CITY OF HAMILTON GRIDS 2 / MCR – PLANNING FOR GROWTH TO 2051:

HOW SHOULD HAMILTON GROW?
EVALUATION OF GROWTH OPTIONS

PREPARED BY DILLON CONSULTING LIMITED

MCR GRIDS 2
Moving Forward Together

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PART 1: INTRODUCTION

Growth Management Context

Hamilton is part of the Greater Golden Horseshoe (GGH), one of North America's fastest growing regions. The GGH, which includes 110 municipalities (21 upper and single municipalities and 89 lower tier municipalities), is a globally competitive region, accounting for approximately 25% of Canada's national GDP. The GGH is a major destination for in-migration and immigration, attracting people from across Canada and internationally due the area's high quality of life and economic opportunities. The GGH is home to approximately 9 million people and is forecast to grow to 14.8 million by 2051[1].

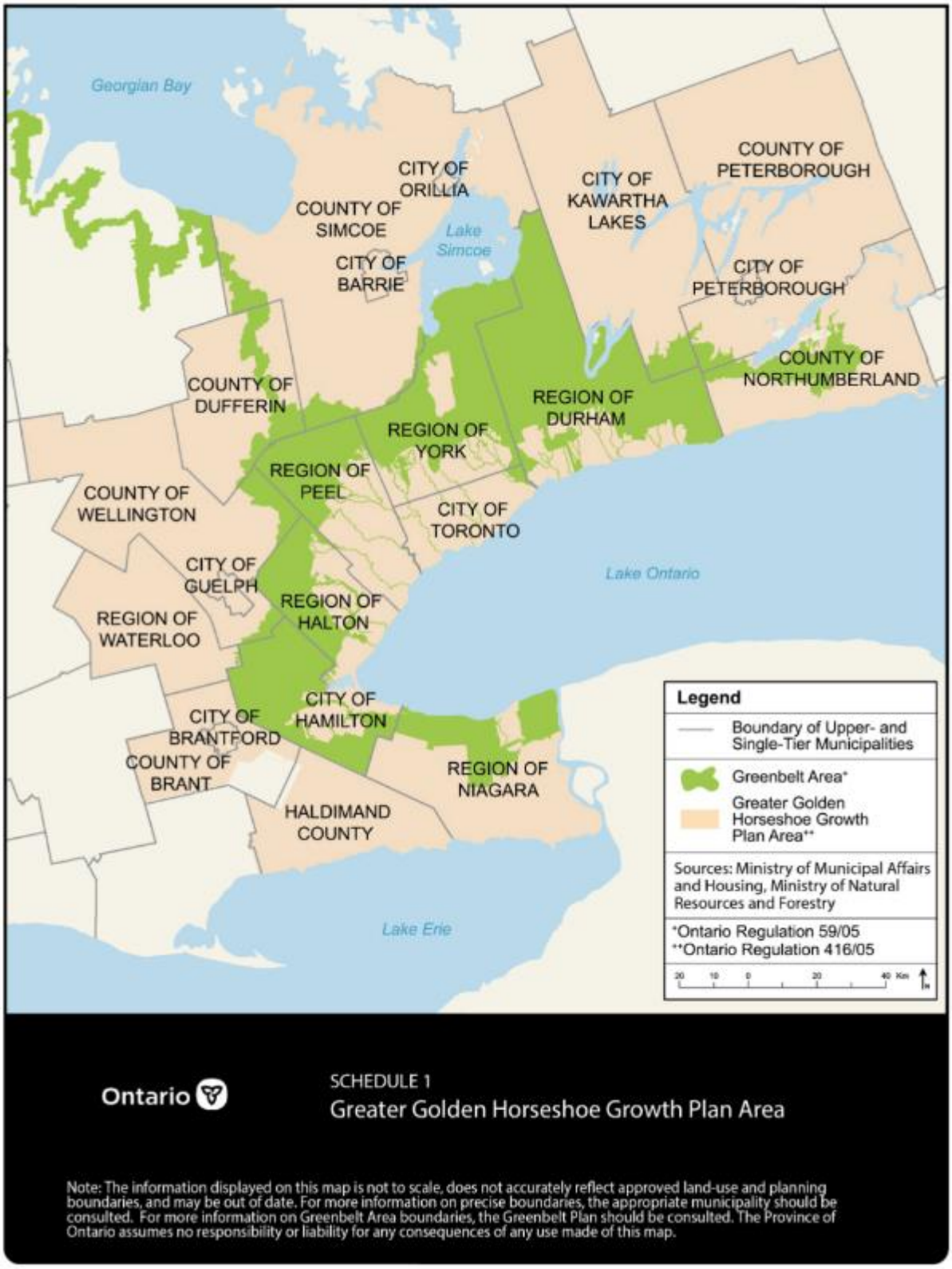
The Province of Ontario provides guidance to municipalities through a long range Plan called A Place to Grow: Growth Plan for the Greater Golden Horseshoe (Growth Plan). All municipalities are required to update their Official Plans through a Municipal Comprehensive Review process (MCR) to conform to the policies of the Growth Plan. The Growth Plan provides policy direction on a number of growth management related matters, including:

- How much growth to plan for (municipal population and employment forecasts to 2051);
- Where and how municipalities should plan for growth (planning for intensification in the built-up area, planning around transit and Urban Growth Centres, ensuring an appropriate range and mix of housing, planning for employment growth, planning for increased densities in the Designated Greenfield Areas and settlement area expansion);
- Infrastructure to support growth (integrated land use and infrastructure planning, transit and transportation planning, goods movement, water/wastewater, stormwater and public service facilities);
- Protecting what is valuable (protection of water resources, natural heritage systems, open space systems, agriculture, mineral aggregate resources and cultural heritage resources); and,
- Implementation and how to interpret the policies of the plan.

The City is in the process of updating its Official Plan through a process called GRIDS 2, which is the City's Municipal Comprehensive. The expectation is that the results of the GRIDS 2 process will produce an Official Plan Amendment that aligns with the policies of the Growth Plan.

[1] A Place to Grow, Government of Ontario, 2020 (see Schedule 3 for 2051 growth forecast).

Figure 1: The Greater Golden Horseshoe (excerpt from A Place to Grow, 2019, as amended)



GRIDS 2

In 2006, Hamilton City Council approved the first Growth Related Integrated Development Strategy (GRIDS). GRIDS was an integrated planning process that identified a broad land use structure, associated infrastructure, economic development strategy and financial implications for growth options to serve Hamilton to year 2031. The GRIDS project is being updated as part of the City's MCR process, taking into account the policy directions from the Growth Plan, including new population, housing and employment projections to year 2051. The Growth Plan's 2051 forecasts for the City of Hamilton are:

1. An increase of 236,000 people (total population of 820,000 by 2051);
2. An increase of 110,000 housing units; and,
3. An increase of 122,000 jobs.

The City is it a critical juncture in the growth management planning process as it must determine how best to accommodate the forecasted growth. The City is contemplating two growth options at the City-scale:

- **Growth Option 1:** an 'Ambitious Density' option reflecting a 1,310 ha expansion for new Designated Greenfield Lands; and,
- **Growth Option 2**: a 'No Urban Boundary Expansion' option which would see all forecast population and employment growth accommodated within the existing urban area.

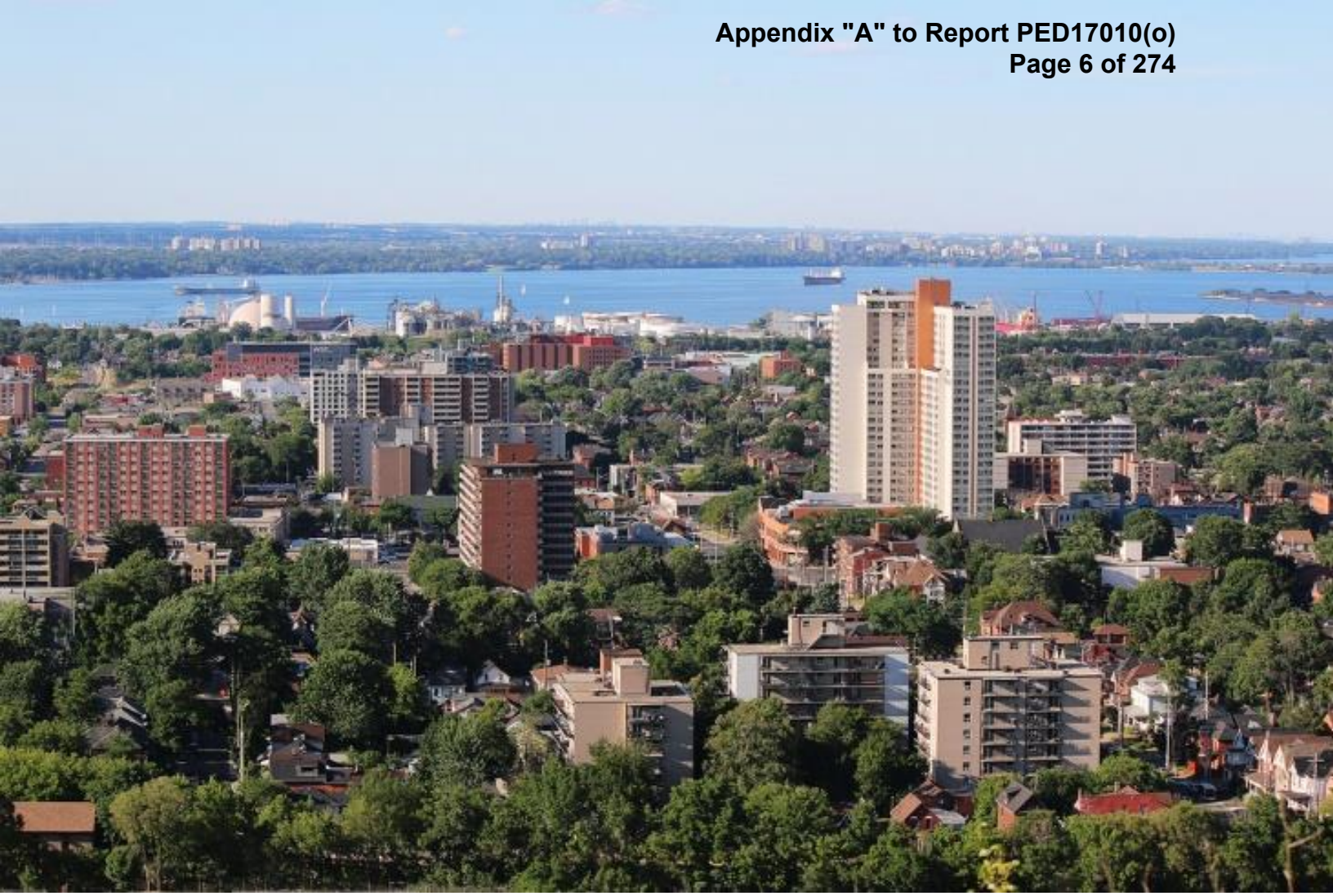
The growth options have different intensification targets, greenfield densities, and housing mixes. They also require different long term urban structure plans/policies to manage growth pressures.

Report Purpose and Organization

The purpose of this report is to identify the different implications associated with the two growth options. The report is intended to support decision-making by providing technical information related to the two growth options.

The following report is organized in five main parts. This first part provided a brief introduction on the background and purpose of the document. The subsequent parts are organized into the following:

- Part 2: Overview of the Growth Options
- Part 3: Evaluation Approach of the Growth Options
- Part 4: Growth Options Evaluation Results by Theme
- Part 5: Growth Options Evaluation Results Summary



PART 2: OVERVIEW OF THE GROWTH OPTIONS

Land Area Context for the Growth Options

The City of Hamilton is comprised of a total of 112,840 hectares of land (see Figure 2). This accounts for all land within the City's municipal boundary. An estimated 88,662 hectares (79%) of land within in the City's municipal bounary are protected by the Greenbelt Plan. The existing urban area includes 23,880 hectares of land (21%). Of those lands, 19,649 hectares (82% of the Urban Area) are within the Built-Up Area[2] and the remaining 4,231 hectares (18% of the Urban Area) are designated greenfield area[3]. An additional 4,321 hectares are referred to as 'Whitebelt' lands, which generally speaking are those lands that are outside of both the Greenbelt Plan area and the existing Urban Area[4]. Should an urban

[2] The Built-up Area is defined by the Province within P2G and includes those lands that were developed when the Growth Plan was first introduced in 2006. Since that time, development within the urban area may have extended beyond the Built-up Area. However, the City is required to plan for intensification within the delineated Built-up Area per P2G.
[3] Designated greenfield area refers to those lands within the urban area but outside the Built-up Area that are available and planned for future development.
[4] Statistics provided by City of Hamilton. Note that a portion of the Greenbelt lands also overlap with lands in the Urban Area and the Whitebelt.

boundary expansion occur as an outcome of this municpal comprehensive review, it is a portion (1,310 ha or approximately 30%) of these Whitebelt lands that would be added to the Urban Area.

Description of the Growth Options

Table 1 provides a detailed breakdown of how the two Growth Options differ in regards to distribution of growth, housing unit forecast, and persons per unit (PPU) assumptions. A brief summary of the options is provided below.

Growth Option 1: Ambitious Density reflects an approach to growth management that is closely aligned to the Provincial policy requirements and would plan for intensificaiton and density targets well above the Growth Plan minimums. This option would see population and employment accommodated through 1,310 ha of new designated greenfield area (i.e., urban boundary expansion) as well as within the existing urban area boundary through intensification. **Figure 2** illustrates a representative allocation of growth for Growth Option 1. This option requires planning for more than 100,000 more people to live within the existing built-up area, planned through intensification, for areas such as the Downtown node and the Centennial Node. It also includes planning for more people to live within designated greenfield areas within existing urban boundary, and approximately 89,000 more people to live within new designated greenfield areas (reflecting an urban boundary expansion).

Growth Option 2: No Urban Boundary Expansion reflects an approach to growth management that takes a firm stance on maintaining the existing urban boundary. This option would see the entire 2051 forecast population growth accommodated within the existing urban area. This would include the build-out of existing designated greenfield area to accommodate more people (the same as Growth Option 1). The remaining population would be accommodated within the existing built boundary. **Figure 3** illustrates a representative allocation of growth for Growth Option 2.

Figure 2: Conceptual Overview of Lands in Hamilton

Numbers may not add up since the land areas in hectares provided for both the whitebelt lands and urban area includes a portion of lands protected by the Greenbelt Plan.

Table 1: Comparing the Two Growth Options

CATEGORY	VARIABLES	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Population Forecast (2021-2051)	2021-2051 Population Growth	• 236,000	• 236,000
Unit Forecast (2021-2051)	2021-2051 Unit Growth	• 110,320	• 110,320
Distribution of Growth	Total Unit Growth within the **Existing Urban Area (Total)** Built-up Area Existing Designated Greenfield Areas	• 81,620 ○ 66,190 ○ 15,430	• 109,880 ○ 94,450 ○ 15,430
	Total Unit Growth within the **Urban Expansion Area**	• 28,060	Not Applicable
	Total Unit Growth in Rural Area	• 440	• 440
Housing Unit Forecast	Overall new Housing Unit Growth, by Type, from 2021 - 2051	Unit Growth 2021 – 2051: • Single / semi – 27,120 (25%) • Towns – 27,600 (25%) • Apartments – 55,600 (50%)	Unit Growth 2021 – 2051: • Single / semi – 9,585 (9%) • Towns – 14,750 (13%) • Apartments – 85,985 (78%)
	Resulting **City-Wide** Housing Mix by Type, 2051 (%)	Total Units by Type, City-wide, 2051 (%) • Single / semi – 46% • Towns – 15% • Apartments – 39%	Total Units by Type, City-wide, 2051 (%) • Single / semi – 41% • Towns – 13% • Apartments – 46%
	Housing Mix – **Urban Expansion Area (%)**	• Single / semi – 65% • Towns – 30% • Apartments – 5%	Not Applicable

CATEGORY	VARIABLES	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
PPU Assumptions	Persons Per Unit Assumption (low, medium, high density) – **Existing Units**	• Single / semi – 2.81 • Townhouse – 2.60 • Apartment – 1.74	• Single / semi – 2.81 • Townhouse – 2.60 • Apartment – 1.74
	Persons Per Unit Assumption (low, medium, high density) – **New Units**	• Single / semi – 3.405 • Townhouse – 2.437 • Apartment – 1.663	• Single / semi – 3.405 • Townhouse – 2.437 • Apartment – 1.663 (70% of apartment growth) • Apartment – 3.250 (30% of apartment growth)
Targets	Intensification Target *(% of new units within Existing Built-up Area)*	• 50% (2021 – 2031) • 60% (2031 – 2041) • 70% (2041 – 2051)	• 81%
	Greenfield Density Target *(Persons and Jobs Per hectare in the Designated Greenfield Area (DGA))*	• 60 (existing DGA in the Urban Area) • 77 (Expansion Area)	• 60 (existing DGA in the Urban Area)
Employment Forecast	2021-2051 Employment Growth	• 122,000	• 122,000
Distribution of Growth -Employment	Employment Growth by Type, 2021 - 2051	• Major office – 32,350 • Population-related – 57,300 • Employment land – 32,350	• Major office – 32,350 • Population-related – 57,300 • Employment land – 32,350
	Employment Growth – Urban Expansion Area, 2021 - 2051	• 11,400	• N/A

Figure 3: Assumed New Unit Allocation to 2051 for Growth Option 1: Ambitious Density

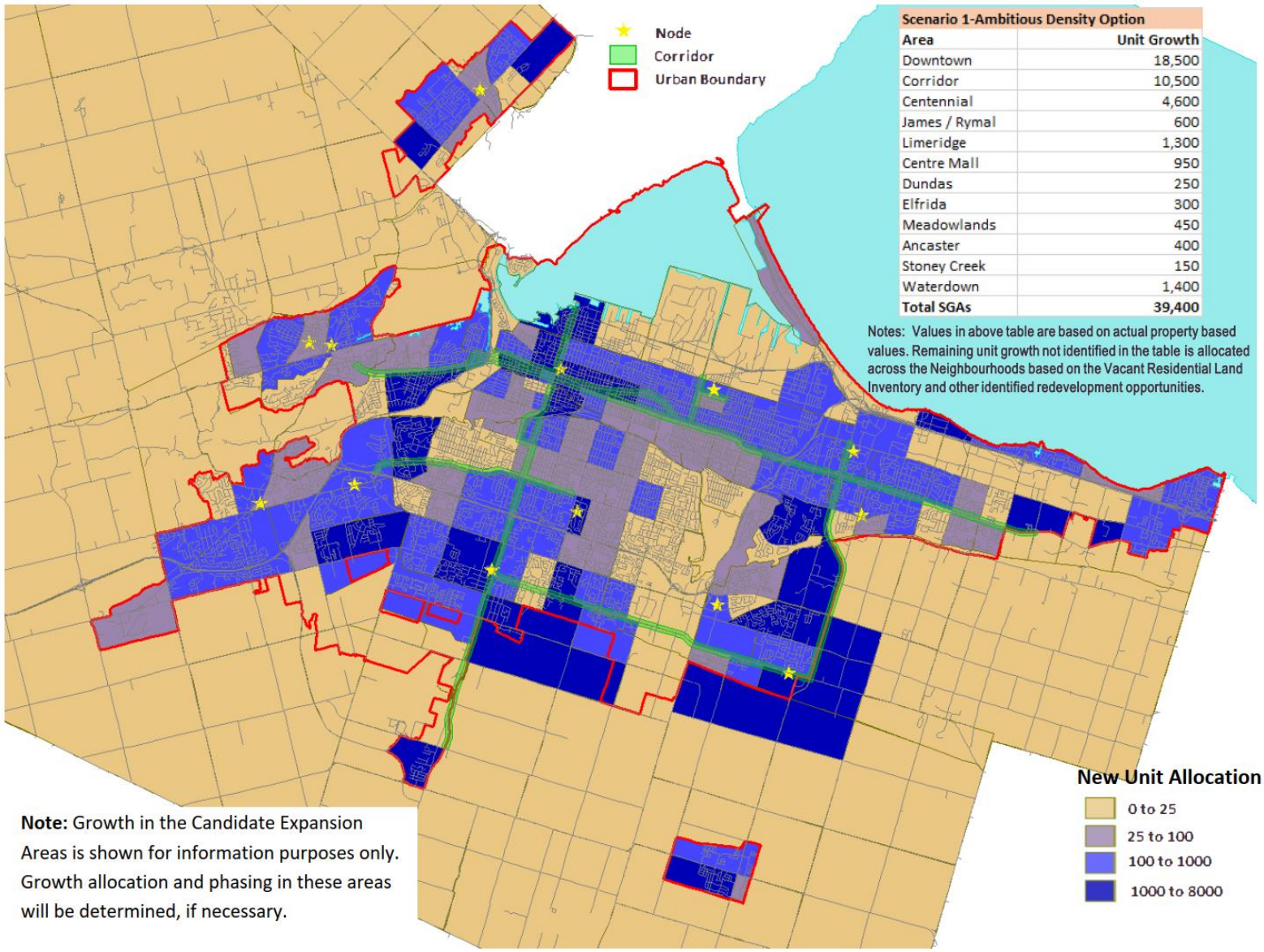
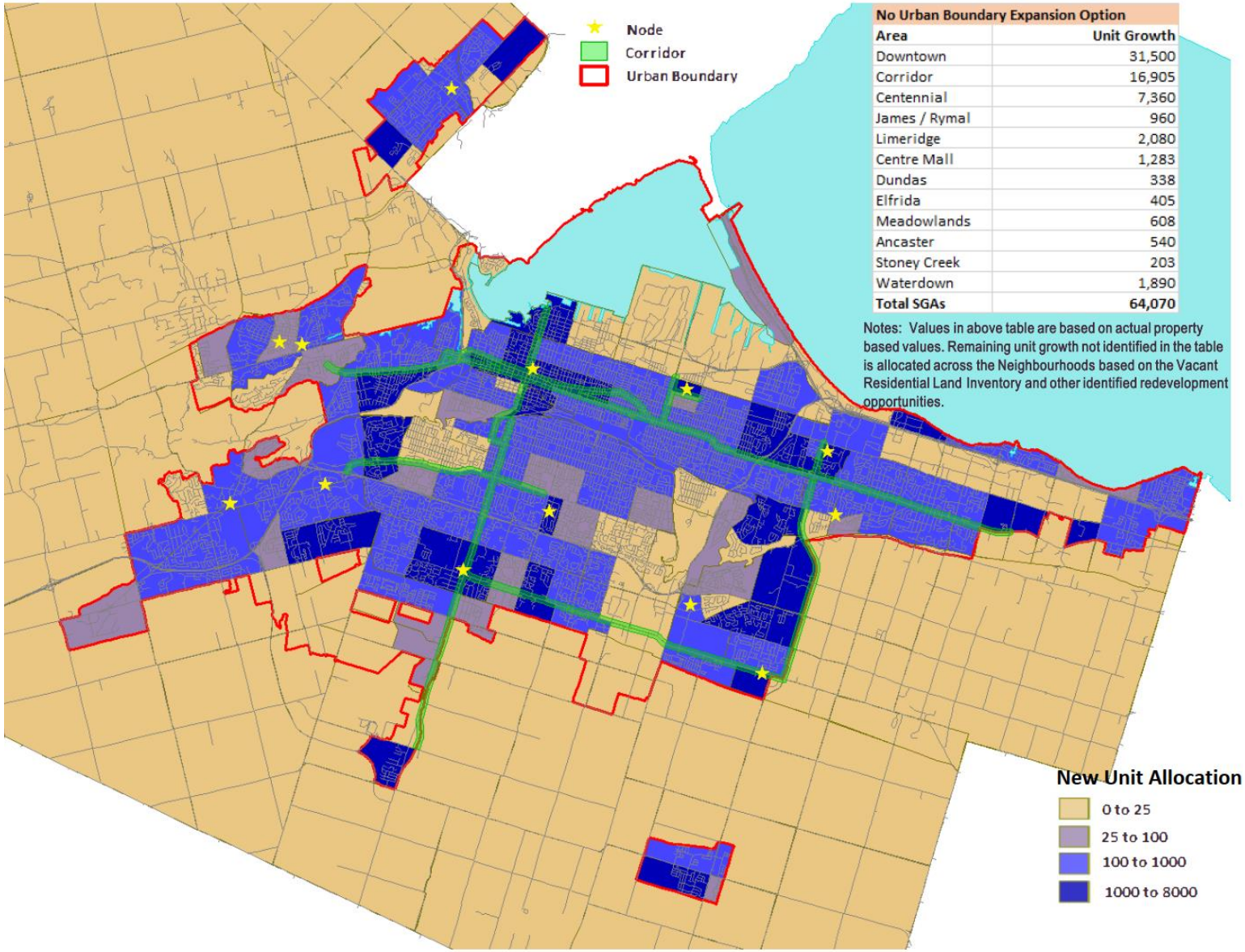


Figure 4: Assumed New Unit Allocation to 2051 for Growth Option 2: No Urban Boundary Expansion



No Urban Boundary Expansion Option	
Area	**Unit Growth**
Downtown	31,500
Corridor	16,905
Centennial	7,360
James / Rymal	960
Limeridge	2,080
Centre Mall	1,283
Dundas	338
Elfrida	405
Meadowlands	608
Ancaster	540
Stoney Creek	203
Waterdown	1,890
Total SGAs	**64,070**

Notes: Values in above table are based on actual property based values. Remaining unit growth not identified in the table is allocated across the Neighbourhoods based on the Vacant Residential Land Inventory and other identified redevelopment opportunities.

PART 3: EVALUATION APPROACH

The purpose of the evaluation framework is to outline the different implications for each growth option. The evaluation framework was first presented to Council in August 2021 and was available for public input and has since been updated to address relevant feedback. The evaluation framework is organized around eleven themes which are presented on the following page. The evaluation framework is not a scoring tool, rather it is a tool to show the trades-offs associated with different themes to help develop a planning rationale for a preferred growth option.

The evaluation framework is informed by specific policies in the Growth Plan. In particular, the policies of section 2.2.1 Managing Growth are of relevance and are used as the basis for the framework. The framework also reflects the Council-approved themes of the GRIDS 2 / MCR 10 Directions to Guide Development.

1. Growth Allocation

2. Climate Change

3. Natural Hazards

4. Municipal Finance

5. Infrastructure & Public Service Facilities

6. Transportation Systems

7. Natural Heritage and Water Resources

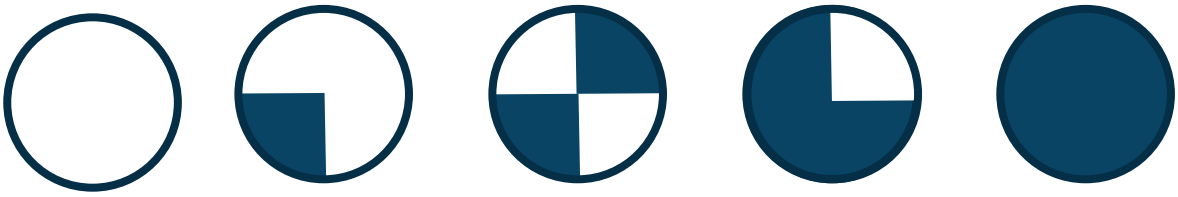
8. Complete Communities

9. Agricultural System

10. Cultural Heritage

11. Conformity with Provincial Methodology

The evaluation results show the line-by-line findings for each theme and the associated considerations. Based on the balance of considerations, each 'How to Grow' growth option receives a theme-level assessment according to the following categories which are used for illustrative purposes only:



No aspect of the consideration is being addressed or considered	One or a couple aspects of the consideration are addressed or considered	Approximately half of the considerations are addressed or considered	The majority of the considerations are addressed or considered	All aspects of the consideration are reasonably addressed or considered

The theme level assessment is provided to help interpret the results, as the technical analysis presented in the evaluation tables is lengthy and at times complex, drawing from a variety of technical sources.

It is important to note that from a policy alignment perspective, there are foundational considerations which must be addressed, consistent with the Provincial planning policy framework. For example, Growth Plan requires municipalities to plan for the population and employment forecasts in Schedule 3; plan to achieve a minimum of 50% intensification across the Built-Up Area; plan to achieve a minimum of 50 people and jobs per hectare across the Designated Greenfield Areas; and requires municipalities to use the provincial methodology for land needs assessment.

Table 2 presents the evaluation framework.

Table 2: Growth Option Evaluation Themes and Considerations

THEME	CONSIDERATIONS
Growth Allocation 	Does the growth option direct the vast majority of growth to the settlement area?
	Does the growth option focus growth in: a) Delineated built-up areas? b) Strategic growth areas? c) Locations with existing or planned transit, with a priority on higher order transit where it exists or is planned? d) Areas with existing or planned public services facilities?
Climate Change 	Does the growth scenario contribute to the City's long-term goal of carbon neutrality by providing opportunities for reductions in greenhouse gas emissions?
	Does the growth option present any significant opportunities to address risks and challenges associated with climate change?
	Does the growth option present any significant risks associated with climate change?
Natural Hazards 	Does the growth option direct development away from hazardous lands?

THEME	CONSIDERATIONS
Municipal Finance 	Are there any significant municipal financial risks associated with the growth option?
Infrastructure & Public Service Facilities 	Does the growth option result in significant impacts to the City's existing or planned infrastructure?
	Does the growth option result in significant impacts to the City's existing or planned public service facilities?
Transportation System 	Does the growth option result in significant impacts to the City's existing or planned transportation infrastructure?
	Does the growth option provide an urban form that will expand convenient access to a range of transportation options including active transportation, to promote complete communities?
	Does the growth option prioritize development of areas that would be connected to the planned BLAST network or existing transit?
Natural Heritage and Water Resources 	Does the growth option avoid and protect Natural Heritage Systems as identified by the City and the Growth Plan?
	Does the growth option demonstrate an avoidance and / or mitigation of potential negative impacts on watershed conditions and the water resource system including quality and quantity of water?

THEME	CONSIDERATIONS
Complete Communities	Does the growth option provide a diverse mix of land uses in a compact built form, with a range of housing options to accommodate people at all stages of life and to accommodate the needs of all household sizes and incomes?
	Does the growth option improve social equity and overall quality of life, including human health, for people of all ages, abilities and incomes?
	Does the growth option expand convenient access to an appropriate supply of open spaces, parks, trails and recreation facilities?
Agricultural System	Does the growth option prioritize development of areas that are non-prime agricultural?
	Does the growth option avoid, minimize and mitigate impacts on the Agricultural System, including Prime Agricultural Lands classifications 1, 2 and 3?
	Does the growth option promote healthy, local and affordable food options, including urban agriculture?
Cultural Heritage	Does the growth option have the potential to impact cultural heritage resources including designated heritage properties, and can they be conserved?
	Does the growth option have the potential to impact significant archaeological resources?

THEME	CONSIDERATIONS
Conformity with Provincial Methodology 	Has the growth option been assessed in accordance with the Provincial Land Needs Assessment Methodology to determine the quantity of land required to accommodate growth to the planning horizon?

PART 4: GROWTH OPTION EVALUATION RESULTS BY THEME

The evaluation results are presented in this section and are organized by theme. The results are further informed by five technical memos completed for input into this evaluation. These reports are referenced where appropriate within the evaluation tables below and are appended to this document as follows:

- **Appendix A: GHG Emissions Report**
- **Appendix B: Municipal Finance Reports**
- **Appendix C: Water, Wastewater, and Stormwater Servicing Report**
- **Appendix D: Transportation Report**
- **Appendix E: Agricultural Report**
- **Appendix F: Urban Hamilton Official Plan Schedules**

Growth Allocation

Where growth would be allocated can have an impact on the efficient and effective use of existing infrastructure and resources. The Growth Plans directs municipalities to allocate growth to existing settlement areas including delineated built-up areas, strategic growth areas, and directing growth in a manner that is transit supportive.

GROWTH ALLOCATION CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION

Does the growth option direct the vast majority of growth to the settlement area?	Growth Option 1 addresses most aspects of this consideration:
	• Growth Option 1 directs the majority of the growth (74%) to the City's urban (settlement) area, with a small allowance for infill units in the rural area and a portion of growth in an urban expansion area.
	• The growth allocations are:
	  ○ 81,620 units (74%) to the existing settlement area,
	  ○ 28,060 units (25.5%) to an urban (settlement) expansion area, and
	  ○ 440 units (0.4%) to infill in the rural area.
	• Additional lands (1,310 hectares) are required to accommodate the full range of growth under this option.
		Growth Option 2 addresses all aspects of this consideration:
		• Growth Option 2 directs almost the entirety of the forecasted growth (99.6%) to the City's urban (settlement) area, with a small allowance for infill units in the rural area.
		• The growth allocations are:
		  ○ 109,880 units (99.6%) to the existing urban (settlement) area
		  ○ 440 units (0.4%) to infill in the rural area.
		• No additional lands (0 ha) are required to accommodate growth under this option.

Does the growth option focus growth in: **a) Delineated built-up areas?** **b) Strategic Growth Areas?** **c) Locations with existing or planned transit, with a priority on higher order transit where it exists or is planned?**	Growth Option 1 addresses most aspects of this consideration: a) Delineated built-up areas: Growth Option 1 assumes 60% of the future growth will occur within the City's Built-Up Area (illustrated in **Appendix F**) through intensification. Growth within the Built-up Area is planned to increase from 50% of the growth between 2021 and 2031, to 60% of the growth between 2031 and 2041, to 70% of the growth between 2041 and 2051. b) Strategic Growth Areas: 'Strategic Growth Areas' are defined within the Growth Plan and include nodes, corridors and other areas within settlement areas that have been identified by	Growth Option 2 addresses all aspects of this consideration: a) Delineated built-up areas: Growth Option 2 assumes 81% of the future growth will occur within the City's Built-Up Areas. b) Strategic Growth Areas: 'Strategic Growth Areas' are defined within the Growth Plan and include nodes, corridors and other areas within settlement areas that have been identified by the Province or municipalities to be the focus for accommodating intensification and higher-density mixed uses in a compact built form (e.g., major transit station areas). In the context of the City of Hamilton, Strategic Growth Areas would include the key urban structure elements identified through Schedule E of

GROWTH ALLOCATION CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
d) **Areas with existing or planned public services facilities?**	the Province or municipalities to be the focus for accommodating intensification and higher-density mixed uses in a compact built form (e.g., major transit station areas). In the context of the City of Hamilton, Strategic Growth Areas would include the key urban structure elements identified through Schedule E of the Urban Hamilton Official Plan (see **Appendix F**). Growth Option 1 assumes that 36% of the future growth will occur within or adjacent to Strategic Growth Areas through intensification. c) Existing / planned transit and higher order transit: The expectation for Growth Option 1 is that the majority of growth will be distributed to support the City's planned urban structure, which includes a number of connected nodes and corridors which are or are planned to be serviced by transit. **Appendix D: Transportation Report** identified 56% of residents and 60.2% of jobs are projected to be within 800 metres of a BLAST corridor, and 66% of residents and 68.6% of jobs are projected to be within 400 metres of local HSR network. d) Existing / planned public service facilities: Defined in the Growth Plan, public service facilities includes lands, buildings, and structures required for the provision of programs and services such as social assistance, recreation, police and fire	the Urban Hamilton Official Plan. Growth Option 2 assumes that 58% of the future growth will occur within or adjacent to Strategic Growth Areas. c) Existing / planned transit and higher order transit: The expectation for Growth Option 2 is that the majority of growth will be distributed to specific nodes and corridors such as the Downtown Node and Centennial Node, which are a part of the City's existing planned urban structure. **Appendix D: Transportation Report** identified 61.3% of residents and 63.5% of jobs are projected to be within 800 metres of a BLAST corridor, and 77% of residents and 75.3% of jobs are projected to be within 400 metres of local HSR network. d) Existing / planned public service facilities: Defined in the Growth Plan, public service facilities includes lands, buildings, and structures required for the provision of programs and services such as social assistance, recreation, police and fire protection, health and education programs, and cultural services. An analysis conducted by the City identified the location of existing public service facilities including parks and open space, arenas, community centres, fire stations, police stations, pools, libraries, and schools and applied a 400 metre buffer to the facilities. Based on the growth allocation assumptions, for Growth Option 2 95% of the 2051 population would be in proximity to existing public service facilities. Further discussion on existing and planned public service facilities can be found in the Infrastructure and Public Service Facilities theme.

GROWTH ALLOCATION CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	protection, health and education programs, and cultural services. An analysis conducted by the City identified the location of existing public service facilities including parks and open space, arenas, community centres, fire stations, police stations, pools, libraries, and schools and applied a 400 metre buffer to the facilities. Based on the growth allocation assumptions, for Growth Option 1, 87% of the 2051 population would be in proximity to existing public service facilities. Further discussion on existing and planned public service facilities can be found in the Infrastructure and Public Service Facilities theme. • Depending on the location selected, the urban expansion required under this Option could be connected to the City's planned urban structure.	
Overall Result	Growth Option 1 addresses most aspects of this theme: 	Growth Option 1 addresses all aspects of this theme: 
Summary	Both growth options allocate the vast majority of growth within the City's settlement area. Growth Option 2 more fully addresses the theme of 'Growth Allocation' as defined by the considerations because it directs more	

GROWTH ALLOCATION CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	growth to the existing settlement area including built-up areas, strategic growth areas, and locations with existing or planned transit.	

Climate Change

Climate change has the potential to have a range of impacts on the City including impacts on infrastructure, the natural environment, and on existing and future residents and their communities. This demands consideration of climate change in the context of long range planning, recognizing both the risks and challenges, as well as the opportunities to proactively plan for climate change mitigation and climate change adaptation.

CLIMIATE CHANGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Does the growth scenario contribute to the City's long-term goal of carbon neutrality by providing opportunities for reductions in greenhouse gas emissions?	Growth Option 1 addresses some aspects of this consideration: • Growth Option 1 assumes increases in residential intensification in the Built-Up Area, with an overall intensification target of 60%. The intensification level of 60% represents a 25% increase over the City's historic average rate of 35%. The increased level of intensification will help to support the City's planned urban structure, including opportunities for transit-supportive development which in turn is supportive of the City's long term goal of carbon neutrality. • Growth Option 1 includes a density target of 60 people and jobs per hectare in the existing DGA and 77 people and jobs per hectare for new DGAs, which will promote more compact built-form and provide opportunities for improved levels of transit services (approaching frequent transit services at 80 people and jobs per hectare). • **Appendix A: GHG Emissions Report** completed by SSG outlines the assumptions, methodology, and results of greenhouse gas emissions modelling for Growth Option 1. • The modelling results are informed by key assumptions that impact the findings:	Growth Option 2 addresses most aspects of this consideration: • Growth Option 2 assumes an increase in residential intensification in the Built-Up Area, with an overall intensification target of 81%. The intensification level of 80% represents an increase of 46% over the City's historic average rate of 35%. The increased level of intensification will support the City's planned urban structure, including significant opportunities for transit-supportive development. The high intensification rate is supportive of the City's long term goal of carbon neutrality and would help to promote reductions in GHG emissions. • Growth Option 2 includes a density target of 60 people and jobs per hectare in the existing DGA, which will promote more compact built-form and provide opportunities for improved levels of transit services (better than basic transit services which require 50 people and jobs per hectare). • **Appendix A: GHG Emissions Report** completed by SSG outlines the assumptions, methodology, and results of greenhouse gas emissions modelling for Growth Option 2. • The modelling results are informed by key assumptions that impact the findings: ○ A "Business As Usual" scenario is included for all the modelled years and up to 2050. This scenario does not account for improvements to building standards for energy efficiency or changes in transportation technology (e.g. elective vehicles).

CLIMIATE CHANGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	○ A "Business As Usual" scenario is included for all the modelled years and up to 2050. This scenario does not account for improvements to building standards for energy efficiency or changes in transportation technology (e.g. elective vehicles). ○ The baseline transportation assumptions are also held constant across all years. The scenario does not account for changes in transportation behaviour and modal split over time. However, the GHG emissions model will be updated to include identified changes to the Vehicle Kilometers Traveled (VKT) for Growth Option 2; VKTs are expected to decrease in comparison to Growth Option 1, thereby reducing GHG emissions, and representing a larger difference between emissions between the two growth options. • As identified in **Appendix A: GHG Emissions Report**, the majority of GHG emissions for the City are related to industrial emissions which would not be impacted by either Growth Option. In terms of opportunities for climate change mitigation for Growth Option 1, the modelling results show cumulative GHG emissions of 261.3 MtCO2e (metric tons of carbon dioxide equivalent) from 2022 to 2050. This reflects a 1.0 metric ton increase over Growth Option 2. The modelling also shows a	○ The baseline transportation assumptions are also held constant across all years. The scenario does not account for changes in transportation behaviour and modal split over time. However, the GHG emissions model will be updated to include identified changes to the Vehicle Kilometers Traveled (VKT) for Growth Option 2; VKTs are expected to decrease for Growth Option 2, thereby reducing GHG emissions by 2050 more significantly than currently represented, as compared to Growth Option 1. • As identified in **Appendix A: GHG Emissions Report**, the majority of GHG emissions for the City are related to industrial emissions which would not be impacted by either growth option. In terms of opportunities for climate change mitigation for Growth Option 2, the modelling results show cumulative GHG emissions of 260.2 MtCO2e (metric tons of carbon dioxide equivalent) from 2022 to 2050. This is reflects a 1.0 metric ton reduction over Growth Option 1. The modelling also shows a scenario of 9.21 MtCO2e annual GHG emissions in 2050 from Growth Option 2, 0.33% lower as compared to Growth Option 1. ○ Note that the City's Transportation model identified savings of 400 million kilometres (VKTs) in 2050, or four times the reduction that was identified in the SSG analysis. As a result, the SSG analysis likely understates the GHG reduction from transportation. Additional analysis of the discrepancy in VKTs between the models is being undertaken, and if necessary, an addendum report will be provided which identifies the GHG reduction resulting from the

CLIMIATE CHANGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	scenario of 9.24 MtCO2e annual GHG emissions in 2050 from Growth Option 1, 0.33% higher as compared to Growth Option 2. ○ Note that the City's Transportation model identified savings of 400 million kilometres (VKTs) in 2050, or four times the reduction that was identified in the SSG analysis. As a result, the SSG analysis likely understates the GHG reduction from transportation. Additional analysis of the discrepancy in VKTs between the models is being undertaken, and if necessary, an addendum report will be provided which identifies the GHG reduction resulting from the increased GHG savings. It is expected that a greater reduction in total GHG emissions related to Growth Option 2 will be presented, as compared to Growth Option 1. • Both Growth Options will require construction to expand services for infrastructure including water/wastewater, stormwater, roads and power. The GHG implications of this approach to growth is difficult to quantify, though it would require aggregate and other material extraction, processing, transportation, as well as additional demand on the utility grid.	increased GHG savings. It is expected that a greater reduction in total GHG emissions related to Growth Option 2 will be presented, as compared to Growth Option 1. • Both Growth Options will require construction to expand services for infrastructure including water/wastewater, stormwater, roads and power. The GHG implications of this approach to growth is difficult to quantify, though it would require aggregate and other material extraction, processing, transportation, as well as additional demand on the utility grid.
Does the growth option present any	Growth Option 1 addresses some aspects of this consideration:	Growth Option 2 addresses all aspects of this consideration:

CLIMIATE CHANGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION

significant opportunities to address risks and challenges associated with climate change?	• Growth Option 1 presents an opportunity to develop new and innovative net zero communities, where infrastructure for the entire community is planned with climate change mitigation and adaptation in mind.
	  ○ This could be encouraged through land use planning instruments and the Secondary Planning process.
	  ○ Provided a climate change lens is applied to the design of new developments, this option presents significant opportunities for consideration of climate change impacts (e.g., consideration for increased tree canopy, shade, active transportation, enhanced connections between natural areas, building design, district energy, other more sustainable energy sources, best practices for storm water management, use of green infrastructure, street design etc.).
	• In support of climate change mitigation, there is the opportunity to plan for transit-supportive densities along key nodes and corridors as well as a greater proportion of trips that are more feasible for other sustainable modes of transportation (walk/cycle). This is enabled by the fact that the intensification rate is higher than historic levels.
	• It is not clear at this stage of water/wastewater servicing planning if any discernible or significant opportunities
		• Growth Option 2 presents an opportunity in terms of a bold and innovative approach to planning for climate change by exploring opportunities as to how the City can intensify within its current urban boundary.
		  ○ This option optimizes the efficiency of land use and limits land consumption reflecting an opportunity to not increase GHG emissions.
		  ○ Land not used for urban boundary expansion could be considered for uses that enhance climate change mitigation and adaption (e.g., naturalization of land, crop production for local food generation, renewable energy generation, enhanced carbon sequestration, flood mitigation, etc.)
		  ○ Building at increased densities also typically leads to smaller dwelling units with decreased gross floor area and reduced energy consumption as compared to detached dwellings supplying housing for the same number of people. However, it should be noted that this growth option would still require larger units of 3+ bedrooms to accommodate growth.
		  ○ Limiting the need to expand the distribution of utilities, which would reduce distribution losses.
		  ○ Provided a climate change lens is applied to the design of new development, this option presents some significant opportunities to consider climate change impacts in planning and design.
		• In support of climate change mitigation, there is the opportunity to plan for transit-supportive densities along key nodes and corridors as well as a greater proportion of trips that are more feasible for other sustainable modes of transportation (walk/cycle). This is enabled by the fact that

CLIMIATE CHANGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	associated with Climate Change are available for Growth Option 1. In regards to stormwater management, the City's requirements for development on private property in combined sewer areas will assist in climate change adaptation by providing over-controls (100 year post to 2 year pre). This will recover some capacity in the existing system.	the intensification rate is significantly higher than historic levels. • It is not clear at this stage if water/wastewaster servicing planning if any discernible or significant opportunities associated with Climate Change are available for Growth Option 2. In regards to stormwater management, the City's requirements for development on private property in combined sewer areas will assist in climate change adaptation by providing overcontrols (100 year post to 2 year pre). This will recover some capacity in the existing system. • Maintains all existing tree cover in Candidate Expansion Areas, potentially mitigating flood risk.
Does the growth option present any significant risks associated with climate change?	Growth Option 1 addresses some aspects of this consideration: • Climate risks for the City of Hamilton include the potential for increased frequency and severity of heat waves; drought; increased severity and frequency of storms; and heavy precipitation leading to flooding, shoreline and escarpment erosion. • The high level of intensification within the Built-Up Area will require a more comprehensive approach to stormwater management, in particular within the City's key nodes and corridors. These areas are generally built-up already and while redevelopment also presents opportunities for innovative low impact development solutions, the increased amount of intensification may also increase the amount of impervious surfaces in the Built-Up Area. The	Growth Option 2 addresses some aspects of this consideration: • Climate risks for the City of Hamilton include the potential for increased frequency and severity of heat waves; drought; increased severity and frequency of storms; and heavy precipitation leading to flooding, shoreline and escarpment erosion. • Under Growth Option 2, the City's intensification rate is planned to achieve 81%, with a significant amount of development and redevelopment occurring in the Built Up Area. The high level of intensification within the Built-Up Area will require a more comprehensive approach to stormwater management, in particular within the City's key nodes and corridors. These areas are generally built-up already and while redevelopment also presents opportunities for innovative low impact development solutions, the increased amount of intensification may also increase the amount of impervious surfaces in the Built-Up Area. The increase in paved surfaces is a risk that would

CLIMIATE CHANGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	increase in paved surfaces is a risk that would need to be managed to reduce the impact of the urban heat island effect and overland flooding. • As identified in **Appendix D: Transportation Report**, as compared to 2016, this option will result in a 58% increase in the vehicle-kilometres travelled, a 66% in passenger-kilometres travelled, and a 9% increase in vehicle-kilometres travelled per capita. This presents a climate change risk in regards to potential greenhouse gas emissions. However, the extent of GHG emissions will be influenced by changes in technology (e.g., electric vehicles). It also presents a risk, (as compared to Growth Option 2), in regards to the financial risk exposure if transportation energy costs increase. • The addition of the new urban land could increase the lands exposed to urban flooding. Similar to the Built-Up Area, a comprehensive approach to stormwater management would be required to minimize/manage the risks associated with urban flooding. • The addition of new urban land could have an impact on wildlife (flora and fauna) habitat and mobility, potentially impacting their ability to respond to climate change. • This option will extend impermeable area into current permeable surface areas that either are or could contribute to growing local food,	need to be managed to reduce the impact of the urban heat island effect and overland flooding. • Compared to Option 1, Option 2 has increased risks for urban stormwater management as well as risks associated with the urban heat island effect. • As identified in the **Appendix D: Transportation Report**, as compared to 2016, this option will result in a 48% increase in the vehicle-kilometres travelled, a 56% in passenger-kilometres travelled, and a 2% increase in vehicle-kilometres travelled per capita. This presents a climate change risk in regards to potential greenhouse gas emissions, but a lower risk overall as compared to Growth Option 1. However, the extent of GHG emissions will be influenced by changes in technology (e.g., electric vehicles).

CLIMIATE CHANGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	provide carbon sequestration, and natural stormwater infiltration (reducing runoff and potential flooding).	
Overall Result	Growth Option 1 addresses some aspects of this theme: 	Growth Option 2 addresses most aspects of this theme: 
Summary	Growth Option 2 more fully addresses the theme of 'Climate Change' as it presents the fewest climate-related risks and slightly more opportunities to proactively plan for climate change adaptation and mitigation including a reduction of 1.0 metric ton of carbon dioxide equivelent from 2022 to 2050 as compared to Growth Option 1.	

Natural Hazards

Natural hazards, such as erosion and flooding hazards, have the potential to have a range of impacts on the City including on infrastructure, the natural environment as well as health and safety of residents and their communities. The Provincial policy framework generally prohibits development in natural hazard lands.

NATURAL HAZARDS CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Does the growth option direct development away from hazardous lands?	Growth Option 1 addresses most aspects of this consideration: • Future development in the existing urban area and within new greenfield areas which is anticipated to take place under Growth Option 1 would be directed away from hazardous lands, as required by the Provincial Policy Statement, Conservation Authorities Act and the City's Official Plan. • Growth Option 1 would require 1,310 ha of new urban land to accommodate growth. Portions of the Candidate Expansion Areas could include lands located within the Sulphur Creek subwatershed, Stoney Creek subwatershed, Sinkhole Creek subwatershed (Hamilton Conversation Authority) and Twenty Mile Creek subwatershed and Welland River subwatersheds (Niagara Peninsula Conservation Authority), depending on where expansion is located. • All Candidate Expansion Areas include lands regulated by the Niagara Peninsula Conservation Authority and/or Hamilton Conservation Authority. Depending on which lands would be selected for expansion, there is high potential for the lands to include natural hazards, mainly floodplains and associated buffers. Based on the City's 2007 Storm Water Management Master Plan, some existing flooding concerns have been identified within the subwatersheds which could potentially be	Growth Option 2 addresses most aspects of this consideration: • Future development of the existing urban area that is anticipated to take place under Growth Option 2 would be directed away from hazardous lands, as required by the Provincial Policy Statement, Conservation Authorities Act and the City's Official Plan. • Growth Option 2 allocates all future growth to lands within the current urban boundary. Natural Hazard lands in the urban boundary are already well known in terms of their role/function in the broader sub-watershed. The existing urban area includes lands within the Sixteen Mile Creek - Credit River, West Lake Ontario, West Lake Ontario Shoreline, Welland Canal – Niagara River, and Lower Grand River watersheds. • While no new natural hazards would need to be identified within the Urban Area, the anticipated amount of growth may add stress to known existing natural hazards within the urban boundary. For example, portions of Dundas as well a number of nodes/corridors (e.g. portions of Rymal Road Secondary Corridor; portions of the Community Node at Stonechruch/Golf Links Road; portions of Centennial Sub-Regional Node) are located within or adjacent to known natural hazards. Accordingly, across the built up and greenfield areas, flooding may be exacerbated by increased impervious surfaces, requiring comprehensive approaches to stormwater management. Note that any redevelopment within the built-up area and greenfield area is subject to planning approval and applicants would be required to demonstrate how stormwater is managed at the site level.

NATURAL HAZARDS CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	affected by the increased runoff volumes and flow rates associated with future development. • Existing Natural hazard lands within the Expansion Areas will be delineated and will inform the layout of future development blocks. • In addition, karst potential (i.e., sinkholes, springs, caves) would be considered and determined through further studies. • Downstream hazard areas and associated buffers will need to be re-evaluated in terms of function and capacity to ensure that they can adequately convey and absorb increased run-off volumes from new development. May require financial investment to increase flow rate and capacity. • Given the high level of intensification planned for Growth Option 1 within the Built-up Area, flooding may be exacerbated by increased impervious surfaces, requiring comprehensive approaches to stormwater management.	
Overall Result	Growth Option 1 addresses most aspects of this theme: 	Growth Option 2 addresses most aspects of this theme: 

NATURAL HAZARDS CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Summary	Growth Options 1 and 2 both mostly address the theme of 'Natural hazards' as defined by the considerations as both growth options have the potential to direct development away from hazardous lands, provided a comprehensive approach to natural hazards is undertaken.	

Municipal Finance

Planning for growth requires the City to consider the financial implications of different growth options. Municipal Finance involves managing existing and future financial impacts on the City, to ensure that the costs associated with growth are financially viable over the long term.

MUNICIPAL FINANCE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Are there any significant municipal financial risks associated with the growth option?	Growth Option 1 addresses most of the consideration: • **Appendix B: Municipal Finance Reports** includes a memo by Watson & Associates Economists Ltd regarding fiscal considerations. This memo identifies that the infrastructure requirements to service an additional 236,000 residents and 132,000 employees will be substantial under both Growth Options. However, based on the information below the anticipated costs will be more significant under Growth Option 2 in comparison to Growth Option 1: **Water / Wastewater** ○ Growth Option 1 will likely require the installation of new transmission infrastructure to provide water to certain Pressure Districts in new greenfield areas. ○ There appears to be no difference in pumping and treatment requirements between the two Growth Options. **Stormwater** ○ Although the expansion into lands outside of the existing urban boundary would entail higher costs for stormwater infrastructure, the capital costs would be offset by development charges. **Transportation** ○ It is less costly to build new roads in new greenfield areas versus expanding existing roadways across the built up area. However, in total, the ambitious density scenario will require more additional roads at a higher overall total capital cost. In addition, the operating costs are	Growth Option 2 addresses some of the consideration: • **Appendix B: Municipal Finance Reports** includes a memo by Watson & Associates Economists Ltd regarding fiscal considerations. This memo identifies that the infrastructure requirements to service an additional 236,000 residents and 132,000 employees will be substantial under both Growth Options. However, based on the information below the anticipated costs will be more significant under Growth Option 2 in comparison to Growth Option 1: **Water / Wastewater** ○ Growth Option 2 will require upgrades and expansion to existing infrastructure across the built up area. Replacement of existing linear water infrastructure normally costs 250-300% more versus the cost of putting new linear services in a greenfield area. ○ In comparison to Growth Option 1, Growth Option 2 may require less new water storage due to certain service areas not needing additional storage to 2051. ○ More combined sewer overflows will be required under Growth Option 2. ○ There appears to be no difference in pumping and treatment requirements between the two Growth Options. **Stormwater** ○ Within the existing urban boundary there is not a significant difference in expected costs as

MUNICIPAL FINANCE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	expected to be higher under the ambitious density scenario. **Transit** ○ Growth Option 1 would require more bus service to accommodate the growth within Whitebelt areas leading to a potentially higher capital expenditure. **Parks / Recreation** ○ Land costs required to develop parks and recreation facilities will be much more substantial across the built up area in comparison to new greenfield areas. Based on the City's OP targets for parkland, it is unlikely that parkland needs will be fulfilled through parkland dedication due to limited availability of developable land across the built up area. • **Appendix B: Municipal Finance Reports** includes a Financing Options for Growth Memo by Watson & Associates Economists Ltd. This memo identifies that financing agreements with developers such as Service Emplacement Agreements function well in greenfield areas, where there is usually a group of developing landowners that own large blocks of developable land. It is more straightforward to engage the group of landowners that are planning to develop large areas to upfront the required costs for infrastructure.	imperviousness does not generally change with intensification. **Transportation** ○ It is more costly to expand existing roadways across the built up area versus building new roads in new greenfield areas. **Transit** ○ As the City is moving ahead with an L.R.T. system within the existing Urban Area, it would appear that servicing within the intensification zones of the lower City will be serviced by this new transit service. **Parks / Recreation** ○ Land costs required to develop parks and recreation facilities will be lower within new greenfield areas in comparison to lands across the built up area. • **Appendix B: Municipal Finance Reports** includes a Financing Options for Growth Memo by Watson & Associates Economists Ltd. This memo identifies that lands to be used for intensification are often owned in small lots by homeowners and businesses. It becomes much more difficult to engage with these landowners to provide upfront financing for infrastructure as usually only large developers would have the financing ability.

MUNICIPAL FINANCE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Overall Result	Growth Option 1 addresses most aspects of this theme: 	Growth Option 2 addresses some aspects of this theme: 
Summary	Growth Option 1 more fully addresses the theme of 'Municipal Finance' as defined by the the consideration as the costs to provide new infrastructure in greenfield areas are lower in comparison to existing. Also, the existing municipal financial tools are better suited to greenfiled areas compared to developing lands within the exisitng built up area.	

Infrastructure and Public Service Facilities

Infrastructure includes the physical structures that form the foundation for development and generally include water and wastewater systems, stormwater management systems and waste management systems. Public service facilities includes lands, buildings, and structures required for the provision of programs and services such as social assistance, recreation, police and fire protection, health and education programs, and cultural services.

INFRASTRUCTURE AND PUBLIC SERVICE FACILITIES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION

Does the growth option result in significant impacts to the City's existing or planned infrastructure?	Growth Option 1 addresses most aspects this consideration:
	• **Appendix C: Water, Wastewater, and Stormwater Servicing Report** identifies that for infrastructure Growth Option 2 will have more impacts within any new greenfield areas as compared to intensification areas.
	• Overall, it is anticipated that additional servicing infrastructure will be required under Growth Option 1 with the potential for more overall length of linear works and potentially more facilities as compared to Growth Option 2.
	• Growth Option 1 will also require upgrades in existing built up areas to accommodate intensification in a number of the nodes and corridors, such as in the Downtown Core. As compared to Growth Option 2, these required upgrades are likely to be less complex.
	• In general, most stormwater impacts can be mitigated with infrastructure upgrades. Both scenarios will require significant on-site controls within intensification areas and, although more growth is projected in the No UBE scenario, the upgrade requirements will likely be similar to that of the Ambitious Density Scenario since the degree of land
		Growth Option 2 addresses most aspects this consideration:
		• **Appendix C: Water, Wastewater, and Stormwater Servicing Report** identifies that for infrastructure Growth Option 2 will have more impacts within intensification areas such as the Downtown Core as compared to Growth Option 1.
		• Overall, it is anticipated that additional servicing infrastructure will be required under Growth Option 2. The infrastructure upgrades required as part of Growth Option 2 are anticipated to be more significant as compared to Growth Option 1. Development, design, and implementation of required upgrades may be more challenging due to a range of factors:
		  ○ More complex servicing solutions required:
		  ▪ Combined system
		  ▪ More infrastructure (# of pipes) impacted by growth
		  ▪ More existing capacity constraints resulting in potential upgrades of existing infrastructure
		  ▪ Potentially larger scale of new/upgraded infrastructure within intensification areas
		  ○ Determination of treatment requirements for municipal and private combined (F-5-5

INFRASTRUCTURE AND PUBLIC SERVICE FACILITIES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	use change (i.e., impervious coverage) will be comparable across both scenarios. • Within Greenfield areas, new stormwater infrastructure will be required for the Ambitious Density Scenario, which may impact natural receiving systems and may require relocation of some watercourses. • Expansion into the Greenfield areas under the Ambitious Density scenario provides an opportunity for 100% funding through the Development Charges (DC) process as well as clear delineation of projects that are dedicated for growth, not for addressing existing constraints (e.g. new PD7 Pumping and Storage, new feedermains for growth areas, Lower Centennial Trunk Sewer, etc.). However, due to the nature of the growth being more spread out over a larger geographical area with relatively little existing servicing, potential for more infrastructure (overall length of linear works and potentially more facilities) will likely be required.	guidelines) and Combined Sewer Overflow requirements ○ Constructability challenges within built-out intensification areas ○ Potential higher cost. • In general, most stormwater impacts can be mitigated with infrastructure upgrades. Both scenarios will require significant on-site controls within intensification areas and, although more growth is projected in the No UBE scenario, the upgrade requirements will likely be similar to that of the Ambitious Density Scenario since the degree of land use change (i.e., impervious coverage) will be comparable across both scenarios. • With Growth Option 2, minimal greenfield growth and subsequent new stormwater infrastructure will be needed, which minimizes potential additional impacts to watercourses (creeks/streams), as well as potential longer-term needs for O&M of natural or man-made infrastructure. • In terms of financing, Growth Option 2 presents the potential for more complex financing scenarios whereby costs of projects may need to be split based on growth-related infrastructure upgrades and benefit to existing population as compared to Growth Option 1.

