# Dufferin Street Avenue Study

## Infrastructure Master Plan

FINAL REPORT
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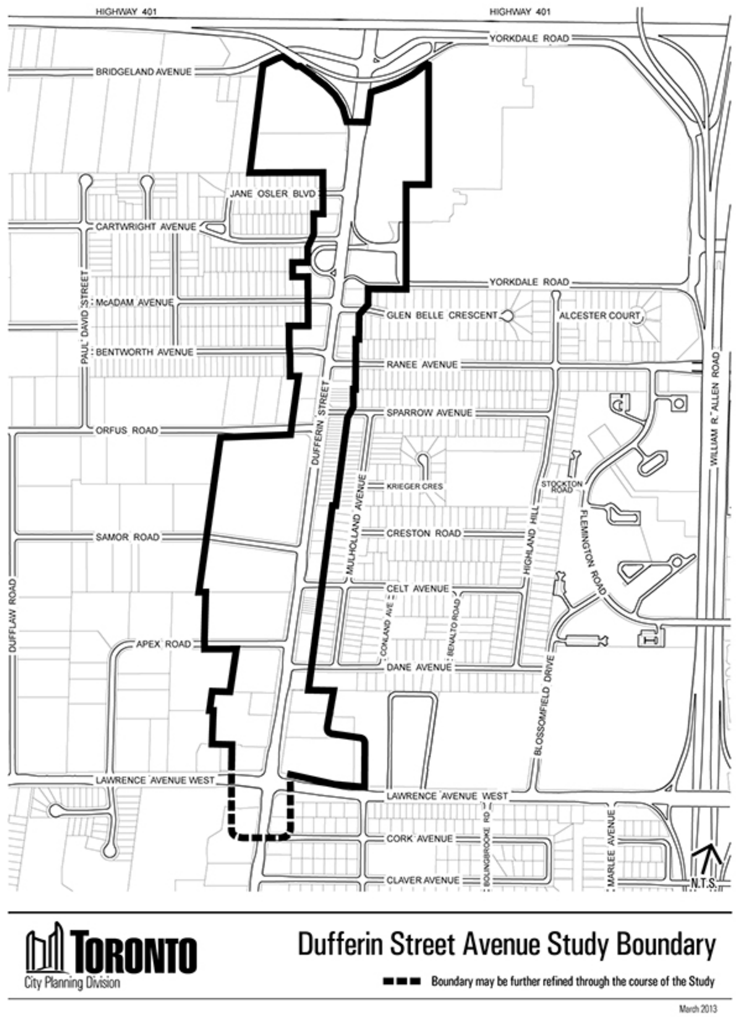
# Executive Summary

The City has undertaken the Dufferin Street Avenue Study to examine the existing, and make recommendations for future, land use and built form along Dufferin Street. The study boundary extends from Highway 401 to Lawrence Avenue West and includes those mixed use properties with frontage on Dufferin Street. In association with this study, both a Transportation Master Plan and Infrastructure Master Plan were undertaken concurrently and followed the Master Plan Class EA process. This report (Infrastructure Master Plan) represents the outcome of the assessment of the existing municipal servicing infrastructure, as well as to identify any improvements required thereto, in order to support the growth envisioned by the preferred land use planning strategy developed in the Dufferin Street Avenue Study.




The land use planning component of the Dufferin Street Avenue Study generally envisions a midrise form of development, composed primarily of residential mixed-use character and mostly limited to four or five stories in height as well as tall buildings limited to the northerly and southerly extents of the study area. The resulting residential population for the 2031 target year is expected to be on the order of 13,580, a notable increase when compared to the estimated existing population of 3,092. The planned intensity of non-residential land uses closely resembles current conditions.

Existing land uses in the study area consist of commercial or mixed-use buildings, with a relatively small proportion being composed of residential land uses typically dating back to the 1950s through to the 1970s. The lands are largely covered by impervious surfaces and there has been a history of basement flooding occurrences in or near to the study area and, accordingly, this was a matter of sensitivity in the development of this Master Plan and which is reflected in the preferred solutions identified herein. Although it is not the intent of this Master Plan to address existing causes of basement flooding – this is a matter that is being dealt with explicitly through detailed Class EA projects for two separate sewersheds which service the study area – the planned intensification of the lands must not exacerbate, and where possible exploit opportunities to ameliorate, this situation.

Based on the Basement Flooding Study Area Class EAs (i.e., Study Areas 16 & 17) that the City has commissioned, the principal cause of flooding issues is the overwhelming of the existing storm drainage system's conveyance capacity, rather than the sanitary sewer system's ability to handle dry weather flows. Accordingly, the improvements identified in said studies are focused on reducing the amount of storm drainage entering the sanitary sewers under wet weather conditions and works to enhance the capacity of the storm drainage system to capture, contain, and convey flow.

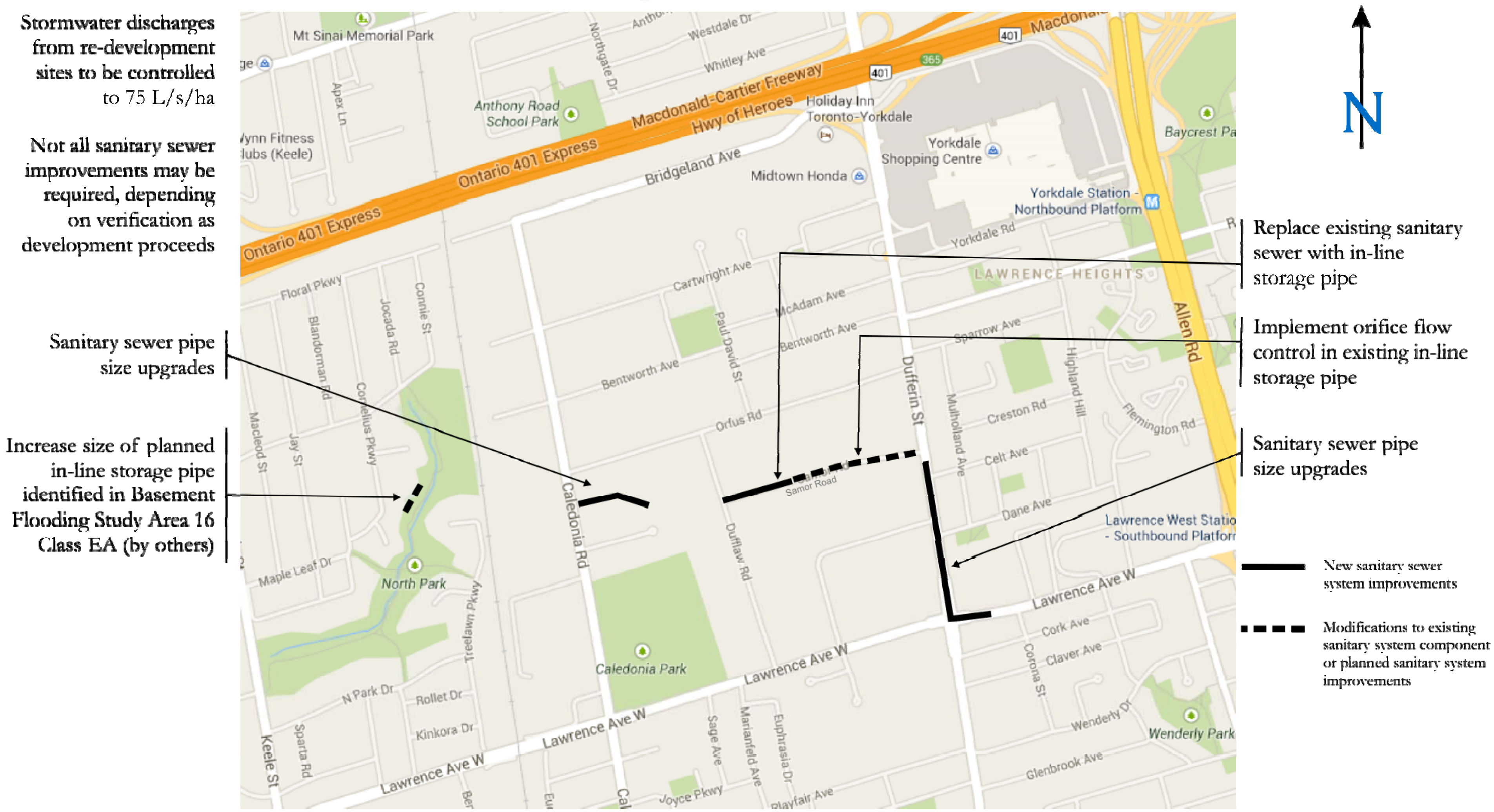
The City's Wet Weather Flow Management Guidelines contain provisions for new developments to control storm drainage from the perspectives of water balance, water quality, and particularly relevant to improving basement flooding conditions, quantity control. The preferred solutions identified in this Master Plan include a provision to control the allowable storm drainage release rate from the site to 75 L/s/ha (being a considerable reduction relative to the noted guidelines) in order to explicitly reduce the rate at which storm drainage enters the receiving storm sewer system. The establishment of this rate was informed by the available calibrated hydrologic/hydraulic model of the storm sewer system in question and is commensurate with existing system flows in the downstream reaches thereof. Accordingly, this rate is custom-suited to fit the system and, as such, is not expected to increase risk in this regard. Also, given that the majority of the study area was developed prior to implementation of these guidelines and generally before modern stormwater management controls became customary, the on-site detention of flows up to and including the 100-year storm is expected to significantly reduce the amount of runoff entering the municipal roadways, thereby reducing the amount of water available for inflow into the sanitary sewer system and, perhaps more significantly, reduce storm flows through the study area.

The existing sanitary sewer system is generally capable of handling the anticipated additional flows with some exceptions. Several improvements to the sanitary sewer system are recommended in the set of preferred solutions and include a combination of pipe size upgrades to improve conveyance, the exploitation of an underutilized existing in-line storage element, the incremental sizing of a planned in-line storage element, as well as an option to implement a further in-line storage element. Special provisions are recommended to allow for development to proceed in anticipation of certain infrastructure improvements provided that specific conditions are met that offset the increase in wastewater flow with *bona fide* reductions in infiltration and inflow resulting from re-development. The figure on the next page indicates the location and type of the recommended works.

The existing water distribution system is composed of a generally well-connected network of watermains which do not require any upgrades in order to support the planned intensification identification in the Dufferin Street Avenue Study.

# Dufferin Street Avenue Study

## Infrastructure Management Plan - Preferred Solutions



# Contents

# Introduction

## PURPOSE

The City of Toronto has initiated an Avenue Study for that portion of Dufferin Street extending from the south side of Highway 401 to just south of Lawrence Avenue West to develop a framework for new development including a Transportation Master Plan as well as an Infrastructure Master Plan (IMP) in support thereof, the latter of which is the subject of this report. The preparation of the IMP follows Phases 1 and 2 of the Municipal Engineers Association Master Plan Class EA process (MEA, October 2000 as amended 2007 and 2011). The IMP is concerned with identifying municipal servicing infrastructure needs to support development within the study area (see below), particularly considering water supply, sanitary sewage and storm drainage/stormwater management.

## STUDY AREA

The study area is shown in Figure 1 and includes properties that have frontage on Dufferin Street as well as the 4 corners at its intersection with Lawrence Avenue West, extending one property south on each side of Dufferin Street.

Of the existing 74 properties that have frontage along Dufferin Street within the study area, the mixture of uses is characterized as follows:

- 41% are purely commercial;
- 39% are mixed use, comprising commercial and residential;
- 12% are purely residential;
- 7% are vacant or used for parking; and
- <1% (1 property) has a community use (a church).

There is a considerable difference between the existing land uses and character along the west and east sides of the street. Along the west side, the properties are generally deep and wide, while the properties along the east side are generally shallow and narrower.

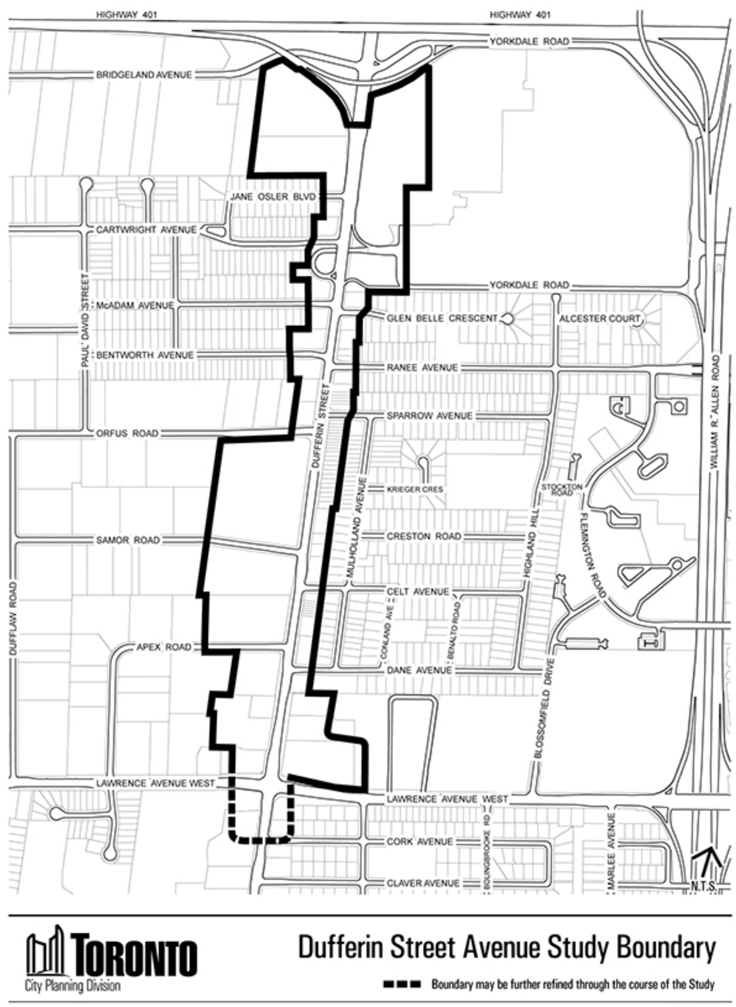



**Figure 1 Study Area**

## CLASS EA MASTER PLAN PROCESS

A Class EA Master Plan is a long range plan which integrates infrastructure requirements for existing and future land use and that ties together the various needs of an overall system, and is typically comprised of a set of separate projects that are to be individually implemented over an extended period of time. A Master Plan considers the individual needs of a system within a broader context, and integrates infrastructure needs with environmental assessment planning principles. Master Plans address Phases 1 and 2 of the Municipal Class EA process and include a stakeholder consultation program:

- **Phase 1.** Identify the problem (deficiency) or opportunity.
- **Phase 2.** Identify alternative solutions to address the problem or opportunity by taking into consideration the existing environment, identifying potential impacts of the alternative solutions on the environment and any measures needed to mitigate those impacts, carry out a comparative evaluation of the alternative solutions and establish the preferred solution taking into account public and review agency input.

The remaining phases of the Class EA process, not included as part of the scope of this work, include Alternative Design Concepts for Preferred Solution (Phase 3), Environmental Study Report (Phase 4), and Implementation (Phase 5). Depending on the nature of the individual projects identified in the Master Plan Class EA, they may be classified as according to the following designations:

- **Schedule A.** These projects are limited in scale, have minimal adverse environmental effects and include a number of municipal maintenance and operational activities. These projects are pre-approved.
- **Schedule A+.** These projects are within existing buildings, utility corridors, rights-of-way, and have minimal adverse environmental effects. These projects are pre-approved, however, the public is to be notified prior to project implementation.
- **Schedule B.** These projects have the potential for some adverse environmental effects. The proponent is required to undertake a screening process, involving mandatory contact with directly affected public and relevant review agencies, to ensure they are aware of the project and that their concerns are addressed. If there are no outstanding concerns, then the proponent may proceed to implementation. Schedule B projects generally include improvements and minor expansions to existing facilities. These projects require completion of Phases 1 and 2 of the Class EA process and which are intended to be fulfilled by this work.
- **Schedule C.** These projects have the potential for significant environmental effects and must proceed under the full planning and documentation procedures specified in the Class EA document. Schedule C projects require that an Environmental Study Report be prepared and filed for review by the public and review agencies. Schedule C projects generally include the construction of new treatment facilities and major expansions to existing treatment facilities.

A flow chart describing the Class EA planning and design process is presented in Figure 2. It is noted that, although the boundary of the study area is limited as identified in Figure 1, this work considers infrastructure beyond these limits to identify the impacts on the existing systems as well as any improvements which may be triggered by the land use planning work conducted in the Avenue Study.

## PROBLEM/OPPORTUNITY STATEMENT

The City of Toronto recognizes that the successful re-development of the Dufferin Street Avenue study area requires an integrated process of land use, transportation and municipal infrastructure planning. The Infrastructure Master Plan is an integral component of the study in order to assess existing capacity of the water distribution, sanitary sewerage and storm drainage infrastructure systems, and establish the infrastructure required to support the re-development of the lands such that these works can be planned for in terms of budgeting and timing of implementation.

In addition to supporting intensification of the lands in the study area, there is an opportunity during such re-development to improve the performance of the existing infrastructure systems, particularly in relation to reducing the risk of basement flooding resulting from extreme rainfall events.

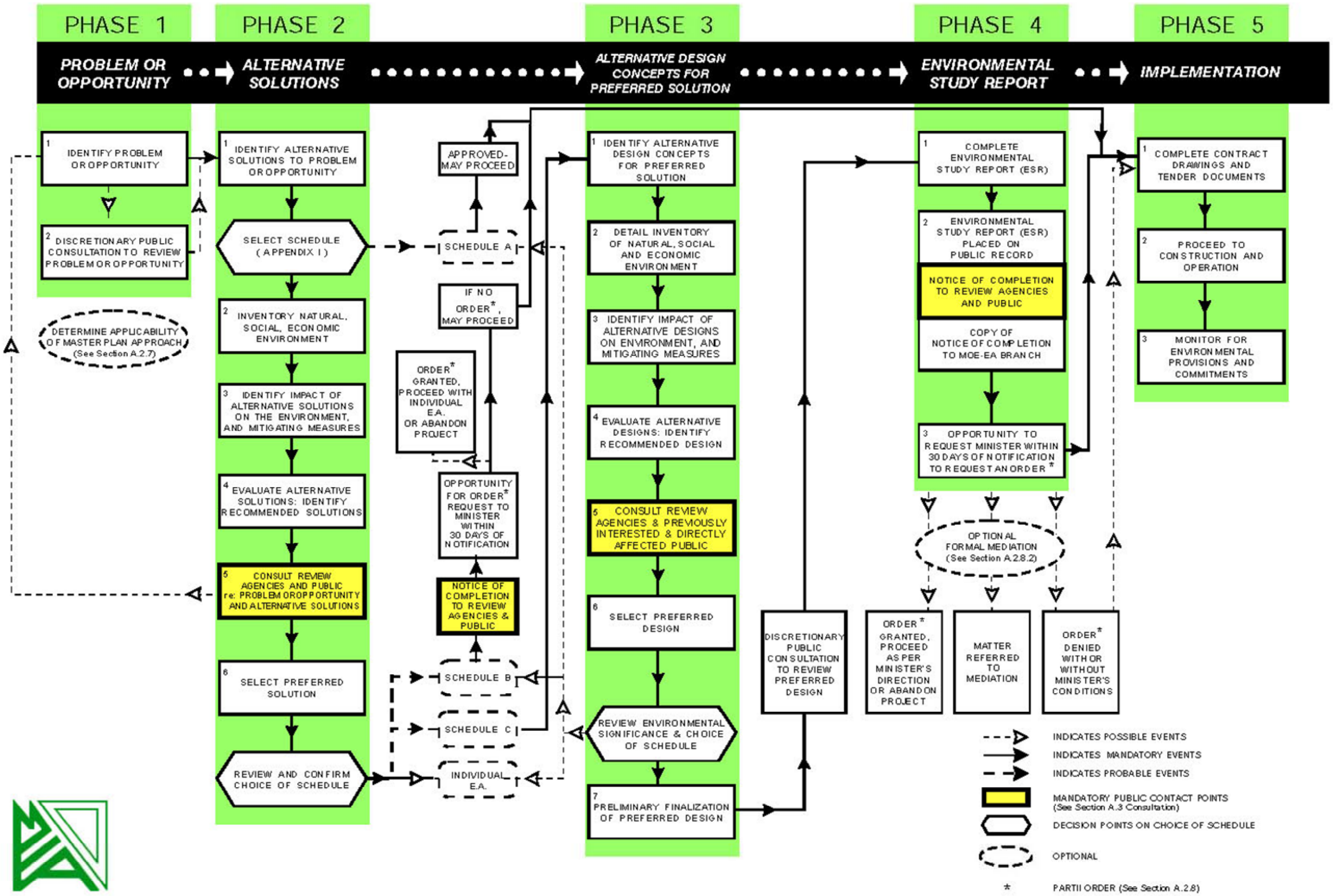



**Figure 2 Class EA Planning and Design Process Flow Chart**

# Description of the Project Area

## DEMOGRAPHICS & LOCAL CONTEXT

A demographic analysis[1] of the wider neighbourhood, including the study area, indicates that the population is significantly older than the city average, includes a higher proportion of families and has a higher proportion of home ownership. There are more immigrants in the study area than the city average, mostly originating from southern and eastern Europe. The most commonly spoken languages are English and Italian. Although the demographic analysis indicates that the unemployment rate in the study area is below the city average, it also demonstrates that incomes are lower than the city average.

