# B.1

**Phosphorus**

Aggreement on Total Phosphorus ESSA

1. The Town's target for total phosphorus of no-net-increase in phosphorus loading following development will be met with use of enhanced level (level 1) of stormwater management ponds alone.

2. There will be no requirement to analyse total phosphorus loading in any subsequent studies.

3. The towns consultants will revise the subwatershed to reflect the above statements

4. An example of the "treatment-train" approach will be included in a revised appendix to the reports. This example will describe the effect of infiltration controls, if any on reduced SWM pond size and loadings of total suspended solids and phosphorus.

[redacted]

May 21 2007.

On Behalf of F. E. Lovat

On Behalf of Donald A. Weatherbe

**Total Phosphorus:**

Add the following paragraph to Section 7.4.5 (second last paragraph):

"It is an objective of the Town that there be no net increase in phosphorus loadings as a result of development. It is recognized that this objective is achieved by requiring stormwater management ponds stormwater in North Oakville East to meet the MOE's Enhanced (Level 1) Guidelines. Provided the MOE's Enhanced (Level 1) Guidelines are met, there is no requirement to further analyze total phosphorus during development approval."

# B.2

**Hydrology Model and Hydraulic Model**

**NORTH OAKVILLE SUBWATERSHED MANAGEMENT STRATEGY (WITHOUT PREJUDICE)**

**Mediation Item:** **Hydrology model and hydraulic model for a portion of Joshua's Creek floodplain mapping (May 31, 2007)**

**Issue:**

Clarification of hydrology and hydraulics modeling details for the purpose of preparing final Joshua's Creek floodplain mapping south of Burnhamthorpe Road along the western tributary of Joshua's Creek ("area of interest").

**Agreement:**

a) The Town's existing conditions GAWSER model will be used for the calculation of a range of flows to be input to the hydraulic model. Modifications will be made to the model to increase model discretization and add reservoir routing. Changes to the GAWSER model (discretization) must ensure that hydrograph characteristics at the confluence with the Main Branch are generally replicated.

b) The HEC2 model will be used for the calculation of water levels for the 100 year and Regional Storm. The May 2007 topographic survey will provide existing conditions topographic information as the basis for this model. The model will be started at critical depth at a location a few hundred metres downstream of the area of interest such that the downstream boundary conditions and water levels are accurately reflected in the model.

c) There are two methods available to refine the flood levels through the area of interest. They include applying appropriate areal flow reduction (on drainage area basis) throughout the subcatchment and reservoir routing analyses. The HEC2 model will be run first using solely flow reductions along the creek system and secondly by adding results of the reservoir routing analysis.

d) To develop the discharge storage curve for reservoir routing, HEC2 results are to be used along with new topographic data. This should be done in two stages – using low flow and high flows.

e) The reservoir routing analysis is to be carried out by routing the flow hydrographs through a reservoir that reflects the flood storage available in the area of interest. The reservoir routing analysis will result in a predicted water level and potential reduction in flows. These reduced flows should then be introduced into the HEC2 model to check the calculated surface water levels. The higher of these water levels calculated from the reservoir routing analyses (reservoir routing water level from GAWSER model or HEC2 model using reservoir routed flows) will be used for this methodology. The use of the reservoir routing approach must consider existing and future Regional Storm runoff volumes.

f) The Town and NOMI consultants will carry out separate analyses, compare results and review with Conservation Halton prior to finalizing flood levels in the area of interest.

g) The final floodplain mapping for the area of interest is subject to regulatory approval of Conservation Halton.

# B.3

**Regional Storm Flood Protection**

**NORTH OAKVILLE SUBWATERSHED MANAGEMENT STRATEGY (WITHOUT PREJUDICE)**

**Mediation Item: Regional Storm Flood Protection (May 30, 2007)**

**Issue:**

The Subwatershed Management Strategy for the Oakville North Subwatersheds and the witness statements of Ray Tufgar and Ray Guther currently require that the stormwater management targets include control of flow peaks to pre-development levels for all design events up to and including the Regional Storm Event.

The concern is that control to Regional Storm levels results in excessively large SWM ponds and that the control requirements include control of peak flow rates to pre-development levels for all return period events up to and including the 1:100 year design flow only, with the exception of Joshua's Creek where control of the Regional Storm event is to be included.

The principle behind providing peak flow control of the Regional Storm is to protect downstream landowners from increased risk to life, and increased risk to property damage.

**Agreement:**

The Subwatershed Study recommends that stormwater management targets include control of the peak flow to predevelopment levels for the 2 year to 100 year return period events and the Regional Storm. However, future land use development applications may carry out an investigation of the potential increase to flood risk to confirm if Regional Storm controls are necessary. This analysis is to include the increase in risk to life as well as the potential for flood risk to private, Municipal, Regional, Provincial and Federal property under Regional Storm conditions. If the study finds, and the Town and Conservation Halton concur in that finding, that no increase in risk occurs to downstream landowners or public uses, the Town in conjunction with Conservation Halton will conclude, subject to consideration of any other relevant factor within their respective mandates, that control at the Regional Storm level is not required. Evaluation of risk may include but not be limited to:

- The analysis will be conducted for all development within Oakville North for the watershed under consideration;
- The analysis for potential increase in flood risk will be conducted for the entire downstream watercourse to its outlet at Sixteen Mile Creek;
- That the examination of potential increase to flood risk include:
  - Potential increase in flood elevations;
  - Potential increase in flood velocities;
  - Potential for the foregoing increases to adversely effect all landowners including individuals, municipal agencies, provincial agencies (MTO, MOE, etc.), and federal agencies;
  - Potential for the foregoing increases to adversely effect all land uses including road crossings, private access roads, parks, storm sewer outlets, etc.;
  - Potential for the implementation of mitigation measures to address any increase in risk as an alternative to the requirement to control Regional Storm flows.