INFRASTRUCTURE AND PUBLIC SERVICE FACILITIES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Does the growth option result in significant impacts to the City's existing or planned public service facilities?	Growth Option 1 addresses most aspects of this consideration: • Growth Option 1 includes an intensification target of 60% growth within the City's built-up area (approximately 66,190 additional units in the Built-Up Area (BUA). This level of growth planned across the BUA is expected to make best use of existing public service facilities, such as parks, libraries, schools, hospitals, fire/emergency services and other public facilities. Targeted upgrades would be required to areas within the BUA that are expected to accommodate the future intensification, such as the Downtown and other key nodes/corridors. The 60% intensification target is a significant amount of population and housing to be allocated within the BUA and would require a comprehensive approach to public services facilities planning. • Growth Option 1 is not expected to have significant impact on planned facilities for existing Designated Greenfield Areas, which have plans in place for future public facilities (DGA is planned to accommodate 15,430 units). • Growth Option 1 would also require a full range of new public facilities to serve the	Growth Option 2 addresses most aspects of this consideration: • In Growth Option 2 for a period of time, existing public service facilities would be used to their maximum service capacity resulting in an efficient use of existing resources. However, over time as growth occurs, certain areas of the City may see a strain on existing service facilities including the Centennial Node (additional 7,360 units) and the Downtown Node (additional 31,500 units). • In regards to planning for future needs, there are expected to be greater challenge in accommodating and planning for parks, recreational and other facilities due to land and capacity constraints within the BUA. Some of the challenges associated with the higher level of intensification would include: ○ Greater need to reinvest in the renewal and expansion of existing facilities within the built-up area to accommodate growing demand. Many of these are located in Lower Hamilton and involve other partners, such as schools and non-profits (e.g., YM/YWCA). ○ Not all existing facilities will be able to accommodate growing demand. Wait lists may increase and access may need to be reallocated to priority groups.

INFRASTRUCTURE AND PUBLIC SERVICE FACILITIES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	population added with 28,260 new units in future expansion area(s). The City's traditional forms of recreation and park facility development would continue in these areas, guided by the principles, needs and strategies identified in the Recreation Master Plan. Examples include the provision of multi-use community centres containing multiple spaces that support all ages and abilities. Community parks containing multiple sports fields and recreation amenities will also be possible. Due to land use patterns in lower density areas, more neighbourhood-level amenities that are provided based on a model of equitable distribution – such as playgrounds, courts, and spray pads – may be required compared to Growth Option 2. • Given the distribution of future population growth across the City, comprehensive master planning for the entire City would be required to plan for and support Growth Option 1 (e.g., cultural plan, fire master plan, parks and recreation plans, libraries, schools, etc.), with a particular emphasis on the Built Up Area's nodes and corridors and any future expansion areas and associated nodes/corridors.	○ Facility provision and development will become more complex, and potentially more costly (due partially to higher land values). A greater focus will need to be placed on innovative facility provision strategies within high density areas, such as those involving partnerships and leased space within integrated multi-partner developments. ○ Private amenity space will become more common (e.g., condo pools, fitness centres, etc.). Municipal programming within these spaces will be restricted, therefore their ability to serve a broader population is likely to be quite limited • Accordingly, accommodating the 81% intensification within the BUA would require the City to explore alternative solutions/standards for parks, recreation and other public facilities. • Similar to Growth Option 1, comprehensive master planning for the entire City would be required to plan for and support Growth Option 2 (e.g., cultural plan, fire master plan, parks and recreation plans, libraries, schools, etc.) for the existing urban area. • The capital cost of some new facilities or the retrofit/expansion of existing facilities to

INFRASTRUCTURE AND PUBLIC SERVICE FACILITIES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	• The capital cost of most new facilities to accommodate growth could be funded through Development Charges and the City would need to plan for any additional operating costs.	accommodate growth could be funded through Development Charges and the City would need to plan for any additional operating costs.
Overall Result	Growth Option 1 addresses most aspects of this theme: 	Growth Option 2 addresses most aspects of this theme: 
Summary	Growth Options 1 and 2 both mostly address the theme of 'Infrastructure & Public Service Facilities' as defined by the considerations as comprehensive master planning would be required to plan for and support future infrastructure and public service facility requirements.	

Transportation Systems

Transportation Systems support the movement of residents and goods within the City as well as establishing a connection to the wider regional transportation network. Transportation Systems are comprised of facilities, corridors and rights-of-way and include roads, transit stops and stations, sidewalks, cycle lanes, bus lanes, HOV lanes, rail facilities, park and ride lots and a host of other transportation facilities.

TRANSPORTATION SYSTEMS CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Does the growth option result in significant impacts to the City's existing or planned transportation infrastructure?	Growth Option 1 addresses some aspects of the consideration: • **Appendix D: Transportation Report** presents the results of transportation modelling conducted by the City and AECOM to a 2051 time horizon with a base model year of 2016. Both options assume the LRT would be in place. It should be noted that the current model does not account for paradigm shifts in transportation (e.g., telecommuting, autonomous vehicles) given the current state of knowledge regarding these trends. The basic modelling results still provide an appropriate basis of comparison for the purpose of evaluating broad growth options. • Growth Option 1 will result in significant impacts to the City's existing and planned infrastructure. • Impacts on the road network include: ○ Projected need for 50.8 km of new roadways (centreline km), 157.16 km of new capacity improvements, 34.71 km of urbanized roads, ○ Two screenlines that would exceed capacity (northbound escarpment and westbound downtown), ○ Significant increase in capital and operating cost associated with	Growth Option 2 addresses most aspects of this consideration: • **Appendix D: Transportation Report** presents the results of transportation modelling conducted by the City and AECOM to a 2051 time horizon with a base model year of 2016. Both options assume the LRT would be in place. It should be noted that the current model does not account for paradigm shifts in transportation (e.g., telecommuting, autonomous vehicles) given the current state of knowledge regarding these trends. The basic modelling results still provide an appropriate basis of comparison for the purpose of evaluating broad growth options. • Growth Option 2 will result in significant impacts to the City's existing and planned infrastructure. • Impacts on the road network include: ○ Projected need for 18.81 km of new roadways (centreline km), 91.35 km of new capacity improvements, 18.81 km of urbanized roads, ○ Notwithstanding an increase in transit mode share for this growth option, the absolute auto volumes will be higher within the inner urban area resulting in greater levels of congestion, ○ There are two screenlines that would exceed capacity (northbound escarpment and westbound downtown), ○ Increased vehicle trips in intensification areas may generate the need for additional traffic calming measures, and

TRANSPORTATION SYSTEMS CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	maintaining, operating and asset management[5], ○ Increase in new roadways will put pressure on the ability to deliver infrastructure at a pace to keep up with demand, ○ Vehicle trips from new growth areas may generate more cut-through traffic in adjacent existing areas resulting in the need for traffic calming measures, and ○ Relative to existing condition and Growth Option 2, Growth Option 1 will see higher per capita vehicle kilometres travelled and higher per capita travel times, suggesting overall network performance will be less efficient. • Overall Growth Option 1 is compatible with the City's "in development" and planned higher order transit corridors. Impacts to transit include: ○ Approximately 79% increase in transit service hours required City-wide, ○ Requires extension of routes or new routes to service new growth areas,	○ A moderate increase in capital and operating cost associated with operating, maintaining and asset management of the road network. • Overall Growth Option 2 is compatible with the City's "in development" and planned higher order transit corridors. Impacts to transit include: ○ Approximately 79% increase in transit service hours required City-wide, ○ Requires enhanced service levels in intensification areas to address growth, ○ Greater reliance on transit to meet modal share targets, given road network constraints in built up areas, ○ Increased need for upgrades to existing transit amenities, and ○ Intensification of development in existing built-up areas and in proximity to existing employment and commercial areas promotes mixed use development, which improve cost efficiency of transit services (e.g., flatter peak loads, two-way travel demands) • Impacts to active transportation include: ○ Will require upgrades to existing and near term planned cycling facilities to facilitate all ages and

[5] Note that there are some differences in how costs are perceived between the Transportation and Municipal Finance analysis. The Transportation analysis notes that there could be lower relative operating/capital costs associated with the road and transit networks when comparing the two options on the basis that the network would need to service new areas (and therefore have higher relative operating costs and possibly capital costs). The Municipal Finance analysis memo examines all type of infrastructure and notes that infrastructure investment as a whole (water, sewer, roads, public service facilities, stormwater, etc) is more costly in the BUA vs. DGA when comparing the capital costs of building in the two different environments, recognizing that there are higher property acquisition costs and need for more complex technical solutions in the BUA compared to DGA.

TRANSPORTATION SYSTEMS CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	○ Increases capital costs for new transit amenities and upgrades to amenities adjacent to new growth areas, and ○ Potential to invest in park and ride facilities to support transit. • Impacts to active transportation include: ○ Transportation networks within Urban Expansion Areas will be designed based on a complete streets approach and include active transportation facilities, ○ Will require connections and enhancements to existing trail system to facilitate commuter travel, and ○ Development of potential urban expansion areas will drive need for addressing sidewalk gaps in nearby adjacent neighbourhoods and connecting streets (e.g. Upper ○ Centennial, Upper James south of Hydro corridor).	abilities travel and accommodate increased demands, ○ Will be more competition for road space between users as a result of higher densities in some areas, and ○ Will increase need for amenities to support walking and cycling trips.
Does the growth option provide an urban form that will expand convenient access to a range of transportation options including active transportation, to	Growth Option 1 addresses some aspects of the consideration: • Increased intensification target of 60% and a planned density of 60 people and jobs per hectare in the existing DGA density and 71 people and jobs per hectare in the expansion area will provide opportunities for more complete community development across the City.	Growth Option 2 addresses some aspects of the consideration: • Increased intensification target of 81% and a planned density of 60 people and jobs per hectare in the existing DGA density will provide opportunities for more complete community development across the City. ○ Both options will increase the number of residents and jobs within transit-supportive areas (i.e., 50 persons and jobs per hectare).

TRANSPORTATION SYSTEMS CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
promote complete communities?	○ Both options will increase the number of residents and jobs within transit-supportive areas (i.e., 50 persons and jobs per hectare). Growth Option 1 will result in 44.8% of the population and 50.2% of jobs being in transit-supportive areas. • 85.4% of residents and 85.3% of jobs are projected to be within 400 m of planned active transportation network. • While planning for complete communities, there is an opportunity to provide accessible and connected active transportation networks. However, boundary expansions with high single-detached dwelling unit counts generally increase trip distances to/from local amenities (e.g. grocery stores etc.) and decreases the likeliness to use active transportation. In addition, the required timeframe to build out new urban areas could mean that options for sustainable transportation are not available for early residents.	Growth Option 2 will result in 53.2% of the population and 55.5% of jobs being in transit-supportive areas. • 89.6% of residents and 87.6% of jobs projected to be within 400 m of planned active transportation network, and • Intensification will support more local amenities (e.g. grocery stores, corner stores, etc.) which in turn allows for more short trips by active transportation.
Does the growth option prioritize development of areas that would be connected to the planned BLAST network or existing transit?	Growth Option 1 addresses some aspects of the consideration: • Growth Option 1 has the potential to prioritize development of areas that would be connected to the planned BLAST network and existing transit. This is in part due to the planned intensification as part of this option, but the overall ability to meet this	Growth Option 2 addresses some aspects of the consideration: • Growth Option 2 prioritizes the development of areas that would be connected to the planned BLAST network and existing transit. Growth Option 2 is projected to result in 61.3% of population and 63.5% of jobs within 800 m of BLAST corridor and 77% of residents and 75.3% of jobs within 400 m of Local

TRANSPORTATION SYSTEMS CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	consideration would depend on which Candidate Expansion Areas are selected should this option is selected. • An expansion of the urban boundary provides an opportunity to build communities around transit. As there is currently minimal local transit within the whitebelt, service extensions will be required, and extension of services would require changes to current area rating policy. • Growth Option 1 is projected to result in 56% of residents and 60.2% of jobs projected to be within 800 m of BLAST corridor and 66% of residents and 68.6% of jobs projected to be within 400 m of Local HSR network. However, densities are unlikely to support transit service levels needed to build transit-oriented communities from day one and maximize transit mode shares, unless there is a mechanism to subsidize transit services in the short term.	HSR network. It is also projected to result in 68,200 more people living (8.4%) within areas that are transit supportive (>50 ppj/ha). • Growth Option 2 leverages investments by senior levels of government in the B-Line and A-Line corridors and overall is more suitable to support transit ridership due to higher densities resulting in an increased possibility of increasing mode share with improved services.
Overall Result	Growth Option 1 addresses some aspects of this theme: 	Growth Option 2 addresses most aspects of this theme: 

TRANSPORTATION SYSTEMS CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Summary	Both options will result in significant impacts to the City's existing and planned infrastructure. Growth Option 2 more fully addresses the theme of 'Transportation Systems' as it has a higher level of intensification and has better potential to support the City's investments in transit.	

Natural Heritage and Water Resources

The Natural Heritage System includes natural heritage features and areas, such as wetlands, woodlands, and wildlife habitat and the linkages that provide connectivity to support various natural processes. Water Resources are a system of features, such as groundwater features and surface water features, as well hydrologic functions which sustain healthy aquatic and terrestrial ecosystems and human water consumption.

NATURAL HERITAGE AND WATER RESOURCES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Does the growth option avoid and protect Natural Heritage Systems as identified by the City and the Growth Plan?	Growth Option 1 addresses some aspects of this consideration: • In general, the Rural Hamilton Official Plan and Provincial policy direct development away from the natural heritage system, including the Greenbelt Natural Heritage System, and require mitigation measures to demonstrate no negative impacts on the natural heritage system where development is proposed in proximity to the system. • Growth Option 1 would require the addition of 1,310 ha of new urban land. Growth Option 1 expands impacts of development into a larger portion of the Natural Heritage System, impacting additional natural heritage features and functions. Portions of the Natural Heritage System are located within the potential Expansion Areas, including Core Areas and Linkages: o Life Science Areas of Natural and Scientific Interest (ANSI) and Earth Science ANSI o Significant Woodlands o Environmentally Significant Areas o Wetlands and Streams o Greenbelt Natural Heritage System • While development would generally be directed away from these features, the presence of development in close proximity is likely to have adverse impacts on the quality of the	Growth Option 2 addresses most aspects of this consideration: • In general, the Urban Hamilton Official Plan and Provincial policy direct development away from the natural heritage system, including the Niagara Escarpment, and require mitigation measures to demonstrate no negative impacts on the natural heritage system where development is proposed in proximity to the system. • Portions of the Natural Heritage System are located within the Urban Boundary, including Core Areas and Linkages: o Life Science ANSI and Earth Science ANSI o Significant Woodlands o Environmentally Significant Areas o Wetlands and Streams o Niagara Escarpment • Significant Woodlands and Environmentally Significant Areas are mainly concentrated along the southern boundary of the Niagara Escarpment Area. In addition to the Niagara Escarpment, a small portion of lands within the existing urban boundary fall under the Parkway Belt West Plan. The Parkway Belt West Plan provides a system of linked natural areas and protected utility corridors. • Growth Option 2 carries the risk that existing natural features within the existing Urban Area will be subjected to increased pressures through encroachment, invasive species, reduced buffers, biodiversity degradation and removal of natural

NATURAL HERITAGE AND WATER RESOURCES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	feature/functions that would need to be minimized/mitigated. • An Environmental Impact Study and Linkage Assessment would be required to demonstrate avoidance and protection of the Natural Heritage System. In addition prior to development or site alteration within 120 m of the Core Area, a vegetation protection zone will have to be determined to protect the features and its functions within the Expansion Area. • Based on the above and in comparisons to Growth Option 2, Growth Option 1 has some potential to avoid and protect the City's Natural Heritage Systems on the basis that development will generally be directed away from designated natural heritage features. Under Growth Option 1, the necessary studies will have to be completed to demonstrate the avoidance and protection of Heritage Systems as identified by the City and the Growth Plan, as well as other Provincial policy direction.	areas as a result of the significantly high quantum of development directed to the Built-Up area and existing Designated Greenfield Areas • Growth Option 2 does not require the addition of new urban land. However, based on the forecasted population growth and the anticipated development/redevelopment within the existing urban boundary, additional environmental studies may have to be completed to determine if further mitigation measures are required to protect the Natural Heritage System within the Urban Boundary. • Based on the above and in comparisons to Growth Option 1, Growth Option 2 has the most potential to avoid and protect the City's Natural Heritage Systems. Under Growth Option 2, development will continue to avoid and protect Natural Heritage Systems as identified by the City and the Growth Plan, as well as other Provincial policy direction.
Does the growth option demonstrate an avoidance and / or mitigation of potential negative impacts on watershed conditions and the water resource system including quality and quantity of water?	Growth Option 1 addresses some aspects of this consideration: • Some Key Hydrological Features are located within the Urban Boundary, including Lakes and Littoral Zones, Streams. The Littoral Zones are concentrated along the Lake Ontario shoreline and the Hamilton Harbour.	Growth Option 2 addresses all aspects of this consideration: • Some Key Hydrological Features are located within the Urban Boundary, including Lakes and Littoral Zones, Streams. The Littoral Zones are concentrated along the Lake Ontario shoreline and the Hamilton Harbour.

NATURAL HERITAGE AND WATER RESOURCES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	• Growth Option 1 would require the addition of 1,310 ha of new urban land. While Sub-watershed Studies have partially been completed (i.e., Phase 1) or fully completed for portions of land associated with the Candidate Expansion Areas, a Sub-watershed Study/Studies would be required to confirm avoidance and / or mitigation of potential negative impacts on watershed conditions and the water resource system • Given that new urban land would be required, Growth Option 1 has the potential to negatively impact new key hydrologic features due to change in runoff regime. In addition, there is the potential to increase sedimentation/pollutants and flooding due to increased impervious surfaces. In addition, resources to monitor water quality would be stretched over a larger area – may not be sufficient resources. • Given that the City of Hamilton is located within three Sourcewater Protection Regions (i.e., Halton-Hamilton, Lake Erie, Niagara Peninsula) and portions of the Rural Area are located within the Greenbelt Plan Area, the City's has a comprehensive policy framework in place to protect its source water areas, including Highly Vulnerable Aquifers and Significant Groundwater Recharge Areas. These areas are critical component to the City's ability to ensure a safe,	• Growth Option 2 does not require the addition of new urban land. However, based on the forecasted population growth and the anticipated development/redevelopment within the existing urban boundary, additional environmental studies may have to be completed to determine if further mitigation measures are required to protect Key Hydrological Features within the Urban Boundary based on the high concentration of new urban development. • An intensification rate of 81% will place significant pressure on the City existing stormwater management infrastructure systems. Growth Option 2 carries risk that flooding may be exacerbated by increased impervious surfaces. However, a more compact urban boundary would require the City to implement low impact developments (LIDs) on a City-wide scale to effectively reduce and mitigate the risk of flooding. • Given that the City of Hamilton is located within three Sourcewater Protection Regions (i.e., Halton-Hamilton, Lake Erie, Niagara Peninsula) and portions of the Urban Area are located within the Niagara Escarpment Plan Area, the City's has a comprehensive policy framework in place to protect its source water areas, including Highly Vulnerable Aquifers and Significant Groundwater Recharge Areas. These areas are critical component to the City's ability to ensure a safe, reliable supply

NATURAL HERITAGE AND WATER RESOURCES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	reliable supply of drinking water for existing and future residents and businesses. • In addition, stormwater management (SWM) is required to protect/manage impacts to watersheds and associated natural systems reliant on water. As per above, since SWM is not 100 % effective there may be some residual impacts on water quality and runoff volumes; peak flows (flood control) expected to be suitably managed to pre-development conditions. • Comprehensive stormwater management would be required to minimize and mitigate negative impacts of urban runoff on water quality and to maximize opportunities for infiltration. • The ability to implement the City's source protection framework under Growth Option 1 presents greater potential risk for source water protection due to the amount of new land required.	of drinking water for existing and future residents and businesses. • Comprehensive stormwater management (SWM) would continue to be required to minimize and mitigate negative impacts of urban runoff on water quality and to maximize opportunities for infiltration. • Based on the above, and in comparison to Growth Option 1, there is limited potential for impacts to external watersheds and the associated runoff regime if development and redevelopment within the Urban Area continues to demonstrate an avoidance and / or mitigation of potential negative impacts on watershed conditions and the water resource system.
Overall Result	Growth Option 1 addresses some aspects of this theme: 	Growth Option 2 addresses most aspects of this theme: 

NATURAL HERITAGE AND WATER RESOURCES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Summary	Growth Option 2 more fully addresses the theme of 'Natural Heritage and Water Resources' as defined by the considerations as there is limited potential for impacts to external watersheds and the associated runoff regime if development and redevelopment within the Urban Area continues to demonstrate an avoidance and / or mitigation of potential negative impacts on watershed conditions and the water resource system. Both Growth Options will continue to avoid and protect Natural Heritage Systems as identified by the City and the Growth Plan, as well as other Provincial policy direction.	

Complete Communities

Complete Communities are places within a community that offer and support opportunities for people of all ages and abilities to conveniently access most of the necessities of daily living, including an appropriate mix of jobs, local stores, services, a full range of housing, transportation options and public service facilities.

COMPLETE COMMUNITIES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Does the growth option provide a diverse mix of land uses in a compact built form, with a range of housing options to accommodate people at all stages of life and to accommodate the needs of all household sizes and incomes?	Growth Option 1 addresses most aspects of this consideration: • Growth Option 1 provides opportunities for compact built form with an overall intensification target of 60% and a DGA density target of 60 people and jobs per hectare within the Urban Area. In addition, Growth Option 1 has a DGA density target of 77 people and jobs per hectare in the Expansion Area. • This option allows for a high level of intensification of existing areas within the urban boundary and plans for new growth in the expansion area to be planned with densities that support the development of a mix of uses in a compact built form. • Growth Option 1 allows for planning for a full range of uses in new expansion areas to ensure a range of housing forms, community amenities, and services are provided that will create a complete community. • Growth Option 1 forecasts a City-wide housing unit growth of 25% single / semi-detached, 25% townhouses, and 50% apartments by 2051. This option allows for a variety of housing options to be developed which could accommodate a variety of households at different stages. There are unknown impacts on the overall affordability of the City's supply of housing under Growth Option 2.	Growth Option 2 addresses some aspects of this consideration: • Growth Option 2 has an 81% intensification target and includes a DGA density target of 60 people and jobs per hectare within the Urban Area. The high intensification rate and DGA density will provide opportunities for compact built form. • This option provides a less diverse mix of land uses because it relies on land available in the existing urban boundary to be developed with medium and high density uses to accommodate growth. Providing space for a mix of community related uses and amenities, like parkland may be challenging. • Growth Option 2 forecasts a City-wide housing unit growth of 9% single / semi-detached, 13% townhouses, and 78% apartments by 2051. The limited percentage of ground-oriented housing options would not provide a full range of housing options. The resulting housing supply could result in a lack of choice for households larger than two persons. There are unknown impacts on the overall affordability of the City's supply of housing under Growth Option 2.

COMPLETE COMMUNITIES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Does the growth option improve social equity and overall quality of life, including human health, for people of all ages, abilities and incomes?	Growth Option 1 addresses most aspects of this consideration: • Aspects of growth management planning which help to improve overall social equity and quality of life for people of all ages, abilities and incomes are associated with access to housing options, opportunities for transit-supportive development, reduced commuting times, job creation and improved access to parks, recreation and other community amenities. • Access to housing across all aspects of the housing continuum is a complex matter, of which housing supply is only one component. Growth Option 1 provides a range of housing options, offering a mix of low, medium and high density housing choices across the City. The housing mix in Option 1 is aligned with anticipated market demand and should help to broaden the housing options for existing and future residents. • With an intensification target of 60%, Growth Option 1 provides opportunities for transit-supportive development in the Built-Up Area. The community area expansion is planned to achieve densities which support transit development, however, there would likely be lower transit ridership levels in locations where there are more ground oriented housing units planned. In these locations, longer commute times could be anticipated.	Growth Option 2 addresses some aspects of this consideration: • Aspects of growth management planning which help to improve overall social equity and quality of life for people of all ages, abilities and income are associated with access to housing, opportunities for transit-supportive development, reduced commuting times, job creation and improved access to parks, recreation and other community amenities. • Growth Option 2 provides a less balanced supply of housing options, offering a mostly high density housing choices and limited options for ground oriented housing. The housing mix in Option 2 is not aligned with anticipated market demand and could have negative impacts on access to housing choices. • Growth Option 2 has more opportunities for transit supportive development compared to Option 1. With 81% of the future growth located in the Built-Up Area, there is potential to increase opportunities, reduce commuting times and improve access to transit for people living and working in the City. Accommodating the 81% intensification rate would require the City to comprehensively update building height and densities along its key nodes and corridors to accommodate the growth. • Growth Options 1 and 2 provide the same employment forecast by type, both offering potential for a wide range of economic development opportunities, job creation and access for people living in the City.

COMPLETE COMMUNITIES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	• Growth Options 1 and 2 provide the same employment forecast by type, both offering potential for a wide range of economic development opportunities, job creation and access for people living in the City. • Growth Option 1 distributes the population growth amongst a number of the City's key nodes and corridors. The Downtown Node is assumed to grow by additional 18,500 units; the Elfrida Node is assumed to grow by additional 300 units; and the James/Rymal Node by additional 600 units; and corridors by 10,500 units. • The scale of future growth and development anticipated for the City's key nodes and corridors will require comprehensive planning to ensure that there is an adequate supply of parks, recreational, education and other community amenities to support future development. However, the distribution of growth around the City will ensure that investment in new or improved community amenities will not only be concentrated in one specific area. This may contribute to quality of life if access to adequate community amenities is disbursed across the City, including in new expansion areas.	• Growth Option 1 distributes the population growth amongst a number of the City's key nodes and corridors. The Downtown Node is assumed to grow by additional 31,500 units; the Elfrida Node is assumed to grow by additional 405 units; the James/Rymal Node by additional 7,360 units; and corridors by 16,905 units. • The scale of future growth and development anticipated for the City's key nodes and corridors will require comprehensive planning to ensure that there is an adequate supply of parks, recreational, education and other community amenities to support future development. While growth is proposed to be disbursed across the City, there would be pressure put on existing community services and amenities that may have limited options for expansion to respond to increased population growth due to lack of land availability and competition for land from other uses. This may impact quality of life, if community amenities are not adequate or available.
Does the growth option expand convenient access to	Growth Option 1 addresses most aspects of this consideration:	Growth Option 2 addresses most aspects of this consideration:

COMPLETE COMMUNITIES CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
an appropriate supply of open spaces, parks, trails and recreation facilities?	• As Growth Option 1 would require 1,310 ha of new urban land to accommodate growth, open spaces, parks, trails and recreation facilities have the potential to be planned to be centralized due to the flexibility of available space within the Expansion Area. • While Growth Option 1 provides the opportunity to plan for equitable access to all facility types, access may potentially be reduced due to the high percentage of single / semi-detached housing units and townhouses, requiring a personal vehicle or transit use to access facilities (such as sports fields and recreation complexes). • Growth Option 1 provides potential to plan for an appropriate supply of open spaces, parks, trails and recreation facilities. The Parks Master Plan and the existing Recreational Trails Master Plan would have to be updated to account for the Expansion Area.	• As Growth Option 2 requires no new urban land to accommodate growth, existing open spaces, parks, trails and recreation facilities which are already established within the Urban Area are generally conveniently accessible. • Neighbourhood-level park amenities are likely to be more congested due to higher use. In addition, space constraints may limit the supply of new open spaces, parks, trails and recreation facilities, pushing larger recreational facilities (such as sports fields and recreation complexes) to suburban areas, necessitating travel beyond the neighbourhood. • Based on the above, and in comparison to Growth Option 1, Growth Option 2 has a higher potential to provide access to existing open spaces, parks, trails and recreation facilities. However, pressure will be placed on existing facilities to meet needs and wait lists may become longer. As no new urban land is added to Growth Option 2, space constraints may impact accessibility and supply. The Parks Master Plan and existing Recreational Trails Master Plan would need to account for appropriate parkland and trail provision given the new DGA density target.

COMPLETE COMMUNITIES CONSIDERATION	**GROWTH OPTION 1:** **AMBITIOUS DENSITY (1,310 HA EXPANSION)**	**GROWTH OPTION 2:** **NO URBAN BOUNDARY EXPANSION**
Overall Result	Growth Option 1 addresses most aspects of this theme: 	Growth Option 2 addresses some aspects of this theme: 
Summary	Growth Option 1 more fully addresses the theme of 'Complete Communities' as defined by the considerations as more undeveloped land is available to plan for an appropriate mix of housing and supply of open spaces, parks, trails and recreation facilities.	

Agricultural System

The agricultural system is the land base used for the purposes of growing food and the raising of livestock, providing a source of food and employment to a community, as well as the agri-food network. The agricultural land base includes prime agricultural areas, specialty crop lands, and rural lands, and the agri-food network refers to the elements that support the viability of the sector, such as farm buildings, farm markets, distributors, processing facilities and transportation networks.

AGRICULTURAL SYSTEM CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Does the growth option prioritize development of areas that are non-prime agricultural?	Growth Option 1 addresses a few aspects of this consideration: • **Appendix E: Agricultural Report** provides a summary of the Agricultural assessment. The current existing land uses within the Whitebelt Area consist of agriculture, speciality crop, rural, open space, and a mineral aggregate resource extraction areas. Growth Option 1 would require 1,310 ha of new urban land to accommodate growth and therefore has a greater potential impact on the existing Prime Agricultural Lands. The majority of lands within the Whitebelt Area are considered to be prime agricultural lands. • Based on the above and in comparison to Growth Option 2, Growth Option 1 would require the conversion of Prime Agricultural Lands to accommodate future development and therefore does not prioritize development of areas that are non-prime agricultural.	Growth Option 2 addresses all aspects of this consideration: • **Appendix E: Agricultural Report** provides a summary of the Agricultural assessment. The current existing land uses within the existing urban boundary consist of neighbourhoods, open space, institutional, utility, commercial and mixed use designations, and employment area designations. Growth Option 2 allocated all future growth to lands within the current urban boundary and would require 0 ha of new urban land needed to accommodate growth. • Based on the above and in comparison to Growth Option 1, Growth Option 2 avoids the need for conversion of Prime Agricultural Lands to accommodate future development and therefore prioritizes development of areas that are non-prime agricultural.
Does the growth option avoid, minimize and mitigate impacts on the Agricultural System, including Prime Agricultural Lands classifications 1, 2 and 3?	Growth Option 1 addresses a few aspects of this consideration: • Based on statistics provided by the City, within the City's rural area, 56% (49,960 ha) of land is designated Agriculture and 26% (23,226 ha) is designated Rural within the RHOP. These designations are based on Land Evaluation and Area Review (LEAR)	Growth Option 2 addresses most aspects of this consideration: • The majority of lands within the existing urban boundary do not include soils with a Canada Land Inventory (CLI) Class 1, 2 or 3 rating. Based on the AIA, Growth Option 2 would require 0 ha of new urban land needed to accommodate growth. In

AGRICULTURAL SYSTEM CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	evaluation. Notably, the LEAR identifies less Prime Agricultural Land because it takes into account land fragmentation, surrounding uses, among others, and by doing so lowers the overall rating. • Based on the analysis and data collected for the AIA, all of the of lands outside the existing urban boundary in the whitebelt (2,197.6 ha or 100%) include soils with a Canada Land Inventory (CLI) Class 1 to 3 rating, which are considered Prime Agricultural Lands within the AIA Study Area: ○ Class 1: 1,522.4 ha or 69.3% ○ Class 2: 556 ha or 25.3% ○ Class 3: 119.1 ha or 5.4% • Based on the AIA, Growth Option 1 would require the conversion of up to 1,310 ha of existing Prime Agricultural Lands with CLI Soil Classes ranging from 1 to 3 to accommodate growth. • Based on the information below, there are 149 farm related active infrastructure, twenty-four (24) within the immediate AIA Study Area and 125 within the 1,500 m buffer area including: ○ Farm-related active infrastructure within the AIA Study Area: two garden centres/nurseries, one cidery, one hay barn, six storage barns, six equipment sheds, one farm house, one hobby farm,	addition, there are 0 ha of Prime Agricultural Lands within the existing urban boundary. • Based on the above and in comparison to Growth Option 1, Growth Option 2 has greater potential to avoid, minimize and mitigate impacts on the Agricultural System.

AGRICULTURAL SYSTEM CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	four grain storage silo, one sod distributor, and one irrigation pond. ○ Farm-related active infrastructure within the 1,500 m buffer area: one cidery, one farmers market, four roadside stands, two cheese shops, five garden centres/greenhouse complexes, three storage barns, one soil mixing area, nine grain storage silos, 25 grain storage bins, 41 equipment sheds, one farm house, one farm machinery repair business, 31 hay barns, and one structure with an undetermined agricultural use. • In addition, the extensive encroachment of future urban land uses would potentially lead to the fragmentation of farm parcels and heavy urban traffic would make operations difficult for future farm operators. • Based on the above and in comparison to Growth Option 2, Growth Option 1 would have significant impacts on the existing Agricultural System and would require measures to minimize the impact on the broader Agricultural System.	
Does the growth option promote healthy, local and affordable food options, including urban agriculture?	Growth Option 1 addresses a few aspects of this consideration: • Growth Option 1 would concentrate the forecasted population growth people within the existing Urban Area, as well as 89,000 people within the Urban Expansion Area, requiring an additional 1,310 ha of land. As	Growth Option 2 addresses most aspects of this consideration: • Growth Option 2 would concentrate the forecasted population growth people within the existing urban area. As Growth Option 2 does not require the conversion of existing Prime Agricultural Lands outside the existing urban boundary, it is anticipated

AGRICULTURAL SYSTEM CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	Growth Option 1 would require the conversion of up to 1,310 ha of land, which is primarily comprised of Class 1, 2 or 3 Prime Agricultural Lands (depending on the location of lands selected in the Whitebelt), it is anticipated that healthy, local and affordable food options would be impacted by the anticipated growth. ○ Based on the AIA, fields within the Urban Expansion Area include crops (corn, soybean, winter wheat and hay), as well as some fallow fields and pasture land. One specialty crop is grown within two orchards (apples), as well as one abandoned orchard (apples). While information regarding active agricultural fields is not available, of the 2,197.6 ha of Candidate Expansion Area, 1,921.4 ha are considered agriculturally viable (meaning a parcel size of greater than 40 ha), and 1,721.4 ha have an existing primary land use of agricultural. ○ Based on the AIA, the following farm related infrastructure have been observed within the Urban Boundary Expansion Area: storage barns, hay barn, equipment sheds, grain storage silos, smaller storage buildings, nursery, garden centre, farm house, hobby farm, sod distributor, cidery, and an irrigation pond. Two livestock operation was observed, an	that healthy, local and affordable food options are maintained, with as more land for agricultural use is available. • Due to the forecasted level of growth within the existing urban boundary, it is anticipated that there would be less potential for urban agricultural uses for Growth Option 2 compared to Growth Option 1, as the scarcity of land within the urban area is likely to promote land uses with higher return on invest. However, the magnitude of difference in this regard between the two options is minimal as both options plan for significant levels of intensification. • Based on the above and similar to Growth Option 1, Growth Option 2 has potential to promote healthy, local and affordable food options, but moderate potential to promote urban agriculture.

AGRICULTURAL SYSTEM CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	equine operation and one poultry and equine operation. • Due to the forecasted level of growth within the existing urban boundary, it is anticipated that there would be less potential for urban agricultural uses, as the scarcity of land within the urban area is likely to promote land uses with higher return on invest. Potential exists to plan for urban agriculture within the Urban Expansion Area. However, the magnitude of difference in this regard between the two options is minimal as both options plan for significant levels of intensification. • Based on the above and in comparisons to Growth Option 2, Growth Option 1 has moderate potential to promote healthy, local and affordable food options, including urban agriculture.	
Overall Result	Growth Option 1 addresses a few aspects of this theme: 	Growth Option 2 addresses most aspects of this theme: 
Summary	Growth Option 2 best addresses the considerations under 'Agriculture System' as growth is concentrated within the existing urban area and no agricultural lands within the City would be developed under this option.	

Cultural Heritage

Cultural heritage resources and archaeological resources that have been determined to have cultural heritage value or interest are to be conserved in order to foster a sense of place and benefit communities.

CULTURAL HERITAGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION

Does the growth option have the potential to impact cultural heritage resources including designated heritage properties, and can they be conserved?	Growth Option 1 addresses most aspects of this consideration:
	• Within the Candidate Expansion Areas:
	  ○ There are no known cultural heritage landscapes, individually designated properties, or Ontario Heritage Trust Easements (Part IV) within the Candidate Expansion Areas.
	  ○ There are 48 heritage properties included on the City's Inventory of Buildings of Architectural and/or Historical Interest (3 registered, and 45 inventoried which have yet to be evaluated for protection or recognition under the Ontario Heritage Act).
	  ○ Any future development will be required to consider the potential for cultural heritage resources within the Candidate Expansion Areas.
	• Within the existing urban area, both of the Growth Options will result in significantly higher levels of intensification than the City has historically experienced, which may result in pressures to redevelop on or adjacent to heritage properties and within cultural heritage landscapes. Opportunities for adaptive reuse of heritage buildings and appropriate redevelopment on or adjacent to heritage properties and within heritage landscapes will need to be considered.
	  ○ For growth anticipated for nodes and corridors in the existing urban area,
		Growth Option 2 addresses most aspects of this consideration:
		• Within the existing urban area, both of the Growth Options will result in significantly higher levels of intensification than the City has historically experienced, which may result in pressures to redevelop on or adjacent to heritage properties and within cultural heritage landscapes. Opportunities for adaptive reuse of heritage buildings and appropriate redevelopment on or adjacent to heritage properties and within heritage landscapes will need to be considered.
		  ○ For growth anticipated for nodes and corridors in the existing urban area, there are 2,859 heritage properties included on the City's Inventory of Buildings of Architectural and/or Historical Interest (231 designated, 965 registered, and 1,663 inventoried which have yet to be evaluated for protection or recognition under the Ontario Heritage Act) and 296 ha of cultural heritage landscapes that overlap with the nodes and corridors.
		• The pressures noted above are anticipated to be greater under Option 2 which includes 28,000 additional units being developed within the existing urban area, with focus on the City's nodes and corridors.

CULTURAL HERITAGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	there are 2,859 heritage properties included on the City's Inventory of Buildings of Architectural and/or Historical Interest (231 designated, 965 registered, and 1,663 inventoried which have yet to be evaluated for protection or recognition under the Ontario Heritage Act) and 296 ha of cultural heritage landscapes that overlap with the nodes and corridors.	

Does the growth option have the potential to impact significant archaeological resources?	Growth Option 1 addresses most aspects of this consideration:
	• Within the Candidate Expansion Areas:
	  ○ There is overall archaeological potential adjacent to or within the majority of the Candidate Expansion Area.
	  ○ Any future development will be required to complete an Archaeological Assessment to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries.
	• Within the existing urban area, both of the Growth Options have the potential to impact areas of archaeological potential. Similar to above, any future development within these areas will be required to complete an Archaeological Assessment to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries.
	• Any future development within may also require municipal engagement with Indigenous communities to consider their interests when identifying, protecting and managing cultural
		Growth Option 2 addresses most aspects of this consideration:
		• Within the existing urban area, both of the Growth Options have the potential to impact areas of archaeological potential. Similar to above, any future development within these areas will be required to complete an Archaeological Assessment to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries.
		• Any future development within may also require municipal engagement with Indigenous communities to consider their interests when identifying, protecting and managing cultural heritage and archaeological resources in accordance with Archaeology Management Plan and the Indigenous Archaeological Monitoring Policy.

CULTURAL HERITAGE CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	heritage and archaeological resources in accordance with Archaeology Management Plan and the Indigenous Archaeological Monitoring Policy.	
Overall Result	Growth Option 1 addresses most aspects of this theme: 	Growth Option 2 addresses most aspects of this theme: 
Summary	Growth Options 1 and 2 both address most aspects of the consideration of 'Cultural Heritage' as both options have the potential to impact cultural heritage resources and both have the potential to impact significant archaeological resources.	

Conformity with Provincial Methodology

In planning for growth, municipalities are required to follow provincial policies and methodologies as outlined in policy documents such as the Growth Plan. The Growth Plan requires that municipalities follow the Provincial Land Needs Assessment Methodology which includes a market-based demand for housing.

CONFORMITY WITH PROVINCIAL METHODOLOGY CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Has the growth option been assessed in accordance with the Provincial Land Needs Assessment Methodology to determine the quantity of land required to accommodate growth to the planning horizon?	Growth Option 1 addresses all aspects of this consideration: • The objective of the Provincial LNA methodology is to ensure that sufficient land is available to accommodate market demand for all housing types including single/semi-detached, row houses and apartment units. • Growth Option 1 is guided by Growth Plan directions to optimize the use of the existing urban land supply to avoid over-designating lands for future urban development. • Growth Option 1 embodies strong growth management principles including a transitional intensification target that increases over the planning horizon, higher densities in new greenfield areas, and optimistic expectations for employment. • A much more intense and compact urban form is generally envisioned compared to historic trends of housing growth and development in the community, in accordance with broad Provincial planning policy directions. • Given the level of policy intervention involved, Growth Option 1 requires careful monitoring and reporting on progress to ensure a balanced supply of housing types	Growth Option 2 does not address this consideration: • Nearly 80% of all new households to 2051 would need to be accommodated in apartment units under Growth Option 2, including those for families. • Achieving this rate of apartment unit construction is unlikely from a market or demographic perspective. As a result, Growth Option 2 is likely to bring about a shortage of ground-related housing units in Hamilton to accommodate market demand, which conflicts with the objective of the Provincial LNA methodology. • Speculation at the urban fringe could lead to poorly-planned, incremental expansions into rural areas which does not reflect comprehensive planning. • Over time, rather than 'shifting' into apartments, the ground-related housing market would likely seek (and find) other locations outside of Hamilton that may be less suited to accommodate growth. ○ Such a redirection of growth would cause a regional misalignment of the Schedule 3 forecasts, which is not in accordance with the Growth Plan. It would also have the effect of planning for a lower growth forecast in Hamilton, which is prohibited.

CONFORMITY WITH PROVINCIAL METHODOLOGY CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
	to 2051, in accordance with the requirements of the Provincial LNA methodology.	There could also be negative regional impacts on Prime Agricultural Areas in Outer Ring communities with lower intensification and density targets that are likely to receive the added growth pressure.
Overall Result	Growth Option 1 addresses all aspects of this theme: 	Growth Option 2 does not address this theme: 
Summary	Growth Option 1 more adequately addresses the theme of 'Conformity with Provincial Methodology' as defined by the considerations since this option is consistent with the land needs assessment methodology and implements Growth Plan policy directions.	

PART 5: GROWTH OPTION EVALUATION SUMMARY

The analysis presented in Part 4 demonstrates that there are a wide range of implications associated with the two different Growth Options (see **Table 3** for a summary). In reviewing the results it's worth noting that there are several areas where the differences between the Growth Options are not obvious. For example, both Growth Options exceed the Province's minimum intensification and density targets; both Options also minimize risks associated with natural hazards, recognizing that the City's Official Plan directs development away from hazardous lands.

In other areas of the analysis, there are clear differences in how the two growth options satisfy the key considerations. However, the noted differences do not necessarily result in a significant overall difference when comparing the two Options. For example, from a cultural heritage perspective, Growth Option 1 is likely to have impacts on cultural heritage resources located in the preferred expansion area where an urban boundary expansion takes place; however, the higher intensification rates under Growth Option 2 potentially will make it more difficult to maximize the protection and conservation of all heritage resources within the Built-Up Area. Similarly, when it comes to infrastructure planning, there are clear differences between the two Growth Options. Option 1 requires more linear infrastructure to service the new urban lands and also comes with additional risks to managing stormwater quality compared to Growth Option 2. However, the technical complexity associated with higher levels of intensification in the Built-Up Area means there is greater uncertainty around infrastructure costs and available capacity.

In a number of other areas, there are very clear differences between the Growth Options. Growth Option 2 better achieves the objectives related to natural environment, agriculture, transportation and climate change. Growth Option 1 better achieves the municipal finance and complete community objectives. The fundamental difference between the two Growth Options is that Growth Option 2 does not conform to the Province's Land Needs Methodology and is unlikely to produce an outcome where the City is able to achieve its growth forecast allocated under the Growth Plan. Conformity with the Province's Growth Plan policies is a fundamental aspect of the Municipal Comprehensive Review process. Given the above, it would not be appropriate to carry Growth Option 2 forward and it is recommended that the City proceed with Growth Option 1 as the basis for long range planning.

Table 3: Growth Option Evaluation Results Overview

THEME	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Growth Allocation		
Climate Change		
Natural Hazards		
Municipal Finance		
Infrastructure & Public Service Facilities		
Transportation Systems		
Natural Heritage And Water Resources		
Complete Communities		
Agricultural System		
Cultural Heritage		
Conformity With Provincial Methodology		

Appendix A:

GHG Emissions Report

City of Hamilton

Impact of GRIDS 2 Scenarios on GHG Emissions

Briefing V.1

October 26, 2021

Disclaimer

The information in this analysis has been compiled to offer an assessment of the GHG emissions for the City of Hamilton. Reasonable skill, care and diligence have been exercised to assess the information acquired during the preparation of this analysis, but no guarantees or warranties are made regarding the accuracy or completeness of this information. This

document, the information it contains and the information and basis on which it relies, are subject to changes that are beyond the control of the author. The information provided by others is believed to be accurate but has not been verified.

Context

This analysis is being undertaken as part of the City of Hamilton's GRIDS 2 / MCR growth management planning exercise to inform the choice of 'How Should Hamilton Grow?' to the year 2051. GRIDS 2 / MCR is examining how the City can accommodate forecasted population and employment growth in the period from 2021 to 2051. The 'How Should Hamilton Grow?' evaluation will evaluate two growth options – the Ambitious Density (AD) scenario which includes an urban boundary expansion of approximately 1,310 ha, while accommodating the majority of the growth in the existing urban boundary; and the No Urban Expansion (NUE) scenario which focuses all of the forecasted growth within the existing urban boundary.

On March 27th, 2019, Hamilton City Council passed a motion stating that the City of Hamilton declared a climate emergency.

As part of this motion, City Council directed Staff to investigate and identify a path for the entire city to achieve net-zero carbon emissions by 2050, including a process for measuring and reporting on progress towards that goal.

Hamilton's Community Energy and Emissions Plan (CEEP) is a major component of the City of Hamilton's strategy for responding to the climate emergency. With the input of local industry, academia, utilities, and local non-profits, this plan aims for Hamilton to achieve net-zero carbon emissions, citywide, by 2050 and become a prosperous, equitable, post-carbon city.

The technical analysis underlying the CEEP evaluated two scenarios to achieve Hamilton's GHG emissions reductions. A Business-As-Planned (BAP) scenario reflects current trends, while a net zero scenario evaluates actions to target net zero emissions by 2050.

In a BAP scenario, Hamilton's 2050 GHG emissions will be far from its net-zero GHG emissions target. In this scenario, by 2050, each Hamiltonian will represent the equivalent of 11.2 tonnes of GHG emissions. As a whole, the City will emit 9.6 Mt CO2e, up from 8.7 Mt CO2e in 2016. The CEEP also plots a pathway to net zero emissions by 2050. In the Net Zero scenario, the city implements ambitious actions in buildings, transportation, energy systems and industry to achieve deep emissions reductions. Each of these actions requires the mobilization of major investments and complex governance and implementation mechanisms.

Land-use policy is an important GHG emissions reduction strategy as it can avoid locking in infrastructure systems and activities that are costly to retrofit or to provide without generating GHG emissions. Conversely, land-use policy can enable cost effective emissions reductions. For example, it is more affordable to provide zero emissions transportation and zero emissions energy to a compact, complete community than to a distributed population. Electric buses can provide a service to more people with shorter routes and lower energy consumption. When destinations are in close proximity, people can walk or cycle. Houses tend to be smaller and share walls, which reduces energy consumption. District energy is more viable when heat loads are concentrated. Land-use policy is also the most cost-effective action a City can take, as it can enable GHG emissions reductions without requiring a direct investment by the City or society.

This analysis considers how the two different land-use scenarios impact patterns of energy consumption and GHG emissions, assuming current technologies and behaviours, by evaluating the impact of the land-use scenarios against the BAP scenario.

Methodology

Modelling Approach

Two land-use scenarios were evaluated for the City of Hamilton in the CityInSight model- Ambitious Density (AD) and No Urban Expansion (NUE). CityInSight is designed to project how the energy flow picture and emissions profile will change in the long term by modelling potential change in the context (e.g. population, development patterns), projecting energy services demand intensities, and projecting the composition of energy system infrastructure, often with stocks. Stock-turnover models enable users to directly address questions about the penetration rates of new technologies over time constrained by assumptions such as new stock, market shares and stock retirements. Examples of outputs of the projections include energy mix, mode split, Vehicle Kilometres Travelled (VKT), energy costs, household energy costs, GHG emissions and others.

The modelling evaluates scenarios that were developed for the City of Hamilton's GRIDS 2 / MCR growth management planning exercise. Both the scenarios evaluated in this analysis are built on the City's Business as Planned (BAP) Scenario used in the Community Energy and Emissions Plan.[1]

In evaluating the scenarios, the following assumptions were applied:

Input data:

- Population, employment, and dwelling unit projections by zone were provided by the City.
- Data on technologies, energy and emissions was derived from the BAP scenario developed for the Community Energy and Emissions Plan.

Assumptions:

- Zonal employment growth is reflective of existing industrial/commercial activity currently taking place within the zone, as attributable to existing floor space attributable to an employment sector within Municipal Property Assessment Corporation (MPAC) data. For example, if employment in a zone is 50% industrial and 50% commercial, new employment will also receive the same share distribution.
- Zones within a modelled "superzone" were aggregated to reflect overall impact at a coarse level due to difference in zone systems used in GRIDS 2 work and the zonal system used in previous CityInSight modelling.
- Transportation modal shares for each zone were held constant across the time period. No additional transit interventions were modelled.
- Actions and assumptions in the BAP scenario are held constant for both of the scenarios.

[1] Additional details on the BAP scenario can be found in this document: https://www.hamilton.ca/sites/default/files/media/browser/2020-12-11/hamilton-baseline-bap-report-dec1-2020.pdf

Method:

- Population, employment, dwelling unit, and non-residential floor space projections, as derived or inferred from the input data, were projected in the CityInSight framework at the zonal level.
- All BAP scenario assumptions and actions were modelled within the timeline to evaluate activity, energy, and emissions impacts of the integrated scenario.

Note that because of the modelling approach and data available, the GHG impact from transportation is likely understated; the City's transportation model found vehicle kilometre travelled (VKT) reductions four times higher than those identified in this analysis. The reduction in vehicular travel will increase the GHG emissions reductions resulting from the NUE scenario over the AD scenario. A future update is planned to address these differences.

GHG Emissions

GHG emissions are lower in the NUE scenario in relation to the AD scenario (Figure 1), but the difference is subtle, illustrated by the closeness of the two curves. Part of the reason that the difference is subtle is because Hamilton's GHG emissions are dominated by industrial emissions (63%) which are not impacted by land-use policy (Figure 2). Transportation emissions account for 19% of the total, while emissions from residential buildings account for 7.6% of the emissions. In order to better illustrate the difference between the two scenarios, the same lines are illustrated against a non-zero y-axis in Figure 3. There is a cumulative reduction of 1 MtCO2e between 2022 and 2050 (Figure 4), which, for scale, is equivalent to 11% of the total annual GHG emissions in 2016.

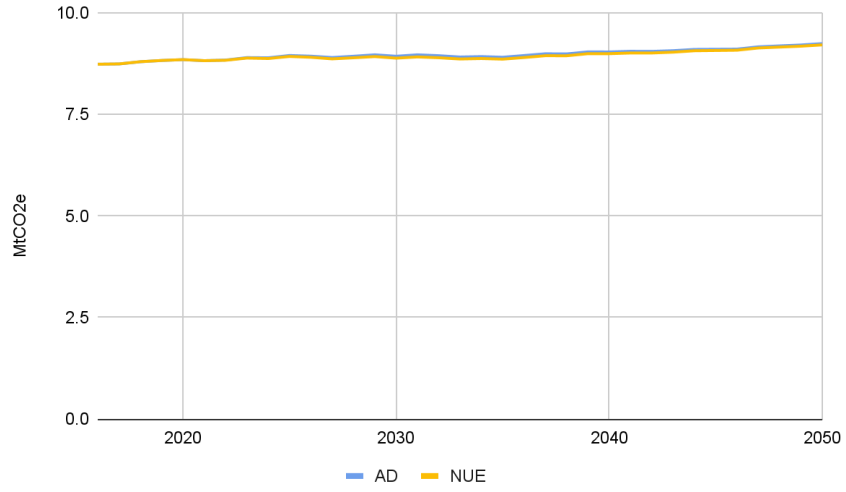


Figure 1: Annual GHG emissions of the AD and NUE scenarios

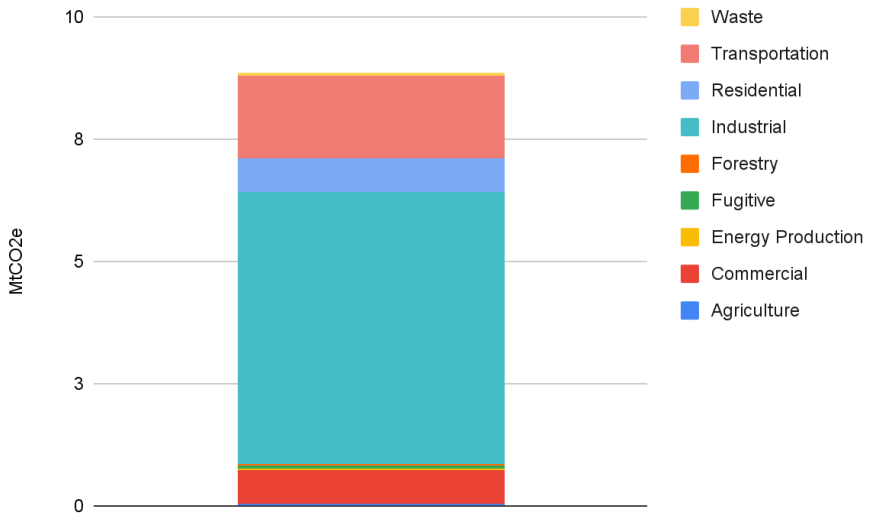


Figure 2: GHG emissions in the City of Hamilton by sector, 2020

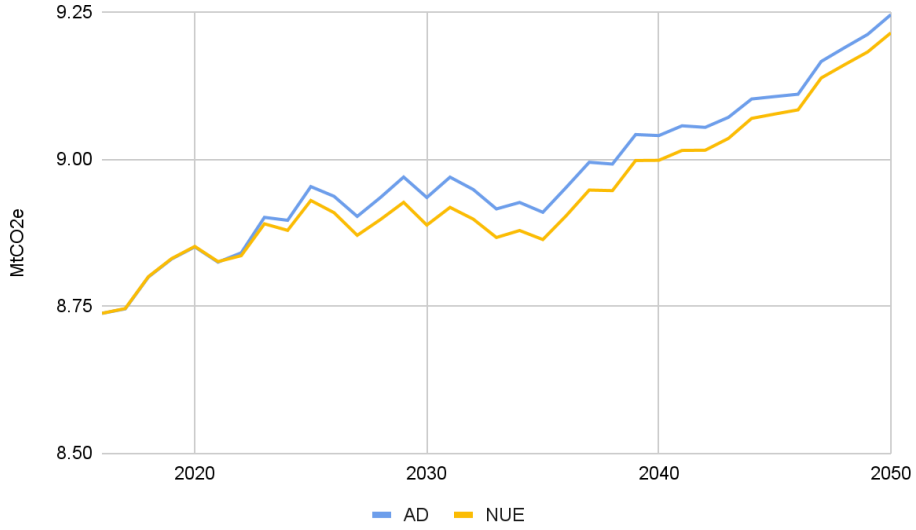


Figure 3: Annual GHG emissions of the AD and NUE scenarios, adjusted y-axis

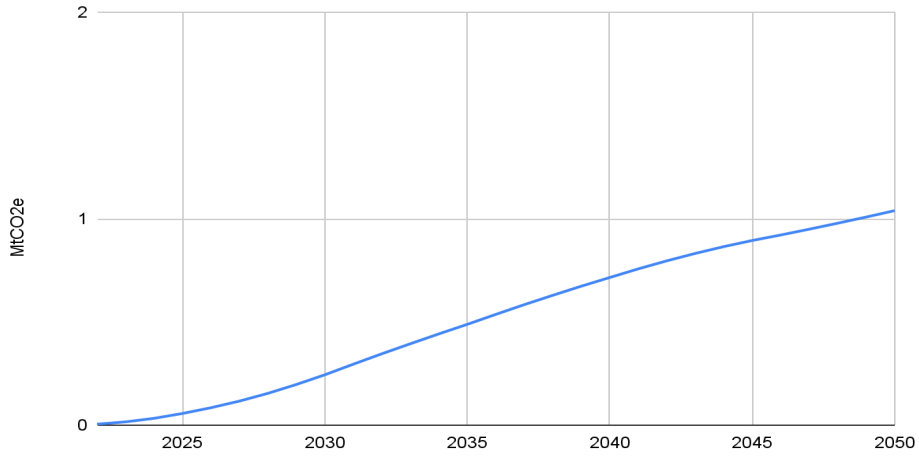


Figure 4: Cumulative emissions reductions of the NUE scenario relative to the AD scenario

While the reduction appears small in the context of the City's total emissions, every tonne of GHG emissions reductions counts in a climate emergency, as each tonne imposes a social and economic cost on society. Further, the incremental cost of achieving these emissions reductions is negligible, since this is a planning decision that doesn't require a direct investment by the municipalities, businesses or households. While there are major economic implications of the scenarios in terms of infrastructure, land costs and other considerations, these are outside of the scope of an analysis of GHG impacts.

Table 1: Summary of GHG Emissions Results

Scenario	Cumulative GHG Emissions (MtCO2e) (2022-2050)	Annual Emissions in 2030 (MtCO2e)	Annual Emissions in 2050 (MtCO2e)
AD	261.3	8.93	9.24
NUE	260.2	8.89	9.21
Reduction over AD	1.0	0.05 (50,000 tCO2e)	0.03 (30,000 tCO2e)
Reduction over AD (%)	0.40%	0.53%	0.33%

To illustrate the drivers of GHG emissions, the differences are illustrated by sector, where negative numbers represent savings in the NUE scenario over the AD scenario. Residential emissions are reduced due to an increased share of more energy efficient apartments in the NUE scenario relative to a greater share of single family homes in the AD scenario. Transportation emissions are reduced as a result of shorter trips. Emissions from sequestration in agriculture, forests and land-use are also decreased due to reduced expansion of the City into greenfield locations.

Assuming the City adopts the CEEP, measures which decarbonise the energy system will reduce the GHG emissions differential between the scenarios, as vehicular travel becomes powered by clean electricity for example. Nevertheless, more energy efficient dwelling types and reduced driving in

turn reduce the burden of decarbonising the electrical grid and reduce the need for additional renewable energy generation.

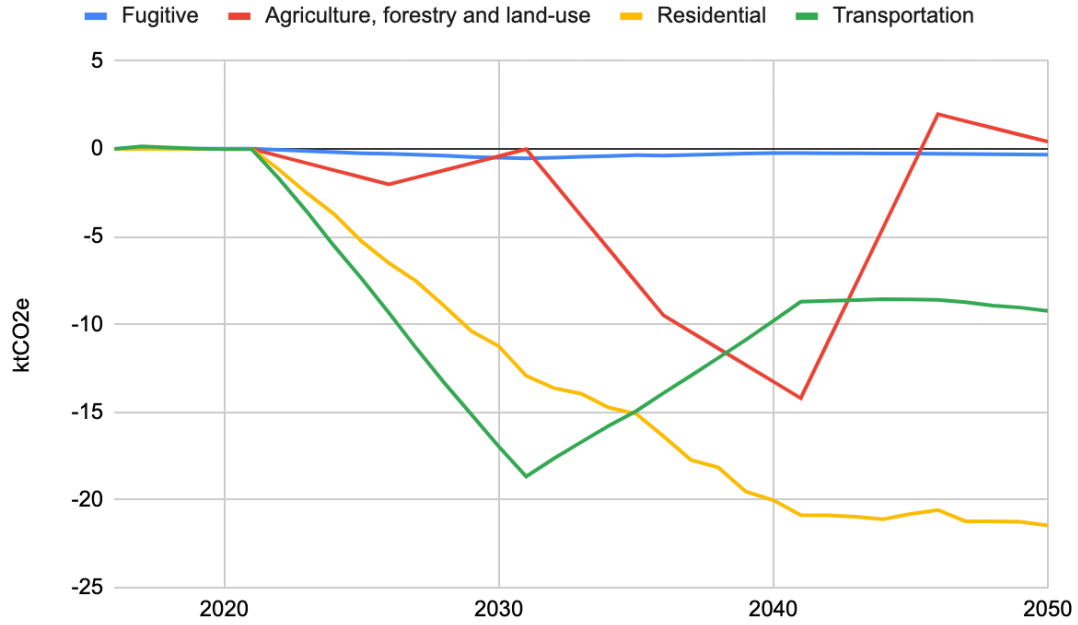


Figure 5: Change in GHG emissions by sector of NUE scenario relative to the AD scenario, (negative emissions equal emissions reductions.

The carbon price places a value on GHG emissions, climbing from $50 per tonne in 2021 to $170 per tonne by 2030. Applying this value to the reduced GHG emissions in the NUE scenario generates an avoided cost of $166 million (undiscounted), or an average of $6 million per year.