## LAND USE

A large portion of the study area consists of commercial or mixed-use buildings, including a number of car dealerships, gas stations and strip malls. Only 15% of the properties within the study area are purely residential. Most buildings within the study area were constructed in the 1950s, 60s and 70s. Given this vintage of construction, it is quite reasonable to expect that foundation drains are largely connected to the sanitary sewer system but that basements are not located deep into the water table.

Recent re-development in the area has mostly consisted of stacked townhouses and loft conversions, or smaller multi-unit condominiums. The largest (re)development in the study area is the ongoing "Treviso" project at the intersection of Dufferin Street and Lawrence Avenue West. Other projects include a mid-rise and townhouse development at the corner of Dufferin Street and McAdam Avenue (approved) and a large condominium complex at the corner of Dufferin Street and Apex Road (not approved). Yorkdale Shopping Centre has a Site Plan Application under review and has expressed interest in potentially expanding its retail operations to Dufferin Street in the future.

Figure 3 identifies individual blocks within the study area, with population estimates for existing and as-of-right conditions indicated in Table 1, as well as later on this document for future conditions[2]. From the table it can be seen that the residential population estimates for both conditions are quite comparable, while the employment population estimate under existing conditions is considerably less than the as-of-right condition.


**Figure 3 Individual Development Blocks & Identification Numbers**

[1] From Community Services & Facilities Strategy Report prepared by R.E. Millward + Associates Ltd. dated 20 May 2014, as summarized by DTAH.

[2] Population estimates for existing, as-of-right and future conditions derived from work of DTAH in consultation with City Planning staff, and based on the likely land use mix and total GFA that would result from full build-out of the entire study area if following the built form and land use recommendations.

**Table 1 Population Estimates for Existing and As-of-Right Conditions[2]**

| Existing | | | As-of-Right | | |
|---|---|---|---|---|---|
| Block ID | Employment | Residential | Block ID | Employment | Residential |
| 1 | 220 | 0 | 1a (Hotel) | 200 | 0 |
| | | | 1b | 397 | 0 |
| 2 | 34 | 0 | 2a (3350 Dufferin) | 3 | 29 |
| | | | 2b (3338 Dufferin) | 117 | 0 |
| 3 | 5 | 231 | 3 (McAdam) | 210 | 231 |
| 4 | 35 | 0 | 4a (3320 Dufferin) | 69 | 0 |
| | | | 4b (3302 Dufferin) | 7 | 70 |
| 5 | 40 | 0 | 5a (3300 Dufferin) | 6 | 61 |
| | | | 5b (3296 & 3280 Dufferin) | 0 | 0 |
| 6 | 300 | 0 | 6 | 1,412 | 0 |
| 7 | 8 | 0 | 7a (3180 Dufferin) | 16 | 0 |
| | | | 7b (3140 Dufferin) | 207 | 0 |
| 8 | 60 | 0 | 8 | 1,160 | 0 |
| 9a | 30 | 0 | 9a | 49 | 0 |
| 9 | 160 | 2,701 | 9 (Treviso) | 160 | 2,701 |
| 10 | 75 | 10 | 10 | 180 | 0 |
| 11 | 82 | 75 | 11a (3175 Dufferin) | 355 | 0 |
| | | | 11b | 65 | 0 |
| 12 | 65 | 17 | 12 | 128 | 0 |
| 13 | 25 | 0 | 13a | 62 | 0 |
| | | | 13b (3309 Dufferin) | 90 | 0 |
| 14 | 10 | 0 | 14 | 0 | 0 |
| **Totals:** | **1,149** | **3,033** | **Totals:** | **4,896** | **3,092** |

## NATURAL ENVIRONMENT

The City's Official Plan identifies no natural features in the study area itself (see Figure 4). That being said, there is the potential that alternative infrastructure solutions may extend outside of the study area and may impact the natural environment and, accordingly, any such alternatives must take this into consideration.

There are no Environmentally Significant Areas within or near to the study area (see Figure 5).

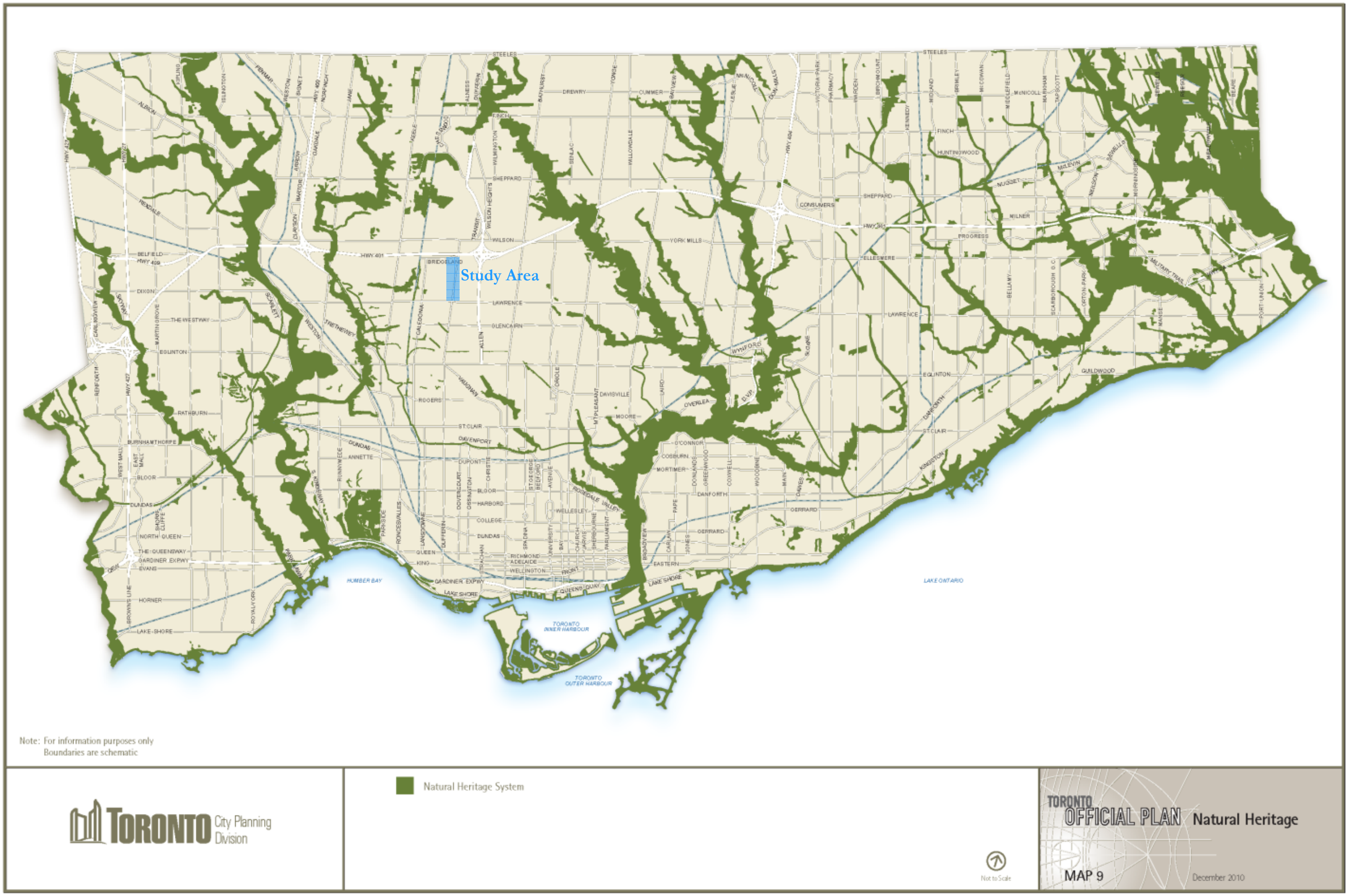



**Figure 4 City of Toronto Natural Heritage Map**

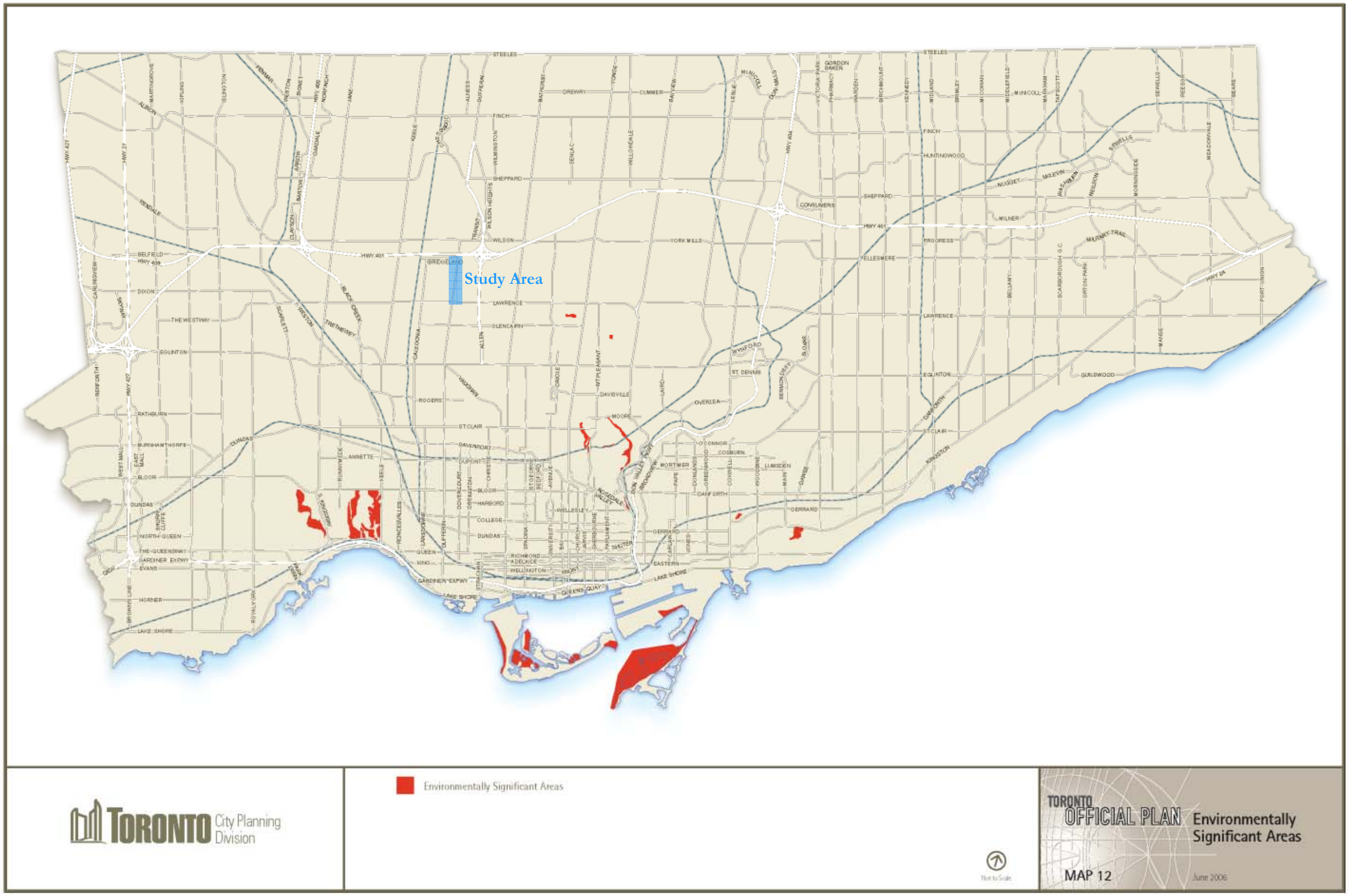



**Figure 5 City of Toronto Environmentally Significant Areas Map**

## SOCIO-ECONOMIC ENVIRONMENT

The study area consists of commercial and mixed-use buildings with 15% of the properties being purely residential. Any future projects must be cognizant of this environment to mitigate negative impacts to it during implementation. Such negative impacts will largely include construction-related impacts, while several beneficial impacts can result to the social and economic environments associated with re-development.

## CULTURAL HERITAGE

A review of the City's Inventory of Heritage Properties[3] indicates that there are no heritage properties in the study area.

With respect to archaeological potential, Figure 6 illustrates those sites in the City's Archaeological Master Plan[4]. Some lands with archaeological potential do exist within and near to the study area and accordingly require some consideration in terms of evaluating potential alternatives. It is noted that municipal servicing infrastructure upgrades are often confined to existing rights-of-way which typically do not contain any archaeological potential.

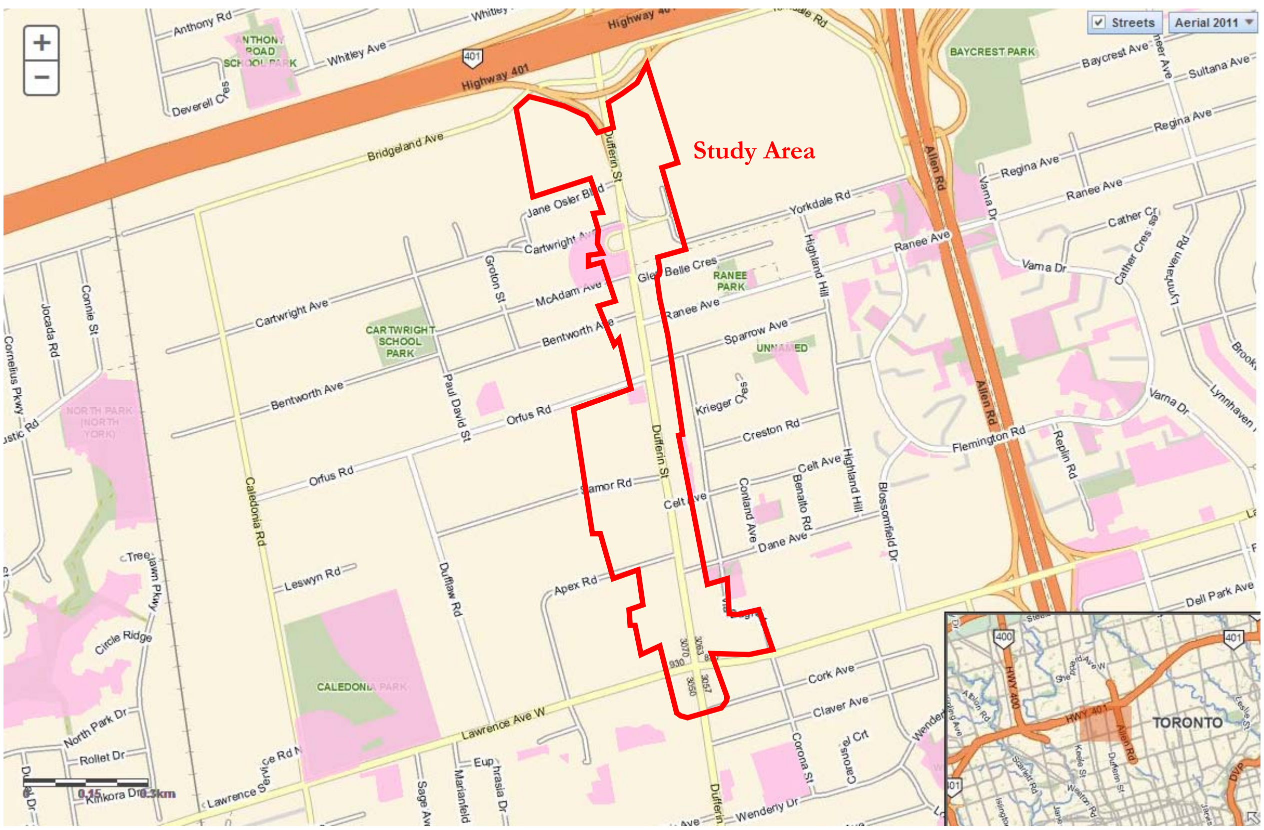



**Figure 6 City of Toronto Archaeological Potential Map** (pink areas)

[3] http://app.toronto.ca/HeritagePreservation/setup.do?action=init
[4] http://map.toronto.ca/maps/map.jsp?app=TorontoMaps_v2

## EXISTING INFRASTRUCTURE

This section outlines the existing servicing infrastructure relevant to the study area. Additional detail is also provided later in this report and in the appendices.

### Water Supply

The water supply and distribution system is composed of a generally well-connected network of watermains located in each of the municipal roads within the study area and ranging in diameter from 150 mm to 300 mm. Local pressures generally lie in the 380 to 480 kPa (55 to 70 psi) range, depending on elevation. Recently conducted hydrant flow tests were derived from various City sources to understand the system's behaviour and to inform the analytical work conducted herein.

### Sanitary Sewerage

Sanitary sewers located in the municipal roadways collect domestic wastewater from the existing developments and convey them to downstream trunk sewers and ultimately to treatment plants prior to discharge back into the environment. Existing developments on the west side of Dufferin Street within the study area discharge wastewater to sanitary sewers located on Bridgeland Avenue, Jane Osler Boulevard and Cartwright Avenue in addition to sewers on Dufferin Street itself. The properties on the east side of Dufferin Street are serviced by sanitary sewers on Dufferin Street. Most of the study area which is tributary to a Dufferin Street sewer is conveyed westerly along Samor Road and thorough easements to the North Park Ravine sub-trunk sewer. The most southerly portion of the study area is tributary to a Dufferin Street sewer which conveys flows southerly into a different sewershed (i.e., Hillhurst Sanitary Trunk Sewer, and ultimately to the North Toronto Sewage Treatment Plant).

More specifically, the study area straddles two of the City's Basement Flooding Study Areas: Study Area 16 lies generally to the west of the study area and accepts most flows generated in the study area; Study Area 17 lies generally to the south of the study area and accepts flows from the southerly part thereof (see Figure 7). The Class Environmental Assessment for Area 16 has been completed while that for Area 17 was ongoing as this project was progressing and was finalized shortly before this document. The final results of the former and interim results of the latter assisted in the assessment of existing infrastructure capacities and any needs for improvements in order to support the planned re-development within the Dufferin Street Avenue Study area. Although the final results and modelling files of the Area 17 work were not available during the course of this particular study, a review of the final Area 17 work confirms that the approach taken was indeed reasonable and no material disconnects are evident.

### Storm Drainage & Stormwater Management (SWM)

The storm drainage system is comprised of sewers that are fully separated from the sanitary sewer system, however, the drainage systems serving the study area have a history of flooding under intense rainstorms and the City has included these systems as part of its Basement Flooding Protection Program. It is noted that the existing developments were generally established in an era prior to when the implementation of any stormwater management controls became customary or mandated and, if any controls were previously implemented, they would likely have been designed prior to the City having established its Wet Weather Flow Management Guidelines and, accordingly, might be expected to provide a lesser degree of control than currently applied to developments in the City. It has been noted that, at the time of design of the storm sewer system in most of the study area, there were no specific considerations given to the overland flow (major) system drainage[5], thereby leading to conveyance constraints and contributing to flooding issues.

As noted above, the study area is located within two Basement Flooding Study Areas (see Figure 8) whose Environmental Assessments were either underway or complete at the time this work was undertaken and, accordingly, the work for this project was guided by the interim or final results of those exercises, as the case may be.

[5] "Sewershed Area 16: Investigations of Basement Flooding Class Environmental Assessment", Stantec, August 2012.

