Technical Appendix 5 - Growth and Allocation

1 Appendix Introduction

This Technical Appendix is intended to summarize Growth Scenarios considered under the Water Distribution Master Plan and summarizes the rational for the preferred growth scenario utilized to develop the recommended water upgrade alternatives. Further, this Technical Appendix outlines methodology to allocate growth demands to the water system and summarizes the projected 2031 water system demands.

2 Overview of Growth Scenarios Growth Scenarios

Initially, City staff identified and assessed three 2031 growth scenarios to determine a preferred growth scenario:

- A "**high**" growth scenario - which encompasses more aggressive population and employment growth; the high growth scenario was based on the Region's Ontario Places to Grow targets (Region of Waterloo, 2016).
- A "**medium**" growth scenario - which projects moderate growth levels; the medium growth scenario was based on the Region's existing Water Supply Master Plan Update (WSMPU) (Stantec, 2014).
- **A "low" growth scenario** - which includes the most conservative levels of population and employment growth. The low growth scenario was based on the City's current Water and Wastewater Rate Study (DFA, 2016), which utilized residential growth from 2013-2014 issued building permits by billing type. Future growth was extrapolated to 2031 using a constant growth rate from the 2013-2014 numbers.

The projected 2031 residential population and employment numbers were based on the following assumptions:

- The growth period occurs between 2011 and 2031.
- The 2011 Census (Statistics Canada, 2011) was used to estimate baseline 2011 residential population.
    - Total residential population of 102,731 in 2011
    - Census population was 98,780 plus 4% for undercount
    - Residential population excludes student population
- A Development Charge Background Study (Hemson, 2012) was used to estimate the baseline 2011 employment and student population numbers.
    - Baseline 2011 employment of 63,473
    - Baseline student population of 16,940
    - Linear growth of 210 additional students per year
    - As per the City of Waterloo Sanitary Master Plan (Stantec, 2015), on-campus population is projected to remain near constant; therefore, on-campus student growth was not considered.

Table 1 and **Table 2** summarize the projected residential and employment growth for each scenario. The DFA Rate Study did not consider employment growth; therefore, a low employment growth was scaled proportionally based on the total residential growth projections of the medium and low scenarios.

Table 1 - Projected Population Growth by Scenario

		Growth Scenarios		
		High	**Medium**	**Low**
Baseline (2011)	Full-Time Residential Population	102,731	102,731	102,731
	Student Population	16,940	16,940	16,940
Future (2031)	Full-Time Residential Population	140,000	139,047	135,022
	Student Population	21,140	21,140	21,140
	Projected Total Residential Population + Students	**161,140**	**160,187**	**156,162**
Projected Change in Growth (2011-2031)	Full-Time Residential Population	37,269	36,316	32,291
	Student Population	4,200	4,200	4,200
	Projected Increase in Residential Population + Students	**41,469**	**40,516**	**36,491**

Table 2 - Projected Employment Growth by Scenario

		Growth Scenarios		
		High	**Medium**	**Low[1]**
Baseline (2011)	Total Employment	63,473	63,473	63,473
Future (2031)	Total Employment	89,000	84,953	82,196
Projected Change in Growth (2011-2031)	**Projected Increase in Employment**	**25,527**	**21,480**	**18,723**

1 – DFA rate study did not considered employment growth; Low Employment Growth number projected using Residential Growth Ratios

2.1 Identification of Preferred Growth Scenario

A preliminary system analysis of the three (3) growth scenarios was completed to determine the preferred growth scenario to carry forward.

Based on the three (3) scenarios, projected 2031 system impacts were reviewed utilizing the hydraulic "all-pipes" IUS model. The current model utilizes 2014 water demands to simulate existing water demand conditions. Water demands were allocated for each growth scenario (**see Section 3 for Allocation Methodology**) based on a calculated water demand rate using a per capita design criteria. **Table 3** summarizes the design criteria, and peaking factor used. The water design criteria is further detailed in **Technical Appendix #3 Section 4**.