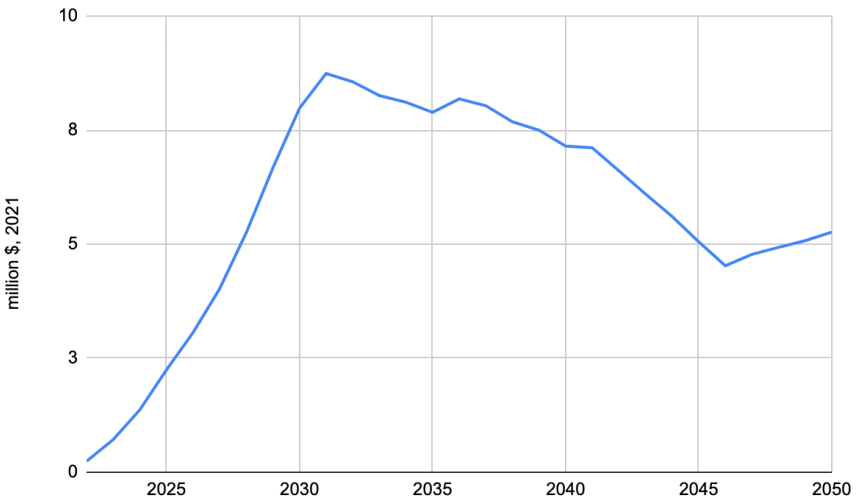


Figure 6: Avoided carbon price expenditure, NUE scenario over the AD scenario, 2022-2050

Table 2: Avoided carbon price expenditures, NUE scenario over the AD scenario

Scenario	Cumulative, 2022-2050 (not discounted, millions, 2021$)	Annual, 2040 (not discounted, millions, 2021$)	Annual, 2050 (not discounted, millions, 2021$)
Reduction over AD	$166	$7	$5.3

Transportation Impacts

In 2020, Hamiltonians drove approximately 4.8 billion kilometres, and by 2040, this climbs to 6.98 billion kilometres. The NUE scenario decreases this total by 100 million or 1.5 percent in 2050 (Figure 7).[2] This reduction results in reduced household travel costs and reduces the burden on the electricity system when the vehicle fleet is electrified.

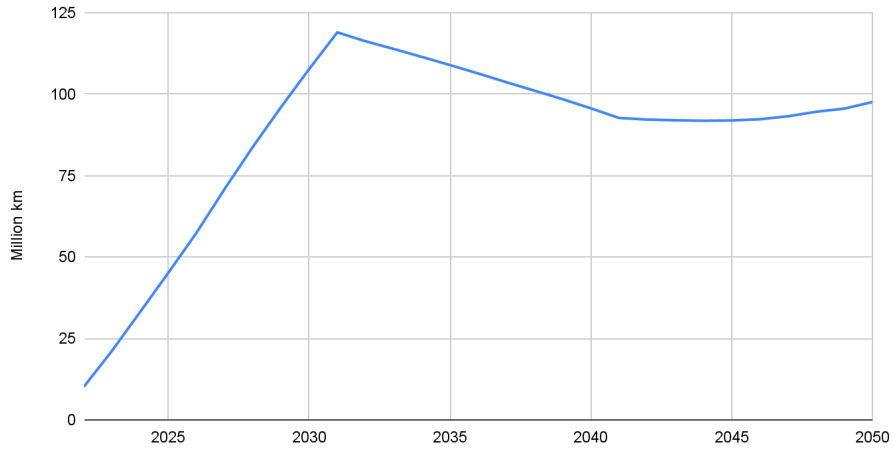


Figure 7: Annual reduction in VKT in the NUE scenario over the AD scenario, 2022-2050

As might be expected there is increased active transportation in the NUE scenario in comparison with the AD scenario. Figure 8 illustrates that there are nearly 2 million kilometres more of walking trips of 2 km length in the NUE scenario, an increase of 30%.

[2] Note that the City's Transportation model identified savings of 400 million kilometres in 2050, or four times the reduction that was identified in this analysis. As a result, this analysis likely understates the GHG reduction from transportation. Additional analysis of the discrepancy in VKTs between the models is being undertaken, and if necessary, an addendum report will be provided which identifies the GHG reduction resulting from the increased GHG savings.

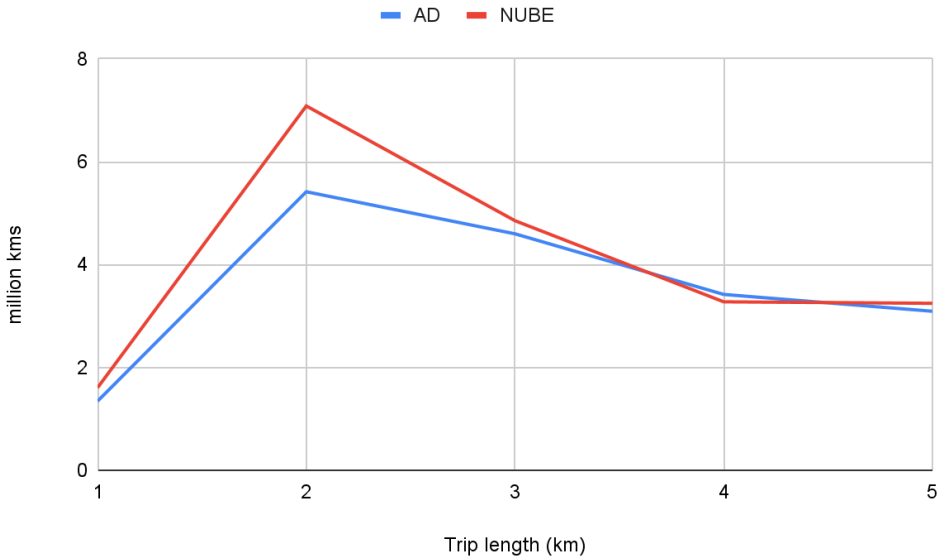


Figure 8: Walking kilometers by trip length, 2050

Energy Impacts

The NUE scenario results in energy savings which climb to nearly 700,000 GJ per year by 2030 (0.7% of total energy consumption in that year). Much of these savings occur in the industrial sector, but Figure 9 illustrates the savings that occur in the residential and transportation sectors, directly benefiting households. The differential in energy consumption in the commercial sector is due to differences in employment rates of growth in the two scenarios as a result of the data sources; by 2050, commercial and industrial floor space are equal in both scenarios. Energy savings result in financial savings. Natural gas costs are approximately $16 per GJ, electricity costs $60 per GJ and gasoline costs $38 per GJ. For illustrative purposes, assuming no increase in gasoline costs, avoided transportation costs total nearly $10 million per year by 2030.

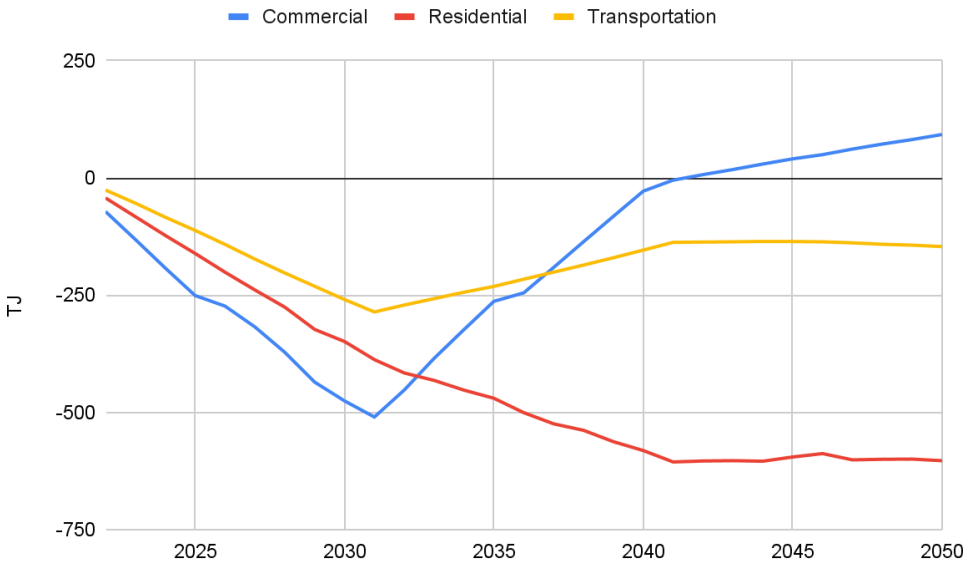


Figure 9: Energy savings by sector, NUE scenario over AD scenario (negative equals energy savings, 1 TJ equals 1,000 GJ), 2022-2050.

Conclusion

As is intuitive, there are GHG emissions reductions that result from concentrating new growth in the urban area; these reductions are primarily the result of reduced vehicular travel and more compact residential buildings. The impact of this change is muted by the interia of the City's existing building stock, travel activity, and industry, the latter of which accounts for 60% of the City's emissions. While the GHG emissions reductions are relatively small, every tonne counts in the context of a net zero target, and in a climate emergency. These reductions are valuable because they are generated without an incremental investment and may enable additional future GHG reductions as measures such as district energy and new forms of public transit can be introduced.

Appendix B: Municipal Finance Reports

GRIDS 2: Ambitious Density vs. No Urban Boundary Expansion – Fiscal Considerations

City of Hamilton

Technical Memo

Table of Contents

1. Introduction and Purpose

The City of Hamilton is currently undertaking a Growth Related Integrated Development Strategy (GRIDS) 2 to allocate forecasted population and employment growth to the year 2051, in accordance with the Provincial Growth Plan. The City is projected to grow by an additional 236,000 people and 132,000 employees. Watson & Associates Economists Ltd. (Watson) was retained to undertake the fiscal analysis of the various growth options to assist the City in identifying a preferred growth scenario to 2051.

Through the GRIDS 2 process, the City is considering "How Should Hamilton Grow?" to compare and evaluate different growth options. The City is evaluating two alternatives through this process. The first option is an "Ambitious Density" scenario which requires an expansion to the existing urban boundary to provide for an additional 1,330 hectares of greenfield area. The other option is a "No Urban Boundary Expansion" scenario where all future growth would be accommodated within existing urban boundaries, largely through infill and intensification.

Council has asked for an evaluation of the Ambitious Density scenario versus the No Urban Boundary Expansion (No U.B.E.) to determine whether an expansion to the urban boundary should be supported. The overall objective of this memo is to provide a high-level analysis on the fiscal considerations between the two options. The commentary provided herein will assist Council in answering the following question: "Are there any significant municipal financial risks associated with the growth options?".

The following sections will provide an analysis on the City services which are expected to be impacted depending on which growth option is supported. The information provided below has not been fully modeled by the individual service departments/consultants and hence provides a more qualitative versus quantitative analysis.

2. Summary of Growth Options

The City's Planning department worked with their consultants to consider the following two development options:

- The Ambitious Density scenario provides for 64% of the noted population growth to be accommodated within the existing urban boundary and 36% to be

accommodated in additional Whitebelt lands (Elfrida, Glanbrook, Mount Hope, etc.). Similarly, for employment, 86% of growth is anticipated within the existing urban boundary versus 14% in Whitebelt and rural lands.

- The No U.B.E. scenario provides for 100% of the population to be accommodated within the existing urban area, however, 1% of the employment growth will be accommodated in rural lands.

The following tables provide for the anticipated population and employment growth in the two scenarios noted above, broken out by area:

Figure 1
Comparison of Population Growth

Area	Existing Population 2021	2051 Population		Net Population Growth		
		Ambitious Density	No U.B.E.	Ambitious Density	No U.B.E.	Comparison
Combined Sewer	215,027	274,905	334,077	59,878	119,050	(59,172)
Separate Sewer System - Other Built Boundary	277,565	313,668	336,695	36,102	59,130	(23,027)
Separate Sewer System - Greenfield	47,946	104,812	107,043	56,867	59,098	(2,231)
Elfrida	2,857	80,450	2,898	77,593	41	77,552
Whitebelt (Excluding Elfrida)	1,424	8,603	1,484	7,179	60	7,119
Rural	39,145	37,933	38,434	(1,211)	(711)	(500)
City of Hamilton	**583,963**	**820,371**	**820,631**	**236,408**	**236,668**	**(260)**

Figure 2
Comparison of Employment Growth

Net Employment Growth (2021 to 2051) - Ambitious Density Scenario							
Area	**Primary**	**Industrial**	**Commercial**	**Institutional**	**Work at Home**	**N.F.P.O.W.**	**Total**
Combined Sewer	-	495	45,626	6,029	1,091	1,244	54,485
Separate Sewer System - Other Built Boundary	-	16,647	3,373	5,000	796	5,918	31,734
Separate Sewer System - Greenfield	-	9,975	4,416	6,508	1,515	4,583	26,997
Elfrida	-	-	4,113	6,033	1,783	1,782	13,711
Whitebelt	-	-	945	1,384	409	408	3,146
Rural	-	655	434	188	246	200	1,723
City of Hamilton	**-**	**27,772**	**58,907**	**25,142**	**5,840**	**14,135**	**131,796**
Net Employment Growth (2021 to 2051) - No U.B.E. Scenario							
Area	**Primary**	**Industrial**	**Commercial**	**Institutional**	**Work at Home**	**N.F.P.O.W.**	**Total**
Combined Sewer	-	495	53,167	8,827	1,561	2,274	66,324
Separate Sewer System - Other Built Boundary	-	16,647	2,375	9,998	2,454	6,217	37,691
Separate Sewer System - Greenfield	-	9,975	3,544	5,548	1,579	5,427	26,073
Elfrida	-	-	-	-	-	-	-
Whitebelt	-	-	-	-	-	-	-
Rural	-	655	303	188	246	200	1,592
City of Hamilton	**-**	**27,772**	**59,389**	**24,561**	**5,840**	**14,118**	**131,680**
Comparison							
Area	**Primary**	**Industrial**	**Commercial**	**Institutional**	**Work at Home**	**N.F.P.O.W.**	**Total**
Combined Sewer	-	-	(7,541)	(2,798)	(470)	(1,030)	(11,839)
Separate Sewer System - Other Built Boundary	-	-	998	(4,998)	(1,658)	(299)	(5,957)
Separate Sewer System - Greenfield	-	-	872	960	(64)	(844)	924
Elfrida	-	-	4,113	6,033	1,783	1,782	13,711
Whitebelt	-	-	945	1,384	409	408	3,146
Rural	-	-	131	-	-	-	131
City of Hamilton	**-**	**-**	**(482)**	**581**	**-**	**17**	**116**

As noted above, both the Ambitious Density and No Urban Boundary Expansion have the same population and employment targets to the year 2051, however the location of

this growth will be different for the various areas of the City. These areas are described as follows:

- Combined Sewer Area: the combined sewer system area is defined by a joint sanitary and stormwater sewer network and is largely found in the older areas of Hamilton (e.g., Lower Hamilton, Downtown areas, Hamilton Mountain north of Fennel).
- Separate Sewer System (Other Built Boundary): areas within the City where the stormwater and sanitary sewers are separated. This includes areas such as Ancaster, Binbrook, Waterdown, parts of Stoney Creek, Upper Mountain south of Fennel.
- Separate Sewer System (Greenfield): These are existing greenfield areas within the City's current urban boundary (e.g. Binbrook, Waterdown, Upper Stoney Creek, etc.)
- Elfrida: lands located to the east and south of the intersection of Upper Centennial Parkway and Rymal Road. This area is bounded by Mud Street East to the north, Second Road East to the east, Golf Club Road to the south and Trinity Church Road to the west. This area is currently outside of the existing urban boundary.
- Whitebelt (Excluding Elfrida): primarily Glanbrook, Mount Hope and parts of Ancaster. Similar to Elfrida, these areas are outside of the existing urban boundary.
- Rural: areas outside the existing urban boundary. No significant growth is planned for these areas under either scenario.

The following section summarizes and compares the population, housing, and employment growth anticipated within these areas for the two growth scenarios.

<u>Population:</u>

- Relative to the Ambitious Density scenario, significantly higher growth is planned in the Combined Sewer System under the No U.B.E. growth option. As this area is predominantly built out, this growth will occur through significant intensification.
- Higher growth is also anticipated within the Other Built Boundary area of the Separate Sewer System under the No U.B.E. scenario, which would also need to be accomplished through intensification. Similar amounts of growth are anticipated in the existing greenfield areas of the City under both scenarios.

- Should the No U.B.E. scenario be the preferred growth option, approximately 85,000 in population would be removed from the Elfrida and Whitebelt areas and relocated to intensification areas.
- It is noted that significant intensification growth is anticipated under both scenarios, however, the degree of intensification growth is higher under No U.B.E. An additional 85,000 people will need to be accommodated within existing urban areas, relative to the Ambitious Density scenario.

Housing:

The table below compares the housing growth provided by the two growth scenarios relative to the present supply of housing within the City:

Figure 3
Housing Mix Comparison

Housing Mix	Low Density	Medium Density	High Density	Total
Existing Housing Units (2021)	136,305	29,694	71,418	237,408
% of total	*57%*	*13%*	*30%*	
Incremental Growth in Housing Units By Scenario (2051):				
Ambitious Density	26,867	23,298	64,925	115,158
% of total	*23%*	*20%*	*56%*	
No U.B.E.	8,579	14,763	89,889	113,240
% of total	*8%*	*13%*	*79%*	

The existing housing mix within the City is largely low density. The growth under both scenarios shows a shift towards high density development, however this is more pronounced under the No U.B.E. scenario. The growth under the Ambitious Density scenario provides for 56% of total units as high density and under No U.B.E., 79% of the additional units are anticipated to be high density.

Employment:

- The amount of growth and overall mix in employment over the forecast period is projected to be similar under both scenarios, with slight variations.
- Under the Ambitious Density scenario, an additional 600 employees are expected in the institutional sector, while 500 fewer commercial employees are anticipated.

- The growth in industrial employment in terms of location as well as the number of employees is expected to be the same under both scenarios (i.e., no industrial employment growth has been planned in the Elfrida and Whitebelt areas).
- Similar to the changes in population, the No U.B.E. scenario moves the employment growth from Elfrida and other Whitebelt areas into the combined sewer system and other built boundary areas.

3. Service Level Analysis

3.1 Water, Wastewater & Stormwater

GM BluePlan and Wood undertook an analysis to address whether there was potential for significant infrastructure impacts within the City as a result of the Ambitious Density and No U.B.E. growth options. The tables below are found in the "Technical Memo – Ambitious Density vs. No Urban Boundary Expansion Analysis of Water, Wastewater, and Stormwater Servicing Needs", prepared by GM BluePlan and Wood. As this was a qualitative assessment of the two growth scenarios, costing estimates were not developed and as such, a high-level discussion on the financial implications is provided in the sections that follow.

3.1.1 Water

Figure 4
Analysis Summary for Water Services (Excerpt)

System Component	Ambitious Density	No U.B.E.
Water		
Transmission	Transmission likely required under the Ambitious Density Scenario in order to provide water to certain Pressure Districts (P.D.) in the Greenfield areas such as P.D.6, P.D.7 and P.D.18 to support growth.	The No U.B.E. scenario does not have any Greenfield growth in new areas of the system so it is less likely that any significant transmission upgrades/infrastructure will be required. However, there is going to be increased intensification in already built-up and congested parts of the City. Transmission/sub-transmission upgrades related to intensification are difficult to predict without detailed hydraulic modelling.

System Component	Ambitious Density	No U.B.E.
Storage	Both scenarios considered have similar storage needs except in P.D.7 and P.D.23. The Ambitious Density Scenario is expected to need more storage upgrades to 2051 than the No U.B.E. scenario because P.D.7 and P.D.23 require further storage despite the planned P.D.7 Elevated Tank. Added storage would likely be in-ground pumped storage.	Both scenarios considered have similar storage needs except in P.D.7 and P.D.23. The No U.B.E. Scenario will likely need less storage upgrades to 2051 than the Ambitious Density Scenario because the planned P.D.7 would be sufficient to handle the P.D.7 and P.D.23 capacity needs in this scenario.
Pumping	Overall, the pump capacity upgrades needed are similar across both scenarios, except for P.D.2, P.D.5 and P.D.7. This scenario requires a smaller pumping station upgrade in P.D.2 than the No U.B.E. scenario. However, P.D.5 and P.D.7 have larger growth in this scenario and will require larger upgrades than the No U.B.E. scenario.	Overall, the pump capacity upgrades needed are similar across both scenarios, except for P.D.2, P.D.5 and P.D.7. This scenario requires a larger pumping station upgrade in P.D.2 than the No U.B.E. scenario (which could justify a second pumping station). Conversely, P.D.5 and P.D.7 have less growth in this scenario and will require smaller upgrades.
Treatment	Treatment requirements are equivalent. No differentiator in scenarios.	Treatment requirements are equivalent. No differentiator in scenarios.

Financial Implications

In order to discuss the financial implications of the required infrastructure, the following descriptions of development charges and benefit to existing allocations are provided for reference:

- Development Charges (D.C.s) are fees collected from developers to help pay for the cost of infrastructure that is required for growth. Although D.C.s are the main financing source for growth-related infrastructure, certain deductions must be applied which may not provide for the full cost of growth to be borne by developers.
- Section 5 (1) 6 of the Development Charges Act (D.C.A.) provides that, "The increase in the need for service must be reduced by the extent to which an increase in service to meet the increased need would benefit existing development". As such, a reduction in the capital costs required for growth would need to be reduced by the extent to which such an increase in service would benefit existing development. This benefit to existing reduction would need to be funded through property taxes/rates.
- Requirement to replace and upgrade existing transmission infrastructure will have the following financial impacts:
    - Upgrading and expanding existing infrastructure may require a sizable benefit to existing allocation as compared to new infrastructure provided in greenfield areas (undeveloped land). Although significant intensification is planned under both scenarios, No U.B.E. will most likely require more upgrades and hence may have more significant impacts. Therefore, the No U.B.E. scenario will likely provide for a higher cost to be borne by existing water users (Note: the scale of the upgrades and the overall difference in the magnitude of the works between the two scenarios is not fully known at this time).
    - Replacement of existing linear water infrastructure normally costs 250-300% more versus the cost of putting new linear services in a greenfield area. This higher cost is largely a result of replacing infrastructure within existing areas and the road reinstatement costs that would be incurred as a result. Hence, potentially increasing the cost to the existing water users under the No U.B.E. scenario.

    - With replacements and upgrade, the timing of replacing the existing pipe is accelerated and replaced well in advance of its long-term useful life causing budgetary impacts earlier than initially planned.
- In regard to water storage, it would appear that the No U.B.E. scenario may provide for a lesser cost due to certain service areas not needing additional storage to 2051.
- Pump capacity upgrades are similar for both scenarios. Certain areas will require new pumping facilities and/or upgrades in the Ambitious Density scenario, however other areas would have less growth and require smaller upgrades. It is unclear whether there would be a significant cost impact for pumping.
- With respect to treatment, there appears to be no cost differential between the two options.

To summarize, although the scale and magnitude of the cost for required infrastructure works is not fully known at this time, it is likely that storage requirements will be higher under Ambitious Density, however these costs will be offset by D.C.s. Transmission infrastructure will be required to service growth in greenfield areas under the Ambitious Density scenario however, these costs will also largely be offset by D.C.s. Alternatively, significant intensification growth may require upgrades to existing transmission infrastructure under both scenarios, however the scale of these works will be greater under No U.B.E. These works within existing urban areas may have a higher B.T.E. allocation resulting in a higher cost to existing ratepayers.

3.1.2 Wastewater

Figure 5
Analysis Summary for Wastewater Services (Excerpt)

System Component	Ambitious Density	No U.B.E.
Wastewater		
Conveyance	Increased conveyance capacity will be required across most catchment areas. Conveyance for most of the identified development areas outside of the existing Urban Boundary has been recently constructed/under design and planned for as part of the Dickenson / Centennial Trunk Sewer	No U.B.E. Scenario significantly increases conveyance requirements in existing catchments, most significantly in the Western Sanitary Interceptor (W.S.I.). Conveyance requirements significantly reduced for the Dickenson / Centennial Trunk Sewer
Pumping	Treatment requirements are equivalent. No differentiator in scenarios.	Treatment requirements are equivalent. No differentiator in scenarios.
Combined Sewer Overflow (C.S.O.s)	Growth within the combined sewer catchments including the W.S.I. and Red Hill Creek Sanitary Interceptor (R.H.C.S.I.) will impact C.S.O.s. The difference between incremental impact and significant risk to increase of number of C.S.O. bypass occurrences requires detailed city-wide modelling.	The increased growth within the W.S.I. under the No U.B.E. scenario will increase impacts to C.S.O.s. Future upgrades of C.S.O. and/or Conveyance will likely be required to accommodate additional flows under the No U.B.E. scenario.

System Component	Ambitious Density	No U.B.E.
Treatment	Treatment requirements are equivalent. No differentiator in scenarios.	Treatment requirements are equivalent. No differentiator in scenarios.

Financial Implications

- Requirement to replace and upgrade existing conveyance infrastructure will have the following financial impacts:
    - Upgrading and expanding existing infrastructure to accommodate intensification growth may require a sizable benefit to existing allocation as compared to new infrastructure provided in greenfield areas. As mentioned previously, although significant intensification growth is planned under both scenarios, the extent of this type of growth is higher under No U.B.E. Hence, the No U.B.E. likely provides for a higher cost to be borne by existing wastewater users. (Note: the scale of the upgrades and the overall difference in the magnitude of the works between the two scenarios is not fully known at this time).
    - Replacement of existing linear wastewater infrastructure normally costs 250-300% more versus the cost of putting new sewer mains in a greenfield area. This higher cost is largely a result of replacing infrastructure within existing areas and the road reinstatement costs that would be incurred as a result. Hence, potentially increasing the cost to the existing wastewater users under the No U.B.E. scenario.
    - With replacements and upgrade, the cost of replacing the existing pipe is accelerated and replaced well in advance of its long-term useful life causing budgetary impacts earlier than initially planned.
    - The Dickenson/Centennial trunk sewer is currently under design and would be used to service growth outside of the existing urban boundary under the Ambitious Density scenario. Under the No U.B.E. scenario, the conveyance requirements will be significantly reduced for this trunk sewer.
- There appears to be no difference in pumping and treatment requirements between the two scenarios.

- Under the No U.B.E. scenario, there is a higher potential impact to C.S.O.s and the associated infrastructure, however, these costs should be predominantly offset by D.C.s.

To summarize, conveyance requirements in existing areas are more significant under the No U.B.E. scenario. As mentioned above, the upgrades required in existing areas may have a higher B.T.E. deduction, resulting in a higher cost to existing ratepayers. A higher potential impact is also anticipated to C.S.O.s under the No U.B.E. scenario, however these costs are likely to be offset by D.C.s. Conveyance requirements in Whitebelt areas will largely be met by the Dickenson/Centennial Trunk Sewer that is currently under design.

3.1.3 Stormwater

Figure 6
Analysis Summary for Stormwater Services (Excerpt)

System Component	Ambitious Density	No U.B.E.
Stormwater		
Trunk Sewers	On-Site controls for re-developments (infill/intensification) should generally mitigate impacts or improve conditions (combined sewer area over control). Controls also typically consider need for further over-control in areas with constrained or under capacity sewers. Greenfield areas would similarly incorporate controls to limit impacts to receiving storm sewers, where available. New storm sewer systems would be expected to be adequately designed for proposed development.	Similar outcomes for re-development; more intense development would generally be more extensively vertically (not horizontally) and therefore have no additional impact with respect to storm flows (potential additional over-control benefit in combined sewer areas). Increased sanitary flows to combined sewers would require consideration but are typically an order of magnitude less than storm flows. Would avoid the need for any additional storm sewers in the developed greenfield area, which would eliminate additional future operating and maintenance (O&M) requirements for the City.

System Component	Ambitious Density	No U.B.E.
Creeks/Streams	On-site controls for infill/intensification areas should generally mitigate impacts to receiving watercourses (separated storms ewer area), other than residual impacts from erosion and quality control. Over-control in combined sewer area may assist in reducing C.S.O. overflows to watercourse to a degree. For Greenfield areas, potential for residual water quality and erosion (runoff volume) impacts to receiving watercourse systems due to greenfield development. Also expected to involve the elimination and/or relocation of watercourses to facilitate development (as per Storm Water Solutions (S.W.S.) recommendations). Flood control maintained as part of stormwater management (S.W.M.) facility design.	Similar results for infill/intensification, no major differences expected in impacts given form of re-development and minimal stormwater changes. No greenfield development involved, thus eliminates any potential additional impacts to watercourses (creeks/streams), as well as potential longer-term needs for O&M of natural infrastructure.

System Component	Ambitious Density	No U.B.E.
S.W.M. Facilities	On-site controls for re-developments (Intensification/Infill) would be expected to be all privately held and therefore not a City responsibility. Greenfield areas would necessitate end of pipe S.W.M. facilities. As per previous consideration, these facilities are not completely effective with respect to quality control or volume (erosion) control, however effective at flood control. Necessitates longer term O&M by City as part of infrastructure holdings.	Similar results for Intensification/Infill lands – minimal if any expected public S.W.M. facility requirements. No greenfield development involved, thus eliminates impacts and also longer-term O&M requirements.

System Component	Ambitious Density	No U.B.E.
Low Impact Development Best Management Practices (L.I.D. B.M.P.s)	City's S.W.M. guidelines require a "treatment train" for water quality treatment, which encourages L.I.D. B.M.P.s. No formal requirement for L.I.D. B.M.P.s however, particularly for residential land uses. This applies both to infill/intensification and greenfield development areas. Potentially greater constraints in implementing L.I.D. B.M.P.s in existing developed areas (Intensification/Infill) as opposed to greenfield areas (greater flexibility to plan and locate L.I.D. B.M.P.s) but would need to be considered on a case-by-case basis.	Similar results with respect to L.I.D. B.M.P.s, implementation however restricted to Intensification/Infill lands, which as noted may potentially have greater constraints than greenfield areas.

Financial Implications

- Within the existing urban boundary there is not a significant difference in expected capital costs as imperviousness does not generally change with intensification.
- Although the expansion into lands outside of the existing urban boundary would entail higher costs for stormwater infrastructure, the capital costs would be offset by development charges, hence the initial net costs to the City are nominal. It is noted that additional operating and lifecycle replacement costs will need to be borne by the City once the infrastructure is put in place.
- Intensification growth would require developers to provide private on-site controls as opposed to the City-owned controls that would be provided for growth in whitebelt areas. Although the initial capital costs for these City-owned controls

will be offset by D.C.s, the ongoing operating costs and the eventual replacement of this infrastructure must be paid for by the City. On the other hand, the ongoing operating and maintenance costs for private on-site controls required for intensification growth are not the City's responsibility. As such, with increased intensification growth, the City would likely experience a lower degree of operating and lifecycle replacement costs.

3.2 Transportation (Roads & Related)

The City prepared a report providing a high level analysis on roads, transit and active transportation needs to accommodate growth to 2051. The following observations are provided:

- Roadways:
    - In existing built-up areas, there is a limited ability to expand roadways for increased traffic flows resulting from growth. As a result, there must be an increase in other modes of transportation such as dependence on active transportation and transit. Needs for investment in these other modes of transportation will be greater within the existing built-up areas for the No U.B.E. scenario.
    - Additional new roads will be required to accommodate growth under the Ambitious Density scenario. This increase in kilometres of roadways will entail higher operating and maintenance costs relative to the No U.B.E. scenario.
- Active transportation/cycling infrastructure:
    - With the No U.B.E. scenario, right-of-way space along existing roadways will need to be reallocated to active transportation networks and cycling facilities. This is in contrast to expansions into Whitebelt areas where new infrastructure can be built into the right-of-way of new roads.

Financial Implications

From the capital cost perspective, it is more costly to expand an existing individual roadway versus building a new roadway in greenfield areas. However, in total, the ambitious density scenario will require more additional roads at a higher overall total capital cost. In addition, the operating costs are expected to be higher under the ambitious density scenario.

Although growth-related works are largely recoverable through D.C.s, a B.T.E. deduction is usually applied to expansions of existing roadways. Hence, if 100% of active transportation is on existing roads, there will be a higher contribution as compared to including these in new roadways within the expanding Whitebelt area.

3.3 Transit

It is observed that there is a positive correlation between transit use and population density where denser communities support higher levels of transit utilization. The following general observations can be made with regards to transit:

- As the City is moving ahead with an L.R.T. system, it would appear that servicing within the intensification zones of the lower City will be provided by this new transit service.
- The City is likely to incur higher operating costs to operate additional buses required for population growth. There is a greater potential that these costs would be recovered through ticket sales under the No U.B.E. scenario, as the buses will have higher utilization with increased population density.
- Growth into new areas under the Ambitious Density scenario may take time to reach densities that support basic transit service. Cost recovery is likely to be low as new areas develop and population and employment has not yet reached its target density. These operating costs for expanding transit into new areas is likely to be a burden on existing taxpayers, at least while development is in its early stages.
- It is unclear whether capital investment would be significantly different given that buses will be needed for the extension of routes under the Ambitious Density, however, under the No U.B.E. scenario, enhanced service levels will be required. Under both scenarios however, the infrastructure will be recoverable through D.C.s.

3.4 Parks

A general discussion with regards to parkland needs was undertaken with staff which focused primarily on the population growth within the existing urban boundary (i.e., does not include rural areas including Carlisle, Freelton etc.). Note that the following tables

and assumed needs are based on known levels of service however are not meant to conflict with the City's ongoing work on the Parks Master Plan.

At present, the City provides 585 hectares (ha) of neighbourhood and community parks. To determine the existing parkland inventory, a current population (within the urban boundary) of approximately 540,000 was identified for calculation purposes. The following table provides for the inventory and needs based on Official Plan (O.P.) targets of 1.4 hectares of parkland per 1,000 people:

Figure 7
Existing Parkland Inventory within the Existing Urban Boundary

Existing Parkland Inventory (Hectares)		
2021 Inventory in Existing Urban Boundary	Land Requirements as per Official Plan (i.e. 1.4 ha/1,000 people)	Shortfall of Parkland in Existing Urban Boundary
585	759	(174)

Based on the above table, it is observed there is an existing deficiency of 174 hectares. Under the two growth scenarios, the forecasted parkland needs required for an additional 236,000 people (based on the O.P. targets) mean an additional 333 hectares of land.

Figure 8
Parkland Needs for Growth Based on 1.4 Hectares per 1,000 People

Parkland Needs for Growth (Hectares)			
Scenario	Existing Urban Boundary	Whitebelt & Elfrida	Total
Ambitious Density	214	119	333
No U.B.E.	333	0	333

Through discussions with staff, it would appear that some of the land requirements within the existing urban boundary may be available in existing greenfield lands, however it is likely that there will still be a shortfall in parkland as a result limited land availability.

Under the Ambitious Density scenario, the Whitebelt areas (including Elfrida) provide further opportunities for parkland acquisition, however under the No U.B.E. scenario it will be extremely difficult to achieve the O.P. target. It is expected that the City would be required to acquire existing developed lands (e.g. industrial lands) and redevelop these into parkland. This would occur at a much higher cost than what is required to develop within greenfield areas.

To further add to the potential costs to the City, under the Planning Act, the City can require dedication or cash-in-lieu for approximately 50% of the lands. The residual must be funded by the City. Under the No U.B.E. scenario the higher land costs within the existing urban boundary would provide a further higher financial impact onto the tax base.

3.5 Recreation

A very high-level needs assessment based on the population targets identified for Ambitious Density vs. No U.B.E., was undertaken. This preliminary needs assessment was undertaken for the purposes of this fiscal analysis and is not meant to conflict with the ongoing work on the City's Recreation Master Plan being undertaken by Monteith Brown. Long-term facility needs will be identified and assessed through the Master Plan process.

Under the No U.B.E. scenario, an additional 85,500 people will need to be accommodated within the existing urban area vs. the Ambitious Density scenario. As such, the associated recreation facilities and amenities will also need to be accommodated within intensification areas. Similar to the discussions above on parks, it is likely that land constraints will exist impacting the ability to achieve level of service targets.

The following high-level analysis was based on recreation standards per 1,000 people (with some adjustments) applied to the growth within the two identified growth areas.

Figure 9
Preliminary Recreation Needs Assessment

Facility Type	Ambitious Density		No Urban Expansion	Recreation Standards/Other Comments
	Whitebelt & Elfrida	Existing Urban Area	Existing Urban Area	
Population Estimate	85,500	150,500	236,000	
Community/ Recreation Centres (indoor pools, gyms, seniors/youth space, etc.)	3	5	up to 8	Based on former provision target (1:30,000); existing facilities may have some capacity for expansion
Arenas (ice pads)	2	3	5	Based on 50% of existing level of service (~1:48,000) to reflect shifting needs and available capacity; further study is required to confirm future service levels
Soccer and Multi-Use Fields (including football)	25	44	69	Based on 75% of existing level of service (~1:4,000) to reflect shifting needs and available capacity; ability to secure land will be restricted in built-up area; assume most fields are lit
Baseball Diamonds	25	44	69	Based on 75% of existing level of service (~1:4,000) to reflect shifting needs and available capacity; ability to secure land will be restricted in built-up area; assume most fields are lit
Cricket Pitches	1	1	2	Based on 150% of existing level of service (~1:130,000) to reflect growing demand; ability to secure land will be restricted in built-up area

Facility Type	Ambitious Density		No Urban Expansion	Recreation Standards/Other Comments
	Whitebelt & Elfrida	Existing Urban Area	Existing Urban Area	
Playgrounds	38	up to 66	up to 104	Based on existing level of service (~1:2,300); figures could be reduced depending on geographic distribution and proximity
Tennis & Pickleball Courts	16	up to 29	up to 45	Based on 125% of former provision target (~1:5,200) to reflect growing demand for pickleball; mix of courts to be determined; figures could be reduced depending on geographic distribution and proximity
Basketball & Multi-use Courts	13	up to 23	up to 36	Based on former provision target (~1:6,500); figures could be reduced depending on geographic distribution and proximity
Spray Pads	8	up to 15	up to 23	Based on former provision target (~1:10,250); figures could be reduced depending on geographic distribution and proximity
Outdoor Pools	1	2	3	Based on former provision target (~1:75,000); to be determined if there is sufficient demand to provide additional pools
Skateboard Parks	2	4	6	Based on 200% former provision target (~1:97,500) to reflect growing demand; includes community and neighbourhood level facilities
Bike Parks and Pump Tracks	tbd	tbd	tbd	tbd

Facility Type	Ambitious Density		No Urban Expansion	Recreation Standards/Other Comments
	Whitebelt & Elfrida	Existing Urban Area	Existing Urban Area	
Leash Free Dog Zones	1	2	3	Based on existing level of service (~1:65.,000)
Outdoor Ice Rinks and Trails (artificial and natural)	10	up to 19	up to 29	Based on existing level of service (~1:8,100); figures could be reduced depending on geographic distribution and proximity

It is expected that certain facility requirements within the existing urban area can be accommodated through expansions to existing facilities, however it is likely that additional land will need to be acquired for some of the new facilities.

In addition to the indoor recreation facility space, outdoor recreational amenities e.g. playgrounds, spray pads, etc., will need to be placed within parks. Based on the discussion in the previous section, with the spatial constraints of parkland within the intensification areas, there will be increased pressures to provide these additional parklands.

The opportunities to acquire land will be constrained under the No U.B.E. scenario, especially for items such as soccer fields, ball diamonds, and cricket fields which are land-intensive recreational activities. It is unlikely that these amenities can be accommodated within the existing urban boundary, however there are greater opportunities to address these needs through the expansion into the Whitebelt & Elfrida areas.

Financial Implications

With the Ambitious Density scenario, the planning and acquisition of parkland within the Whitebelt areas appears easier to acquire than under the No U.B.E. scenario. Under both scenarios, there will be difficulty in locating and securing lands as a result of limited availability in the existing urban area. Land within intensification areas is much more expensive than greenfield lands, and as a result, no U.B.E. will likely entail higher costs which must be funded from the property tax base.

As parkland acquisition may not be provided by D.C.s, land must be funded by either dedication or be purchased by the City. As noted, the Planning Act will limit acquisition and as a result, a significant funding requirement will be placed on property taxes. Funding all recreation land and parkland needs may become cost-prohibitive consequently leading to a reduction in service levels.

It is acknowledged that certain needs could possibly be met through external partnerships (e.g., school boards, local non-profit organizations, etc.), but it is unlikely these partnerships will fulfill the needs of the entire population.

As a result of the above, meeting service level targets appears more attainable and less costly under the Ambitious Density scenario, largely as a result of land availability and the potential costs to acquire these lands in the Whitebelt areas. For both scenarios, the acquisition of lands within the urban area to accommodate parkland and recreation needs will be challenging from both a financial and land availability perspective.

4. General Observations/Conclusions

Higher Costs for Infrastructure in Existing Urban Areas

The infrastructure requirements to service an additional 236,000 residents and 132,000 employees will be substantial under both scenarios, however, based on the above discussion, it is likely that costs will be more significant under the No U.B.E. option. In general, it can be observed that costs are significantly higher to provide new infrastructure in existing areas vs. greenfield areas. These additional costs will have major implications to provide water, wastewater, roads, and stormwater services.

Land costs required to develop parks and recreation facilities will be much more substantial in existing urban areas. Given the higher degree of intensification growth under No U.B.E., it is likely that these costs will be more significant. Based on the City's O.P. targets for parkland, it is unlikely that parkland needs will be fulfilled through parkland dedication. As a result, these higher land costs will be a direct impact onto the City's property tax base.

Benefit to Existing Deductions on Growth-Related Works

Although the infrastructure requirements required to service growth are significant under both scenarios, there are major differences in the nature of the capital works required and the resulting financial impacts.

With regards to water, wastewater, stormwater, and roads infrastructure, it is recognized that there would be some benefit to existing (B.T.E.) allocation for projects that are required to service intensification growth within existing urban areas. There are often deficiencies in the existing infrastructure that would need to be addressed in conjunction with the growth-related works required for intensification. For these projects, a non-growth component would relate to one or more of the following:

- Upgrades to the existing system;
- Upgrades to alleviate existing capacity deficiencies;
- Facilities that are required to maintain an adequate level of service to existing users; and
- Infrastructure required to fulfill critical security/redundancy requirements.

In the City's 2019 D.C. background study a B.T.E. deduction between 10% to 50% was applied to water and wastewater projects that were driven by growth but were also likely to address issues in the existing system. This is in contrast to infrastructure that is primarily located in new growth areas where there would be limited non-growth components as part of the capital works.

As the City would be required to fund the B.T.E. components of these growth-related works, it is important to understand the differences between the two growth scenarios and how the nature of the required works would affect B.T.E. deductions. Although works are required in existing areas under both growth scenarios, the infrastructure requirements are larger in magnitude under the No U.B.E. option relative to the Ambitious Density option. Given that there are many capacity constraints and issues in the existing system, the works that would be required to allow for the increased intensification under the no U.B.E. scenario would likely entail significant B.T.E. deductions. This is an important financial consideration in determining how the City will grow as these deductions are likely to impact existing residents through user rates and property taxes.

Where the timing of replacement of existing water and wastewater infrastructure is accelerated as a result of growth, there must be a recognition that there is a benefit to the existing community. When the infrastructure is replaced well in advance of its useful life, this will cause budgetary impacts earlier than initially planned and impact the City's existing residents.

Financing Options for Growth

In planning for growth, municipalities often face cash flow issues based on the need to build infrastructure in advance of growth. For example: prior to the issuance of building permits: water, wastewater, stormwater, and to a certain extent, roads infrastructure must be in place for development to proceed. As payment of D.C.s normally occurs at the time of building permit issuance (i.e. well after the installation of the infrastructure), cash flow problems can be experienced by the municipality. A municipality may issue growth-related debt as a form of bridge financing prior to the receipt of D.C. revenue however, municipalities are limited in the amount of debt they can issue (i.e. 25% of own source revenues). When the debt financing burden for growth-related works becomes extensive, municipalities may seek agreements with developing landowners to assist in paying for works.

These financing agreements with developers function well in greenfield areas, where there is usually a group of developing landowners that own large blocks of developable land. It is more straightforward to engage the group of landowners that are planning to develop large areas to upfront the required costs for infrastructure. In contrast, lands to be used for intensification are often owned in small lots by homeowners and businesses. It becomes much more difficult to engage with these landowners to provide upfront financing for infrastructure as usually only large developers would have the financing ability.

Financial Risk if Intensification Growth is Not Realized

A significant amount of intensification growth is planned under both scenarios. Most often when looking to expand infrastructure to allow for intensified growth, the services are sized for the ultimate development in that area. However, the certainty of the growth within the medium to longer term is less clear, hence there is a higher risk for receiving the return on investment within reasonable time horizons. As the No U.B.E.

scenario provides for a higher level of intensification growth it is perceived that there is a higher level of risk of receiving the return on investment under this growth scenario.

Lifecycle Replacement Costs for New Infrastructure

A significant amount of new infrastructure will be required for growth under both scenarios. As mentioned, new infrastructure required for growth is generally paid for through D.C.s (or constructed by the developer as a local service). As such, new infrastructure is constructed/installed with minimal impacts to the taxpayer/ratepayer. However, once the infrastructure is assumed, the City begins to allocate funds, on an annual basis, to replace the infrastructure at the end of its useful life. These annual contributions are referred to as lifecycle expenditures and must be borne by taxpayers/ratepayers. Given that new infrastructure requirements may be more significant to expand into Whitebelt areas, these annual lifecycle costs could be higher in the future under the Ambitious Density scenario.

Concluding Remarks

The review of the various services and the associated financial commentary provided herein is qualitative in nature. This high-level analysis was completed to assist Council in understanding significant financial risks associated with the two growth options. Once a preferred growth scenario is approved by Council, a quantitative analysis of the financial impacts of growth will be developed.

Review of Financing Options for Growth: GRIDS 2

City of Hamilton

Review of Financing Options for Growth: City of Hamilton GRIDS 2

1. Introduction

The City of Hamilton is currently undertaking a Growth-Related Integrated Development Strategy (GRIDS 2), to allocate forecasted population and employment growth to the year 2051, in accordance with the Provincial Growth Plan.

Identifying financing options to accommodate growth is a key consideration in ensuring the growth strategy is financially sustainable over the forecast period. The purpose of this memo is to provide a review of various financing options that are available to the City. Although Development Charges (D.C.) are the main financing source for growth-related infrastructure, certain challenges may arise in utilizing this funding source, specifically in high-growth municipalities. The following list provides some examples where municipalities may face financial challenges as a result of growth:

- There are a number of services that are ineligible under the Development Charges Act (D.C.A.) which would have growth-related expenditures (i.e. waste management/landfill services, general corporate administrative space, arts and entertainment facilities, computer equipment, vehicles and equipment with a useful life of six years or less, hospitals, municipal parking, etc.).
- The D.C.A. also requires an average 10-year historic service standard calculation to be undertaken to provide a ceiling on D.C. recoveries for all services other than water, wastewater, and stormwater. This requirement can have significant implications for high-growth municipalities.
- Certain growth-related expenditures (e.g. water and wastewater related works) are required prior to development proceeding. As a result, D.C. expenditures are required prior to collection of the corresponding D.C. revenue. This may result in cash flow issues for a municipality.
- The Province regulates the level of debt incurred by Ontario municipalities. Under Ontario Regulation 403/02, a municipality's debt capacity is capped at a level where no more than 25% of the municipality's own purpose revenue may be allotted for debt charges. Hence, proper management of capital spending and the level of debt issuances must be monitored with respect to this limit. As

certain growth-related capital expenditures may be significant, debt capacity issues may limit the amount of growth in a municipality.

The preceding list provides just a couple examples of the issue's municipalities are facing as they plan for growth over long-term horizons. The following survey provides examples of some of the practices in place for financing growth-related infrastructure in other municipalities across Ontario. A description of each financing tool is provided along with legislative context and the associated policies, advantages, and disadvantages of each option.

It is noted that the City is currently exploring various growth options with respect to expanding the urban areas versus intensification within the existing built boundary. Once a growth scenario is selected by Council, a preferred financing option will be recommended based on the results of the full fiscal impact analysis to be undertaken.

2. Financing Options – D.C. Legislation

2.1 Voluntary Developer Contributions

2.1.1 Description & Associated Policies

The D.C.A. mandates service exemptions, reductions, deductions, and recovery limits which then require present taxpayers to fund a portion of the growth-related costs. Historically, municipalities have had the ability to negotiate additional capital contributions in excess of the D.C. to allow growth to proceed. These payments have been made to assist municipalities in financing capital projects to mitigate the impact of growth on tax rates and debt capacity limits.

It is noted that although this was a tool utilized in the recent past, Bill 73 (Smart Growth for Our Communities Act, 2015) introduced the "no additional levies" clause to the D.C.A. which prohibits municipalities from imposing additional payments with regards to new developments, except as permitted under the D.C.A.

2.1.2 Example: City of Barrie

Based on the 2014 Fiscal Impact Study completed by Watson, it was determined that growth-related financing burdens were outside the City's financial authority and that Provincially imposed debt capacity limits would be breached. As a result, the City

engaged developing landowners to participate in assisting to finance the capital program, as growth would not be able to proceed without further financial assistance. Capital contribution provisions were negotiated and made in recognition of: D.C.-ineligible expenditures, the 10% mandatory D.C. deduction (note: this contribution was negotiated pre-Bill 197), and the historic service standard exceedance.

A per unit capital provision was calculated based on the growth-related capital infrastructure that was not an eligible expenditure under the D.C.A. but was still required to service growth. The capital expenditures identified include costs related to the 10% mandatory deduction, amounts in excess of the allowable service standard, City Hall expansions, and expenditures related to landfill.

Developing landowners signed a memorandum of understanding to provide this per unit capital contribution to the City at building permit issuance.

Other municipalities that have negotiated a similar capital contribution include the Towns of Milton, Erin, Whitchurch-Stouffville, and Caledon, the Township of King, and the Region of York.

2.1.3 Advantages

A capital contribution provided on a per unit basis can decrease the financial risk to a municipality by imposing the costs on new growth. This would decrease the impact to existing taxpayers and the burden on property taxes as a result of funding non-D.C. eligible growth expenditures. Capital contributions also provide a degree of certainty in the amount of money being contributed for growth-related works.

2.1.4 Disadvantages

The Province released Bill 73 in 2016 which led to the introduction of the “no additional levies” clause in the D.C. legislation. As a result, municipalities cannot mandate capital contribution charges in excess of the D.C. onto development. It should be noted however, that there have been instances whereby the municipality has sought to phase growth to minimize the overall impact of growth onto their debt capacity and tax/user rates. Some developing landowners have offered to assist in financing some of these costs to reduce the impact and to allow additional growth to proceed. These contributions are truly offered by the landowner and have not been mandated as the legislation has required.

2.2 Development Phasing/Staging

2.2.1 Description & Associated Policies

In general, servicing costs (water, wastewater, and some roads) are incurred prior to development. This can cause cash flow issues for a municipality when D.C.s are being paid subsequent to the corresponding capital expenditures. Financial issues such as exceeding debt capacity limits are often a concern in high-growth municipalities where up-front costs required for development can be significant.

In order for growth to proceed in a manner that is financially sustainable for a municipality, staging or phasing of development may be pursued. Providing certain thresholds through a formal policy or agreement of when development can proceed in certain areas allows for a municipality to closely monitor key financial metrics and ensure that growth is occurring in a manner that is financially affordable.

In addition, establishing development phasing ensures that development coincides with the construction of the associated infrastructure that is required in a specific area such as roads, schools, parks, water, and wastewater services.

2.2.2 Example: Town of Milton

The Town of Milton's Official Plan sets out detailed policies requiring the phasing and financing of development. Progression from one phase to another within the Urban Expansion Area is based on substantial occupancy of the earlier phase and availability of infrastructure.

Prior to a subsequent phase of growth, financial agreements are signed with developing landowners for cost sharing agreements. Subsequent planned phases throughout the Town are not able to proceed until the recommendations in the financial impact study for that phase are secured to the satisfaction of Council.

2.2.3 Advantages

Staging of development provides the municipality with a certain degree of control over allowing development to proceed in a financially sustainable manner. In many cases, financial agreements between a municipality and developing landowners have also been entered into to assist in minimizing the impact to existing taxpayers. Providing

certain thresholds and financial metrics that must be met prior to development proceeding also has the potential to limit financial risk to the municipality.

Additionally, staging development allows a municipality to strengthen its capital budgeting process over a long-term time horizon. Understanding where development is going to occur assists the municipality in planning and undertaking high-priority projects that are required for specific developments. Aligning growth with the associated servicing and infrastructure requirements limits the occurrence of unexpected capital projects that would otherwise be required to service additional land that was not previously planned for.

2.2.4 Disadvantages

Although this approach provides municipalities with a higher degree of control on the financial sustainability of development, it may slow down the rate of growth within a municipality. This can also limit the municipality's ability to attract new development opportunities as developers may look to areas with less stringent requirements.

2.3 Prepayment/Front-Ending Agreements

2.3.1 Description & Associated Policies

Front-Ending: Under Section 44 of the D.C.A., a municipality may enter into front-ending agreements for projects related to water, wastewater, stormwater, and services related to a highway. These agreements provide for developing landowners to fully fund the works required for development to proceed. The funds are then flowed back to the original developing landowners as other developments pay D.C.s. Note that this form of agreement requires several administrative requirements including detailed agreements, annual statements to the front-ender, indexing of outstanding amounts to be recovered, etc.

Prepayment: Under Section 27 of the D.C.A., a municipality may enter into an agreement with a person who is required to pay a D.C. providing for all or any part of a D.C. to be paid before or after it would otherwise be payable. If the municipality does not have the ability to finance a project, developing landowners could enter into an early payment agreement to provide the municipality the funds to construct the works

required for development. The funds are then recovered by the developer by receiving credits as the development proceeds.

2.3.2 Example: Region of Halton, Town of Milton

Without front ending and early payments, residential development in Oakville and Milton would not proceed in a timely fashion. Through negotiations, developing landowners are required to execute an allocation agreement which in turn provides for pre-payment and front-ending of the development charges.. The allocation agreement provides an allocation of residential water and wastewater capacity to participating landowners. A specific number of single detached equivalents (S.D.E.s) are reserved for each participating landowner. In addition to a prepayment of the D.C.s for water, wastewater, and roads, each participating owner must also contribute a set amount per S.D.E. for front-end financing of the roads, water, and wastewater projects. These front-end financing payments are required on certain dates as per the executed agreement from all participating landowners. These amounts are repaid to landowners plus compounded interest. A projection of repayments is provided to landowners but there is no guarantee from the Region that the repayments will occur at the same time as provided for in the projection. Actual recoveries are dependent on the pace of residential development. In order to allow for the reimbursement to the landowners that front-ended costs beyond their share of the benefit, a per unit residential front-ending recovery payment is imposed on future development, in addition to the D.C.

As per the allocation agreement, each participating landowner is also required to provide security to the Region for early payment of the water and wastewater component of the D.C. for every S.D.E. that is reserved in the allocation agreement to that participating owner. The initial security provided to the Region is replaced with payments for the water and wastewater projects when they are required. No servicing capacity is allocated to development until the financing agreements are executed and securities (letters of credit) are provided.

The Town of Milton provides another specific example of prepayment agreements related to road works. Through an agreement with developers, each landowner at the time of registration of a plan of subdivision is to provide an indexed letter of credit for each unit in the subdivision, in order to provide cash flow assistance to fund the construction of necessary roadworks. This was required due to the net shortfall in D.C. funding of roadworks required for development in the Town’s secondary plans. These

letters of credit are to be drawn on whenever there is a shortfall in the funding of growth-related roadworks. The landowners would be reimbursed without interest over time, through the collection of roads D.C.s.

Other municipalities undertake front-ending agreements however this is not commonly used given the amount of administration required to undertake this type of agreement. Municipalities such as the Town of Erin, The Region of Peel, The Region of York, and the City of Barrie have undertaken such agreements.

Prepayment Agreements are quite common and are often used to fund smaller assets such as watermains, sewers, pumping stations, parks, etc.

2.3.3 Advantages

Front-ending agreements can provide for the upfront costs to be borne by one or more developers who are, in turn, reimbursed in the future by person who develop land defined in the agreement. By requiring developers to pay for these capital expenditures, the municipality limits its financial risk by transferring the assumption of the costs required to support the development to the landowners.

Accelerated payment agreements assist municipalities with cash flow to build specific projects. Through prepayment of all or a portion of the D.C., the municipality is able to collect revenue ahead of when the timing of the associated capital expenditures are required.

2.3.4 Disadvantages

With prepayment agreements, the municipality will receive the D.C.s upfront and would not receive the associated indexing that could be collected if D.C.s are paid at building permit stage.

Front-ending agreements have higher administrative costs on the municipality as they must keep track of the funds in the agreements and flow them back to the front-ending landowner. Legal costs are also higher due to the costs in setting up agreements.

Front-ending agreements may not be as feasible when the housing market is not strong as the development community may be unwilling to assume the financing risk involved.

2.4 Service Emplacement Agreements

2.4.1 Description and Associated Policies

Section 38 of the D.C.A. provides that a developing landowner may construct or provide a service which relates to a service in the D.C. by-law. Through an agreement with the developer, the municipality shall provide a credit towards the D.C. in accordance with the agreement. Note: alternative repayment agreements can be utilized. The amount of the credit is equivalent to the reasonable cost of doing the work as agreed upon by the municipality and the developer who is to be given the credit and is to be applied against individual projects and not against the D.C. A credit given in exchange for work done is a credit only in relation to the service to which the work relates (e.g. an agreement to build a park will provide that the credit is against the parkland component of the D.C.). Should the project cost exceed the credit amount, the municipality would need to identify how the excess amount will be repaid. These service emplacement agreements most often apply to stormwater projects, smaller watermain and sewer extensions, as well as parkland development.

These agreements are similar to the prepayment agreements discussed above, however instead of providing the D.C. funds directly to the municipality, the developer builds the infrastructure and receives a credit against the future D.C. payable.

2.4.2 Example

This is a relatively common approach used for smaller projects such as parks, watermains, stormwater management works, etc. Municipalities of varying sizes, including the Regions of Peel, Halton, York, and Durham, and the Cities of Toronto and Ottawa utilize these agreements for construction of capital works.

2.4.3 Advantages

As the developer agrees to construct the capital works, full funding is provided for the specific project. Based on the wording in the D.C.A., the credit provided can only relate to the service provided. If a stormwater management pond was constructed, a credit would only be applied to that specific project. As a result, the developer bears the risk of a slower pace of development in that area as the credits would only be recovered through development that benefits from those works.

2.4.4 Disadvantages

Additional administrative costs would need to be borne by the municipality in order to track the credits.

Accelerating project construction can lead to increased financial risk to the municipality in that limited new net revenues accrue to the D.C. reserve funds, but new liabilities arise for providing repayments in the future.

2.5 Accelerated Payment of Hard Service D.C.s at Subdivision/Consent Agreement Stage

2.5.1 Description and Associated Policies

The D.C.A. provides for two points in time where a municipality can, by by-law, mandate the collection of the D.C.:

- Section 26(1) provides the charge shall be payable at the time the building permit is issued
- Section 26(2) provides that for Water, Wastewater, Stormwater, and Services Related to a Highway, a municipality may provide that the D.C. be payable immediately upon the parties entering into a subdivision agreement or consent agreement.

As opposed to the formal agreements that are required under Section 27 for the prepayment of D.C.s, these accelerated payments for hard services can be achieved through the D.C. by-law. This policy imposed through the D.C. by-law may assist a municipality in collecting revenues at the time they are required for the associated capital expenditures, and as such, this may minimize the need for the municipality to assume financing costs.

2.5.2 Example

There are a number of municipalities that provide for the early payment of D.C.s for certain services within their respective by-laws. These municipalities include the Regions of Halton and Durham, the Towns of Milton and Oakville, and the Cities of Markham and Vaughan.

2.5.3 Advantages

As the infrastructure related to hard services is often required in advance of the building permit stage, accelerated payment agreements assist municipalities with cash flow that is required for the associated capital expenditures.

Compared to Section 27 prepayment agreements (see Section 2.3), formal agreements are not required with the developers. This is a policy that can be emplaced into a D.C. by-law for all development (subject to certain limitations discussed in the next section).

2.5.4 Disadvantages

Requiring the collection of certain services at subdivision/consent agreement while collecting the remaining services at building permit stage imposes a higher administrative burden on the municipality, as opposed to collecting all D.C.s at a single point in time.

Similar to prepayment agreements, the municipality may not receive the associated indexing for the services collected for at the subdivision/consent agreement stage, as opposed to building permit stage.

Through recent legislative changes (i.e. Bill 108), installment payments are now imposed for certain types of development (i.e. rental housing, institutional development and non-profit housing). As a result, the associated D.C.s for water, wastewater, stormwater, and services related to a highway cannot be collected at the subdivision/consent agreement stage for these types of development.

2.6 Contributions Toward Non-Growth-Related Costs

2.6.1 Description and Associated Policies:

Although this financing option is a variation of the voluntary capital contributions discussed in Section 2.2, it is unique in the way it is carried out and hence provided as a separate section.

A municipality may require developers to make a contribution toward non-growth-related component costs where certain works (which are required for development to proceed) are advanced well in excess of when these expenditures are planned in a municipality's

capital budget. This policy can assist in minimizing impacts on existing residents when development proceeds ahead of when the municipality has planned for it.

2.6.2 Example: York Region

Based on the Region's 2017 D.C. Background Study, developers may be required to make a contribution towards the non-growth portion of costs where works are being constructed in advance of the Region's capital program.