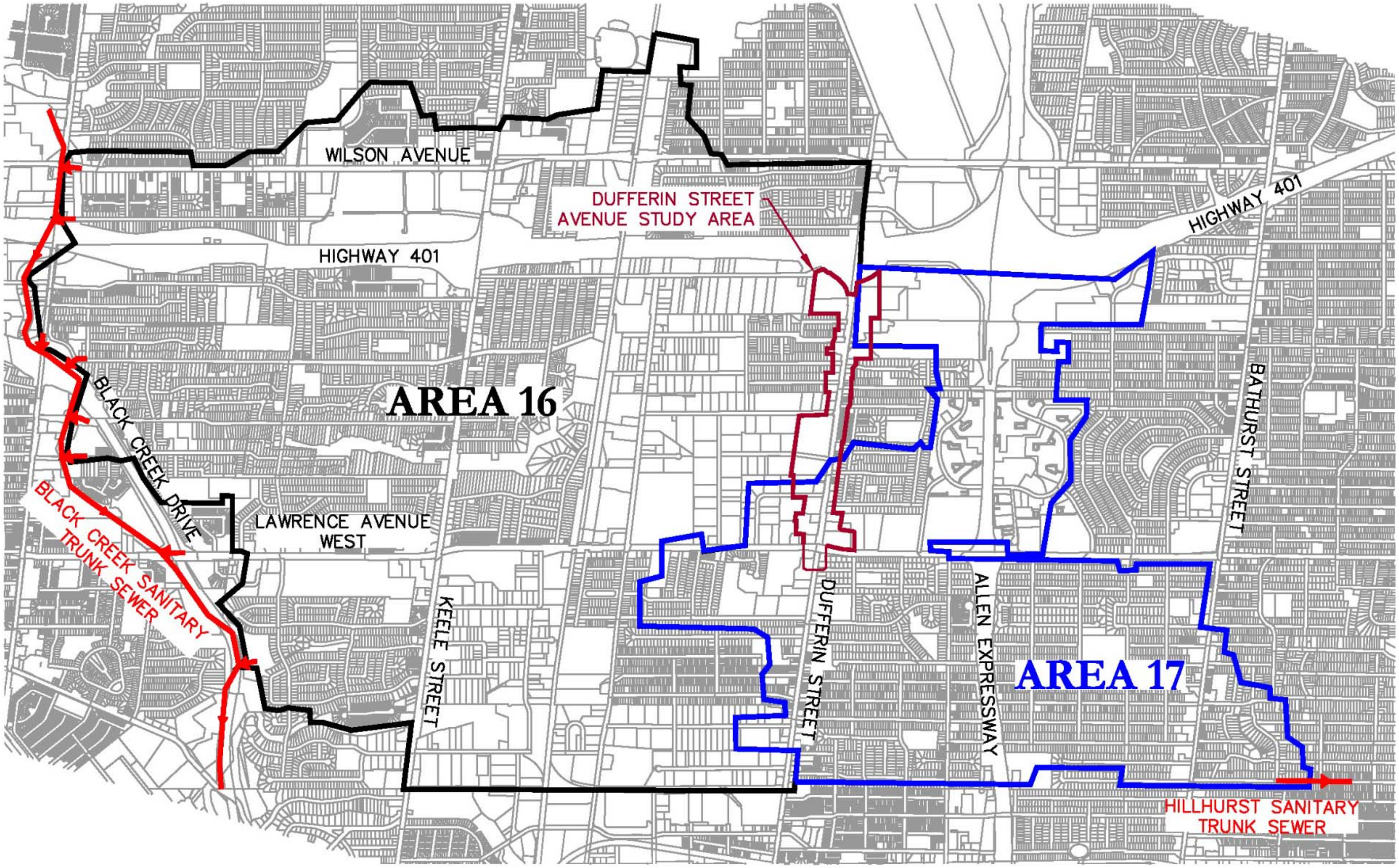



**Figure 7 Study Area in Relation to the City's Sanitary Sewersheds**

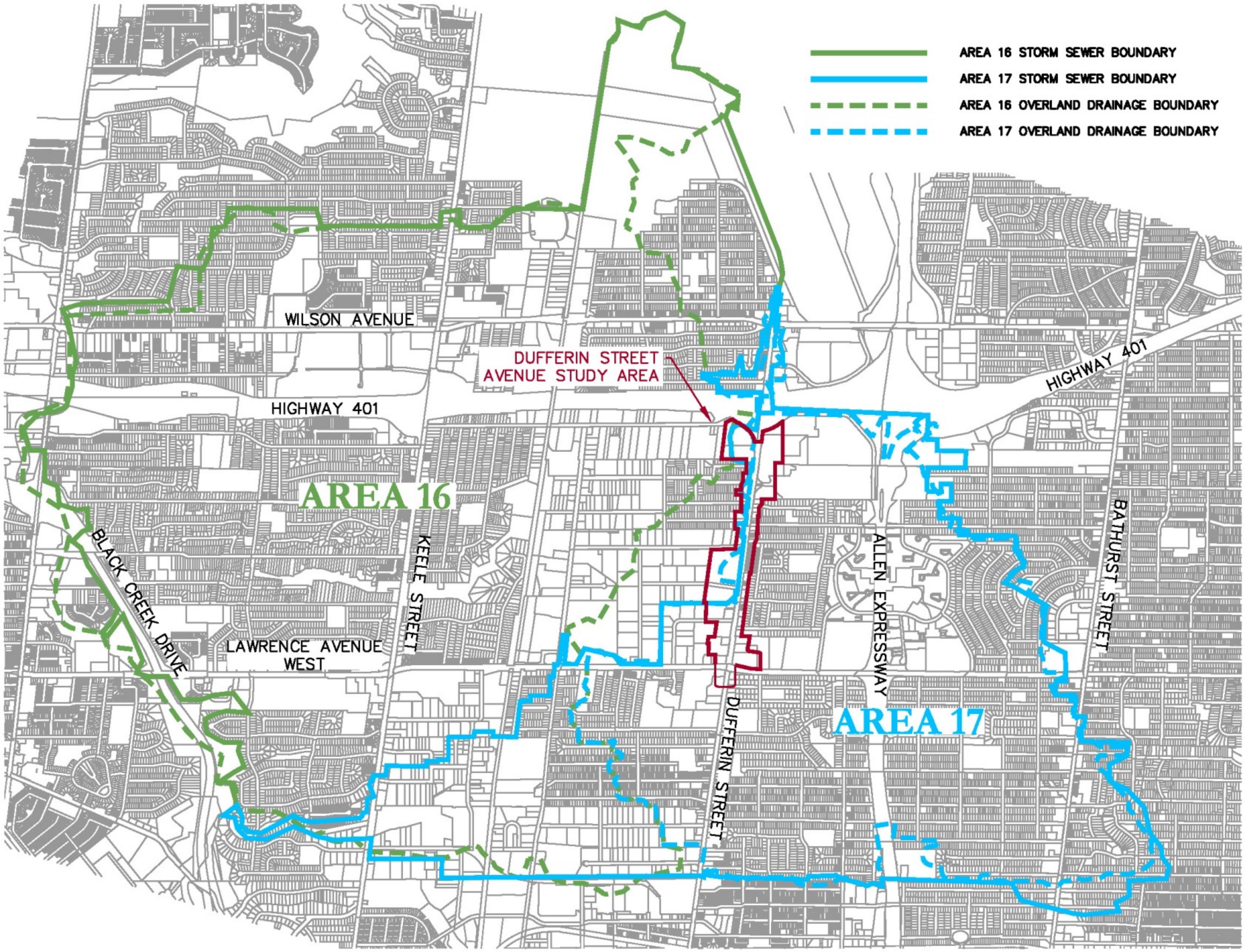



**Figure 8 Study Area in Relation to the City's Storm Sewersheds and Overland Drainage Boundaries**

### Basement Flooding Study Area Class EAs

Arguably the most sensitive matter with respect to municipal servicing infrastructure within this study area is the history of basement flooding. Below are some of the relevant matters with respect to the City's initiatives that are taken into account for the purposes of this study which, in and of itself, is not intended to address the existing flooding concerns, but rather to ensure that any additional development and population growth in the study area does not exacerbate current conditions, and where appropriate, to identify opportunities to effect improvements within the context of re-development.

Some of the relevant findings of the Area 16 Class EA study[6] to the Dufferin Street Avenue Study include:

- The absence of basements and connections to non-residential properties without basements may deem the City's 100-year hydraulic grade line criteria unnecessary.
- The existing or potential for on-site stormwater detention controls via surface, underground or roof storage may offset the need for, or extent of, storm sewer improvements.
- Although the most prolific storm event (in terms of rainfall volume) for the City as a whole occurred on 19 August 2005 (as at the time of preparation of that report), there were fewer reported flooded basements in Area 16 during that event than during the 12 May 2000 event, due to the differences in the spatial and temporal distribution of these rainfalls.
- The results of the modelling generally show no hydraulic issues in the sanitary system, suggested that the isolated flooding reports recorded for the 12 May 2000 event are related to the storm drainage system, temporary blockage, or private-side issues rather than system capacity issues.
- While many pipes experience some degree of surcharge, the hydraulic grade line in the sanitary sewer system is maintained well below the theoretical basement elevation.
- The sanitary sewer system operates well under the 12 May 2000 and 450 Lpcd design condition, with only a few scattered bottlenecks and shallow sewers that do not meet the City's level of service criteria. It is evident that performance of the storm sewer and surface drainage system during extreme events has a negative influence on the sanitary system that cannot be evaluated directly by modelling due to the uncertainty in potential cross-connections that are activated during these events[7].
- Under the modelled 100-year design conditions, many storm sewers are surcharged to the surface and overland flow is exceeding the capacity of the roadway and other surface components in many areas.

Based on the foregoing, it is evident that the sanitary sewer system is generally of sufficient capacity which is only compromised by the infiltration and inflow (I/I) impacts of intense rainfall events, suggesting that the key issue is that of wet weather flow. Accordingly, these findings suggest that the control of storm drainage flows from the subject lands will be helpful with respect to improving existing performance concerns. Of course, the City's efforts at implementing the preferred solutions identified in the Area 16 Class EA (as budget permits) will improve this situation. The introduction of additional population in the area covered by the Dufferin Street Avenue Study can therefore be assessed in this context.

Although the Class EA for Basement Flooding Study Area 17 had not been completed at the time of writing, the preliminary preferred solutions that had been identified – and subsequently confirmed in the finalized version of that work – and related discussions also suggest that the principal cause of basement flooding is due to the influence of storm

[6] Sewershed Area 16 Investigations of Basement Flooding Class Environmental Assessment, Project File Document, Stantec Consulting, dated August 2012.

[7] In addition, it is worth noting that there is difficulty in determining foundation drain connection points and correlation between rainfall and foundation flow rate, and accordingly it can be extremely difficult to determine/separate between flooding caused by storm sewer backup, sanitary sewer backup and/or overland flow.

drainage. Accordingly, the improvements to be identified in that work are expected to alleviate these concerns and, as noted earlier, imposing appropriate storm drainage controls on re-developments within the Dufferin Street Avenue Study will further serve to improve matters.

It is further noted that a portion of the sanitary sewer on Lawrence Avenue West is being upgraded to accommodate the Treviso (Duflaw) condominium development at the northeast corner of the intersection of Dufferin Street and Lawrence Avenue West. This work is accounted for in the assessment of the system as an "existing" condition.

## FUTURE CONDITIONS

Through the Dufferin Street Avenue Study process, the preferred land use planning alternative identified generally included a midrise form of development, of primarily residential mixed-use character with densities, as measured by the Floor Space Index (FSI), of between 2.0 and 2.5. The midrise buildings would mostly be limited to four or five stories, as density permitted, and tall buildings would be limited to the northern and southern ends of the study area. In addition, consideration for large big-box development on one of the blocks was identified as an option. Given that this option would impose less demand on the supporting municipal servicing infrastructure systems, the preferred land use planning alternative was used for the analysis conducted herein since it represents the more conservative of the cases.

The relevant population projections (2031 target year) and distribution throughout the study area, with comparative figures for the current as-of-right condition, are provided in **Error! Reference source not found.**. As can be seen from the table, a general reduction in employment population from the as-of-right condition is planned, although the projected total of 830 persons is not too dissimilar from existing conditions (i.e., 1149 as shown in Table 1). As well, there is a substantial planned increase in residential population from the current as-of-right condition.

**Table 2 Future Development Statistics[2]**

| Block ID | Area ($m^2$) | Non-Residential GFA (Future; $m^2$) | Employment Population | | Residential Population | |
|---|---|---|---|---|---|---|
| | | | Future (2031) | As-of-Right | Future (2031) | As-of-Right |
| 1 | 37,392 | 9,348 | 234 | 597 | 2,284 | 0 |
| 2 | 2,879 | 356 | 9 | 121 | 184 | 29 |
| 3 | 2,715 | 210 | 5 | 210 | 231 | 231 |
| 4 | 4,476 | 560 | 14 | 76 | 289 | 70 |
| 5 | 3,805 | 476 | 12 | 6 | 245 | 61 |
| 6 | 37,244 | 4,656 | 116 | 1,412 | 2,401 | 0 |
| 7 | 31,699 | 3,962 | 99 | 223 | 2,043 | 0 |
| 8 | 24,947 | 3,118 | 78 | 1,160 | 1,608 | 0 |
| 9a | 1,348 | 169 | 4 | 49 | 87 | 0 |
| 9 | 18,252 | 6,400 | 160 | 160 | 2,701 | 2,701 |
| 10 | 4,958 | 620 | 15 | 180 | 320 | 0 |
| 11 | 11,581 | 1,448 | 36 | 421 | 747 | 0 |
| 12 | 3,539 | 442 | 11 | 128 | 228 | 0 |
| 13 | 3,310 | 414 | 10 | 153 | 213 | 0 |
| 14 | 50,724 | 0 | 25 | 0 | 0 | 0 |
| **Totals:** | **238,839** | **32,178** | **830** | **4,896** | **13,580** | **3,092** |

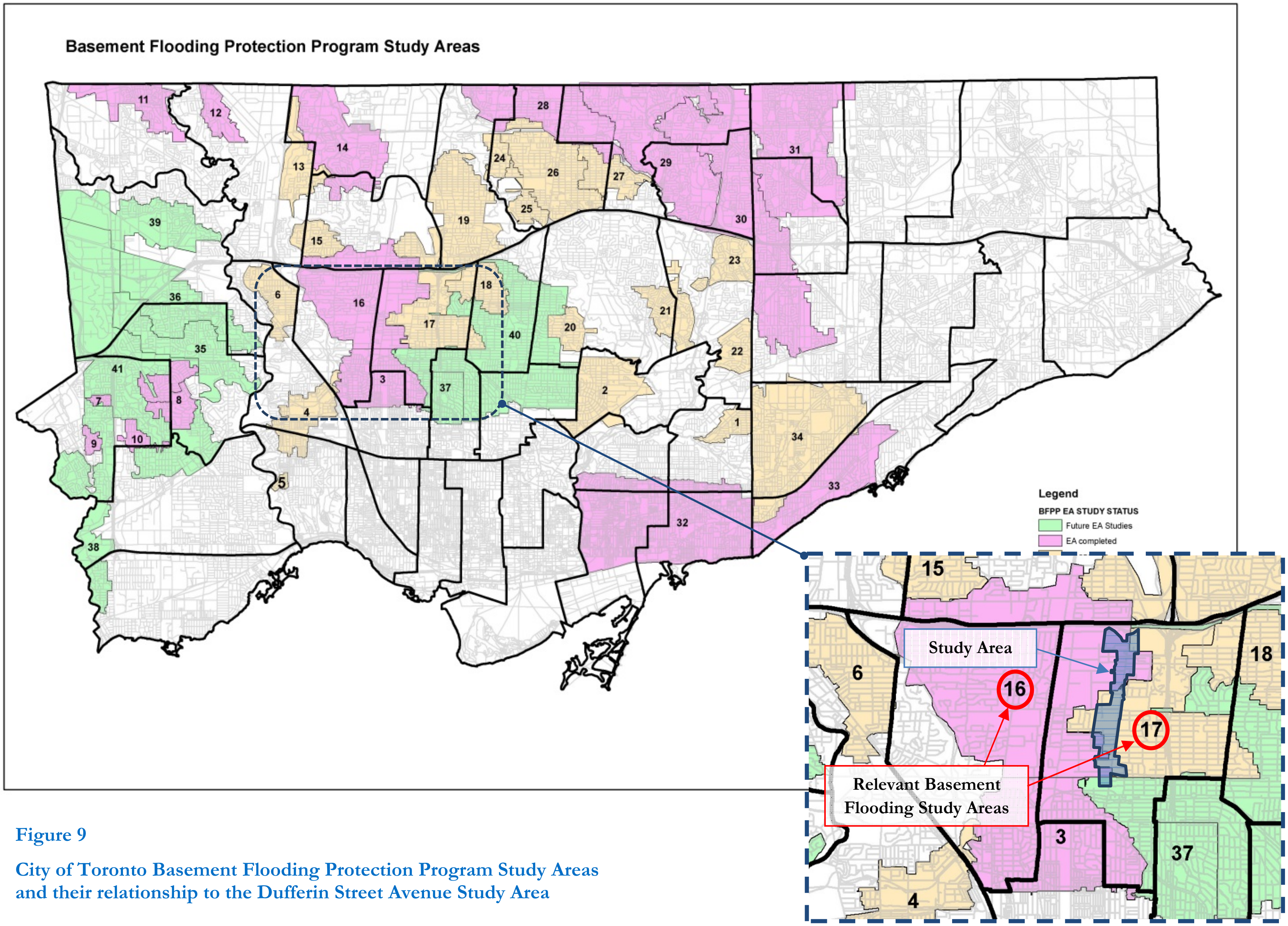



**Figure 9**

**City of Toronto Basement Flooding Protection Program Study Areas and their relationship to the Dufferin Street Avenue Study Area**

# Evaluation of Alternatives

This section discusses the master planning-level alternatives identified and the evaluation methodology applied when assessing alternatives for each of the servicing elements of this study. For each servicing element (e.g., water distribution, sanitary sewerage, storm drainage and stormwater management), specific components for each of the master planning-level alternatives are identified following an assessment of existing infrastructure in relation to the estimated demands and hydraulic loadings resulting from the proposed land use intensification in the study areas, detailed in later sections of this report.

## ALTERNATIVES

The following are the master planning-level alternatives that have been developed for consideration and each will include different specific components for each of the specific infrastructure systems in question (i.e., water, sanitary and storm) that are elaborated upon in later sections of this report.

- **Alternative 1: Do Nothing**

  This alternative considers no changes to the status quo in terms of infrastructure while permitting full re-development of the study area lands.

- **Alternative 2: Expand and/or Upgrade Existing Infrastructure**

  As its name suggests, this alternative assesses the capacity and suitability of existing infrastructure systems to meet the needs of the anticipated re-development of the study area lands, and identifies any expansions, improvements or upgrades that may be necessary in order to ensure that an appropriate level of service is delivered.

- **Alternative 3: Implement On-Site Best Practices**

  This alternative seeks to use the opportunity afforded through re-development of the properties in the study area to reduce or minimize their imposition on the supporting municipal infrastructure systems through on-site measures. These practices include measures intended to reduce water demand, reduce sanitary sewage flows, as well as to reduce storm drainage flows through stormwater management measures.

- **Alternative 4: Limit Community Growth**

  This alternative considers the phasing and implementation timing of development to match the capacity availability of the supporting infrastructure as it is currently, or becomes, available.

## EVALUATION METHODOLOGY

Each of the alternatives is evaluated comparatively and qualitatively against the various criteria and sub-criteria discussed below.

### Technical Merit

The technical merit of each alternative was assessed based on the following sub-criteria:

- **Functionality** – considers the ability to meet the demands
- **Constructability** – considers the ease and extent of construction as well as required construction methods
- **Maintenance Requirements –** considers the effort required by the City to maintain the infrastructure
- **Life-Cycle Cost** – considering capital, operations and maintenance costs over an appropriate time frame

### Natural Environment

This criterion relates to potential impacts to the natural and physical components of the environment (i.e., air, land, water and biota) including natural and/or environmentally sensitive areas. The following criterion was applied in the assessments:

- **Impact on the Natural Environment** – considers impacts to terrestrial habitat, land and water

### Socio-Economic Environment

This criterion considers the potential impact to private property, archaeological and cultural heritage resources according to the following sub-criteria:

- **Cultural Heritage Impact** – considers cultural heritage and potential disruptions to surrounding areas
- **Construction Impact** – considers the impacts due to construction, road closures/detours and public transit disruptions resulting from implementation of the alternative
- **Residential and Business Impact** – considers the proximity of the proposed work to residences, businesses, and institutions in addition to matters such as public safety and perception, also including odour and air quality issues

# Water Distribution

The water supply and distribution system is composed of a network of watermains located in each of the municipal roads within the study area and ranging in diameter from 150 mm to 300 mm. Local pressures generally lie in the 380 to 480 kPa (55 to 70 psi) range, depending on elevation.

The City of Toronto has identified several upgrades to the local water distribution system which are scheduled to occur:

- Cork Avenue – Watermain Replacement in 2014
- Glen Belle Crescent – Watermain Replacement in 2014
- Orfus Road – Watermain Replacement in 2016
- Apex Road – Watermain Cathodic Protection in 2017
- Samor Road – Watermain Structural Relining in 2018

The upgrades involving watermain replacement and structural relining are expected to improve hydraulic performance of the system, although they are not expected to materially increase system capacity since the nominal pipe sizes will not be changed through this work. Cathodic protection and structural relining efforts will extend the service life of the existing infrastructure.