Table 3 - Design Criteria for Water Demands

Development Type	Average Day Demand	Max Day Peaking Factor
Residential	170 L/c/d	1.65
Employment	108 L/c/d	1.65

Table 4 summarizes the results of all three growth scenarios by a percentage of deficient properties (by MOECC and FUS standards only) under a max day scenario.

Table 4 - Percentage of Deficient Properties by Growth Scenario

Analysis Type	Growth Scenario		
	High	Medium	Low
Pressure	1.9%	1.6%	1.3%
Fire Flow	7.6%	7.6%	7.5%

Based on the preliminary system analysis, the high growth scenario had lower overall system performance, generating an increased number of system deficiencies, relative to the medium and low growth scenarios. However, the overall difference between the three scenarios was marginal.

Due to the marginal difference in system performance across all growth scenarios, it was determined, in consultation with the City, to carry forward the High growth scenario in all further WDMP analyses and development of preferred alternatives as it would generate the most conservative upgrade recommendations.

3 Growth Allocation Methodology

The City of Waterloo has indicated four areas or "categories" of growth, as identified in **Figure 1**. The growth areas consist of:

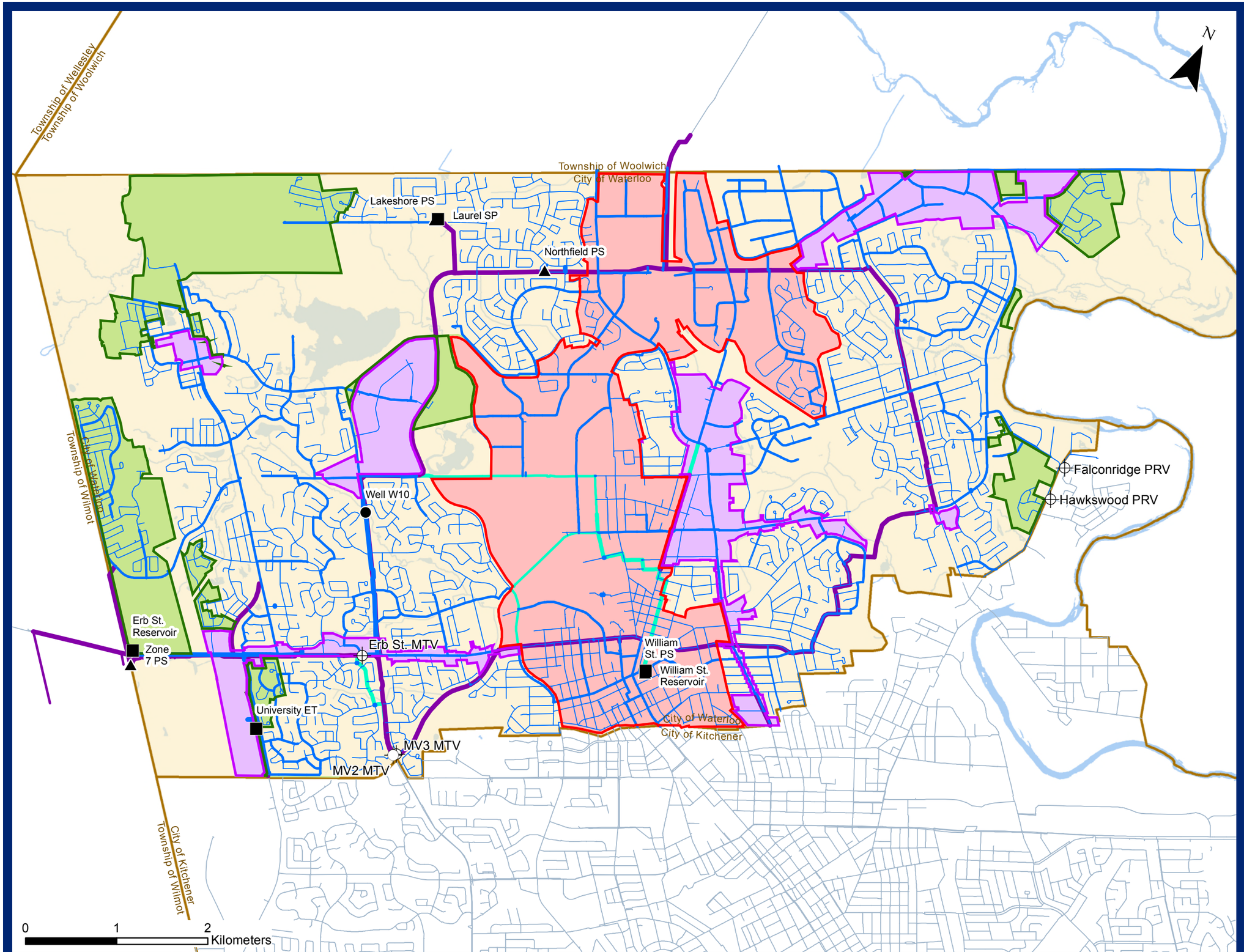
- Designated Greenfield areas – low density
- Official Plan corridors – medium-high density
- LRT station areas – medium-high density
- General infill and intensification – stable growth area

