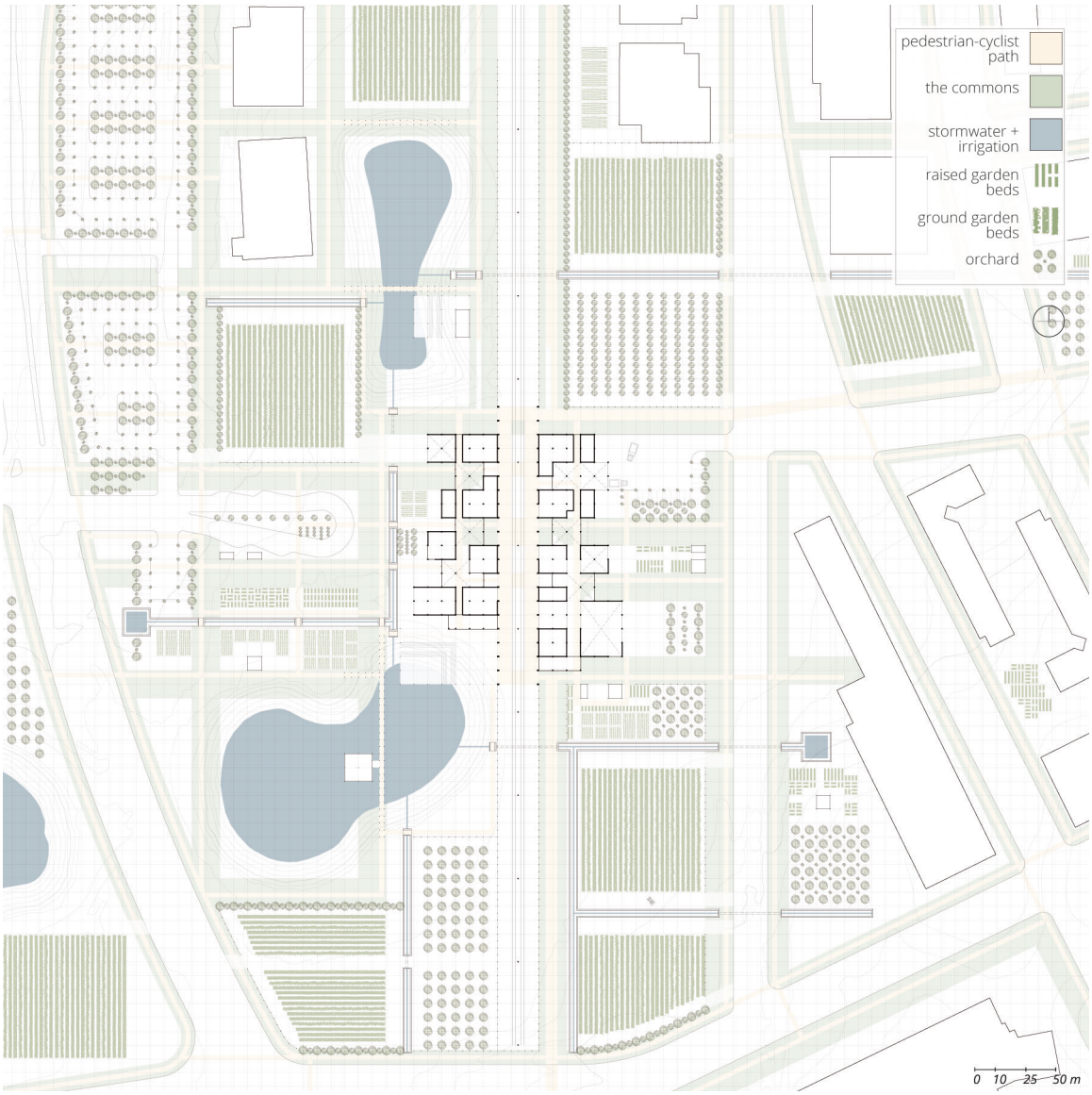
Wall parcels within the project.

A series of wall parcels were developed to create the patterning of the building. Exterior walls respond to the activities within, where polycarbonate panels provide shelter for indoor growing, corrugated panels wrap major program, and glazed walls signify entry points and programmatic transparency. Large garage doors create porosity between different spaces, and solid and transparent panels promote or obscure visual connections.



Ground parcels across the site.

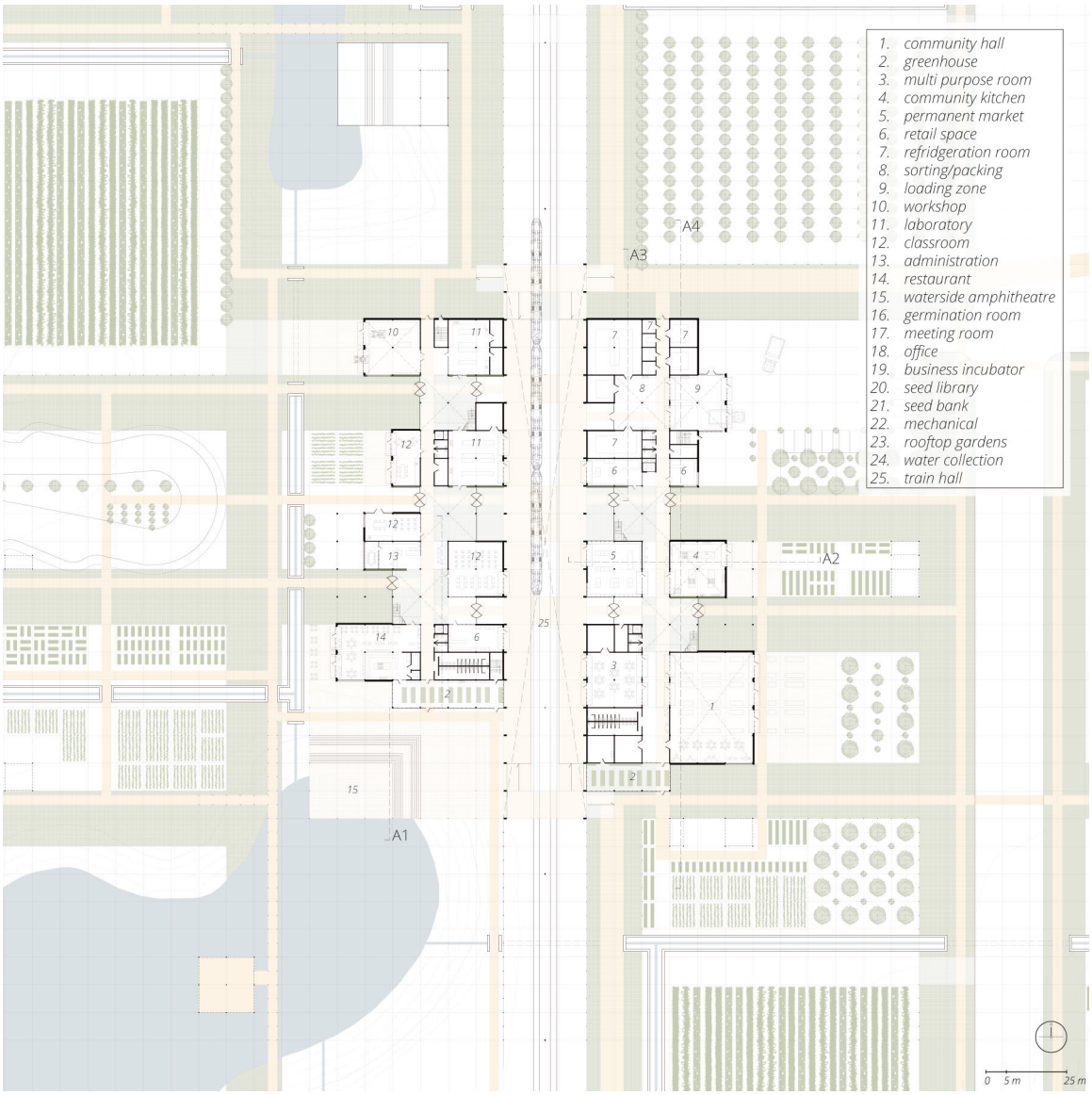
There are also a series of ground parcels that create the patterning of the site. Areas for cultivation consist of raised beds, ground plots, and orchards. These growing areas are serviced by hybrid infrastructures, including water canals for irrigation and leisure, orchard parking areas for car transportation and growing, and a hybrid swath (“the commons”) used for growing and pedestrian and cyclist transportation. The commons stretch through the project as swaths of circulation and growing, creating connections between agricultural areas.



Site plan for the agricultural transit hub in Seton.