To establish boundary conditions used for hydraulic modelling of the water distribution system, a review of available hydrant flow tests in the vicinity of the study area was undertaken. In general, the flow test results are indicative of a well looped network of watermains capable of delivering relatively high flows at suitable pressures.

Figure 10 provides an illustration of the existing water distribution network and the development blocks considered in this Dufferin Street Avenue Study. Detailed modelling information and results are presented in Appendix A.

## DESIGN CRITERIA

The following design criteria were applied to assess the existing water distribution system's ability to support the anticipated intensification within the study area[8]:

- Average Day Demand, residential: 191 Lpcd (multi-unit)
- Minimum Hour Peaking Factor: 0.84 (apartments, commercial, industrial & institutional)
- Peak Hour Peaking Factor: 2.50 (apartments), 1.20 (commercial) and 0.90 (industrial & institutional)
- Maximum Day Peaking Factor: 1.30 (apartments), 1.10 (commercial, industrial & institutional)
- Fire Flow: 19,000 L/min (317 L/s; commercial over 2 stories, high-rise residential, industrial park)
- Preferred Pressure Ranges:
  - Average Day & Maximum Day: 350 kPa to 550 kPa (50 to 80 psi)
  - Minimum Hour & Peak Hour: 275 kPa to 700 kPa (40 to 100 psi)

Additional details are available in Appendix A.

[8] City of Toronto, "Design Criteria for Sewers and Watermains", First Edition, November 2009

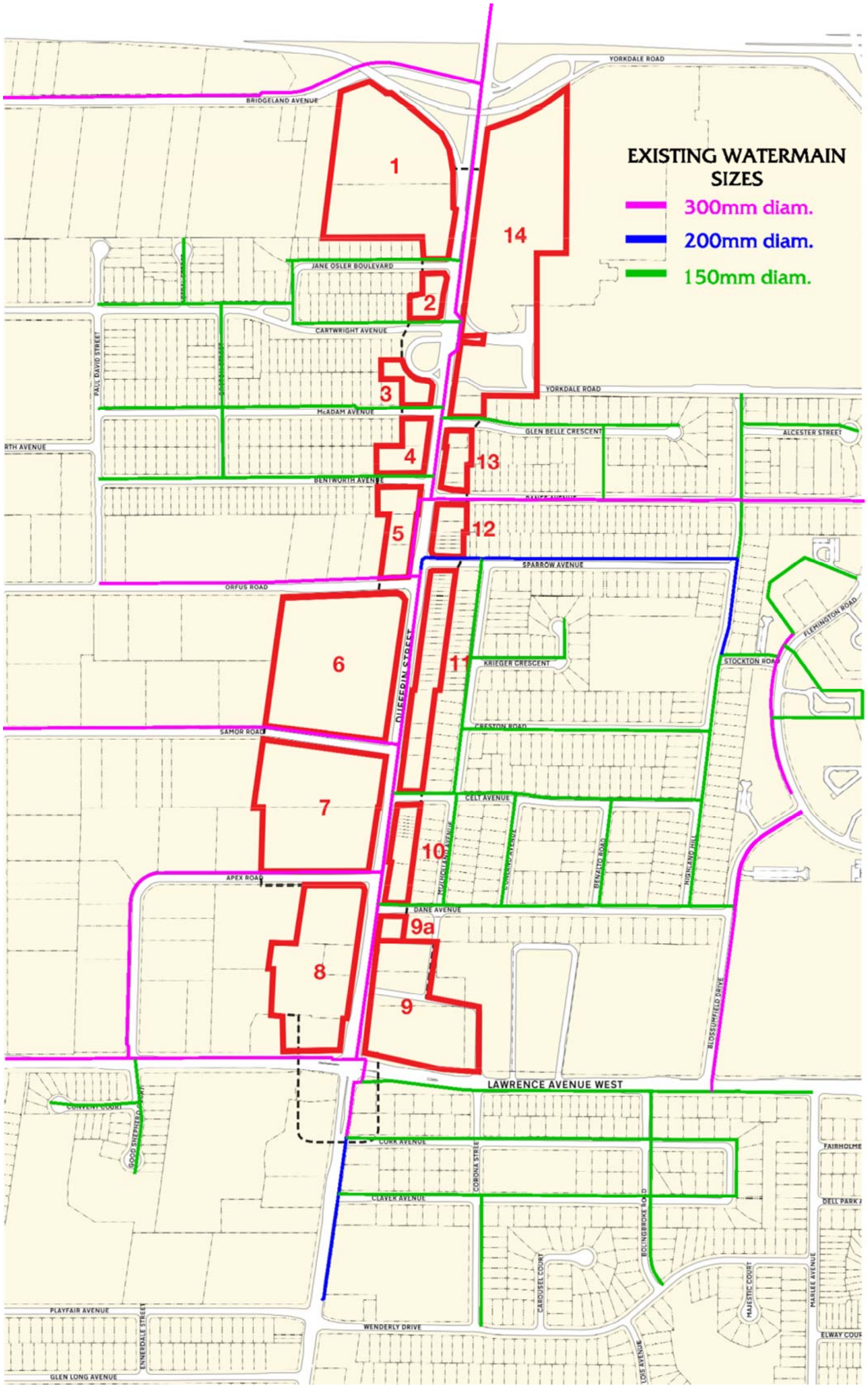



**Figure 10 Existing Water Distribution Network & Study Area Development Blocks**

## ALTERNATIVES

The following is a brief description of the Master Plan alternatives considered in the context of water distribution:

### Alternative 1: Do Nothing

This alternative considers no changes to the existing system, although it does consider the implementation of water conservation measures. It is noted that this alternative does not account for any expansion of the existing infrastructure into any new roads proposed through the land use planning exercise of the Avenue Study.

### Alternative 2: Expand and/or Upgrade Existing Infrastructure

This alternative considers the addition of new watermains and appurtenances on new roads planned within the study area, as well as any upgrades to the existing water distribution network to support planned growth through re-development.

### Alternative 3: Implement On-Site Best Practices

In the context of water distribution, this alternative contemplates the adoption of strategies to reduce water demand from the municipal infrastructure system including conservation efforts.

### Alternative 4: Limit Community Growth

This alternative is focused on phasing and timing the growth within the study area to within the limits of the available servicing infrastructure capacity as it currently exists and/or as it increases through the implementation of system improvements.

## ASSESSMENT & EVALUATION OF ALTERNATIVES

**Table 3 Assessment & Evaluation of Alternatives – Water Distribution**

<table>
<tr><th>Criteria</th><th>Sub-Criteria</th><th>Alternative 1:<br>Do Nothing</th><th>Alternative 2:<br>Expand/Upgrade Ex. Infrastructure</th><th>Alternative 3:<br>Implement On-Site Best Practices</th><th>Alternative 4:<br>Limit Growth</th></tr>
<tr><td rowspan="4">Technical Merit</td><td>Functionality</td><td rowspan="9">Existing infrastructure capable of supporting planned growth.<br><br>No environmental impacts resulting from this alternative.<br><br>This alternative does not allow for extension of infrastructure into new roads.</td><td rowspan="9">New watermains constructed in new roads have minimal impacts.<br><br>Impacts would include marginally increased maintenance obligations and life-cycle costs for the City, offset by increased tax and user base offered by development.<br><br>Also, construction activities may impact the local environment (e.g., noise, vibration), although these are not expected to be significant in relation to the overall construction activity. Mitigation measures to be implemented.</td><td rowspan="9">No negative environmental impacts.<br><br>Reduction in water demand from municipal system expected to reduce financial and environmental costs associated with water production, pumping, transmission, distribution. Also, reduction in sewage generation expected to result.</td><td rowspan="9">No negative environmental impacts.<br><br>Not necessary to implement.</td></tr>
<tr><td>Constructability</td></tr>
<tr><td>Maintenance Requirements</td></tr>
<tr><td>Life-Cycle Cost</td></tr>
<tr><td>Natural Environment</td><td>Impact on the Natural Environment</td></tr>
<tr><td rowspan="4">Socio-Economic Environment</td><td>Cultural Heritage Impact</td></tr>
<tr><td>Construction Impact</td></tr>
<tr><td>Residential and Business Impact</td></tr>
<tr></tr>
<tr><td colspan="2">Preferred Solution</td><td colspan="4">No improvements to existing water distribution system necessary.<br>Extend/expand existing system into new roadways wherever required.<br>Encourage implementation of water conservation measures.</td></tr>
</table>

## PREFERRED SOLUTION

As noted above, the preferred solution consists of the following elements:

- Extend municipal watermains into any new roadways as required to provide adequate water supply for domestic use and fire-fighting needs.
- While not needed from a technical perspective, the implementation of water conservation measures is a good practice and to be encouraged to the extent that it is practical. Such measures may include water efficient fixtures in the buildings as well as rainwater harvesting systems for irrigation and possibly toilet flushing.

### Project Schedules

The extension of the water distribution system into new roadways are a **Schedule A** activity. That is, these projects are approved and may proceed.

### Mitigation Measures

Of the few impacts associated with the extension of the water distribution system into new roadways, they are all relatively minor and straightforward to deal with using standard, customary mitigation practices.

Environmental Impacts

- **Sedimentation and Dust Control** is required for all construction activities in the City of Toronto. The implementation of standard mitigation practices (e.g., silt fences, mud mats, etc.) are expected to provide adequate controls in this regard, and it is expected that this construction will occur concurrently with other construction activities in the roadway, thereby minimizing the duration during which these impacts may be felt.

Social Impacts

- **Traffic, Noise and Vibration** result from almost all construction activities of this nature. Similar to the above, standard mitigation practices are expected to provide adequate controls in this regard, and construction is expected to occur concurrently with other construction activities in the roadway, thereby minimizing the duration during which these impacts may be felt.
- **Safety During Construction** for both workers and the general public is of obvious importance. All construction practices will be required to conform to both the City's requirements as well as the Province's legislation in this regard.

## IMPLEMENTATION CONSIDERATIONS

It is recommended that the City continue to follow its standard practice of requiring hydrant flow tests to support individual development applications. The results from these tests should confirm that the performance of the system when tested is consistent with the basis upon which this study was undertaken, as well as to confirm the suitability of the system to support the development intended by the application. These tests also provide the City with valuable information related to the ongoing monitoring of the behaviour and performance of its infrastructure.

# Sanitary Sewerage

As noted earlier, the existing sanitary sewer system appears to have sufficient capacity to convey dry weather wastewater flows while maintaining an adequate level of performance under current conditions, however, its capacity during heavy rainfall events needs more careful consideration. These heavy rainfall events that have contributed to historical basement flooding occurrences are being assessed by the City under separate Class EA studies dealing specifically with these matters. The addition of flows due to population growth in the study area is assessed herein and recommendations for improvements are identified. Implementation of the measures identified in the Basement Flooding Class EAs will serve to improve the infrastructure's ability to respond to rainfall events.

## DESIGN CRITERIA

A brief summary of the design criteria applied in the analyses conducted as part of this work is provided below, however, more detailed information and modelling results are presented in Appendix B.

### Basement Flooding Study Area 16 Sewershed

The City's detailed and calibrated hydrodynamic models for this sewershed were obtained and used as the basis for modelling the impacts of development in the study area on the receiving sewer system. Two models were obtained, representing the range of future conditions that can reasonably be expected: (i) existing conditions (i.e., worst case); and (ii) conditions after all the preferred solutions identified in the Area 16 EA have been implemented. In general, these models apply monitored diurnal patterns to the populations generating the sewage flow, combine these flows with infiltration and inflow (I/I) based on the 12 May 2000 storm event, and dynamically route these flows through the sewer network, accounting for backwater and surcharge conditions that may result.

In terms of design criteria applied in this analysis, some modifications were made to the models provided by the City. For instance, the diurnal pattern contained in the models resulted in a relatively low peak-to-average ratio. While this ratio was based on monitored flow and is considered to be relevant, a more conservative diurnal pattern which provides a peak-to-average ratio matching that determined using the traditional Harmon formulation was applied. In addition, the average daily flow rate was changed to the realistic and often-used value of 240 Lpcd. (See Appendix B.)

### Basement Flooding Study Area 17 Sewershed

The now finalized Basement Flooding Study Area 17 Class EA had not yet been completed when the work for this study took place and, as such, the detailed and calibrated hydrodynamic model resulting from that work was not available for this study. Instead, a more traditional spreadsheet-based model was used and, in fact, was the same model developed and used in support of the application for the Treviso (Duflaw) high-rise condominium development at the northeast corner of Lawrence Avenue West and Dufferin Street. In reviewing the results documented for the above noted Class EA, the design criteria applied below have been confirmed to be reasonable (see below as well as the additional information provided in Appendix B.

The following design criteria were applied to assess the existing sanitary sewer system's ability to support the anticipated intensification within the study area, maintaining consistency with the above noted analysis:

- Average Daily Residential Wastewater Flow[9]: 240 Lpcd
  - Harmon equation applied for peak factor[10]
- Average Daily Non-Residential: Wastewater Flow: 250 Lpcd
  - Peak factor included in average flow
- Extraneous Flows[11]: 0.26 L/s/ha

## ALTERNATIVES

The following is a brief description of the Master Plan alternatives considered in the context of sanitary sewerage:

### Alternative 1: Do Nothing

This alternative considers no changes to the existing system.

### Alternative 2: Expand and/or Upgrade Existing Infrastructure

This alternative considers the addition of new sanitary sewers and appurtenances on new roads planned within the study area, as well as any upgrades to the existing sanitary sewer network to support planned growth through re-development.

### Alternative 3: Implement On-Site Best Practices

In the context of sanitary sewerage, the implementation of on-site best practices is relatively congruent to water supply, in that strategies to reduce water demand using high-efficiency plumbing fixtures, for example, will also reduce the amount of sewage generated. In addition, on-site privately owned and operated pumping stations with storage capacity can be considered to control the discharge rate of sanitary sewage from development sites, however, these systems may only be appropriate for larger development sites.

### Alternative 4: Limit Community Growth

This alternative is focused on phasing and timing the growth within the study area to within the limits of the available servicing infrastructure capacity as it currently exists and/or as it increases through the implementation of system improvements.

[9] It is noted that the use of this unit generation rate is reasonable given that the adjusted sewage flow in the model calibration for the Area 17 Class EA was determined to be 265 Lpcd (Monitor HH01A525). While somewhat higher than 240 Lpcd, this difference is more than offset by the application of the more conservative Harmon peaking factor. See Appendix B for additional information.
[10] This peaking factor is deemed to be rather conservative for purposes of the analysis conducted herein noting that the diurnal pattern used in the above noted calibrated model has peak-to-average flow ratio of 1.58, being considerably less than the factor that would be computed using the Harmon equation. See Appendix B for additional information.
[11] See Appendix B for additional information.

## ASSESSMENT & EVALUATION OF ALTERNATIVES

**Table 4 Assessment & Evaluation of Alternatives – Sanitary Sewerage**

<table>
<tr><th>Criteria</th><th>Sub-Criteria</th><th>Alternative 1:<br>Do Nothing</th><th>Alternative 2:<br>Expand/Upgrade Ex. Infrastructure</th><th>Alternative 3:<br>Implement On-Site Best Practices</th><th>Alternative 4:<br>Limit Growth</th></tr>
<tr><td rowspan="4">Technical Merit</td><td>Functionality</td><td rowspan="8">Performance standards not expected to be maintained throughout entire receiving sewer system with the additional population resulting from envisioned intensification in study area. Potential negative impacts on natural environment (e.g., spills), socio-economic environment (e.g., basement flooding and service disruptions), including additional operation, maintenance and crisis/reaction costs.</td><td rowspan="8">Upgrade sewers in existing roads. New sanitary sewers constructed in new roads have minimal impacts.<br><br>Impacts would include increased capital and maintenance obligations and life-cycle costs for the City, offset by increased tax and user base offered by development. Disruption of traffic during construction and potential odours during operation.<br><br>Also, construction activities may impact the local environment (e.g., noise, vibration), although these are not expected to be significant in relation to the overall construction activity.<br><br>Mitigation measures to be implemented.</td><td rowspan="8">No negative environmental impacts.<br><br>Reduction in water demand through the use of high-efficiency plumbing fixtures (e.g., dual-flush toilets, low flow shower heads, etc.) to be encouraged.<br><br>For larger developments, consideration of on-site pumping systems with storage to control discharge rates to sewer system may be considered.</td><td rowspan="8">No negative environmental impacts.<br><br>Development approvals may be contingent upon upgrades identified in this study, as well as those identified in the Area 16 and Area 17 Basement Flooding Study Area Class EAs.</td></tr>
<tr><td>Constructability</td></tr>
<tr><td>Maintenance Requirements</td></tr>
<tr><td>Life-Cycle Cost</td></tr>
<tr><td>Natural Environment</td><td>Impact on the Natural Environment</td></tr>
<tr><td rowspan="3">Socio-Economic Environment</td><td>Cultural Heritage Impact</td></tr>
<tr><td>Construction Impact</td></tr>
<tr><td>Residential and Business Impact</td></tr>
<tr><td colspan="2">Preferred Solution</td><td colspan="4">Extend existing system into new roadways wherever required.<br>Increase size of in-line storage element identified in Project SAN-NP-1 of Basement Flooding Study Area Class EA<br>Modify outlet control of existing sanitary storage element on Samor Road.<br>Construct new sanitary storage element on Samor Road (optional).<br>Upgrading of sanitary sewer on Dufferin Street southerly from Samor Road to Lawrence Avenue West, then easterly to Treviso (Duflaw) connection point. (It is noted that this work, in conjunction with specific works identified in the Basement Flooding Study Area 17 Class EA in the vicinity of Mulholland Avenue and Dane Avenue, is expected to reduce the risk of future flooding in this area.)<br>High-efficiency plumbing fixtures to be encouraged.</td></tr>
</table>

## PREFERRED SOLUTION

The preferred solution consists of three option pairs discussed below which result in similar performance levels and are provided here as belonging to the preferred solution in order to give the City some flexibility in future implementation. Additional discussion of these results is provided in Appendix B and summarized in Table 5.

The following elements of the preferred solution are common to all option pairs:

- Extend sanitary sewers into any new roadways as required to support new development forms.
- The sanitary sewer on Dufferin Street extending from its intersection with Samor Road southerly, then easterly along Lawrence Avenue West to the point where the Treviso (Duflaw) development connects are to be upgraded from the existing 250 or 300 mm ø with a 450 mm ø pipe, matching the sizing downstream as implemented in support of said development. It is noting that the Area 17 Class EA makes similar conclusions, however, for the sake of completeness, are also included here since these upgrades are necessary to support the population growth resulting from the land use planning component of the Dufferin Street Avenue Study.
- It is generally good practice to encourage the implementation of water efficient fixtures to the extent that it is practical, as these serve to reduce the volume of wastewater generated, thereby imposing less hydraulic load on the receiving sewer system. Such measures may include dual flush toilets and high efficiency showerheads.

Although details of the infrastructure improvement option pairs are summarized in Table 5, the following is a general description of the context in which they are presented:

- The sub-trunk sanitary sewer located in the North Park Ravine was modelled in the Area 16 Class EA to surcharge to the surface under existing conditions with infiltration and inflow resulting from the 12 May 2000 storm event. Accordingly, the Class EA recommended the implementation of a 1200 mm ø in-line storage element to replace the existing sewer (Project SAN-NP-1). The options noted below provide various alternative sizes for this storage element, depending on the degree to which the preferred solutions identified in the Area 16 Class EA are implemented, however, special considerations in relation to this project are recommended herein. Refer to the Implementation Considerations section.
- There is an existing 1350 mm ø sanitary sewage storage element located on Samor Road from Dufferin Street to approximately 340 m west thereof and which appears to not be used by the City for this purpose. The options considered include implementing an outlet orifice control to make effective use of this existing infrastructure. It is noted that, during the detailed design stage, consideration should be given toward the incorporating an emergency relief from the storage element to the downstream maintenance hole/sewer pipe.
- The options consider replacement of the existing 250 mm diameter sanitary sewer on the remainder of Samor Road with a 1200 mm ø sanitary sewage storage element with an outlet control orifice. Similarly, consideration should be given toward incorporating an emergency relief from the storage element to the downstream maintenance hole/sewer pipe during the detailed design stage (should this option be ultimately selected).
- There is a bottleneck in that part of the existing sanitary sewer system which runs from the intersection of Samor Road and Duflaw Road westerly through easements toward Caledonia Road. The pipe sizes in the easement reduce from a 300 mm ø to a 250 mm ø, then increase again downstream thereof to 375 mm ø. The result is that the two legs of sewer that are 250 mm ø in size cause a significant rise in the hydraulic grade line under surcharged conditions, thereby imposing a tailwater on upstream pipe segments. The area in question is largely industrial with no basements and connections, and arguably the existence of surcharging is less relevant, particularly given that it is expected to be more than 1.8 m below the road surface. Nevertheless, the options shown below consider upgrades to these pipes.