The City-Wide Growth Forecast (BrookMcIlroy, nblc, & CH2MHill, 2014) was used to allocate the total 2031 growth for the four growth categories.

For those areas where specific planning (unit/population) information was available, specifically for Greenfield growth, population and employment were allocated on a block level basis. However, where detailed planning (unit/population) information was not available, population growth was distributed evenly across each "Growth Area" based on existing/projected land uses and development types. The spatial allocation for 2031 growth was distributed to the four areas outlined below, as identified in **Figure 2**.

- **Designated Greenfield areas**
    - Greenfield growth areas **with** existing secondary plans or other area specific growth projections:
        - Allocation of block level residential population and employment using provided (City of Waterloo) Greenfield development information.
        - Total growth numbers assumed to correspond to high growth scenarios.
    - Greenfield growth areas **without** existing secondary plans or other area specific growth projections:
        - Remaining Greenfield growth numbers are calculated by subtracting the already allocated Greenfield growth (above) from the total Greenfield projected growth (**Table 5** and **Table 6**).
        - Remaining Greenfield residential population and employment growth is allocated to remaining Greenfield areas proportionally based on total growth area.

- **Official Plan corridor**
  - No area specific growth numbers provided.
  - Population growth allocated to residential properties proportionally based on existing parcel area.
  - Employment growth allocated to ICI properties proportionally based on existing parcel area.
- **LRT station areas**
  - For Northdale study area:
    - Allocation of block level residential population and employment using provided (IBI Group) buildout numbers.
    - Total growth numbers assumed to correspond to high growth scenarios.
    - All student growth was allocated to the Northdale study area
  - For Remaining LRT station areas:
    - Subtract Northdale growth numbers from total LRT station growth allocation.
    - Population growth allocated to residential properties proportionally based on existing parcel area.
    - Employment growth allocated to ICI properties proportionally based on existing parcel area.
- **Remaining city lands**
  - Population growth allocated to residential properties proportionally based on existing parcel area.
  - Employment growth allocated evenly to ICI properties proportionally based on existing parcel area.



THE CITY OF Waterloo

Water Distribution Master Plan

Figure 1 - Growth Areas

Water Infrastructure

- Pumping Station
- Well
- Reservoir
- Valve

Growth Corridors

- LRT Station Areas - Medium - High Density
- Official Plan Corridor - Other Medium - High Density Growth
- Designated Greenfield Areas - Low Density Growth
- Remaining City Lands - Stable Areas

Watermain (mm)