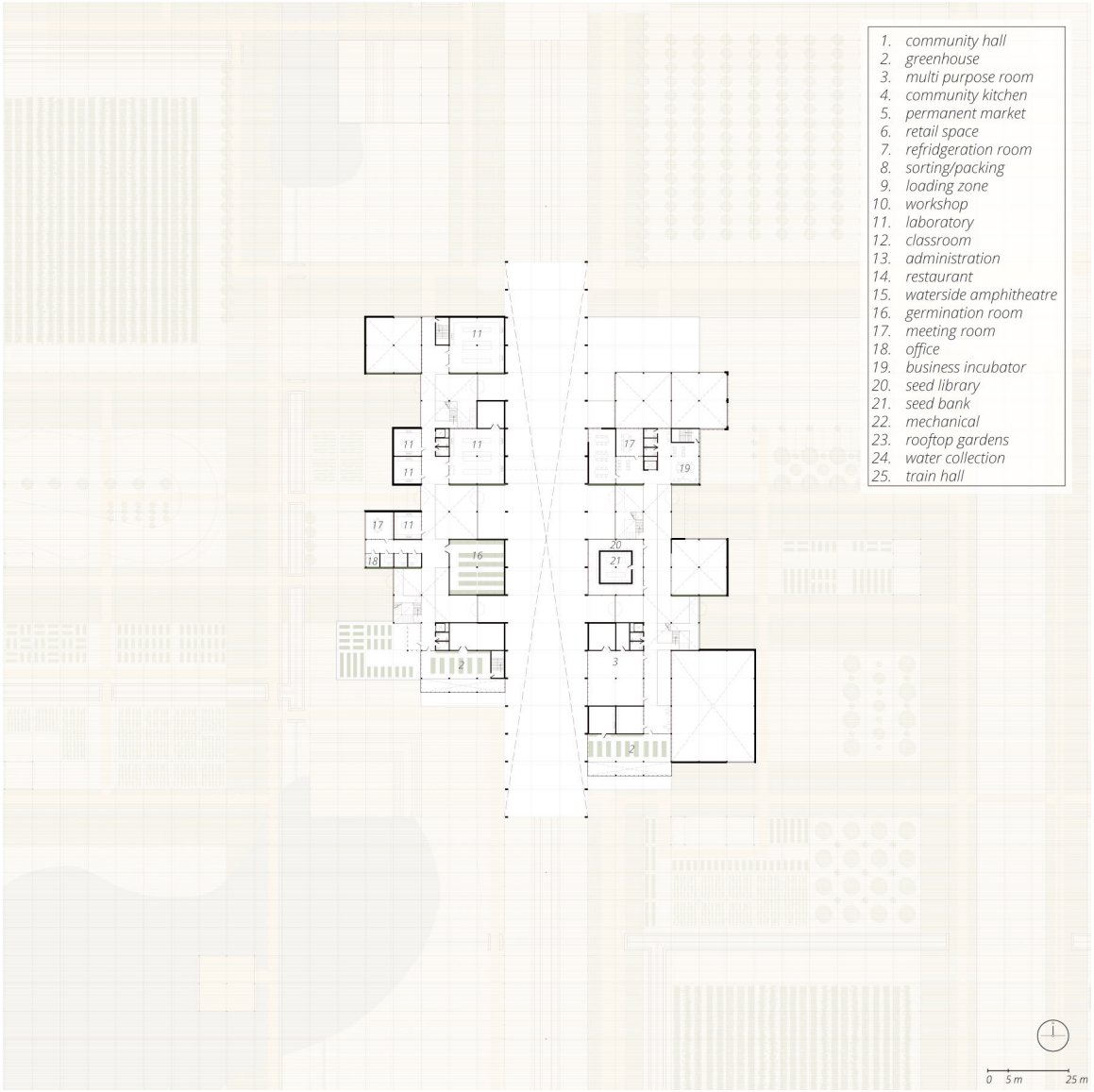
Patterns of the Site

A system of productive gardens and support structures are pixelated across the site. The continuous swath of the commons frames a variety of agricultural types, such as sub-acre farms, orchards, and allotment gardens. These garden networks connect to the transit networks: an LRT station runs through the middle of the building and the site, linking to a bus loop, park-n-ride's, and pedestrian and cyclist networks. These come together to make a multi-modal hub, providing a direct distribution link

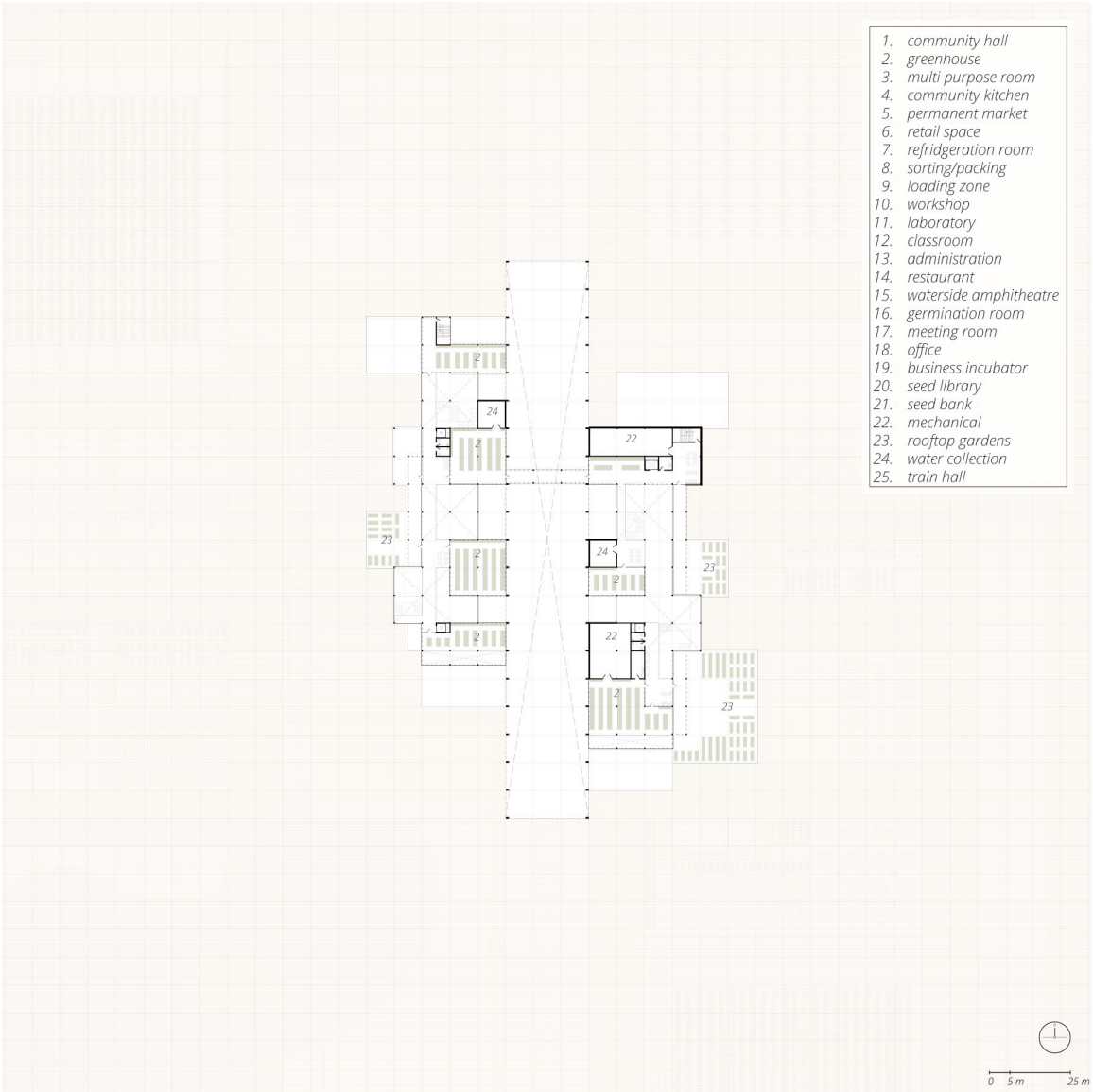


Ground floor building plan.

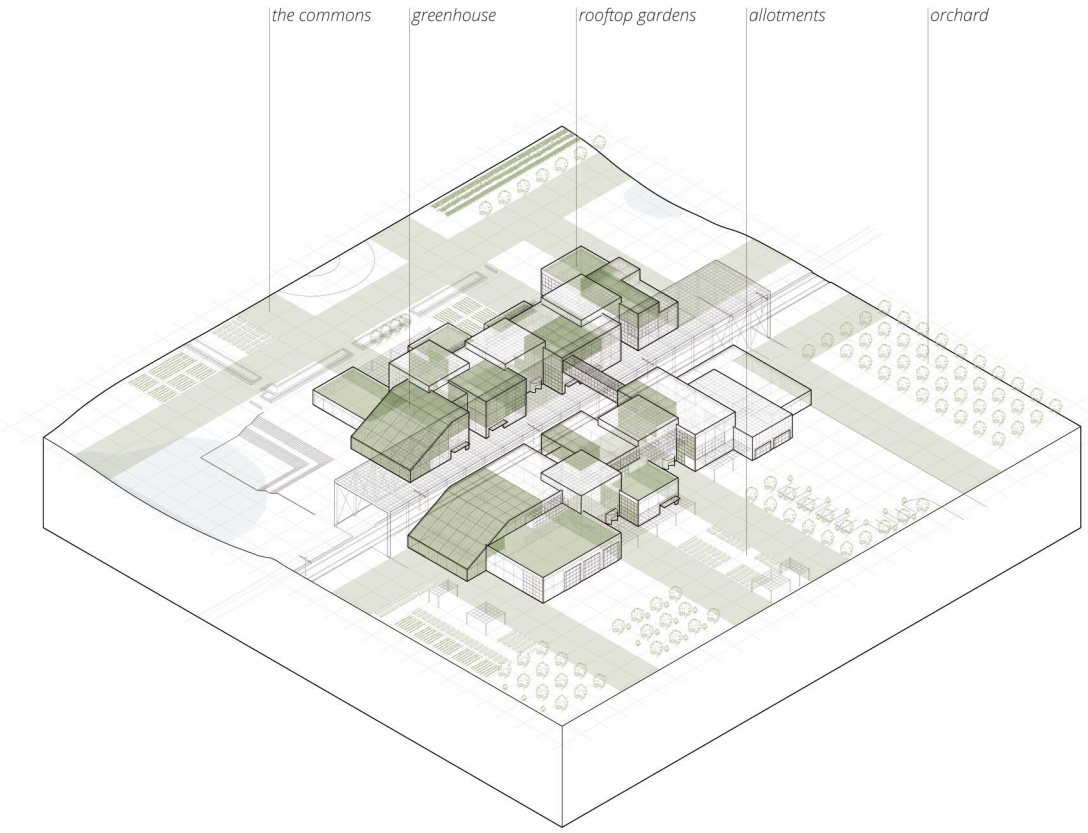
for the agricultural goods on the site. An irrigation network is also laid overtop the agricultural network, where stormwater ponds that were created in preparation for the development of Seton are repurposed to provide irrigation to the gardens on the site. These feed irrigation canals that stretch across the landscape.



Second floor building plan.



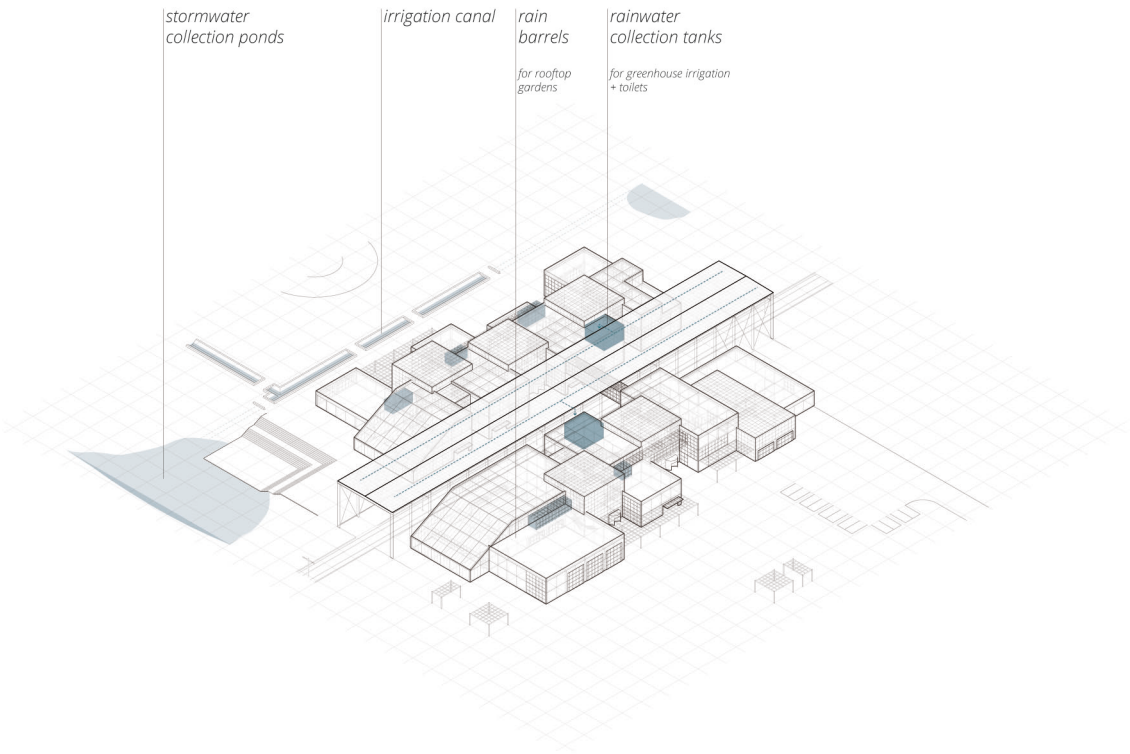
Third floor building plan.