Where capital works are included within the ten-year forecast and works are advanced to the current budget year, the Region would reimburse the developer for an amount equivalent to the present value of York Region funding the non-growth portion of the costs.

Where capital works are not included in the ten-year capital forecast (i.e. may have been identified in a master plan but construction of the work was planned outside the budget forecast period), the developer would not be reimbursed and would be required to make a non-recoverable contribution for the non-growth costs.

2.6.3 Advantages

This practice strengthens long-term financial planning practices. A municipality would not have to adjust the capital program and associated financing if certain works are required ahead of schedule.

2.6.4 Disadvantages

As mentioned in the section related to voluntary capital contribution, with the introduction of the "no additional levies" clause to the D.C.A., this policy may be difficult to mandate; however, there may be occasions where a developer may wish to fund these costs based on an offering from them.

2.7 Local Service Policy Requirements

2.7.1 Description & Associated Policies

Municipalities may elect to impose a broader local service policy requiring certain works, which would traditionally be funded through development charges, to be a direct developer responsibility. As the D.C.A. does not define what level to set the local

service policy, a municipality can identify specific types of works as a developer responsibility if they are required for a specific development.

2.7.2 Example: Township of Springwater

As per the Township of Springwater's 2018 D.C. Background Study, specific capital works related to water, wastewater, roads, and parks that are required for development in the Midhurst Secondary Plan have been identified as developer responsibility. Capital costs such as water and wastewater treatment plants, major pumping, trunks mains and arterial roads, have been included in their local service definition whereas most municipal policies do not include these higher-level works..

2.7.3 Advantages

Through the local service policy document, clear guidelines are provided as to what is considered developer responsibility. Providing a higher threshold as to what is considered developer responsibility limits financial exposure to the municipality while development is proceeding.

2.7.4 Disadvantages

Developers may contest whether certain works are required specifically for their development. A challenge to this option is that cost-sharing agreements among developers may be required for certain works in an area. Some developers may be unwilling to negotiate with each other.

2.8 Area-Specific D.C.s

2.8.1 Description and Associated Policies

A uniform D.C. is standard municipal practice but provides limited incentives for developers to focus on areas which are already serviced or can be serviced at low cost. In order to recover growth-related expenditures from the development that directly benefits from the work, a localized D.C. charge related to works in a specific area can be imposed to recover the higher costs related to servicing a new area. This is often a useful funding tool in Secondary Plans where localized infrastructure related to water, wastewater, and roads is required to support a specific development and is often not in

place. Instead of imposing these local costs across an entire municipality, the benefitting area is responsible for all of the costs.

Area-specific charges are also often used in conjunction with front-ending agreements to recover costs from subsequent benefitting development.

2.8.2 Example: Richmond Hill

Richmond Hill imposes area specific D.C.s for certain hard services that solely benefit the development area. These works include collector roads, water mains, sewer mains, stormwater management measures and localized studies whereas the City-wide D.C. would provide for arterial roads, major trunk water/sewer mains and broader growth-related studies.

The Cities of Markham and Vaughan also impose a similar style of City-wide and area specific charges. It is also noted that the City of Hamilton has imposed a similar style of area specific D.C.s in Dundas and Waterdown for wastewater services as well as in Binbrook for water and wastewater services.

2.8.3 Advantages

This financing option can be utilized as an alternative funding tool when developing landowners are unwilling to co-operate amongst each other with regards to front-ending or cost sharing agreements. Area-specific D.C.s also provide a degree of transparency to developers in that localized works are being funded by the landowners that directly benefit from them.

Many municipalities are focusing on intensification and high-density development to infill areas. D.C.s could be used to encourage development in the existing urban areas and discourage development in the outer areas by using area specific D.C.s instead of uniforms D.C.s. The following list provides a few reasons why costs may differ by area:

- Distance from major facilities (e.g. length of trunk to sewage treatment plants will vary);
- Capacity may already be available in existing infrastructure; and
- Services levels may vary among developments (e.g. reduced automobile use in higher density areas).

Although an area-specific D.C. approach generally only has the potential to affect a portion of the D.C. rate (i.e., sewer trunks, watermains, etc.), the use of these differentiated rates could potentially promote intensification in existing areas.

2.8.4 Disadvantages

Although this methodology of area specific D.C.s is feasible with highly localized works, such as stormwater management, this would be difficult to put into practice for services such as recreation facilities or parks where the service is not restricted to one specific area and is often used by all residents.

In addition, with area specific D.C.s, some areas would pay very high D.C.s while others would pay much lower rates for what may be similar types of development. As these developments occur in similar housing (or non-residential) markets, varying D.C. quanta could place the higher charge areas at a competitive disadvantage. As a result, development opportunities may be difficult in certain areas due to development costs and hence, may restrict overall growth.

Appendix C:
Water, Wastewater, and Stormwater Servicing Report

Prepared By:

CITY OF HAMILTON

TECHNICAL MEMO – AMBITIOUS DENSITY VS. NO URBAN BOUNDARY EXPANSION ANALYSIS OF WATER, WASTEWATER AND STORMWATER SERVICING NEEDS

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Hamilton

REVISION LOG

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1	Sept 6, 2021	Draft to City
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GM BluePlan Signatures

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1. INTRODUCTION & PURPOSE

GM BluePlan Engineering and Wood Environment & Infrastructure Solutions (Wood) (Master Plan Team) have been retained by the City of Hamilton to prepare the Water, Wastewater and Stormwater Master Plan. The Master Plan was originally scoped to provide a Water, Wastewater and Stormwater servicing strategy to meet growth to 2041.

Following the Province's Places to Grow update in 2020, which sets a new planning horizon to 2051, the City has been reviewing greenfield density and additional land needs to support population and employment growth between 2041 and 2051. The population and employment projection inputs are developed by the City Planning department under the Growth Related Integrated Development Strategy (GRIDS) 2 process and consists of population, employment, and densities within existing areas (infill / intensification) and new Greenfield growth to 2051.

Data was provided to the Master Plan Team through the GRIDS 2 Process in June 2021 that updated the planning horizon to 2051 under an Ambitious Density Scenario (including 1,340 hectares of urban expansion). This scenario considers an Urban Boundary Expansion by identifying new Greenfield growth, as well as infill and intensification areas within the existing City core. The Ambitious Density Planning scenario that has been identified is not yet approved by Council. A Council and Committee meeting is planned for October 2021 that will identify whether an Urban Boundary Expansion is supported. This decision will be based on a detailed and comprehensive review of the Lands Needs Assessment and public input. To help inform the planning process and selection of potential new growth areas, the City has requested that the Master Plan Team conduct a high-level comparative review of the impacts to the City's existing and/or planned infrastructure and public service facilities of a No Urban Boundary Expansion (No UBE) growth option vs. the Ambitious Density Scenario. The No UBE option focuses on infill and intensification within the City's existing boundary limits, including key areas such as the Downtown Core.

In summary, the overall objective of the analysis was to compare the two planning options and answer the following question:

Does the growth option result in significant impacts to the City's existing or planned infrastructure and public service facilities?

2. PLANNING SUMMARY

Two scenarios are being evaluated at a desktop level for the purposes of this assessment: An Ambitious Density Scenario and a No Urban Boundary Expansion Scenario. The planning information for the Ambitious Density and No UBE scenarios helps to inform the comparative analysis by identifying potential areas of opportunities and constraints within the existing built and/or greenfield areas in the City.

The following summarizes the planning information provided for each of the scenarios identified, delineated by Municipal Areas within the city.

2.1 Ambitious Density

The Ambitious Density growth option includes four scenarios (1, 2, 3 and 5b), however for the purposes of this analysis, only Scenario 1 was reviewed and compared with the No UBE scenario. Scenario 1, 2 and 3 all have similar boundaries and 2051 population and employment projections for the same Traffic Survey Zones (TSZs). The existing and future planning projections for 2051 can be seen in Table 2-1 for the City's core communities.

Table 2-1 – Ambitious Density Phasing Scenario 1 Based on an Expanded Urban Boundary

Ambitious Density -Sc 1	2021			2051			2021-2051 Growth		
	Pop	Emp	Total	Pop	Emp	Total	Pop	Emp	Total
Waterdown	23,527	7,562	31,089	36,122	11,963	48,085	12,595	4,401	16,996
Dundas	31,127	17,115	48,242	31,731	17,585	49,316	604	470	1,074
Ancaster	39,632	14,219	53,851	45,508	20,804	66,312	5,876	6,585	12,461
Lower Hamilton	201,932	102,961	304,893	270,795	165,549	436,344	68,863	62,588	131,451
Upper Hamilton	152,735	44,423	197,158	177,216	56,179	233,395	24,481	11,756	36,237
Mount Hope / AEGD	3,779	3,537	7,316	13,660	18,546	32,206	9,881	15,009	24,890
Glanbrook	8,177	2,487	10,664	27,000	10,141	37,141	18,823	7,654	26,477
Stoney Creek	78,192	27,533	105,725	170,466	49,823	220,289	92,274	22,290	114,564
Binbrook	11,018	955	11,973	14,960	2,000	16,960	3,942	1,045	4,987
Total in Urban Area	**550,119**	**220,792**	**770,911**	**787,458**	**352,590**	**1,140,048**	**237,339**	**131,798**	**369,137**
Rural	33,844	7,640	41,484	32,913	7,641	40,554	(931)	1	(930)
Total	**583,963**	**228,432**	**812,395**	**820,371**	**360,231**	**1,180,602**	**236,408**	**131,799**	**368,207**

2.2 No Urban Boundary Expansion

The No UBE scenario considers growth strictly within the existing Urban Area, focusing on infill and intensification within local communities. The existing population numbers and No UBE planning projections for 2051 are provided in Table 2-2 for the City's core communities.

Table 2-2 – No Urban Boundary Expansion Projections

No UBE	2021			2051			2021-2051 Growth		
	Pop	Emp	Total	Pop	Emp	Total	Pop	Emp	Total
Waterdown	23,527	7,562	31,089	37,721	12,363	50,084	14,194	4,801	18,995
Dundas	30,219	17,115	47,334	31,920	17,853	49,773	1,701	738	2,439
Ancaster	39,368	14,040	53,408	46,230	20,255	66,485	6,862	6,215	13,077
Lower Hamilton	201,932	102,961	304,893	335,290	181,685	516,975	133,358	78,724	212,082
Upper Hamilton	152,735	44,423	197,158	188,328	58,952	247,280	35,593	14,529	50,122
Mount Hope / AEGD	3,193	3,317	6,510	6,715	15,092	21,807	3,522	11,775	15,297
Glanbrook	8,177	2,487	10,664	9,233	4,487	13,720	1,056	2,000	3,056

No UBE	2021			2051			2021-2051 Growth		
	Pop	Emp	Total	Pop	Emp	Total	Pop	Emp	Total
Stoney Creek	77,741	27,358	105,099	114,813	38,600	153,413	37,072	11,242	48,314
Binbrook	11,018	955	11,973	14,960	2,000	16,960	3,942	1,045	4,987
Total in Urban Area	**547,910**	**220,218**	**768,128**	**785,210**	**351,287**	**1,136,497**	**237,300**	**131,069**	**368,369**
Rural	36,053	8,214	44,267	**35,421**	**8,928**	**44,349**	-632	714	82
Total	**583,963**	**228,432**	**812,395**	**820,631**	**360,215**	**1,180,846**	**236,668**	**131,783**	**368,451**

2.3 Growth Comparison: Ambitious Density vs. No Urban Boundary Expansion

Table 2-3 below shows the planning projection comparison between the Ambitious Density Scenario and No UBE in 2051 within the City's local communities.

Table 2-3 – Ambitious Density Scenario vs. No Urban Boundary Expansion Projections

Communities	Ambitious Density Scenario 1 - 2051			No Urban Boundary Expansion - 2051			Growth Comparison (AD to No UBE)			
	Pop	Emp	Total	Pop	Emp	Total	Pop	Emp	Total	%
Waterdown	36,122	11,963	48,085	37,721	12,363	50,084	1,599	400	1,999	4%
Dundas	31,731	17,585	49,316	31,920	17,853	49,773	189	268	457	1%
Ancaster	45,508	20,804	66,312	46,230	20,255	66,485	722	-549	173	0%
Lower Hamilton	270,795	165,549	436,344	335,290	181,685	516,975	64,495	16,136	80,631	18%
Upper Hamilton	177,216	56,179	233,395	188,328	58,952	247,280	11,112	2,773	13,885	6%
Mount Hope / AEGD	13,660	18,546	32,206	6,715	15,092	21,807	-6,945	-3,454	-10,399	-32%
Glanbrook	27,000	10,141	37,141	9,233	4,487	13,720	-17,767	-5,654	-23,421	-63%
Stoney Creek	170,466	49,823	220,289	114,813	38,600	153,413	-55,653	-11,223	-66,876	-30%
Binbrook	14,960	2,000	16,960	14,960	2,000	16,960	0	0	0	0%
Total in Urban Area	**787,458**	**352,590**	**1,140,048**	**785,210**	**351,287**	**1,136,497**	**-2,248**	**-1,303**	**-3,551**	**0%**
Rural	32,913	7,641	40,554	35,421	8,928	44,349	2,508	1,287	3,795	9%
Total	**820,371**	**360,231**	**1,180,602**	**820,631**	**360,215**	**1,180,846**	**260**	**-16**	**244**	**0%**

The population and employment growth comparison for the two scenarios has been graphically presented in the following maps:

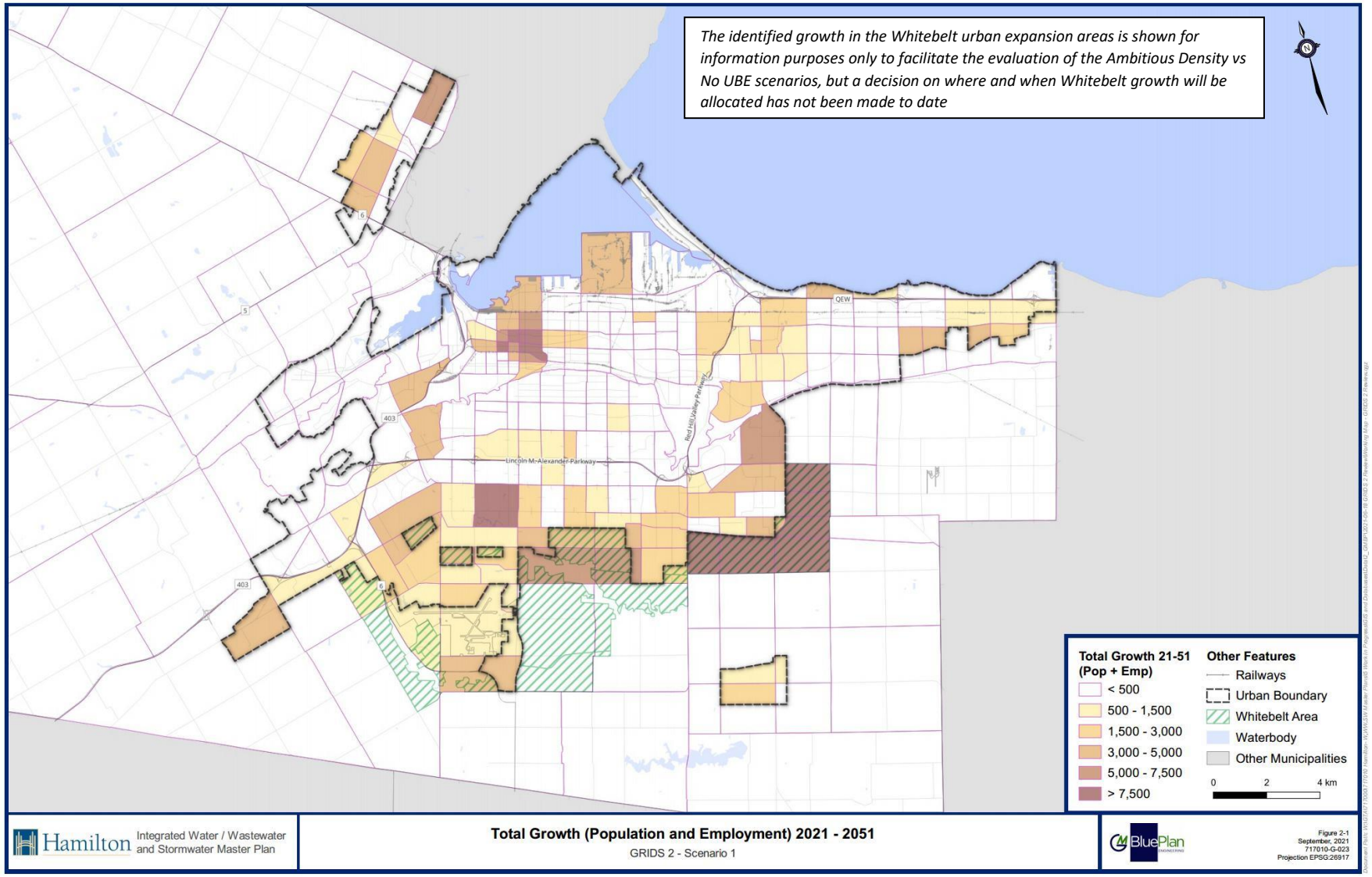

Figure 2-1 Ambitious Density Scenario 1 – Total Growth from 2021 to 2051

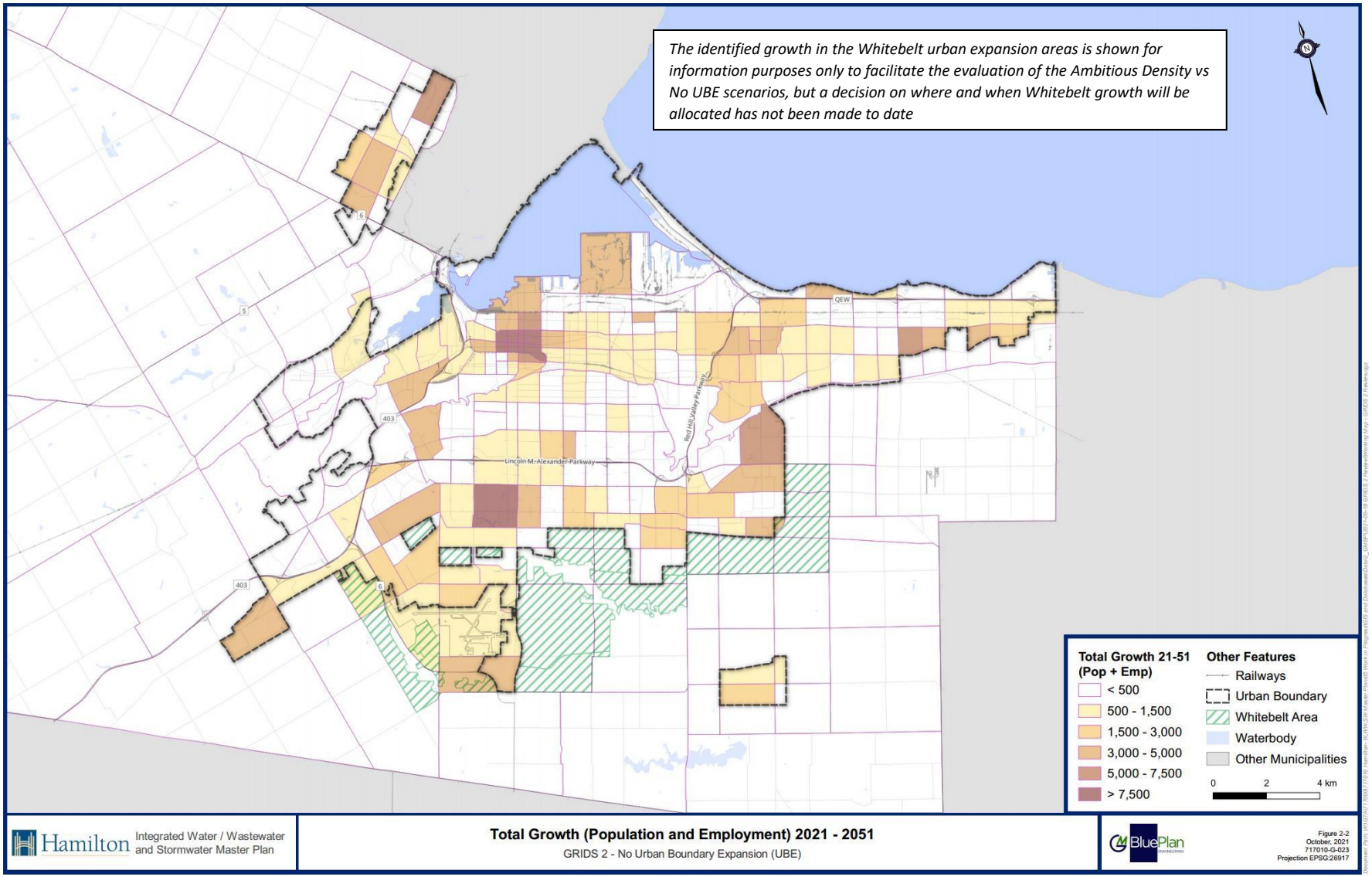

Figure 2-2 No Urban Boundary Scenario – Total Growth from 2021 to 2051

Overall, the largest differences in growth between the Ambitious Density and No UBE Scenarios is limited to the significant decrease in growth in the Greenfield areas, outside of the existing Urban Boundary, and the significant increase in growth within the Downtown Core and the eastern extents of Stoney Creek into Lower Hamilton, with some additional infill and intensification within the Upper Hamilton community under the No UBE scenario.

Figure 2-3 provides a graphic representation of the increase or decrease in growth throughout the City when comparing the Ambitious Density Scenario to the No UBE Scenario.

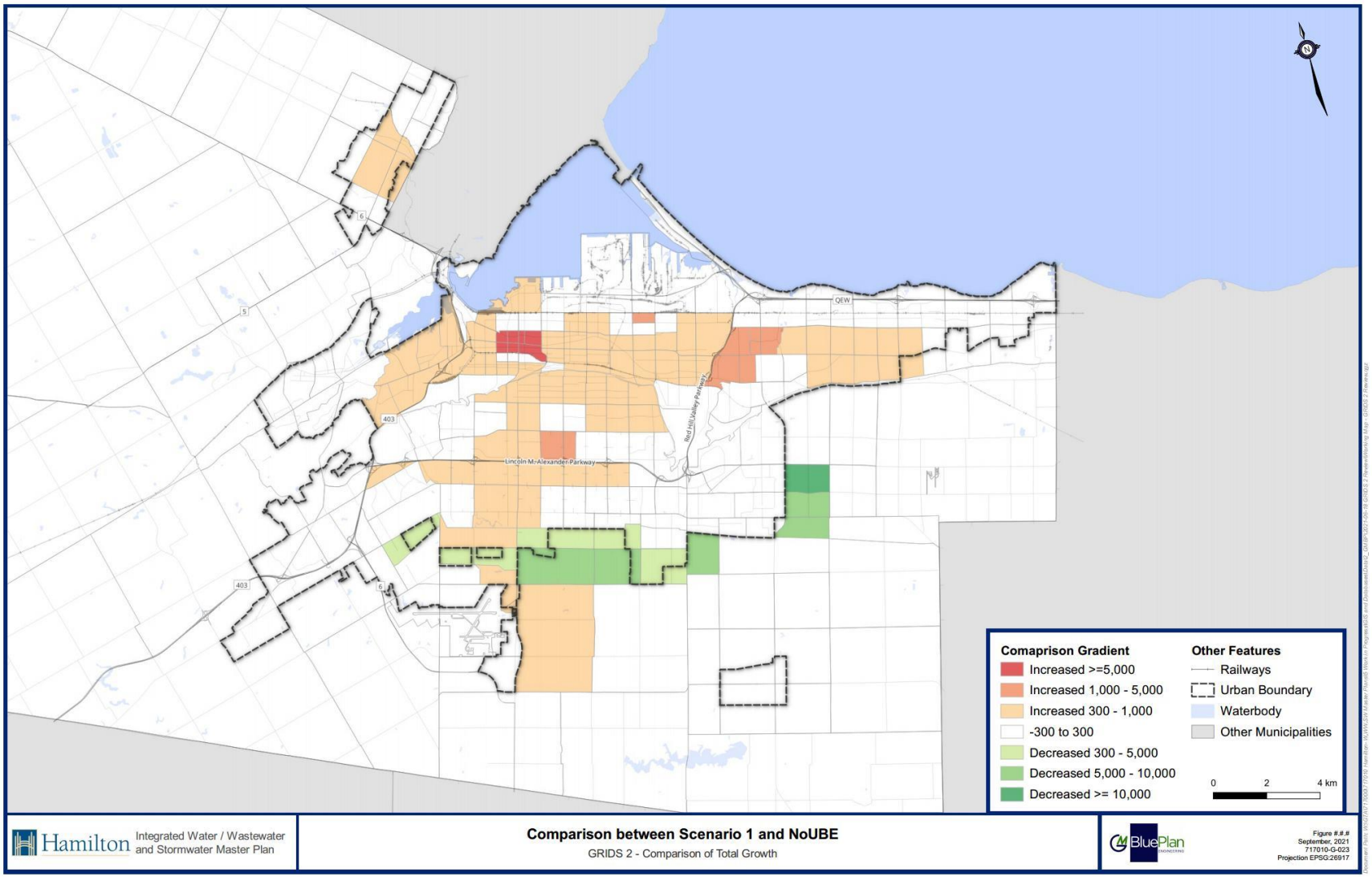

Figure 2-3 Total Growth Comparison Between Ambitious Density Scenario 1 and No UBE Scenario

3. ANALYSIS METHODOLOGY

3.1 Water/ Wastewater / Stormwater

3.1.1 Master Plan Criteria

The Master Plan Team completed a review of the existing design criteria as part of the Master Plan update, similar to previously completed Master Plans. Detailed assumptions, factors and criteria can be found in Technical Memo #4 (Water and Wastewater) and Technical Memo #5 (Stormwater) which summarizes the completed design criteria review and confirms the relevant design criteria to be used as a basis for the Master Plan. The focus of the design criteria review was to assess the residential and employment water demand consumption and wastewater flow generations to ensure that the projections are accurate and reflect new trends to support decision making for the sizing and timing of future infrastructure including pipes and facilities.

The following sub-sections provide summary tables of the recommended water, wastewater, and stormwater design criteria

Water Demand Criteria

Based on a review of City of Hamilton production, billing, and SCADA data (further detailed in Technical Memo #4), the following table presents a summary of the recommended Master Plan Water Design Criteria to be applied to new growth.

Table 3-1 Water Demand Design Criteria

Per Capita Demand Criteria	
Average Day Demand – Residential (L/person/d)	300
Average Day Demand – Employment (L/employee/d)	260
Max Day Peaking Factor	1.9
Peak Hour Peaking Factor	3.0
System Design Criteria	
Pumping – Firm Capacity	Firm Capacity is defined as the capacity with the largest pump out service
Pumping – Requirements	• A pressure district with no storage, floating or inground, must receive the greater of Maximum Day Demand (MDD) + Fire Flow (FF) or Peak Hour Demand (PHD) from the upstream pressure district and supply the greater of MDD+FF or PHD to the downstream pressure district • A pressure district with pumped storage only must receive MDD from the upstream pressure district, as peak flows can be managed through the reservoir, and supply the greater of PHD or MDD+FF to the downstream pressure district; further, pumped storage must not float the upstream pressure district • A pressure district with floating storage must receive MDD from the upstream pressure district and supply MDD to the downstream pressure district as peak flows can be managed by the floating storage

Storage	Provide Ministry of the Environment Conservation and Parks (MECP) Storage requirements within a given zone (equalization, fire, and emergency storage)
Distribution – Conveyance	Convey larger of peak hour or max day plus fire
Distribution – Target Pressure	40 psi – 100 psi
Treatment	• When flows reach 80% of plant capacity, the planning process for plant expansion will be flagged • When 90% of plant capacity has been reached, expansion should be completed

Wastewater Flow Criteria

Based on a review of historical wastewater treatment plant flow trends, population and Billing Data, Industry Design Criteria, F-5-5, Combined Sewer Overflow (CSO) and Hamilton Harbor Remedial Action Plan (HHRAP) criteria (further detailed in Technical Memo #4), the following table presents a summary of the recommended Master Plan Wastewater Design Criteria for new growth.

Table 3-2 Wastewater Design Criteria

Criteria	2018 Master Plan
Average Dry Weather Flow – Residential (L/person/d)	300
Average Dry Weather Flow – Employment (L/employee/d)	260
Peaking Factor	Babbitt Formula
Extraneous Flow Allowance	0.4, 0.6[1]
Pumping – Firm Capacity	Firm Capacity is defined as the capacity with the largest pump out service
Treatment	• When flows reach 80% of plant capacity, the planning process for plant expansion will be flagged • When 90% of plant capacity has been reached, expansion should be completed
Design Storms	2 yr-24 hr SCS, 5 yr-6hr SCS
Conveyance Upgrade Trigger – Separated	q/Q >0.75 and HGL <1.8 m below ground under 5yr Design Storm
Conveyance Upgrade Trigger – Combined	q/Q >0.85 and HGL <1.8 m below ground under 5yr Design Storm

(1) An infiltration factor of 0.6 L/ha/s where no storm sewers, or shallow storm sewers which require weeping tiles of dwellings to be drained by sump pump

Stormwater Criteria

Based on a review of the City's Stormwater Management Policies (as per Technical Memorandum #5 and subsequent policy updates completed in May 2020), the following table presents a summary of the key stormwater design criteria guiding growth management. Reference should be made to the preceding documents (as well as the City's most current Comprehensive Development Guidelines and Financial Policies Manual) for additional specifics.

In addition to the preceding, policy updates (May 2020) re-affirmed City support for Low Impact Development Best Management Practices (LID BMPs), subject to the completion of site-specific studies. LID BMPs (and retention of the first 5 mm of rainfall) was supported for Industrial/Commercial/Institutional (ICI) lands specifically. Support for other lands (i.e. residential) may be supported on a case-by-case basis.

Criteria	Value
Storm Sewer (Minor System) Design Basis	1 in 5-year return period, 85% full flow capacity
Overland Flow (Major System) Design Basis	1 in 100-year return period 0 mm depth above crown (arterials), 150 mm depth above crown (other roads)
Stormwater Quality Controls	70% or 80% Average Annual Total Suspended Solids (TSS) Removal (depending on watershed) Treatment Train Approach (more than one treatment method)
Stormwater Erosion Controls	Extended Detention of the 25 mm storm event (24-hours) or Criteria as determined through Subwatershed Study
Stormwater Quantity Controls	Combined Sewer area: 100-year post-development peak flow to 2-year pre-development peak flow Separated Sewer area: post-development to pre-development peak flow control for 2-year to 100-year events

3.1.2 Desktop Level Analysis

A Framework for 'How Should Hamilton Grow?' was created by the City of Hamilton, in conjunction with Dillon Consulting, in response to the Council direction to evaluate a No UBE option as opposed to the Ambitious Density Growth Option. This framework does not evaluate 'where' or 'when' growth would occur, rather, it is intended to provide support information to assist Council in answering the question of whether or not an urban boundary expansion should proceed.

In response to this framework, a desktop analysis and review of impacts for both the no UBE and Ambitious Density Growth options was completed to address a single criterion regarding the ***potential for significant impacts to the existing or planned infrastructure within the City***. This desktop level analysis is a qualitative assessment, leveraging knowledge of areas across the City with existing constraints and opportunities, and did not include an analytical (i.e. modelling) evaluation of phasing options. High level calculations of water demand and wastewater flows were completed to identify general areas that could potentially be constrained and where these locations may differ between the two scenarios.

It should be noted that servicing strategy alternatives have not been fully developed at this time as models have not been loaded with growth for either scenario in order to determine specific potential areas of impact. As such, a list of projects has not been identified, resulting in a limited ability to generate high-level costing estimates for either scenario.

The results of this high-level assessment, detailed in the following sections, provides information regarding the comparative analysis between scenarios premised on infrastructure.

4. RESULTS AND SUMMARY

4.1 Water

4.1.1 Population and Employment Projections

Population and Employment Planning Projections were provided by the City for both the Ambitious Density Scenario and No UBE Scenario based on Traffic Survey Zones (TSZs). The growth identified in the TSZs is considered uniform throughout the parcel so the planning numbers could be easily allocated to the underlaying Pressure Districts across the City. The overall growth projected for 2051 is approximately 369,000 people and jobs or an increase of 48% from the existing population in 2021.

The following table provides the existing population and planning projections to 2051 by pressure district for both the Ambitious Density Scenario and the No UBE Scenario:

Table 4-1 Pressure District Population Projection Comparison

Pressure District		Ambitious Density			No Urban Boundary Expansion			Ambitious Density to No Urban Boundary 2051
	Existing 2021	2051	2021 - 2051	2021 - 2051	2051	2021 - 2051	2021 - 2051	
	Total	Total	Growth	% Growth	Total	Growth	% Growth	
1	223,998	290,841	66,843	30%	317,295	93,296	42%	+26,453
2	115,246	199,065	83,819	73%	253,328	138,082	120%	+54,263
3	12,168	14,235	2,067	17%	15,071	2,903	24%	+836
4	39,972	44,029	4,058	10%	48,806	8,834	22%	+4,776
5	96,616	121,343	24,727	26%	114,851	18,235	19%	-6,492
6	135,633	210,625	74,992	55%	192,825	57,192	42%	-17,800
7	22,795	94,949	72,154	317%	34,459	11,664	51%	-60,490
9	8	17	9	104%	17	9	104%	0
10	1,032	1,983	951	92%	1,983	951	92%	0
11	18,769	19,484	715	4%	19,792	1,023	5%	+308
12	6,805	7,069	264	4%	7,069	264	4%	0
13	668	700	33	5%	710	42	6%	+10
14	525	519	-6	-1%	519	-6	-1%	0
15	120	122	2	2%	122	2	2%	0
16	24,318	34,042	9,724	40%	36,041	11,723	48%	+1,999
17	2,575	2,566	-9	0%	2,708	133	5%	+142
18	43,075	59,476	16,401	38%	55,687	12,612	29%	-3,790
19	516	499	-17	-3%	499	-17	-3%	0
20	196	190	-6	-3%	190	-6	-3%	0
21	650	656	5	1%	671	21	3%	+16
22	3,594	3,648	54	2%	3,661	68	2%	+14
23	11,901	16,857	4,956	42%	16,857	4,956	42%	0
24	6,771	14,043	7,272	107%	14,043	7,272	107%	0
25	6,938	6,955	17	0%	6,955	17	0%	0

As can be seen from the data in Table 4-2Table 4-1, the following conclusions can be made regarding the key projected growth by pressure district in the Ambitious Density and No Urban Boundary Expansion scenarios:

Table 4-2 Projected Growth by Pressure District Summary

Pressure District	Ambitious Density Scenario Growth from 2021 - 2051	No Urban Boundary Expansion Scenario Growth from 2021 - 2051	Commentary
PD1	30% increase in growth	42% increase in growth	No UBE Scenario has slightly more growth demonstrating increased intensification
PD2	73% increase in growth	120% increase in growth	No UBE Scenario has significantly more growth demonstrating increased intensification
PD6	55% increase in growth	42% increase in growth	No UBE Scenario has slightly less growth due to the removal of certain urban boundary expansion areas
PD7	300+% increase in growth	51% increase in growth	No UBE Scenario has significantly less growth due to the removal of urban boundary expansion areas
PD16	40% increase in growth	48% increase in growth	No UBE Scenario has similarly high growth as the Ambitious Density Scenario
PD18	38% increase in growth	29% increase in growth	No UBE Scenario has slightly less growth due to the removal of certain urban boundary expansion areas
PD23	42% increase in growth	42% increase in growth	No UBE Scenario has similarly high growth as the Ambitious Density Scenario
PD24	100+% increase in growth	100+% increase in growth	No UBE Scenario has similarly high growth as the Ambitious Density Scenario

Other pressure districts not listed above are generally expected to experience growth (2021 to 2051) of less than 30% of the existing population in both the No UBE and Ambitious Density Scenarios.

Leveraging knowledge of the existing system, GMBP identified several areas of assessment to be analyzed at a desktop level, for both scenarios, in order to identify potential constraints and/or opportunities. For the water system, these areas of assessment were the water demands, storage requirements and pumping requirements.

4.1.1 Water Demands & Treatment Requirements

Overall water demands were calculated for 2051 using the "Starting Point Methodology". This means that, rather than using the 2021 GRIDS2 data and design criteria, the 2021 demands are based off of historical flow balance information that was used to update the hydraulic model in 2018. It should be noted that a comparison was conducted to ensure that the use of the "Starting Point Methodology" was suitable; Overall, the difference between the "Starting Point Methodology" and the "Design Criteria Methodology" was negligible in terms of average day demands. The main difference was in terms of maximum day demands and peak hour demands where the design criteria is noticeably more conservative than recent history. This is common practice for Master Planning, where it is beneficial to be slightly more conservative to account for the potential for higher peak demands than recent history due to drought conditions.

Regardless of the choice in methodology for identifying the baseline (2021) demands, the projected growth in water demand from 2021 to 2051 is identical for both the Ambitious Density and No Urban Boundary Expansion scenarios because both scenarios use the design criteria and total population growth. The increase in Average Day Demand from the existing baseline (2021) to 2051 was determined to be approximately 105 Mega Litres per Day (MLD) (from 226 to 331 MLD). This increase is consistent under both the Ambitious Density Scenario and No Urban Boundary Expansion Scenario. The calculated Maximum Day Demand is approximated to be increasing from ~364MLD to ~565 MLD.

Since the water production needs at the treatment plant level are the same in both the Ambitious Density and No Urban Boundary Expansion scenarios, it does not require further analysis since any infrastructure upgrades for treatment would be equivalent in both scenarios.

Table 4-3 identifies the water system demands for each Pressure District in the City.

Table 4-3 Water System Demands by Pressure District

Pressure District	2021 ADD (MLD)	2021 MDD (MLD)	Ambitious Density		No UBE	
			2051 ADD (MLD)	2051 MDD (MLD)	2051 ADD (MLD)	2051 MDD (MLD)
PD1	84.2	135.7	103.2	171.9	110.9	186.6
PD2	29.3	47.2	52.7	91.6	68.5	121.8
PD3	3.2	5.2	3.8	6.3	4.1	6.8
PD4	11.3	18.3	12.5	20.5	13.9	23.2
PD5	24.3	39.2	31.5	52.8	29.6	49.2
PD6	37.9	61.1	59.4	101.9	54.2	92.1
PD7	4.6	7.5	25.7	47.4	7.9	13.8
PD9	0.01	0.01	0.01	0.02	0.01	0.02
PD10	0.1	0.1	0.3	0.7	0.3	0.7
PD11	5.6	9.0	5.8	9.4	5.9	9.5
PD12	1.6	2.6	1.7	2.8	1.7	2.8
PD13	0.3	0.4	0.3	0.5	0.3	0.5
PD14	0.2	0.3	0.2	0.3	0.2	0.3
PD15	0.1	0.1	0.1	0.1	0.1	0.1
PD16	5.3	8.6	8.1	13.9	8.7	15.0
PD17	0.7	1.1	0.7	1.1	0.7	1.1

Pressure District	2021 ADD (MLD)	2021 MDD (MLD)	Ambitious Density		No UBE	
			2051 ADD (MLD)	2051 MDD (MLD)	2051 ADD (MLD)	2051 MDD (MLD)
PD18	10.5	17.0	15.1	25.6	14.0	23.6
PD19	0.1	0.1	0.1	0.1	0.1	0.1
PD20	0.05	0.1	0.05	0.1	0.05	0.1
PD21	0.1	0.2	0.1	0.2	0.1	0.2
PD22	1.0	1.6	1.0	1.7	1.0	1.7
PD23	2.2	3.6	3.7	6.4	3.7	6.4
PD24	1.2	1.9	3.3	5.9	3.3	5.9
PD25	2.0	3.2	2.0	3.2	2.0	3.2
Total	**226**	**364**	**331**	**564**	**331**	**565**

* Average Day Demand (ADD)
* Maximum Day Demand (MDD)

4.1.2 Storage Requirements

The storage requirements for each Pressure District were calculated individually for the 2021 baseline, 2031, 2041 and 2051 growth projections for the Ambitious Density Scenario phasing options. Fire, Equalization and Emergency Storage were summed to determine overall storage requirements in each pressure district using MECP suggested fire flow storage guidelines and the required equalization storage based on Maximum Day Demands.

In cases where some Pressure Districts (PDs) are supporting other Pressure Districts (e.g. PD16 providing storage for PD16, PD19, PD20 and PD24), an overall storage need was calculated to ensure that sufficient storage exists to cover its storage needs, as well as the storage needs for districts that it supports.

The following summarizes the governing pressure districts that were identified as having a storage deficit or limitation in 2051, while providing additional details about the pressure district and potential mitigation measures to minimize impacts.

Table 4-4 Water Storage Deficits / Limitations

Pressure District	Pressure District Comments / Background	Issues: Ambitious Density Scenario	Opportunities: Ambitious Density Scenario	Comparison with No Urban Expansion Scenario
6	• Large PD that only has pumped storage currently	• Existing storage (HDR05) has sufficient volume, but it is all pumped, which is a resiliency and operational challenge	• Should assess feasibility of adding floating storage to PD6 to improve operations and resiliency	• Similar deficit in No UBE scenario as per the Ambitious Density Scenario • Negligible difference between scenarios

Pressure District	Pressure District Comments / Background	Issues: Ambitious Density Scenario	Opportunities: Ambitious Density Scenario	Comparison with No Urban Expansion Scenario
7	• Does not support other PDs • "Closed" PD, but with pumped storage from HDR07	• Significant storage capacity deficit identified in 2051. • Growth driven. • Future deficit exists even if the planned 9-10ML ET is added to the existing storage volume.	• Opportunity to increase pumped storage in PD7 (in addition to the planned floating storage) • Potential opportunity to "borrow" from surplus storage capacity identified in PD5 (pumped storage).	• Deficit significantly smaller in the No UBE Scenario. • Currently planned 9-10 ML Elevation Tank (ET) and the existing pumped ground storage would be able to meet ultimate growth needs. • No UBE scenario avoids further growth-driven storage upgrades
10	• Also provides storage to PD 9 • Existing storage filled from Grimsby. Can float PD10 storage needs.	• Minor storage deficit identified due to growth to 2051.	• Deficit could be mitigated depending on supply / storage availability from Grimsby.	• Deficit is the same in No UBE scenario as per the Ambitious Density Scenario • No differences between scenarios
12	• Does not support other PDs • Existing storage (floating) provided by HDT12	• Small storage deficit identified, which is consistent from 2021 to 2051 (existing issue) • Not growth related	• Able to use surplus pump station capacity to "borrow/pump" storage from PD11 to PD12 • No change in future	• Deficit is the same in No UBE scenario as per the Ambitious Density Scenario • No differences between scenarios
18	• Large PD that only has pumped storage currently	• Existing storage is sufficient in volume, but it is all pumped, which is a resiliency and operational challenge	• Should continue to assess feasibility of adding floating storage to PD18 to improve operations and resiliency	• Deficit is the same in No UBE scenario as per the Ambitious Density Scenario • Negligible difference between scenarios
22	• Does not support other PDs • Existing storage (floating) provided by HDR00	• Storage deficit identified, which is consistent from 2021 to 2051 (existing issue) • Not growth related	• Opportunity to "borrow" surplus pumping and storage from PD11 and/or PD18	• Deficit is the same in No UBE scenario as per the Ambitious Density Scenario • No differences between scenarios
23	• Does not support other PDs • Existing storage (floating) provided by HDT23	• Storage deficit identified, which is a minor deficit in 2021, but increases by 2051 • Is growth related	• Solution could be embedded with PD7 storage solutions (e.g. partially pumped storage in addition to the ET).	• Growth in PD7 is lower under the No UBE Scenario which allows for the opportunity to pump PD7 surplus capacity to PD23 once the proposed ET is constructed in PD7.

Overall, the storage differences between Ambitious Density Scenario and No Urban Boundary Expansion Scenario are limited to the storage needs in PD7 and PD23. Generally speaking, the No Urban Boundary Expansion Scenario would require less storage capacity over the next 30 years than the Ambitious Density Scenario because the planned PD7 Elevated Tank would cover the ultimate PD7 & PD23 needs in the No Urban Boundary Expansion Scenario.

4.1.3 Pumping Requirements

The governing water demands were determined for each pressure district based on a detailed assessment of the total flow requirement for the individual pressure district plus the downstream flow requirements of other dependent pressure districts. The flow requirements depend on the available storage in each pressure district as follows:

- A pressure district with no storage, floating or inground, must receive the greater of Maximum Day Demand (MDD) + Fire Flow (FF) or Peak Hour Demand (PHD) from the upstream pressure district and supply the greater of MDD+FF or PHD to the downstream pressure district
- A pressure district with pumped storage only must receive MDD from the upstream pressure district, as peak flows can be managed through the reservoir, and supply the greater of PHD or MDD+FF to the downstream pressure district; further, pumped storage must not float the upstream pressure district
- A pressure district with floating storage must receive MDD from the upstream pressure district and supply MDD to the downstream pressure district as peak flows can be managed by the floating storage

The flow requirements are next compared with the available firm capacity of the pumping stations that supply the pressure district. The firm capacity of the pumping stations was determined based on the following criteria:

- The capacity of the pumping station with the largest unit out of service is used if the station supplies a pressure zone with adequate storage available for fire protection and balancing.
- The capacity of the pumping station with the two largest units (including the fire pump(s), if any) out of service if the pumping station serves a pressure zone that does not have adequate floating storage available and is the sole source of supply in the area.

Using this information, the pumping station capacity and the future pumping requirements were determined for each PD. Based on this assessment, the following pump capacity deficits or pumping limitation are identified and summarized in Table 4-5.

Note that pump station (PS) capacities are currently theoretical (based on the design flow and head of each pump). It is often the case that due to other limitations (transmission, etc.) or due to deterioration of the original pumps that pump capacity can be less than theoretical. These considerations will be made during later parts of the project (modelling) but are not able to be considered during this comparative desktop assessment.

Table 4-5 Water Pumping Station Deficits / Limitations

Pressure District	Pressure District Comments / Background	Issues: Ambitious Density Scenario	Opportunities: Ambitious Density Scenario	Comparison with No Urban Expansion Scenario
2	• PD2 also provides downstream supply towards PD3, PD11, PD12, PD16, PD17, PD19, PD20, PD21, and PD24. • PD has floating storage and a single PS.	• Demands are shown to increase noticeably with growth, resulting in a slight pumping deficit in 2051. • Current single PS is a resiliency and operational challenge.	• Potential to add a second pump station for added resiliency, while also helping to meet the future growth.	• Higher PD2 (and downstream) growth is identified in the No UBE scenario, which emphasizes the need for increased PD2 PS capacity.

Pressure District	Pressure District Comments / Background	Issues: Ambitious Density Scenario	Opportunities: Ambitious Density Scenario	Comparison with No Urban Expansion Scenario
5	• PD5 also provides downstream supply towards PD6, PD7, PD13, PD14, PD15, PD18, PD22, PD23, PD25. • PD has floating storage and two pumping stations for supply.	• Demands are shown to increase noticeably with growth, resulting in a slight pumping deficit in 2051. • Greenhill PS Analysis identified that pumps are operating below their design firm capacity, so there is potential for this deficit to be larger during operation.	• Upgrades likely required (as also identified in Greenhill PD5 Analysis). • Potential to make improvements (larger pumps, etc.) at both the existing PD5 PS facilities	• Noticeably less downstream growth resulting in a reduced 2051 capacity need in No UBE scenario. • Upgrades likely still required, but smaller in magnitude.
7	• PD7 currently uses pumped storage, so capacity must exceed MDD+FF / PHD. • Single PS currently • Also provides supply towards PD23.	• Significant growth in PD7 leads to pumping deficit by 2031, which becomes a large deficit in 2051. • Overall pumping strategy in PD7 will be linked with storage strategy for PD7 + PD23 since floating storage reduces need for full MDD+FF pumping capacity	• Potential to add a second pump station for added resiliency, while also being necessary to meet the future growth.	• Noticeably less PD7/PD23 growth in No UBE scenario • Minor deficit still identified in the No UBE scenario in 2051, but not likely to require a new PS.
16	• PD has floating storage and the primary PS (HD016) as supply. • PD16 also provides downstream supply towards PD19, PD20 and PD24.	• Moderate growth leads to a slight pumping deficit in the future.	• Potential to either increase capacity of the existing PS or could even consider other upgrades to improve resiliency from the HD016 PS to the PD16 service area.	• Deficit is the same as under the Ambitious Density Scenario. • No differences between scenarios
17	• PD has no storage so MDD+FF is required. • Current PS firm capacity is insufficient for MDD+FF • Class EA RFP was recently submitted related to this PS	• Significant deficit identified under existing conditions as well as in the future. • Deficit is not growth related and should be addressed during Class EA.	• New PS should include fire pumps and duty pumps to cover wide range of flow requirements.	• Deficit is the same as under the Ambitious Density Scenario. • No differences between scenarios
18	• PD does not have floating storage and is provided by a single PS. • PD18 also provides downstream supply towards PD13, PD14, PD15 and PD22.	• A pumping deficit is identified for both existing and future conditions. • Growth is occurring, but the deficit is not growth related. Deficit exists due to lack of floating storage and the need to have two pumps out of service for the firm capacity calculation.	• Various upgrade options exist to be considered • Consider adding floating storage to reduce needs for MDD+FF supply • Consider a secondary Pumping Station for improved resiliency	• Deficit is the same as under the Ambitious Density Scenario. • No differences between scenarios

Pressure District	Pressure District Comments / Background	Issues: Ambitious Density Scenario	Opportunities: Ambitious Density Scenario	Comparison with No Urban Expansion Scenario
21	• PD does not have storage and single pump station is designed with two duty pumps and two fire pumps.	• Overall, this PD seems OK as long as design criteria considers taking one fire pump and one duty pump out of service for firm capacity. • Area does not experience growth.	• Facility seems suitable. One duty pump can meet 2051 PHD. One fire pump closely matches MDD + Fire need.	• Same as under the Ambitious Density Scenario. • No differences between scenarios

Overall, the pump capacity differences between Ambitious Density Scenario and No Urban Boundary Expansion Scenario are limited to the pumping needs in PD2, PD5 and PD7. Both scenarios do require PD2 PS upgrades, but the need for capacity upgrades in PD2 is increased for the No UBE scenario. This enhances the need of adding a second PS for growth, but with the added value of increased resiliency. Both PD5 and PD7 have noticeably less growth in the No UBE scenario, which would require less upgrades, or at least upgrades that are smaller in magnitude than the Ambitious Density Scenario.

4.2 Wastewater

Similar to the comparative analysis between the two scenarios completed for water, an assessment and analysis of the potential impacts on the existing and planned City infrastructure was completed for the wastewater system.

4.2.1 Population and Employment Projections

Population and Employment Planning Projections for both the Ambitious Density Scenario and Urban Boundary Expansion Scenario based on Traffic Survey Zones (TSZs) were compared, considering the overall wastewater subcatchments in the City, as well as specific Sewage Pumping Station (SPS) drainage areas to determine the high-level impacts of varying growth on the system. The following sections detail the existing population and growth projections to 2051 for both scenarios, considering the wastewater subcatchments and Sewage Pump Stations, and the resulting wastewater flows.

4.2.2 Wastewater Flows and Treatment Needs

The projected total growth in wastewater flows from 2021 to 2051 is the same for both the Ambitious Density and No Urban Boundary Expansion scenarios because both scenarios use the City's design criteria and total population growth. Similar to water demands and treatment requirements, the wastewater flows experienced at the treatment plant level will be the same under both scenarios, resulting in no further comparative analysis required for treatment as it is not considered a differentiator at this level of analysis.

4.2.3 Subcatchment Area Flow Comparison

The City of Hamilton has seven primary wastewater subcatchments:

1. Eastern Sanitary Interceptor (ESI)
2. Western Sanitary Interceptor (WSI)
3. Dundas WWTP
4. Red Hill Creek Sanitary Interceptor (RHCSI)
5. Fennell Trunk
6. Waterdown (Former Waterdown Wastewater Treatment Plant, now Borer's Creek Trunk)
7. Future Dickenson / Upper Centennial Trunk Sewer Catchment

The WSI Catchment receives flows from the Dundas Wastewater Treatment Plant (WWTP) Catchment as well as part of the Fennell Trunk Catchment. The Fennell Trunk Catchment conveys flows to the Western Interceptor as well as to the Red Hill Valley Trunk Sewer. Flow splits to downstream catchments are controlled through a combination of dynamic and static flow controls, including the City's Real Time Control (RTC) structures/facilities.

The RHCSI conveys flows from areas located across the escarpment, including Binbrook, and discharges to the Red Hill Creek Trunk Sewer. Ahead of construction of the proposed Dickenson and Centennial Trunk Sewers, development flows from the Airport Employment Growth District (AEGD) will be conveyed (via the Twenty Road SPS) to the RHCSI Catchment and the Red Hill Trunk Sewer.

The ESI Catchment does not convey flows from any upstream trunk level catchments. The ESI outlets directly to the Woodward Wastewater Treatment Plant.

The Future Dickenson / Upper Centennial Trunk Sewer Catchment includes planned and recently constructed sewer infrastructure intended to convey flows from future development from significant growth areas including the AEGD

and Elfrida area. This catchment will outlet to the ESI just upstream of the Woodward WWTP until the Lower Centennial Trunk Sewer is constructed – with future outlet to the RHCSI or directly to the Woodward Avenue WWTP to be considered.

Wastewater catchments are shown in Figure 4-1.

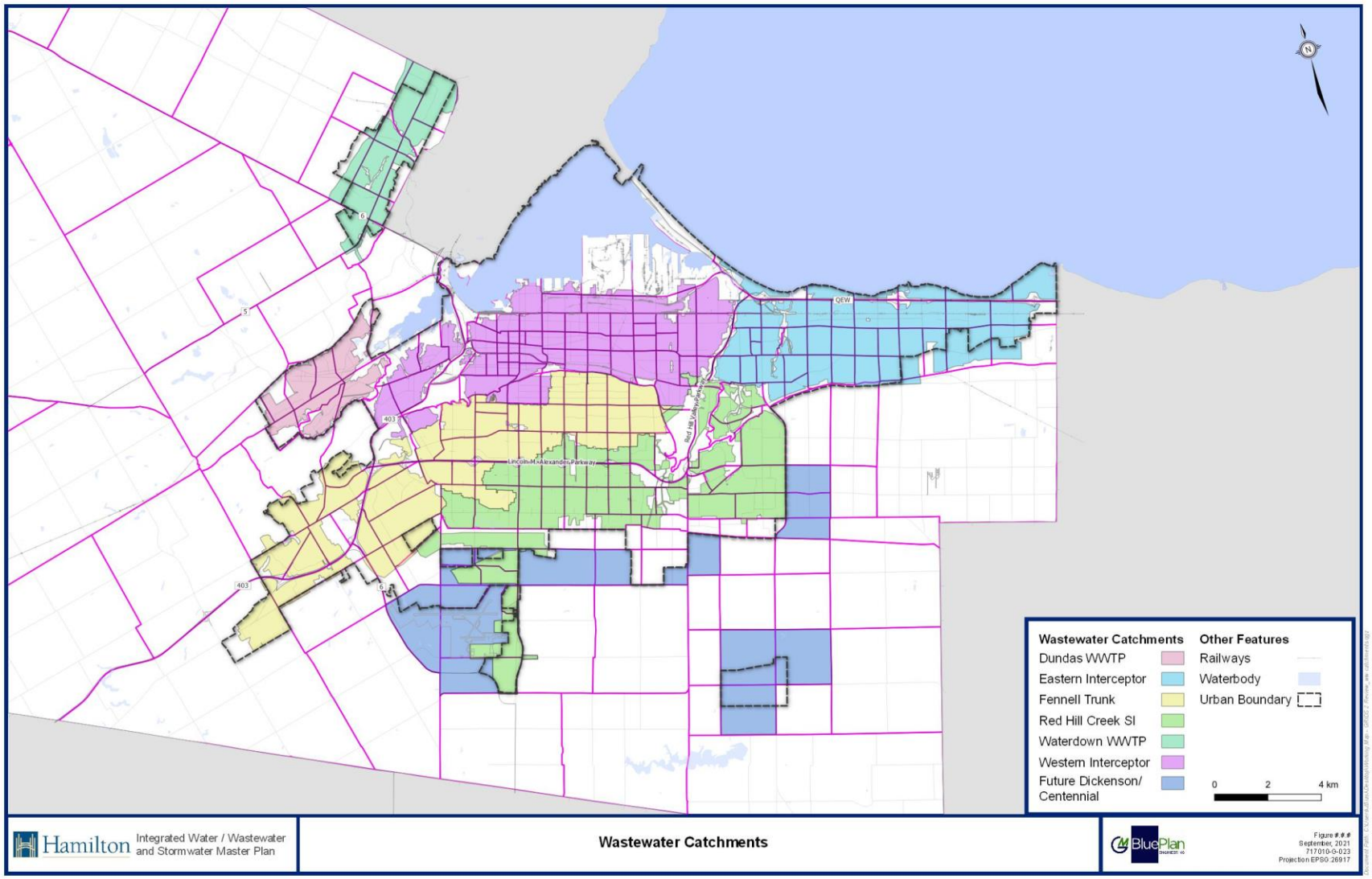

Figure 4-1 City of Hamilton Wastewater Catchments

Existing and 2051 projected populations by wastewater catchment area under the Ambitious Density and No UBE planning scenarios are summarized in Table 4-6.

Table 4-6 Wastewater Subcatchment Populations

Wastewater Catchment	Catchment Populations							
	Ambitious Density (Persons Plus Jobs)			No UBE (Persons Plus Jobs)			Change from Ambitious Density to No UBE	
	2021	2051	2051 - 2021	2021	2051	2051 - 2021	2051 PPJ	2051 % Increase
Eastern Interceptor	103,416	140,376	36,960	103,416	156,513	53,097	16,137	44%
Dundas WWTP	29,232	30,541	1,309	29,232	30,961	1,729	420	32%
Red Hill Creek SI	130,265	179,734	49,469	130,265	181,075	50,810	1,340	3%
Western Interceptor	282,968	402,840	119,872	282,968	473,485	190,516	70,644	59%
Fennell Trunk	161,112	189,463	28,352	161,112	193,339	32,228	3,876	14%
Waterdown	33,638	50,593	16,955	33,638	52,592	18,954	1,999	12%
Future Dickenson / Upper Centennial Trunk	20,637	129,753	109,116	20,637	36,693	16,056	-93,060	-85%

Growth as a percentage increase for both the Ambitious Density and No UBE scenarios are summarized in Table 4-7.

Table 4-7 Projected Growth by Wastewater Catchment Summary

Wastewater Catchment	Ambitious Density Scenario Growth from 2021 - 2051	No Urban Boundary Expansion Scenario Growth from 2021 - 2051	Commentary
Eastern Interceptor	36% increase in growth	51% increase in growth	Significant growth in the ESI Catchment Area under both Ambitious Density and No UBE Scenarios with more intensification primarily located east of the RHVP near Queenston Road
Dundas WWTP	4% increase in growth	6% increase in growth	Minimal growth under both scenarios, with marginally more growth projected under No UBE scenario (less than 500 Persons Plus Jobs (PPJ))
Red Hill Creek SI	38% increase in growth	39% increase in growth	Significant growth in the RHCSI Catchment Area under both Ambitious Density and No UBE Scenarios with minimal difference between growth scenarios.

Wastewater Catchment	Ambitious Density Scenario Growth from 2021 - 2051	No Urban Boundary Expansion Scenario Growth from 2021 - 2051	Commentary
Western Interceptor	42% increase in growth	67% increase in growth	Most of the City's planned growth is projected for the WSI Catchment Area under both Ambitious Density and No UBE Scenarios • Significant intensification located in area north of Hamilton GO Station (between Queen and Wellington)
Fennell Trunk	18% increase in growth	20% increase in growth	Significant growth projected for the Fennell Trunk Catchment Area under both scenarios • Increased intensification under No UBE distributed across TSZs within catchment area
Waterdown	50% increase in growth	56% increase in growth	Significant growth projected for the Waterdown Catchment Area under both scenarios • Increased intensification under No UBE distributed across TSZs within catchment area
Future Dickenson / Upper Centennial Trunk	529% increase in growth	78% increase in growth	Significant growth projected for the AEGD and east areas and Elfrida development areas located outside of Urban Boundary contributing to higher growth under Ambitious Density scenario

Leveraging knowledge of the existing system, GMBP identified several areas of assessment to be analyzed at a desktop level, for both scenarios, in order to identify potential constraints and/or opportunities. For the wastewater system, these areas of assessment were the treatment, conveyance and pumping capacity and the impact on combined sewer overflow (CSO) facilities and risk of increase of CSO occurrences and basement and surface flooding.

The increase / decrease in peak wastewater flows from Ambitious Density to No UBE was also considered in terms of equivalent sewer size required to convey additional intensification flows. Conceptual sewer sizes for the flow differences were calculated for each Wastewater Catchment based on the City's design criteria and an assumed minimum slope of 0.20% (based on minimum flow velocities and constructability considerations).

Using the population projections for both scenarios, and the design criteria discussed in Section 2, the peak wastewater flows were calculated for the primary catchments for the Ambitious and No UBE scenarios. Design flows for the catchments are summarized in Table 4-8.