- < 200 mm
- 250 - 350 mm
- > 400 mm
- Regional Watermains
- Dual Watermains

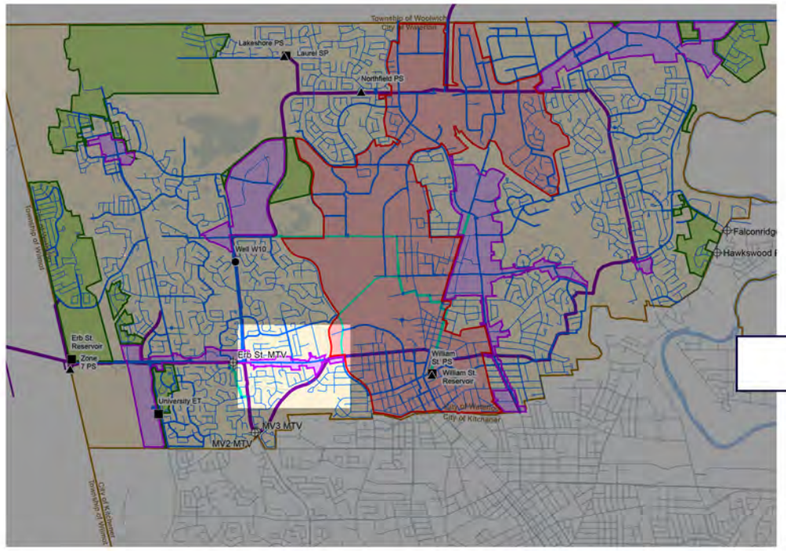
Environmental Features

- Municipal Boundary
- River, Lake

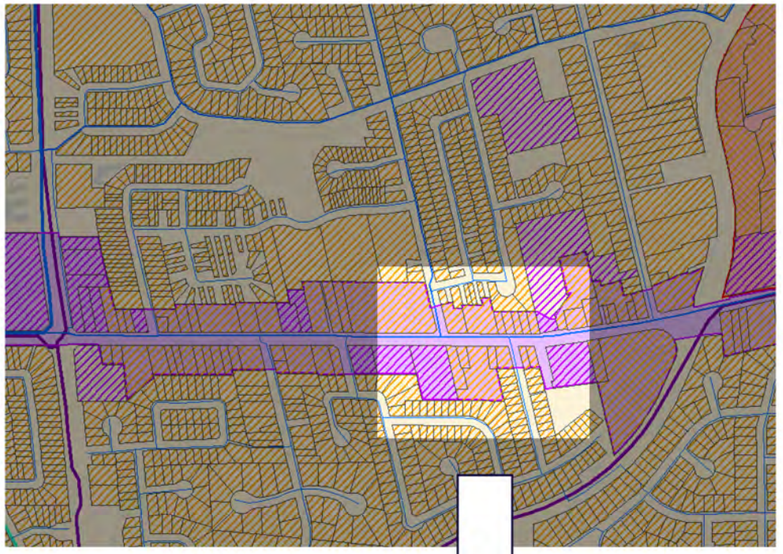
BluePlan ENGINEERING

615036-2-W
January 2017
Data Source: City of Waterloo
Scale: 1:40,000 | NAD 1983 UTM Zone 17N

1. Growth Areas within the City



2. Land Use Within a Growth Area



3. Parcels within Land Use Designation and Growth Area

4. Growth Allocation

		Official Plan	Property
Total Residential Area (m^3)		153,000	882
Residential Population Growth	High	5,218	30
	Medium	5,084	29
	Low	4,521	26

THE CITY OF Waterloo

Water Distribution Master Plan

Figure 2 - Growth Allocation

Water Infrastructure

- Pumping Station
- Well
- Reservoir
- Valve

Growth Areas

- LRT Station Areas
  Medium - High Density
- Official Plan Corridor - Other
  Medium - High Density Growth
- Designated Greenfield Areas
  - Low Density Growth
- Remaining City Lands
  - Stable Areas

Land Use

- Institutional, Commercial, Industrial
- Residential

Environmental Features

- Municipal Boundary
- River, Lake

BluePlan ENGINEERING

615036 - Growth Allocation
March 2016
Data Source: City of Waterloo
NAD 1983 UTM Zone 17N

3.1 Projected Population by Growth Area

The projected residential population growth, excluding the student population, was allocated spatially for each of the growth areas. **Table 5** depicts this breakdown, as well as allocation percentages that were identified by the City-wide growth forecast.

