4. FUTURE GROWTH NEEDS

Population and water demand/sewage flow projections were required to confirm future water/wastewater servicing requirements. From a population growth perspective, the City adopted growth projections to 2027 as part of the Development Charges Study as prepared by C.N. Watson and Associates in 2003. These growth projections were used as the starting point for the Water Supply Master Plan. In addition, and for consistency purposes, C.N. Watson was retained to project growth beyond 2027 to 2054 (i.e. a 50-year period) for the WSMP. These population projections were used as the basis for determining water demands and sewage flows well into the future.

The WSMP concluded that the City's existing groundwater system would at best service approximately 145,000 people and employment equivalent of 80,000 people (225,000 total) if optimized and maximized. If new wells outside of the City's jurisdiction were considered along with local water supply from Guelph Lake and Aquifer storage recovery this could increase to as much as 210,000 people and an employment equivalent of 115,000 people (335,000 total).

Based on the above referenced growth projections this represents a growth accommodation potential between Year 2017 and 2037. Preliminary growth projections from the Local Growth Management Strategy calls for 165,000 people and a 30,000 population equivalent (195,000 total) to the year 2031. Other alternative scenarios to as high as 195,000 people and a 45,000 population employment equivalent (240,000 total) were also examined as part of the background in the preparation of the LGMS.. The lower figure is based on preliminary outputs from the Wastewater Treatment Master Plan and the assimilative capacity of the Speed River.

The above population projections were used to estimate future water demand and sewage flows based on per capita consumption and contribution, with allocations for industrial, commercial and institutional use.

Details of the population, water demand and sewage flow projections are provided herein.

4.1. Population Projections

Watson and Associated Ltd. provided long term population, housing and employment projections (including population equivalents) for the Water Supply Master Plan study period of 2004 to 2054 as shown by Table 4.1. Preliminary population projection outputs from the LGMS as provided in November

2007 (GMS1/GMS2), and in March 2008 (GMS3) were added to this information. Details of the LGMS population projections are provided in Appendix F.

It was not the intention of the Water/Wastewater Servicing Master Plan to establish growth targets for the City but to consider a range of potential growth that may occur in the planning period and to develop water and wastewater servicing alternatives to satisfy the full range of potential growth. As a result, three population growth scenarios were considered:

- Scenario 1 – Preliminary GMS outputs (175,000 population and an additional 35,000 employment equivalent population inside the City);
- Scenario 2 – Preliminary GMS (195,000 population and an additional 45,000 employment equivalent population inside and outside the City);
- Scenario 3 – Preliminary LGMS and Wastewater Treatment Master Plan outputs (165,000 population and an additional 30,000 employment equivalent population inside the City limits).

The low growth scenario annual growth rate (1.5%) from the WSMP was the growth rate utilized in the Guelph Development Charges Background Study (February 2004), and in the City's Official Plan, and represented an extension of the rate presently endorsed by City Council. The other growth rates used for the WSMP (medium, 2.0% and high, 2.5%) represented the possible range of growth rates which could be considered by the City at the time (2006). For example, the high growth scenario included an estimate of projections from the Provincial *Places to Grow, Better Choices, Brighter Future, 2004*, although the increases in population included in this document were combined for Guelph and Wellington County. The forecasts are significantly higher than the projected planning rates of growth for the City and Wellington County.

The City's and County's position with respect to Places to Grow have now been finalized with a 2031 city population forecast of 165,000 (equivalent to a Places to Grow defined population with undercount to 171,000 people). The Local Growth Management Strategy will define the City's ability and capacity to grow into the future.

The intent of providing this range in growth is to capture potential growth that may occur in the current City and identify/confirm water and wastewater servicing alternatives to support this potential growth in the future.

4.1.1. Final Population/Flow Projections

The following populations/flow projections were used for the project in the order of the items discussed:

1. 2001 total inlay population of 110,696 people were used in the TransCAD model as the basis for population distribution across the fifty traffic zones. This included the University of Guelph allowance of 4800 on campus beds which were pro-rated for the growth projections outlined in Item 2. The Transportation Master Plan includes population information established in 2001, which was was distributed across the existing City for intensification and new growth purposes. The TransCAD model has 50 traffic zones which covers all area within the current boundary of the City of Guelph. The intensification component in the TransCAD model was only 10% infill within the built up area of the city, whereas Places to Grow and the Local Growth Management Strategy were looking at up to 40%. The latter was used for project purposes.