It is understood that not all increases in flood velocity or flood elevation will necessarily lead to an

[redacted]

Without Prejudice
June 19, 2007

**Proposed Policy regarding Regional Storm Controls**

1. Change the title of Section 7.4.13 from "Floodplains" to "Flood Control".

2. Add the following new section number and title to the existing policy in Section 7.4.13:

   "7.4.13.1 FLOODPLAINS"

3. Add a new Section 7.4.13.2 as follows:

   "7.4.13.2 PEAK STORMWATER FLOW CONTROL

   The North Oakville Creeks Subwatershed Study recommends that stormwater targets include control of the peak flow to predevelopment levels for various return periods, including the Regional Storm. Through the land use development application process, an investigation of the potential increase to flood risk may be carried out to confirm if Regional Storm controls are necessary, in accordance with the directions established in the North Oakville Creeks Subwatershed Study.

# B.4

**Erosion Control for Storm Water/Management Erosion Thresholds**

# North Oakville
# Subwatershed Management Strategy
# (Without Prejudice)

**Mediation Item: Erosion Control for Stormwater Management (May 31, 2007)**
**Erosion Thresholds**

**Issue:**

Clarification of requirements for determination of erosion thresholds and erosion control analysis for stormwater management.

**Agreement:**

While it is acknowledged that water quality and water quantity are integral components of the proposed stormwater management (including treatment train) approach in North Oakville, so too is erosion control. Stormwater flows need to be controlled and released in such a manner that existing channel erosion or aggradation is not exacerbated by the land use change. This is accomplished through the incorporation of erosion thresholds within the stormwater management strategy.

Erosion thresholds will be determined for each stormwater management facility, based on the following steps:

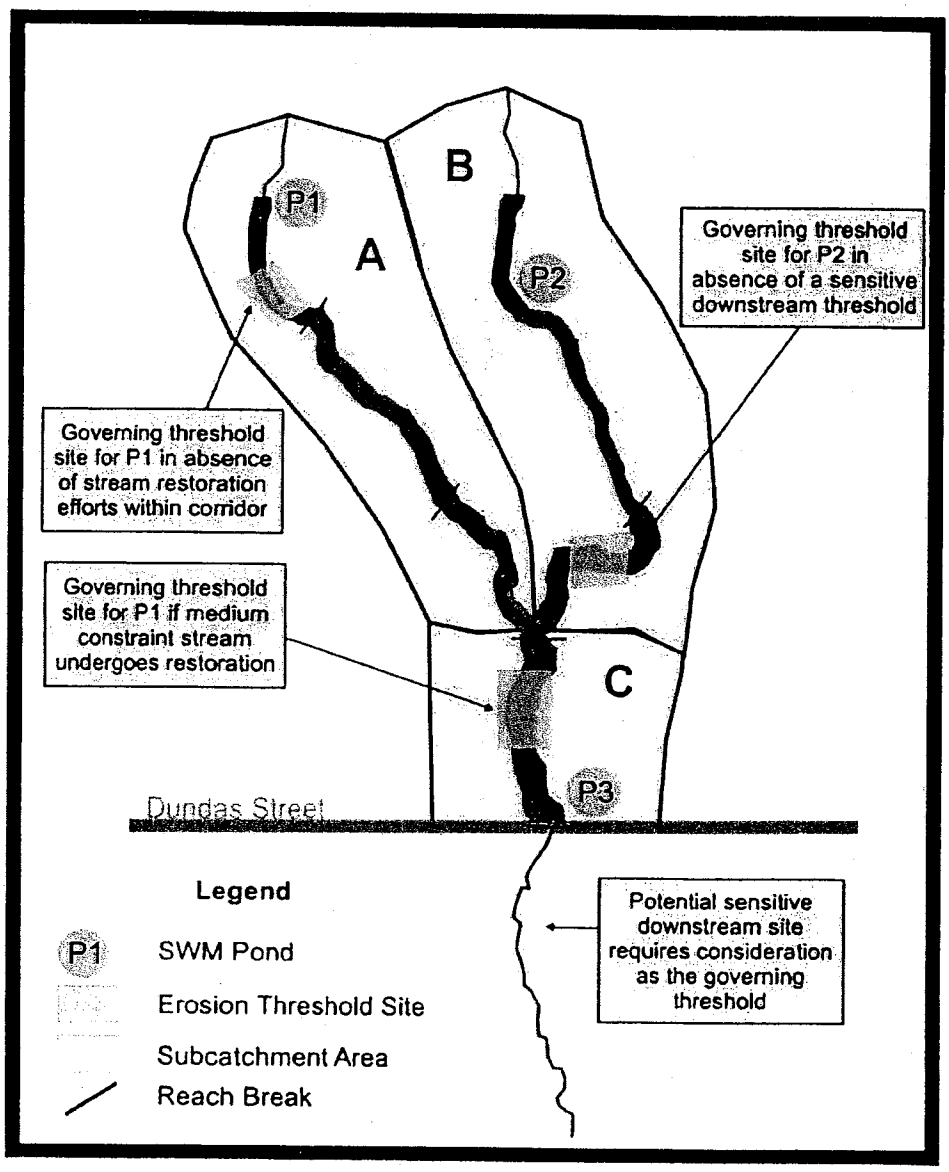
1. Downstream of a proposed SWM facility, the most sensitive (or less stable) reach will be identified through a Rapid Field Assessment or suitable synoptic level survey. As a general approach, the spatial extent should include the stream length to the next downstream confluence and at least one reach (as defined in the EIR stage) beyond to ensure that highly sensitive channels, in relative close proximity to the SWM Pond, are included in the assessment (**Figure A**).
2. Once the most sensitive reach has been selected, detailed field work will be completed to a suitable level of resolution to be representative of field conditions. The data collected must be thorough enough to permit a range of hydraulic analyses to be completed.
3. The erosion threshold would be selected through a suite of analytical techniques, including, but not limited, to substrate and bank shear stress and permissible velocity. The actual threshold value will be selected based, in part, on the experience of the practitioner and shall be representative of the field conditions.
4. It is possible that the site selected is so unstable that the stormwater management may not satisfy the erosion control target. In this instance, restoration of the stream would be warranted and an erosion threshold from the next most sensitive area be used.
5. In the North Oakville area, erosion threshold work will need to be extended downstream of Dundas Street (beyond the boundary of the EIR Subcatchments and as per Step 1). Also, while it is anticipated that numerous thresholds would be