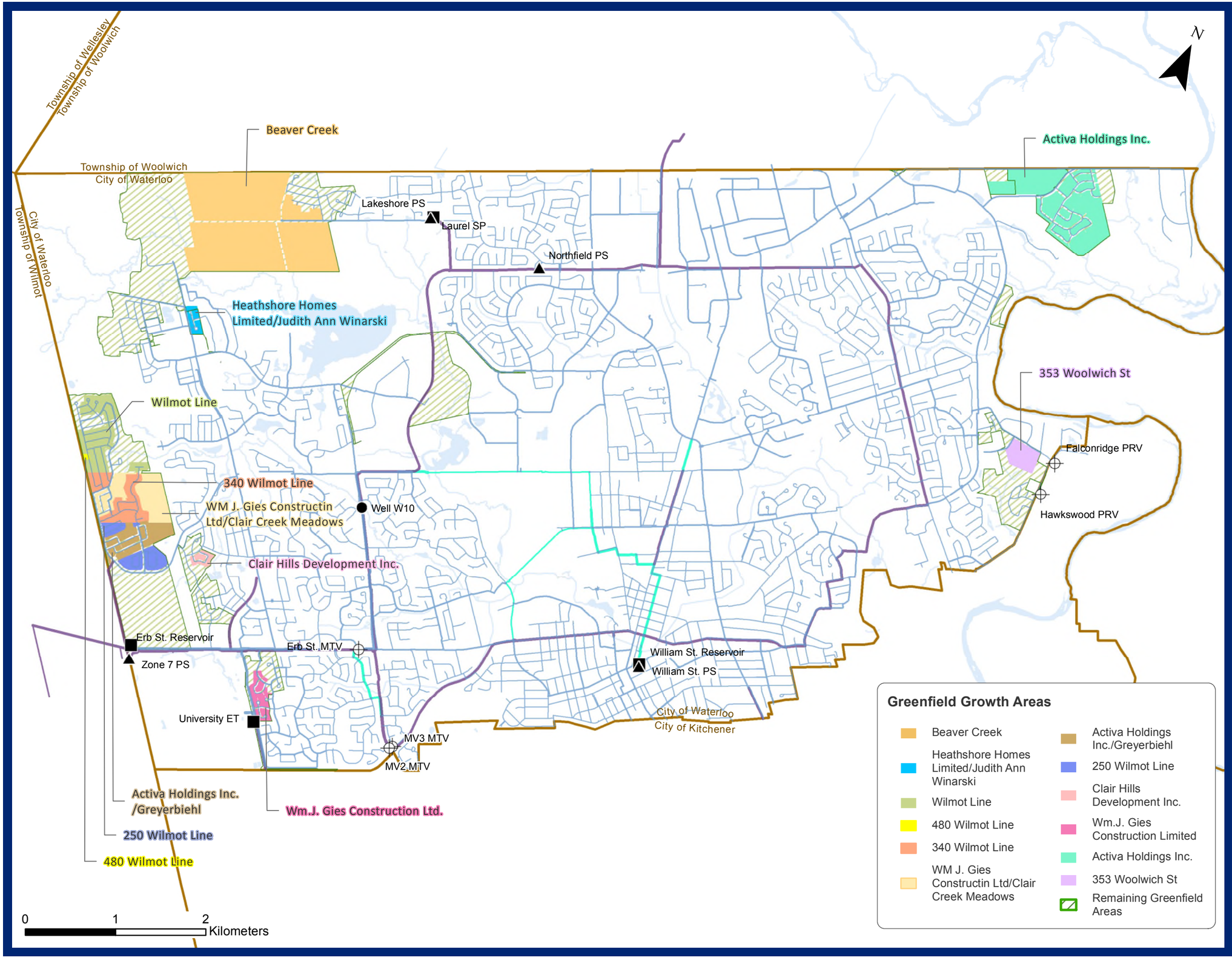
Table 5 - Projected Population Growth by Growth Area