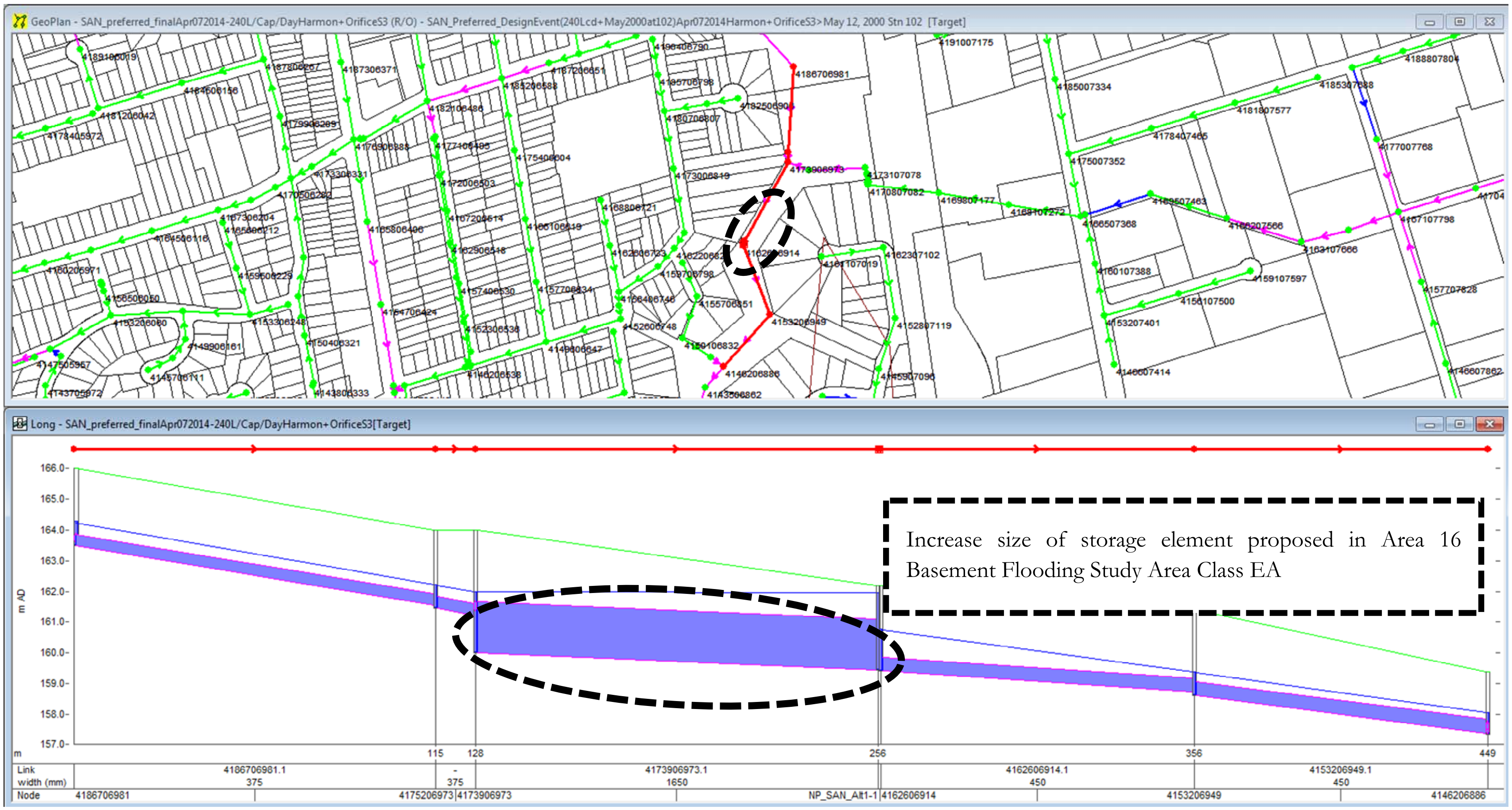
**Table 5 Option Pairs for Sanitary Sewer Infrastructure Upgrades[12]**

| **Option ID** | Option 1 | | Option 2 | | Option 3 | |
|---|---|---|---|---|---|---|
| **Area 16 Class EA Modelling Condition[13]** | Area 16 - Ex | Area 16 – Pref | Area 16 - Ex | Area 16 – Pref | Area 16 - Ex | Area 16 – Pref |
| **Description of Upgrade** | | | | | | |
| Increase size of SAN-NP-1 storage element[14,15] from 1200 mm ø to: | 2-2400×1500 | 1500 mm ø | 2-2400×1500 | 1500 mm ø | 1-2400×1500<br>1-3000×1500 | 1650 mm ø |
| Modify outlet orifice of existing Samor Road storage element to: | 200 mm ø | | 150 mm ø | | 200 mm ø | |
| Add new 1200 mm ø Samor Road storage element with outlet orifice of: | 200 mm ø | | n/a | | n/a | |
| Increase pipe sizes for 2 legs of sewer in easement from 250 mm ø to: | n/a | | n/a | | 375 mm ø | |
| **Evaluation of Options** | | | | | | |
| Capital Cost | Highest[16] | | Lowest | | Moderate | |
| Operating & Maintenance Costs | Highest[17] | | Moderate[18] | | Lowest | |
| Technical Performance | All generally similar and satisfy City guidelines and accepted practices | | | | | |

[12] Consideration is to be made at the detailed design stage for suitable velocities for conveyance and transport of solids during periods of low flow.
[13] Upgrades are based on which Area 16 Class EA base model was used. "Area 16 – Ex" refers to the existing conditions and is representative of the worst-case scenario assuming none of the preferred solutions to deal with basement flooding identified in the Area 16 Class EA are implemented, and "Area 16 – Pref" considers the case where all such solutions are implemented.
[14] As identified in Basement Flooding Study Area 16 Class EA preferred solution. In all cases, the pipe downstream of the storage element is increased to 450 mm ø as per the study.
[15] It is to be recognized that the increase in sizing for this storage element between the "preferred" and "existing" conditions is largely due to the rainfall-derived infiltration and inflow, rather than by development growth. See additional discussion below in the Implementation Considerations section.
[16] This option is deemed to have the highest cost due to the implementation of a new 1200 mm ø storage element on Samor Road.
[17] With the additional storage element on Samor Road, there is expected to be higher operation and maintenance costs with this option.
[18] Although very similar to Option 3, this option considers a 150 mm ø orifice (i.e., smaller than 200 mm ø orifice in Option 3) for the existing Samor Road storage element, thereby increasing the need for the City to be vigilant with respect to its continued operational performance.

## Description of Upgrades: Increase of Area 16 Class EA Project SAN-NP-1 Storage Element in North Park Ravine

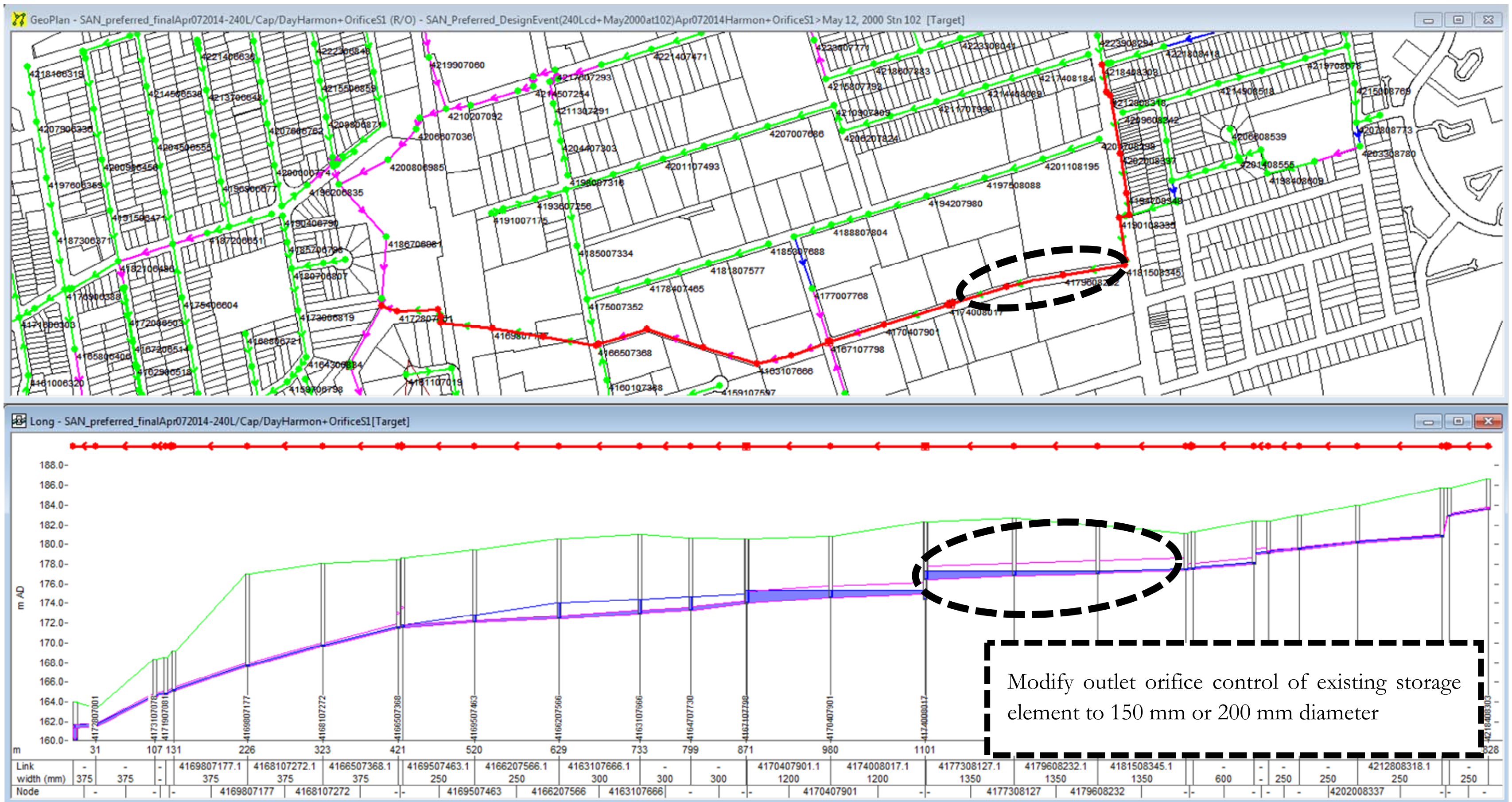
- Option 1: 2 - 2400×1500 mm box sections (can be reduced to 1500 mm ø pipe if all Area 16 preferred solutions implemented)
- Option 2: 2 - 2400×1500 mm box sections (can be reduced to 1500 mm ø pipe if all Area 16 preferred solutions implemented)
- Option 3: 1 - 2400×1500 mm + 1 - 3000×1500 mm box sections (can be reduced to 1650 mm ø pipe if all Area 16 preferred solutions implemented)




* This option is subject to special considerations discussed in the Implementation Considerations section below.

## Description of Upgrades: Modify Outlet of Existing Samor Road Storage Element

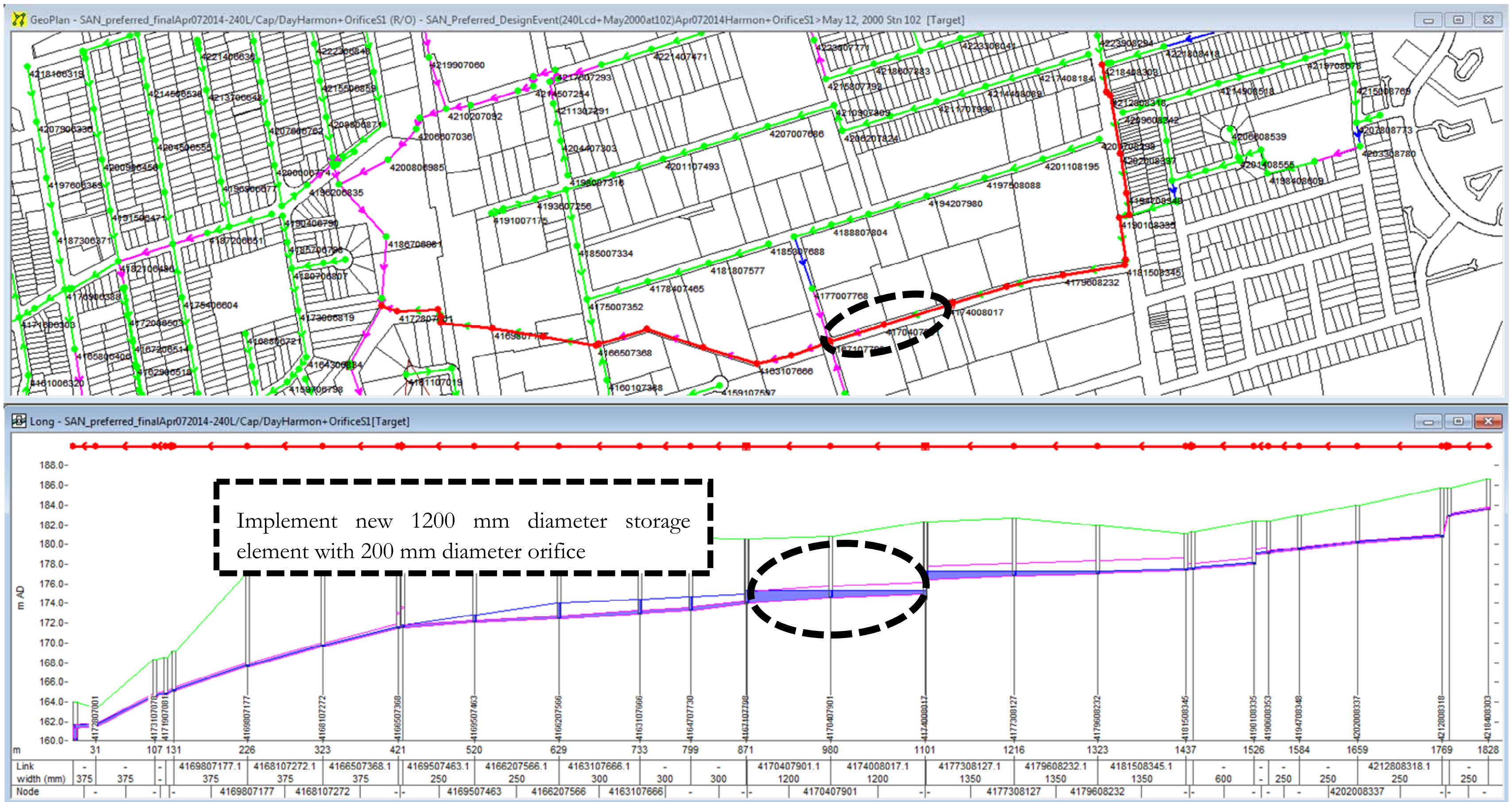
- Option 1: 200 mm ø Orifice
- Option 2: 150 mm ø Orifice
- Option 3: 200 mm ø Orifice




* Consideration is to be made during detailed design stage with respect to exact location of controls (e.g., upstream side of maintenance hole) so as to duly account for maintenance needs.

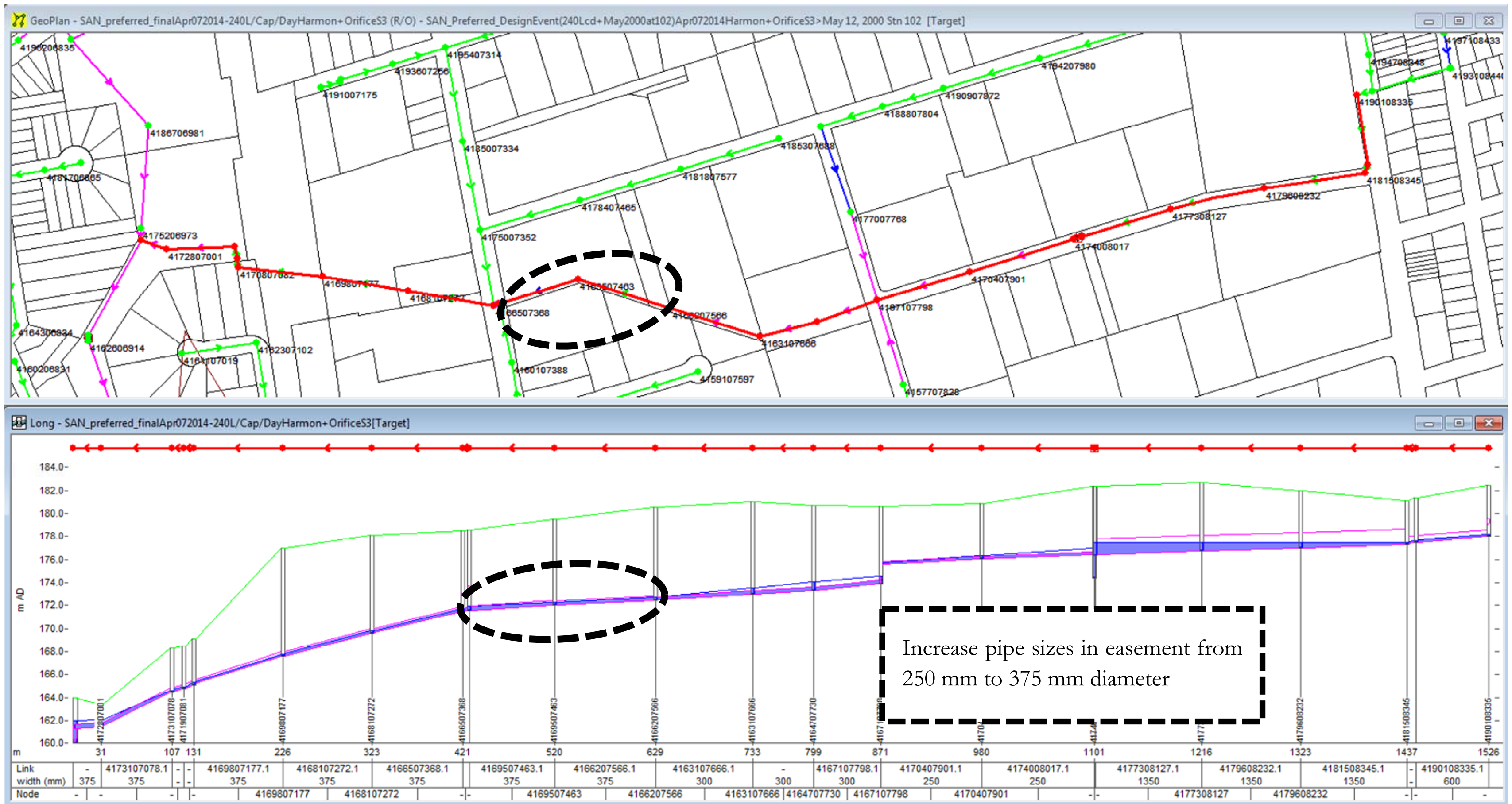
### Description of Upgrades: Add New 1200 mm ø Storage Element on Samor Road with 200 mm Orifice

- Option 1: Applicable
- Option 2: Not Applicable
- Option 3: Not Applicable



## Description of Upgrades: Increase Pipe Sizes for 2 Legs of Sewer in Easement Between Dufflaw Road & Caledonia Road

- Option 1: Not Applicable
- Option 2: Not Applicable
- Option 3: 375 mm ø



### Project Schedules & Implementation Triggers

This Class EA Master Plan provides a broad framework for the implementation of individual projects identified in the preliminary preferred solution. Each project is further classified as belonging to one of the following schedules which has specific requirements for fully satisfying the Class EA process prior to implementation:

- **Schedule A**: These projects are approved and may proceed.
- **Schedule A+**: These projects are approved; however, public notice of implementation is required.
- **Schedule B**: These projects require documentation about the preferred method of implementation and mitigation of environmental impacts, including documentation of the public consultation process, all in accordance with Phases 1 and 2 of the Class EA process. These requirements are satisfied through this Master Plan Class EA study and, provided that the Screening Process for these projects confirms the Schedule, these projects are approved.

Implementation triggers are identified in a general sense for each of the projects. Variations may be considered, depending on the nature and timing of development applications supported by defensible justification therefor.