warranted in each watershed, it is possible that one, sensitive downstream value may govern (see **Figure A**).

Once the erosion threshold has been provided, exceedance analyses should be completed using a continuous flow model. Specifically, the frequency and duration of time (expressed as hours) that the erosive threshold flow is exceeded, in the pre-development condition, is to be matched in the post-development condition. It is acknowledged that matching may be difficult due to scalar factors, sensitivity of the analytical methods and degree of stability of the receiving channel. It is agreed that, if the results are within approximately 5% of the pre-development condition, this constitutes a 'match'. Before this is accepted, work needs to be completed as to the likely effects and implications of this nominal increase to determine whether further mitigation or model refinement or monitoring is warranted. In this approach, any increase in runoff volume would be released from the stormwater management facility below the erosive threshold flow. This would typically take the form of increased baseflow in the channel.

It should be noted that, while the erosion threshold assessment is conducted on a single Subcatchment Area basis, the proponent must be aware that areas downstream need to be considered when selecting the most sensitive reach as depicted in **Figure A**.

**Figure A.** A hypothetical example illustrating relevant erosion threshold procedures in the context of Subcatchment Areas.




**Note:** The most sensitive reach for SWM P1 is highlighted in the green shaded area downstream of the pond. However, an assessment of downstream reaches beyond the subcatchment boundary is required in order to ensure that no additional impacts are created. Moreover, if restoration of the medium constraint stream is anticipated, then an analysis of downstream reaches would be required to determine the governing threshold for SWM P1. As discussed in the previous text, the governing threshold could be located downstream of Dundas Street (beyond the boundary of the EIR Subcatchments), depending on the relative sensitivity of stream conditions. In this example, the shaded area in Subcatchment A would govern as the most sensitive reach for SWM P1. Also, in

the event that the shaded area downstream of SWM P1 was so unstable that erosion threshold targets could not be met, this reach could be restored and enhanced and the threshold for Subcatchment C would then apply.

# B.5

**Infiltration**

**OAKVILLE NORTH SUBWATERSHED MANAGEMENT STRATEGY (WITHOUT PREJUDICE)**

**Infiltration**

**Issue:**

As part of the North Oakville Creeks Subwatershed Study infiltration of surface water to the groundwater system was considered and recommendations have been provided as it relates to future land use changes, drainage and stormwater management.

Concern has been expressed that clarification is needed on some of the report wording.

**Proposed Approach:**

A meeting was held to discuss the proposed wording changes. The following notes summarize the results.

1. We reviewed witness statement comments regarding the hydrogeology findings in the Town of Oakville, North Oakville Creeks Subwatershed Study.

2. It is agreed that, with respect to groundwater infiltration issues, there are refinements required in the wording between Section 6.3.6.2 (management strategy) and Section 7.4.5 (implementation strategy). In addition, clarification is needed between the first and last bullets in Sections 7.4.5 as they are currently presented.

3. It is agreed that these refinements can be achieved by rewording the first and last bullets in Section 7.4.5 as follows:

First Bullet:

ξ Any underground services must consider hydrogeological functions/characteristics and must use Best Management Practices, where feasible and practical, to preserve:
- Groundwater sources to terrestrial features;
- Wetland features (i.e., maintain water levels);
- Baseflow to streams;
- Groundwater quality;
- Groundwater recharge (e.g., use of perforated storm sewers – Etobicoke Infiltration System)

Last Bullet:

ξ Design servicing to minimize net changes to the hydrological and hydrogeologic conditions.