Growth Area	%	Growth Scenarios		
		High	Medium	Low
Greenfield	62%	23,107	22,516	20,020
Official Plan	14%	5,218	5,084	4,521
LRT Stations	20%	7,454	7,263	6,458
Remaining Land	4%	1,491	1,453	1,292
Total Residential Growth	**100%**	**37,269**	**36,316**	**32,291**

The City provided additional Greenfield growth information through approved, pending, and draft Greenfield development plans. **Table 6** summarizes the build-out populations for each Greenfield development type and the population to be allocated evenly throughout the remaining Greenfield areas (see **Figure 3**)

Table 6 - Projected Greenfield Population Growth

Growth Area	Development Name	%	Growth Scenario		
			High	Medium	Low
Greenfield	Beaver Creek	29%	6,790	6,616	5,883
	Heathshore Homes Ltd.	<1%	81	79	70
	Activa Holdigns Inc.	6%	1,499	1,461	1,299
	Wm.J. Gies Construction Ltd.	2%	410	400	355
	Clair Hills Development Inc.	1%	179	174	155
	Clair Creek Meadows	1%	338	329	293
	Greyerbiehl	3%	583	568	505
	Wilmot Line	9%	2,067	2,014	1,791
	250 Wilmot Line	6%	1,440	1,403	1,248
	340 Wilmot Line	6%	1,304	1,271	1,130
	353 Woolwich St	1%	224	218	194
	480 Wilmot Line	<1%	59	57	51
	Remaining	35%	8,133	7,925	7,046
	Total	**100%**	**23,107**	**22,516**	**20,020**



THE CITY OF Waterloo

Water Distribution Master Plan

Figure 3 - Designated Greenfield Growth Areas

Water Infrastructure

- Pumping Station
- Well
- Reservoir
- Valve

Watermain (mm)

- < 200 mm
- 250 - 350 mm
- > 400 mm
- Regional Watermains
- Dual Watermains

Environmental Features

- Municipal Boundary
- River, Lake

BluePlan ENGINEERING

615036-3-W
January 2017
Data Source: City of Waterloo
Scale: 1:40,000 | NAD 1983 UTM Zone 17N

3.2 Projected Student Population by Growth Area

The student population was projected to be the same for all three growth scenarios:

- A total of 4,200 additional students are projected to be living in the City of Waterloo by 2031.
    - Based on the DC, the student population will experience a linear growth rate of 210 students per year.
    - Experienced student growth of 16,940 (2011) to 21,140 (2031).
- All student growth was allocated to the Northdale neighbourhood located within the area bound by University Avenue to the south, Phillip Street to the west, Columbia Street to the north, and King Street to the east.
- The on-campus student population was not included in this allocation process as it is anticipated to remain near constant as determined by the Waterloo Sanitary Master Plan (Stantec, 2015).

3.3 Projected Employment by Growth Area

The projected employment growth was allocated spatially by growth area. **Table 7** summarizes the breakdown for each growth scenario as well as allocation percentages that are identified by the City-wide growth forecast.

Table 7 - Projected Employment by Growth Area

Growth Area	%	Growth Scenarios		
		High	Medium	Low
Greenfield	23%	5,990	5,040	4,393
Official Plan	17%	4,285	3,606	3,143
LRT Stations	47%	12,067	10,154	8,851
Remaining Land	12%	3,185	2,680	2,336
Total Employment Growth	**100%**	**25,527**	**21,480**	**18,723**

The City provided additional growth information through approved, pending, and draft Greenfield development plans. **Table 8** provides an overview of the projected employment for the Beaver Creek development, as well as additional employment that is to be allocated evenly throughout the remaining Greenfield areas.