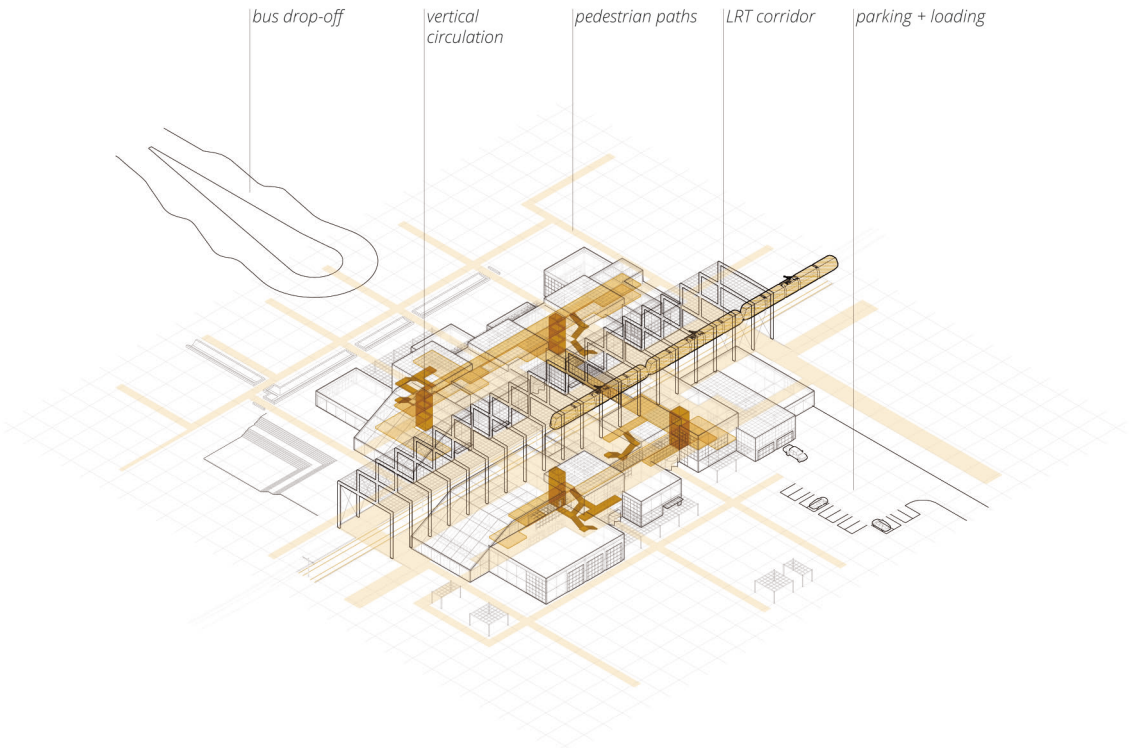
Garden networks within and around the building.

Building Networks

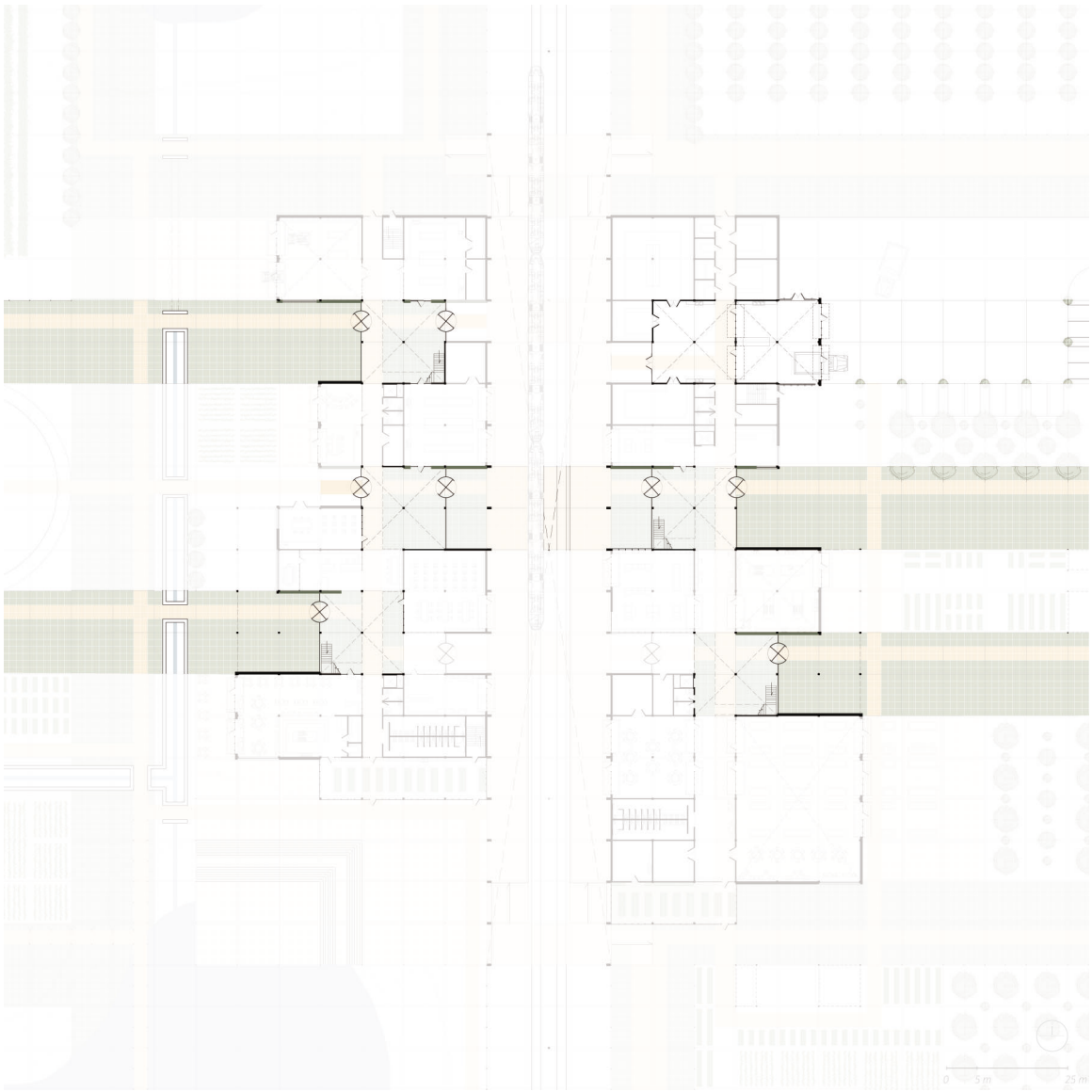
Similar to how continuous networks stretch across the site, a variety of systems operate within the building. Growing spaces that begin in the agricultural zone stretch into the building, creating both vertical and horizontal growing spaces. A water collection grid is laid overtop the structural grid to provide irrigation for the plants within and around the building. Major circulation routes connect to the train hall and between the program areas, which are divided into innovation and research, retail and commercial, processing and storage, and community gathering. Within these major program areas, a great deal of overlap occurs, where depending on the time of day or the season, different groups will be using the same spaces for different reasons.



Water networks within and around the building.



Circulation networks within and around the building.



Atriums highlighted as major points of entry.

Atriums and Layered Circulation

The building is seen as an extension of the agricultural landscape it sits within. The commons stretches into the building at large atrium spaces that moderate between the exterior agricultural landscape and the interior spaces, inviting people into the building. These atriums shoot up into the second and third floor of the building, connecting outside growing occurring on the ground to greenhouses and rooftop gardens on the upper floors.

Sectional model showing of a main entry atrium. Basswood and Pine.

This building provides a constant connection to the cultivation of local produce. As you enter the building through the commons, continuity between growing spaces is achieved by green walls on both the interior and exterior of the building, creating ambiguity between indoor and outdoor spaces. The atriums themselves are areas of layered circulation, providing a constant connection to the growing areas as people travel from floor to floor. In the early morning, as traffic from the LRT and people coming to work within the Agricultural centre enter the building, the atriums would be extremely active. Based on maximum train capacity, almost 1,000 people could be passing through the building every three to five minutes during peak hours.