[redacted]

February 22, 2007

# B.6

**Maintaining Stage/Storage/Discharge Characteristics**

# OAKVILLE NORTH SUBWATERSHED MANAGEMENT STRATEGY (WITHOUT PREJUDICE)

## Maintaining Stage – Storage - Discharge Characteristics

**Issue:**

The Subwatershed Management Strategy for the Oakville North Subwatershed Strategy and witness statements of Ray Tufgar and Ray Guther currently require that, if any alternatives are made to a stream, or its floodplain, that the stage-storage-discharge characteristics are to be maintained as under existing conditions, up to and including the Regional Storm Event.

It is acknowledged that medium constraint streams may be lowered in North Oakville, subject to the necessary approvals.

The concern is that, if a stream is lowered, the frame of reference for the stage (or elevation) will change and it is not feasible to maintain stage-storage-discharge.

The principle behind maintaining stage-storage-discharge is to preserve the floodplain storage characteristics through various flow depths. This will then maintain peak discharge levels for the full range of design events, thereby protecting downstream lands from potential increases in either flood depths or erosion. Similarly, when flow stages are maintained for the full range of flows, it prevents upstream lands from being impacted by increased flood elevations, and acts to maintain depth-storage-characteristics to preserve floodplain storage.

**Revised Wording:**

Any modification to a stream or its associated floodplain must address the storage characteristics in such a manner as to protect both the downstream receiving reach and upstream reaches from adverse impacts as follows:

- Storage-discharge characteristics must be preserved in a manner to prevent increases in peak flowrates in downstream reaches.
- Any changes to a stream reach must address upstream impacts as well, specifically ensuring that there are no adverse impacts on hydraulics (i.e. no increase in flood levels) on adjacent and upstream properties
- Where application of the storage-discharge criteria results in an adverse impact to an upstream or adjacent property (i.e. increase in flood elevation), adherence to stage-storage-discharge criteria (i.e. thereby avoiding the impact), or alternatively obtaining the consent of the impacted property owners, will be required
- In addition the lowering of a stream must consider the potential lowering of flood elevations in upstream reaches that are not lowered thereby, reducing floodplain storage and potentially increasing peak flows. This potential is to be evaluated and mitigative measures proposed to prevent increases in peak flows.
- The storage-discharge characteristics are to be evaluated for all range of design events 2, 5, 10, 25, 50, 100 year and Regional storm events.

February 21, 2007

# B.7

**Depressional Storage**

# NORTH OAKVILLE SUBWATERSHED MANAGEMENT STRATEGY (WITHOUT PREJUDICE)

**Mediation Item: Depressional Storage (May 30, 2007)**

**Issue:**

The existing lands within Oakville North have a significant number of depressional areas that are poorly drained. The characteristics of this topography have an impact on the response characteristics of the area during precipitation and runoff events.

The North Oakville Creeks Subwatershed Study has indicated that, as part of the Environmental Implementation Report (EIR), that the storage within the topographic depressions be refined. This is to be checked against the storage within proposed stormwater management ponds in the drainage area to verify that the SWM pond storage is equal to or greater than the depressional storage.

**Agreement:**

To clarify the requirements, the following is proposed.

1. In general, the hydrologic model incorporates depressional storage to establish unit area target flow rates. The calculation and comparison of depressional storage to SWM storage is intended as a check to ensure that existing condition peak flow rates do not increase as a result of land development. The principle behind this approach is to ensure that the hydrologic analysis and SWM approach reflects the existing site conditions that include a number of topographic depressions.

2. The principle is to ensure that the natural depression storage is maintained in the SWM system. This approach is not to include artificially created storage such as that created by embankments or dug facilities. The topographic depressions are illustrated on Figure A, referred to as pits, ponds and depressions. Current mapping does not provide for accurate delineation of these depressions.