Table 4-8 Wastewater Subcatchment Flows

Wastewater Catchment	2051 – 2021 Growth					
	Ambitious Density 2051		No UBE 2051		Increase/Decrease (From AD to No UBE)	
	PDWF	PWWF	PDWF	PWWF	PDWF/PWWF	Equivalent Sewer Dia.[1]
Eastern Interceptor	933	2,364	1,043	2,473	+158	525mm
Dundas WWTP	260	613	263	616	+7	150mm/200mm

Wastewater Catchment	2051 – 2021 Growth					
	Ambitious Density 2051		No UBE 2051		Increase/Decrease (From AD to No UBE)	
	PDWF	PWWF	PDWF	PWWF	PDWF/PWWF	Equivalent Sewer Dia.[1]
Red Hill Creek SI	1,207	3,695	1,216	3,704	+22	250mm
Western Interceptor	2,647	4,146	3,125	4,623	+512	750mm
Fennell Trunk	1,273	3,126	1,300	3,153	+45	300mm/375mm
Waterdown	387	1,150	400	1,163	+30	300mm
Future Dickenson / Upper Centennial Trunk	870	3,243	293	2,666	-640/-1000	975mm

[1]Note: Sewer sizes are shown for illustration of increase in flow between scenarios only and do not represent upgrade recommendations
**Peak Dry Weather Flow (PDWF)*
**Peak Wet Weather Flow (PWWF)*

For the wet weather flow (WWF) calculations for this assignment, the future developable area was based on the areas from the TSZ contributing to inflow and infiltration was assumed to be the same for the existing catchment areas. A conservative estimate of ~1200 Ha. of developable land outside of the Urban Boundary was estimated for the calculation of the Future Dickenson / Upper Centennial Trunk WWF.

The equivalent of an additional 525mm diameter sewer required to service the ESI Catchment under the No UBE scenario as well as the 750mm diameter sewer required to service the WSI Catchment are considered the most significant.

As shown on Figure 2-3 in Section 2.3, much of the increased intensification for both the ESI and WSI Catchment Areas is concentrated within smaller areas of the catchment. The following sections include analysis of the increased intensification areas located within the WSI, ESI and RHCSI catchments as well as the decreased growth within the Dickenson / Upper Centennial Trunk catchment.

It is anticipated that the marginally increase in intensification in the Dundas WWTP and Waterdown WWTP Catchment Areas can be accommodated without the requirements for significant additional infrastructure. Infrastructure upgrades will be required to service growth within the Waterdown catchment; however, it is assumed that similar infrastructure will be required to service growth under the Ambitious Density scenarios as well as the No UBE scenario as growth numbers for both scenarios are similar.

Increased intensification in the Fennell Trunk Catchment Area under the No UBE scenario is generally well distributed across the catchment and it is also anticipated that future infrastructure requirements would be similar for both Ambitious Density and No UBE scenarios in the Fennell catchment. Although increased intensification flow is expected to incrementally reduce downstream sewer capacity, there is increased risk that available capacity within existing sewers is reduced to below sewer upgrade triggers based on City standards.

Western Sanitary Interceptor

The change to the No UBE planning scenario will significantly increase growth within the WSI Catchment. The Western Interceptor under the No UBE scenario will also convey flows from the slightly increased projected population in the Dundas catchment and a portion of the increased flows from the increased population in the Fennell Trunk Catchment.

Based on a desktop analysis of the City's wastewater system, the WSI is currently experiencing capacity constraints in the existing system within the Downtown Core. These constraints will require sanitary infrastructure upgrades under the Ambitious Density scenario and additional infrastructure or larger scale upgrades under the No UBE scenario due to an increased amount of allocated growth. The estimated flows that will be experienced within the downtown core growth under the No UBE scenario could result in an equivalent 750mm diameter sewer section to manage capacity constraints. Note that this 750 mm is a theoretical sewer size to accommodate flows from the No UBE which are over and above what would be required for conveying flow under the Ambitious Density Scenario. Both Scenarios will experience constraints, however, the additional growth and density in the downtown core results in the equivalent pipe diameter noted above.

Combined sewer overflow (CSO) facilities connected to the WSI include the Bayfront Park CSO Tank, James Street CSO Facility, Main/King CSO Tank, Eastwood Park CSO Tank, Wentworth/Rosemary CSO Gate, Brampton/Strathearne CSO Gate, Wellington/Burlington CSO Gate and Parkdale Wastewater Pumping Station. Increased growth flows to the WSI under the No UBE scenario will increase total flow under wet weather events and there will be resultant impacts to CSO facilities. CSO impacts are complex and are required to be evaluated utilizing detailed modelling that considers the City-wide system response to extreme wet weather events (including operation of the City's RTC facilities). CSO facilities' impacts and evaluation is discussed further in Section 4.2.5.

Increased growth within the WSI Catchment Area is most significant in the area generally bounded by Cannon Street to the north, Wellington Street/Claremont Access to the east, Hunter Street West/Rail Corridor to the south and Queen Street to the west. Within this area, an additional 45,264 PPJ are projected for 2051 under the No UBE scenario. This equates to 75% of the additional No UBE growth within the WSI Catchment Area, and approximately 410 L/s of additional peak wastewater flow. Additional conveyance capacity within the system equivalent to a new 675mm/750mm diameter would be required to effectively convey the 410 L/s peak flow difference from this area alone.

Existing trunk sewers that service the combined area include an extensive network of sub-trunk combined sewers with many connections to large diameter storm overflow relief sewers. There are existing combined trunk sewers running north along Bay Street, MacNab Street, James Street, Catharine Street and Wellington Street that take divergent flow paths with flow splits before outletting at various connection locations to the WSI. Some existing area trunk sewers have insufficient capacity to convey flows under the City's 2-year and 5-year design storms. Growth flows to this section of the system under both scenarios may further increase the risk of basement flooding as the existing sewer network is already over-capacity conveying wet weather flows. Infrastructure upgrades will be required to address constraints in both scenarios.

Eastern Sanitary Interceptor

Increased growth within the ESI catchment area is most significant in the area generally bounded by Barton Street East to the north, Stoney Creek/Lake Avenue to the east, Queenston Road/King Street East to the south and the Red Hill Valley Parkway to the west. Within this area, an additional 9,190 PPJ are projected for 2051 under the No UBE

scenario. This equates to nearly 70% of the additional No UBE growth within the ESI Catchment Area, and approximately 120 L/s of additional peak wastewater flow. Additional conveyance capacity within the system equivalent to a new 450mm diameter is required to effectively convey the 120 L/s peak flow difference.

There are separated sanitary and storm sewers in the area with 375mm – 525mm diameter sanitary sewers that run north along Nash Road, Kenora Avenue and Centennial Parkway ultimately outletting to the ESI. Existing modelling for the area shows available capacity within the sanitary sewers with significant increase in flows under the 2-year and 5-year design storm events (especially for a separated system). The capacity of separated sewers, sized for sanitary flows only, will be more sensitive to increases in growth flows than in the combined areas where wet weather flow is the primary contributor to peak flows.

Additional growth flows of 80 L/s were already projected for this area surrounding Queenston Road under the Ambitious Density Scenarios and there is potential that similar infrastructure upgrades will be triggered by both the Ambitious Density scenario as well as the No UBE scenario. The triggered infrastructure upgrades will be required to be larger to accommodate the No UBE scenario flows, with some risk that sections of existing infrastructure has available capacity to accommodate growth under the Ambitious Density Scenario but will be triggered for upgrades to convey flows from increased intensification under the No UBE scenario.

Existing downstream sewers along Nash Road, Kenora Avenue and Centennial Parkway servicing the increased intensification area run for up to two kilometres before connecting to the ESI. Upstream development has the potential to trigger upgrade sewer requirements across the full length of the downstream sewer.

Red Hill Creek Sanitary Interceptor

Peak flows in the RHCSI Catchment Area are not projected to significantly change from the Ambitious Density scenario to the No UBE scenario. There is an increased intensification area in the RHCSI catchment generally focused near the boundary of the RHCSI and Fennell Trunk catchment areas on either side of the Lincoln Alexander Parkway, with the highest increase in No UBE growth in the area from Upper Wellington Street to east of Upper Wentworth Street, south of Mohawk Road. It is anticipated that most of the growth in this area will discharge to separated local sanitary sewers and ultimately connect to the existing Red Hill sub-trunk sewer. Area local sewers as well as the 525mm diameter sanitary sub-trunk sewer running south along Upper Wentworth / east along Limeridge Road connecting to the Red Hill Trunk have available conveyance capacity under the City's 2-year and 5-year design storm and are expected to be adequately sized to convey the additional 45 – 75 L/s peak sanitary flow under the respective Ambitious Density and No UBE scenarios.

Future Dickenson / Centennial Trunk Sewer Catchment Areas

A Future Dickenson / Centennial Trunk Sewer Catchment was established as part of the analysis to assess the impact on recently constructed and future under-design and planned infrastructure primarily intended to service the AEGD and Elfrida growth areas as well as relieve some flow from the combined RHCSI Catchment Area and reduce CSO bypass occurrences and volumes.

Peak flows to the future Dickenson and Centennial Trunk Sewer Catchment Areas are expected to significantly decrease under the No UBE scenario, with the elimination of growth areas outside of the City's Urban Boundary.

The Dickenson Road Trunk Sewer is a deep 1200mm – 1500mm diameter trunk sewer currently under design. The new trunk sewer is proposed to convey sanitary flows from the AEGD as well as areas to the east, primarily between Dickenson Road East/Golf Club Road and the existing Urban Boundary, generally located north of Twenty Road East.

The Dickenson Road Trunk Sewer will outlet into the recently constructed Upper Centennial Trunk Sewer at the intersection of Golf Club Road and Regional Road 56.

The Upper Centennial Trunk Sewer is a deep 1800mm – 2400mm diameter trunk sewer that has been recently constructed along Upper Centennial Parkway from Golf Club Road to King Street. The Upper Centennial Trunk Sewer currently outlets to the existing 1500mm diameter trunk at King Street East sewer that runs through the Bow Valley and along Lake Avenue and ultimately to the ESI. The new Upper Centennial Trunk Sewer is planned to connect to a future twinned Lower Centennial Trunk Sewer at King Street East that will discharge into a downstream section of the RHCSI or directly to Woodward Avenue WWTP. A Municipal Class Environmental Assessment (EA) has not yet been initiated for the Lower Centennial Trunk Sewer and alternative routing, outlets and sizing has not yet been evaluated under any project specific studies.

There are areas of significantly decreased growth within the Future Dickenson / Centennial Trunk Sewer Catchment Areas, located outside of the City's current Urban Boundary.

The large area generally bounded by the Urban Boundary (north of Twenty Road East) to the north, Fletcher Road to the east, Dickenson Road East/Golf Club Road to the south and Upper James Street to the west will see a reduction of nearly 30,000 PPJ going to the No UBE scenario from the Ambitious Density scenario. This equates to a peak wastewater flow of 600 L/s – 700 L/s (including projected inflow and infiltration for the nearly 1400 Ha. with potential to be developed). The reduction in peak flow roughly equates to 15 to 30 percent of the proposed 1200mm – 1500mm diameter Dickenson Trunk Sewer.

In the east Elfrida area generally bounded by Mud Street East to the north, Second Road East to the east, mid-block between Regional Road 20 and Golf Club Road to the south and Regional Road 56 to the west. More than 30,000 Persons Plus Jobs (PPJ) are projected for this area under the Ambitious Density scenario. This equates to a peak wastewater flow of 400 – 450 L/s (including projected inflow and infiltration) to be outletted to the recently constructed 1800mm-2400mm dia. Upper Centennial Trunk Sewer.

The Upper Centennial Trunk Sewer has been constructed to accommodate growth on Hamilton Mountain according to the GRIDS planning projections. The Dickenson Trunk Sewer is currently under detailed design based on conveyance capacity to meet projected growth within the upstream AEGD catchment with potential to accommodate additional growth from other outlying areas. At the time of design of the Dickenson Sewer, the Ambitious Density Scenario had not been fully developed. The Dickenson Sewer will be constructed by a combination of open-cut and trenchless methodologies. The open cut section of 1200mm diameter sewer will run from Upper James Street to west of Miles Road with the remaining downstream section tunnelled to Regional Road 56. Although the Dickenson Sewer will likely be able to convey growth flows in line with the Ambitious Density Scenario, it is not anticipated that the Sewer would be re-designed for *reduction* in flows if the No UBE Scenario is carried forward. The future Dickenson Trunk Sewer / Centennial Trunk Sewer has also been identified as an essential project to alleviate future AEGD growth flows from the Red Hill Valley Trunk Sewer and CSO and reduce CSO volumes and occurrences related to capacity issues within the Red Hill Valley Trunk system.

4.2.4 Sewage Pump Station Drainage Area Flows

Existing pumping stations capacity to pump growth flows from the Ambitious Density scenario and the No UBE scenario was reviewed across the City. The City's wastewater model was used to complete upstream traces of the existing pumping station areas and 2051 flows were calculated based on planning projections and City design standards. Growth flows were compared to the available pumping station firm capacity information (from available

existing MECP Environmental Compliance Approvals (ECAs) and the City's wastewater model). Existing pumping stations were found to have capacity to pump 2051 flows under the Ambitious Density and No UBE scenario. This will be reviewed in more detail as the Master Plan wastewater evaluation is progressed to ensure that any existing stations with known capacity issues are accurately modelled.

For this analysis, the relative evaluation of projected flows difference between Ambitious Density and No UBE was the primary consideration (in order to understand if there were pumping stations where there was potential that only one scenario growth flows would trigger pumping station upgrades). No existing pumping stations were shown to have significantly different flows under the Ambitious Density compared to the No UBE scenario.

Desktop analysis of the wastewater pumping requirements at key stations shows that there is minimal difference between the Ambitious Density and No UBE scenarios and there is not expected to be a significant change to required pumping infrastructure.

The current Twenty Road SPS upgrades project is a current project intended to service future growth in the AEGD. The pumping station upgrades project is an interim growth servicing measure ahead of construction of the Dickenson Trunk Sewer. The station upgrade to a firm capacity to 1,000 L/s has been designed to accommodate significant growth within the AEGD. After commissioning of the Dickenson Trunk Sewer, flows to the Twenty Road SPS from the AEGD will be reallocated to the Dickenson Road Trunk Sewer and the reduction of flows to the Twenty Road SPS has already been planned for.

4.2.5 Combined Sewer Overflows

Increase of growth flows to combined sewer catchments WSI and RHCSI will impact CSO volumes under extreme wet weather events. However, evaluation of CSO volume and number of bypass occurrences at the City's CSO facilities is complex and a desktop analysis cannot determine the increase to number of bypass occurrences at CSO facilities without more detailed modelling. Detailed modelling includes consideration for City-wide operating procedures and RTC facilities and procedures. Increase of growth flows to the WSI and RHCSI catchment areas under the No UBE scenario can be potentially mitigated through city-wide initiatives including implementation of Flooding and Drainage Master Servicing Study and Pollution Prevention and Control Plan (PPCP) recommendations and RTC improvements. At a minimum, future upgrades of CSO facilities will be required to consider additional flows under the No UBE scenario.

4.3 Stormwater

4.3.1 Land Uses

As noted in the Water and Wastewater sections (Section 4.1 and 4.2) data from the City's planning department has been provided in Traffic Survey Zones based on anticipated population changes in these large block areas. Across the City there are 265 TSZs at an average size of about (400 ha +/-), with 195 TSZ in the separated area and the balance in the combined area. The issue for the stormwater assessment relates to both scale and form of these data. The catchments in the current drainage modelling are much more resolute than the TSZ, hence it is not practically feasible to identify where in the TSZ the intensification would be expected to occur, and this is understandably important when evaluating the impacts to local drainage systems. As noted by City Planning staff, it is unlikely that low density single family residential will be converted to higher densities and rather most of this redevelopment will be in medium to high density uses and on vacant lands. That said these data are not readily available. Another issue is the form of the data expressed as population changes. For stormwater assessments the human density in an area is not

the key parameter and rather the lot coverage in hard surfaces under and existing and future land use scenario is more important as it relates to runoff potential (i.e., more hard surfaces more runoff).

The data/mapping provided by the City show potential areas for redevelopment under the Ambitious Density and No UBE scenarios. From dialogue with City staff, it is understood that for current planning purposes the spatial extent of redevelopment under the respective alternatives will be generally the same (no horizontal differences) and rather it is primarily the vertical extent of development that would be expected to change (i.e., number of stories of medium/high density residential buildings). Under this assumption the runoff characteristics of the two scenarios within the urban boundary (excluding greenfield areas) would be expected to be common, as would the expected impacts to the receiving infrastructure (i.e., trunk storm sewers).

Furthermore, given that the extent of impact from existing uses to future uses relates to cover (imperviousness) the amount of existing hard surfaces related to the existing uses is also important. Most of the areas cited for re-development have substantial impervious cover as the growth is directed to the City's nodes and corridors hence the net difference under an intensified use would be unlikely to be overly significant.

4.3.2 Impact Assessment

Premised on the foregoing, the high-level impact assessment for stormwater servicing has considered the three (3) main drainage systems for the two (2) land use scenarios – Ambitious Density and No UBE. The areas of potential impacts include the combined and separated systems in the existing built-up area of Hamilton, and the receiving network of streams in the lands external to the existing City limits associated with the greenfield growth. For the latter, greenfield growth has been considered in WhiteChurch, Elfrida, Twenty Rd. East and Twenty Rd. West.

Combined Service Area

As noted in Section 3.1, the management criteria for redevelopment in the Combined Service area in the City of Hamilton requires "over-control" whereby the 100-year post development runoff peak is controlled to the 2-year pre-development rate. The responsibility for these quantity controls rests with the development proponent. The intention in this regard is to reduce the rate of runoff to less than current conditions due in part to the management of CSOs as well as the general lack of gravity-based overland flow routes in the older part of the City (Downtown Core). The application of these criteria to redeveloping areas within the Combined Service area will in fact reduce flood risks from their exiting state, however for the reasons identified earlier, there is not anticipated to be any difference in the servicing requirements for the Ambitious Density vs. the No UBE scenarios. The City is currently conducting an update to the Flood and Drainage Management Servicing Study (FDMSS) which is separately identifying the need for public system improvements to the Combined Service Area. These works will improve the capacity of the system and lessen overall flood risks but as noted are not expected to change the management requirements for the respective planning scenarios – hence no impact to existing or planned drainage infrastructure. Notably the same cannot be assumed for the sanitary flows in these areas and given that much of the system is combined and much is expected to remain as a combined service area, the sanitary needs are expected to dictate the impacts for these areas.

The City also typically mandates stormwater quality controls be implemented for developments within the combined sewer service area despite the fact that low flows are directed to the wastewater treatment plant. The rationale is that such areas may undergo a sewer separation at some point in the future and should therefore have controls in place for that eventuality to avoid contributing untreated stormwater to a future separated outfall. Similarly, to the preceding, given that there is no expected change in overall impervious coverage for the two scenarios, there would be no expected change in stormwater quality treatment requirements.

As noted previously, GM BluePlan and Wood are currently supporting the City with an update to the FDMSS for the combined sewer service area. Although this work remains under assessment, typical issues relate to combined sewer systems with insufficient capacity, such that various degrees of surcharging occur for more frequent storm events (as indicated by reported basement flooding, or simulated system constraints from previous modelling. In addition, an overland flow assessment has been completed based on topographic data which has identified depressed areas (ponding areas with no clear outlet). Both these metrics suggest constraints within the available minor and major drainage systems in the combined sewer service area. As noted previously, stormwater site controls for re-development should actually benefit conditions, either in the Ambitious Density or No Urban Boundary Expansion scenario. Increased density would however increase the amount of wastewater flows, which while typically an order of magnitude less than stormwater flows, could potentially impact combined sewer capacity, more so for the No Urban Boundary Expansion scenario.

Separated Service Area

Section 3.1 indicates for the separated service area; the City requires proponents to control peak flows to pre-development levels (for all storm events up to and including the 100-year return period) and also provide contemporary on-site controls for water quality. While similar to the Combined Service area, the differences between the two land use scenarios are expected to be common as runoff conditions will generally be the same. What differs from the Combined system vs. the Separated system is the need and extent of any off-site improvements and/or differences in control criteria. Specifically, there will be areas in the separated system where the receiving infrastructure does not have adequate capacity under its current form (i.e., surcharged storm sewers (particularly in areas with direct basement connections) and/or overland flow routes which reach private lands (do not completely flow within municipal Right of Ways)). Deficient storm sewer systems were identified in the previous Stormwater Master Plan (2007) and updated as part of the current Stormwater Master Plan update being completed by Wood in conjunction with GM BluePlan. Deficiencies in the overland flow route system were not assessed as part of the 2007 Master Plan but are being considered (on the basis of surface topography) as part of the update but are still in process.

The extent of off-site improvements (within the public realm) and/or the areas of unique criteria for Stormwater Management (SWM) are not yet defined as this is the scope of work related to the modelling of the Ambitious Density Scenario. In the event that post- to pre-control criteria are adopted in a Subcatchment under I/I pressure, the impact to existing and planned infrastructure is expected to be largely neutral, as flows will not change. Depending on the level of volume control through water balance there may or may not be a volume increase however this would not affect system capacity. In areas where over control is required due to downstream constraints and no public system upgrades are recommended there would be an improvement to system capacity as the private on-site SWM would reduce flows within the public system; however as noted this would be common for both land use scenarios.

With respect to stormwater quality treatment, requirements would be similar as noted for the combined sewer area (i.e. no expected change in impervious coverage and therefore no change in stormwater quality treatment requirements).

Greenfield Areas (expansion areas)

As noted, for the Ambitious Density scenario there would be over 1300 ha of greenfield development outside of the current City limits when compared to the No UBE scenario. This development has been notionally assigned to WhiteChurch, Elfrida, Twenty Rd. East and Twenty Rd. West. These areas currently have no storm servicing hence new drainage infrastructure will be required including: SWM facilities (ponds), Low Impact Development (LID)

practices, Creek works (erosion and realignments) and local storm sewers and trunks. Various studies have begun to define the scope of these works (such as the Elfrida Subwatershed Study, and the recent White Church Lands assessment by GM BluePlan and Wood). The works as generally outlined are required to maintain runoff quantity and quality to Provincial and municipal standards.

Typically end of pipe SWM facilities are implemented for new greenfield development to provide a combination of water quality treatment, erosion control, and flood (quantity control).

It should be noted that water quality is expected to be slightly degraded from development despite the presence of a SWM facility, since the typical highest form of water quality treatment is not 100% effective (70% to 80% treatment depending on watershed), hence there would be an increase in contaminant loading to the receiving watercourse.

Erosion control typically involves the temporary detention and attenuation of smaller, more frequent rainfalls to avoid “flashy” responses and erosion to the downstream watercourse. The required extended detention is typically confirmed through a subwatershed study. Notably however this does not control runoff volumes, which are increased under post-development conditions and may cause longer-term erosion issues downstream. Future efforts by the City to require water balance/water budget assessments may result in a greater degree of infiltration and thus volume control, however this remains uncertain.

With respect to quantity and flood controls, peak flow rates would normally be managed to existing conditions (+/-) hence there would be no adverse impacts anticipated to the receiving stream from a flooding standpoint under the development scenario.

Based on the preceding, it is noted that the Ambitious Density Scenario, which would include greenfield development, would result in some expected impacts to downstream receivers with respect to water quality (contaminant loading) and also increases in runoff volume.

The ultimate receivers of drainage from SWM facilities are stream networks (watercourses). In many cases watercourses, particularly smaller ones, are eliminated, or re-aligned and re-constructed to facilitate development, which disrupts natural drainage features (although such works are typically supported by an underlying subwatershed study assessment). The residual/constructed stream networks are considered important municipal infrastructure albeit not part of the built environment and notionally understood to be “natural infrastructure”. Notwithstanding, as important elements of the City’s drainage system, the streams will require long-term Operations and Maintenance investment (O&M), as would the supporting SWM infrastructure (SWM facilities, LID practices, storm sewers) for the greenfield areas.

Deficiencies and issues in the watercourse system were also identified as part of the 2007 SWM Master Plan, but also updated more recently as part of the Development Charges Background Study (refer to Figure G1 from that document), including future channel projects and erosion control system projects, which may be impacted due to additional drainage to these receivers and the preceding considerations. On that basis, it would be expected that the No Urban Boundary Expansion scenario would be more beneficial by avoiding these impacts altogether, as compared to the Ambitious Density Scenario, which would involve development and additional flows in greenfield areas.

5. EVALUATION

A high-level approach was taken to address the criterion and evaluate the two scenarios, first considering the potential impacts to the individual factors encompassed in the water, wastewater, and stormwater systems first and then the overall summary result of each scenario. The summary results consider the individual infrastructure and identifies whether or not there will be ***potential significant impacts*** on the system as a whole.

Table 5-1 Analysis Summary by System Components

System Component	Ambitious Density	No UBE
Water		
Transmission	Transmission likely required under the Ambitious Density Scenario in order to provide water to certain Pressure Districts in the Greenfield areas such as PD6, PD7 and PD18 to support growth.	The No UBE scenario does not have any Greenfield growth in new areas of the system so it is less likely that any significant transmission upgrades/infrastructure will be required. However, there is going to be increased intensification in already built-up and congested parts of the City. Transmission/sub-transmission upgrades related to intensification are difficult to predict without detailed hydraulic modelling.
Storage	Both scenarios considered have similar storage needs except in PD7 and PD23. The Ambitious Density Scenario is expected to need more storage upgrades to 2051 than the No UBE scenario because PD7 and PD23 require further storage despite the planned PD7 Elevated Tank. Added storage would likely be in-ground pumped storage.	Both scenarios considered have similar storage needs except in PD7 and PD23. The No UBE Scenario will likely need less storage upgrades to 2051 than the Ambitious Density Scenario because the planned PD7 Elevated Tank would be sufficient to handle the PD7 and PD23 capacity needs in this scenario.
Pumping	Overall, the pump capacity upgrades needed are similar across both scenarios, except for PD2, PD5 and PD7. This scenario requires a smaller PS upgrade in PD2 than the No UBE scenario. However, PD5 and PD7 have larger growth in this scenario and will require larger upgrades than the No UBE scenario.	Overall, the pump capacity upgrades needed are similar across both scenarios, except for PD2, PD5 and PD7. This scenario requires a larger PS upgrade in PD2 than the No UBE scenario (which could justify a second Pump Station). Conversely, PD5 and PD7 have less growth in this scenario and will require smaller upgrades.
Treatment	Treatment requirements are equivalent. No differentiator in scenarios.	Treatment requirements are equivalent. No differentiator in scenarios.

System Component	Ambitious Density	No UBE
Wastewater		
Conveyance	Increased conveyance capacity will be required across most catchment areas. Conveyance for most of the identified development areas outside of the existing Urban Boundary has been recently constructed/under design and planned for as part of the Dickenson / Centennial Trunk Sewer	No UBE Scenario significantly increases conveyance requirements in existing catchments, most significantly in the WSI. Conveyance requirements significantly reduced for the Dickenson / Centennial Trunk Sewer
Pumping	Pumping requirements are equivalent. No differentiator in scenarios.	Pumping requirements are equivalent. No differentiator in scenarios.
CSOs	Growth within the combined sewer catchments including the WSI and RHCSI will impact CSOs. The difference between incremental impact and significant risk to increase of number of CSO bypass occurrences requires detailed city-wide modelling.	The increased growth within the WSI under the No UBE scenario will increase impacts to CSOs. Future upgrades of CSO and/or Conveyance will likely be required to accommodate additional flows under the No UBE scenario.
Treatment	Treatment requirements are equivalent. No differentiator in scenarios.	Treatment requirements are equivalent. No differentiator in scenarios.
Stormwater		
Trunk Sewers	On-Site controls for re-developments (infill/intensification) should generally mitigate impacts or improve conditions (combined sewer area over control). Controls also typically consider need for further over-control in areas with constrained or under capacity sewers. Greenfield areas would similarly incorporate controls to limit impacts to receiving storm sewers, where available. New storm sewer systems would be expected to be adequately designed for proposed development.	Similar outcomes for re-development; more intense development would generally be more extensively vertically (not horizontally) and therefore have no additional impact with respect to storm flows (potential additional over-control benefit in combined sewer areas). Increased sanitary flows to combined sewers would require consideration but are typically an order of magnitude less than storm flows. Would avoid the need for any additional storm sewers in the developed greenfield area, which would eliminate additional future O&M requirements for the City.

System Component	Ambitious Density	No UBE
Creeks/Streams	On-site controls for I/I areas should generally mitigate impacts to receiving watercourses (separated storms ewer area), other than residual impacts from erosion and quality control. Over-control in combined sewer area may assist in reducing CSO overflows to watercourse to a degree. For Greenfield areas, potential for residual water quality and erosion (runoff volume) impacts to receiving watercourse systems due to greenfield development. Also expected to involve the elimination and/or relocation of watercourses to facilitate development (as per SWS recommendations). Flood control maintained as part of SWM facility design.	Similar results for infill/intensification, no major differences expected in impacts given form of re-development and minimal stormwater changes. No greenfield development involved, thus eliminates any potential additional impacts to watercourses (creeks/streams), as well as potential longer-term needs for O&M of natural infrastructure.
SWM Facilities	On-site controls for re-developments (I/I) would be expected to be all privately held and therefore not a City responsibility. Greenfield areas would necessitate end of pipe SWM facilities. As per previous consideration, these facilities are not completely effective with respect to quality control or volume (erosion) control, however effective at flood control. Necessitates longer term O&M by City as part of infrastructure holdings.	Similar results for I/I lands – minimal if any expected public SWM facility requirements. No greenfield development involved, thus eliminates impacts and also longer-term O&M requirements.
LID BMPs	City's SWM guidelines require a "treatment train" for water quality treatment, which encourages LID BMPs. No formal requirement for LID BMPs however, particularly for residential land uses. This applies both to infill/intensification and greenfield development areas. Potentially greater constraints in implementing LID BMPs in existing developed areas (I/I) as opposed to greenfield areas (greater flexibility to plan and locate LID BMPs) but would need to be considered on a case-by-case basis.	Similar results with respect to LID BMPs, implementation however restricted to I/I lands, which as noted may potentially have greater constraints than greenfield areas.

6. CONCLUSIONS

A high-level desktop comparative analysis was completed to determine the potential impacts on the existing and planned City infrastructure by 2051 based on two planning scenarios. The Ambitious Density Scenario considered an expanded Urban Area boundary, taking on new greenfield growth, while the No Urban Boundary Expansion scenario focused on maintaining the existing Urban Boundary and planning infill and intensification growth throughout the City. Notably, the extent of development (spatial coverage) within the existing urban boundary is common between both scenarios with the main difference being the densities, with the No UBE being considerably higher.

- In response to an initiative requested by City Council, the overall objective of the analysis was to compare the two planning options and answer whether the two growth options result in significant impacts to the City's existing or planned infrastructure and public service facilities.

The three systems: water, wastewater, and stormwater, were reviewed individually to determine the impacts of growth across the City by 2051. Each system compared the planned projections for the Ambitious Density Scenario and No UBE Scenario, considering the associated water demands and anticipated wastewater and stormwater flows as a result.

Under both scenarios, significant impacts to the existing water and wastewater systems will be experienced, with the Ambitious Density Scenario having more impacts within the Greenfield areas, and the No UBE scenario having more impacts within intensification areas such as the Downtown Core. It is likely that additional w/ww infrastructure and/or infrastructure upgrades will be required under both scenarios.

- **Ambitious Density** - Expansion into the Greenfield areas under the Ambitious Density scenario provides an opportunity for 100% funding through the Development Charges (DC) process as well as clear delineation of projects that are dedicated for growth, not for addressing existing constraints (e.g. new PD7 Pumping and Storage, new feedermains for growth areas, Lower Centennial Trunk Sewer, etc). However, due to the nature of the growth being more spread out over a larger geographical area with relatively little existing servicing, potential for *more* infrastructure (overall length of linear works and potentially more facilities) will likely be required.
- **No UBE** - Upgrades and expansions within the Downtown Core and other intensification areas are likely required in the Ambitious Density Scenario, however, these upgrades are potentially much more significant in the No UBE Scenario. Intensification upgrades also provide opportunity for DC funding of projects that are triggered by and service growth. However, development, design and implementation of these upgrades may be more challenging due to the following factors:
    - More complex servicing solutions required:
        - Combined system
        - More infrastructure (# of pipes) impacted by growth
        - More existing capacity constraints resulting in potential upgrades of existing infrastructure
        - Potentially larger scale of new/upgraded infrastructure within intensification areas
        - F-5-5 and CSO requirements
    - Constructability challenges within built-out intensification areas
    - Potential higher cost
    - Potential for cost split of projects (DC and Benefit to Existing vs 100% DC)

In general, most stormwater impacts can be mitigated with infrastructure upgrades. Both scenarios will require significant on-site controls within intensification areas and, although more growth is projected in the No UBE

scenario, the upgrade requirements will likely be similar to that of the Ambitious Density Scenario since the degree of land use change (i.e., impervious coverage) will be comparable across both scenarios. Within Greenfield areas, new stormwater infrastructure will be required for the Ambitious Density Scenario, which may impact natural receiving systems and may require relocation of some watercourses. With No UBE, minimal greenfield growth and subsequent new stormwater infrastructure will be needed, which minimizes potential additional impacts to watercourses (creeks/streams), as well as potential longer-term needs for O&M of natural or man-made infrastructure.

City policy requires over-control of post-development runoff in the combined sewer areas and as a result intensification will not require significant additional infrastructure within the combined sewer areas, since system capacity will actually be recovered as development proceeds. The City is currently updating the FDMSS to improve the capacity of the combined and storm systems, and opportunities to divert runoff from the combined sewer system to the separated storm system will continue to be explored as part of future development.

The assessment/review documented herein was qualitative, addressing a single criterion in order to provide support to City Council to recommend one of the two scenarios that would best suit the needs of the City of Hamilton. Once a Scenario has been approved by Council, the Master Plan team will move forward with modelling growth across the City and developing servicing strategies, including potential upgrades and/or new facilities if required.

Appendix D:

Transportation Report

PLANNING FOR GROWTH TO 2051
EVALUATION OF SCENARIOS

Background Report on GRIDS 2 Transportation Criteria

October 2021

Hamilton

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1 Introduction

Through the Growth-Related Integrated Development Strategy (GRIDS) 2 and the Municipal Comprehensive Review (MCR), the City is mandated by Provincial policy to determine how and where to plan for forecasted population and employment growth to the year 2051, in accordance with the Provincial population and employment growth forecasts and land needs assessment methodology.

In August 2021, Council approved an updated evaluation framework to guide decisions on growth management. The framework is intended to help inform three sequential questions:

How to grow?

The City is contemplating two alternatives at the City-scale: an 'Ambitious Density' Growth Option (1,310 ha expansion for new Designated Greenfield Lands) and a second alternative, called the 'No Urban Boundary Expansion' Growth Option. The growth options have different intensification targets, greenfield densities and housing mixes. They would also require different long-term urban structure plans/policies to manage growth pressures.

Where to grow?

Depending on the Preferred 'How to Grow' Option, if an urban boundary expansion is required, determining where the City can feasibly expand its urban boundary by evaluating Candidate Expansion Areas.

When to grow?

Once the feasible Candidate Expansion Areas are determined, evaluating phasing scenarios to decide when these areas should be planned for development.

1.1 Purpose of Report

The evaluation of growth options is being undertaken based on a comprehensive approach based on ten themes. In August 2021, a background report was prepared to present both the evaluation framework as well as criteria for each theme.

The purpose of this report is to provide information and analysis to support ***Theme 6. Transportation Systems***. The report also presents information to support ***Theme 2: Climate Change***.

The focus of the analysis is primarily on Stage 1 of the evaluation framework, addressing the question of How to Grow. The analysis will be extended through subsequent iterations of this report as the evaluation progresses to support Stages 2 and 3 of the framework.

1.2 Description of Growth Alternatives

GRIDS 2 will result in a long-term growth strategy which allocates forecasted population and employment growth for the 2021 to 2051 time period. The Provincial forecasts for Hamilton project a total 2051 population of 820,000 persons and total employment of 360,000 jobs, a net increase of 236,000 persons and 122,000 jobs.

As part of the question of “How to Grow?” two alternatives at the City-scale are being contemplated:

- An ‘Ambitious Density’ Growth Option (1,310 ha expansion for new Designated Greenfield Lands)
- A ‘No Urban Boundary Expansion’ Growth Option

A map of the potential new designated greenfield lands also referred to as ‘whitebelt’ lands, is provided in Figure 1.1, with a summary of the key features of each growth option is provided in Table 1-1.

Figure 1.1: Whitebelt Lands in Hamilton

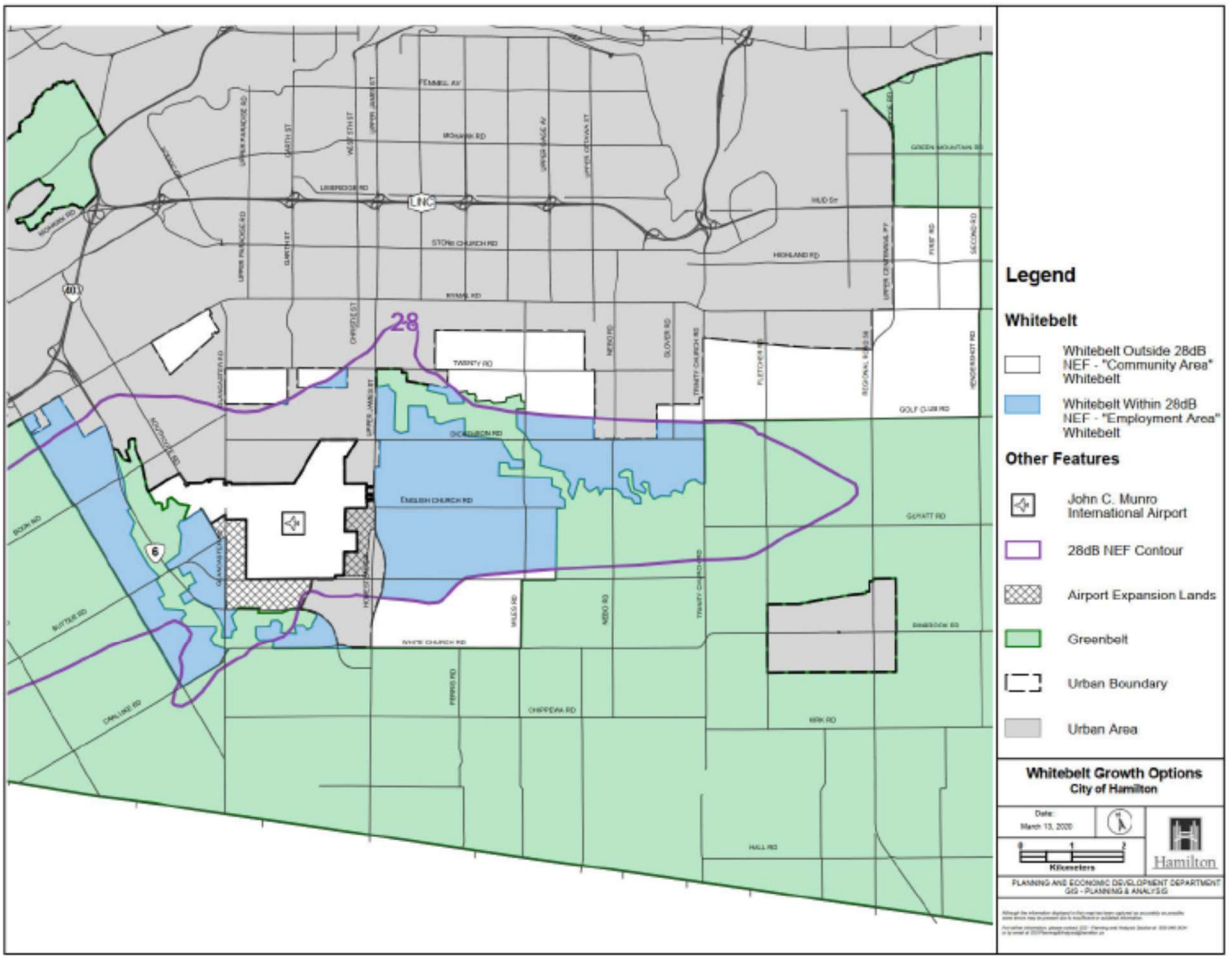


Table 1-1: Comparison of Growth Options

THEME	CONSIDERATION	GROWTH OPTION 1: AMBITIOUS DENSITY (1,310 HA EXPANSION)	GROWTH OPTION 2: NO URBAN BOUNDARY EXPANSION
Population / Unit Forecast	2021-2051 Population Growth 2021-2051 Unit Growth	• 236,000 • 110,320	• 236,000 • 110,320
Distribution of Growth	Total Unit Growth within the **Existing Urban Area (Total)** Built-up Area Existing Designated Greenfield Areas	• 81,620 ➢ 66,190 ➢ 15,430	• 109,880 ➢ 94,450 ➢ 15,430
	Total Unit Growth within the **Urban Expansion Area**	• 28,260	N/A
	Total Unit Growth in Rural Area	• 440	• 440
Targets	Intensification Target *(% of new units within Existing Built-up Area)*	• 50% (2021 – 2031) • 60% (2031 – 2041) • 70% (2041 – 2051)	• 81%
	Greenfield Density Target *(Persons and Jobs Per hectare in the Designated Greenfield Area (DGA))*	• 60 (existing DGA in the Urban Area) • 77 (Expansion Area)	• 60 (existing DGA in the Urban Area)
Employment Forecast	2021-2051 Employment Growth	• 122,000	• 122.000

2 How Hamilton Travels Today

In order to inform the evaluation of growth alternatives, it is useful to have an understanding of how and where people currently travel. This section presents a high level overview of key transportation indicators and travel patterns primarily based on the Transportation Tomorrow Survey (TTS). The TTS is a survey that is conducted across the Greater Golden Horseshoe every five years. Although the most recent survey is from 2016, the data is considered indicative of travel patterns today and is the most up to date source of information on macro-level travel patterns.

2.1 Transportation Analysis Zones

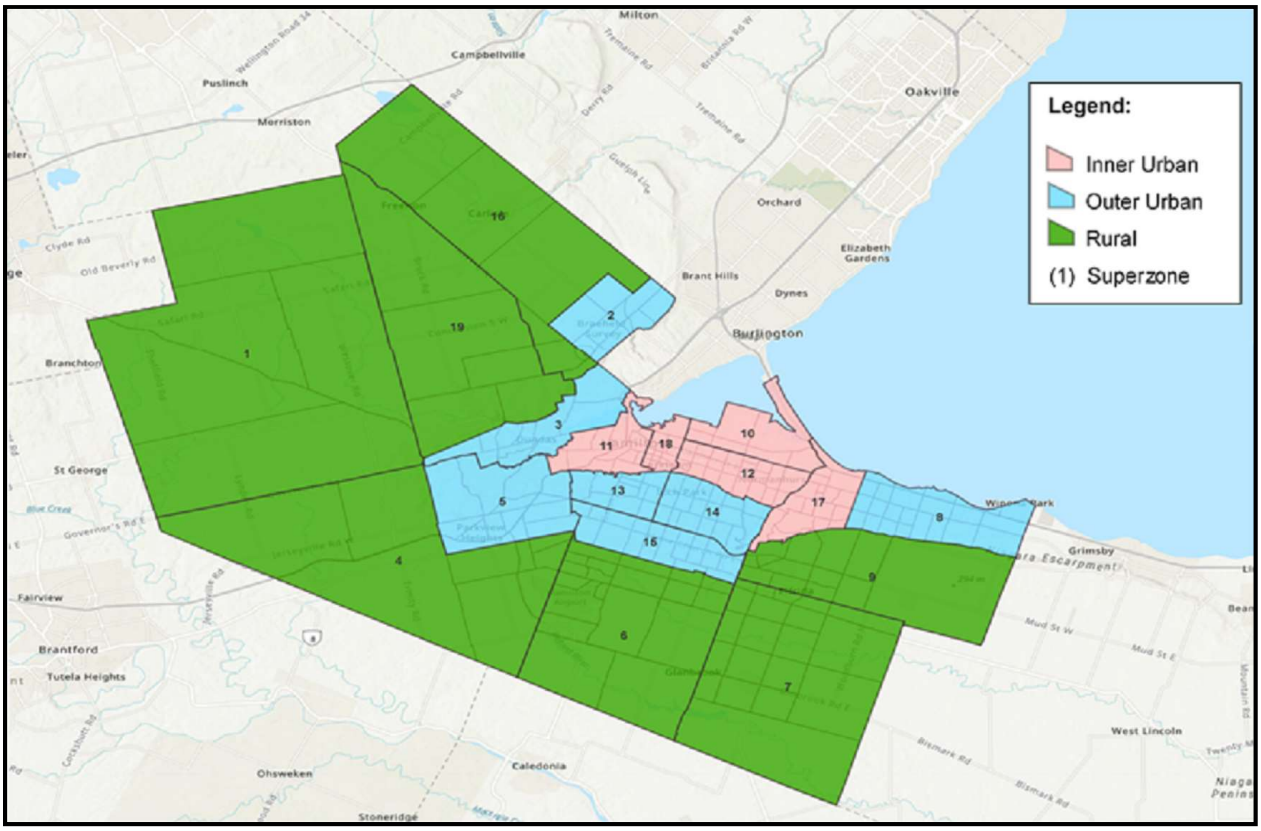
Throughout this chapter and remainder of report, data is presented at different levels of aggregation depending on the indicator. These levels are illustrated in Figure 2.1 and described as follows:

- **Traffic zone level:** This is the smallest zone level and represents zones that average approximately 400 hectares in size and generally increase in size from the inner area to the rural areas depending on population density. Within the City there are some 265 traffic zones and these form the basis for the macro-level model;

- **Superzones**: These zones are comprised of groups of traffic zones and are useful for presenting data for the purpose of examining trends. Two different superzone systems are utilized including a four-zone system and a 19-zone system. The four-zone system is comprised of the Inner Urban Area, Outer Urban Area, Rural Area and areas outside of Hamilton. Note that these areas are not based on electoral boundaries and are simply for the purpose of tabulating data on an aggregate level; and,

- **City wide level**, for presentation of macro indicators such as vehicle kilometres of travel.

Figure 2.1: Transportation Analysis Zone System



2.2 Overall Travel Patterns

The distribution of population and employment within the City has an impact on where people travel, what modes are viable for different types of trips and how long trips are in terms of distance. Based on a data from 2016 (Table 2-1), Hamiltonian's made approximately 235,439 trips in the morning peak hour (6AM-9AM).

Table 2-1: AM Peak Period Trips in 2016

Origin	Destination				Total Origins
	Inner Urban	Outer Urban	Rural	Outside of Hamilton	
Inner Urban	43,607 (18.52%)	12,309 (5.23%)	2,545 (1.08%)	17,839 (7.58%)	76,300 (32.41%)
Outer Urban	30,472 (12.94%)	56,879 (24.16%)	6,854 (2.91%)	27,304 (11.60%)	121,509 (51.61%)
Rural	6,344 (2.69%)	9,926 (4.22%)	10,686 (4.54%)	10,674 (4.53%)	37,630 (15.98%)
All Origins	**80,423 (34.16%)**	**79,114 (33.60%)**	**20,085 (8.53%)**	**55,817 (23.70%)**	**235,439**

Approximately 76.3% of these trips remained within the City of Hamilton while 23.7% were destinated to external destination. Overall, there is a reasonably high degree of self-containment of trips in the City. For example, of the 121,000 trips that originate in the Outer Urban Area, approximately 57,000 are destined to other parts of the Outer Urban Area. For trips starting in the Inner Urban Area, almost 60% remain in the Inner Urban Area, which is understandable given the largest concentration of employment is in the Downtown Core and Inner Area.

2.3 Mode Choice and Urban Form

Mode Choice

On a City-wide basis in 2016, approximately 65.6% of all morning peak period trips where made by single occupant automobiles. A further 11% were made by auto passengers, 7% by local transit, 9.5% by foot or bike, 6% by other modes (e.g. taxi and school bus) and less than 1% by GO Train.

Mode shares have not changed significantly in the past 20 years, which is consistent with many parts of the broader Greater Toronto and Hamilton Area (Table 2-2). The fact that mode shares have been relatively constant may be surprizing in light of investments in sustainable transportation; however, it must be recognized that the pattern of growth has a significant impact on city-wide mode share trends. If a majority of growth occurs in areas that have higher than average auto mode shares than in areas with higher transit shares, then overall city-wide average auto mode share will naturally increase.

Table 2-2: City-Wide Mode Share (2016) AM Peak Period

Primary Travel Mode	2001	2006	2011	2016
Auto Driver	64.1%	63.3%	64.6%	**65.6%**
Auto Passenger	12.2%	12.0%	12.4%	**11.0%**
Walk	10.4%	9.8%	7.7%	**8.2%**
Transit Excluding GO Rail	5.9%	7.3%	7.8%	**7.0%**
School Bus	5.4%	5.8%	5.6%	**5.3%**
Cycle	0.7%	0.5%	0.6%	**1.3%**
GO Rail Only	0.6%	0.5%	0.7%	**0.8%**
Joint GO Rail & Transit	0.4%	0.4%	0.4%	**0.4%**
Motorcycle & Other	0.1%	0.1%	0.1%	**0.2%**
Taxi Passenger	0.2%	0.3%	0.1%	**0.1%**

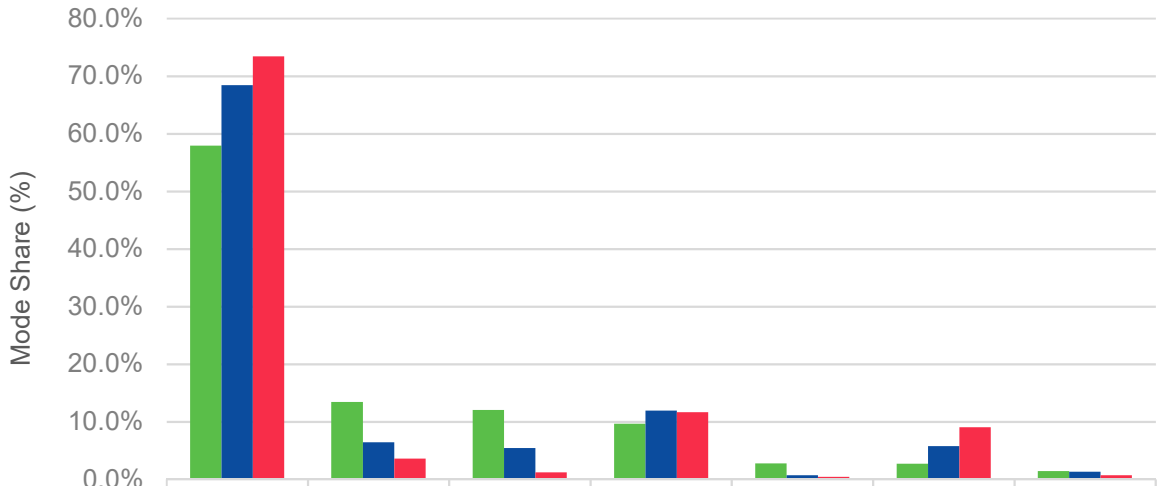
Source: Transportation Tomorrow Survey

Notably, although cycling represents a small proportion of total trips, there has been a significant increase in cycling mode shares since 2001 with mode shares nearly doubling. Key factors influencing this trend include investments in cycling infrastructure,

the rising cost of auto ownership and increased development in the downtown and other cycling supportive areas.

Figure 2.2 provides a breakdown of mode shares by the area of Hamilton that trips originate in. As would be expected, the highest propensity for walk, cycle and transit use is in the Inner Urban Area given. Approximately 30% of all AM peak period trips originating in the Inner Urban Area are made using sustainable modes (i.e. walk, cycle transit, GO Rail). Conversely, the combined sustainable mode share drops to 13.8% in for trips originating in the Outer Urban Area and 5.9% for the rural area.

Figure 2.2: AM Peak Period (600 to 900) Originating Trip Mode Shares (2016)



	Auto Driver	Walk	Transit Exl. GO	Auto Passenger	Cycle	School Bus	GO Rail & Joint Transit
Inner Urban	57.9%	13.4%	12.1%	9.7%	2.8%	2.7%	1.4%
Outer Urban	68.4%	6.4%	5.4%	11.9%	0.7%	5.8%	1.3%
Rural	73.4%	3.6%	1.2%	11.6%	0.4%	9.0%	0.7%

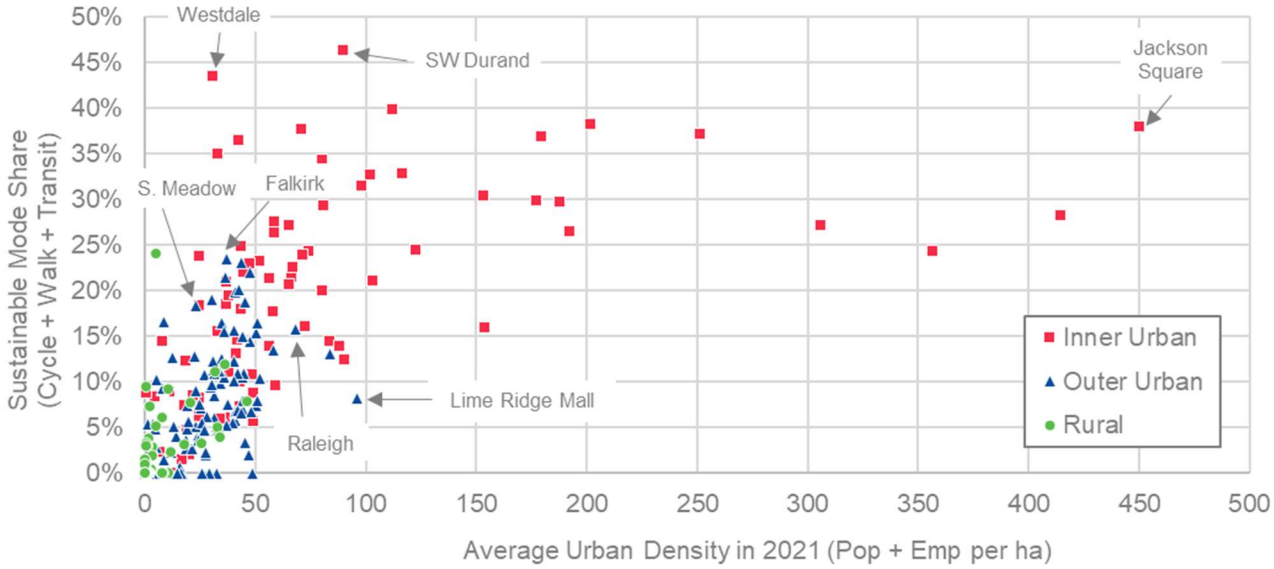
Source: Transportation Tomorrow Survey

Urban Form

While mode share is affected by several factors including availability of different modes, there is a strong relationship between mode shares and density. Denser, mixed-use communities help to influence travellers to choose to get around without a car. And at the same time, denser communities support higher levels of transit service.

Figure 2.3 shows the average urban net density (population + jobs per hectare) for each traffic analysis zone in 2021 and their respective sustainable mode share in 2016.

Figure 2.3: All-Day Sustainable Mode Share (2016) by Origin Traffic Zone vs. Average Urban Density (2021)



Source: Transportation Tomorrow Survey

The 2018 Transportation Master Plan (TMP) sets an aspirational mode share target of 15% for walk & cycle and 12% for local transit (27% total). Based on current trends, this is achieved in zones with an average urban density of 75 to 100 people and jobs per ha (gross). Approximately half of the Inner Urban area meets or exceeds the mode share target due to shorter trip lengths, frequent transit, and mixed-use land patterns. No zones in the Outer Urban currently meet the 27% sustainable mode share target, which reflects the need for higher densities to better support financially viable frequent transit and high-quality cycling facilities. Sustainable mode share in Rural areas is low, which is not surprising given the absence of transit and the longer trip distances, which are not conducive to walking and cycling, and the nature of trips such as for farming purposes.

A greater emphasis should be placed on planning for densities in these higher thresholds for future growth. Under the Ambitious Density Scenario, the whitebelt areas are to be planned to achieve 77 pjh (net developable area). As shown in Figure 2.4, the Elfrida area is planned for 77 people and jobs per ha (net), which corresponds to an average urban density of approximately 60 people and jobs per ha (gross)1. The No Boundary Expansion scenario (Figure 2.5) would see more intensification into existing urban areas to support higher densities within existing neighbourhoods, supporting higher sustainable mode share. However, intensification within some existing

[1] Assumes 21% of land is allocated to right-of-way.

neighbourhoods may be challenging due to land availability and assembling opportunities, community support, and area-specific issues.

Further discussion on transit supportive densities is provided in Section 3.

Figure 2.4: Projected 2051 Urban Density – Ambitious Density

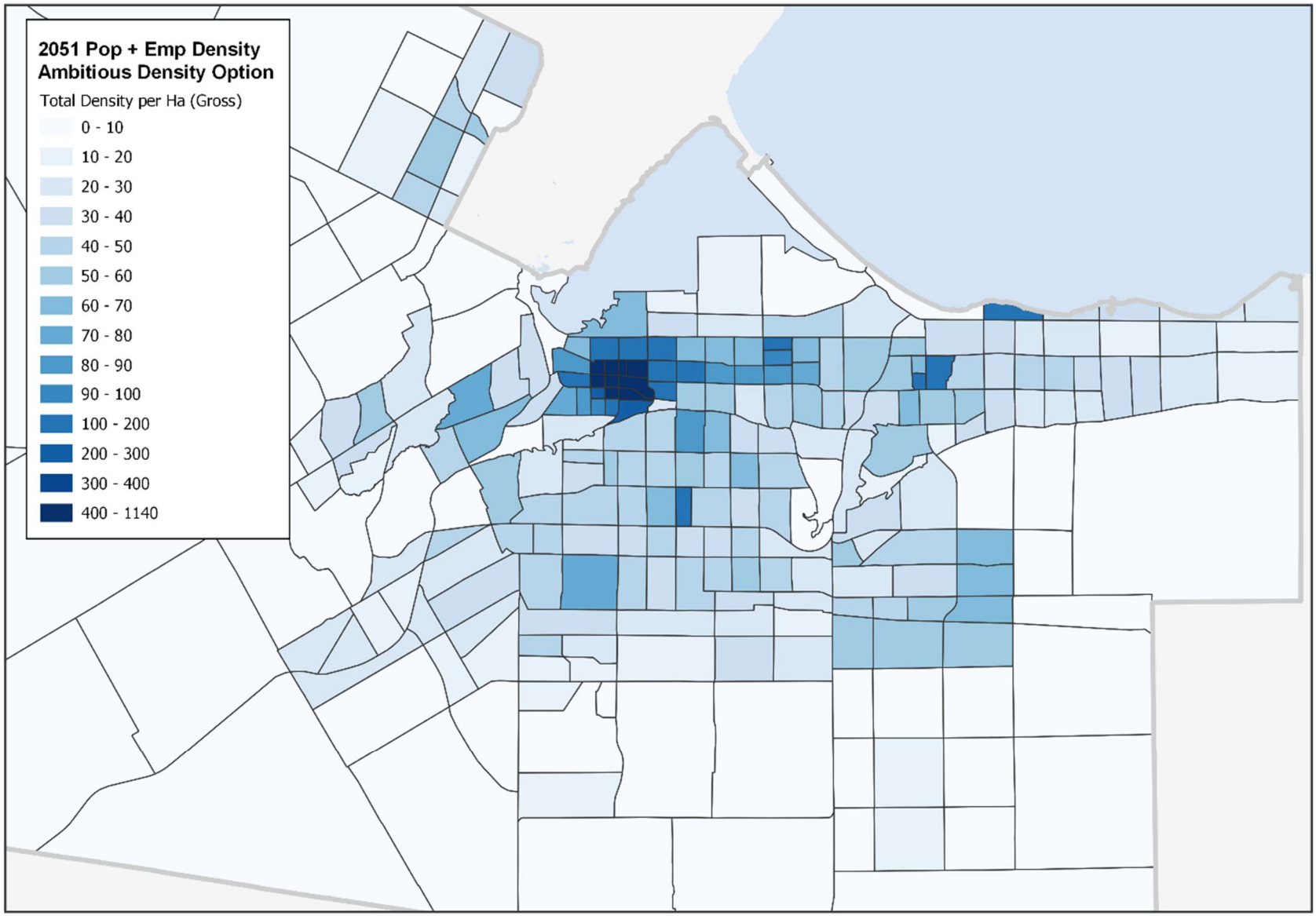
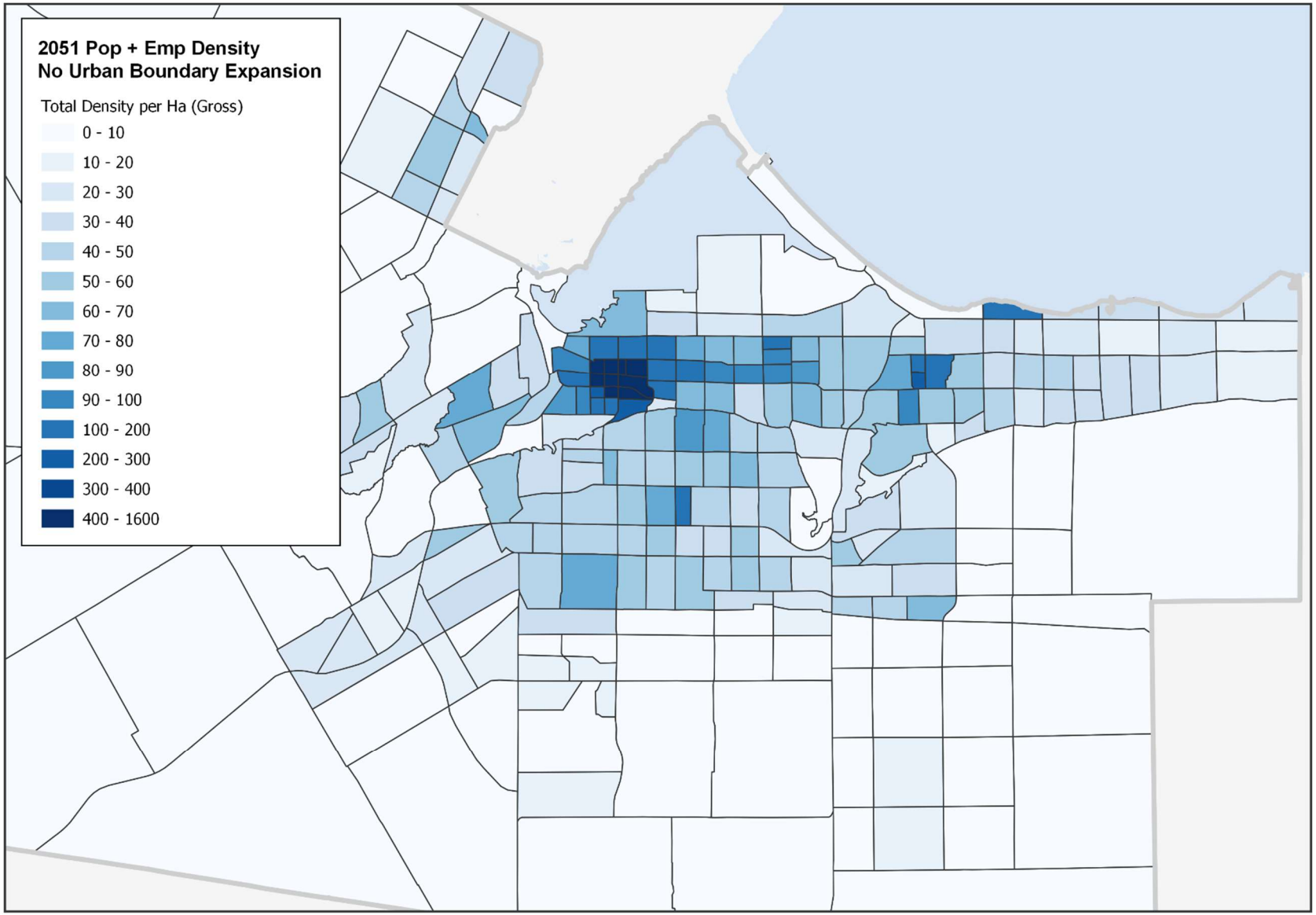


Figure 2.5: Projected 2051 Urban Density – No Urban Boundary Expansion



2.4 Factors Influencing Active Transportation

Trips shorter than 5 km represent 49.9% of all trips originating in Hamilton or 491,000 daily trips. These “short trips” are the distances at which travellers will typically consider active transportation as a trip can be made in 30 minutes or less, taking into account the varying speeds. An abled-bodied cyclist can travel about 5 km in 30 minutes, while a pedestrian can go 2 km.