1. Stormwater Pond

2. Waterside Amphitheatre

3. Greenhouse

4. Washroom

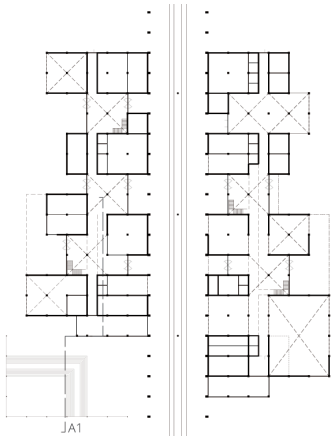
5. Universal Washroom

6. Atrium

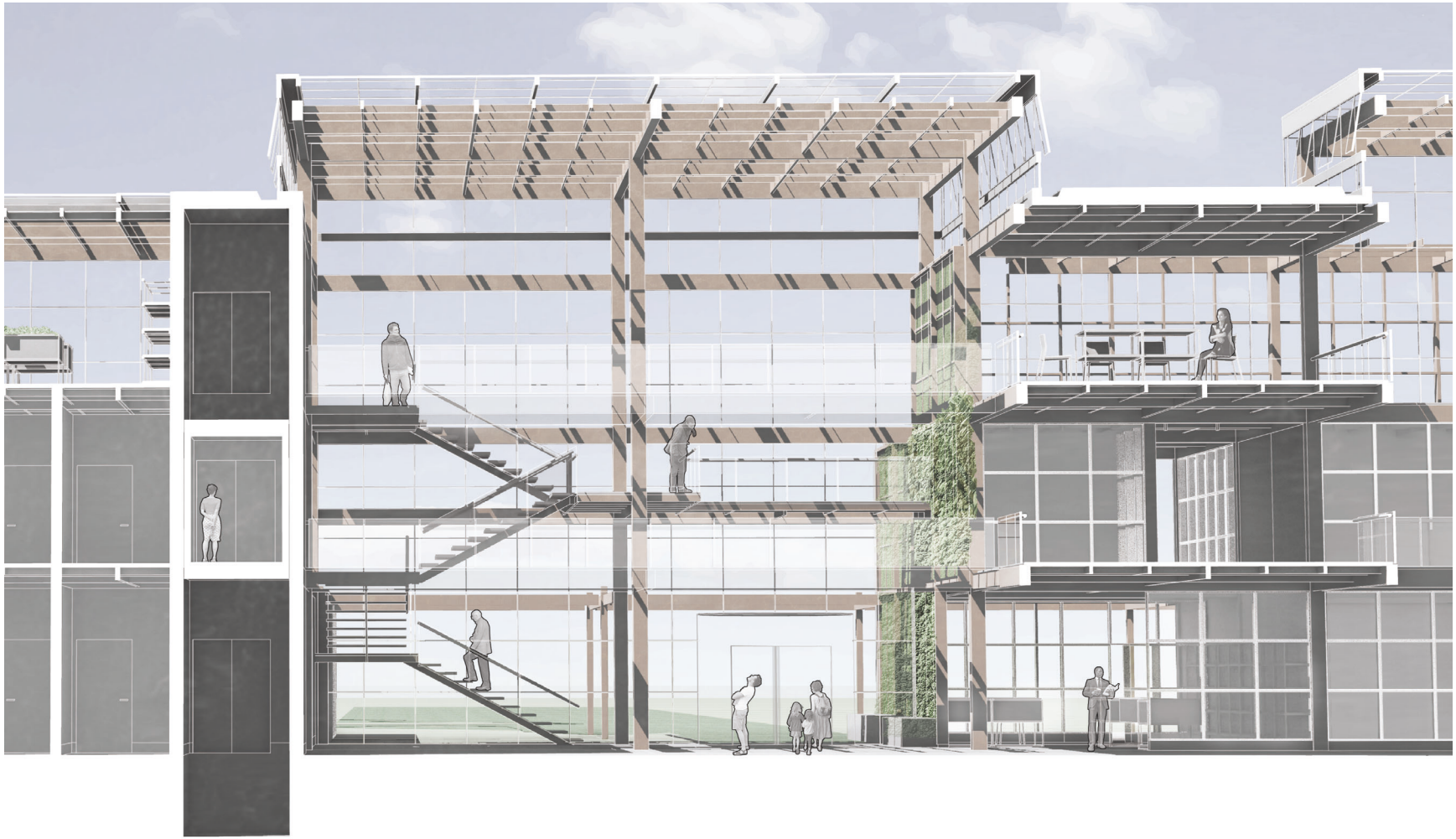
7. Green Wall

8. Offices

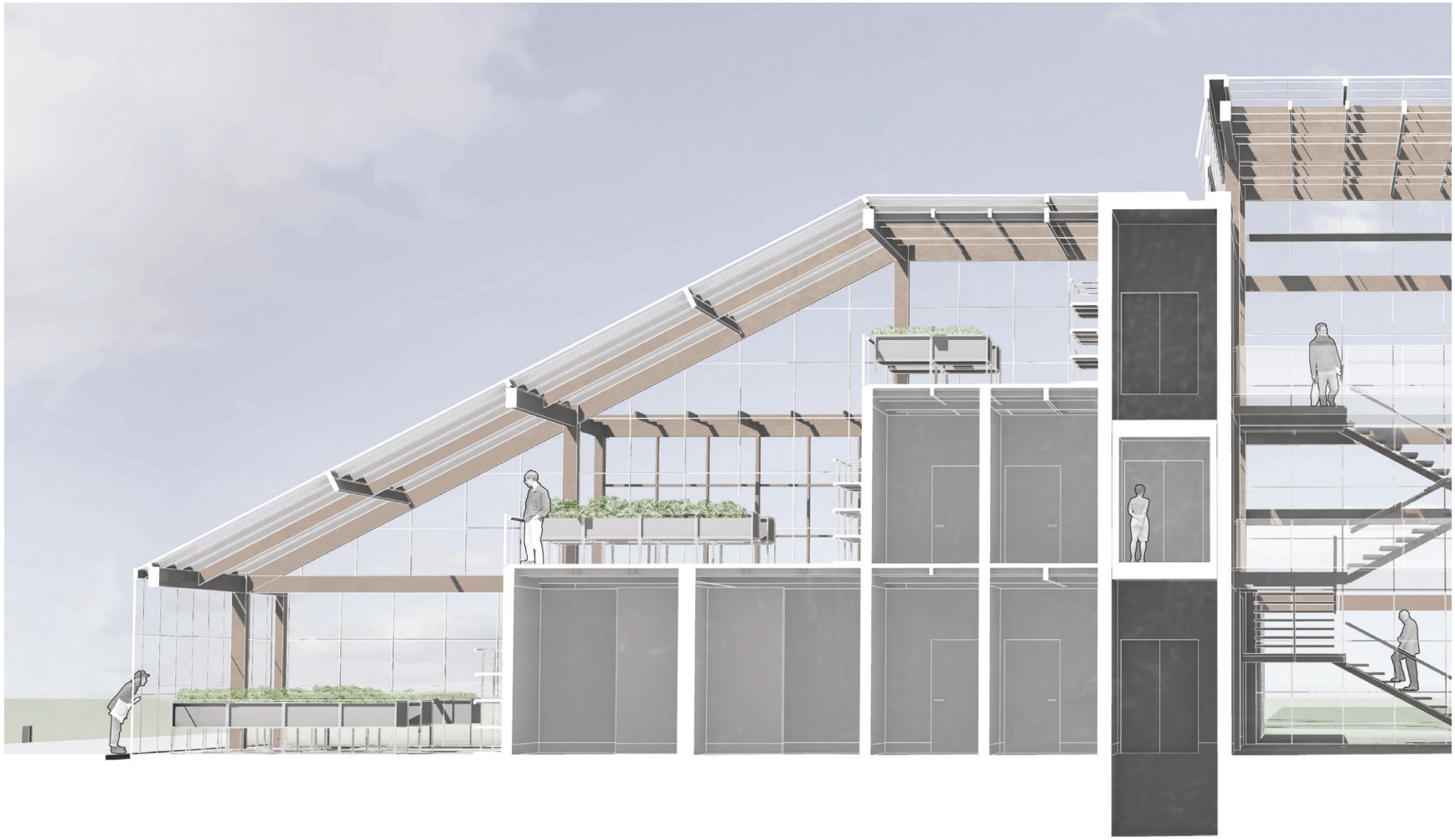
9. Administration



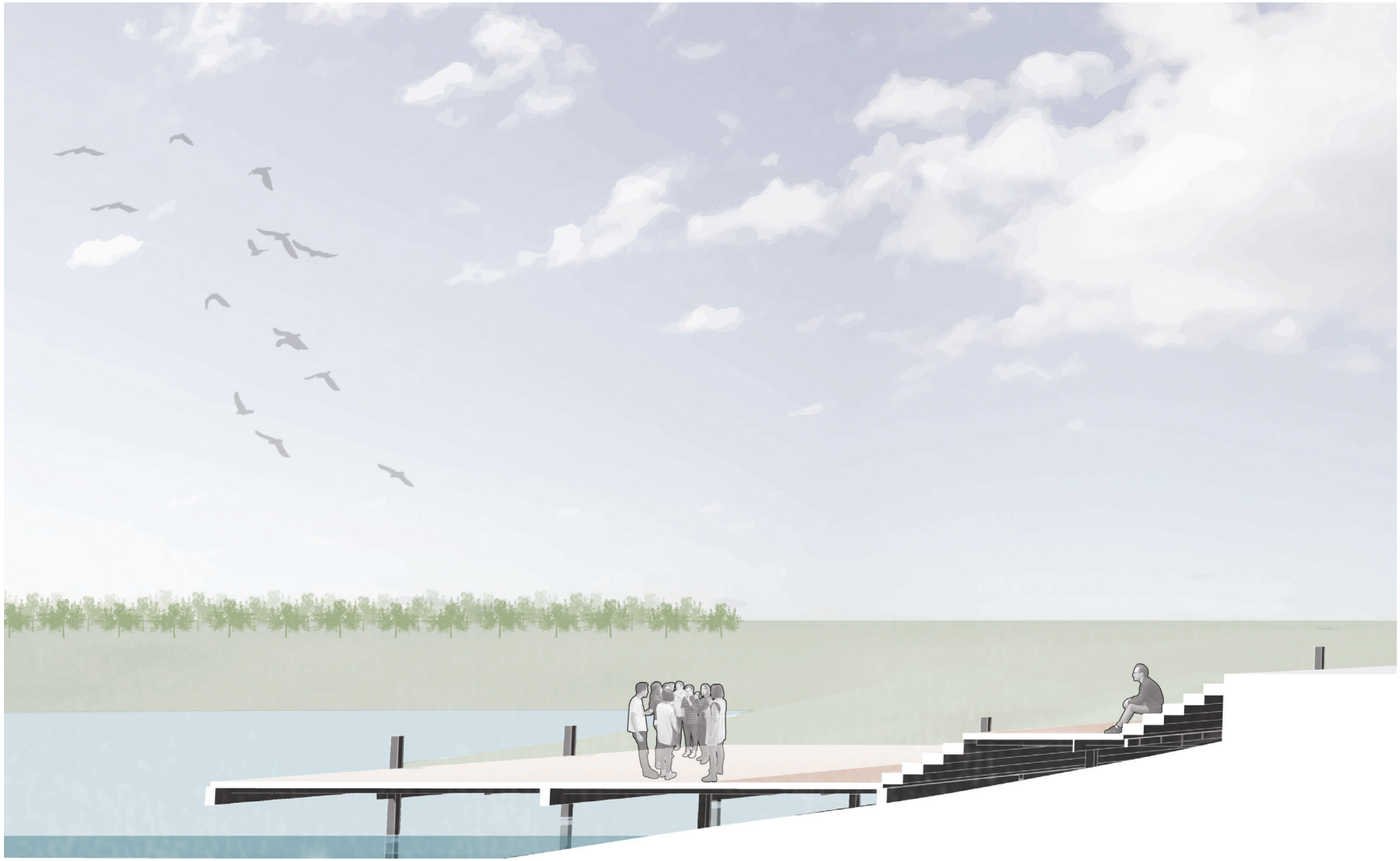
A1: Sectional perspective of atrium and growing spaces.



Layered circulation and green wall in the atrium space.



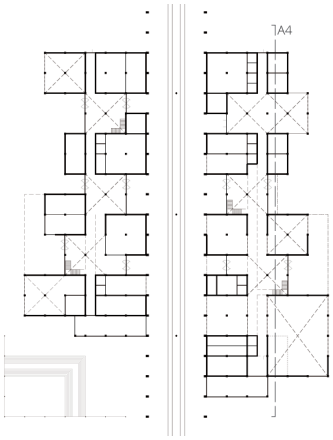
Tiered greenhouse adjacent to atriums.