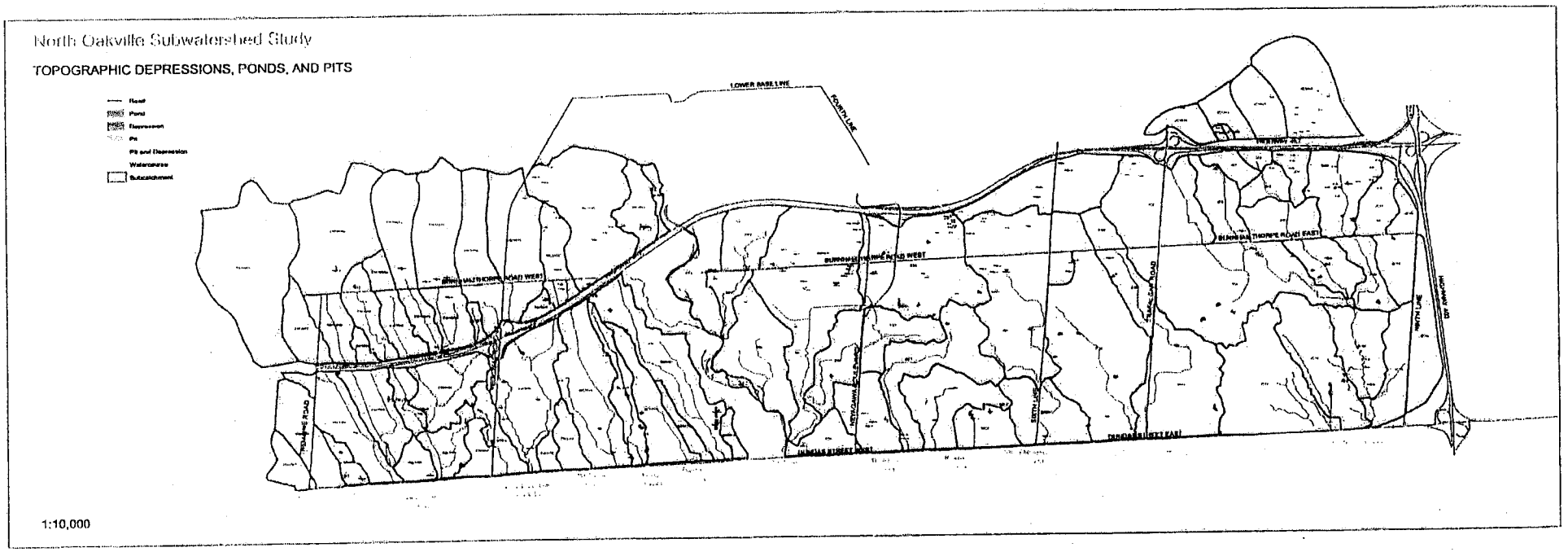
3. During the EIR stage, more detailed topographic mapping and other relevant investigations are to confirm the existence, nature, (natural or artificial), and storage volume of these depressions.

4. To ensure that the storage volume of the depressional areas is maintained, the calculated depression volume is to be compared to the SWM pond volume of the proposed SWM facility within the same drainage area. If the depressional volume is less than or equal to the SWM facility volume, no additional analysis or change to the SWM facility design is required. In the event that the depressional storage is greater than the SWM facility volumes, the SWM facility volume (as noted in item 5) is to be adjusted to be equal to the depressional storage volume.

5. Calculations and volume comparisons shall be done as follows:
   - 2 year event: Calculate the 2 year depressional volume and compare this volume to the water quality (extended detention and permanent pool) volume in the SWM facility.
   - 100 year event or Regional Storm (whichever is applicable): Calculate the 100 year or Regional Storm depressional volume and compare it to the total storage volume (permanent and active storage) in the SWM facility (up to 100year or Regional Storm event).

[redacted]

**Figure A**


North Oakville Subwatershed Study
TOPOGRAPHIC DEPRESSIONS, PONDS, AND PITS
Road
Pond
Depression
Pit
Pit and Depression
Watercourse
Subcatchment
LOWER BASE LINE
SIXTH LINE
TRAFALGAR ROAD
HIGHWAY 407
1:10,000

# B.8

**Stream Corridor Components**

# North Oakville
# Subwatershed Management Strategy
# (Without Prejudice)

**Mediation Item: Stream Corridor Components (May 31, 2007)**

**Issue:**

Clarification of terminology and components for stream corridor width determination and application.

**Agreement:**

See attached Figures 6.3.15a and 6.3.15b (Confined and Unconfined River and Stream Corridors) and Figure 6.3.15c (Flow Chart):

# North Oakville
# Subwatershed Management Strategy
# (Without Prejudice)

**Mediation Item: Stream Corridor Components (May 31, 2007)**

**Issue:**

Clarification of terminology and components for stream corridor width determination and application.

**Agreement:**

See attached Figures 6.3.15a and 6.3.15b (Confined and Unconfined River and Stream Corridors) and Figure 6.3.15c (Flow Chart):