Table 8 - Projected Greenfield Employment

Growth Area	Development Name	%	Growth Scenario		
			High	Medium	Low
Greenfield	Beaver Creek	7%	402	338	295
	Other Developments	93%	5,588	4,702	4,098
	Total	**100%**	**5,990**	**5,040**	**4,393**

4 Projected 2031 Demand & Allocations

Table 9 summarizes the existing and projected 2031 system demands based on the Preferred Growth Scenario. These demands are based on the Region's WDSOMP which account for declining per capita demand rates. Further breakdown of the 2031 growth demands and allocations is provided in **Appendix A**.

Table 9 - Projected 2031 Populations and Demands by Pressure Zone

		Wat 4	Wat 4B	Wat 4C	Wat 5	Wat 6	Wat 7
Projected 2031 Growth	Residential	12,793	678	5,472	7,712	3,363	7,251
	Student	4,200	0	0	0	0	0
	Employment	17,231	432	712	3,859	1,891	1,402
System Demands	Existing Demands (L/s)	254	22	6	52	44	<1
	Growth Demands (L/s)	55	2	12	20	9	16
	2031 Total Demands (L/s)	309	24	18	72	53	17

4.1 Regional Growth

In addition to servicing the local users, the City's water distribution system directly supplies areas outside of the City limits which includes Kitchener, Woolwich Stockyards, Elmira, and St. Jacobs. Due to these external demands, their considerations was included when developing the Water Distribution Master Plan preferred serving alternatives.

This section summarizes the projected 2031 growth for external areas supplied directly by the City's water system.

4.1.1 Kitchener Growth

The Region's existing WSMPU (Stantec, 2014) does not identify population or employment growth on a pressure zone basis. It was noted that the internal zone demands within Kitchener Zone 4A did not experience a change from 2011 to 2031.

4.1.2 Elmira & St. Jacobs Growth

The Region's existing WSMPU (Stantec, 2014) projected population and employment growth within the Elmira and St. Jacobs service areas, as summarized in **Table 10**.

Table 10 - Elmira and St. Jacobs Projected Growth

	Residential	Employment
Baseline (2011)	11,835	8,071
Future (2031)	17,617	11,529
Projected Growth (2011-2031)	**5,782**	**3,458**

4.1.3 Woolwich Stockyards

Growth numbers for the Stockyards, summarized in **Table 11,** were estimated using the estimated residential population and employment growth over the period 2006 to 2029, as outlined in the Townships Stockyards Area Secondary Plan Terms of Reference (Woolwich Township, 2015).

Table 11 - Woolwich Stockyards Growth

	Residential	Employment
Baseline (2011)	22,796	14,683
Future (2031)	33,578	19,257
Growth (2011-2031)	**10,782**	**4,574**

APPENDIX A

Table 1: Residential Growth by Land Use

Growth Area	Land Use	%	Population Growth
Greenfield	Single-Family	88%	20,228
	Multi-Family	12%	2,878
Official Plan	Single-Family	0%	0
	Multi-Family	100%	5,218
LRT Station	Single-Family	69%	5,115
	Multi-Family	31%	2,339
Remaining Land	Single-Family	0%	0
	Multi-Family	100%	1,491
Total Residential Growth			**37,269**

Table 2: Employment Growth by Land Use

Growth Area	Land Use	%	Population Growth
Greenfield	Commercial	85%	5,080
	Industrial	9%	533
	Institutional	6%	377
Official Plan	Commercial	56%	2,393
	Industrial	12%	529
	Institutional	32%	1,363
LRT Station	Commercial	13%	1,542
	Industrial	47%	5,649
	Institutional	40%	4,876
Remaining Land	Commercial	60%	1,921
	Industrial	2%	74
	Institutional	37%	1,190
Total Employment Growth			**25,527**