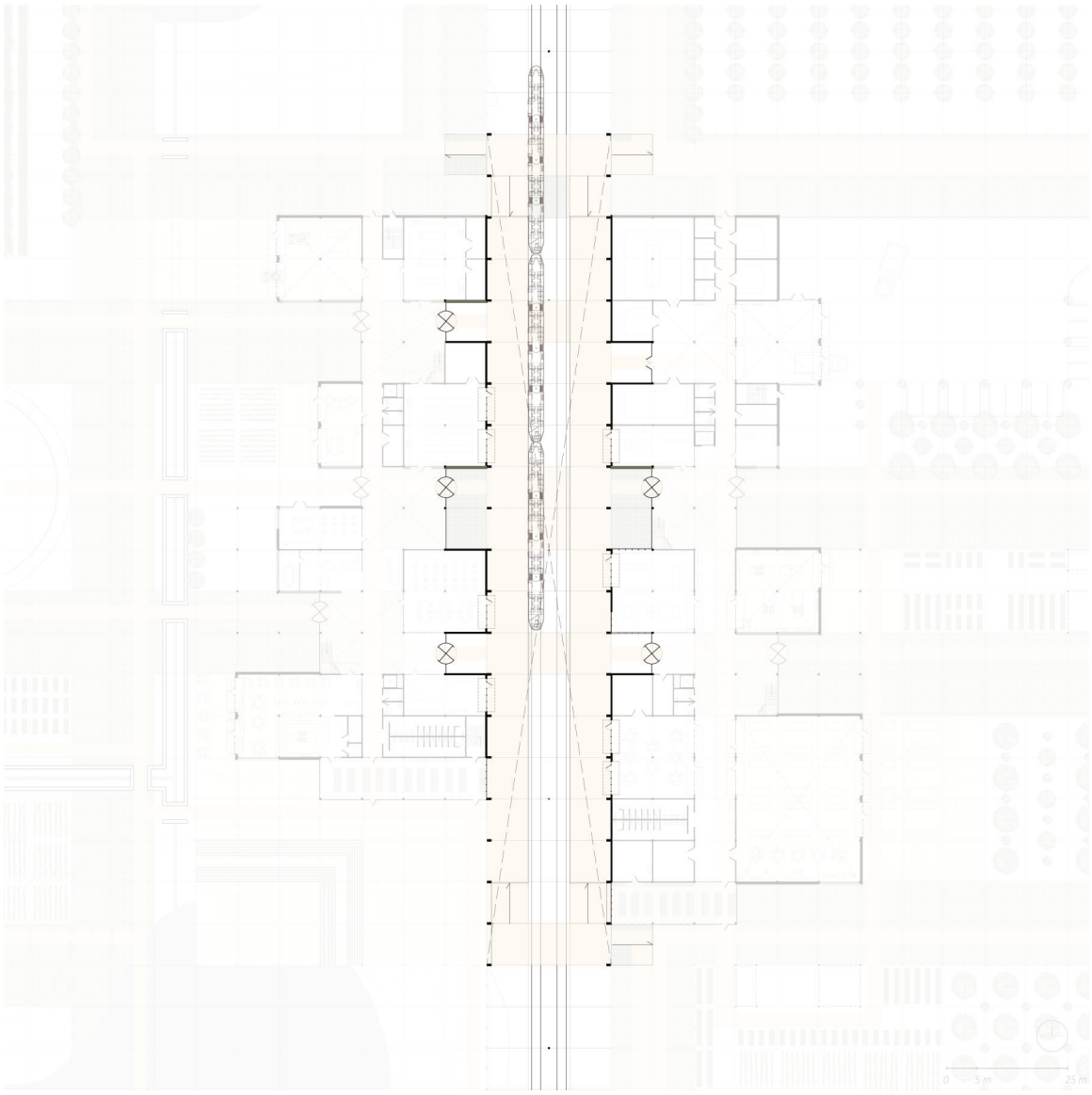


Waterside amphitheatre and gathering space.

A4: east view of sectional model, atriums and program areas. Pine and basswood.

A4: west view of sectional model, atriums and program areas. Pine and basswood.





Train hall and major points of access.

Activation of the Train Hall

The train hall runs through the center of the building and is surrounded by the program of the agricultural hub. The train tracks can be crossed at both ends of the hall by ramps, or at the extension of the entryways by a stair. This allows for the train hall to be a space open to anyone crossing through the site and allowing for a variety of interactions to occur. Adjacent spaces within the agricultural innovation centre open onto the platform, creating a high degree of porosity between programs.

1. Train Hall

2. Water Collection

3. Seed Library

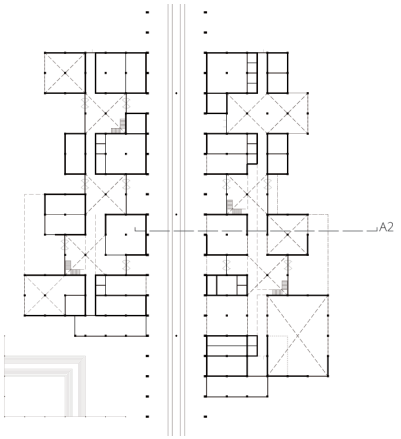
4. Seed Bank

5. Permanent Market

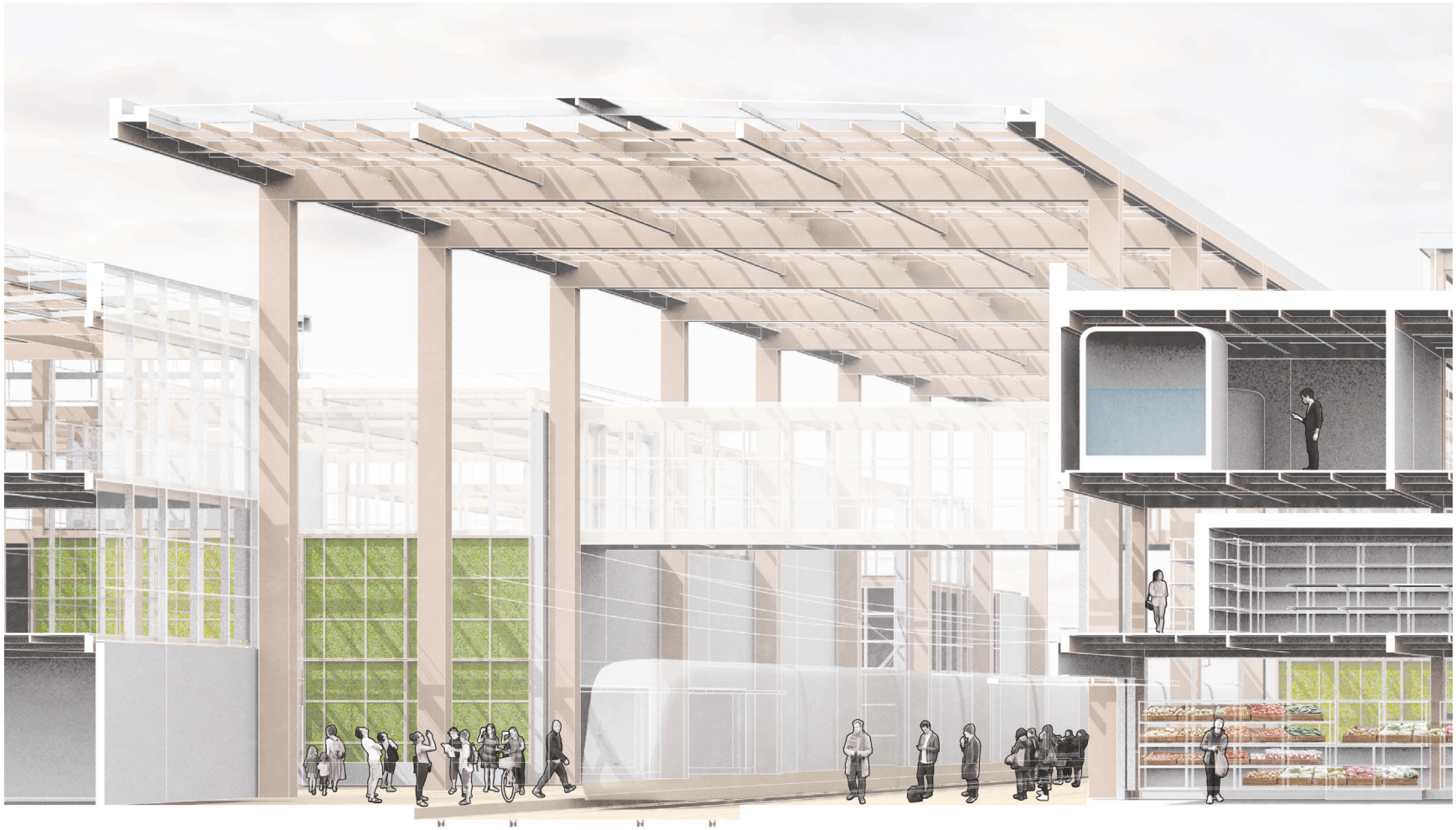
6. Rooftop Garden

7. Community Kitchen

8. Market Gardens



A2: sectional perspective of train hall and spaces associated with growing, cooking, and distributing.



Sectional perspective of train hall with garage doors opening up to the permanent market.

Planting – Nurturing – Harvesting – Eating

As people travel through the station on their way home from work, they are able to seamlessly pass into the permanent market and collect fresh local groceries for their evening meal. Alternatively, an LRT passenger could tend their garden plot while they pass between work and home, collecting their self-grown produce. Or, they could attend evening cooking classes in the community kitchen, where fresh vegetables harvested from the community gardens are used as a basis for the meals. The entire growing process becomes a cycle within the building. It begins with the seed library that is shared by the community, as well as protected, local seeds within a seed bank. These are used to plant the various gardens, which are then harvested and sold in the permanent market before they are finally cooked and consumed.