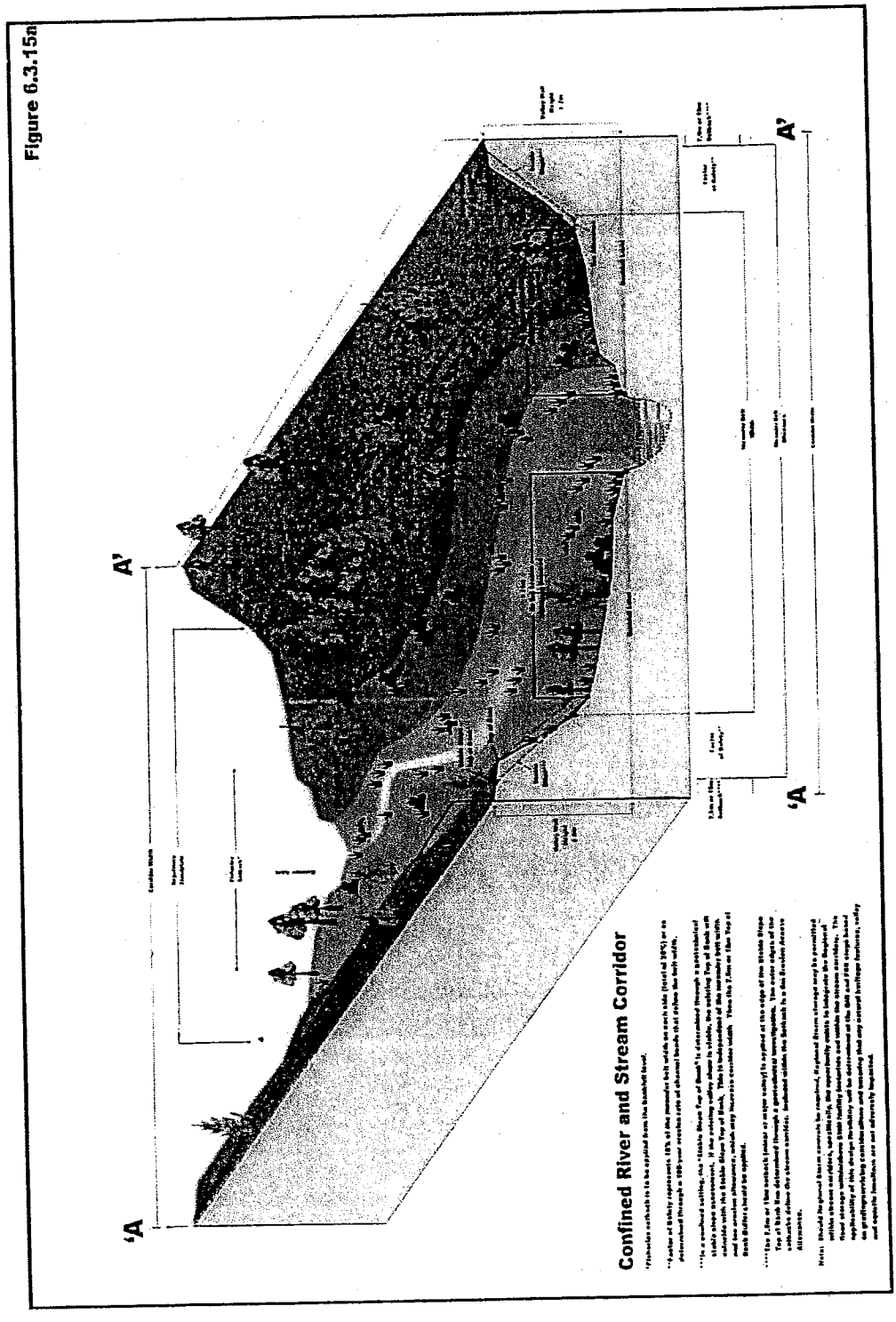


Figure 6.3.15a
A'
'A
Confined River and Stream Corridor

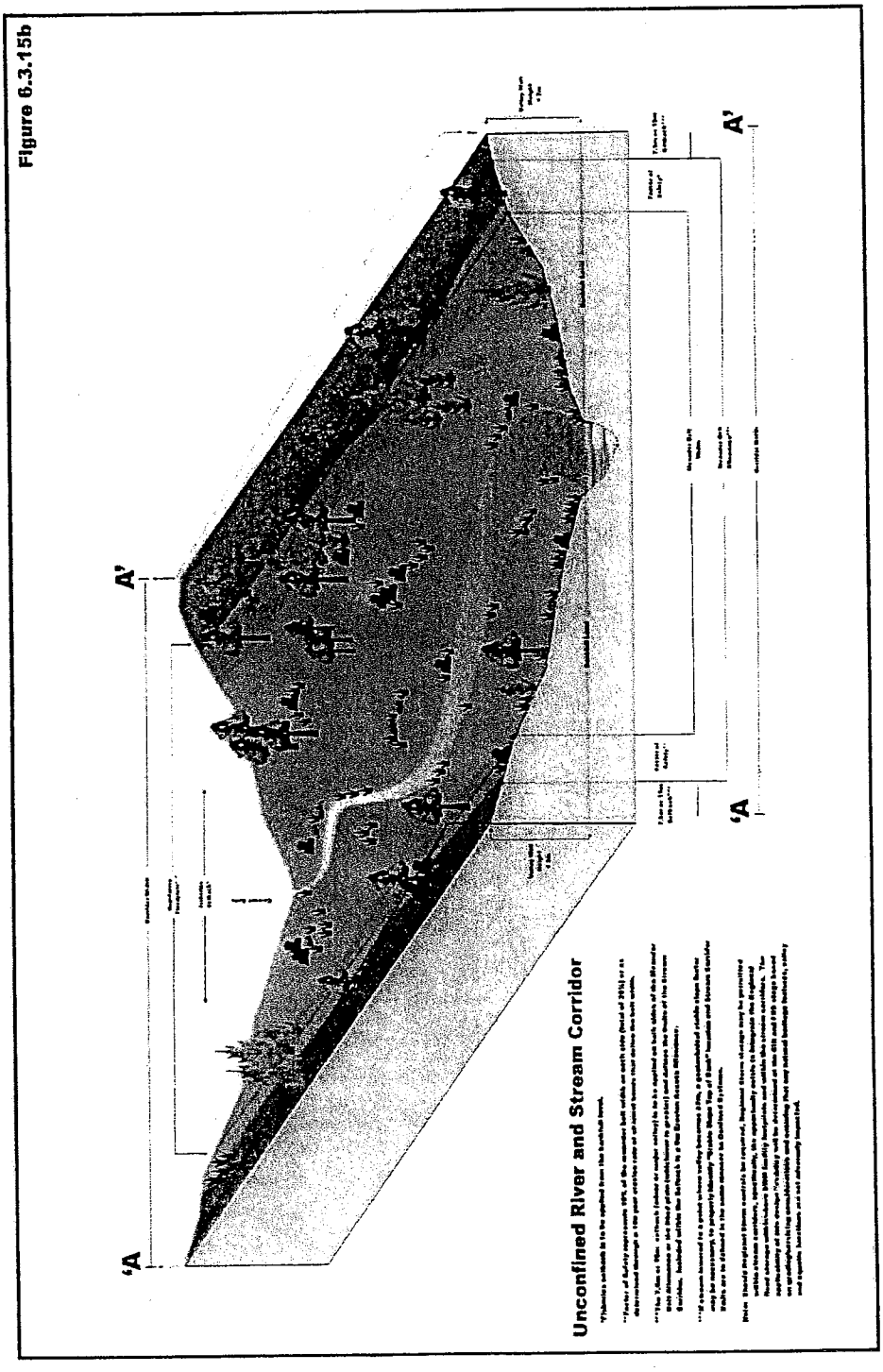
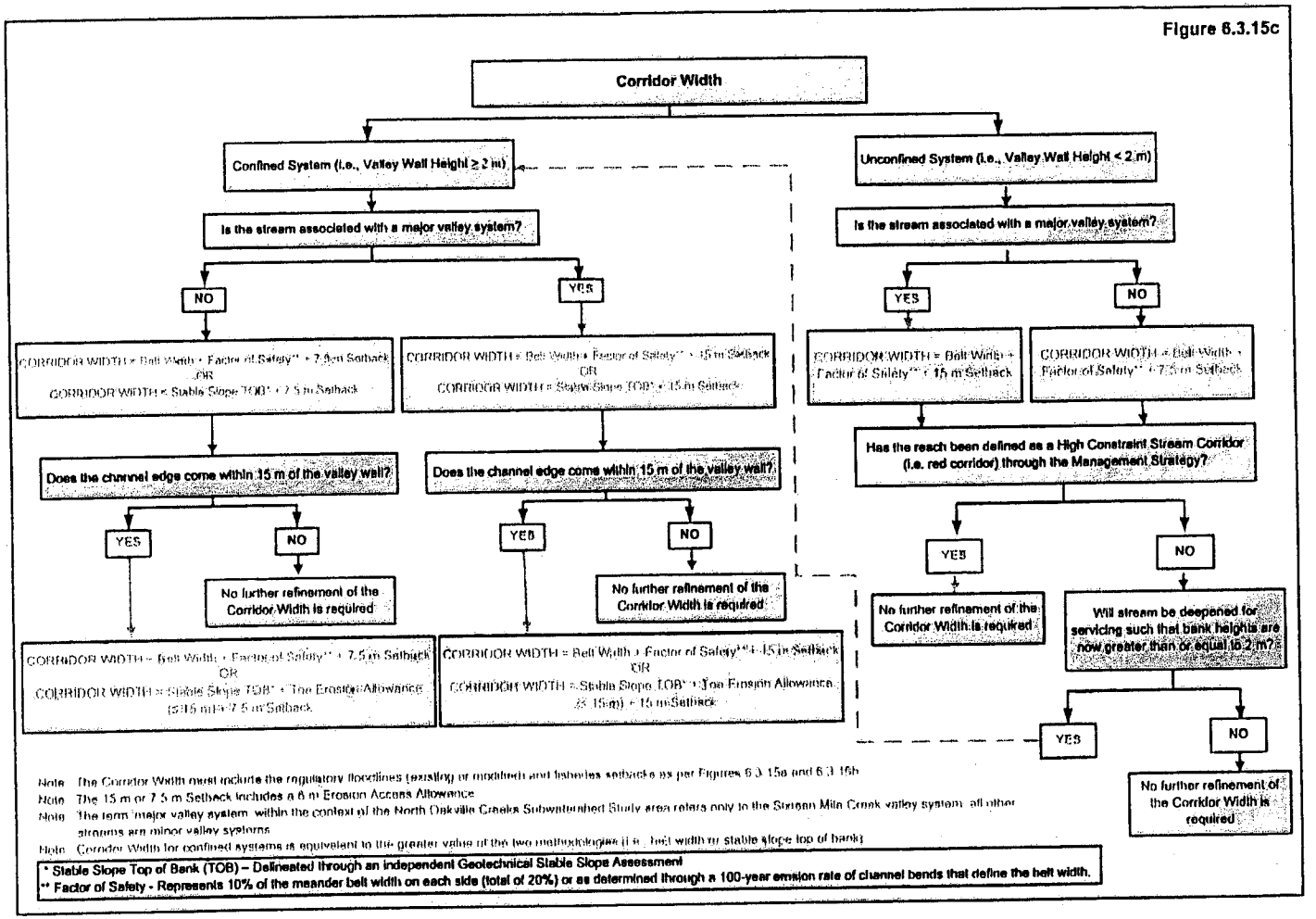


Figure 6.3.15b
A'
A
A'
A
Unconfined River and Stream Corridor

Figure 6.3.15c



**Stream Corridor Cross-Section and Flow Chart**

Figures 6.3.15 a, 6.3.15 b and 6.3.15 c agreed upon in mediation will be added to the Secondary Plan as Appendix 7.4. In addition, a policy is to be added to section 7.4.7.2 of the Plan as follows:

"Stream Corridor Components: Appendix 7.4 illustrates the required components of Stream Corridors and provides direction on how they are measured."