In Hamilton, as trip distance increases, the rate by which trips are made by foot or bike decreases (Table 2-3). Of all trips less than 5 km, 16.9% are made by active modes, though the levels vary by ward. The older, lower city wards have the highest pedestrian and cyclist activity rate, while suburban areas are lower, and the rates are very low in rural areas.

Table 2-3: Active Transportation Mode Share by Trip Length (2016)

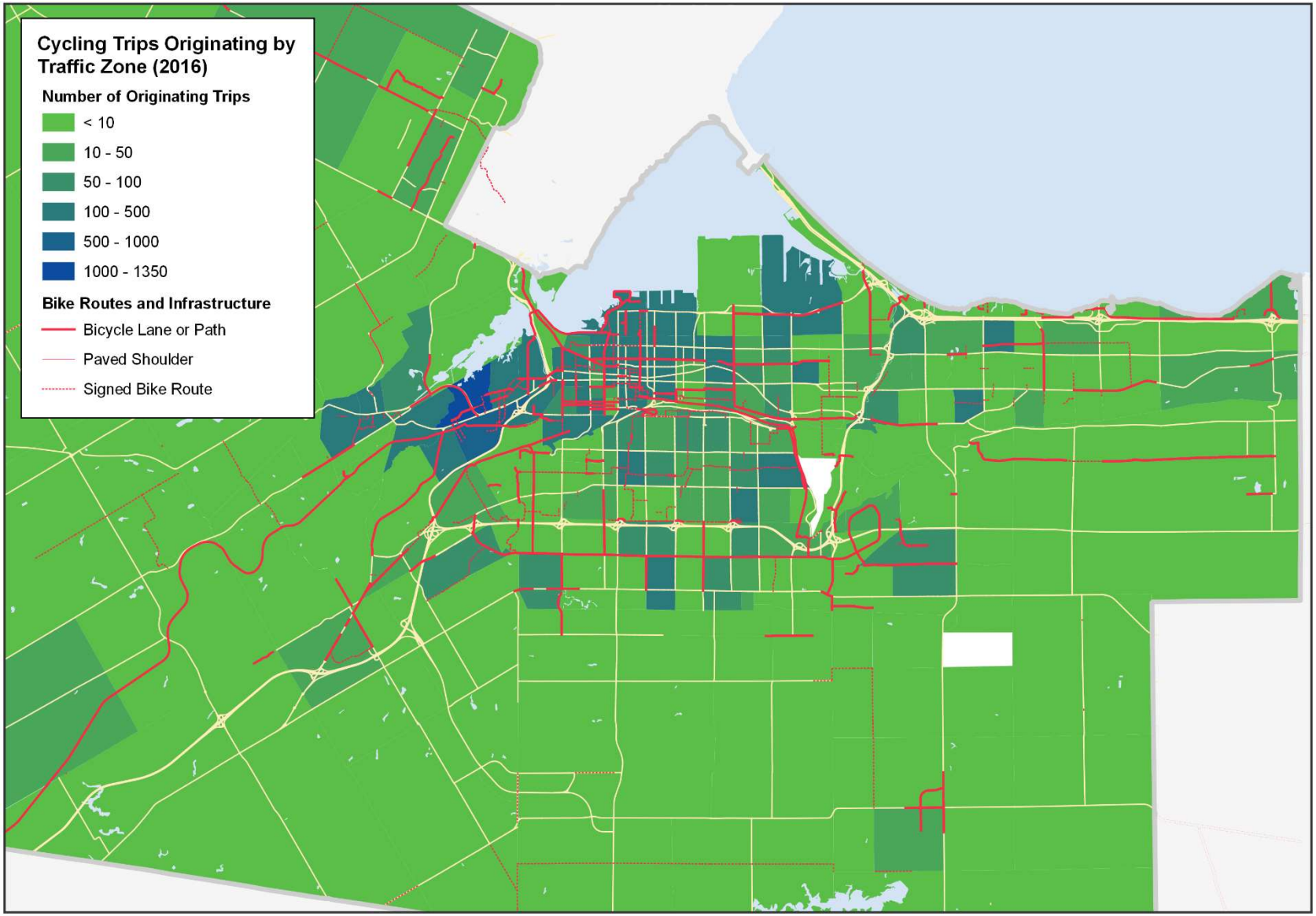
Mode	< 1 km	1 to 2 km	2 to 5 km	5 to 10 km	10 to 20 km	20+ km
Cycle	2.5%	3.7%	2.1%	0.6%	0.4%	0.1%
Walk	38.1%	15.9%	2.6%	0.1%	0.0%	0.1%
Total	40.6%	19.6%	4.7%	0.7%	0.4%	0.2%

Source: Transportation Tomorrow Survey

Looking at the trends of where cycling trips originated in 2016 (Figure 2.6), there is a strong association between the density of cycling infrastructure and the number of trips. This can be observed in the McMaster to Downtown corridor, which has the City's highest cycling route density and trip origins. The west mountain has a less connected cycling network, which is reflected in the lower number of trips.

New cycling infrastructure and enhancements will be needed for both growth scenarios. The No Boundary Expansion scenario will require right-of-way space along existing streets to be reallocated to provide sufficient capacity and enhancement to existing routes. The Ambitious Density scenario offers an opportunity to plan from scratch within the expansion area to create a high-quality cycling network within the area. Enhancements will be required in the surrounding area to connect the new Urban Expansion Areas with nearby destinations, such as Heritage Green and Lime Ridge Mall.

Figure 2.6: Origin of Cycling Trips Made in Hamilton (2016, All Day)



Source: Transportation Tomorrow Survey and Hamilton Open Data

3 Assessment of Future Transportation Needs and Opportunities

The purpose of this section is to provide a high-level future outlook for transportation in Hamilton in 2051. Specifically, it provides travel demand forecasts for each scenario in 2051, discusses assumptions about base case transportation improvements and summarizes the key transportation outcomes by scenario. This information provides the basis for the identification of specific needs and evaluation of scenarios presented in Section 4.

3.1 Future Travel Demand

Future travel demand is a function of three primary variables:

- Land use, including number of residents and jobs as well as urban form
- Transportation supply, which influences the choices available to people for different trips
- Travel behaviour including what modes people chose to use and the decision factors that go into these choices

In order to project future travel demand, and the interactions between land use, transportation supply and travel behaviour, a major exercise was undertaken to update and modernize Hamilton's Travel Demand Model. This model is a four-staged model consisting of trip generation, trip distribution, modal split and trip assignment. The model is developed using the EMME modelling platform and is capable of producing detailed forecasts for vehicles and transit. It is sensitive to variables such as congestion levels and transit speeds/headways.

At time of this report, a 2051 model has been developed and validated. However, given the model was only recently completed, it has not undergone rigorous testing. As such, model results presented in this report may be updated in future reports, but are considered acceptable for broad evaluation purposes.

It is also noted that the current model does not account for paradigm shifts in transportation such as permanent changes in telecommuting/work from home patterns or major technology shifts such as connected and autonomous vehicles. While these changes may influence travel outcomes differently by growth option, given the state of knowledge of these trends is still uncertain, it is reasonable to accept that the basic

modelling results still provide an appropriate basis of comparison for the purpose of evaluating broad growth options.

For each growth scenario, travel demand was forecasted for the year 2051, as well as intermediate years. For this stage of analysis, only road infrastructure improvements that were identified as part of the 2018 TMP were incorporated in the future year modelled network. For transit, it was assumed that LRT would be in place for both scenarios and the 10 year transit service plan would be fully implemented. Further refinements of the network are considered in the needs assessment presented in Section 4.

Based on the above assumptions, Figure 3.1 illustrates the projected auto trips for year 2051 under two land use density scenarios. Overall, total trips are similar for the two scenarios with differences being explained by the prevailing trip propensities by area. In comparing overall auto trips, the ambitious density scenario is expected to see a 67% increase in trips vs. a 62% increase for the no boundary expansion scenario. As expected, the majority of auto trip growth will occur in the rural + expanded areas due to the allocation of 85,500 to these areas. Conversely, under No Urban Boundary expansion scenario, in the Inner Urban and Outer Urban zones, the auto trip projection is higher in the inner area, which will result in increased congestion levels in the lower city.

Figure 3.1: Future Auto Trip Demand (AM Peak Hour)

AM Peak Hour Trips			
Total Trips - Origins			
Area	**2016**	**No Expansion**	**Ambitious Density**
Inner Urban	21,009	46,413 (+120%)	39,764 (+89%)
Outer Urban	35,642	62,548 (+75%)	59,358 (+67%)
Rural+Expansion Areas	12,308	19,398 (+58%)	32,410 (163%)
Total	**68,959**	**128,359 (+86%)**	**131,532 (+91%)**
Auto Trips – Origins			
Inner Urban	19,968	37,389 (+87%)	32,504 (+63%)
Outer Urban	37,995	57,896 (+52%)	55,127 (+45%)
Rural + Expansion Areas	12,417	18,706 (+51%)	29,597 (+138%)
Total	**70,380**	**113,991 (+62%)**	**117,228 (+67%)**

The differences in the distribution of population across for the two land use scenarios has an observed impact on trip distribution, average travel distances and mode splits. Based on an evaluation of the travel patterns for the base year (2016), approximately 1,113,000 kilometres were travelled by auto and 61,000 passenger kilometres travelled by transit in the AM peak hour. Given the projected increase in population and employment by 2051, a comparable evaluation was carried out to test the sensitivity of two growth scenarios (Table 3-1). The estimated distance travelled by automobile during AM peak hour increases from 2016 to 2051 by 48.2% under No Boundary Expansion and 58% under Ambitious Density. However, the observed vehicle hours travelled in 2051 shows an over 105% increase when compared to the base year. The estimated travel time increase is primarily related to the effect of congestion which will result in lower average travel speeds as growth increases.

For transit, there is a measurable impact on city-wide mode shares with the No Urban Boundary Expansion. Measured in terms of 'motorized shares', transit shares are projected to be 11.4% for the ambitious density scenario and 11.9% for the no boundary expansion scenario. *Note that due to the model configuration, these are different than the description of TMP targets whereby mode split is expressed as a percentage of all trips including walking and cycling.*

Passenger kilometres travelled would be higher for the ambitious density scenario due to longer average trip distances.

Table 3-1: Peak Hour vehicle and passenger distance travelled

Performance Indicator	2016 Base Year	2051 Ambitious Density	2051 No Boundary Expansion	% Increase	
				Scenario 1: Ambitious	Scenario 2: No Boundary Expansion
Vehicle Kilometres Travelled	1,113,000	1,759,000	1,650,000	58.0%	48.2%
Vehicle Hours Travelled	18,000	38,000	37,000	111%	105%
Passenger Kilometre Travelled	61,000	101,000	95,000	65.6%	55.7%
Transit Mode Share (% of motorized trips)[a]	11.7%	11.4%	11.9%		

Notes: [a] Excludes walking & cycling trips.

3.2 Planned Transportation Infrastructure

In 2018, City Council approved a new City-wide Transportation Master Plan (TMP). The 2018 TMP provides an overall policy framework and infrastructure plan to accommodate growth to 2031 and beyond. The TMP included strategic improvements for all modes of transportation including roads, higher order transit, cycling, walking and goods movement. Recommendations also reflected directions from parallel plans including the Metrolinx Regional Transportation Plan and Hamilton's Ten-Year Transit Service Plan. Policies and infrastructure recommendations were based on the target of achieving a 12% mode split for transit by 2021 in order to help off-set the need for major road improvements, while also achieve more environmentally sustainable outcomes.

Notwithstanding that the horizon year for the 2018 TMP was 2031 vs. the current planning horizon year for GRIDS 2 is 2051 the major strategic transportation improvements are intended to address long term needs. Major improvements include the following:

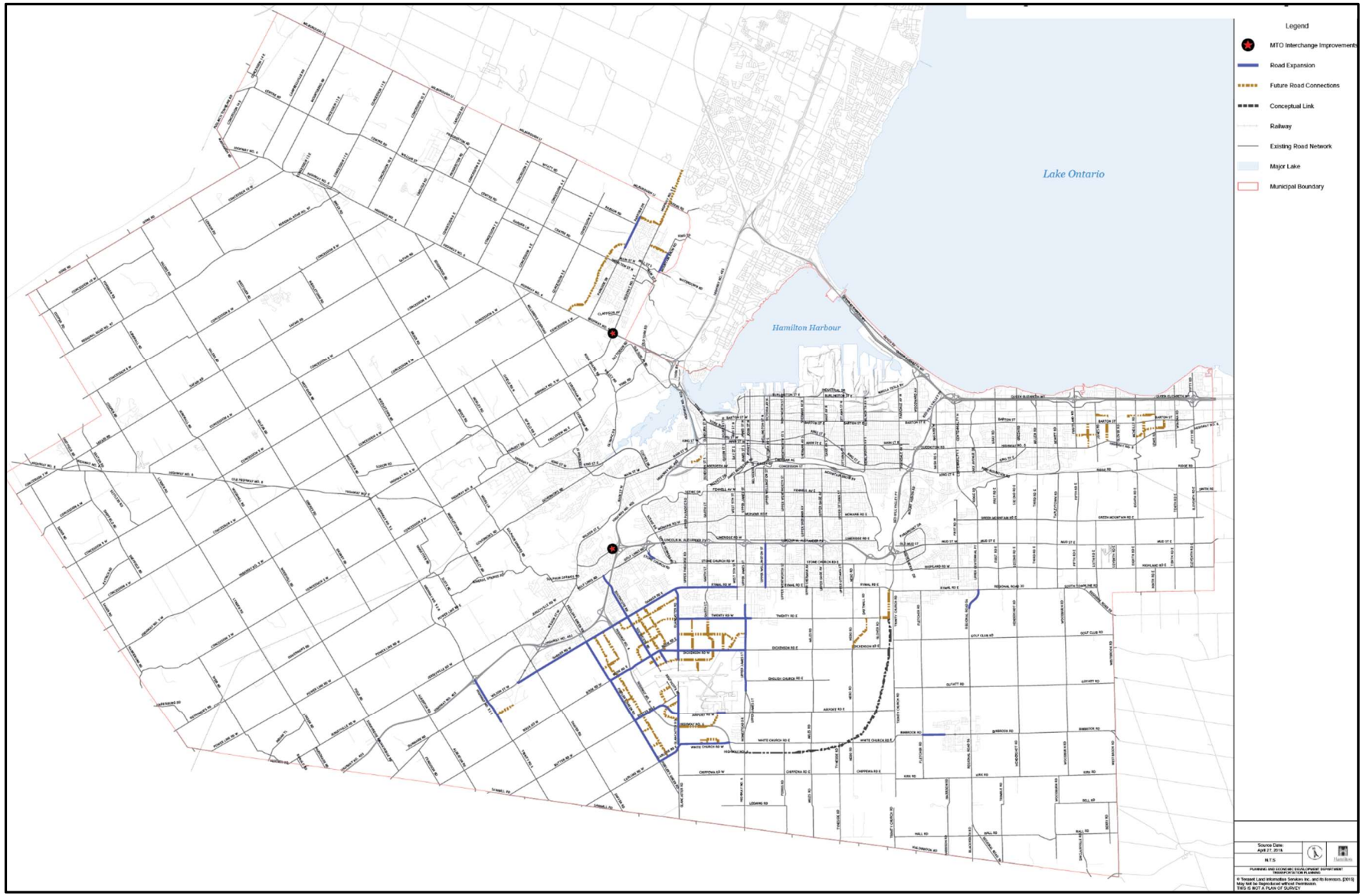
- **Road network:** Committed road widenings, two-way conversions and new roads generally serving the Hamilton Airport Employment Growth District and Stoney Creek growth areas, as shown on Figure 3.2.

- **Transit Network:** Higher order transit network that includes the BLAST network, GO Rail system and supported by a frequent transit network as shown on Figure 3.3. For the purposes of current model updates, it is assumed that both the B-line and A-line with operate primarily in exclusive lanes (with the B-Line operating as LRT) and at 5-minute headways. For the base transit network the L, T and S lines are assumed to be operating as Priority Bus corridors with some exclusive lanes in higher demand areas and at 10 minute headways. Improvements in service frequencies and coverage for local transit routes were improved based on growth in specific areas.

- **GO Transit:** Includes all-day hourly service to West Harbour GO station and Lakeshore West line extension to Niagara Falls, with new stations along the line including Confederation station. Adjustments were also assumed for the GO Bus network based on growth.

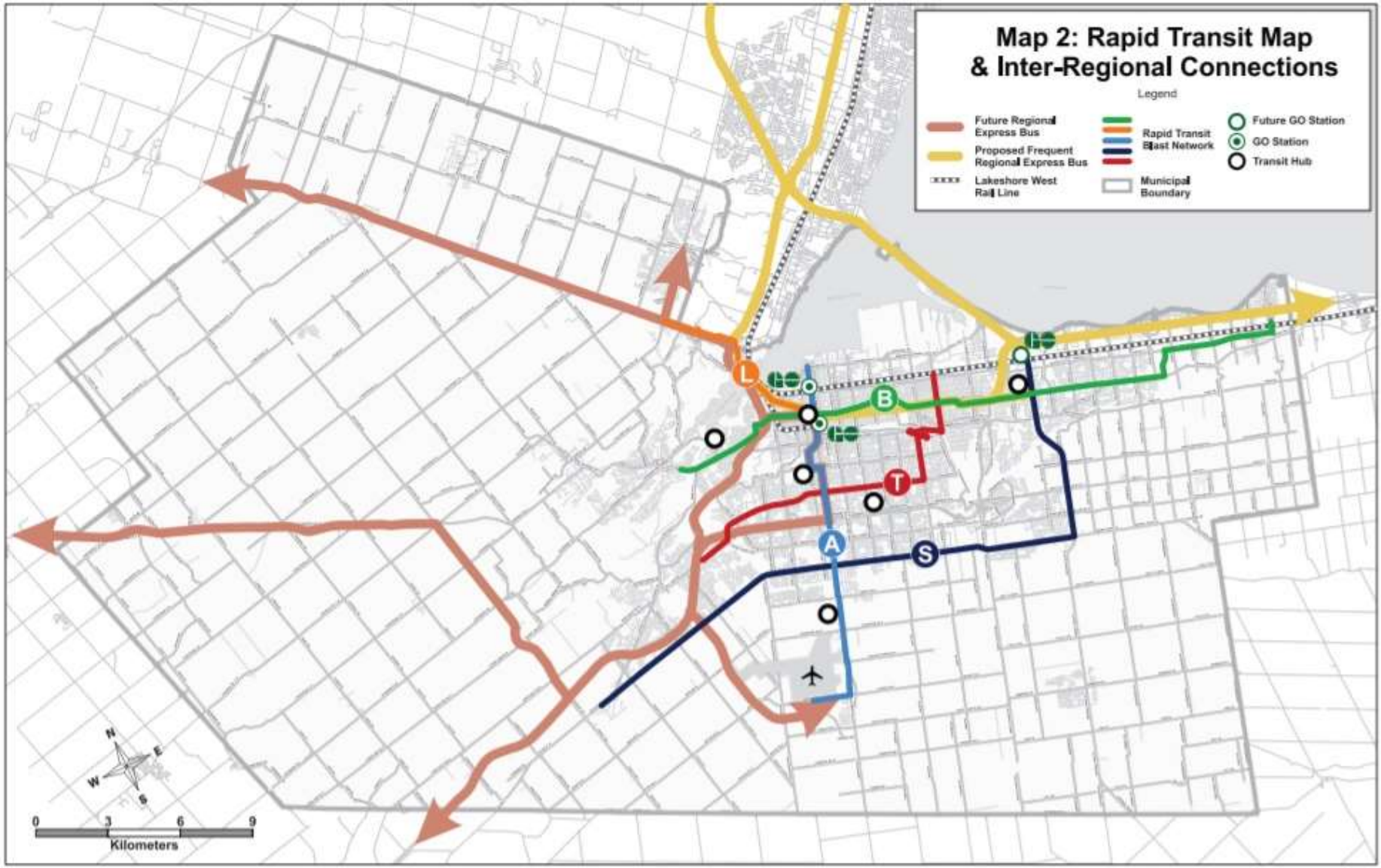
- **Provincial Highways:** Committed infrastructure improvements including Highway 6 South widening (Highway 403 to Upper James Street) and increased capacity for QEW/403.

Figure 3.2: Planned 2031 Road Network (Based on 2018 TMP)



Source: Hamilton Transportation Master Plan Update 2018

Figure 3.3: Planned 2031 Higher Order Transit Network (Based on 2018 TMP)



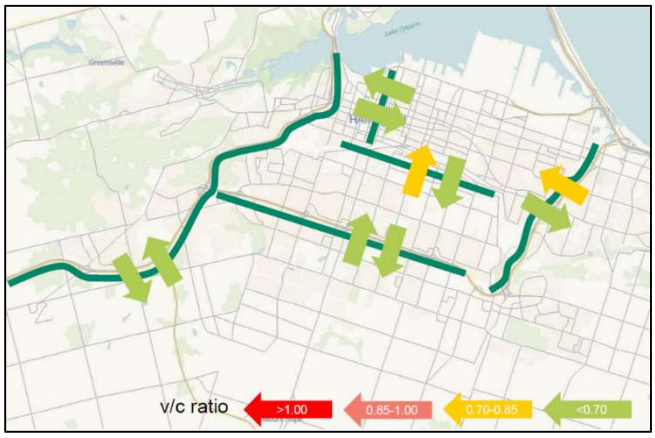
Source: Hamilton Transportation Master Plan 2018

3.3 Road Network Performance

The Hamilton Transportation Demand Model is capable of forecasting traffic volumes at different levels, including down to the individual road link level. For the purpose of evaluating “How we grow”, it is appropriate to compare traffic volumes and capacities at the screenline level. A screenline is essentially an imaginary line defined by a geographic or transportation feature where trips cross (e.g. the LINC is used to examine north south travel in the South Mountain area). For planning purposes, a volume to capacity (v/c) ratio of greater than 0.85 would represent a situation where congestion is likely to occur.

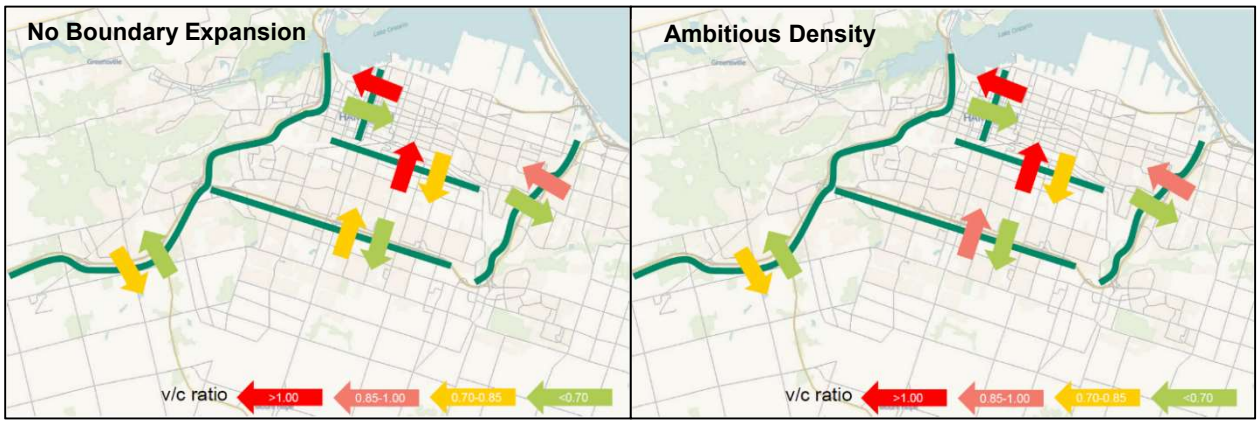
Figure 3.4 illustrates the v/c ratios across major screenlines in the City for the base model year of 2016. As shown, most screenlines operate below capacity, however, it is recognized that some roads within each screenline may be approaching or above capacity (screenline v/c’s are an aggregation of multiple roads).

Figure 3.4: 2016 Screenline level network capacity deficiency



Assignment of the 2051 travel demand on the future road and transit networks reveal capacity deficiencies on nearly all network linkages within the Inner Urban Area (Figure 3.5). The forecasted demand exceeds capacity across escarpment crossing and downtown screenlines in both growth scenarios. Notably, the Ambitious Density scenario demand increases demand across the LINC screenline, due to proposed spatial allocation of population and employment densities in the whitebelt lands and their interaction with the downtown node. Increased demand across the LINC screenline is also a reflection of employment growth near the airport and associated trip interactions with activity centres in the inner urban and outer urban areas.

Figure 3.5: Comparison of screenline deficiencies for 2051 growth options



Increase in screenline level travel demand is evident across the inner urban screenlines. This indicates continued self-containment of trips in the City in the forecasted year.

In order to rectify the projected capacity deficiencies and provide reliable travel options for Hamiltonians, an equivalent of four travel lanes across the escarpment screenline and two travel lanes across the downtown screenline would be required. Given the inner urban area's existing built form and road fabric, the feasibility of road widening in the lower City is neither practical or desirable from an urban form perspective. Therefore, investments in transit an active transportation together with travel demand management will be require to address road capacity deficiencies. This need for investments in transit and active transportation, particularly in the lower city, would be greater with the No Urban Boundary Scenario.

3.4 Transit Supportive Densities

As development densities increase, the number of potential passengers per route kilometre grows, helping to generate more ridership and higher revenues. With increasing cost recovery, transit operators can provide more frequent service within their available subsidies. Experience shows that a density of at least 50 people and jobs per hectare (gross density) is the threshold to provide a financially viable local transit route (Table 3-2). Higher tiers of transit service become a possibility as density increases, such as very frequent bus routes and rapid transit.

Table 3-2: Transit Supportive Densities

Minimum Urban Density (People + Jobs per ha)	Appropriate Transit Service Type(s)
More than 200	• Rapid Transit (subway at headways under 5 mins)
80 to 200	• Very Frequent Transit (bus every 5 min. with priority treatments) • Rapid Transit in higher density areas
50 to 80	• Local Transit (minimum bus every 30 mins) • Semi-Rapid Transit in higher density areas
30 to 50	• Local Transit (minimum bus every 30 mins) on key corridors • Demand Responsive Transit in lower density areas connecting to hubs
10 to 30	• Demand Responsive Transit connecting to hubs

Source: Adapted from Metrolinx's Regional Transit Network Planning Study and MTO's Transit-Supportive Guidelines

Both scenarios will increase the number of residents and jobs within transit supportive areas (i.e. > 50 persons+jobs/hectare gross), with nearly 50% living or working in these areas compared to today Table 3-3). The No Boundary Expansion scenario will lead to more homes and jobs in these areas due to the net benefit of intensifying existing communities that may not reach the threshold today, thereby benefiting current and future residents and workplaces.

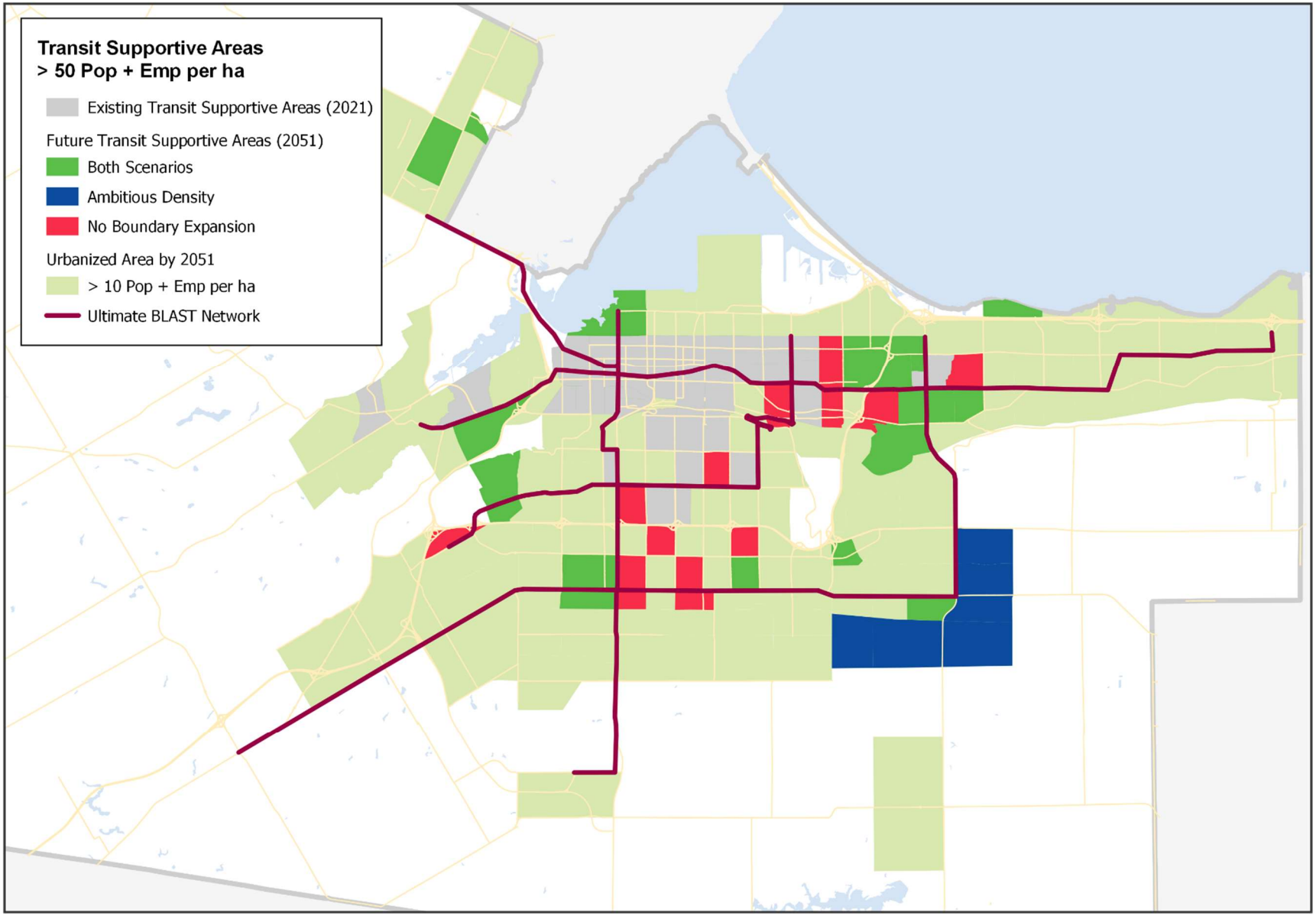
Table 3-3: Population and Jobs Located Within Transit Supportive Areas

Scenario	Population	Jobs
2021	152,700 (26.1%)	85,500 (37.4%)
No Boundary Expansion	436,000 (53.2%)	199,800 (55.5%)
Ambitious Density	367,800 (44.8%)	180,700 (50.2%)

Figure 3.6 compares what areas will become transit supportive by 2051. Both scenarios will see nodes across the City become transit supportive. The No Boundary Expansion scenario will lead to more intensification along the B-Line corridor, the Centennial Neighbourhoods area, and the south mountain. The increased intensification within the existing urbanized area with no expansion means many existing neighbourhoods will become more transit supportive. The forecasted densities in Elfrida and other potential Urban Expansion Areas, planned as part of the Ambitious Density scenario, will exceed the transit supportive density threshold; however, many of the surrounding areas will be below the threshold, which makes providing frequent transit a challenge.

It should be noted that an Urban Transit Boundary expansion would be required under both scenarios to include the AEGD. In addition, the Ambitious Density Scenario will need to include a further expansion to add areas not currently in the defined service area.

Figure 3.6: Comparison of Future Transit Supportive Areas



3.5 Transit Accessibility

The number of residents and jobs living within a given distance of different transit services is shown in Table 3-4, along with the percent of forecasted residents or jobs. For the BLAST and HSR indicators, the value reflects the number of people living within the distance from a route, not a stop. Further analysis and planning are required to determine exact routes for the future scenario.

Table 3-4: Transit Accessibility Indicators (% of city-wide value*)

Scenario	Population	Jobs
Within 800 m of a BLAST Corridor		
No Boundary Expansion	502,500 (61.3%)	228,500 (63.5%)
Ambitious Density	459,100 (56.0%)	216,675 (60.2%)
Difference	43,400 (+5.3%)	11,825 (+3.3%)
Within 400 m of an HSR Corridor ** (Summer 2021 Network)		
No Boundary Expansion	631,000 (77.0%)	271,000 (75.3%)
Ambitious Density	541,500 (66.0%)	247,100 (68.6%)
Difference	89,500 (+11.0%)	23,900 (+6.7%)
Within 2.0 km of a GO Rail Station		
No Boundary Expansion	214,500 (26.5%)	134,000 (36.1%)
Ambitious Density	164,600 (20.0%)	121,500 (33.8%)
Difference	49,000 (+6.5%)	12,500 (+2.3%)

* Percentage based on City-wide population and includes rural areas

** The Summer 2021 HSR network was used for analysis and excludes TransCab routes. It is expected that the bus routes will evolve over the next 30 years, particularly to serve growth areas that may not be along existing routes.

4 Assessment of Growth Alternatives

4.1 Transportation Criteria

In order to assist Council in making a decision on the question of 'How to Grow', a framework on the evaluation approach for comparing two 'How to Grow' growth options: 'No Urban Boundary Expansion' and 'Ambitious Density' was prepared. This framework was outlined in the reported entitled *City of Hamilton GRIDS 2 / MCR- Planing for Growth to 2051: Final Growth Evaluation Framework and Phasing Criteria*, prepared by Dillon Consulting. This report and the accompanying evaluation framework was presented to the General Issues Committee on August 4, 2021. Under the theme of Transportation Systems, three criteria were proposed to inform the evaluation as follows:

- Does the growth option result in in significant impacts to the City's existing or planned transportation infrastructure?
- Does the growth option provide an urban form that will expand convenient access to a range of transportation options including active transportation, to promote complete communities?
- Does the growth option prioritize development of areas that would be connected to the planned BLAST network or existing transit?

The purpose of this section is to describe the technical assessment that was prepared to help assess each of these criteria.

The August 2021 Evaluation Framework Report also presented more detailed criteria to help evaluation the question of where to grow (Stage 2) and when to grow (Stage 3), which will be evaluated depending on the Preferred 'How to Grow' Option, if an urban boundary expansion is required. The technical analyses described in this section has been developed to have regard to those key considerations including:

- Prioritizing Public Transit;
- Comprehensive Active Transportation Network; and,
- Connected Street Network.

4.2 Road Infrastructure

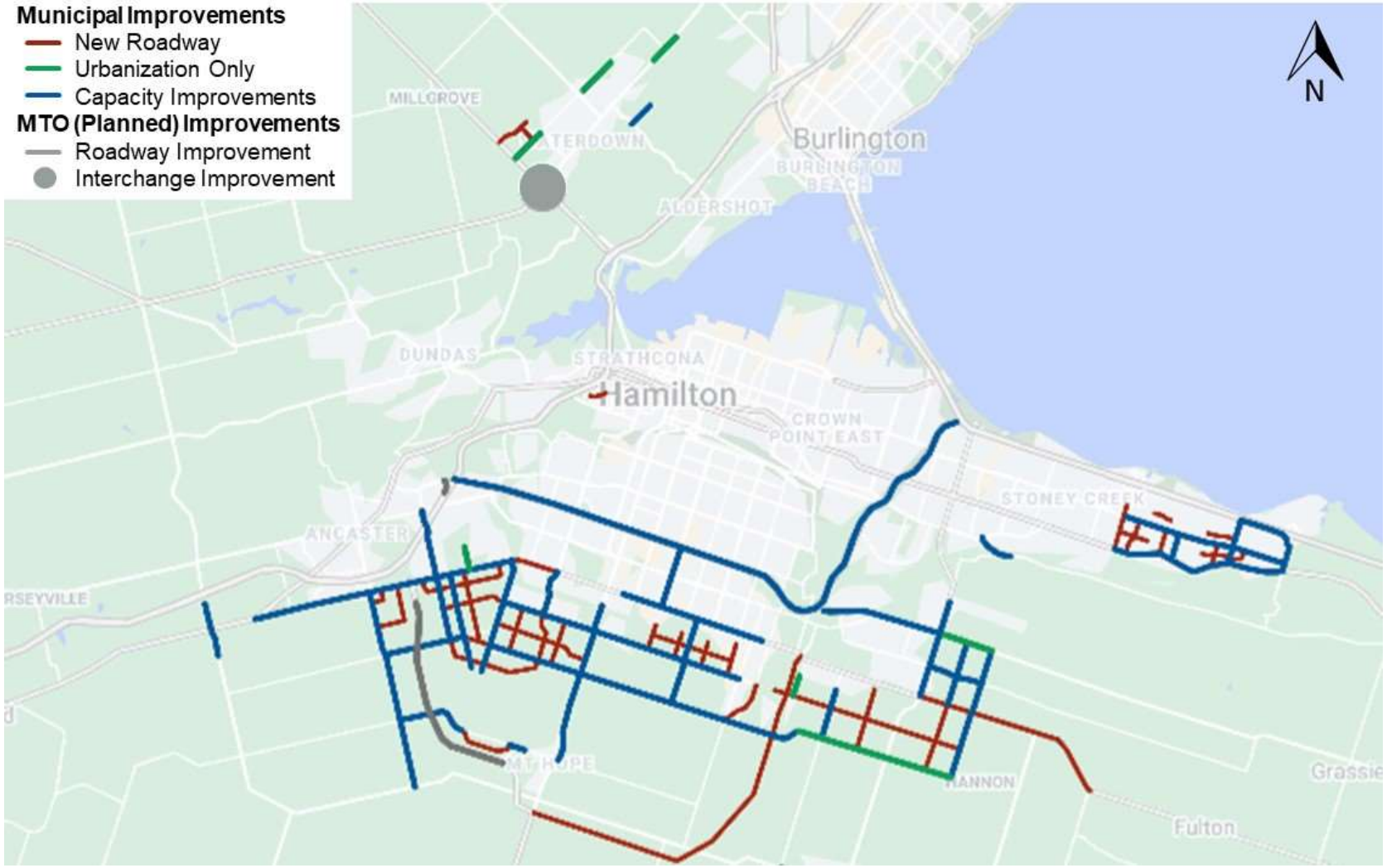
Planning for growth whether through intensification or within new growth areas located in the White Belt lands associated with an urban boundary expansion will require new or upgraded road infrastructure. The road network was developed through existing plans and by applying transportation planning principles that includes spacing and distribution of a road network to achieve the highest and best use and function of the transportation system.

Figure 4.1 identifies a number of potential road improvements relating to future growth. This map shows all road improvements that were identified as part of the 2031 TMP plus the additional road improvements that are potentially required to address needs to 2031 for the Ambitious Density scenario.

Generally, the 2031 TMP network as planned will address needs for the No Urban Boundary Expansion scenario. This includes planned roads for the AEGD and SCUBE growth areas. It is noted that for many intensification areas, road capacity may be exceeded but it is not feasible to expand roads beyond their current capacity due to physical constraints. As such, the No Urban Boundary Expansion Scenario will require increased focus on ensuring more reliable and higher frequency transit, active transportation and transportation management measures, as well as facilitating complete streets concepts.

A discussion of road network needs for each of the potential urban boundary expansion areas is provided in the following sections. It should be noted that the recommended networks would be subject to the allocation of population and employment to each area and not all improvements may be required. In all growth areas the phasing of development and the strategic implementation of the supporting road network will be an important part of the implementation strategy. This will assist in minimizing the impacts of growth on the transportation system. Design and construction of roadways applying policies such as Complete Streets and Vision Zero will assist creating inclusive spaces within communities and thus assist in reducing community impacts such as traffic infiltration (short-cutting) and speeding.

Figure 4.1: Potential Future Road Improvements



Twenty Road East and West Growth Areas

Table 4-1 provides a summary of potential road improvements that may be required to support the Twenty Road East and Twenty Road West expansion areas. For Twenty Road East this includes approximately 13.25 kilometres of collector and arterial roads at an estimated cost of $90 million (gross) in road infrastructure investment.

The Twenty West lands could require approximately 4.3 kilometres of collector and arterial roadways to support the forecasted growth for that area. This will equate to about $28 million (gross) in road infrastructure investment.

Table 4-1 Summary of Potential Twenty Road West / East Road Improvements

Road Name Segment (To / From)	Length (linear KM)	Improvement Type
Twenty East Area		
Upper Wentworth (end to Twenty)	0.75	New Road - 4 Urban
Upper Sherman (end to Twenty)	1.3	New Road - 4 Urban
Upper Gage (end to Twenty)	0.75	New Road - 4 Urban
Upper Ottawa (end to Twenty)	0.95	New Road - 4 Urban
Miles Road (Rymal to Dickenson)	2.6	Upgrade - 2 Rural to 4 Urban
East-West Arterial (Upper Wentworth to Upper Ottawa)	2.3	New Road - 4 Urban
Twenty Road (Upper James to Nebo)	4.6	Upgrade - 2 Rural to 4 Urban
Twenty West Area		
Collector Road N/S 1	0.65	New Road - 4 urban
Collector Road N/S 2	0.65	New Road - 4 Urban
Twenty Road (Glancaster to Upper James)	3.0	Upgrade - 2 Rural to 4 Urban

Elfrida Growth Area

The Elfrida area represents the largest potential urban boundary expansion as part of the Ambitious Density growth scenario. Within this growth area about $200M (gross) in road infrastructure investment could be required. A total of 38.5 centreline kilometres

has been identified as the road network to support the forecasted growth within the Elfrida urban boundary expansion lands. Table 4-2 below provides a summary of improvements assumed for Elfrida comprised of new roadways, urbanization of roadways and the addition of travel lanes with and without urbanization. Note that this does not include broader improvements to the RHVP and LINC as discussed below.

Table 4-2 Summary of Potential Elfrida Road Improvements

Road Name Segment (To / From)	Length (linear KM)	Improvement Type
First Road East (Highway 20 to Mud Street)	2.1	Upgrade - 2 Rural to 3 Urban
First Road East (oversizing - Highway 20 to Golf Club Road)	2.21	New Road - 3 Urban
Golf Club Road (Trinity Church Road to Hendershot Road)	7.0	Upgrade - 2 Rural to 2 Urban
Hendershot Road (Highway 20 to Golf Club Road)	2.1	Upgrade - 2 Rural to 3 Urban
Highland Road (Upper Centennial Parkway to Second Road East)	2.0	Upgrade - 2 Rural to 3 Urban
Mud Street (Upper Centennial Parkway to Second Road East)	2.0	Upgrade - 2 Rural to 3 Urban
Second Road East (Highway 20 to Mud Street)	3.0	Upgrade - 2 Rural to 3 Urban
Arterial N-S (Bellagio to Golf Club)	1.88	New Road - 4 Urban
Dickenson Extension (Trinity Church to Golf Club)	0.85	New Road - 4 Urban
Mud Street (Upper Centennial Parkway to RHVP)	3.6	Upgrade - 4 Urban to 6 Urban
Twenty Road (Trinity Church to Hendershot)	5.47	New Road - 4 Urban
Highway 20 (500m east of Upper Centennial to Hendershot)	1.68	Upgrade - 4 Rural to 4 Urban
Highway 20 (Hendershot to Hamilton boundary)	4.57	Upgrade - 2 Rural to 4 Rural

In addition, there are roadways that will need improvement under either growth scenario, specifically Upper Centennial Parkway, Fletcher's and Trinity Church Roads. These improvements represent approximately $38M (gross) of investment would be attributed to corridors associated with growth within the no UBE option and are summarized in Table 4-3 below. These improvements, while required under both scenarios, will serve to benefit the Elfrida area.

Table 4-3 Summary of Other Road Improvements in Elfrida Area

Road Name Segment (To / From)	Length (linear KM)	Improvement Type
Fletcher Road (500m South of Rymal to Golf Club Road)	1.6	Upgrade - 2 Rural to 3 Rural
Trinity Church Road (Hydro corridor to Golf Club Road)	2.0	Upgrade - 2 Rural to 2 Urban
Upper Centennial Parkway (Green Mountain Road to Highway 20)	2.9	Upgrade - 4 Urban to 5 Urban

Another key transportation corridor that was identified in the 2018 is conceptual link connecting the Upper Red Hill Valley Parkway near the Red Hill Business Park and the Airport Employment Growth District (See Figure 4.1). One implication of the Ambitious Density Scenario on this corridor roadway is that it may need to take on a role other than a trade corridor since the increase in residential traffic volumes will be attracted to available routes that provide travel time savings.

Conversely, without an urban boundary expansion growth will place pressure on the existing road network. This may require increased investment in transit and other travel modes. It may also distribute vehicular traffic to the constrained Provincial Highway network, which could result in constrained feeder corridors within the City.

Broader Area Network Implications

The network also considers up- and down-stream impacts of future growth on the existing transportation system, which includes impacts on the City's LINC and RHVP as well as escarpment crossings and road urbanizations.

Due to their significance in the transportation network, a focused capacity analysis for the LINC, RHVP and parallel arterial corridors was undertaken. This analysis should be considered preliminary as the model is still being refined.

The analysis examined the projected volume to capacity ratios at the peak demand locations based on 2051 projected traffic volumes and is summarized in Table 4-4. In broad terms, a v/c ratio of greater than 0.85-0.90 would indicate a potential need for widening (or other mitigation measures).

Shown, based on projected volumes, both the LINC and RHVP are projected to operate over capacity in 2051. The need for widening (or other mitigation measures) would be greater, and required sooner, under the Ambitious Density Scenario. Given that both

the RHVP and Centennial Parkway are projected to be over capacity under the Ambitious Density Scenario, this would also suggest that further capacity improvements across the escarpment may be required in the longer term.

Table 4-4: Analysis of Selected Road Corridors

Network Corridors	Mainline Capacity (veh/hr/dir)	2051 Projected Demand (No Boundary Expansion Scenario)	v/c ratio	2051 Projected Demand (Ambitious Density Scenario)	v/c ratio
Red Hill Valley Parkway	3400	3834	**1.13**	4162	**1.22**
Centennial Parkway	2000	1973	**0.99**	2353	**1.18**
LINC	3600	3464	**0.96**	3574	**0.99**

4.3 Transit Infrastructure

Similar to the road network consisting of highways, arterials, collectors and local streets, transit infrastructure is a hierarchical system. In Hamilton, the transit system is anchored by major transit routes traversing the B-Line and A-Line corridors, as well as the emerging S-Line, L-Line and T-Line corridors. GO Rail stations and related rail lines are also considered higher-order facilities. Generally, these higher order "frequent transit networks" will be similar for both the Ambitious Density and No Urban Boundary Expansion scenarios. However, as discussed below, their characteristics and performance may be influenced by the location and form of growth.

Local transit service operates throughout the City within the defined Urban Transit Boundary, but service provision varies based on a number of factors including population and employment density, demographics, and location of major transit ridership generators such as post-secondary institutions, medical centres and major employers. The provision of transit service is also influenced by current area rating policy whereby tax rates vary for transit based on service levels in the former municipalities.

In addition to higher order transit and regular transit service, the transit hierarchy also includes the TransCab service, DARTS accessible transit and the newly established on-demand transit service in Waterdown. As these services provide a flexible alternative to fixed route transit, and in the case of TransCab, acts as an extension of fixed route transit service operating in less dense and lower demand areas, their impact on the evaluation of growth options is less applicable. .

In terms of the BLAST network, both scenarios will result in the majority of the city's residents and jobs being within a 10 minute walk (800 m) of a higher order transit

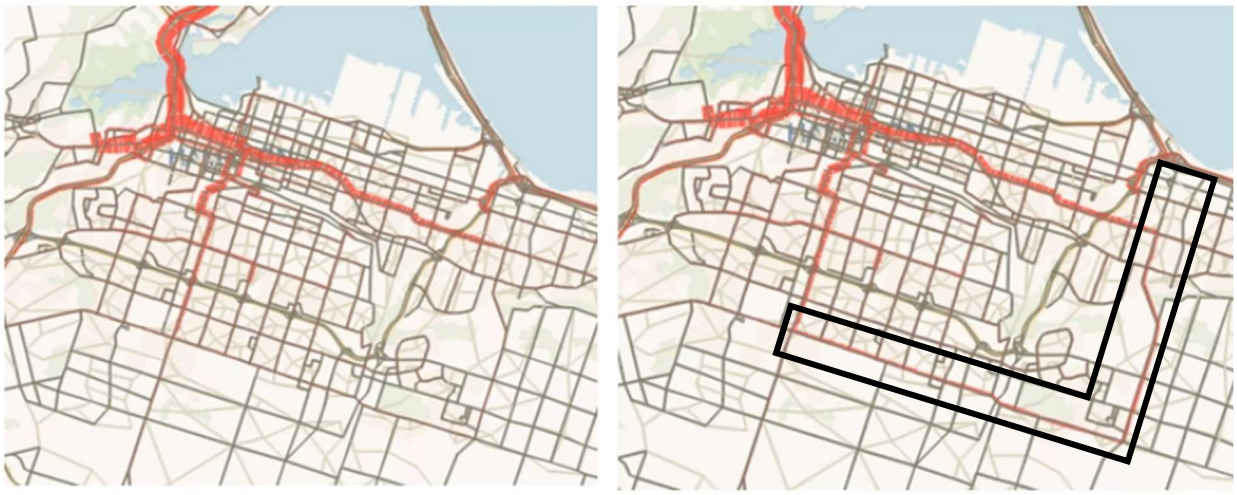
corridor and as such justify investments in these planned corridors. One major difference between the growth scenarios is that the Ambitious Density scenario offers the potential to shape new urban expansion areas to leverage the BLAST network. Specifically, with the possibility for more between 16,000 - 20,000 new units in the Elfrida Area and with target densities of 77 person and jobs per hectare, this would support investments in the S-Line. In addition, ridership on the S-Line could further be maximized by providing efficient feeder services and cycling walking corridors from the core of the Elfrida neighbourhood, or conversely, creating a branch of the S-Line to extend into the new Elfrida development. The potential for the Ambitious Density scenario to generate higher ridership in the S-Line corridor (along Rymal Road and Upper Centennial) is illustrated in Figure 4.3.

At the same time, while generating increased ridership potential for the S-Line, the Ambitious Density Scenario will; however, accelerate the need for physical improvements to the S-Line corridor to ensure priority for transit. This includes queue jump lanes or dedicated transit lanes, which may be difficult to implement throughout the corridor due to property restrictions. In addition, Rymal Road was recently widened to four lanes between Dartnall Road and Upper Centennial, with minimal provision for physical transit priority measures.

For the No-Urban Boundary Expansion Scenario, there will similarly be a need to tailor plans for the BLAST Corridors. For example, this scenario will see increased levels of intensification along the A-Line, accelerating the need for more aggressive transit priority measures. However, this is consistent with current plans wherein the A-Line shows the highest potential for return on investment.

Impacts on the expansion of the GO Rail system are unlikely to differ by scenario as the planned Confederation GO Station is already justified and works to extend service levels to Niagara are in progress. One potential difference is the need for park and ride at the Confederation Station to accommodate demand from Elfrida and other expansion areas.

Figure 4.2: Comparison of S-Line Transit Usage for 2051



No Urban Boundary Expansion Scenario **Ambitious Density Scenario**

Impacts to local service and related infrastructure were also examined using simplified approaches. Further analysis including development of more refined service plans by area will be undertaken during the next stages of evaluation.

For the purposes of this stage of evaluation, an approximation of annual service hours was developed by assigning a target service level by superzone based on existing trends, accounting for the 2018 TMP mode share target of 12% for transit. Service hours are the main driver of other transit infrastructure including fleet and facility requirements. The resulting service levels by growth scenario are presented in Table 4-5. Overall, it is expected that service hours required for each scenario would be similar at the city-wide level, but the distribution of service levels increases would be applied differently. Under the Ambitious Density Scenario, service hour increases would be related to growth in new areas and new or extended routes, whereas under the No Boundary Expansion scenario, service hour increases would primarily be due to improving frequencies and capacities for existing routes and corridors.

A key advantage of the No Urban Boundary expansion scenario is that the capacity provided by the B-Line LRT could be leveraged and possibly reduce the need for service level increases overall. From an infrastructure needs perspective, the provision of services in new Urban Expansion Areas would also require new infrastructure such as stops, waiting areas benches and signage.

Table 4-5 Projected Weekday Service Hours by Scenario*

	2016 Base Year	2051 Ambitious Density	2051 No Boundary Expansion
Inner Urban	324,800	496,400	541,500
Outer Urban	211,200	464,200	416,900
Total	536,000	960,600	958,400
% Increase from 2016		79%	79%

* Based on Revenue Service Hours excluding dead-heading

A final consideration in evaluating the impacts of each scenario on transit needs is the phasing of development. While existing urban areas can support incremental increases in service levels, new expansion areas may take time to realize densities that can support basic transit service at reasonable cost recovery levels. In turn this makes transit less attractive and difficult to achieve target mode shares during early phases of development. For this reason, some municipalities require the development industry to subsidize the cost of providing transit at planned service levels until development densities can support those planned levels in a cost-effective manner.

4.4 Active Transportation Needs

Under any future growth scenario, active transportation will need to play a prominent role in meeting future travel needs. Moreover, active transportation is also critical to achieving improved public health outcomes, environmental goals and the realization of complete livable communities.

Staff are working to deliver the Cycling Master Plan (2018), which today offers a cycling facility within 400 m of approximately all residents and jobs (Table 4-6). Taking a Complete Streets approach, all roads built or improved to support growth must be built to include cycling and walking facilities. Such facilities would not only support active transportation within these growth areas, but also facilitate first and last mile connections to transit. This would complement the planned Cycling Master Plan network, which should review broader network connections to growth areas as part of the next update.

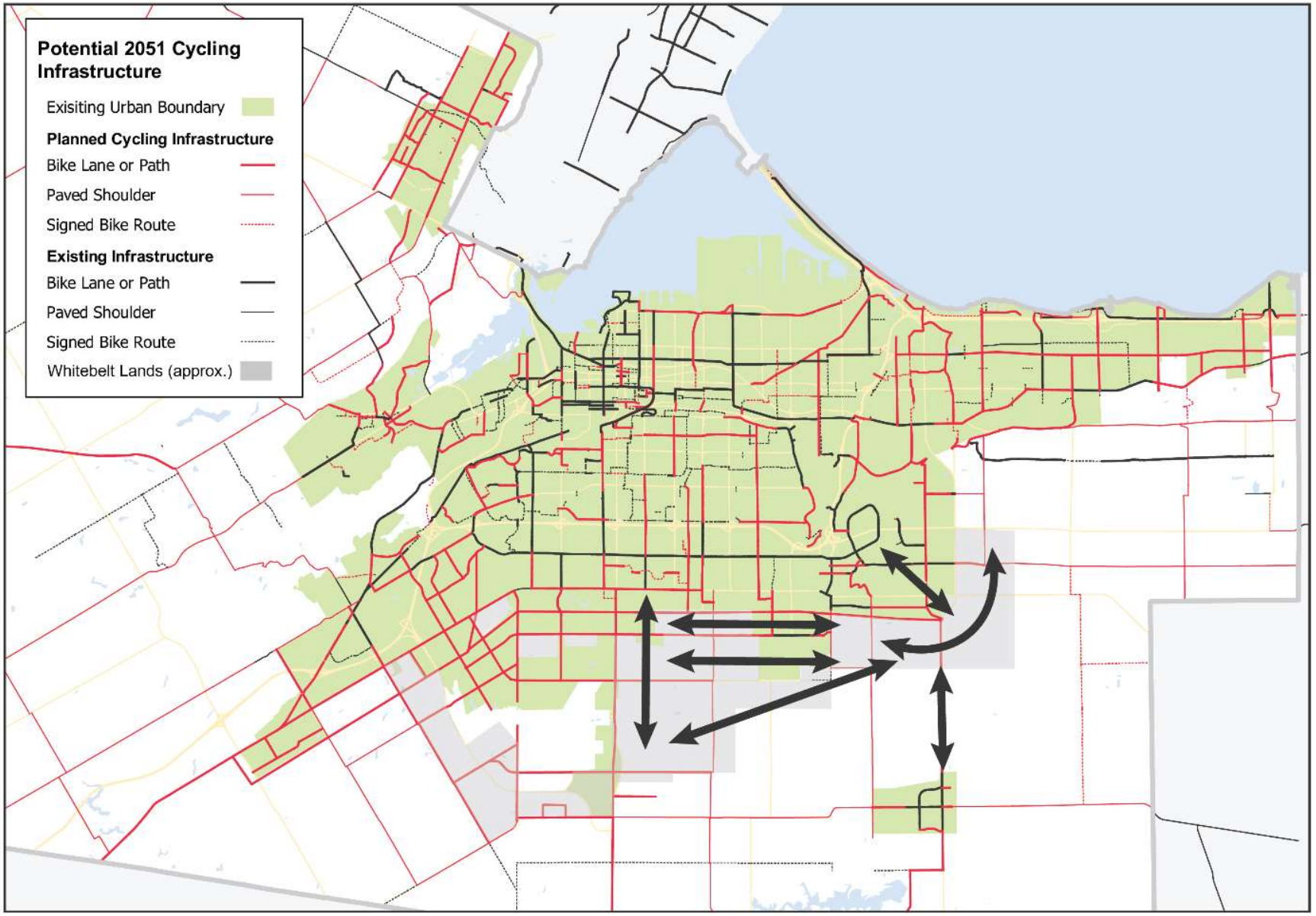
Table 4-6: Number of People and Jobs Within 400 m of a Cycling Facility

Scenario	Existing Network		Full Cycling Master Plan	
	Population	Jobs	Population	Jobs
2021	410,900 (70.2%)	160,200 (70.1%)	513,100 (87.7%)	196,900 (86.2%)
No Boundary Expansion	587,800 (71,2%)	253,000 (70.3%)	736,000 (89.6%)	315,200 (87.6%)
Ambitious Density	521,300 (63.6%)	238,200 (66.2%)	700,600 (85.4%)	307,300 (85.4%)

At a high level, the Ambitious Density Scenario would require the construction of new walking and cycling facilities within each growth area as well as new connections to the existing and planned active transportation network. Figure 4.3 illustrates how these connections might be achieved given the existing and planned network.