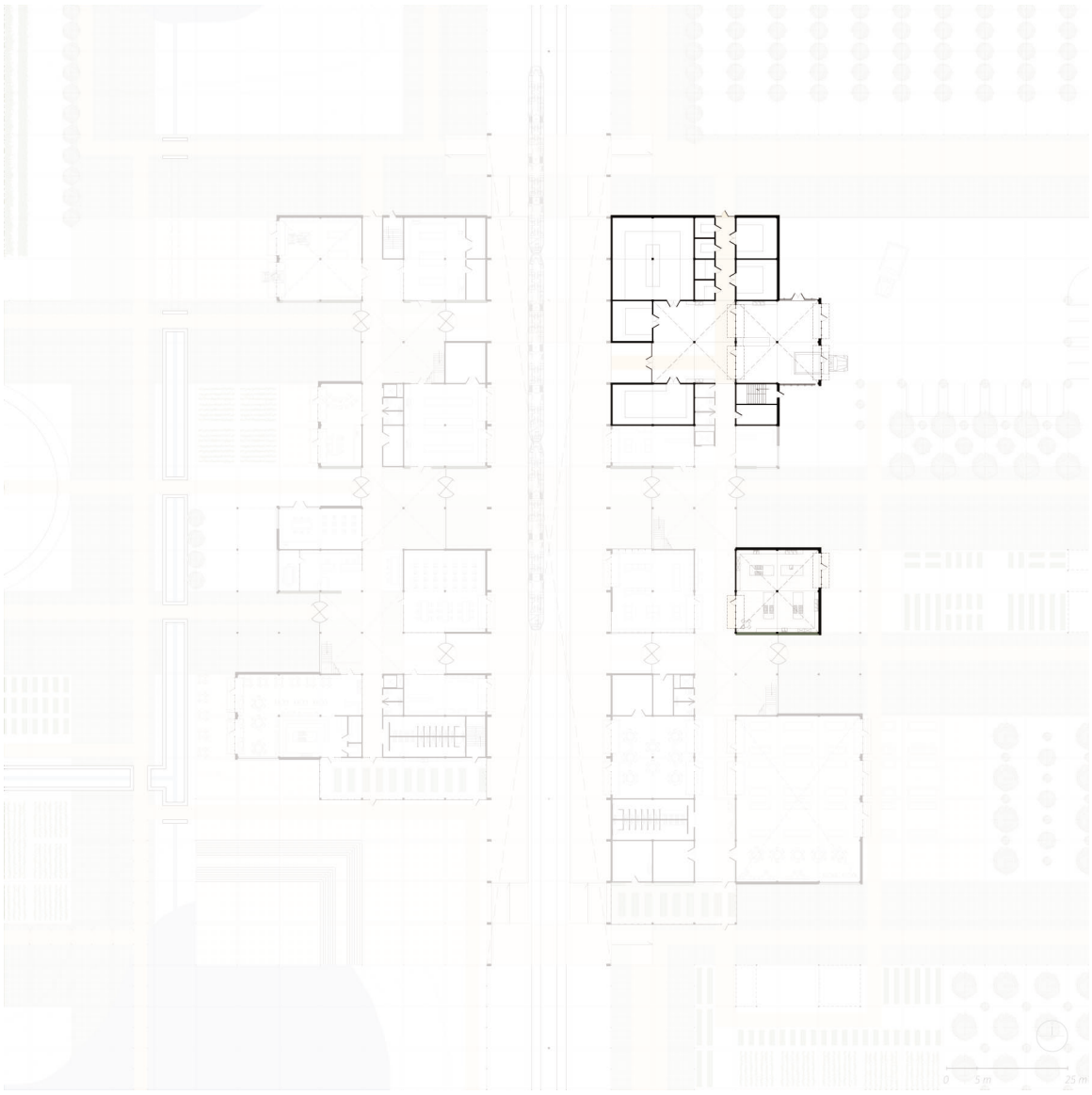
Planting, nurturing, harvesting, distributing, and cooking.

Connections between rooftop gardens, outdoor growing spaces, and cooking areas.

Innovation and educational areas.

Innovation and Education

This cycle of growing, harvesting, and eating is supported by the education and innovation components of the building. Research laboratories, offices, and phytotrons allow for focused experimentation and innovation in the fruit and vegetable industry in Calgary. Workshops and classroom areas contribute to the agricultural education of school-age children, as well as continuing education for adults.

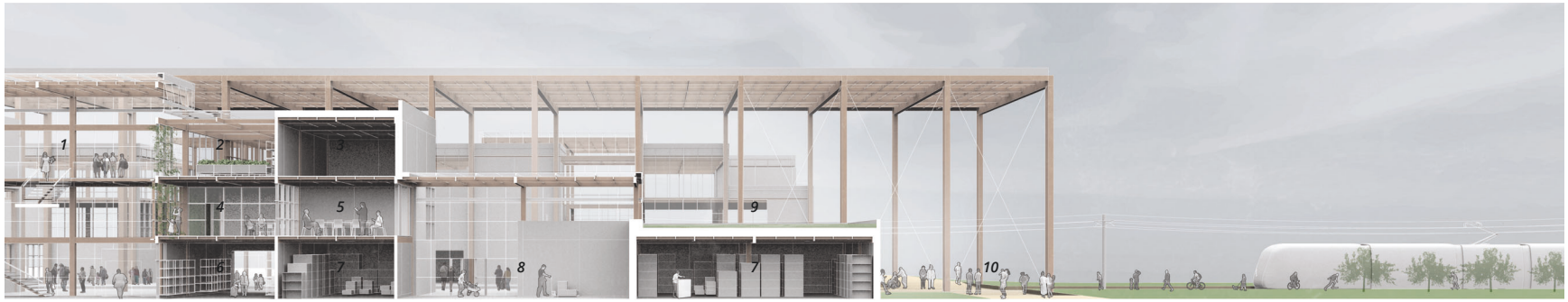


Industry support spaces.

Industry Support

Support spaces for farmers in the project include storage and processing facilities, as well as areas for marketing and business planning. One of the key barriers to growth of the fruit and vegetable industry in Alberta is storage capacity, so the building includes a variety of temperature and humidity controlled rooms to prolong the distribution potential of locally grown foods. Off-heating from refrigeration units could be captured and returned to heat greenhouses within the building, creating

another energy network between the preservation and growing of agriculture. An industry business incubator overlooks these processes, allowing producers to be directly connected with their products even after harvest.