**Table 6 Project Schedules & Implementation Triggers**

| Project Description | Class EA Schedule | Implementation Trigger[19] |
|---|---|---|
| Extend sanitary sewers into new roads | A | As needed to support re-development. |
| Increase size of SAN-NP-1 storage element in North Park Ravine (as identified in Area 16 Class EA) | B[20] | Refer to special considerations discussed in Implementation Considerations section. |
| Modify existing sanitary storage on Samor Road | A+ | Re-Development of Blocks 5, 11, 12 or 13 |
| Construct new sanitary storage element on Samor Road | B[21] | Re-Development of Blocks 6 or 7 (subject to optionality as noted herein) |
| Upgrading of sanitary sewers in easement between Dufflaw Road and Caledonia Road | A+ | Re-Development of Blocks 6 or 7 (subject to optionality as noted herein) |
| Upgrading of sanitary sewers on Dufferin Street & Lawrence Avenue West | A+ | Re-Development of Blocks 7, 8, 9a, 10 or 11 (unless it can be justified otherwise) |

### Mitigation Measures

The anticipated impacts associated with the projects identified are presented below along with mitigation measures which may be applied.

Environmental Impacts

- **Sedimentation and Dust Control** is required for all construction activities in the City of Toronto. The implementation of standard mitigation practices (e.g., silt fences, mud mats, etc.) are expected to provide adequate controls in this regard, and it is expected that this construction will occur concurrently with other construction activities in the roadway, thereby minimizing the duration during which these impacts may be felt.

[19] These implementation triggers are presented in a general sense, and variations may be considered, depending on the nature and timing of development applications.
[20] Class EA process satisfied by Basement Flooding Study Area 16 Class EA (completed by others).
[21] Class EA process satisfied by this study (i.e., Dufferin Street Avenue Study Infrastructure Master Plan Class EA).

Social Impacts

- **Odour** may be a concern in relation to the augmented use of in-line sanitary storage. To mitigate these concerns, the City consider the following:
  - Installation of charcoal (activated carbon) filters in the affected maintenance holes where the sewer system vents to the road surface. These devices require periodic maintenance to exchange the activated carbon.
  - Sewer cross-sections that maintain proportional velocities (e.g., egg-shape or similar).
  - Sealed maintenance hole covers.
  - Victorian vents.
- **Traffic, Noise and Vibration** result from almost all construction activities of this nature. Similar to the above, standard mitigation practices are expected to provide adequate controls in this regard, and construction is expected to occur concurrently with other construction activities in the roadway, thereby minimizing the duration during which these impacts may be felt.
- **Safety During Construction** for both workers and the general public is of obvious importance. All construction practices will be required to conform to both the City's requirements as well as the Province's legislation in this regard.

Operational Impacts

- **Operation & Maintenance of Sanitary Storage Elements** requires additional effort above and beyond that required for sanitary sewers since velocities can be greatly reduced while the storage is being utilized, thereby increasing the potential for deposition of solids and eventual blockages. These issues can be reduced by improving overall velocities at the outlet orifice as well as through routine inspection and flushing of the storage element.

### Cost Estimates

Order of magnitude cost estimates are provided here for budget planning purposes only. These estimates do not include soft costs, such as design and permitting fees, nor do they include or account for utility diversions, and are subject to revision and refinement through future detailed design processes.

Area 16 Class EA Project SAN-NP-1, as modified

In order to improve the known flooding situation in Basement Flooding Study Area 16, this project was a part of the solution and considered a 1200 mm ø storage pipe. Accordingly, only the increase in pipe sizes proposed herein are attributable to the growth proposed in the Dufferin Street Avenue Study. Special considerations are recommended with respect to implementation of development in respect of this matter and are discussed at greater length below in the Implementation Considerations section.

- Option 1:
  - Existing Conditions: 128 m – 2×(2400×1500 mm) @ $10,000 ≈ $1,300,000
  - With Area 16 Class EA Preferred Solutions Implemented: 128 m – 1500 mm ø @ $3,750 ≈ $480,000
- Option 2:
  - Existing Conditions: 128 m – 2×(2400×1500 mm) @ $10,000 ≈ $1,300,000
  - With Area 16 Class EA Preferred Solutions Implemented: 128 m – 1500 mm ø @ $3,750 ≈ $480,000

- Option 3:
    - Existing Conditions: 128 m – (2400×1500 mm + 3000×1500 mm) @ $11,500 ≈ $1,500,000
    - With Area 16 Class EA Preferred Solutions Implemented: 128 m – 1650 mm ø @ $4,000 ≈ $520,000

Modify existing sanitary storage on Samor Road

- Applies to all options.
- Excavate and re-construct interface between storage pipe and maintenance hole with orifice pipe.
- Estimated Construction Cost: $100,000

Construct new sanitary storage element on Samor Road

- Applies to Option 1 only.
- Remove and replace existing approximately 230 m of 250 mm ø sanitary sewer with new 1,200 mm ø sanitary sewer storage pipe with 200 mm ø orifice pipe, including traffic control, by-pass pumping, unshrinkable fill, etc.
- Estimated Construction Cost: 230 m @ $3,650 ≈ $850,000

Upgrading of sanitary sewers on Dufferin Street & Lawrence Avenue West

- Applies to all options.
- Remove and replace existing approximately 575 m of 250 mm ø sanitary sewer with new 450 mm ø sanitary sewer, including traffic control, by-pass pumping, unshrinkable fill, etc.
- Estimated Construction Cost: 575 m @ $1,450 ≈ $850,000

Upgrading of sanitary sewers in easement

- Applies to Option 3 only.
- Remove and replace existing approximately 208 m of 250 mm ø sanitary sewer with new 375 mm ø sanitary sewer, including traffic control, by-pass pumping, unshrinkable fill, etc.[22]
- Estimated Construction Cost: 208 m @ $1,650 ≈ $350,000 (rounded)

## IMPLEMENTATION CONSIDERATIONS

As with current development planning application processes, the proponent will be responsible for the preparation of Functional Servicing Reports in support of any applications. These reports should clearly demonstrate to which sanitary sewers the flows are directed and demonstrate consistency with the assumptions identified herein. Additional modelling work may be required to assess the impact of variations between development proposals and the assumptions in this work. The need for this work should be established in consultation with Toronto Water and can be undertaken with the use of the InfoWorks CS dynamic hydraulic models developed as part of the Basement Flooding Study Area Class EAs, as determined appropriate through consultation with the City.

Given the sensitivity of the sanitary sewer infrastructure in response to increased population and potential rainfall-derived infiltration and inflow, and in light of the timing required for the ongoing implementation of improvement works to both the storm and sanitary infrastructure systems recommended by the Area 16 and Area 17 Basement Flooding Study Area Class EAs, it is strongly recommended that additional flow (and rainfall) monitoring be conducted by the City at key locations so as to further confirm current performance of the system and the assumptions driving the

[22] For initial budgeting purposes, replacement by traditional excavation considered herein, although this does not preclude the future consideration of other installation techniques (e.g., tunneling).

InfoWorks dynamic hydraulic model. The preliminary preferred solutions identified herein are based, in part, on the calibrated hydraulic model for the Area 16 sewershed. It would be useful to confirm the validity of the model and make any modifications thereto (if and as necessary) in order to further use the model to assist in making decisions on whether individual development applications can proceed and when the projects identified herein, as well as those identified in the Basement Flooding Study Area Class EAs, must be made and to what extent. The following locations are recommended (as a minimum) for additional flow monitoring and model verification/calibration (see Figure 11):

- Bridgeland Avenue, immediately upstream of its connection to sub-trunk sewer
- Cartwright Avenue, immediately upstream of its connection to sub-trunk sewer
- Caledonia Road, immediately upstream of its connection to sewer in easement
- Easement sewer, immediately upstream of its connection with Caledonia Road

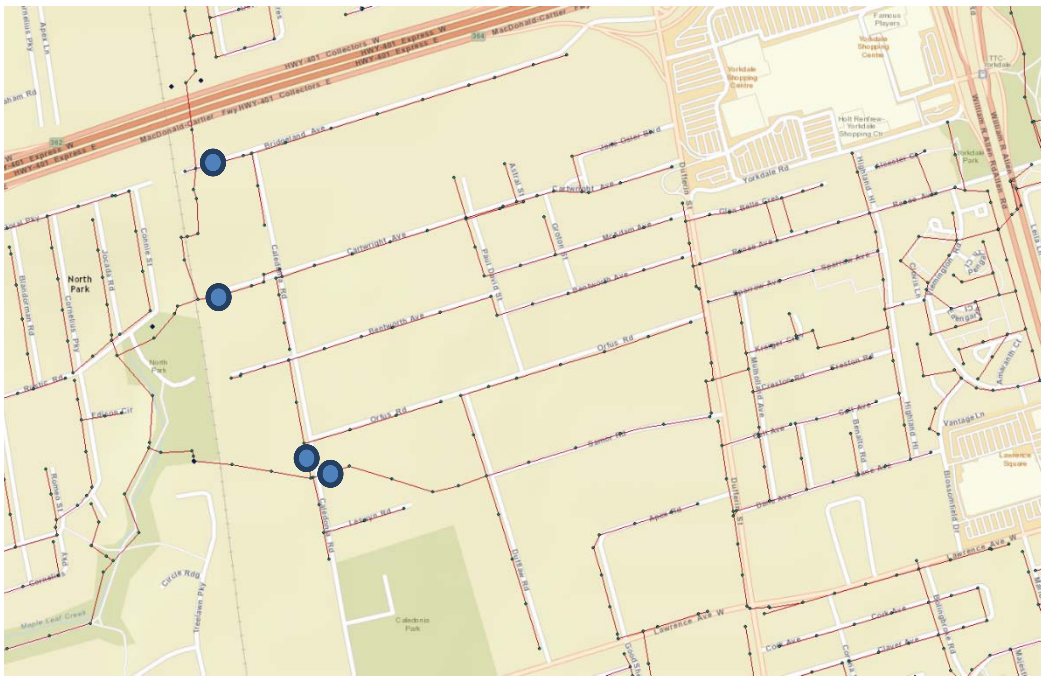


**Figure 11 Locations where additional flow monitoring recommended**

Prior to any detailed design and implementation of the various projects identified in the preferred solutions, it is strongly recommended that additional modelling and analysis be undertaken to account for available information at that time and to confirm sizing, etc.

With respect to the Area 17 sewershed, the analysis undertaken as part of this study employed a more traditional spreadsheet-based approach to assessing the performance of the sanitary sewer infrastructure, given that the calibrated InfoWorks model for this sewershed was not available at the time this work was conducted. Accordingly, the findings of this work can be confirmed and/or refined with the Area 17 Basement Flooding Study Area Class EA calibrated model(s), should it be desired.

In terms of processing development applications, it is recommended that the development proponent undertake a specific hydraulic analysis with the verified/calibrated InfoWorks model with relevant monitoring information for the receiving sewer in question (as noted above). These analyses should consider the improvement works that will be in place as at the time that development proceeds. This process will assist in confirming when the specific improvements identified in this study, as well as those identified in the Basement Flooding Study Area Class EAs need to be implemented, in addition to whether or not the development may proceed or whether it is constrained by pending improvement works.

Although noted earlier herein, it is reiterated that there is some flexibility in the implementation of the projects identified through this study, depending on the timing and nature of development and the practicality of implementation. The final determination of this will necessarily require supporting justification from the development community and, of course, the acceptance by the City. To use an example, the additional sanitary storage element on Samor Road may not be needed if the North Park Ravine sub-trunk storage element is sufficiently increased in size, the upgrades to the sewer pipes in the easement are made and the existing Samor Road storage element is controlled satisfactorily. Of course, such a conclusion can only be reached in light of actual development activities and improvement works which occur over time.

It is noted that detailed dynamic hydraulic modelling of the receiving sanitary sewer system may be overly burdensome for very small development applications. The City may wish to exercise some discretion in the extent of analysis required on a case-by-case basis, and in light of the evolution of the re-development in the study area and implementation of improvement projects identified either through this study or the Area 16 and 17 Basement Flooding Study Area Class EAs.

### North Park Ravine Storage Pipe

It is recommended that the City permit development prior to implementation of this previously identified project, subject to the requirements noted below, and that the final sizing of the storage pipe be confirmed at the detailed design stage with the best available information at that time, noting that incremental sizing is shown to be warranted based on the projected population growth in the Dufferin Street Avenue Study area.

It is recommended that development be allowed to proceed provided that the increase in peak sanitary sewage flow from the re-developed site is less than the reduction in inflow and infiltration afforded by the re-development, perhaps combined with a funding arrangement (e.g., cash-in-lieu contribution, developer front-ending agreements, etc., depending on size and nature of development proposal) to support implementation of the project (e.g., SAN-NP-1). Using this approach, re-development activity will not exacerbate current conditions and affords the opportunity to improve them, particularly in combination with the proposed stormwater management controls. This further affords the City the opportunity to prioritize, plan, schedule and implement overall system upgrades as budget permits.

# Storm Drainage & Stormwater Management (SWM)

The City's Wet Weather Flow Management Guidelines (WWFMG) provide a comprehensive methodology for guiding the design of stormwater management measures for developments and are expected to result in an overall reduction in stormwater volumes and peak flows to levels which are at or below the capacity of the receiving drainage system. For instance, the WWFMG considers the detention of drainage for storms up to the 100-year return period frequency with a stringently controlled discharge rate. It is expected that many of the properties in the study area currently do not deliver this level of performance and, therefore, upon re-development, the adoption of such practices are expected to reduce the hydraulic loading on the receiving drainage systems. In addition to runoff quantity control, the WWFMG contains provisions for water balance – which reduces the amount of runoff exiting the site – and water quality control.

As noted earlier, the recommendations of the Basement Flooding Study Area Class EAs provide significant guidance on system improvements required to minimize the probability and frequency of flooding in the drainage sheds relevant to this study area. As at the time of preparation, the scheduled infrastructure upgrades in the vicinity of the study area resulting from the Basement Flooding Study Area work include improvements on Jane Osler Boulevard in 2014[23]. The purpose of this study is not to address current basement flooding issues, but rather to identify improvements needed to service growth in the study area and without exacerbating current conditions.

Given the configuration of the study area and the nature of Dufferin Street and other existing roadways, there is generally little opportunity to implement centralized measures to address stormwater management objectives. On the other hand, the re-development of individual sites will necessitate observance of the WWFMG, thereby resulting in the improved rainfall-runoff characteristics of, and potential reductions in overland flow within, the overall study area relative to current conditions.

Additional information is provided in Appendix C.

## STORMWATER MANAGEMENT OBJECTIVES

All existing properties and anticipated development blocks in the study area are expected to be less than 5.0 ha in size, qualifying as "small new developments" pursuant to the WWFMG document. The following are the applicable objectives and requirements for such developments:

### Water Balance

Developments are required to retain all runoff from a 5 mm rainfall event through infiltration, evapotranspiration and rainwater reuse. Despite this, it may be worthwhile considering a higher target for developments in this study area given the known historic flooding concerns associated with heavy rainfalls. A review of the available geotechnical information suggests that the underlying soils in the study area, while expected to capable of modest amounts of infiltration, are not expected to be suitable for more aggressive targets in this regard (see Appendix C). Accordingly, the target 5 mm volume noted above is to be maintained for developments in the study area. Of course, higher captured runoff volumes (rainfall depths) should be welcomed and encouraged, offering the simultaneous benefit of assisting to achieve water quality objectives.

Measures which can be considered to achieve water balance objectives include (but are not necessarily limited to):

- Green[24] or Blue[25] Roofs
- Infiltration Chambers/Galleries

[23] K. Crowther, personal communication, 05 September 2013

[24] Relevant Resources: Toronto Green Roof By-Law; Toronto Green Roof Biodiverse Guidelines; Toronto Green Roof Construction Standards; Toronto Green Standard. See www.toronto.ca/greenroofs.

[25] Blue roofs are non-vegetated source controls that detain stormwater, preferably with light coloured roofing material.

- Permeable Pavement
- Bioretention
- Rainwater Harvesting

It is important to note that the appropriateness of each of these measures, used alone or in some combination, is dependent upon a variety of factors including development size, actual soil characteristics, capital cost and maintenance considerations as well as intensity of demand for reuse in the case of rainwater harvesting. It is expected that the larger sites will have opportunities to implement several of these measures, while the smaller sites will be quite limited. As with current protocols for development in the City, it will be the development proponent's responsibility to demonstrate that the water balance objective is being achieved.

### Water Quality

Developments are required to achieve a long-term average total suspended solids (TSS) removal from runoff of 80% on an annual loading basis, with the overall site removal efficiency including runoff retention and other on-site controls (i.e., treatment train approach). An example of a linkage between measures which provide the dual benefit of water balance and water quality is captured in the following passage:

> *Bioretention provides effective removal for many pollutants as a result of sedimentation, filtering, soil adsorption, microbial processes and plant uptake. It is also important to note that there is a relationship between the water balance and water quality functions. If a bioretention cell infiltrates and evaporates 100% of the runoff from a site, then there is essentially no pollution leaving the site in surface runoff.* [26]

Similar to the case for water balance, smaller sites are anticipated to be somewhat more challenged at meeting the water quality criterion and limited in the options available to be practically deployed. Historically, oil-grit separators have been used in such situations, however, the performance of most such technologies are deemed by Toronto to achieve at most 50% TSS removal and such devices must be accompanied by other measures in a treatment train to achieve the desired 80% TSS removal target. Media filtration devices with small footprints and capable of controlling finer particles (pollutants), comparable in size to traditional oil-grit separators, are available and which are capable of achieving the water quality target have been deployed on development projects elsewhere in the City, as an alternative. It is noted that operational and cost considerations may favour low impact development (LID) technologies over oil-grit separators.

### Flood Flow Management

As noted earlier, the primary cause of historic flooding complaints has been the overwhelming of the capacity of the existing storm and sanitary sewage conveyance systems in response to heavy rainfalls. Although it is not the mandate of this study to resolve the existing causes of flooding as these are being handled under the City's Basement Flooding Protection Program; however, measures to decrease flows from the re-development sites will be required through the WWFMG, and are expected to relieve some of the stress of the receiving drainage system.

### Discharge Criteria to Municipal Infrastructure

The allowable release rate to the municipal storm sewer system is governed by the lesser of the peak pre-development runoff rate or the available capacity of the receiving sewer. To estimate the pre-development peak runoff rate, a maximum runoff coefficient of 0.5 may be used, irrespective of the actual pre-development imperviousness of the site.

[26] "Low Impact Development Stormwater Management Planning and Design Guide", CVC/TRCA, 2010, Page 4-71.

## ALTERNATIVES

The following is a brief description of the Master Plan alternatives considered in the context of storm drainage:

### Alternative 1: Do Nothing

This alternative considers no changes to the existing system.

### Alternative 2: Expand and/or Upgrade Existing Infrastructure

This alternative considers the implementation of infrastructure to extend the existing storm drainage system such as the case of new roadways to be implemented. The City's current Wet Weather Flow Management Policy requires that flows be controlled to within the limits of the existing system's capacity, subject to additional considerations, and therefore the option of upgrading existing infrastructure (i.e., increasing conveyance) is not applicable in this context.

### Alternative 3: Implement On-Site Best Practices

In the context of storm drainage, this alternative considers the implementation of stormwater management measures both on individual development sites as well as within potential roadways. Stormwater management measures would have the effect of reducing and/or controlling runoff volumes exiting the site. They also offer water quality benefits and may also address water balance objectives, depending on site suitability. The City has adopted a Wet Weather Flow Management Guideline (WWFMG) document that has detailed information to guide design practices in this regard.

### Alternative 4: Limit Community Growth

This alternative is deemed to not be applicable in this context and is accordingly not considered further for evaluation, but is presented here for the sake of completeness and consistency with the remainder of this document. The rationale underlying this position is based on the fact that this option does not decrease storm runoff. Moreover, the existing hydrology within the study area is characterized by hard surfaces such that any re-development of the lands would not materially exacerbate this condition given that the WWFMG would continue to be applied as per current City policy.