2. The Water Supply Master Plan growth projections were used as shown in Table 4.1. An additional 4800 University of Guelph on-campus bed allowance was provided as per the City's August 21, 2006 comments and revised 2006 population. These populations were distributed as per the TransCAD model on a pro-rated basis compared to the 2001 information. The WSMP (2039) growth scenario was used for long term servicing (equivalent to the maximum water supply capacity for the City), the reason being that differences in the main size and/or storage or pumping capacity created is minimal. Pipe size/cost differential is typically less than 10% between the high and low figures (i.e. pipe sizes do not change significantly), and pump sizes were revised accordingly using the middle estimates. However, in the 175000 and 195000 population projection scenarios, the difference in growth was established outside the City and therefore the marginal cost increases are not reflected. There is significantly more infrastructure required to service the additional population outside of the City boundaries.

Table 4.1: City of Guelph Water Distribution/Storage and Wastewater Conveyance Master Plan Future Population, Water Demands and Sewage Flows

Year (1)	Population (2)	Employment Population Equivalent (3)	Total Population (2) + (3)	Water Avg. Day Use (4) (m^3/day)	Sewage Avg. Day Flow (5) (m^3/day)
2001 (6)	109450 (6)				
2004	119000	65224	184224	55267	55267
2006 (7)	120000				
2009	129400	73520	202920	60876	60876
2014	138400	78333	216733	65020	65020
2019	146100	81987	228087	68426	68426
2024	153400	85273	238673	71602	71602
2029	168200	93214	261414	78424	78424
2031 (GMS3)(8)	**165000**	**30000**	**195000**	**58500**	**58500**
2031 (GMS1)(8)	**175000**	**35000**	**210000**	**63000**	**63000**
2031 (GMS2)(8)	**195000**	**45000**	**240000**	**72000**	**72000**
2034	195000	107842	302842	90853	90853
2039	221900	122727	344627	103388	103388
2044	248700	137141	385841	115752	115752
2049	275600	151803	427403	128221	128221
2054	302400	166163	468563	140569	140569

Notes:

(1) From C.N. Watson memo dated September 19, 2005 used for the Water Supply Master Plan growth projections, unless otherwise noted. The 2.5% Growth assumption was used for consistency with "Places to Grow", and to size distribution/conveyance works appropriately in the long term. Water Storage is MOE criteria driven.

(2) Residential Population only from (1).

(3) Population "Equivalent" for Industrial/Commercial/Institutional from (1).

(4) 300 litres per equivalent population per day average daily water use assumption (used for both residential and employment demands). Add 1.5 maximum day factor (=450 lpcd) from the Water Supply Master Plan for maximum flow requirements.

(5) 300 litre per equivalent population per day sewage flow assumption (used for both residential and employment demands). Add 0.1/s/ha Infiltration/Inflow allowance plus Harmon factor for peak flows.

(6) From TRANS CAD Model, used as the basis for this population distribution by Traffic zone within the city boundary.

(7) Current Population Reconciliation confirmed by the City Planning Department for the Growth Management Strategy, as per August 21, 2006 comments.

(8) Preliminary population information as provided by the City of Guelph LGMS, November 2007 to March 2008.

3. The LGMS preliminary population and employment equivalent population outputs were then used to determine water distribution and sewer collection system sizing and lengths, and to

determine pump station, booster station and storage reservoir requirements because this information more closely represented the anticipated growth strategy to be adopted by the City of Guelph in the future. This also reflected wastewater treatment capacity limitations based on the assimilative capacity of the Speed River. Water demands and sewage flow projections were determined on this basis.

4.2. Water Demand Projections

The MOE Guidelines for the Design of Water Distribution Systems (July 1985), dictates that water supply systems be designed to satisfy the greater of the maximum day demand plus fire flow or peak rate (maximum hourly demand).

4.2.1. Average Day Demand

The Average Day Demand over the period 1997 to 2003 as taken from the WSMP was approximately 52,700 m^3/day. This value represented water pumped to the distribution system from the water supply system.

Design guidelines were available for estimating water demand on a per capita basis, however sufficient existing information was available for the City of Guelph to determine historical demands and develop reasonable estimates for projecting future demands as part of the WSMP. Based on consumption records for the period of 2000-2004 (i.e., actual billings to customers), and the "equivalent" population for this period, water demand was approximately equal to 264 L/equivalent capita day (i.e. 45,479 m^3/day). However, this did not include unaccounted for water (UFW), which includes watermain breaks, exfiltration, water used for water main flushing, meter inaccuracies, etc. A comparison of pumped versus billed water indicated this to be approximately 14% (37 L/equiv.cap.day) over the same period. This percentage amount was carried forward as a worse case and did not include 1 to 2% of use that is accounted for but not billed. Therefore, including unaccounted water, water demand was equal to approximately 300 L/cap.day based on equivalent population. This figure was used to determine future water demands for the WSMP and was maintained for the purpose of this study. See Table 4.1.