1. Atrium

2. Greenhouse

3. Mechanical Room

4. Business Incubator

5. Meeting Room

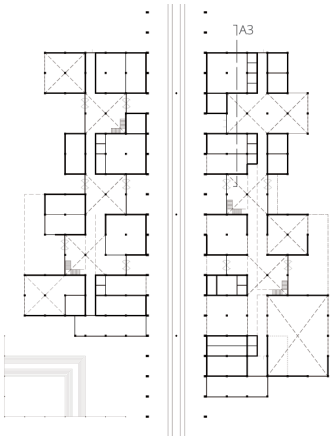
6. Retail Space

7. Refrigerated Room

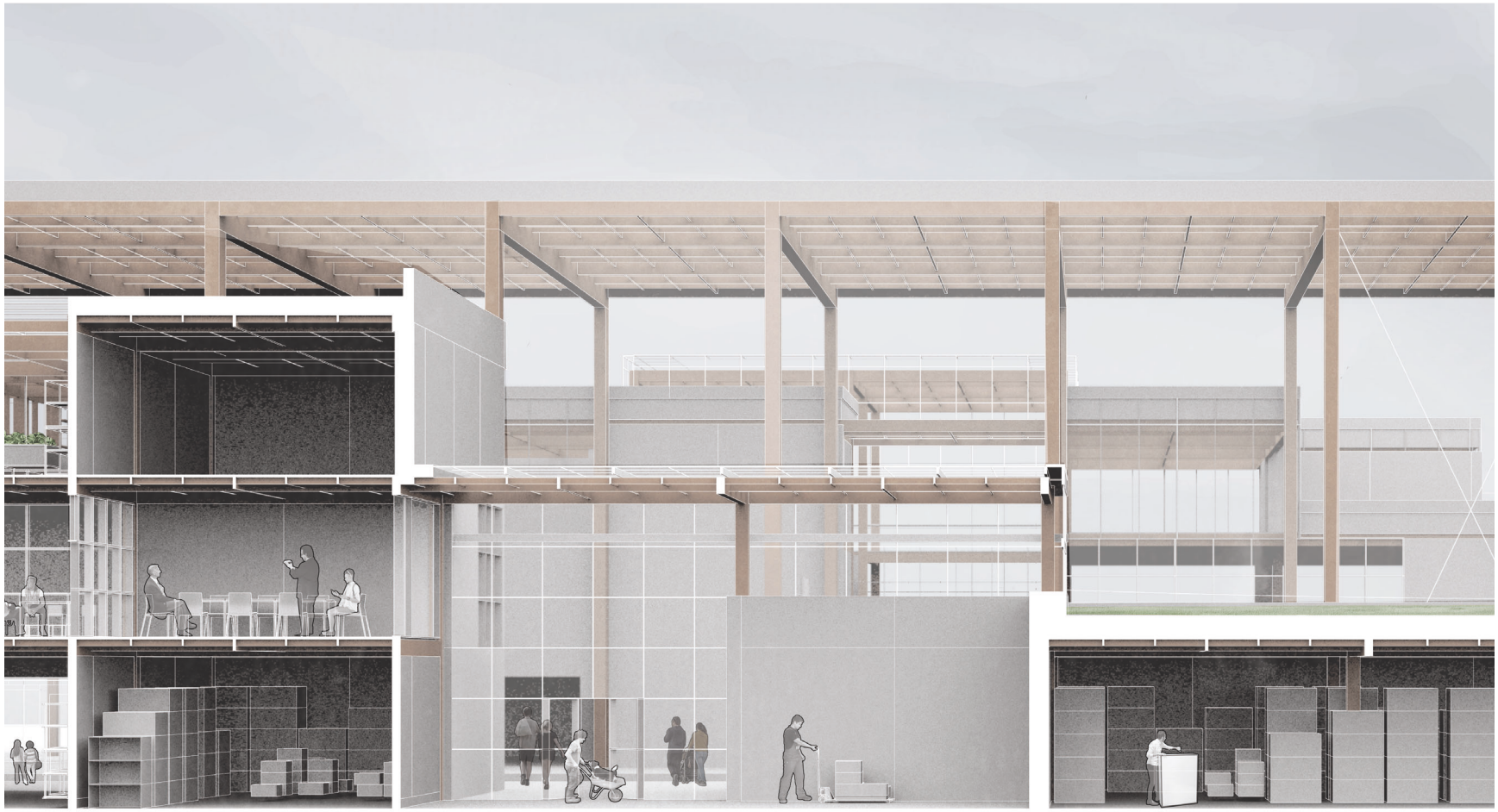
8. Sorting and Processing

9. Green Roof

10. Pedestrian Crossing

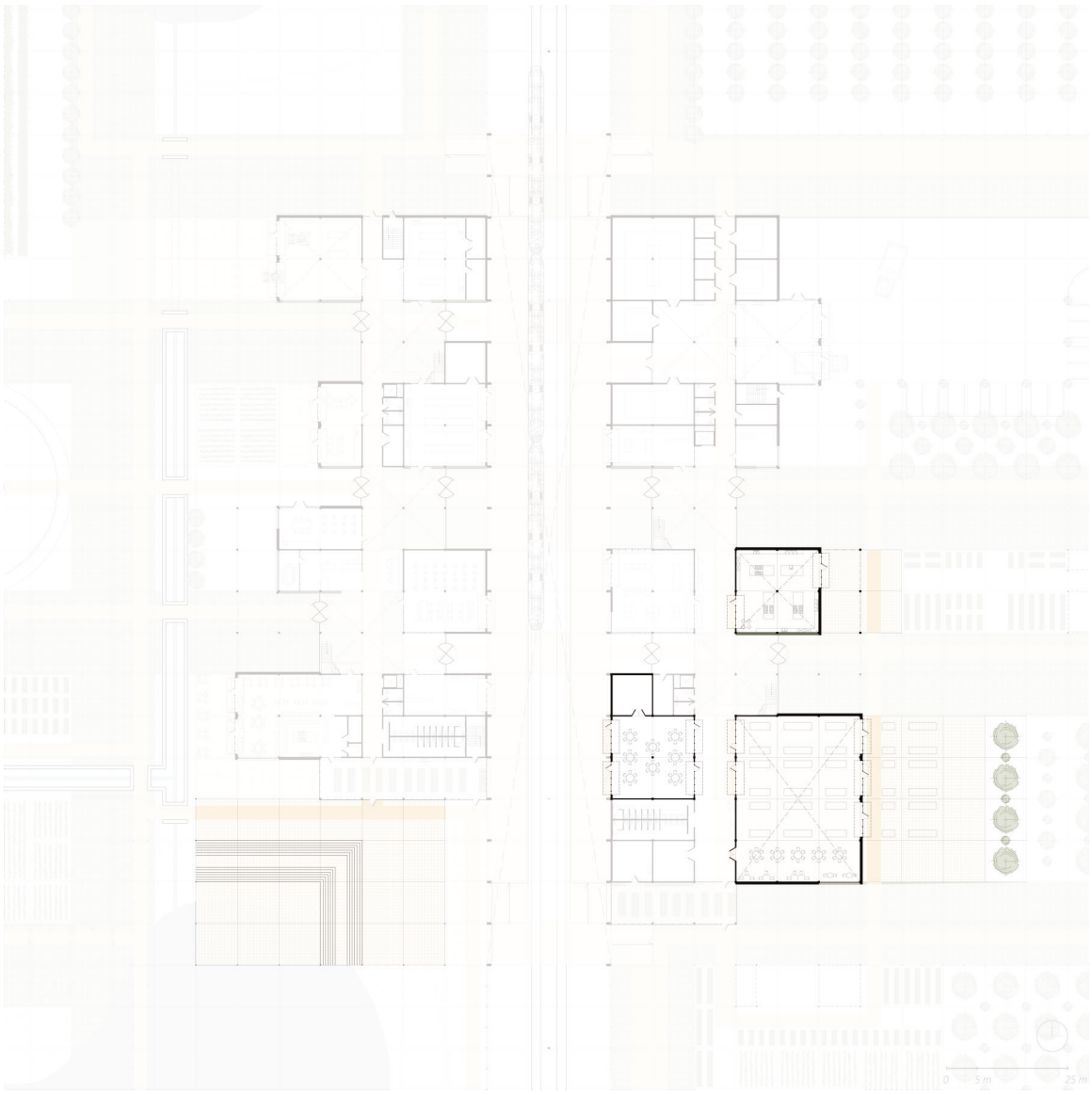


A3: sectional perspective of industry support spaces.



Processing and sorting atrium connected to refrigeration and industry spaces.

Industry support spaces.



Major areas for community functions.

Community Gathering

All these programmed areas are supported by areas of community gathering. A community kitchen has already been mentioned as a point of interaction between citizens of the neighbourhood and farmers. Multi-purpose rooms are another such area. These spaces can be used for classes or meetings related to agricultural activities, but can also become spaces for fitness and arts classes, or community events like bingo nights and holiday celebrations. Finally, a large banquet hall that

opens to a plaza surrounded by growing areas provides a major amenity to the community residents. Housing private events, agricultural conferences, or a weekly farmers market, this space would allow for day-to-day workings of the neighbourhood to come together within the center of a site of growing.

As a continuous extension of the agricultural landscape introduced within the suburban realm, this project situates itself as a new structure of identity for the prairie provinces. It is connected symbolically and functionally to the agrarian history of Alberta, but it also looks to the future of the city, providing fundamental requirements of food, gathering, and learning to the community it sits within.

Weekend farmers' market taking place within the community hall.

The agricultural transit centre activated by its community.

CHAPTER 7: CONCLUSION

This project proposes the development of a multifunctional infrastructure in order to support hybrid urban growth. It aims to activate local fruit and vegetable networks, while also fostering an agrarian identity tied to place and landscape. By operating at multiple scales – from the region, to the neighbourhood, to the site – a holistic approach to agricultural production within the city of Calgary was explored. Although a potentially idealized version of development has been envisioned, it is not a futuristic utopia of agrarianism in the city – one that is impossible to apply and can exist in "no place". Rather, a "good place", a eutopia of practical aspirations for the Albertan context is proposed. It is this consideration of the people and the conditions of the environment that would allow for the viable development of the project, and governmental policy, practical capacities, and the broader implications of an agricultural-transit network would need to be further addressed.

Land Policy and Governmental Protection

> The technological and social changes taking place today suggest that the conventional dichotomies between city and countryside could give way to an integration of the two and begin to shape new landscapes and planning policies. (Hough 1990, 146)

A significant amount of government intervention would be necessary to apply a project of this scale. Federal and provincial land policy regarding agricultural protection and city growth would have to be developed in parallel with city zoning bylaws in order to ensure the agricultural security of the entire region. This has already been noted by a Report for the Standing Committee on Agriculture and Agri-Food, stating that:

> the federal government could adopt a clear, direct statement of policy to protect the agricultural land base and to support

> its use for farming...[ensuring] that the public interest in protecting farmland is integrated across provincial, territorial, and local jurisdiction. (A Food Policy for Canada 2017, 27)

Unlike city greenbelt models that tend to exacerbate growth beyond its boundaries, the entire Edmonton-Calgary corridor should be considered within a similar framework so that issues of growth and agricultural loss aren't simply redirected to another location. Similarly, the interplay between settlement and agricultural capacity must be considered by policymakers in order to ensure the continued food security of the region.

Balancing Agricultural Capacity and Settlement

The proposed neighbourhood strategy for Seton is introduced as a typological strategy for urban expansion in Calgary in order to develop a method of city growth that occurs within its agricultural capacity. The current strategy for Seton accounts for roughly 22% of the fruit and vegetable production required to feed a community of 17,500 people; however, further development could seek to achieve a total balance between settlement and agricultural capacity. This settlement capacity is highly dependant on the yields of fruits and vegetables. Currently, Alberta has a lower average yield than Canada as a whole, which is lower than climatically similar countries, such as Norway. The following table shows a comparison between yields of fruits and vegetables, and the impact of those yields on density and the total population of new communities.

Interaction between crop yields and settlement density (Begam and Adilu; Statistics Canada 2017c; Statistics Norway 2016).

	Alberta	***Canada***	***Norway***
Fruit and Vegetable Yield (tonnes/acre)*	5.17	5.52	6.92
People Fed/Acre	21.54	23.01	28.83
Settlement to Farmland Ratio**	1 to 2.98	1 to 2.79	1 to 2.23
Settlement Density (# of people/acre)	16	17	20

**yield includes field crops only*

***calculated using density of new suburban communities in Calgary (64.22 people/acre)*

This balance between yields and settlement has implications for how agriculture could be re-introduced into existing city neighbourhoods, as well as how future developments could be formed. In 2016, the city of Calgary had an overall density of 6.07 people/acre (Statistics Canada 2017c). Seton is projecting a density of 58.33 people/acre; this proposal calls for density of new developments in the range of 16-20 people/acre. Although this is a broad simplification of a variety of unique urban conditions, there is potential to increase the overall city density and introduce agricultural production into underutilized space. Furthermore, there is an opportunity to explore the pattern and form of new residential settlement based on these agricultural constraints. These new residential forms could begin to shape a site-specific character to the city, exchanging a placeless environment with an agrarian vision for the city.

Broader Implications of an Agricultural-Transit Infrastructure

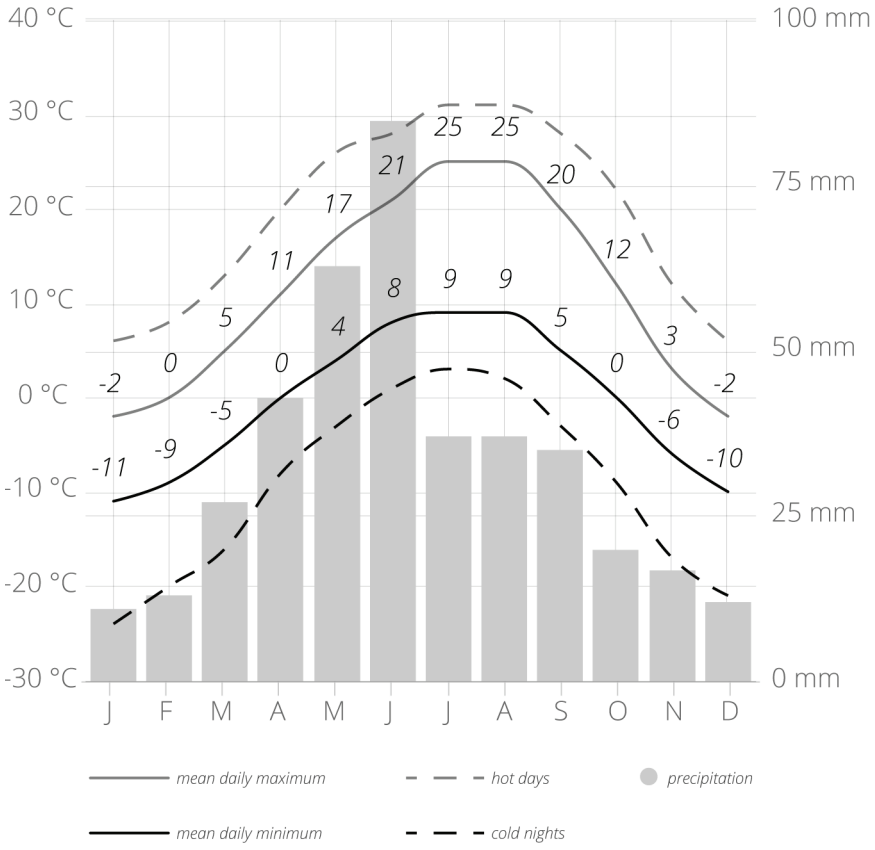
The implementation of an agricultural-transit centre in the hybrid suburban zone is seen as a typological approach for similar stations throughout the city. This project focused on new suburban developments in order to project a future growth model for the city, proposing to deal with issues of horizontal expansion and loss of agricultural land as it is occurring. It was an exercise in ensuring that new growth is beneficial to the city ecosystem, rather than continuing to aggravate the problem. By looking at other terminus LRT stations, important infrastructures for the mixed agricultural and settlement areas in the urban periphery under a new regional city model could be developed.