## ASSESSMENT & EVALUATION OF ALTERNATIVES

**Table 7 Assessment & Evaluation of Alternatives – Storm Drainage & Stormwater Management (SWM)**

<table>
<tr><th>Criteria</th><th>Sub-Criteria</th><th>Alternative 1:<br>Do Nothing</th><th>Alternative 2:<br>Expand/Upgrade Ex. Infrastructure</th><th>Alternative 3:<br>Implement On-Site Best Practices</th><th>Alternative 4:<br>Limit Growth</th></tr>
<tr><td rowspan="4">Technical Merit</td><td>Functionality</td><td rowspan="9">This alternative is not in compliance with the City's existing policies and guidelines.<br><br>This alternative does not consider extension of services into new roads.</td><td rowspan="9">New storm sewers constructed in new roads have minimal impacts.<br><br>Impacts would include marginally increased maintenance obligations and life-cycle costs for the City, offset by increased tax and user base offered by development.<br><br>Also, construction activities may impact the local environment (e.g., noise, vibration), although these are not expected to be significant in relation to the overall construction activity. Mitigation measures to be implemented.</td><td rowspan="9">No negative environmental impacts.<br><br>Reduction in runoff and quality controls will improve environmental health of watershed and reduce hydraulic loading to receiving drainage system.</td><td rowspan="9">Not applicable.<br><br>This option does not decrease runoff. Existing hydrology of study are is predominantly impervious and any new development will be subject to application of the City's Wet Weather Flow Management Guidelines.</td></tr>
<tr><td>Constructability</td></tr>
<tr><td>Maintenance Requirements</td></tr>
<tr><td>Life-Cycle Costs</td></tr>
<tr><td>Natural Environment</td><td>Impact on the Natural Environment</td></tr>
<tr><td rowspan="4">Socio-Economic Environment</td><td>Cultural Heritage Impact</td></tr>
<tr><td>Construction Impact</td></tr>
<tr><td>Residential and Business Impact</td></tr>
<tr></tr>
<tr><td colspan="2">Preferred Solution</td><td colspan="4">Expand existing system into any new roads.<br>Guided application of wet weather flow management guidelines for all new (re-)developments.<br>Encourage the "greening" of all public and private spaces.</td></tr>
</table>

## PREFERRED SOLUTION

The preferred solution consists of the following elements:

- **Expand Existing System into New Roads**

  Where new public roads are to be developed, the expansion of the existing storm sewer system into these roads for purposes of collecting and conveying drainage from new development sites as well as runoff originating on the roads themselves is a sensible standard practice. Runoff from new sewer systems will need to be limited in accordance with the City's Wet Weather Flow Management Guidelines discharge criteria (e.g., the lesser of: flow rate calculated with a runoff coefficient of 0.5; existing discharge rate; or the *pro rata* share of receiving sewer system capacity.

- **Guided Application of the City's Wet Weather Flow Management Guidelines (WWFMG)**

  In general, the City's WWFMG are to be applied for any developments in the study area with one modification relating to the discharge criteria to the local municipal infrastructure where release rates from each site are to be controlled to 75 L/s/ha. It is important to note that this applies only to areas which currently drain to the storm drainage system within the study area, and not to areas that drain to systems outside thereof[27].

[27] As a specific example, the storm drainage from Yorkdale Shopping Centre is currently directed easterly, away from the study area and, accordingly, any development activity or similar situations which cause changes in the way drainage is handled on this site must consider the context of the system currently accepting such drainage. Of course, this does not preclude the opportunity for specific

It is noted that this release rate (i.e., 75 L/s/ha) is lower than what would be calculated through strict application of the WWFMG in consideration of the known flooding concerns in the area and their direct relationship to stormwater runoff. Additional discussion on the formulation of this criterion is provided in Appendix C.

For greater clarity, the runoff resulting from the 100-year return period design storm is to be contained on site and released at or below the control rate established using the above criteria. This is expected to greatly reduce the amount of water entering the municipal sewers and road surfaces for most rainfalls.

- **"Greening"**

  The application of the WWFMG implies the implementation of green measures to control runoff from sites. Nevertheless, additional "greening" of private sites as well as on public roadways wherever practical is generally expected to lead to additional environmental benefits and represents good practice.

## Project Schedules

The extension of the storm drainage system into new roadways is a **Schedule A** activity. That is, these projects are approved and may proceed. The other elements of the preferred solution are either private-side controls or general "greening" measures, neither of which require fulfilment of the Class EA process in this context.

## Mitigation Measures

Of the few impacts associated with the extension of the storm drainage system into new roadways, they are all relatively minor and straightforward to deal with using standard, customary mitigation practices.

Environmental Impacts

- **Sedimentation and Dust Control** is required for all construction activities in the City of Toronto. The implementation of standard mitigation practices (e.g., silt fences, mud mats, etc.) are expected to provide adequate controls in this regard, and it is expected that this construction will occur concurrently with other construction activities in the roadway, thereby minimizing the duration during which these impacts may be felt.

Social Impacts

- **Traffic, Noise and Vibration** result from almost all construction activities of this nature. Similar to the above, standard mitigation practices are expected to provide adequate controls in this regard, and construction is expected to occur concurrently with other construction activities in the roadway, thereby minimizing the duration during which these impacts may be felt.
- **Safety During Construction** for both workers and the general public is of obvious importance. All construction practices will be required to conform to both the City's requirements as well as the Province's legislation in this regard.

studies to be conducted in support of directing storm drainage to other available systems, subject to satisfying the City with respect to the appropriateness thereof.

## IMPLEMENTATION CONSIDERATIONS

As with current development planning application processes, the proponent will be responsible for the preparation of Functional Servicing and Stormwater Management Reports in support of any applications. These reports should clearly document how the proposed servicing strategy for the development in question satisfies the WWFMG, as modified by the Preferred Solution noted above.

For larger sites, it may become necessary to test the impact of the development on the receiving downstream sewer network to determine whether there might be adverse impacts on the performance of the sewer system, depending on the extent of implementation of measures identified in the relevant Basement Flooding Study Area Class EAs. The need for this work should be established in consultation with Toronto Water and can be undertaken with the use of the InfoWorks CS dynamic hydraulic models developed as part of the Basement Flooding Study Area Class EAs.

Very small sites may be challenged to meet the guideline relating to water balance or water quality control. In such instances, it should be demonstrated by the development proponent that meeting these guidelines would be either overly burdensome or impossible. As an alternative in these cases, the City may consider accepting cash-in-lieu financial contributions which may be applied toward other improvements in the same watershed. Similarly, smaller sites may be challenged to meet the 75 L/s/ha controlled release rate criterion and, in such instances, the City may consider accepting vortex-flow control devices that offer lower release rates with protection against clogging.

# Public & Stakeholder Consultation

The Master Plan Class EA process culminating in this Infrastructure Master Plan for the Dufferin Street Avenue Study was conducted in conjunction with a land use planning exercise and alongside a Transportation Master Plan Class EA process. As a result, there were numerous points of contact with the public and other affected stakeholders as part of this integrated process. Below is some information related to the Local Advisory Committee and the Public Consultations which took place. In addition thereto, a Design Charrette also took place, however, is not reported here since its scope and intent is not concerned with municipal servicing infrastructure matters.

In general, there were relatively few comments received through this process in relation to municipal servicing infrastructure, and those that were received are reported and discussed below. More detailed information relating to the public consultation process is provided in Appendix D.

## LOCAL ADVISORY COMMITTEE (LAC)

A Local Advisory Committee (LAC) was formed and which held meetings throughout the course of the study and comprised local area residents, business owners and property owners. The role of the LAC was to advise City Planning staff and the consulting team of issues and opportunities within the area, and to provide feedback throughout the study process. The Summary Reports from these meetings are provided in the Appendix and include the list of participants. It is noted that there were no servicing issues or concerns raised during these interactions.

## PUBLIC OPEN HOUSE # 1

The first public open house[28] for this project took place on Wednesday 06 November 2013 with approximately 100 people participating. The format of the meeting included the following components:

- **Open House** format with display panels and an opportunity for participants to speak with City staff and the project team.
- Formal **Presentation** delivered by the project team followed by a **Q&A** session.
- Small **roundtable discussions** followed by a full-room plenary.

With respect to its relevance in the Master Plan Class EA process, this discretionary consultation took place at the end of Phase 1 of the process (i.e., identification of problem or opportunity).

### Comments Received

The following comments relating to municipal servicing infrastructure were received at this meeting and documented in the Meeting Summary report provided in the Appendix:

- **Improve the sewer and storm water drainage system and resolve issues related to flooding and drainage**, as experienced by residents living on McAdam Street and Mulholland Avenue. Several participants said the planning department could improve their process to demonstrate how input and feedback from the community is used.

  *Response: This study is sensitive to the flooding issues experienced in the vicinity of the study area, and the development of alternative solutions was to ensure that existing conditions were not worsened, and that opportunities to improve the performance of the supporting infrastructure systems were explored. The outcome of this work includes on-site stormwater storage and discharge control measures that are more conservative than those currently deployed by the City pursuant to its Wet Weather Flow*

[28] The terms "Public Meeting" and "Public Open House" were generally used interchangeably throughout this study.

*Management Guidelines and certainly represent an improvement over existing conditions. In addition, specific improvements to the wastewater conveyance system to control flow levels therein have been identified. It is important to note that it is not within the scope of this study to address current issues of this nature which have, or are being, more appropriately addressed through the City's much broader and focused Basement Flooding Protection Program. Specifically, the sewersheds within this study area have been, or are being, assessed in a detailed manner through the Basement Flooding Study Area Class EAs for Area 16 and 17. (See below for additional commentary and references to the City's relevant websites dealing with this matter.)*

## PUBLIC OPEN HOUSE # 2

The second public open house for this project took place on Wednesday 26 February 2014 with approximately 90 people participating. The format of the meeting included the following components:

- **Open House** format with display panels and an opportunity for participants to speak with City staff and the project team.
- Formal **Presentation** delivered by the project team followed by a **Q&A** session.
- Small **roundtable discussions** followed by a full-room plenary.

With respect to its relevance in the Master Plan Class EA process, this discretionary consultation took place in the midst of Phase 2 of the process (i.e., identifying and evaluating alternative solutions).

### Comments Received

The following comments relating to municipal servicing infrastructure were received at this meeting and documented in the Meeting Summary report provided in the Appendix:

- One of the "key messages" from the feedback received was that **basement flooding continues to be a priority for the neighbourhood.** This was followed up with questions for clarification:
  - **"Given the existing issues with basement flooding, how is basement flooding going to be addressed with new development?"**

    *Response provided at Open House and documented in Meeting Summary: "There are ongoing studies that deal specifically with basement flooding. We are here to ensure that whatever is proposed is not overwhelming the existing system or we will improve the infrastructure."*
  - **"When is something going to be done about basement flooding? What is the timeline for the studies to be complete"**

    *Response provided at Open House and documented in Meeting Summary: "The two basement flooding studies have identified a number of projects that will be carried out in the next several years. There is more information on the City's webpage which we will provide to you. This is definitely a factor in this study; this study will not provide recommendations that will make the issue worse."*

To follow on from the above, the City's relevant websites concerned with basement flooding in the study area are as follows:

- What the City is doing: Basement Flooding Protection Program[29]
- Current Basement Flooding Investigation Environmental Assessment Studies[30]
- Black Creek, Highway 401 and Dufferin Area 16 flooding investigation study[31]
- Investigation of Flooding: Study Areas 17, 18 & 19 (Allen Road / Hwy 401)[32]

- **Deliver sewer and stormwater improvements.**

  *Response: As noted above, the outcome of this work includes on-site stormwater storage and discharge control measures that are more conservative than those currently deployed by the City pursuant to its Wet Weather Flow Management Guidelines and specific improvements to the wastewater conveyance system to control flow levels therein have been identified. It is important to note that it is not within the scope of this study to address current issues of this nature which have, or are being, more appropriately addressed through the City's much broader and focused Basement Flooding Protection Program. Specifically, the sewersheds within this study area have been, or are being, assessed in a detailed manner through the Basement Flooding Study Area Class EAs for Area 16 and 17. (See above for additional commentary and references to the City's relevant websites dealing with this matter.)*

## PUBLIC OPEN HOUSE # 3

The third public open house for this project took place on Wednesday 23 April 2014 with approximately 65 people participating. The format of the meeting included the following components:

- **Open House** format with display panels and an opportunity for participants to speak with City staff and the project team.
- Formal **Presentation** delivered by the project team followed by a **Q&A** session.
- Small **roundtable discussions** followed by a report-back period.

With respect to its relevance in the Master Plan Class EA process, this discretionary consultation took place toward the end of Phase 2 of the process (i.e., identification of preliminary preferred alternative). The feedback received during this interaction and within the subsequently allotted comment period was used to develop the Preferred Alternative documented herein.

### Comments Received

Comments were received from the engineering consultants representing Yorkdale Shopping Centre in relation to infrastructure supporting future expansions of the mall. The nature of the information provided was preliminary and extended well beyond the defined limits of the Dufferin Street Avenue Study. Accordingly, these future needs were not able to be incorporated into the projected planning populations developed and used for the Avenue Study and, by extension, this work which is based thereon. Therefore, assessment of the supporting municipal infrastructure systems for Yorkdale Shopping Centre's future needs was determined to lie outside of the scope of this particular study. Nevertheless, it is not expected that any of the work and recommendations made herein will unduly constrain future expansion of Yorkdale and any future studies in support of the expansion are expected to be able to identify upgrades to the existing system, if any are required.

[29] http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=69c75830a898e310VgnVCM10000071d60f89RCRD&vgnextchannel=f041ffa6ee33f310VgnVCM10000071d60f89RCRD
[30] http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=51e28da78b151410VgnVCM10000071d60f89RCRD
[31] http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=7d31a66bffa51410VgnVCM10000071d60f89RCRD&vgnextfmt=default
[32] http://www1.toronto.ca/wps/portal/contentonly?vgnextoid=bf31a66bffa51410VgnVCM10000071d60f89RCRD&vgnextfmt=default

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# Appendix A

## Water Distribution System Modelling Information & Results

Infrastructure Master Plan | Dufferin Street Avenue Study
City of Toronto
Final Report | November 2014

This appendix to the Infrastructure Master Plan provides relevant information in respect of the modelling of the water distribution system affecting the Dufferin Street Avenue Study.

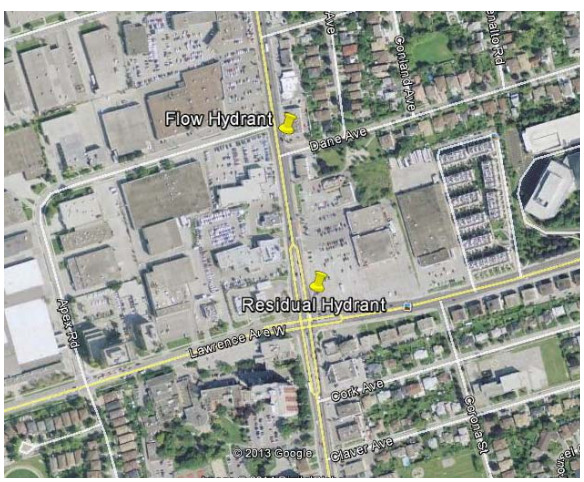
### Boundary Conditions

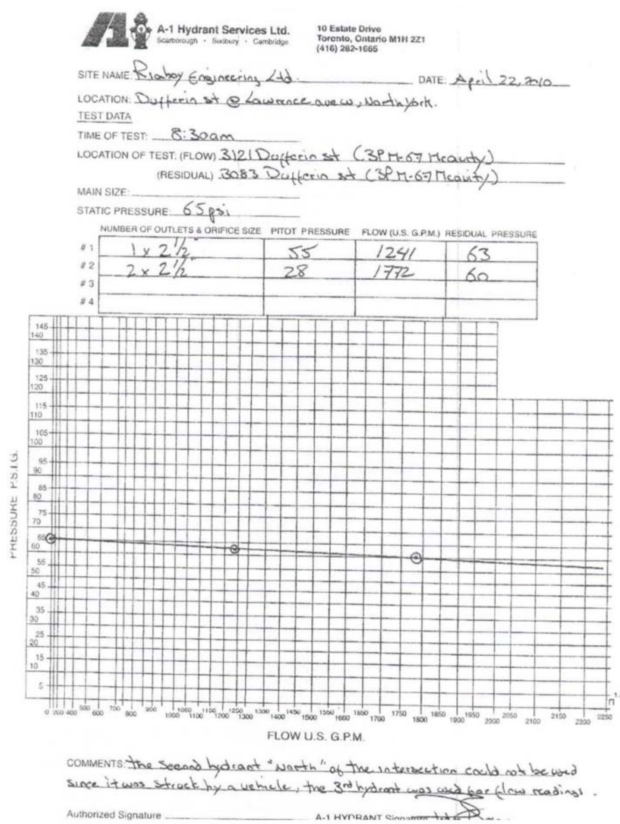
Based on information provided by Toronto Water and the City's Development Engineering group in the North York District, several hydrant flow tests were reviewed for applicability with the following selected for use in this work, largely based on location and currency:

Dufferin Street @ Lawrence

- Date Conducted: 22 April 2010
- Elevation: ±180.6 m
- Estimated Flow @ 20 psi: 300 L/s

| Flow | | Residual Pressure | | HGL |
|---|---|---|---|---|
| (usgpm) | (L/s) | (psi) | (m $H_2O$) | (m) |
| 0 | 0 | 65 | 45.7 | 226.3 |
| 1241 | 78 | 63 | 44.3 | 224.9 |
| 1772 | 112 | 60 | 42.2 | 222.8 |





A-1 Hydrant Services Ltd.
Scarborough · Sudbury · Cambridge
10 Estate Drive
Toronto, Ontario M1H 2Z1
(416) 282-1665

SITE NAME: Riaboy Engineering Ltd. DATE: April 22, 2010
LOCATION: Dufferin st @ Lawrence ave w, North york.
TEST DATA
TIME OF TEST: 8:30am
LOCATION OF TEST: (FLOW) 3121 Dufferin st (3P M-67 Mcavity)
(RESIDUAL) 3083 Dufferin st (3P M-67 Mcavity)
MAIN SIZE:
STATIC PRESSURE: 65psi

| | NUMBER OF OUTLETS & ORIFICE SIZE | PITOT PRESSURE | FLOW (U.S. G.P.M.) | RESIDUAL PRESSURE |
|---|---|---|---|---|
| # 1 | 1 x 2½" | 55 | 1241 | 63 |
| # 2 | 2 x 2½ | 28 | 1772 | 60 |
| # 3 | | | | |
| # 4 | | | | |



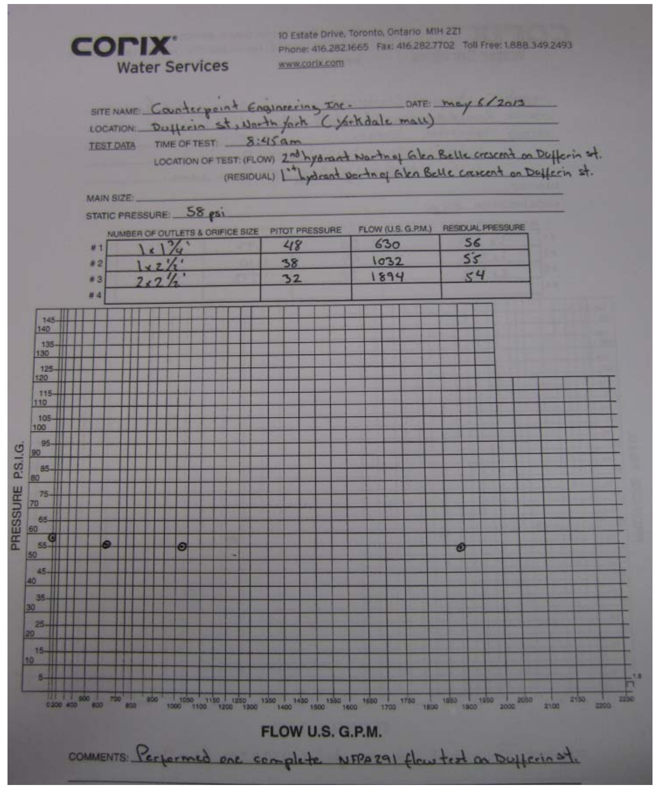
COMMENTS: the second hydrant "North" of the intersection could not be used since it was struck by a vehicle, the 3rd hydrant was used for flow readings.