4.2.2. Maximum Day/Maximum Week Demand

The maximum day demand for the period 1997 to 2003 has ranged from 61,629 to 73,744 m^3/day.

The MOE Guidelines for the Design of Water Distribution Systems provides a table of peaking factors for municipal water supply systems to be used in design where existing information may not exist (i.e. "wherever possible, peaking factors based on usage records for the water supply system should be used"). This table indicates that as population increases, the maximum day factors (maximum day is maximum day factor multiplied by average day demand), decrease from 2.75 to reflect a dampening of the seasonal demand curve for larger communities, with an additional variety of water uses (i.e. industrial and commercial). For a community of between 75,000 and 150,000, a maximum day factor of 1.65 is recommended. At a population greater than 150,000, a maximum day factor of 1.50 should be used.

Water efficiency has become such a well-established way of thinking in the City of Guelph that, not only is the maximum day factor suppressed during the times of year where water restrictions are enforced, but during other times as well. This puts Guelph in the position where, as long as water conservation and efficiency programs are in place and well promoted, a maximum day factor that is lower than that recommended by the MOE could be adopted for design. Maximum day demand is normally defined as the average of the highest five days of water usage experienced in an average demand year.

For the purposes of evaluating water supply alternatives, the MOE standard for maximum day factor of 1.5 for the projected population was applied for the WSMP and has been maintained for this study in long term scenarios. A maximum day factor of 1.35 was used in short term scenarios until additional water supply sources are assumed available per the WSMP schedule for implementation.

4.3. Sewage Flow Projections

The following steps were taken to determine sewage flow projections for the City of Guelph into the future:

1. The population information outlined in Section 4.1 was utilized to determine residential and employment needs on an equivalent population basis well into the future.

2. Flow monitoring results and modeling analysis was used to confirm the equivalent Lpcd for new development planning, and existing sanitary sewerage system assessment purposes. For modeling purposes 300 lpcd was used for the WSMP and for water demand determination purposes. This is the equivalent lpcpd water demand, taking into account unaccounted for water and compares favourably to the 290 lpd avg. sewage flow rate determined from the flow monitoring program. These water and wastewater unit rates were used for new greenfield

development and for intensification purposes only. Existing system characteristics are as per the model outputs calibrated to the flow monitoring information (i.e., variability in each sewershed area reflects the flow monitoring results under both dry and wet weather conditions for base inflow and rainfall induced inflow/infiltration). See Section 2.2.3.2.

3. Current and future or agreed upon flows for Gazer-Mooney (300 people, 7.2 l/s peak), and Rockwood (4511 people, 26.7 l/s peak), were added to the population/employment equivalent population flows determined as per our October 4, 2006 model presentation. The landfill leachate load also allowed for was 7.3 l/s.

4. For peak sewage flows, the Harmon factor as calculated (or the City standard for peak sewage flow of 1.7 L/s/ha), was used.

5. For I/I allowance purposes in new greenfield areas, a design standard of 0.1 l/s/ha was used. This design standard is the norm for new development areas used by most municipalities and is recommended by the Ministry of the Environment. This reflects the recognition that new sanitary sewer installations using PVC and/or gasketed concrete pipe materials present less potential for base inflow and/or rainfall induced inflow/infiltration. Again, within the existing service areas of the City, actual flow monitoring and/or modeled outputs based on flow monitor calibration was utilized. Given the base inflow rate alone within the City is equal to this design criteria (approximately 0.1 l/s/ha), with rainfall induced I/I in the existing City averaging 0.72 l/s/ha (based on a 25-year storm event), both amounts are excessive and should not be expected for new Greenfield Development or Intensification (added growth component only).

6. All other criteria are as per City standards. Assumed:

    - min/max velocities of 0.60 to 4.5 m/s for gravity sewers; 0.8 to 4 m/s for forcemains;
    - Manhole losses as per equation or City standard;
    - Manning's equation being used for roughness (0.13 for less than 1650 mm diameter and 0.11 for greater).
    - Minimum cover to obvert of 2.4 m.
    - Manhole spacing 90 m for less than 450 mm diameter; 150 m for greater.
    - The equivalent population sewage flow per capita figure of 300 lpcd being used for Institutional/Commercial/Industrial (ICI) areas.
    - For rainfall induced I/I analysis, standard City IDF curves were used.

On this basis sewage flow projections were determined to trunk sewer and/or pumping needs. Average day sewage flows generated as per the aforementioned steps are shown by Table 4.1.