However, stations throughout the entire city should be considered within the agricultural-urban framework. Much of Calgary has a low density/high open land ratio that could support

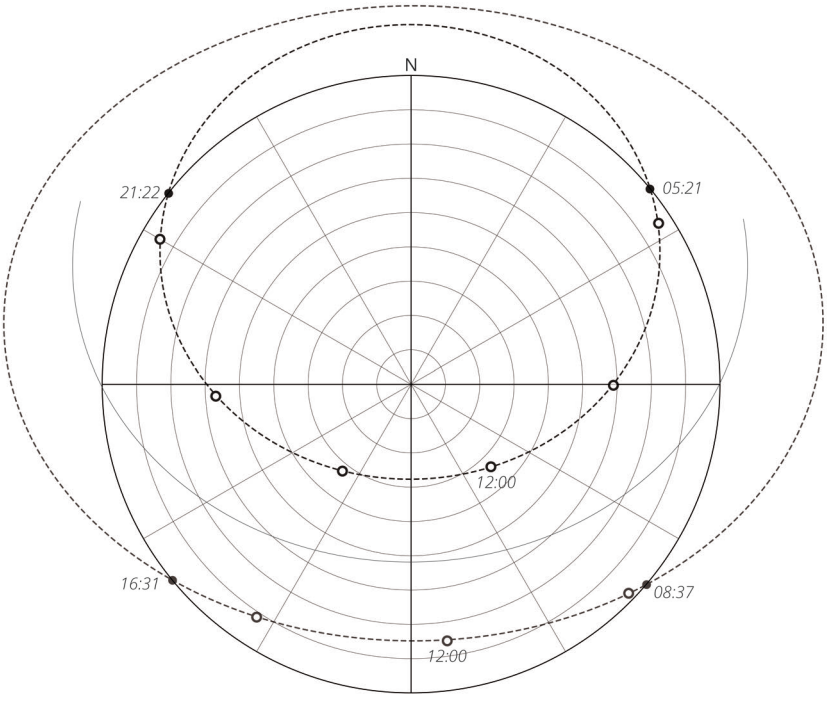
fruit and vegetable production within the urban environment, and even more dense, inner city neighbourhoods could include small scale, intensive farming practices. To support these activities, a reciprocal relationship between farmers and city infrastructure could begin to shape the agriculturally aware urban environment. Transit stations throughout the city could include food distribution sites, educational areas, seed libraries, and growing sites; the scale of these station interventions would vary depending on neighbourhood density, open spaces, agricultural capacity, existing operators, and many other factors that would have to be identified.

A fundamental requirement for this system is the interplay between top-down planning and bottom-up approaches. The overarching schemes of regional growth and city-wide multi-functional infrastructures must remain cognisant of the actors within the network, and be flexible enough to support changing methods of farming, living, and travelling. If properly considered, the resulting city could become an expression of its ecological capacity, its surrounding landscape, and the ideologies of the people living and working within it.

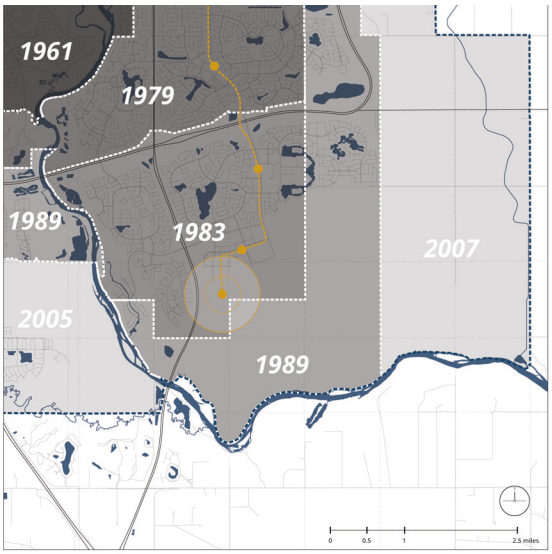
APPENDIX: SETON SITE STUDY



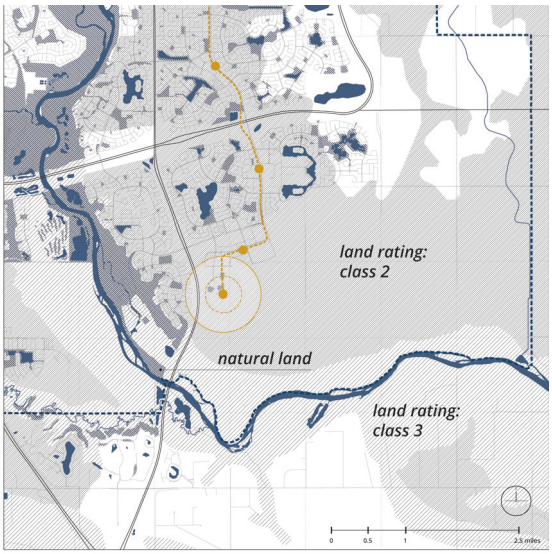
Average temperatures and precipitation for Calgary (Source: Meteoblue).



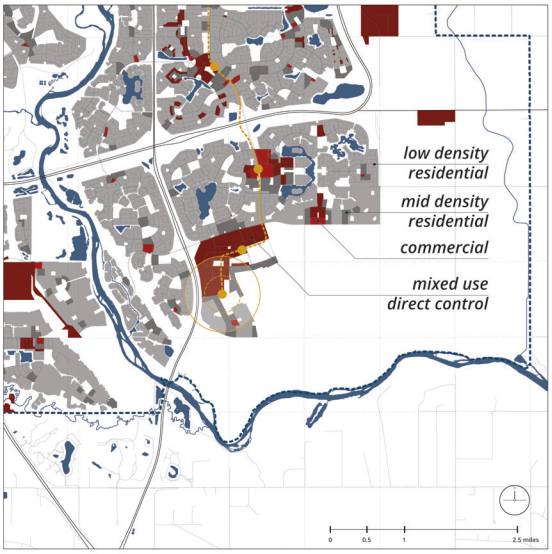
Solar diagram for Calgary (Source: Gaisma).



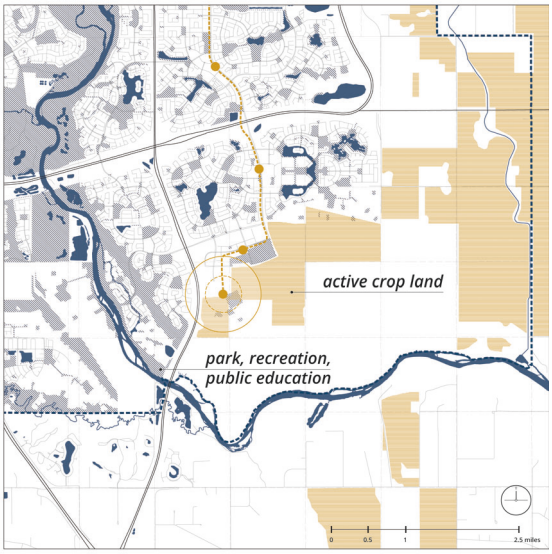
Historical City Annexation



Land Suitability Rating and Natural Lands

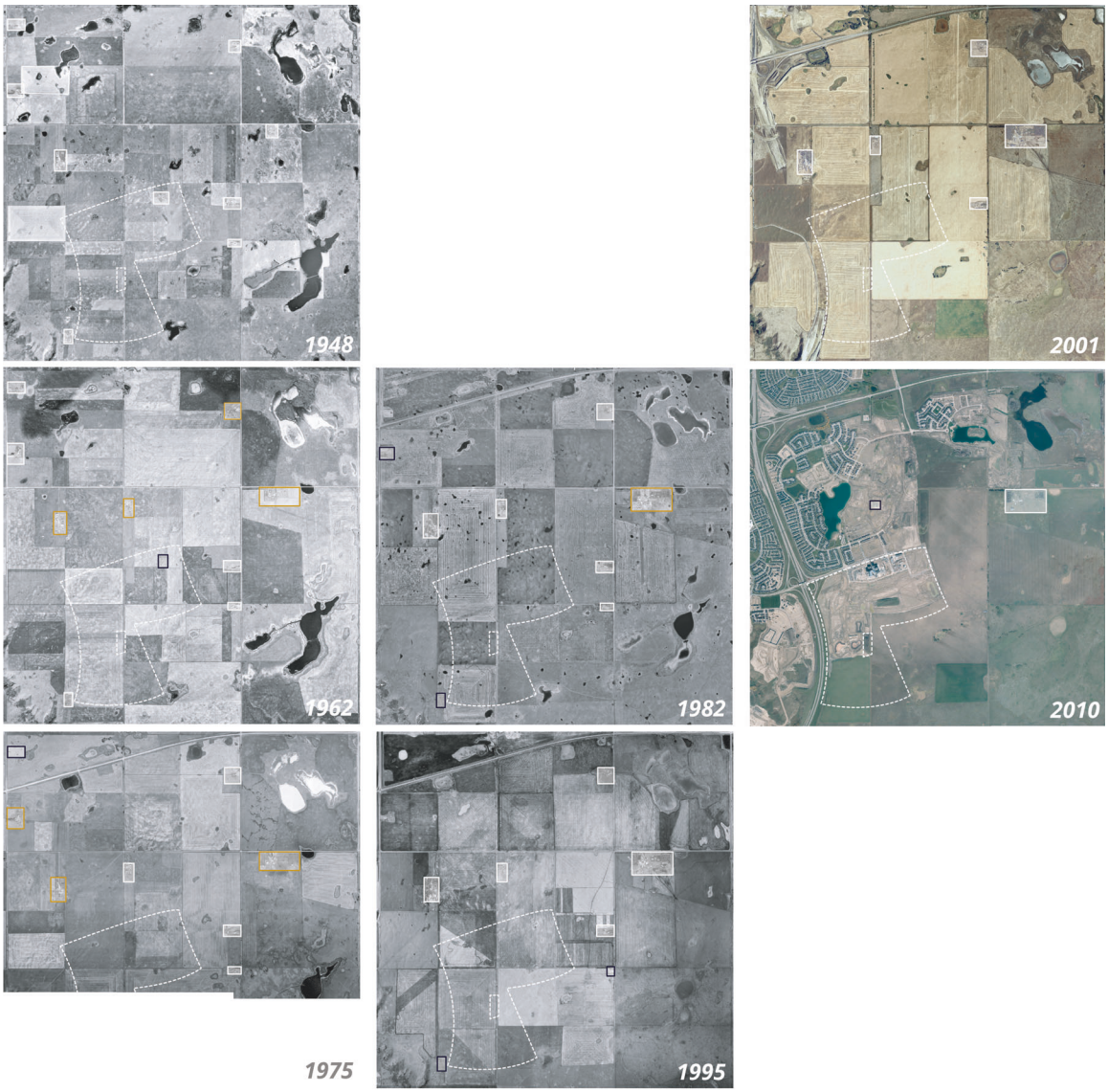


Land Use and Zoning



Active Cropland and Parks

Southeast Calgary design considerations (Open Calgary; Alberta Agriculture and Forestry; City of Calgary).



Orthographic aerial photographs of southeast Calgary over the past 60 years. Farm growth and eventual disappearance is highlighted (The City of Calgary).

Images of Seton in August 2018 and December 2018, cataloguing current buildings, infrastructures, and traces of agriculture in the developing community.

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