For the Elfrida Area, connections could be made to the existing bike lanes on Stone Church Road as well as the Red Hill Valley trail and Paramount Road links. A number of existing links would need be upgraded to make existing/planned facilities are more accessible for all ages and abilities. Improved cycling infrastructure on Rymal Road would be desirable to maximize active transportation shares from Elfrida and other new growth areas. One major opportunity that could support greater levels of active transportation under the ambitious density scenario is the development of a major east-west spine pathway system that follows the hydro corridor between Rymal Road and Twenty Road, as envisioned in the Recreational Trails Master Plan.

Figure 4.3: Existing and Future Active Transportation Network



Active transportation needs and opportunities for the No Boundary Expansion alternative would primarily be related to the upgrading of existing facilities and the acceleration of the build-out of Planned Cycling Network as developed through the 2018 Cycling Master Plan. Greater pedestrian and cyclist trip density in intensified areas will generate a need to build higher quality, separated cycling facilities. This may include new or separated cycling facilities along Upper Ottawa, Upper Wellington and West 5th, to properly connect with the broader municipal network, to provide safe connections to the city-wide network. Higher trip density in this scenario could lead to existing communities being able to support amenities locally, they currently need to travel elsewhere for. Reducing trip distances will help make active modes more competitive for these shorter distances, which experience shows should lead to more active trips.

In both scenarios, there may be a need to upgrade and install other existing infrastructure. This could include installing sidewalks where there are none, making sidewalks that connect to key destinations wider, upgrading unpaved trails to year-round facilities, and other localized enhancements.

4.5 Emissions from Transportation

In addition to developing the background to evaluate the criteria under Transportation Systems, this report also provides a forecast of key inputs required to estimate Greenhouse Gas (GHG) emissions from transportation, as input to the Climate Change Theme criteria.

As background, transportation in Hamilton currently accounts for 13% of GHG emissions from all sources. Excluding industrial sources, which dominate Hamilton's GHG emissions, transportation accounts for 39% of emissions produced (Source: Hamilton and Burlington Low-Carbon Scenario and Technical Report 2016 to 2050, Sustainability Solutions Group)

Using the Hamilton Transportation Demand Model, it is possible to estimate total vehicle-kilometres (VKT) travelled by personal automobiles and passenger-kilometres travelled (PKT) by transit, each of which can be converted to GHG emissions based on fuel efficiency. VKT and PKT are key indicators of greenhouse gas emissions. While the resultant emissions are dependent on projected trends in fuel efficiency and fuel type mix (e.g. gasoline, diesel, natural gas, hydrogen, or electric), fundamentally VKT and PKT represent travel effort for which energy is required.

As shown on Table 4-7 both growth scenarios will result in significantly more VKT and PKT being generated by Hamilton residents, as expected due to increased population and employment. Comparing the two growth scenarios, the Ambitious Density Scenario would result in a 58% increase in VKT vs. 48% for the No Urban Boundary scenario. A

similar magnitude difference is projected for PKT as well, due to the fact transit trips would be longer on average for the Ambitious Density scenario.

On a per capita basis, VKT per capita is projected to increase by 9% and 2% for the ambitious and no boundary expansion scenario respectively.

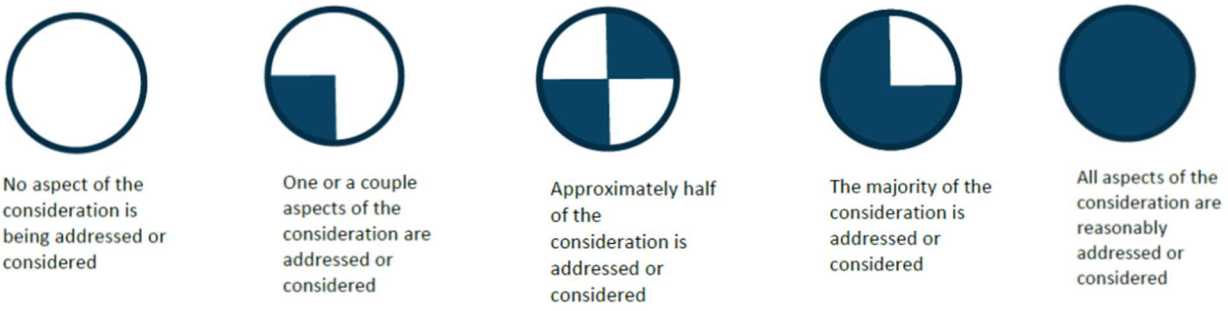
Table 4-7 Projected GHG Indicators (VKT and PKT)

Metric	2016 Base	2051 Ambitious Density	2051 No Boundary Expansion
VKT (Peak hour)	1113000	1759000	1650000
PKT (Peak hour)	61000	101000	95000
VHT	31 mins/veh	42 mins/veh	40 mins/veh
VKT (Per annum)	4,062,450,000	6,420,350,000	6,022,500,000
% increase from 2016		58%	48%
VKT per capita	7,196	7,827	7,339
% increase from 2016		9%	2%
PKT (Per annum)	183,000,000	303,000,000	285,000,000
		66%	56%

5 Evaluation Summary

Based on the analysis outlined in the preceding chapters, this section summarizes the findings and applies the evaluation criteria under the Theme of Transportation Systems. Information is also provided to support estimates of GHG emissions from transportation, which will be incorporated into the broader evaluation of the Climate Change Theme.

An assessment was undertaken based on the following five ranking criteria:



The evaluation discussion is provided below.

5.1 Transportation and Climate Change

Table 5-1: Evaluation Table | GHG Emissions from Transportation & Climate Change

Growth Option 1: Ambitious Density (1,310 Ha Expansion)	Growth Option 2: No Urban Boundary Expansion
Does the growth option present any significant risks associated with climate change?	
• 58% increase in auto vehicle kilometres of travel compared to 2016 • 66% increase in auto vehicle kilometres of travel compared to 2016 • 9% increase in VKT per capita compared to 2016 • Based on projected average auto trips lengths and projected mode shares, residents will be more exposed to financial risk if transportation energy costs increase	• 48% increase in auto vehicle kilometres of travel compared to 2016 • 56% increase in auto vehicle kilometres of travel compared to 2016 • 2% increase in VKT per capita compared to 2016
Overall Result Addresses a couple of aspects of this theme. 	**Overall Result** Addresses some aspects of this theme. 
Does the growth option present any significant opportunities associated with climate change?	
• Targeted densities in new growth areas could support forms of development that are conducive to working from home • Population and employment will increase in transit supportive areas • Streets for new growth areas can be designed to mitigate impacts of climate change (i.e. Stormwater management, street trees)	• Population and employment will increase in transit supportive areas • Based on average trip distance and access to higher order transit, a greater proportion of trips are “feasible” trips for sustainable modes (walk/cycle/transit)

Overall Result Addresses a couple aspects of this theme. 	**Overall Result** Addresses some aspects of this theme. 

5.2 Transportation System

Table 5-2: Evaluation Table | Transportation System

Growth Option 1: Ambitious Density (1,310 Ha Expansion)	Growth Option 2: No Urban Boundary Expansion
Does the growth option result in significant impacts to the City's existing or planned transportation infrastructure?	
Road Network • Projected need for 50.8 km of new roadways (centreline km), 157.16 km of new capacity improvements, 34.71 km of urbanized roads • There are two screenlines exceeding capacity (NB escarpment and WB downtown) • Significant increase in capital and operating cost associated with maintaining, operating and asset management • Increase in new roadways will put pressure on the ability to deliver infrastructure at a pace to keep up with demand • Relative to the No Boundary Expansion option and existing conditions, this option will see higher per capita vehicle kilometres travelled and higher per capita travel times, suggesting overall network performance will be less efficient	**Road Network** • Projected need for 18.81 km of new roadways (centreline km), 91.35 km of new capacity improvements, 18.81 km of urbanized roads • Notwithstanding an increase in transit mode share for this growth option, the absolute auto volumes will be higher within the inner urban area resulting in greater levels of congestion • There are two screenlines exceeding capacity (NB escarpment and WB downtown) • A moderate increase in capital and operating cost associated with operating, maintaining and asset management of the road network • Increased vehicle trips in intensification areas may generate the need for additional traffic calming measures

Growth Option 1: Ambitious Density (1,310 Ha Expansion)	Growth Option 2: No Urban Boundary Expansion
• Vehicle trips from new growth areas may generate more cut-through traffic in adjacent existing areas resulting in the need for traffic calming measures	
Transit Network • This alternative is compatible with the city's 'in development' and planned higher order transit corridors • Approximately 79% increase in transit service hours required City-wide • Requires extension of routes or new routes to service new growth areas • Increases capital costs for new transit amenities and upgrades to amenities adjacent to new growth areas • Potential to invest in park and ride facilities to support transit	**Transit Network** • This alternative is compatible with the city's 'in development' and planned higher order transit corridors • Approximately 79% increase in transit service hours required City-wide • Requires enhanced service levels in intensification areas to address growth • Greater reliance on transit to meet modal share targets, given road network constraints in built up areas • Increased need for upgrades to existing transit amenities • Intensification of development in existing built up areas and in proximity to existing employment and commercial promotes mixed use development, which improves cost efficiency of transit services (e.g. flatter peak loads, two-way travel demand)
Active Transportation Network • Transportation networks within Urban Expansion Areas will be designed based on a complete streets approach and include active transportation facilities • Will require connections and enhancements to existing trail system to facilitate commuter travel • Planned cycling and trails in outer areas may need to be accelerated to address gaps between existing networks and new growth areas	**Active Transportation Network** • Will require upgrades to existing and near term planned cycling facilities to facilitate all ages and abilities travel and accommodate increased demands • Will be more competition for road space between users as a result of higher densities in some areas • Will increase need for amenities to support walking and cycling trips

Growth Option 1: Ambitious Density (1,310 Ha Expansion)	Growth Option 2: No Urban Boundary Expansion
• Development of New Urban Expansion areas will drive need for addressing sidewalk gaps in nearby adjacent neighbourhoods and connecting streets (e.g. Upper Centennial, Upper James south of Hydro corridor)	
Overall Result Addresses some aspects of this theme. 	**Overall Result** Addresses most aspects of this theme 
Does the growth option provide an urban form that will expand convenient access to a range of transportation options including active transportation, to promote complete communities?	
• 85.4% of residents and 85.3% of jobs projected to be within 400 m of planned active transportation network • Boundary expansions with high single-detached family dwelling unit counts generally increase trip distances to / from local amenities (e.g. grocery stores etc.) and decreases the likeliness to use active transportation • Required timeframe to build out new growth areas could mean that option for sustainable transportation are not available for early residents	• 89.6% of residents and 87.6% of jobs projected to be within 400 m of planned active transportation network • Intensification will support more local amenities (e.g. grocery stores, corner stores, etc.) which in turn allows for more short trips by active transportation
Overall Result Addresses some aspects of this theme. 	**Overall Result** Addresses some aspects of this theme. 
Does the growth option prioritize development of areas that would be connected to the planned BLAST network or existing transit?	

Growth Option 1: Ambitious Density (1,310 Ha Expansion)	Growth Option 2: No Urban Boundary Expansion
• 56% of residents and 60.2% of jobs projected to be within 800 m of BLAST corridor • 66% of residents and 68.6% of jobs projected to be within 400 m of Local HSR network • Development of new urban expansion areas provides opportunity to build communities around transit • Density in Elfrida area has potential to exceed 50 persons plus jobs per hectare which supports basic transit service • Currently there is minimal local transit within the Urban Expansion Areas, therefore service extensions will be required. • Extension of services would require changes to current defined transit service area and area rating policy • Densities are unlikely to support transit service levels needed to build transit-oriented communities from day one and maximize transit mode shares, unless there is a mechanism to subsidize transit services in the short term • Development of Elfrida area could be served by new inter-regional transit service given concentration of population	• 61.3% of population and 63.5% of jobs projected to be within 800 m of BLAST corridor • 77% of residents and 75.3% of jobs projected to be within 400 m of Local HSR network • Will result in 68,200 more people living (8.4%) within areas that are transit supportive (>50 ppj/ha) • Leverages investments by senior levels of government in the B-Line and A-Line corridors • Higher densities are more suitable to support transit ridership, which would increase mode share with improved services •
Overall Result Addresses some aspects of this theme. 	**Overall Result** Addresses some aspects of this theme. 

Appendix E:

Agricultural Report

To: Heather Travis, RPP, Project Manager, City of Hamilton

From: Sue Reimer, BSc RPP MCIP AScT

Date: October 20, 2021

Subject: **Stage 1 – Growth Options Evaluation - Agriculture - GRIDS 2/MCR**

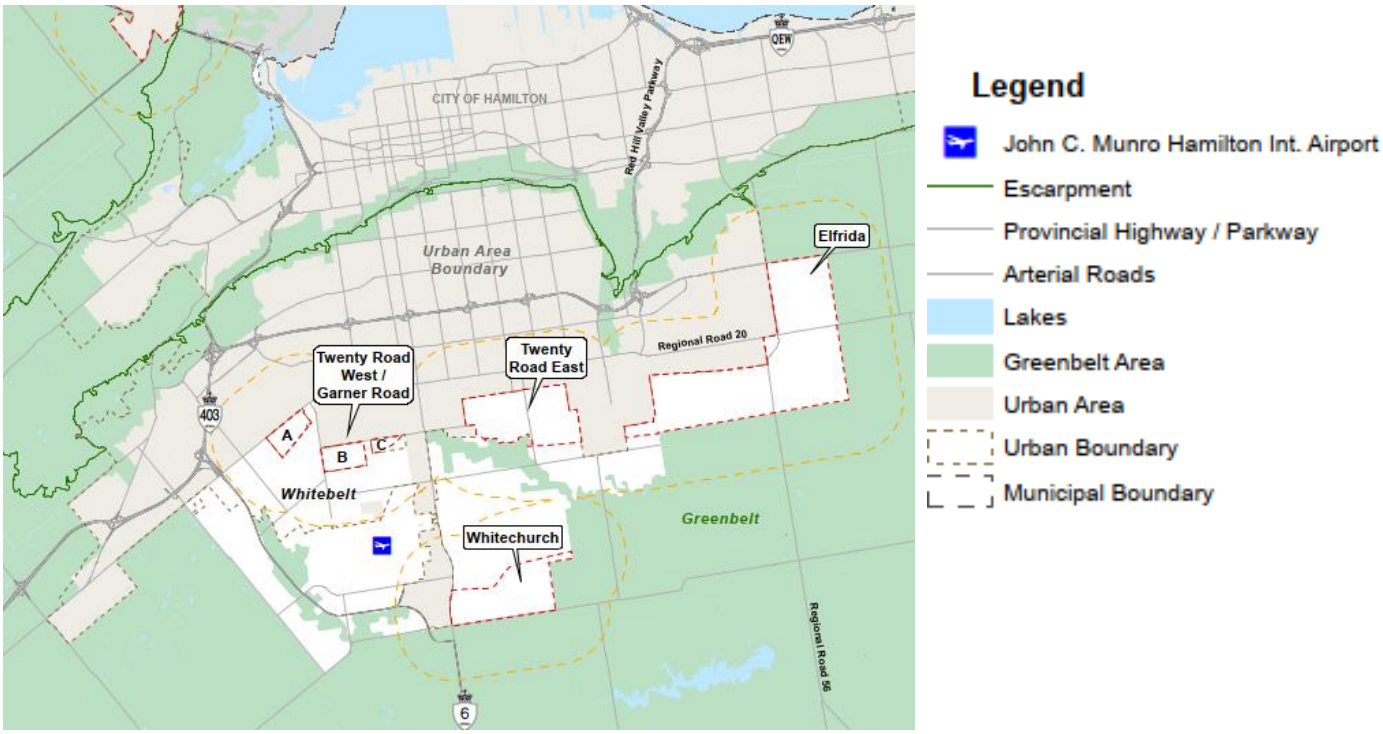
Our File: 17-6785 9001

1.0 Introduction

The purpose of this Stage 1 – Growth Options Evaluation is to answer the question of "How should Hamilton grow?" with respect to agriculture. This evaluation considers two Growth Options: Growth Option 1: Ambitious Density (1,310 ha expansion) and Growth Option 2: No Urban Boundary Expansion Option. The previously completed Agricultural Impact Assessment report provided much of the background information for this Stage 1 evaluation.

Most of lands outside of the existing urban boundary are protected by the Greenbelt Plan and as a result Candidate Expansion Areas are found in the whitebelt. The whitebelt is defined as lands that are not part of the Greenbelt and are located outside the existing City of Hamilton urban boundary. **Figure 1-1** provides the location of the four Candidate Expansion Areas (CEA), located within the whitebelt, which would be considered for the 1,310 ha boundary expansion should Growth Option 1 be selected. The CEAs are lands outside of NEF 28 contour of the Hamilton International Airport, and can accommodate residential or employment uses, consistent with City Urban Hamilton Official Plan policy.

Figure 1-1: Location Map



1.1 Methodology

The findings provided in this memo are based primarily on existing conditions and analysis completed as part of the Agricultural Impact Assessment (AIA) for the City of Hamilton. As part of the AIA, Dillon Consulting Limited (Dillon) conducted a windshield survey from publicly accessible roadways, of existing agricultural conditions, in order to identify and document the existing conditions of each of the identified CEAs, and using the data gathered to provide a baseline.

The extent of agricultural and non-agricultural land uses within the CEAs and in their surrounding 1,500 m buffer areas, was determined through a review of aerial photography (ca. May 9, 2013), and through roadside observations of adjacent properties that occurred on May 6, 2021 (Twenty Road West/Garner Road and Twenty Road East), May 27, 2021 (Whitechurch), and June 17, 2021 (Elfrida). The survey also included determining whether any fields were being used for speciality crops. **Attached Figures 1 through 4** shows the field survey results of land uses and agricultural infrastructure (e.g., barns/silos etc.) as well as the cropping activity that was occurring within the 1,500 m, referred to as the buffer area.

A Minimum Distance Separation (MDS) analysis was also completed as part of the AIA. This included conducting MDS calculations and completed MDS worksheets for Type B Land Use for new or expanding settlement area boundary. Further detail on the methodology for MDS can be found in **Section 3.3** of this memo.

Findings were applied to the considerations of the Agricultural theme as part of the Growth Options evaluation framework.

1.2 Document Outline

In addition to the introduction and methodology overview, this document consists of three main sections:

- Planning Policy Context;
- Summary of Applicable AIA Findings; and
- Evaluation.

2.0 Planning Policy Context

2.1 Federal Agriculture

2.1.1 Canada Land Inventory (CLI) – Soil Capability for Agriculture (1968)

Soils are grouped into seven different classes on the basis of soil survey information, based on the following important factors:

- Soils are well managed and cropped, using mechanized operational systems;
- Land areas that require improvement can be made relatively economically by the farm operator, and is classed according to its limitations or hazards in use after the improvements have been implemented. Land that requires improvements beyond what the farm operator can economically accomplish is classed according to its present condition;
- Not considered are: kinds of roads, size of farms, type of ownership, skill or resource of individual farm operators, hazard of crop damage by storms;
- Does not include soil capability for trees, specialty crops, recreation or wildlife; and
- Soil classes are based on intensity, rather than kinds, of their limitations for agriculture.

Soils that are classified as Class 1, 2, or 3 are considered as Prime Agricultural lands under the CLI framework. A table outlining the CLI classes is included at the end of this memo for reference purposes.

2.2 Provincial Planning

2.2.1 Provincial Policy Statement (2020)

The Provincial Policy Statement (PPS) 2020, issued under Section 3 of the Planning Act, provides policy direction on matters of provincial interest related to planning and regulating the development and use of land. The Planning Act requires that all decisions that affect land-use planning matters must be

consistent with the PPS, therefore all municipal Official Plans are required to be consistent with the policies in the PPS.

Section 1 of the PPS outlines policies on "Building Strong Healthy Communities." This section promotes strong, livable and healthy communities. Specific policies relevant to the expansion of settlement areas in the context of GRIDS 2 include the following:

- **Municipal Comprehensive Review:** The expansion of a settlement area boundary may only occur as part of a municipal comprehensive review (MCR) process and requires a settlement boundary expansion assessment (Policy 1.1.3.8).
- **Settlement Area Boundary Expansion:** The complexity and scale of the assessment is dependent on the context of the proposed expansion (Policy 1.1.3.8), but must demonstrate the following:
    - Demonstrate that the forecasted growth cannot be accommodated through the intensification and redevelopment of existing designated growth areas (Policy 1.1.3.8a).
    - Determine that the existing or planned infrastructure and public services have sufficient capacity to accommodate the proposed expansion (Policy 1.1.3.8b).
    - In areas where a settlement area expansion includes prime agricultural areas, the lands must not include specialty crop areas and alternative locations must have been evaluated (Policy 1.1.3.8c). This supported by PPS policy 2.3.5.1, which acknowledges the removal of land from prime agricultural areas may only occur for the purposes of settlement area boundary expansion in accordance with policy 1.1.3.8.
    - Follow the minimum distance separation formulae for all new or expanding settlement area (Policy 1.1.3.8d). In addition, any impacts from new or expanding settlement areas on agricultural operations must be mitigated to the extent feasible (Policy 1.1.3.8e).

Settlement area boundaries may also be adjusted outside the MCR process if the adjustment does not result in a net increase in land within the settlement areas and complies with the PPS policies noted above (Policy 1.1.3.9).

2.2.2 Greenbelt Plan (2017)

The Greenbelt Plan, under the authority of the *Greenbelt Act, 2005*, protects agricultural lands, water resources and natural areas in Ontario's Greater Golden Horseshoe region. The region has some of Canada's most important and productive farmland. The fertile soil, moderate climate and abundant water resources support agricultural production that cannot be duplicated elsewhere in the province and in the country.

The Greenbelt Plan is a strategy and framework that provides clear direction for where and how future growth should be accommodated and what must be protected for current and future generations. It includes the lands within the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan. Together, they identify where urbanization shouldn't happen in order to protect the agricultural land base and the ecological features. The Greenbelt Plan vision is the protection of the agricultural land base

against fragmentation, loss to urban uses, and supports agriculture as the predominant land use. It builds resilience to and mitigates climate change, and also gives permanent protection to the natural heritage and water resource systems that sustain ecological and human health; and supports a diverse range of economic and social ventures associated with agriculture, tourism, rural communities, resource use, and recreation.

Like all provincial plans, the Greenbelt Plan builds upon the policy foundation provided by the PPS, and has more specific/additional land use planning policies to address issues facing this specific geographic area. It is to be read in conjunction with the PPS; policies of the Greenbelt Plan take precedence over the PPS to the extent of any conflict, except where the relevant legislation provides otherwise. Where the policies of the Greenbelt plan addresses the same, similar, related, or overlapping matters as in the PPS, applying the specific policies of the plan satisfies the requirements of the more general policies of the PPS.

The Greenbelt Plan must also be read in conjunction with other provincial plans, related planning mechanisms, regulations and standards of conservation authorities, other agencies and the federal government. This includes the Growth Plan and the NEP. Others that also apply include: source water protection plans under the *Clean Water Act*, upper and lower tier Official Plans, zoning by-laws, Minister's zoning orders, *Endangered Species Act*, and the *Conservation Authorities Act*. Other agency plans, regulations or standards must also conform to the Greenbelt Plan.

With respect to the Growth Plan for the Greater Golden Horseshoe, the policies of the Growth Plan that address the same, similar, related or overlapping matters as the Greenbelt Plan do not apply within the Greenbelt Area, except where the policies of the Greenbelt plan are provided. In contrast, where matters addressed in the Growth Plan don't overlap with policies in the plan, those Growth Plan policies must be independently satisfied. Section 3.4.3 of the Greenbelt Plan stipulates that the following policies apply for lands within Towns/Villages in the Protected Countryside:

1. *Towns/Villages are subject to the policies of the Growth Plan and continue to be governed by Official Plans and related programs or initiatives and are not subject to the policies of the Greenbelt Plan, save for the policies of sections 3.1.5, 3.2.3, 3.2.6, 3.3 and 3.4.2.*

2. *Extension or expansions of services to settlement areas within the Protected Countryside shall be subject to the infrastructure policies of section 4.2 of the Greenbelt Plan, including the requirements regarding environmental assessments and agricultural impact assessments.*

3. *As part of a municipal comprehensive review under the Growth Plan, an upper- or single-tier planning authority may allow expansions of settlement area boundaries in accordance with the policies 2.2.8.2 and 2.2.8.3 of the Growth Plan.*

2.2.3 Growth Plan for the Greater Golden Horseshoe (2019, as amended)

The Provincial Growth Plan includes population and employment forecasts and policy direction for a range of areas including land use, infrastructure, housing, transportation planning, and employment. The Growth Plan also includes intensification and density targets which municipalities must plan to achieve.

The recently updated Growth Plan features several new policies and targets which have potential to impact the evolution of the City's planned urban boundary expansion. Of particular relevance to this exercise are the following key policies:

Key Policy Directions from Growth Plan

- Settlement area boundary expansion can only occur as part of MCR.
- The intensification / density targets in the Growth Plan and a land need assessment must be carried out.
- An Agricultural Impact Assessment may be required for settlement area boundary expansions

- **Municipal Comprehensive Review:** Similar to PPS policy 1.1.3.8, a settlement area boundary expansion may only occur through a MCR process. In addition, the expansion must be based on the minimum intensification and density target laid out in the Growth Plan and a land needs assessment (Policy 2.2.8.2a). As per Amendment 1 to the Growth Plan, the planning horizon is the year 2051.
- **Settlement Area Boundary Expansion:** Where a need for a settlement area boundary expansion has been justified the feasibility and appropriate locations of the proposed expansion must be determined based on the comprehensive application of all of the policies within the Growth Plan (Policy 2.2.8.3), including the following:
    - As per policy (2.2.8.3 f), avoid prime agricultural areas where possible. The expansion into these areas must be supported by an evaluation of alternatives based on avoiding, minimizing and mitigating the impact on the Agricultural System and in accordance with the following:
        i. *expansion into specialty crop areas is prohibited;*
        ii. *reasonable alternatives that avoid prime agricultural areas are evaluated; and*
        iii. *where prime agricultural areas cannot be avoided, lower priority agricultural lands are used (policy 2.2.8.3g).*
    - Follow the minimum distance separation formulae for all new or expanding settlement area (Policy 2.2.8.3g).
    - Complete an Agricultural Impact Assessment to determine how the expansion of the settlement areas avoids, minimizes, and mitigates against any adverse impacts on the agri-food network (Policy 2.2.8.3 h).

2.3 Provincial Agricultural Planning Policy

2.3.1 Draft Agricultural Impact Assessment (AIA) Guidance Document (2018)

In March 2018, the Province of Ontario released a document entitled Draft Agricultural Impact Assessment (AIA) Guidance Document[1]. The goal of this document is to ensure that farmland, farm operations and supporting infrastructure, services and assets are sustained to support a prosperous agri-food sector and strong rural community. The Guidance Document identifies best practices and resources for mitigating impacts to farmland, farm operations and the Agricultural System; and supports existing provincial land use plans, namely: Growth Plan, Greenbelt Plan, Oak Ridges Moraine Conservation Plan, the Niagara Escarpment Plan, and the Provincial Policy Statement. The document indicates that AIA's are required for certain types of development within the Greater Golden Horseshoe.

For this agricultural assessment, the AIA Guidelines were adhered to with respect to secondary study area distance of 1,500 m in order to address all land uses within the buffer area of the CEAs.

2.3.2 Guidelines on Permitted Uses in Ontario's Prime Agricultural Areas (2014)

This document helps with the interpretation of policies in the Provincial Policy Statements on the uses that are permitted in prime agricultural areas; comprising the guidelines referred to in section 2.3.3.1 of the PPS.

Guidance is provided on:

- Agricultural, agriculture-related and on-farm diversified uses described in Policy 2.3.3 of the PPS;
- Removal of land for new and expanding settlement areas (PPS Policy 2.3.5) and limited non-agricultural uses in prime agricultural areas (PPS Policy 2.3.6); and
- Mitigation of impacts from new or expanding non-agricultural uses (PPS Policy 2.3.6.2).

These guidelines were devised to complement and explain (and be consistent with) the intent of the PPS. Where specific parameters are proposed, these represent best practices rather than specific standards.

2.3.3 Minimum Distance Separation (MDS) Document – Formulae and Guidelines for Livestock Facility and Anaerobic Digester Odour Setbacks (2014)

The MDS Document is meant to be read in conjunction with the Planning Act, 1990, the Building Code Act, 1992, the Nutrient Management Act, 2002, the policies of the Provincial Policy Statement 2020 (PPS) and other applicable laws and provincial/municipal plans. In accordance with Section 2.3.3.3 of the PPS, new land uses in prime agricultural areas and on rural lands must comply with the Minimum Distance Separation Formulae (MDS-I), prior to the approval of proposed lot creation, rezoning or re-

[1] The Ministry of Agriculture, Food and Rural Affairs is currently updating the draft document to reflect comments received through consultation and to align with provincial directions. (as of May 28, 2021)

designation, in accordance with the implementation guidelines in The Minimum Distance Separation (MDS) Document (Ontario Ministry of Agriculture, Food and Rural Affairs, 2017).

MDS-I is applied as a planning tool to determine appropriate setback distances in an effort to minimize land use conflicts and to minimize nuisance complaints related to agricultural livestock related odour sources. Where a setback is determined to be required, the "measurements are taken as the shortest distance between the proposed structures and either the manure storages, or anaerobic digesters, or the livestock occupied portions of the livestock barns"[2].

2.3.4 Agricultural System Land Base Mapping

Municipalities are required to bring their Official Plan into conformity with the A Place to Grow: Growth Plan for the Greater Golden Horseshoe and the Greenbelt Plan by July 1, 2022, in part, by incorporating the agricultural land base into their official plan. OMAFRA's Agricultural System land base mapping for the Greater Golden Horseshoe (GGH) (February 2018) along with Implementation Procedures (March 2020) and the Agricultural System Portal mapping was finalized in February 2018. The web-based Agricultural System Portal contains map layers that are to be used to identify existing agri-food assets, and to analyze potential adverse impact on the agricultural system from non-agricultural land uses. Provincial policy requires AIAs for settlement area expansions, infrastructure projects and mineral aggregate operations in prime agricultural areas to identify ways to avoid or, if avoidance is not possible, to minimize and mitigate adverse impacts on the Agricultural System.

OMAFRA invited municipalities to come forward with refinements to augment the Agricultural System land base mapping which identified prime agricultural areas. Official plan schedules must ensure prime agricultural areas are identified and mapped with an appropriate agricultural designation. Both of OMAFRA's implementation procedures and agricultural land base map are required to be applied to land use planning decisions. The intent is that municipalities map prime agricultural areas and rural lands as a continuous, interconnected system of agricultural lands.

The City of Hamilton submitted a request to OMAFRA in May 2019 to refine the Agricultural System land base mapping for the City's Whitebelt lands only. Further refinement requests for the remainder of the City's rural area will be submitted to OMAFRA in the future. Appendix C contains the correspondence with OMAFRA regarding the specific changes. OMAFRA recognized that the Rural Hamilton Official Plan (RHOP) policies are generally more restrictive towards non-agricultural development than rural land use designations in other GGH municipalities and accepted refinements to provincial mapping based on the City's extensive studies, and the City of Hamilton made suggested adjustments to its RHOP to conform to provincial plans through the MCR.

2.3.5 Land Evaluation and Area Review (LEAR)

The Provincial Land Evaluation and Area Review (LEAR) developed by OMAFRA as a high level decision-making tool, helps to identify prime agricultural areas /land base, to support agricultural operations. LEAR is a tool that quantitatively evaluates the relative importance of lands for agriculture based on its

[2] OMAFRA (2017), MDS publication 853.

characteristics affecting agricultural potential use. The evaluation consists of two parts: the Land Evaluation (LE) that uses the Canada Land Inventory mapping to identify and compare soil and climatic conditions of the agricultural capability for common field crops; and Area Review (AR) which considers other factors important to agricultural potential such as fragmentation of land parcels and how the land is being used.

The component scores from the LE and AR are weighted and combined to provide an overall LEAR score for each land unit. The highest scoring represents areas with the greatest agricultural potential. For the Greater Golden Horseshoe (GGH), OMAFRA assigned 60% of the LEAR score to LE factors to emphasize the suitability of the land for agriculture in the GGH; and 40% to the AR factors. A balanced approach is used where agriculture and natural heritage features overlap. These studies are used to help inform the revisions of municipal Official Plans.

The City of Hamilton, being the only single tier municipality in the Greater Golden Horseshoe with rural lands, completed planning exercises for its rural lands including the adoption of the Rural Hamilton Official Plan (RHOP) in 2006 and the Rural Zoning By-law in 2015. The adoption of the RHOP followed extensive public and stakeholder consultation and the completion of Hamilton's own Greenbelt LEAR study in 2005. It was a comprehensive study that considered local conditions, ground-truthing of sites, and substantive input from the local Agricultural and Rural Affairs Advisory Committee. Hamilton's LEAR is consistent with and does not conflict with Provincial Greater Golden Horseshoe LEAR and Greeenbelt LEAR, rather Hamilton's LEAR reflects local site conditions and factors not reflected in the provincial mapping.

The differences in the LEAR studies completed by Hamilton and the Province are primarily related to the AR factors. The LE factor for both was consistent at 60%, though the Hamilton LEAR used site visits to confirm land classifications whereas the Provincial LEAR did not. Further, regarding the AR factors, the Hamilton LEAR evaluated three factors: agriculture within 1 km; conflicting land use within 1 km; and land fragmentation with the three factors weighted equally. The Provincial LEAR evaluated only two factors: agriculture within 750 m; and land fragmentation, with the agriculture within 750 m accounting for 30% of the score, and land fragmentation only 10%. In addition, the Hamilton LEAR evaluation unit was at the parcel level; whereas the Provincial LEAR evaluation unit was one hectare.

The differences between the Hamilton LEAR and the Province's LEAR are not conflicting, rather they are the result of refinement at the local level using local knowledge and site conditions to refine the factors and weighting resulting in a truer representation of the City's agricultural land base. The Provincial LEAR disproportionately weights existing agriculture as the major AR factor when identifying lands as prime, and does not take into account existing land uses which will not revert to prime, or other conflicting land uses.

OMAFRA completed the Greater Golden Horseshoe LEAR to support the development of its Agricultural System land base mapping issued in February 2018. It is important to note that while LEAR studies frequently draw similar conclusions, for specific geographic areas the results of LEAR studies can vary based on different criteria or scoring. These differences in LEAR outcomes are consistent with the LEAR methodology which allows some flexibility and customization for criteria and scoring.

2.4 Municipal Planning

2.4.1 Rural Hamilton Official Plan

In March 2012, City Council adopted the new Rural Hamilton Official Plan ("Rural Official Plan"). The Rural Official Plan establishes the long term vision and policies to direct and manage development within the lands that are identified on Schedule D of the Rural Official Plan. A portion of the Rural Area which is not located within the Greenbelt Protected Countryside is identified as "whitebelt" lands, which are the focus of the boundary expansion analysis in this report.

The rural land use designations are identified on **Attached Figure 5** in this report and Schedule D of the 2012 Rural Official Plan. The designations include Agriculture, Specialty crop, Rural, Mineral Aggregate Resource Extraction Areas, Open Space and Utility. In the context of this study, the lands within the rural boundary that are located within the whitebelt are designated as Agriculture, Rural, and Open Space.

The following policies are of relevance in the context of this study.

- **Open Space:** Lands designated Open Space are intended to provide recreational activities, conservation management and other open space uses, including passive and active recreational opportunities for residents and visitors to the City (policy C.3.3.1). Lands within the Open Space designation are public or private areas.
- **Agriculture:** Lands designated Agriculture are intended to protect prime agricultural areas for agricultural use. The policies in Chapter D, Section D.2.0 – Agriculture Designation in the City's adopted 2012 Rural Official Plan promote a range of agricultural uses, agricultural-related commercial, agricultural-related industrial uses and on- farm secondary uses. As per Rural Official Plan policy D.2.1.2., agricultural-related uses are small scale and serve primarily to provide faming-related products and services. The intent of on-farm secondary uses to encourage on-farm economic diversification (Policy D.2.1.3).
- **Rural:** While lands designated 'Rural' have lower agricultural capabilities than lands designated as Agriculture, the intent for these lands is to maintain their agricultural use and to protect these lands from incompatible development. The policies in Chapter D, Section D.4.0 – Rural Designation in the City's adopted 2012 Rural Official Plan permits the agricultural uses identified in Section D.2.0of the Rural Official Plan, as well as other resource-based rural uses and institutional uses serving the rural community. As per policy D.4.1.1 these uses must be compatible with the surrounding agricultural uses or existing farm operations.

2.4.2 Urban Hamilton Official Plan

Chapter B, Section B.2.2 – Urban Boundary Expansion in the City's 2013 Urban Hamilton Official Plan includes the following policies that are of relevance in the context of this study:

- **Municipal Comprehensive Review:** As per Policy B.2.2.1 and B.2.2.2, a municipally initiated comprehensive review must be completed for the lands to be included in the urban boundary expansion. This review is currently being completed as part of the City's MCR process.

- **Urban Boundary Expansion:** As per Policy B.2.2.3, an MCR and a secondary plan review must be undertaken prior to initiating the urban boundary expansion, which includes the following:
  - Complete a comprehensive review and land budget analysis to confirm that forecasted growth cannot be accommodated within the existing urban boundary (Policy B.2.2.3a).
  - Demonstrate that any impacts agricultural operations adjacent to the new or expanding urban area are mitigated to the extent feasible (Policy B.2.2.3b), and:
    i. *the designation of appropriate land uses and policies pertaining to the design and density of such uses (Policy B.2.2.3b);*
    ii. *completion of Class Environmental Assessments for major urban servicing infrastructure deemed to be essential for commencement or completion of development of all or part of the lands (Policy B.2.2.3b); and,*
    iii. *an urban development staging, phasing or implementation strategy in keeping with City-wide master plan priorities and secondary plan objectives (Policy B.2.2.3b).*
  - Complete a financing policy for urban services and other community infrastructure (Policy B.2.2.3f).

2.4.3 Zoning By-laws

This municipal tool regulates the use of land and controls how each property can be developed and how it can be used. Along with the Official Plan, Zoning By-laws ensure that planning decisions are consistent with the Provincial Policy Statement and conform to the Provincial Growth Plan and Greenbelt Plan.

2.5 Summary of Key Agricultural Policy Directions

The City's 2012 Rural Hamilton Official Plan provides the long term vision and policy directive for lands outside the urban boundary. Of primary interest are the lands located outside the urban boundary that are not part of the Greenbelt Plan. Both Official Plans are currently under review as part of the MCR process to bring them into conformity with the Growth Plan, 2019 and Greenbelt Plan 2017. **Table 1** below summarizes the key policy directions which are addressed in the sections that follow.

Table 1: Summary of Policy Directions

Policy Context	Key Policy Directions
Provincial Policy Statement, 2020	• Settlement area boundary expansion can only occur as part of MCR. • The introduction of non-agricultural uses on prime agricultural lands within the proposed settlement area boundary expansion may only take place if alternative locations have been evaluated.

Policy Context	Key Policy Directions
Growth Plan, 2019 (as amended)	• Settlement area boundary expansion can only occur as part of MCR. • The intensification and density targets in the Growth Plan and a land need assessment must be carried out. • An Agricultural Impact Assessment may be required for settlement area boundary expansions.
Urban Hamilton Official Plan, 2013	• Settlement boundary expansion can only occur as part of MCR and must include a comprehensive review and land budget analysis. • A MCR and a secondary plan review must be undertaken prior to initiating the urban boundary expansion.
Rural Hamilton Official Plan, 2012	• The primary intent of lands located within the Rural Area is to protect the agricultural areas and uses from incompatible development.

3.0 Summary of Applicable AIA Findings

This section provides an overview of those lands that could potentially be added to the urban area as part of Growth Option 1: Ambitious Density (1,310 ha expansion) based on the findings of the Agricultural Impact Assessment. This includes an overview of the CEA boundaries, the existing conditions based on a windshield survey, and the results of the MDS analysis.

3.1 Candidate Expansion Area Boundaries

The boundaries of the four Candidate Expansion Areas are outlined below.

The **Twenty Road West/Garner Road** CEA is composed of three smaller areas labelled as ‘a’, ‘b’, and ‘c’ with the following boundaries:

Area ‘a’

- Northern Boundary = Garner Road East
- Eastern Boundary = 164 m west of Glancaster Road
- Southern Boundary = 1,264 m north of Book Road East
- Western Boundary = 837 m east of Southcote Road

Area ‘b’

- Northern Boundary = Twenty Road West
- Eastern Boundary = 1,728 east of Upper James Street
- Southern Boundary = 697 m north of Dickenson Road West

- Western Boundary = Glancaster Road

Area 'c'

- Northern Boundary = Twenty Road West
- Eastern Boundary = 632 east of Upper James Street
- Southern Boundary = 1,010 m north of Dickenson Road West
- Western Boundary = 1,391 m east of Glancaster Road

The **Twenty Road East** CEA has the following boundaries:

- Northern Boundary = 579 m south of Rymal Road East
- Eastern Boundary = 391 m west of Nebo Road
- Southern Boundary = 427 m north of Dickenson Road East
- Western Boundary = Greti Drive / 322 m east of Alderlea Avenue

The **Whitechurch** CEA has the following boundaries:

- Northern Boundary = Airport Road East
- Eastern Boundary = Miles Road
- Southern Boundary = White Church Road East
- Western Boundary = Upper James Street

The **Elfrida** CEA has the following boundaries:

- Northern Boundary = Mud Street East
- Eastern Boundary = Second Road East / Hendershot Road
- Southern Boundary = Golf Club Road
- Western Boundary = Trinity Church Road

3.2 Existing Conditions

The windshield survey was carried out over four days (May 6 and 27, and June 10 and 17, 2021) by a professional agrologist (P.Ag) with the assistance of a GIS mapping expert for each of the four CEAs. Mapping of Canada Land Inventory for these areas are attached as **Figures 6 through 9**.

The following summary of existing conditions, as originally identified through the AIA, provides general information on what was observed.

Many of the fallow fields within the northern portions of CEAs and buffer areas for Twenty Road West/Garner Road, Twenty Road East and Elfrida, were observed to have been un-tilled for numerous years, which is well beyond the normal no-till and fallow rotation system timeframes, and indicates non-farm ownership in anticipation of potential urban development.

Twenty Road West/Garner Road CEA and buffer area have extensive encroachment of residential development, heavy urban traffic, and non-agricultural uses that surround the farmland and would make farming difficult for farm operators. Areas 'a' and 'b' have poorer soils than 'c', which would have moderate to severe limitations for growing crops, and the immediate wetland areas where there is a drop in elevation. The Twenty Road West/Garner Road CEA and associated buffer area has very little agricultural infrastructure, is fragmented, and is surrounded by urban uses; remnant farming operations are perceived to have many operational challenges due to proximity to urban land uses, and heavy traffic on rural roads.

Twenty Road East CEA is similar to Twenty Road West/Garner Road CEA in that it is surrounded by urban land uses on three sides, namely north, east and west. The southern buffer area of Twenty Road East has three viable livestock operations (two beef cattle, one equine). There is predominantly Class 1 soils, with some Class 2 soils situated irregularly to the north and east of the CEA indicating few limitations to crop production within this area and its buffer area. In the buffer area, there are two wetland areas that pose limitations. Rural roads having higher than average urban and heavy truck traffic along Nebo Road, both from construction vehicles as well as freight trucks travelling to/from Highway 403 and nearby industrial operations. The Twenty Road East CEA and associated buffer area has little in the way of agricultural infrastructure, is fragmented, and surrounded on three sides by urban uses; the remaining farming operations are perceived to have many operational challenges due to proximity to urban land uses, and heavy traffic on rural roads.

Whitechurch CEA and buffer area has the most extensive agricultural activity/infrastructure compared to the other areas which is indicative of a vibrant agricultural sector in that area. The existing limitations would be limited to the immediate areas of ponding and water management where there is a drop in elevation, and also at the two cemeteries and the former landfill site. Soils are Class 1 soils within the Whitechurch CEA, and in the buffer area a mix of Class 1 and 2 soils; overall very good for crop production. The Whitechurch CEA and associated buffer area, although similarly affected by heavy traffic conditions, has good soil conditions for crop production and has numerous viable livestock operations.

Elfrida CEA is similar to Twenty Road East CEA in that it is surrounded by urban land uses on the west side, and due to the narrow shape of the study area, agricultural operations are fragmented and adversely affected by proximity to industrial, commercial and other urban land uses. The southern buffer area contains most of the livestock operations/infrastructure. The extensive encroachment of urban land uses, heavy urban traffic along Rymal Road East and Highway 56 from construction vehicles as well as freight trucks travelling to/from Highway 403, would make operations difficult for farm operators. Soil in the northern extension are Class 3 and 4 soils with moderately severe to moderate limitations to crop production, as well as the watershed and floodplain areas where there is a drop in elevation. There is predominantly Class 2 lands mixed with Class 1 lands within the remainder of the Elfrida CEA with no significant limitations for crop production. The southern extent of the buffer area has a mix of Class 1 and 2 soils with moderate to no significant limitations to crop production. The Elfrida CEA and associated buffer area has little in the way of agricultural infrastructure, is fragmented, and surrounded by urban uses; the remaining farming operations are perceived to have many operational

challenges due to proximity to soil conditions, urban land uses, and heavy traffic on rural roads. The earthworm production facility (Horvat's Live Bait Inc., 200 Green Mountain Rd E) was not considered to be a farm, but this should be verified by Canada Revenue Agency (CRA) at the time of building permit application, as they may have received prior permission to be categorized as an agricultural operation by the CRA.

3.3 Minimum Distance Separation (MDS)

Refer to Appendix A depicting MDS calculations for the CEAs (with MDS worksheets available in the AIA).

The Minimum Distance Separation I (MDS I[3]) calculation worksheets for Type B Land Use for new or expanding settlement area boundary, were used for livestock operations identified with permanent agricultural structures used in housing livestock and measuring greater than ten square meters. The four main factors used to calculate the MDS includes: the potential for odour, the size of the barn structure dictating the maximum number of animals that can be housed, the type of manure storage, and the encroaching factor (Type B Land Use for New or expanding settlement area boundary).

Although every effort was taken to be reasonably accurate and to reflect existing conditions at the time of the windshield survey, there were assumptions made during the calculation of MDS as no farm owner/operator interviews were conducted to obtain detailed data, and observations were made only from publicly accessible municipal roadways. Overall assumptions were made that:

- Livestock were permitted outdoors;
- The maximum number of animals were being raised – calculated through the MDS based on barn size (obtained by air photo interpretation); and
- Manure storage was located outdoors/uncovered.

These assumptions were ascertained to provide each farming operation the maximum use of existing agricultural infrastructure, as well as a reasonable means of comparison between the levels of agricultural activity between Candidate Expansion Areas. At the time of building permit, site specific data will need to be confirmed with an on-site detailed survey and interview with the farm owner/operator.

Table 2 provides a summary of general findings from conducting the MDS calculations for each of the livestock operation in the CEAs. Two areas, namely: Twenty Road West/Garner Road and Twenty Road East, have no livestock operations within the boundary of the Candidate Expansion Area. The remaining two areas have each only one livestock operation, both located near the outer boundary of their respective CEA.

[3] Ministry of Agriculture, Food and Rural Affairs (OMAFRA), AgriSuite software program for determining MDS.

Table 2: Summary of Livestock Operations Requiring MDS

	Twenty Road West/ Garner Road	Twenty Road East	Whitechurch	Elfrida
# Livestock/Type Within CEA	Nil	Nil	1	1
# Livestock/Type Within Buffer Area	1	3	10	8

Within the buffer areas, both Twenty Road West/Garner Road and Twenty Road East have minimal livestock operations[4]. Elfrida buffer area had eight livestock operations, six of which are scattered in the southern extent. Whitechurch CEA had the most number of livestock operations scattered within the north, east and southern extents of the buffer area.

[4] Twenty Road East buffer area overlaps with the Elfrida buffer area; three farms affect both (See MDS Figure, Farms #1, #2, and #29). Twenty Road East is mildly impacted by one of these livestock operation located outside of the boundary but whose MDS area affects the southeast corner of its buffer area. Similarly, Twenty Road East buffer area overlaps with the Whitechurch buffer area; one farm affects both (See Appendix A - MDS Figure, Farm #8).

4.0 Growth Option Evaluation

Table 3 outlines the evaluation for Growth Option 1: Ambitious Density (1,340 ha expansion) and Growth Option 2: No Urban Boundary Expansion for those considerations developed as part of the "How should Hamilton Grow?" evaluation framework and primarily the findings of the AIA.

Table 3: Agricultural Evaluation for Growth Options

Agricultural Considerations	Growth Option 1: Ambitious Density (1,340 ha Expansion)	Growth Option 2: No Urban Boundary Expansion
Does the growth option prioritize development of areas that are non-prime agricultural?	Growth Option 1 addresses a few aspects of this consideration: • The current existing land uses within the Whitebelt Area consist of agriculture, specialty crop, rural, open space, and a mineral aggregate resource extraction areas. Growth Option 1 would require 1,310 ha of new urban land to accommodate growth and therefore has a greater potential impact on the existing Prime Agricultural Lands. The majority of lands within the Whitebelt Area are considered to be prime agricultural lands. • Based on the above and in comparison to Growth Option 2, Growth Option 1 would require the conversion of Prime Agricultural Lands to accommodate future development and therefore does not prioritize development of areas that are non-prime agricultural.	Growth Option 2 addresses all aspects of this consideration: • The current existing land uses within the existing urban boundary consist of neighbourhoods, open space, institutional, utility, commercial and mixed use designations, and employment area designations. Growth Option 2 allocated all future growth to lands within the current urban boundary and would require 0 ha of new urban land needed to accommodate growth. • Based on the above and in comparison to Growth Option 1, Growth Option 2 avoids the need for conversion of Prime Agricultural Lands to accommodate future development and therefore prioritizes development of areas that are non-prime agricultural.

Agricultural Considerations	Growth Option 1: Ambitious Density (1,340 ha Expansion)	Growth Option 2: No Urban Boundary Expansion

Does the growth option avoid, minimize and mitigate impacts on the Agricultural System, including Prime Agricultural Lands classifications 1, 2 and 3?	Growth Option 1 addresses a few aspects of this consideration:
	• The City's Rural Area is comprised of 88,830 hectares. Within the City's Rural Area, 56% (49,960 ha) of land is designated Agriculture and 26% (23,226 ha) is designated Rural within the RHOP. These designations are based on Land Evaluation and Area Review (LEAR) evaluation. Notably, the LEAR identifies less Prime Agricultural Land because it takes into account land fragmentation, surrounding uses, among others, and by doing so lowers the overall rating.
	• The majority of lands outside the existing urban boundary in the whitebelt (2,197.6 ha or 100%) include soils with a Canada Land Inventory (CLI) Class 1 to 3 rating, which are considered Prime Agricultural Lands within the AIA Study Area:
	  ◦ Class 1: 1,522.4 ha or 69.3%
	  ◦ Class 2: 556 ha or 25.3%
	  ◦ Class 3: 119.1 ha or 5.4%
	• Based on the AIA, Growth Option 1 would require the conversion of up to 1,310 ha of existing Prime Agricultural Lands with CLI Soil Classes ranging from 1 to 3 to accommodate growth.
	• Based on the information below, there are 149 farm related active infrastructure, twenty-four (24) within the immediate
		Growth Option 2 addresses all aspects of this consideration:
		• The majority of lands within the existing urban boundary do not include soils with a Class 1, 2 or 3 rating. Based on the AIA, Growth Option 2 would require 0 ha of new urban land needed to accommodate growth. In addition, there are 0 ha of Prime Agricultural Lands within the existing urban boundary.
		• Based on the above and in comparison to Growth Option 1, Growth Option 2 has greater potential to avoid, minimize and mitigate impacts on the Agricultural System.

Agricultural Considerations	Growth Option 1: Ambitious Density (1,340 ha Expansion)	Growth Option 2: No Urban Boundary Expansion
	AIA Study Area and 125 within the 1,500 m buffer area including: • Farm related active infrastructure within the AIA Study Area: two garden centres/nurseries, one cidery, one hay barn, six storage barns, six equipment sheds, one farm house, one hobby farm, four grain storage silo, one sod distributor, and one irrigation pond. • Farm related active infrastructure within the 1,500 m buffer area: one cidery, one farmers market, four roadside stands, two cheese shops, five garden centres/greenhouse complexes, three storage barns, one soul mixing area, nine grain storage silos, 25 grain storage bins, 41 equipment sheds, one farm house, one farm machinery repair business, 31 hay barns, and one structure with an undetermined agricultural use. • In addition, the extensive encroachment of future urban land uses would potentially lead to the fragmentation of farm parcels and heavy urban traffic would make operations difficult for future farm operators. • Based on the above and in comparison to Growth Option 2, Growth Option 1 would have significant impacts on the existing Agricultural System and would require measures to minimize the impact on the broader Agricultural System.	

Agricultural Considerations	Growth Option 1: Ambitious Density (1,340 ha Expansion)	Growth Option 2: No Urban Boundary Expansion

Does the growth option promote healthy, local and affordable food options, including urban agriculture?	Growth Option 1 addresses a few aspects of this consideration:
	• Growth Option 1 would concentrate the anticipated population growth of 150,500 people within the existing Urban Area and 85,500 people within the Urban Expansion Area, requiring an additional 1,310 ha of land. As Growth Option 1 requires the conversation of up to 1,310 ha, which is mainly comprised of Prime Agricultural Lands (depending on the location of lands selected in the Whitebelt), it is anticipated that healthy, local and affordable food options would be impacted by the anticipated growth.
	  ◦ Based on the AIA, fields within the Urban Expansion Area include crops (corn, soybean, winter wheat and hay), as well as some fallow fields and pasture land. One specialty crops are grown within two orchard (apples), as well as one abandoned orchard (apples). While information regarding active agricultural fields is not available, of the 2,197.6 ha of Candidate Expansion Area, 1,921.4 ha are considered agriculturally viable (meaning a parcel size of greater than 40 ha), and 1,721.4 ha have an existing primary land use of agricultural.
	  ◦ Based on the AIA, the following farm related infrastructure have been observed within the Urban Boundary Expansion Area: storage barns, hay barn, equipment sheds, grain storage silos, smaller storage
		Growth Option 2 addresses most aspects of this consideration:
		• Growth Option 2 would concentrate the anticipated population growth of 236,000 people within the existing urban area. As Growth Option 2 does not require the conversation of existing Prime Agricultural Lands outside the existing urban boundary, it is anticipated that healthy, local and affordable food options are maintained, with as more land for agricultural use is available.
		• Due to the forecasted level of growth within the existing urban boundary, it is anticipated that there would be less potential for urban agricultural uses for Growth Option 2 compared to Growth Option 1, as the scarcity of land within the urban area is likely to promote land uses with higher return on invest. However, the magnitude of difference in this regard between the two options is minimal as both options plan for significant levels of intensification.
		• Based on the above and in comparison to Growth Option 1, Growth Option 2 has potential to promote healthy, local and affordable food

Agricultural Considerations	Growth Option 1: Ambitious Density (1,340 ha Expansion)	Growth Option 2: No Urban Boundary Expansion
	buildings, nursery, garden centre, farm house, hobby farm, sod distributor, cidery, and an irrigation pond. Two livestock operation was observed, an equine operation and one poultry and equine operation. • Due to the forecasted level of growth within the existing urban boundary, it is anticipated that there would be less potential for urban agricultural uses, as the scarcity of land within the urban area is likely to promote land uses with higher return on invest. Potential exists to plan for urban agriculture within the Urban Expansion Area. However, the magnitude of difference in this regard between the two options is minimal as both options plan for significant levels of intensification. • Based on the above and in comparisons to Growth Option 1, Growth Option 2 has moderate potential to promote healthy, local and affordable food options, including urban agriculture.	options, but moderate potential to promote urban agriculture.
Overall Result	Growth Option 1 addresses a few aspects of this theme.	Growth Option 2 addresses most aspects of this theme.

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Definitions

For reference purposes, below provides the definitions for several key terms which are defined in Provincial Plans and referred to further in this report.

Table 4: Definitions

Term	Definition
Agri-Food Network	Within the Agricultural System, a network that includes elements important to the viability of the agri-food sector such as regional infrastructure and transportation networks; on-farm buildings and infrastructure; agricultural services, farm markets, distributors, and primary processing; and vibrant, agriculture-supportive communities. (Greenbelt Plan)
Agricultural Impact Assessment	A study that evaluates the potential impacts of non-agricultural development on agricultural operations and the Agricultural System and recommends ways to avoid or, if avoidance is not possible, minimize and mitigate adverse impacts. (Greenbelt Plan)
Agricultural System	The system mapped and issued by the Province in accordance with this Plan, comprised of a group of inter-connected elements that collectively create a viable, thriving agricultural sector. It has two components: 1. An agricultural land base comprised of prime agricultural areas, including specialty crop areas, and rural lands that together create a continuous productive land base for agriculture; 2. An agri-food network which includes infrastructure, services, and assets important to the viability of the agri-food sector. (Greenbelt Plan)
Minimum Distance Separation Formulae	Formulae and guidelines developed by the Province, as amended from time to time, to separate uses so as to reduce incompatibility concerns about odour from livestock facilities. (PPS, 2020)
Municipal Comprehensive Review	A new official plan, or an official plan amendment, initiated by an upper- or single-tier municipality under section 26 of the Planning Act that comprehensively applies the policies and schedules of this Plan.
Prime Agricultural Areas	An area where prime agricultural lands predominate. This includes areas of prime agricultural lands and associated Canada Land Inventory Class 4 through 7 lands and additional areas where there is a local concentration of farms which exhibit characteristics of ongoing agriculture. Prime agricultural areas are to be identified by the Ontario Ministry of Agriculture, Food and Rural Affairs using guidelines developed by the Province as amended from time to time. (Based on PPS, 2020 and modified for this Plan)

Term	Definition
Prime Agricultural Lands	Specialty crop areas and/or Canada Land Inventory Class 1, 2, and 3 lands, as amended from time to time, in this order of priority for protection (PPS, 2020).
Settlement Area	Urban areas and rural settlements within municipalities (such as cities, towns, villages and hamlets) that are: a) built up areas where development is concentrated and which have a mix of land uses; and b) lands which have been designated in an official plan for development in accordance with the policies of this Plan. Where there are no lands that have been designated for development, the settlement area may be no larger than the area where development is concentrated. (Based on PPS, 2020 and modified for this Plan)
Specialty Crop Areas	Areas designated using guidelines developed by the Province, as amended from time to time. In these areas, specialty crops are predominantly grown such as tender fruits (peaches, cherries, plums), grapes, other fruit crops, vegetable crops, greenhouse crops, and crops from agriculturally developed organic soil usually resulting from: soils that have suitability to produce specialty crops, or lands that are subject to special climatic conditions, or a combination of both; farmers skilled in the production of specialty crops; and a long-term investment of capital in areas such as crops, drainage, infrastructure and related facilities and services to produce, store, or process specialty crops. (PPS, 2020)

Table 5: Soil Classes of the Canada Land Inventory (CLI)[5]

Classes	Description
Class 1	Soils in this class have no significant limitations in use for crops.
Class 2	Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.
Class 3	Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices.
Class 4	Soils in this class have severe limitations that restrict the range of crops or require special conservation practices.
Class 5	Soils in this class gave very severe limitations that restrict their capability in producing perennial forage crops, and improvement practices are feasible.
Class 6	Soils in this class are capable only of producing perennial forage crops, and improvement practices are not feasible.
Class 7	Soils in this class have no capacity for arable culture or permanent pasture.
Class 0	Organic Soils (not placed in capability classes).