Authorized Signature A-1 HYDRANT Signature

## Dufferin Street @ Yorkdale

- Date Conducted: 13 May 2013
- Elevation: ±190.0 m
- Estimated Flow @ 20 psi: 1,000 L/s

| Flow | | Residual Pressure | | HGL |
|---|---|---|---|---|
| (usgpm) | (L/s) | (psi) | (m $H_2O$) | (m) |
| 0 | 0 | 58 | 40.8 | 230.8 |
| 630 | 40 | 56 | 39.4 | 229.4 |
| 1032 | 65 | 55 | 38.7 | 228.7 |
| 1894 | 119 | 54 | 38.0 | 228.0 |

corix Water Services
10 Estate Drive, Toronto, Ontario M1H 2Z1
Phone: 416.282.1665 Fax: 416.282.7702 Toll Free: 1.888.349.2493
www.corix.com

SITE NAME: Counterpoint Engineering Inc. DATE: may 6/2013
LOCATION: Dufferin st, North York (Yorkdale mall)
TEST DATA TIME OF TEST: 8:45am
LOCATION OF TEST: (FLOW) 2nd hydrant North of Glen Belle crescent on Dufferin st.
(RESIDUAL) 1st hydrant North of Glen Belle crescent on Dufferin st.
MAIN SIZE:
STATIC PRESSURE: 58 psi

| | NUMBER OF OUTLETS & ORIFICE SIZE | PITOT PRESSURE | FLOW (U.S. G.P.M.) | RESIDUAL PRESSURE |
|---|---|---|---|---|
| # 1 | 1 x 1 3/4' | 48 | 630 | 56 |
| # 2 | 1 x 2 1/2' | 38 | 1032 | 55 |
| # 3 | 2 x 2 1/2' | 32 | 1894 | 54 |
| # 4 | | | | |

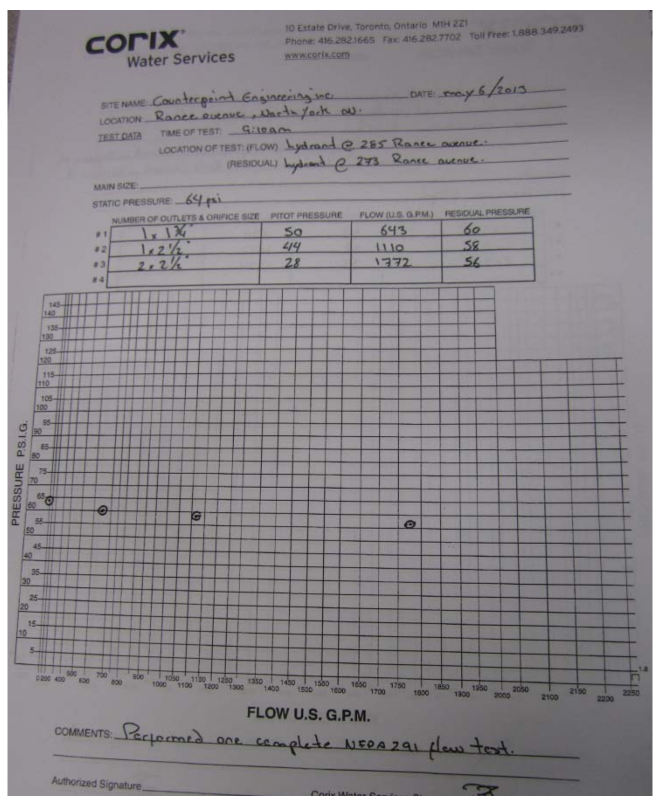
PRESSURE P.S.I.G.
FLOW U.S. G.P.M.

COMMENTS: Performed one complete NFPA 291 flow test on Dufferin st.

## Ranee Avenue

- Date Conducted: 13 May 2013
- Elevation: ±188.0 m
- Estimated Flow @ 20 psi: 570 L/s

| Flow | | Residual Pressure | | HGL |
|---|---|---|---|---|
| (usgpm) | (L/s) | (psi) | (m $H_2O$) | (m) |
| 0 | 0 | 64 | 45.0 | 233.0 |
| 643 | 41 | 60 | 42.2 | 230.2 |
| 1110 | 70 | 58 | 40.8 | 228.8 |
| 1772 | 112 | 56 | 39.4 | 227.4 |

corix Water Services
10 Estate Drive, Toronto, Ontario M1H 2Z1
Phone: 416.282.1665 Fax: 416.282.7702 Toll Free: 1.888.349.2493
www.corix.com

SITE NAME: Counterpoint Engineering inc. DATE: may 6/2013
LOCATION: Ranee avenue, North York ON.
TEST DATA TIME OF TEST: 9:10am
LOCATION OF TEST: (FLOW) hydrant @ 285 Ranee avenue.
(RESIDUAL) hydrant @ 273 Ranee avenue.
MAIN SIZE:
STATIC PRESSURE: 64 psi

| | NUMBER OF OUTLETS & ORIFICE SIZE | PITOT PRESSURE | FLOW (U.S. G.P.M.) | RESIDUAL PRESSURE |
|---|---|---|---|---|
| # 1 | 1 x 1 3/4' | 50 | 643 | 60 |
| # 2 | 1 x 2 1/2' | 44 | 1110 | 58 |
| # 3 | 2 x 2 1/2' | 28 | 1772 | 56 |
| # 4 | | | | |

PRESSURE P.S.I.G.
FLOW U.S. G.P.M.

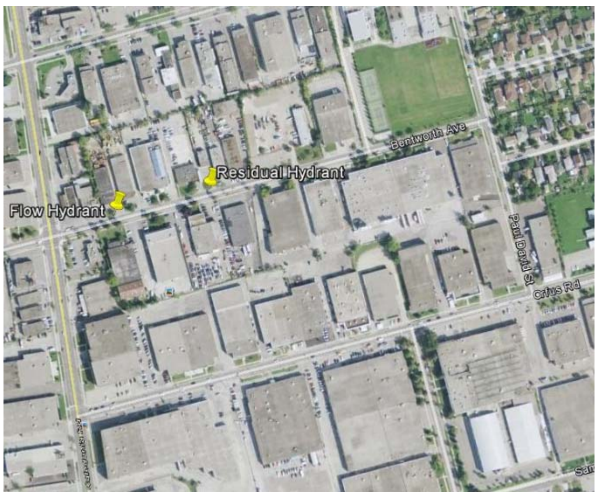
COMMENTS: Performed one complete NFPA 291 flow test.

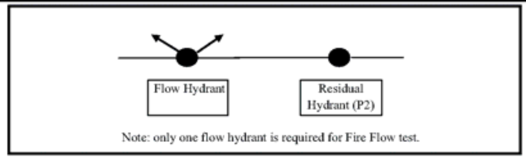
Authorized Signature

## Bentworth Avenue

- Date Conducted: 31 July 2007
- Elevation: ±182.4 m
- Estimated Flow @ 20 psi: 260 L/s

| Flow | | Residual Pressure | | HGL |
|---|---|---|---|---|
| (usgpm) | (L/s) | (psi) | (m $H_2O$) | (m) |
| 0 | 0 | 67.3 | 47.3 | 229.7 |
| 903 | 57 | 64.8 | 45.6 | 228.0 |
| 1168 | 74 | 63.2 | 44.4 | 226.8 |



Flow Hydrant | Residual Hydrant (P2)

Note: only one flow hydrant is required for Fire Flow test.

Date: 31-Jul-07 Time: 12:10pm

Location: Bentworth Avenue

Test performed by: David Kerins

Test No. 110 Static Pressure Hydrant 67.3 psi

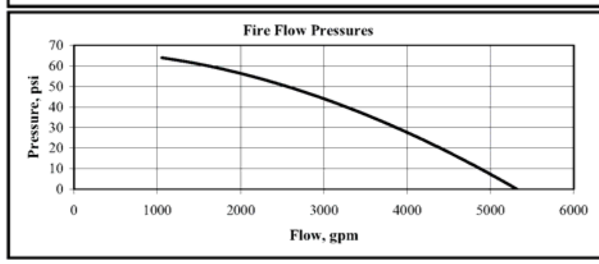
Required Residual Pressure During Fire Flow 20 psi

| Flow - 1 Hydrant Port Open | | | Flow - 2 Hydrant Ports Open | | |
|---|---|---|---|---|---|
| Flow Rate | 903 | usgpm | Flow Rate | 1168 | usgpm |
| Residual Pressure | 64.8 | psi | Residual Pressure | 63.2 | psi |
| Fire Flow | 4430 | usgpm | Fire Flow | 4361 | usgpm |

| | | | | |
|---|---|---|---|---|
| NFPA Average Fire Flow Available at | 20 | psi is | 4396 | usgpm |
| MOE Average Fire Flow Available at | 138 | kPa | 277 | l/s |
| NFPA Hydrant Colour Code | BLUE | | | |

$Q_f = Q_t (P_s - P_f)^{0.54} / (P_s - P_t)^{0.54}$

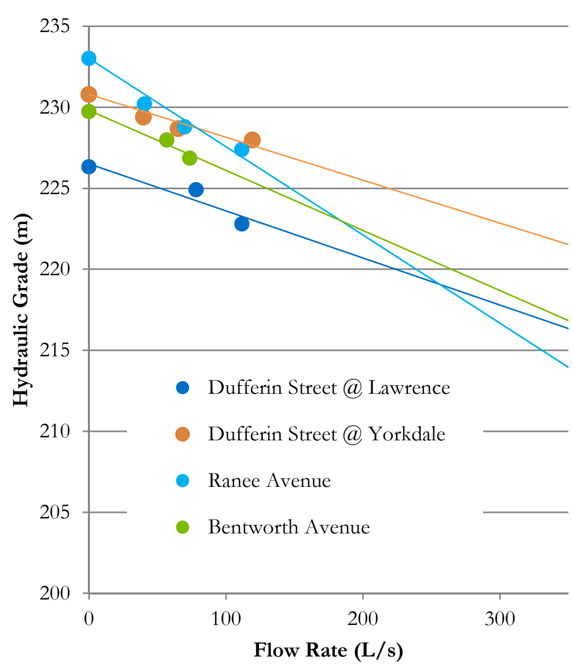
$Q_f$=flow at residual pressure, gpm
Qt=flow during test, gpm
Ps=Static pressure, psi
Pf=residual pressure during fire, psi
Pt=residual pressure during test



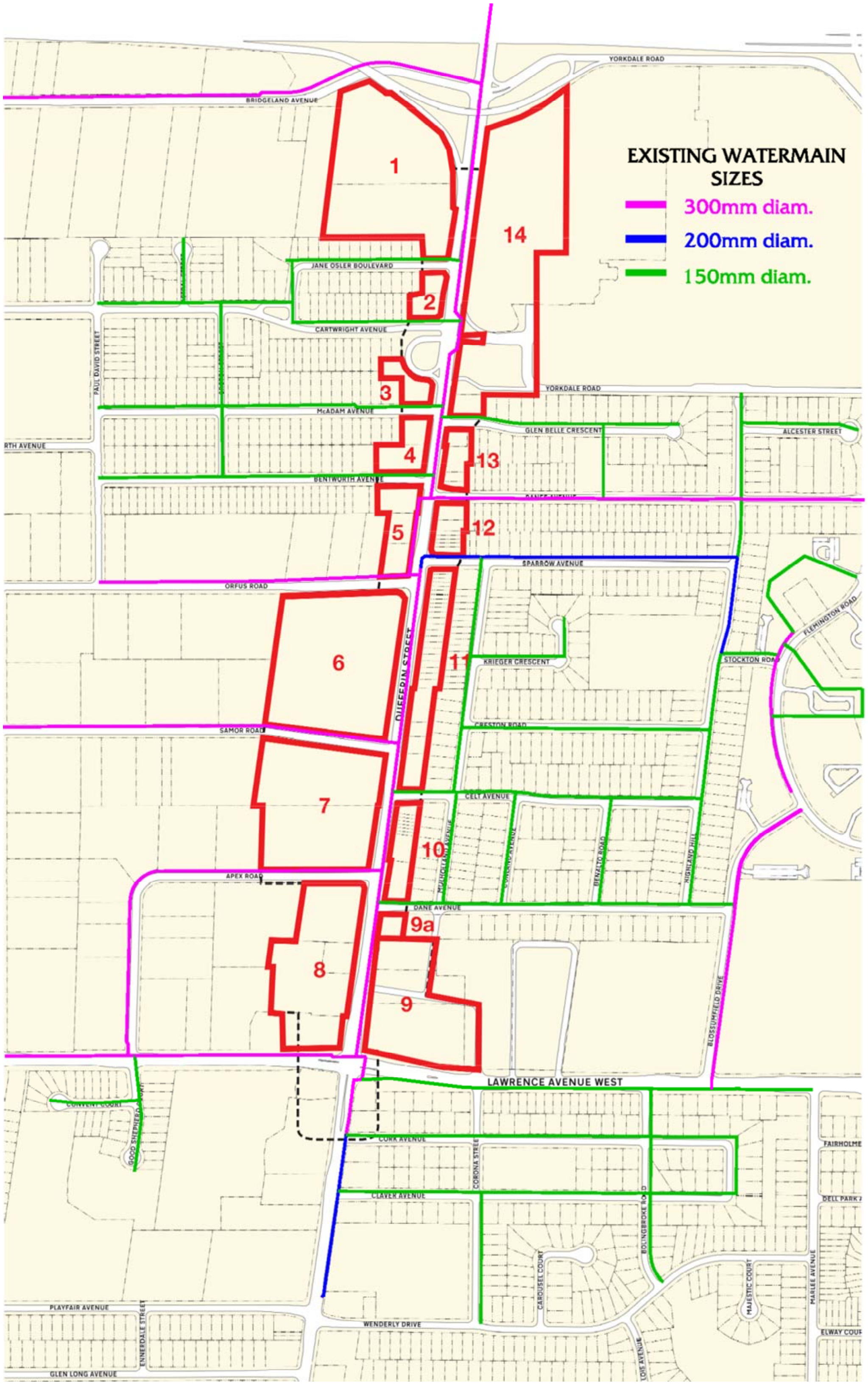

## Modelling of Boundary Conditions

The above hydrant flow test results, adjusted for elevation and shown in terms of hydraulic grade, are presented to the right. For purposes of hydraulic modelling, the boundary conditions are modelled as fixed head reservoirs with a hydraulic grade of 220 m, being somewhat conservative in light of the hydrant flow test information.

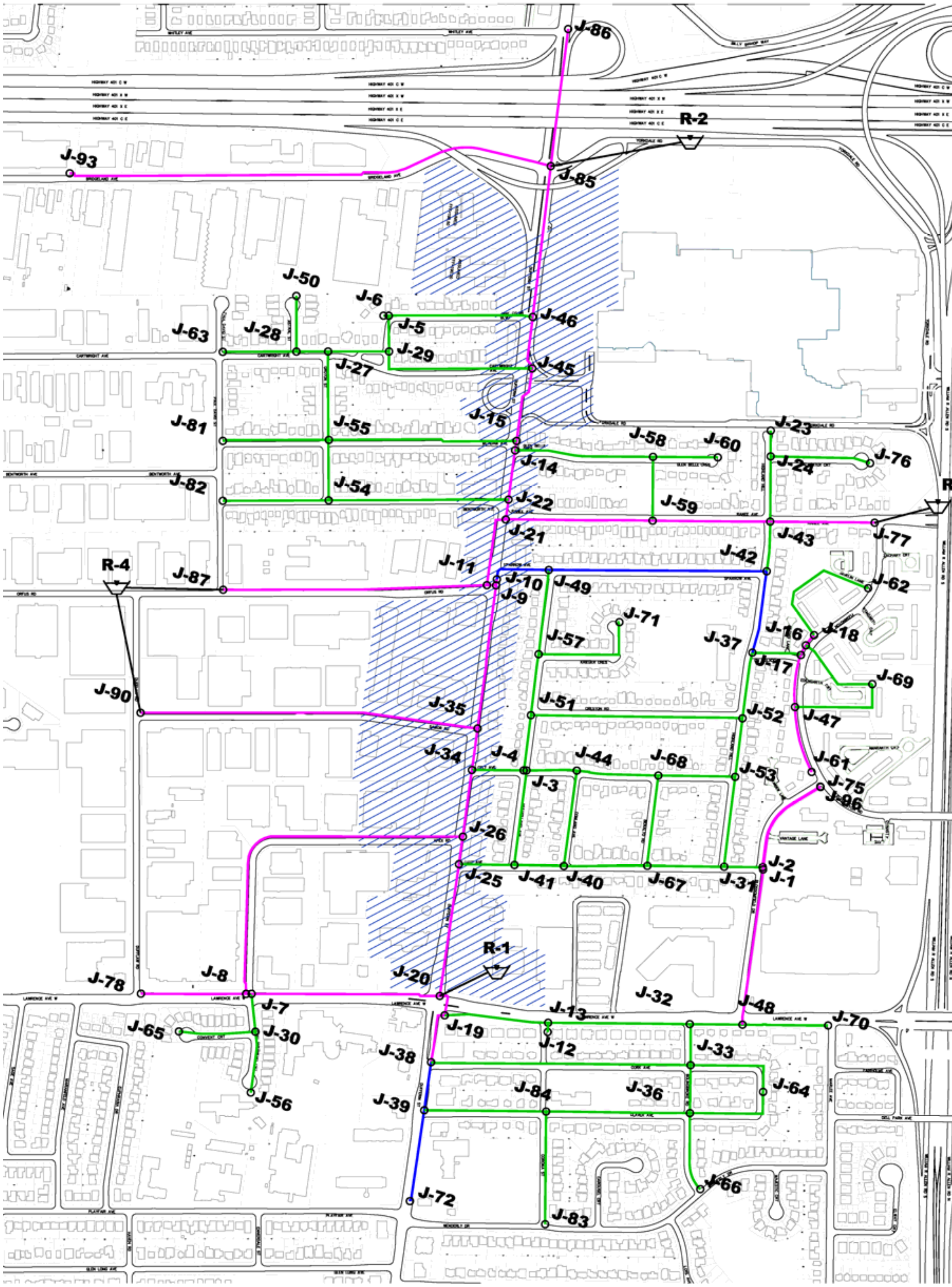
The following pages provide an illustration of the water distribution system along with the development block numbers for the Study Area, as well as a schematic representation of the water distribution model used in this analysis.



### Existing Water Distribution Network and Study Area Development Block Numbers



## Schematic of Water Distribution Model



## Demand Estimation

The following design criteria were applied to assess the existing water distribution system's ability to support the anticipated intensification within the study area[1]:

- Average Day Demand, residential: 191 Lpcd (multi-unit)
- Minimum Hour Peaking Factor: 0.84 (apartments, commercial, industrial & institutional)
- Peak Hour Peaking Factor: 2.50 (apartments), 1.20 (commercial) and 0.90 (industrial & institutional)
- Maximum Day Peaking Factor: 1.30 (apartments), 1.10 (commercial, industrial & institutional)
- Fire Flow: 19,000 L/min (317 L/s; commercial over 2 stories, high-rise residential, industrial park)
- Preferred Pressure Ranges:
  - Average Day & Maximum Day: 350 kPa to 550 kPa
  - Minimum Hour & Peak Hour: 275 kPa to 700 kPa

### Existing & Future (2031) Conditions within Study Area

| | Existing Conditions | | | | | Future Conditions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Study Area Block | Employment | Population | Avg Day (L/s) | Max Day (L/s) | Peak Hour (L/s) | Employment | Population | Avg Day (L/s) | Max Day (L/s) | Peak Hour (L/s) |
| 1 | 220 | 0 | 0.486 | 0.535 | 0.584 | 234 | 2284 | 5.565 | 6.121 | 6.678 |
| 2 | 34 | 0 | 0.075 | 0.083 | 0.090 | 9 | 184 | 0.426 | 0.468 | 0.511 |
| 3 | 5 | 231 | 0.522 | 0.677 | 1.291 | 5 | 231 | 0.522 | 0.677 | 1.291 |
| 4 | 35 | 0 | 0.077 | 0.084 | 0.092 | 14 | 289 | 0.669 | 0.736 | 0.803 |
| 5 | 40 | 0 | 0.089 | 0.098 | 0.107 | 12 | 245 | 0.569 | 0.625 | 0.682 |
| 6 | 300 | 0 | 0.664 | 0.731 | 0.797 | 116 | 2401 | 5.565 | 6.121 | 6.678 |
| 7 | 8 | 0 | 0.017 | 0.019 | 0.021 | 99 | 2043 | 4.736 | 5.210 | 5.684 |
| 8* | 60 | 0 | 0.133 | 0.146 | 0.159 | 97 | 2010 | 4.659 | 5.125 | 5.591 |
| 9a | 30 | 0 | 0.066 | 0.073 | 0.079 | 4 | 87 | 0.201 | 0.222 | 0.242 |
| 9 | 160 | 2701 | 6.324 | 8.150 | 15.349 | 160 | 2701 | 6.324 | 8.150 | 15.349 |
| 10 | 75 | 10 | 0.188 | 0.211 | 0.254 | 15 | 320 | 0.741 | 3.770 | 7.126 |
| 11 | 82 | 75 | 0.346 | 0.413 | 0.628 | 36 | 747 | 1.730 | 11.136 | 21.049 |
| 12 | 65 | 17 | 0.180 | 0.205 | 0.264 | 11 | 228 | 0.529 | 1.991 | 3.764 |
| 13 | 25 | 0 | 0.056 | 0.061 | 0.067 | 10 | 213 | 0.495 | 0.544 | 0.593 |
| 14 | 10 | 0 | 0.023 | 0.025 | 0.027 | 25 | 0 | 0.056 | 0.062 | 0.067 |

*Populations used for Block 8 are 25% higher than preferred planning solution to afford flexibility in final density.

### Existing Development External to Study Area

For areas external to the Dufferin Street Avenue Study, but within the modelling boundary, the following assumptions were applied to the existing land uses:

- Residential: 1.9 persons per unit[2] or 170 persons per hectare[1] (townhouse)
- Industrial 136 persons per hectare[1]
- Commercial: 110 persons per hectare[1]
- Institutional: 86 persons per hectare[1]

[1] City of Toronto, "Design Criteria for Sewers and Watermains", First Edition, November 2009

[2] DTAH Development Statistics for Dufferin Street Avenue Study