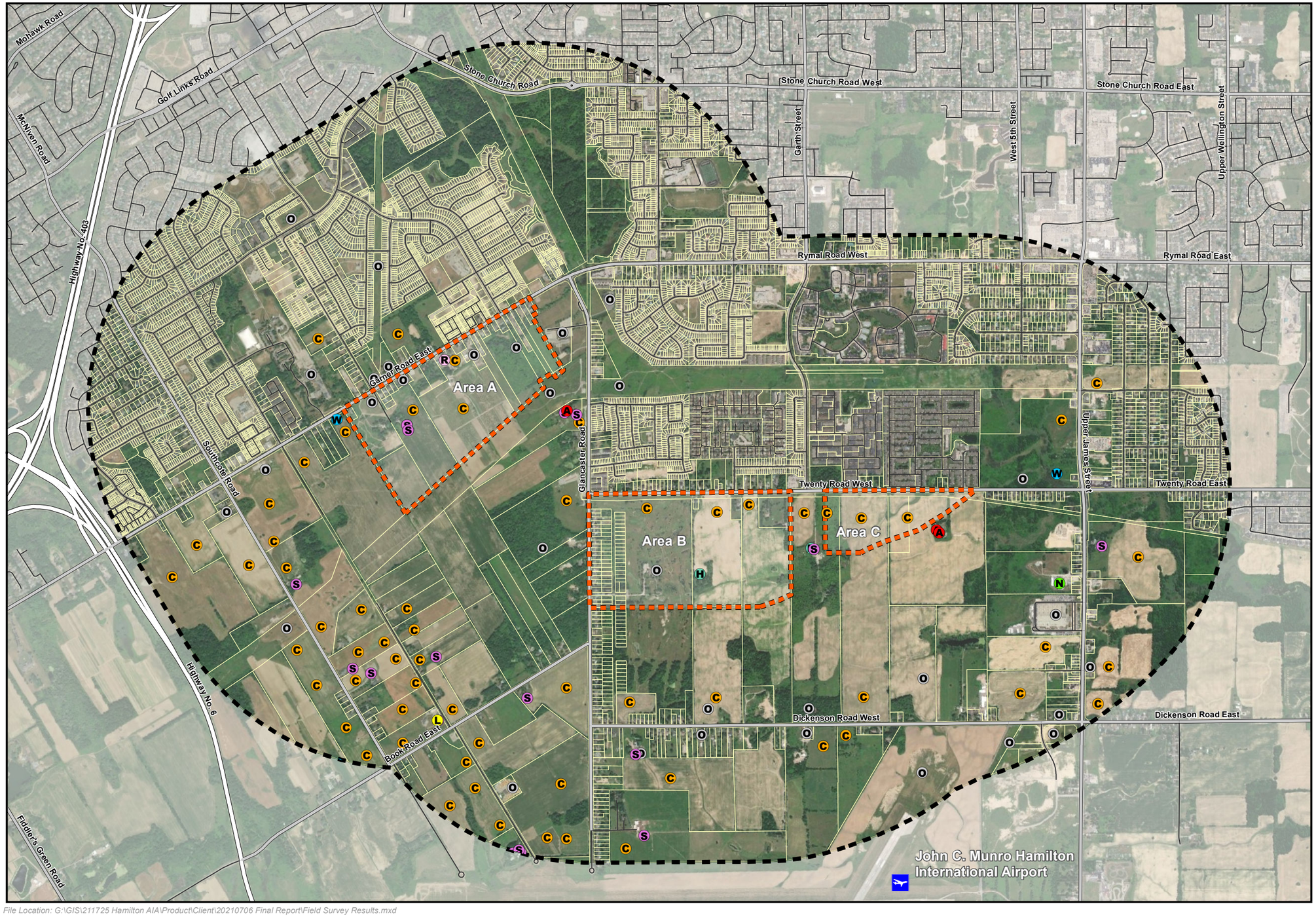
[5] OMAFRA. Canada Land Inventory. Table of Soil Classes.

Figures

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

FIELD SURVEY RESULTS - TWENTY ROAD WEST / GARNER ROAD

FIGURE 1



Field Survey Results

- N Nursery/Greenhouse
- L Livestock
- C Crop
- A Abandoned Storage
- S Storage
- R Farm Related
- W Water
- H Farm House
- O Other

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- John C. Munro Hamilton Int. Airport
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads

NORTH

Map Prepared by: PFM
Dillon Consulting Limited
Map Checked by: SR
Dillon Consulting Limited

August 24, 2021

Scale 1:23,000

Meters
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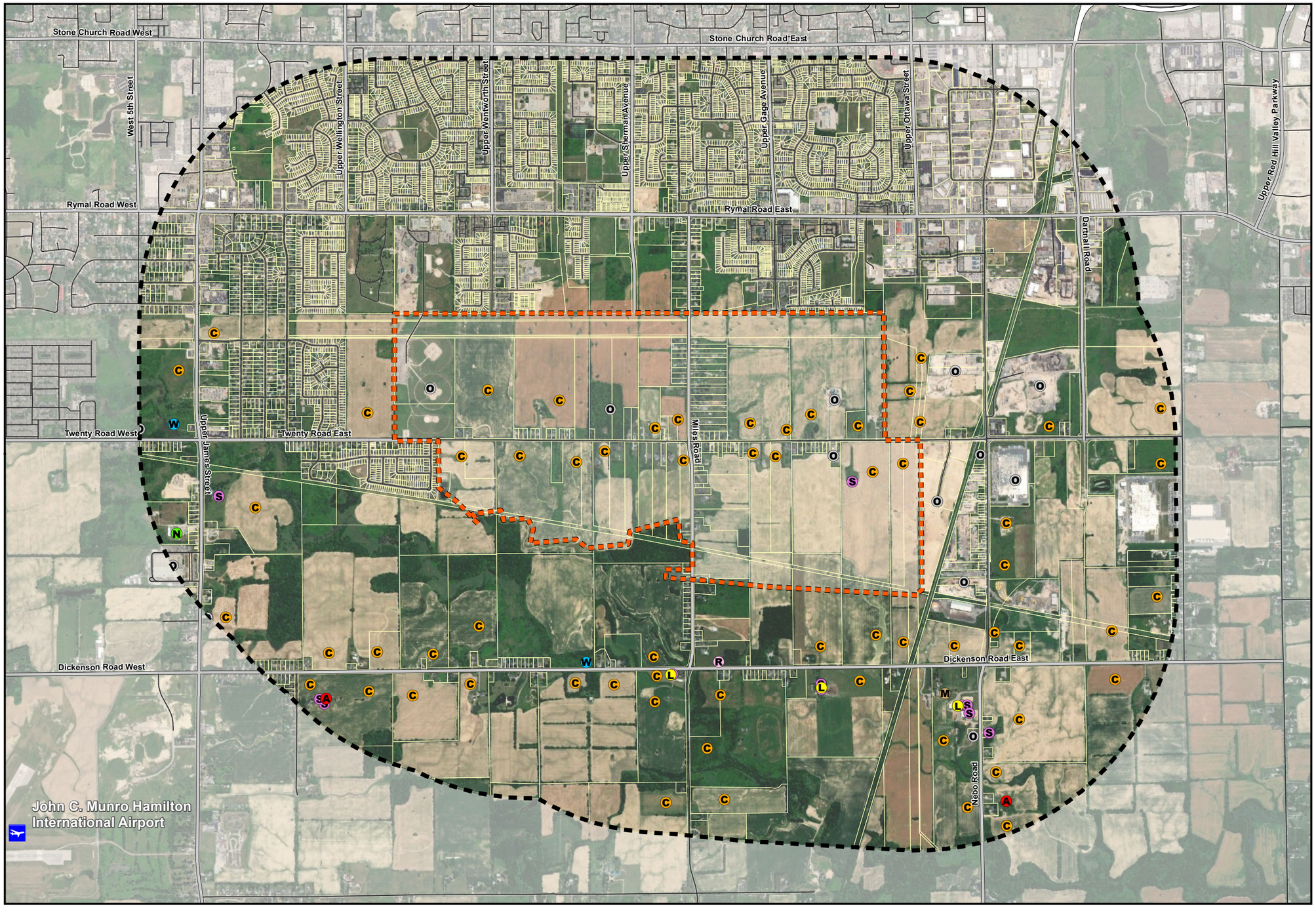
File Location: G:\GIS\211725 Hamilton AIA\Product\Client\20210706 Final Report\Field Survey Results.mxd

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

FIELD SURVEY RESULTS - TWENTY ROAD EAST

FIGURE 2



Field Survey Results

- N Nursery/Greenhouse
- L Livestock
- M Manure
- C Crop
- A Abandoned Storage
- S Storage
- R Farm Related
- W Water
- O Other

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- John C. Munro Hamilton Int. Airport
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads

NORTH

Map Prepared by: PFM
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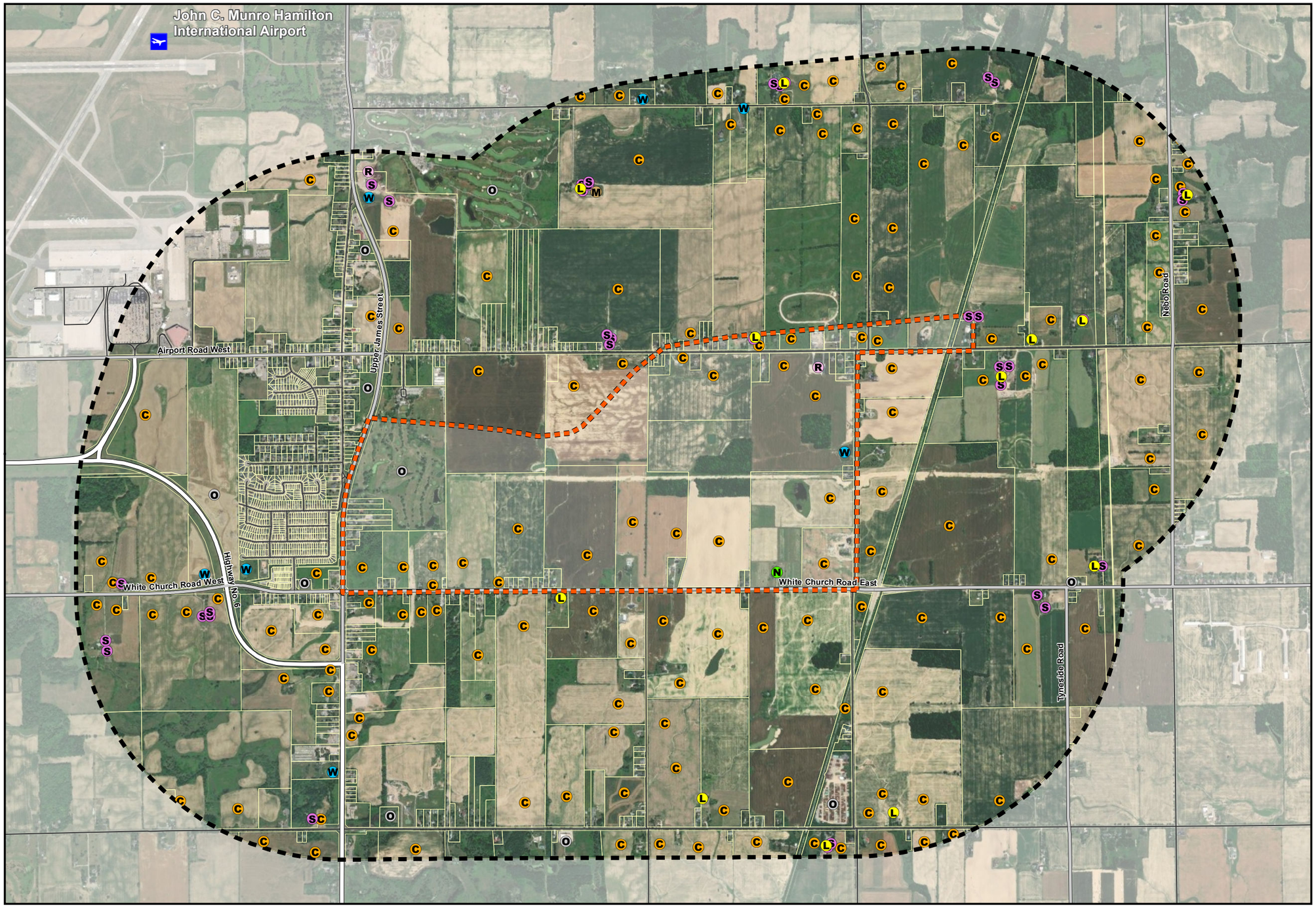
HAMILTON AGRICULTURAL IMPACT ASSESSMENT

FIELD SURVEY RESULTS - WHITECHURCH

FIGURE 3



Field Survey Results

- N Nursery/Greenhouse
- L Livestock
- M Manure
- C Crop
- S Storage
- R Farm Related
- W Water
- O Other

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- John C. Munro Hamilton Int. Airport
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads

NORTH

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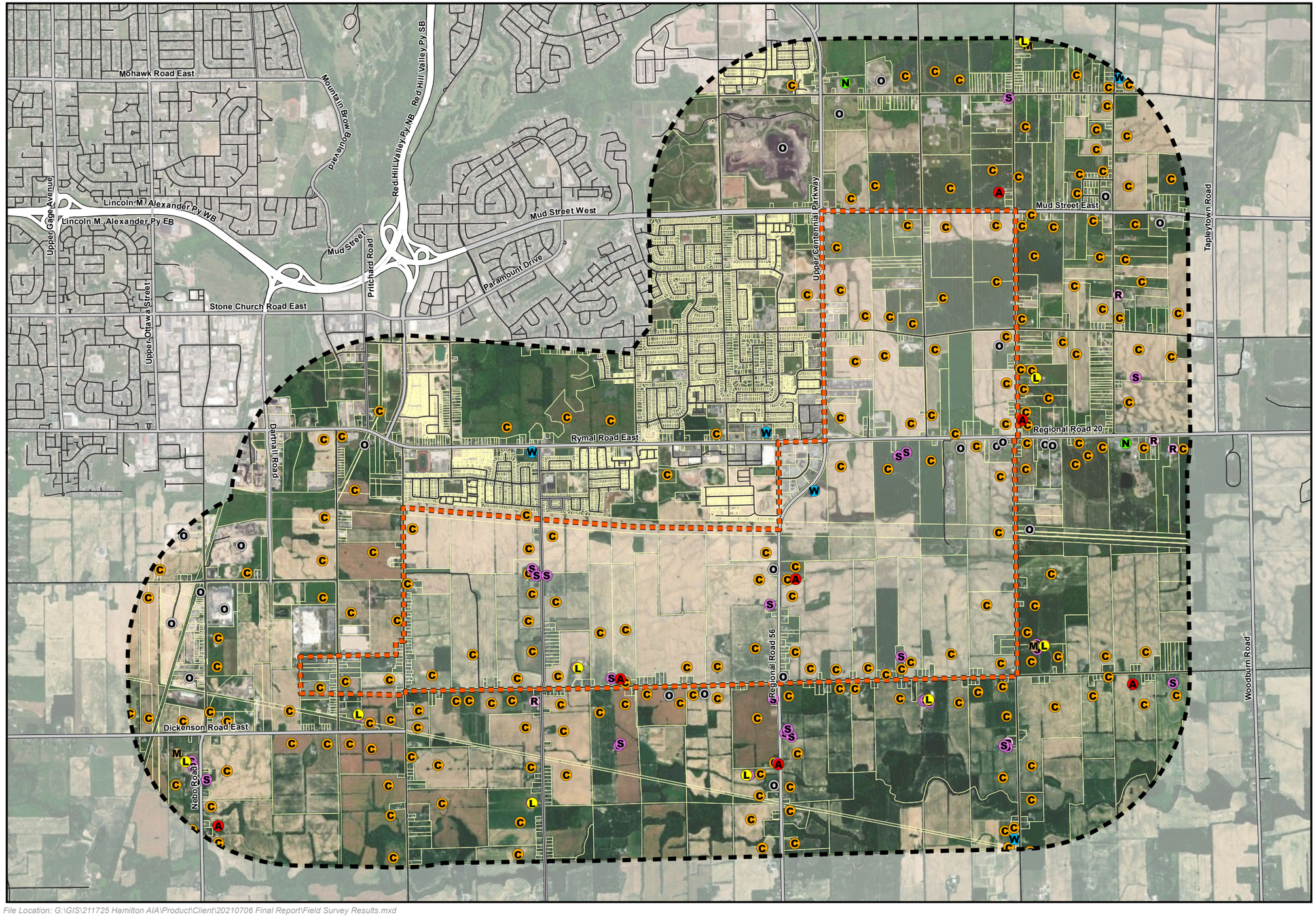
HAMILTON AGRICULTURAL IMPACT ASSESSMENT

FIELD SURVEY RESULTS - ELFRIDA

FIGURE 4



Field Survey Results

- N Nursery/Greenhouse
- L Livestock
- M Manure
- C Crop
- A Abandoned Storage
- S Storage
- R Farm Related
- W Water
- O Other

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads
- Municipality Boundary

NORTH

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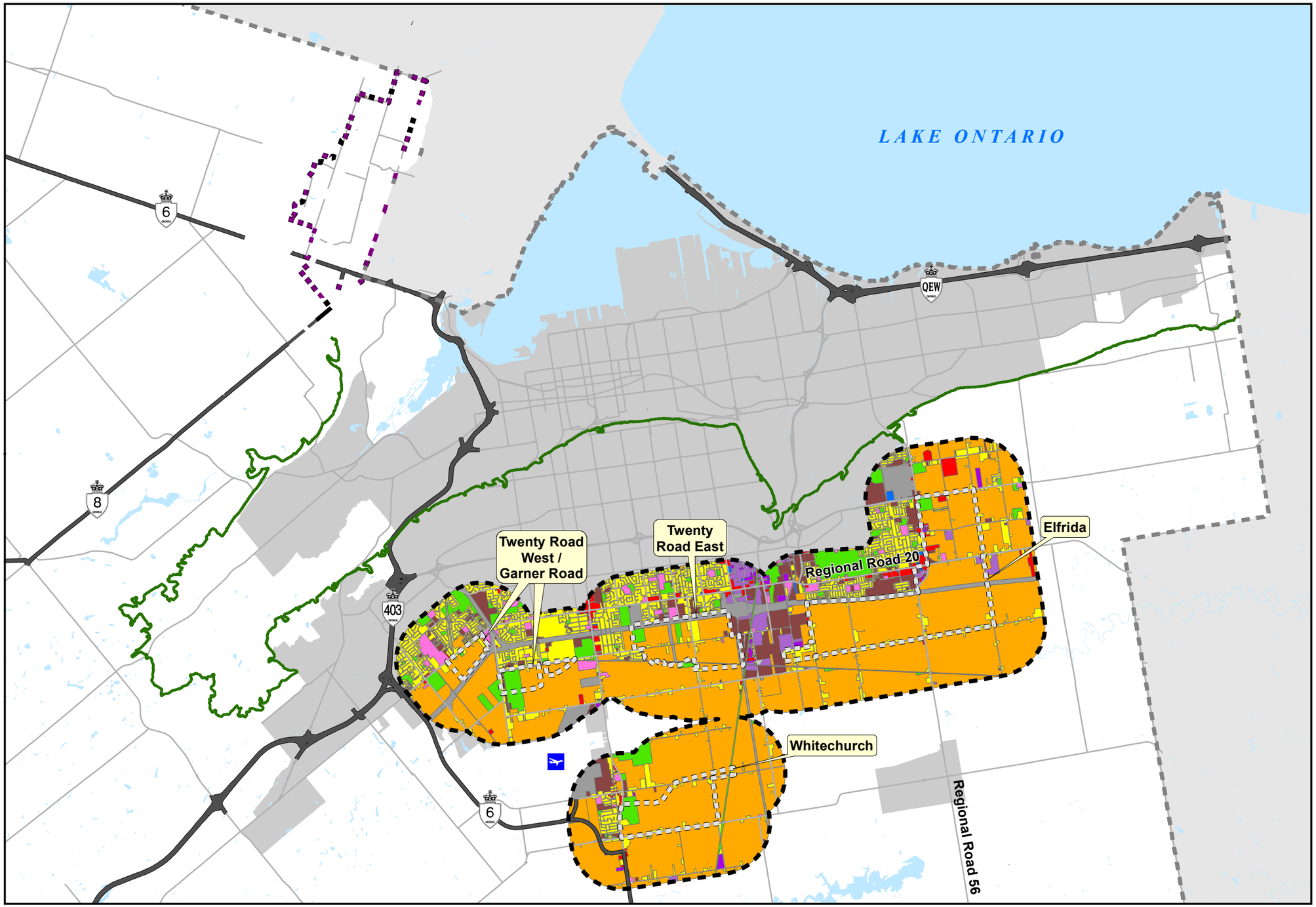
HAMILTON AGRICULTURAL IMPACT ASSESSMENT

LAND USE

FIGURE 5



Legend

- John C. Munro Hamilton Int. Airport
- Escarpment
- Provincial Highway
- Major Roads
- Urban Area
- Lakes
- Study Area
- Study Area Buffer (1,500 m)
- Municipal Boundary

Primary Land Use

- Agricultural
- Commercial
- Institutional
- Industrial
- Warehousing
- Office
- Parks/Open Space
- Residential
- Transportation/Utilities
- Vacant Lands

NORTH

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Dillon Consulting Limited

July 05, 2021

Scale 1:115,000

DILLON CONSULTING

Kilometers
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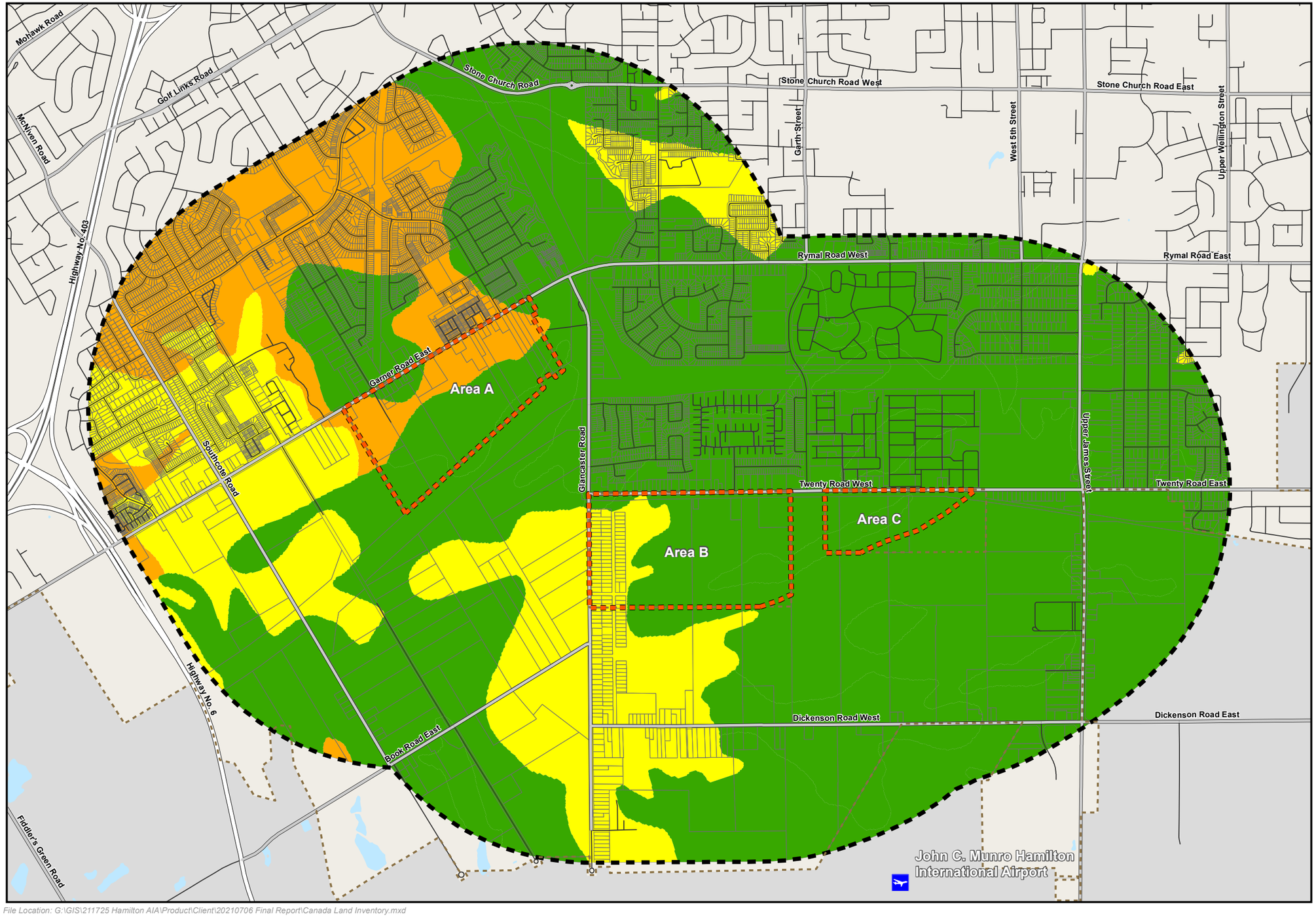
File Location: G:\GIS\211725 Hamilton AIA\Product\Client\20210611 Memo\Land Use.mxd

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

CANADA LAND INVENTORY SOIL CLASSES - TWENTY ROAD WEST / GARNER ROAD

FIGURE 6



Canada Land Inventory

Canada Land Inventory Class A

Primary and/or Dominant CLI Class

- 1 - No Significant Limitation
- 2 - Moderate Limitations
- 3 - Moderately Severe Limitations

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- John C. Munro Hamilton Int. Airport
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads
- Property Parcels
- Lakes
- Urban Area
- Urban Boundary

NORTH

Map Prepared by: PFM
Dillon Consulting Limited
Map Checked by: SR
Dillon Consulting Limited

July 14, 2021

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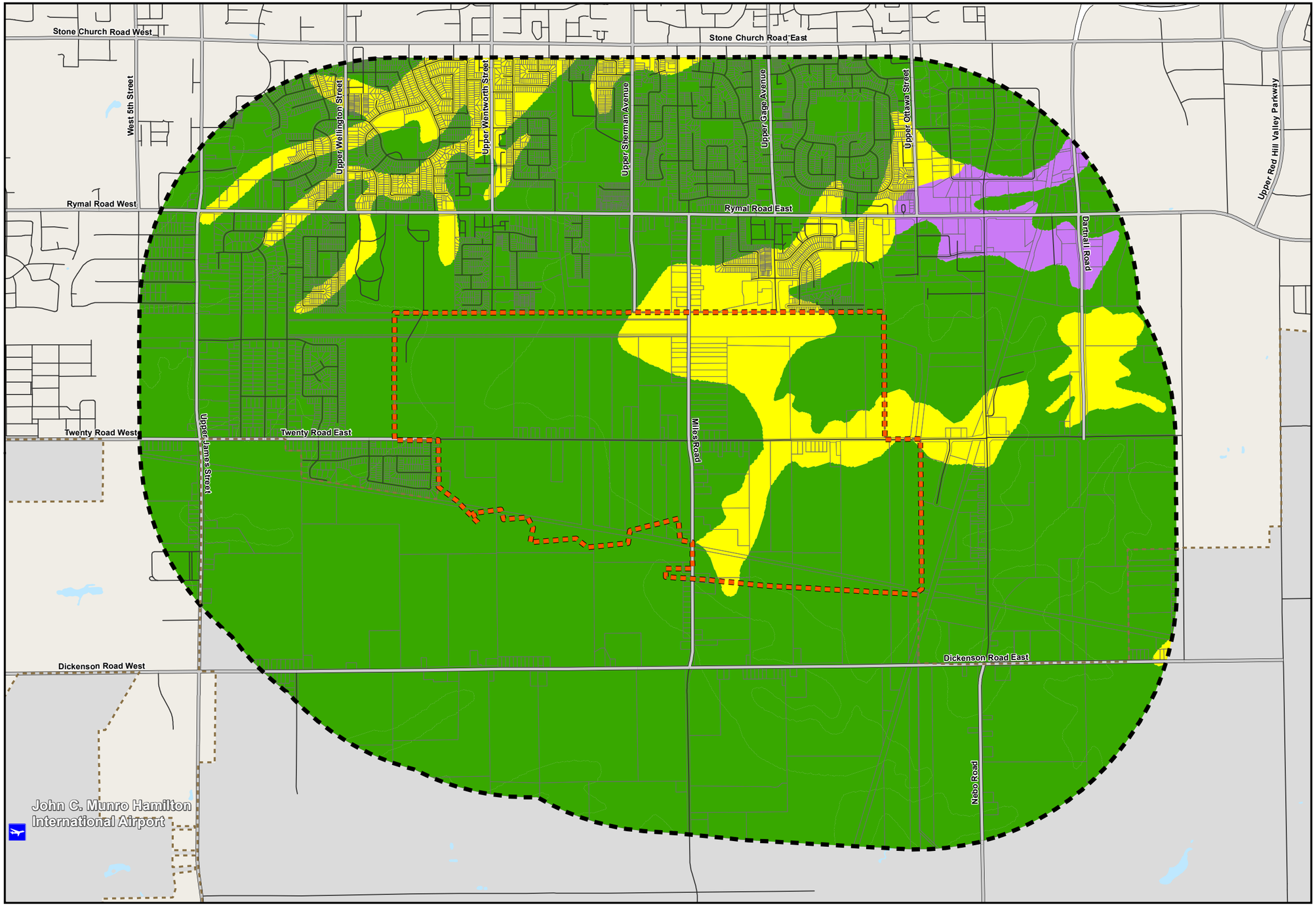
File Location: G:\GIS\211725 Hamilton AIA\Product\Client\20210706 Final Report\Canada Land Inventory.mxd

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

CANADA LAND INVENTORY SOIL CLASSES - TWENTY ROAD EAST

FIGURE 7



Canada Land Inventory

Canada Land Inventory Class A

Primary and/or Dominant CLI Class

- 1 - No Significant Limitation
- 2 - Moderate Limitations
- 6 - Forage Crops - Improvement Practices Not Feasible

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- John C. Munro Hamilton Int. Airport
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads
- Property Parcels
- Lakes
- Urban Area
- Urban Boundary

NORTH

Map Prepared by: PFM
Dillon Consulting Limited
Map Checked by: SR
Dillon Consulting Limited

July 14, 2021

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Meters
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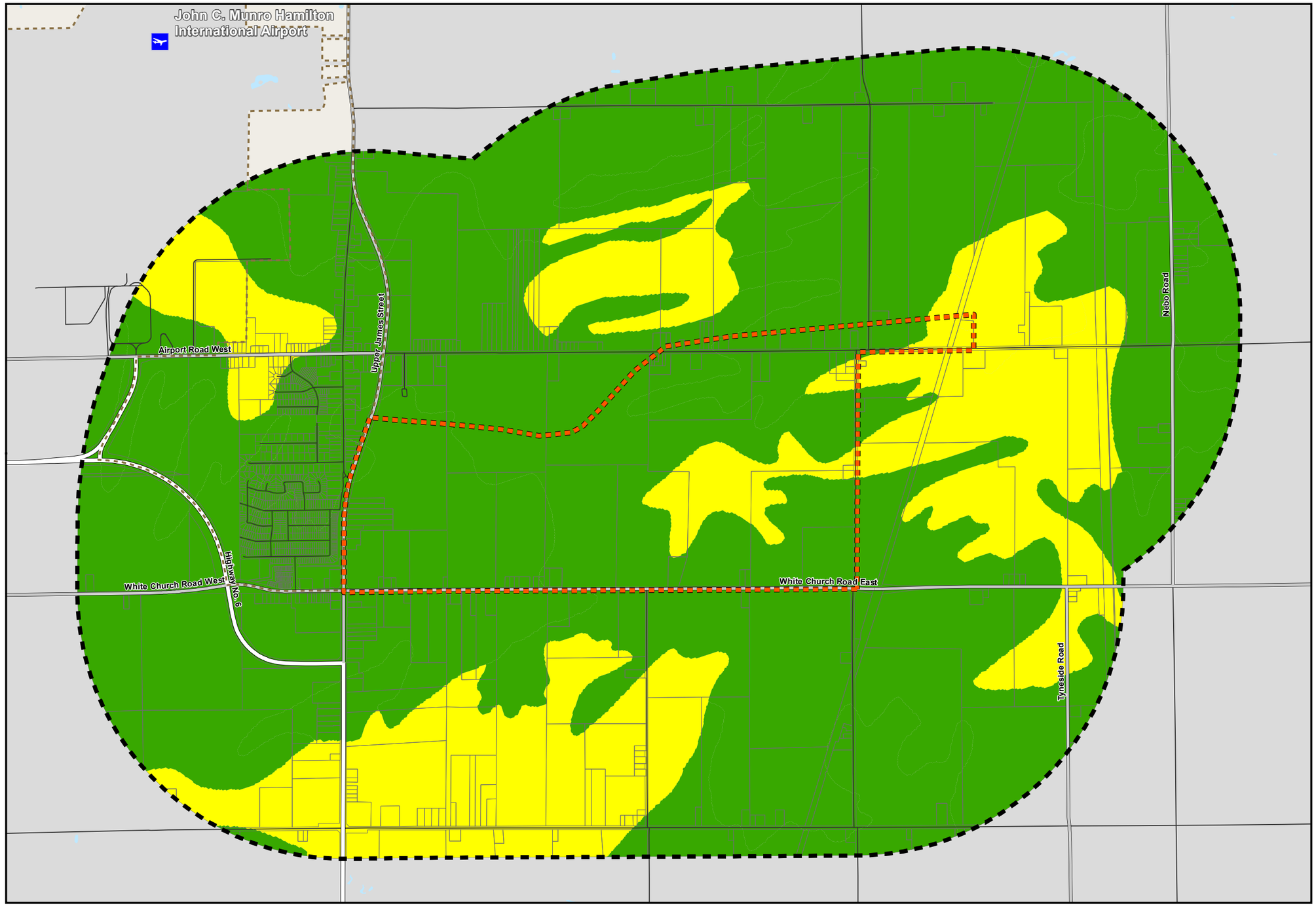
File Location: G:\GIS\211725 Hamilton AIA\Product\Client\20210706 Final Report\Canada Land Inventory.mxd

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

CANADA LAND INVENTORY SOIL CLASSES - WHITECHURCH

FIGURE 8



Canada Land Inventory

Canada Land Inventory Class A

Primary and/or Dominant CLI Class

- 1 - No Significant Limitation
- 2 - Moderate Limitations

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- John C. Munro Hamilton Int. Airport
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads
- Property Parcels
- Lakes
- Urban Area
- Urban Boundary

NORTH

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July 14, 2021

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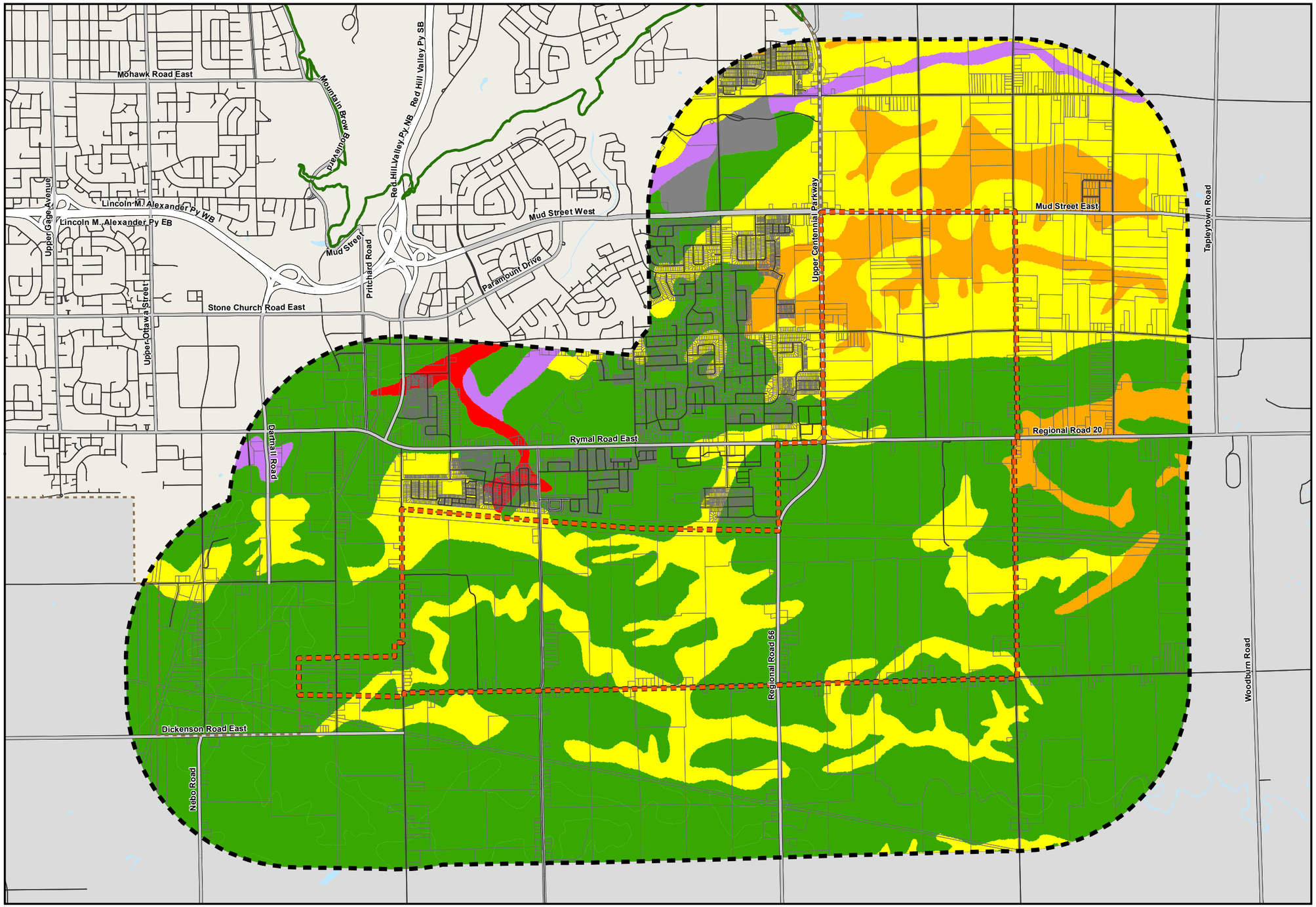
HAMILTON AGRICULTURAL IMPACT ASSESSMENT

CANADA LAND INVENTORY SOIL CLASSES - ELFRIDA

FIGURE 9



Canada Land Inventory

Canada Land Inventory Class A

Primary and/or Dominant CLI Class

- 1 - No Significant Limitation
- 2 - Moderate Limitations
- 3 - Moderately Severe Limitations
- 4 - Severe Limitations
- 6 - Forage Crops - Improvement Practices Not Feasible
- 7 - No Capability for Arable Culture or Permanent Pasture

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- Escarpment
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads
- Property Parcels
- Lakes
- Urban Area
- Urban Boundary
- Municipality Boundary

NORTH

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Map Checked by: SR
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July 14, 2021

Scale 1:34,000

Meters
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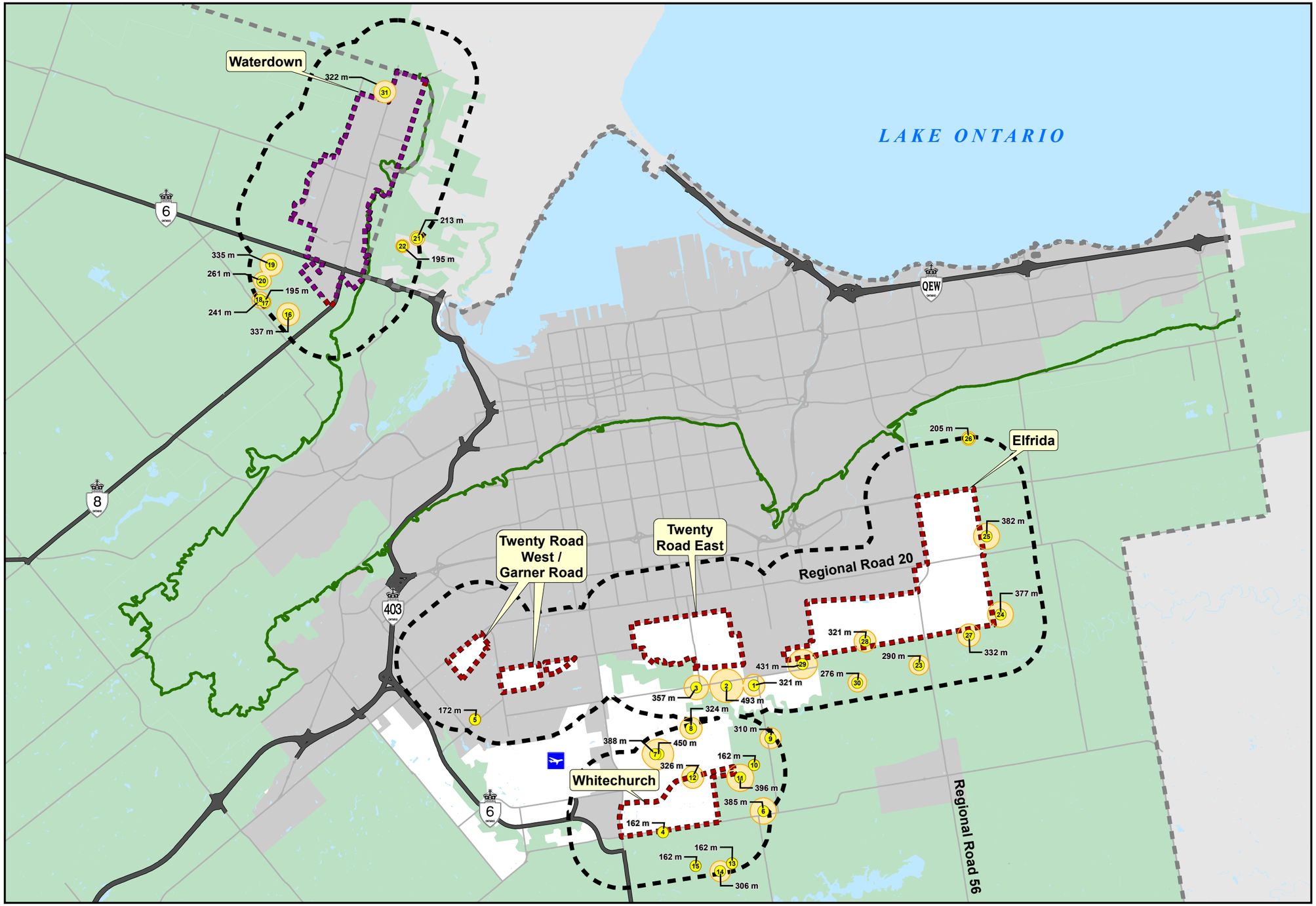
Appendix A
Minimum Distance Separation (MDS)

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

FIELD SURVEY RESULTS - MINIMUM DISTANCE SEPARATION



Legend

- John C. Munro Hamilton Int. Airport
- Escarpment
- Provincial Highway
- Major Roads
- Urban Area
- Lakes
- Greenbelt Area
- CEA Study Area
- CEA Study Area Buffer (1,500 m)
- Municipal Boundary
- Waterdown Urban Area
- Waterdown Study Area (1,500 m Buffer)

Field Survey Results

- Farms Requiring MDS
- Building Base Distance (Minimum Distance from Livestock Barn)

NORTH

Map Prepared by: PFM
Dillon Consulting Limited
Map Checked by: SR
Dillon Consulting Limited

July 05, 2021

Scale 1:115,000

DILLON CONSULTING

Kilometers
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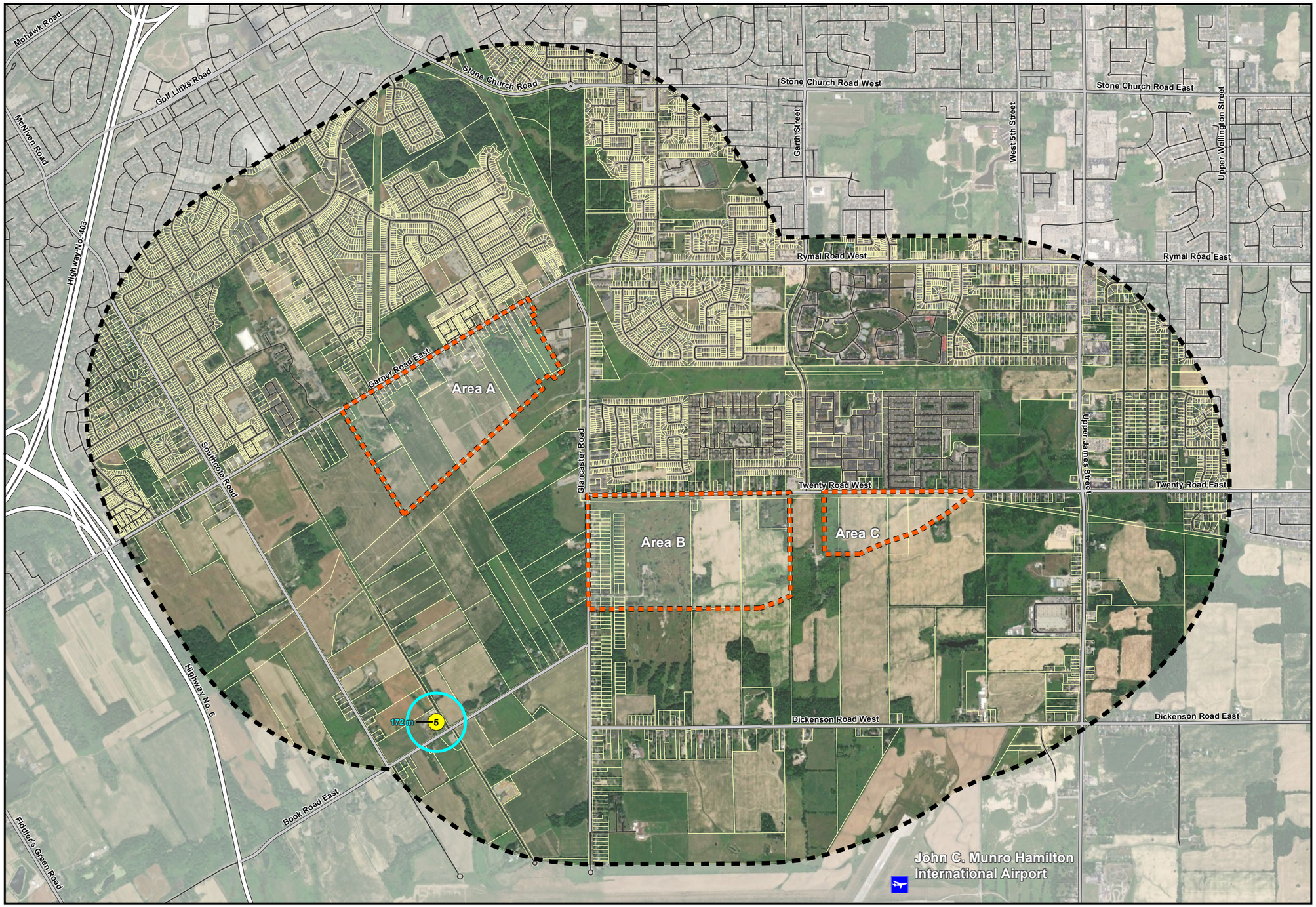
File Location: G:\GIS\211725 Hamilton AIA\Product\Client\20210611 Memo\Field Survey Results - MDS.mxd

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

MINIMUM DISTANCE SEPARATION FACILITIES, LOCATIONS & BUFFER AREAS - TWENTY ROAD WEST / GARNER ROAD



MDS Facilities

- Farms Requiring MDS
- Building Base Distance (Minimum Distance from Livestock Barn)

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- John C. Munro Hamilton Int. Airport
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads

NORTH

Map Prepared by: PFM
Dillon Consulting Limited
Map Checked by: SR
Dillon Consulting Limited

August 24, 2021

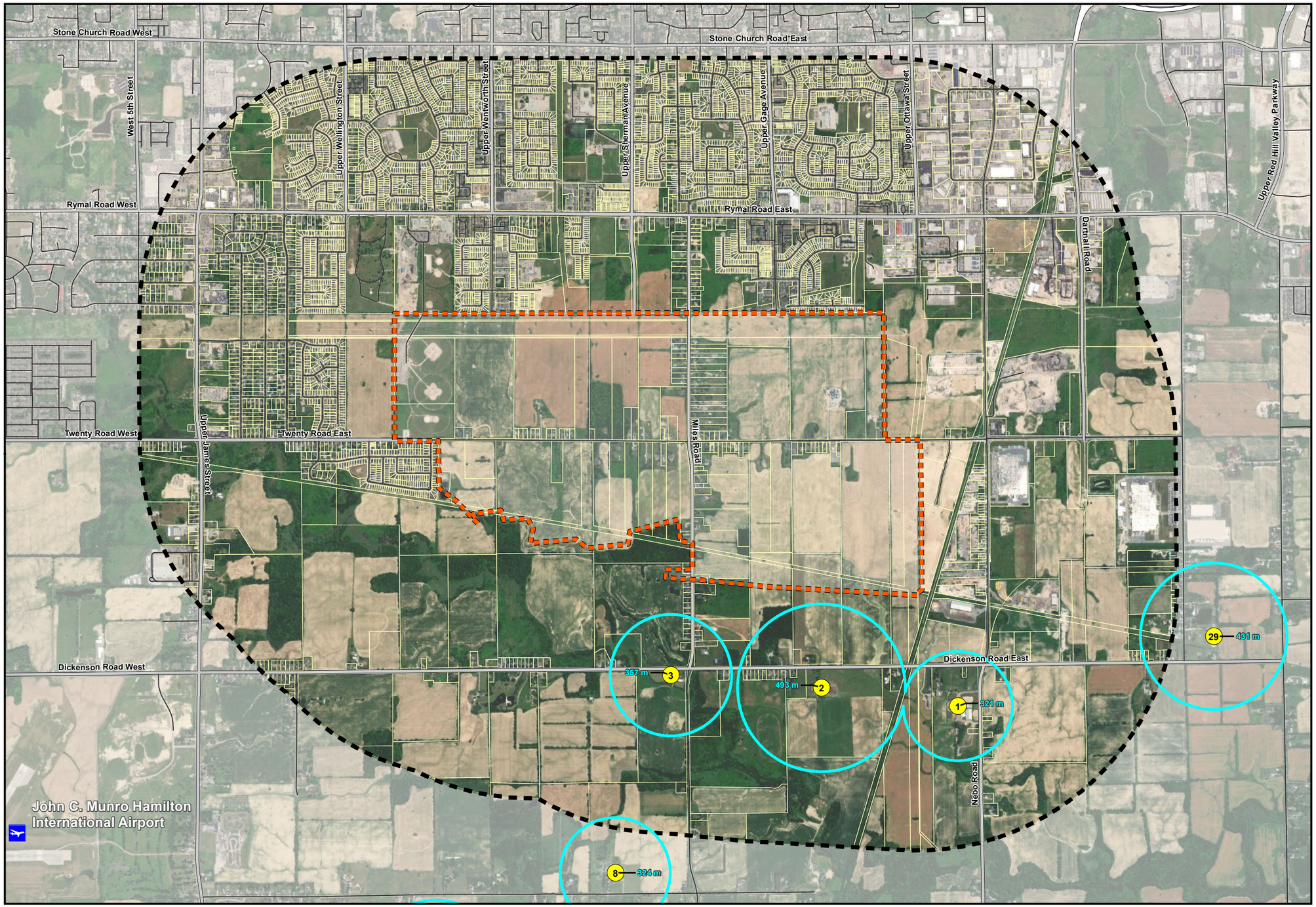
Scale 1:23,000

Meters
0 250 500 1,000

File Location: G:\GIS\211725 Hamilton AIA\Product\Client\20210706 Final Report\Minimum Distance Separation.mxd

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

MINIMUM DISTANCE SEPARATION FACILITIES, LOCATIONS & BUFFER AREAS - TWENTY ROAD EAST



MDS Facilities

- Farms Requiring MDS
- Building Base Distance (Minimum Distance from Livestock Barn)

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- John C. Munro Hamilton Int. Airport
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads

NORTH

Map Prepared by: PFM
Dillon Consulting Limited
Map Checked by: SR
Dillon Consulting Limited

August 24, 2021

Scale 1:23,000

Meters
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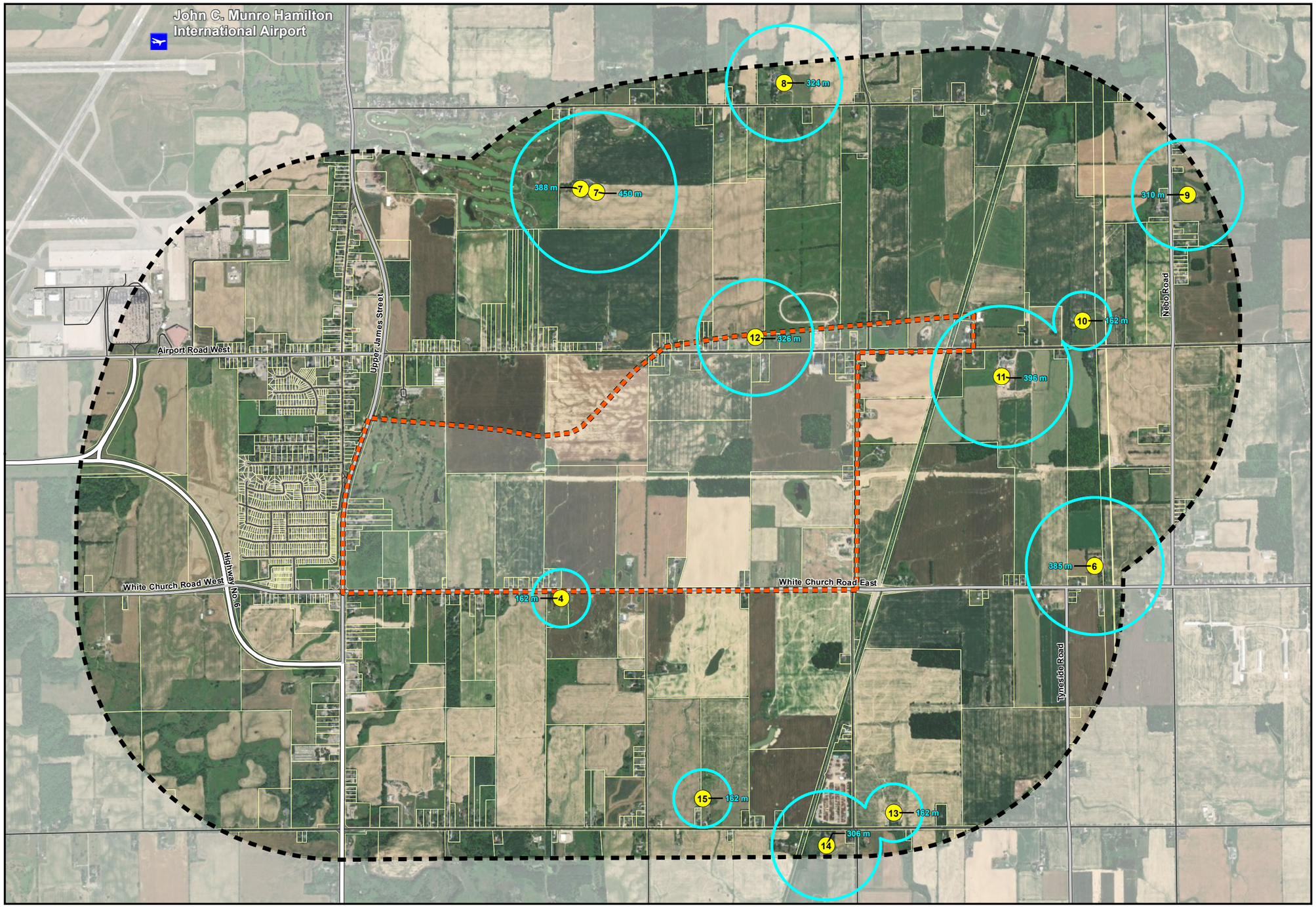
File Location: G:\GIS\211725 Hamilton AIA\Product\Client\20210706 Final Report\Minimum Distance Separation.mxd

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

MINIMUM DISTANCE SEPARATION FACILITIES, LOCATIONS & BUFFER AREAS - WHITECHURCH



MDS Facilities

- Farms Requiring MDS
- Building Base Distance (Minimum Distance from Livestock Barn)

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- John C. Munro Hamilton Int. Airport
- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads

NORTH

Map Prepared by: PFM
Dillon Consulting Limited
Map Checked by: SR
Dillon Consulting Limited

August 24, 2021

Scale 1:22,000

Meters
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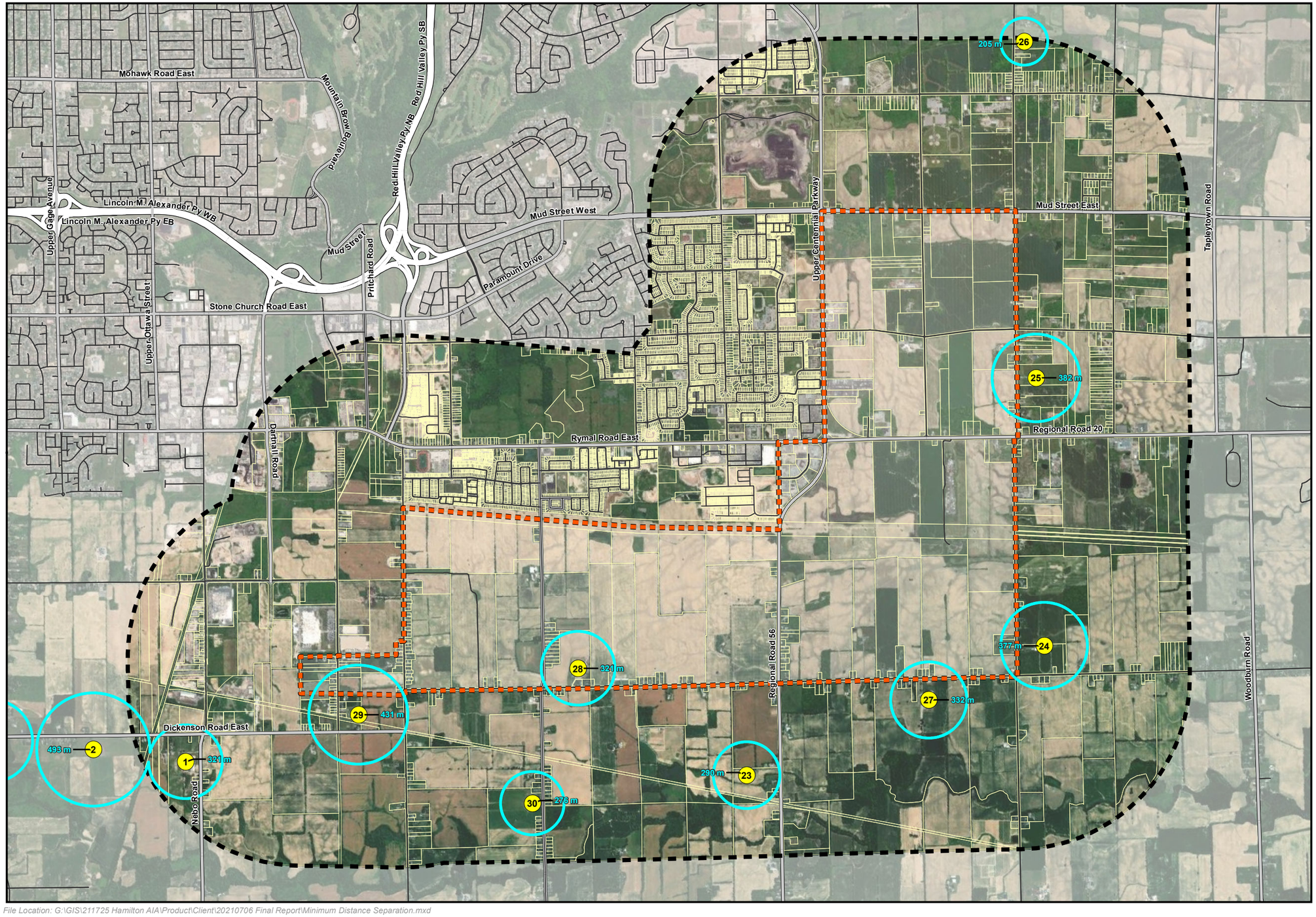
DILLON CONSULTING

File Location: G:\GIS\211725 Hamilton AIA\Product\Client\20210706 Final Report\Minimum Distance Separation.mxd

HAMILTON AGRICULTURAL IMPACT ASSESSMENT

MINIMUM DISTANCE SEPARATION FACILITIES, LOCATIONS & BUFFER AREAS - ELFRIDA



MDS Facilities

- Farms Requiring MDS
- Building Base Distance (Minimum Distance from Livestock Barn)

Study Area

- Study Area
- Study Area Buffer (1,500 m)

Base Mapping

- Provincial Highway / Parkway
- Arterial Roads
- Minor Roads
- Municipality Boundary

NORTH

Map Prepared by: PFM
Dillon Consulting Limited
Map Checked by: SR
Dillon Consulting Limited

August 24, 2021

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File Location: G:\GIS\211725 Hamilton AIA\Product\Client\20210706 Final Report\Minimum Distance Separation.mxd

Appendix F:

UHOP Schedules

APPEALS

The southern urban boundary that generally extends from Upper Centennial Parkway and Mud Street East in the east, following the hydro corridor and encompassing the Red Hill Business Park to Upper James Street remains under appeal.

Lands Subject to Non-Decision 117 (a)
(353 James Street North)

Lake Ontario

Hamilton Harbour

Legend

Urban Structure Elements

- Neighbourhoods
- Employment Areas
- Major Activity Centres
- Major Open Space

Nodes

- Downtown Urban Growth Centre
- Sub Regional Service
- Community

Corridors

- Primary
- Secondary

Other Features

- Rural Area
- John C. Munro Hamilton International Airport
- Niagara Escarpment
- Urban Boundary
- Municipal Boundary
- Lands Subject to Non Decision 113 West Harbour Setting Sail

Council Adoption: July 9, 2009
Ministerial Approval: March 16, 2011
Effective Date: August 16, 2013

Urban Hamilton Official Plan Schedule E

Urban Structure

Not To Scale

Date: February 2021

PLANNING & ECONOMIC DEVELOPMENT DEPARTMENT

APPEAL

The southern urban boundary that generally extends from Upper Centennial Parkway and Mud Street East in the east, following the hydro corridor and encompassing the Red Hill Business Park to Upper James Street remains under appeal – see illustration on Schedules E and E-1, Volume 1

Lake Ontario

Hamilton Harbour

Legend

- Built Boundary
- Built-up Area
- Central Hamilton

Other Features

- Rural Area
- John C. Munro Hamilton International Airport
- Niagara Escarpment
- Urban Boundary
- Municipal Boundary

Council Adoption: July 9, 2009
Ministerial Approval: March 16, 2011
Effective Date: August 16, 2013

Urban Hamilton Official Plan
Appendix G
Boundaries Map

Not To Scale

Hamilton

Date: February 2021

PLANNING & ECONOMIC DEVELOPMENT DEPARTMENT