2303365.1

# B.9

**Storm Water Management Ponds Outside of Cores and Linkages**

# NORTH OAKVILLE SUBWATERSHED MANAGEMENT STRATEGY
## (Without Prejudice)

**Mediation Item: Stormwater Management Ponds (SWM) Outside of Cores and Linkages (June 19, 2007)**

**Issue:**

The Town's North Oakville Creeks Subwatershed Study (NOCSWS) and the North Oakville Management Inc. Subwatershed Studies (NOMI SWS) recommend differing SWM pond locations. Changes have been made to ponds and their location to agree upon a final SWM plan for incorporation into the NOCSWS and North Oakville East Secondary Plan. .

**Agreement:**

a) All SWM ponds illustrated in the Town's NOCSWS (August 2006) and the NOMI SWS (August 2004) along with a few suggested new ponds are shown on Figure A. As part of these discussions, SWM ponds were numbered for reference purposes only.

b) Mediation did not include discussions on the specific location of NOMI proposed SWM ponds partially in cores. These include ponds 8, 9, and 33.

c) Discussions regarding each of the proposed SWM locations (Town and NOMI ponds) resulted in agreement on revisions to some SWM pond location recommendations.

d) Figure B reflects the agreed upon and not agreed upon conceptual SWM pond locations. Table A presents the status of all SWM ponds (i.e., agreements on ponds that can be removed, ponds that are needed, ponds not agreed upon and pond not discussed).

e) It is noted, and agreed upon, that the plans (Figure B) are conceptual, illustrating the general number of ponds and their location. During the Environmental Implementation Report (EIR) phase, the number, location and size of SWM ponds will be finalized.

f) In areas with drainage areas that are judged to be less than 5 hectares, no SWM ponds are shown. In these locations, subject to confirmation that drainage areas are less than 5 hectares, it is intended that other Best Management Practices may potentially be implemented to address water quality and quantity control requirements. The final approaches to these areas will be addressed as part of the EIR phase.

[redacted]

# Figure A - SWM Pond Discussions
## June 19, 2007
## Without Prejudice

- Agreement on general pond location (January 2007)
- On NOMI plan, not onTownPlan
- On Town Plan, not on NOMI Plan,
- InCore or Linkage or Stream
- New Pond

NOTE: This Plan must be read in conjunction with MAP 1, MAP 3 & MAP 4

LEGEND

- SECONDARY PLAN AREA BOUNDARY
- PROVINCIAL FREEWAY
- BOULEVARD/TRANSIT CORRIDOR
- MAJOR ARTERIAL/TRANSIT CORRIDOR
- MINOR ARTERIAL/TRANSIT CORRIDOR
- AVENUE/TRANSIT CORRIDOR
- CONNECTOR/TRANSIT CORRIDOR
- TRANSITWAY
- VILLAGE SQUARE
- DUNDAS URBAN CORE AREA
- NEYAGAWA URBAN CORE AREA
- TRAFALGAR URBAN CORE AREA
- TRANSITIONAL AREA
- EMPLOYMENT DISTRICT
- NATURAL HERITAGE SYSTEM AREA
- COMMUNITY PARK AREA
- CEMETERY AREA
- INSTITUTIONAL AREA
- NEIGHBOURHOOD AREA
- JOSHUA CREEK COMMUNITY PARK AREA
- JOSHUA CREEK FLOODPLAIN AREA subject to Section 7.4.13b & c



**Town of Oakville**

North Oakville East of Sixteen Mile Creek Secondary Plan

FEBRUARY 16, 2007

# Figure B - SWM Pond Locations
## June 19, 2007
## Without Prejudice

Agreedupon pond locations

Not agreed upon pond locations

| Table A<br>Comments on Subwatershed Study Stormwater Management Pond Locations<br>(See Figure A for SWM pond locations) | |
|---|---|
| **Pond** | **Comments** |
| 1 | • Pond not agreed upon |
| 2 | • Pond removed, subject to confirmation of drainage area at EIR stage<br>• Best Management Practices approach will be used in this drainage area that is less than 5 hectares in size. |
| 3 | • Pond needed; outlets to SMB-3 |
| 4 | • Pond needed; outlets to SMB-4 |
| 5 | • Pond needed; potential to be combined with Pond 5a; to be addressed at EIR |
| 5 (a) | • Pond needed; potential to be combined with Pond 5; to be addressed at EIR stage |
| 6 | • Pond needed in approximately this location to outlet to SMA-9 |
| 7 | Pond removed on the understanding that Pond 7 is combined in Pond 6; to be addressed at EIR stage |
| 8 | • Pond not discussed (in core) |
| 8a | • Pond needed; intent is to control flows prior to release across Burnhamthorpe Road |
| 9 | • Pond not discussed (in core) |
| 9a | • Pond needed; intent is to control flows prior to release across Burnhamthorpe Road |
| 10 | • Pond needed in this general location; SWM pond may be located on the green stream; to be addressed at EIR/FSS stage |
| 11 | • Pond needed |
| 11(a) | • Pond needed unless Best Management Practices can be used; to be addressed at EIR stage |
| 12 | • Pond needed |
| 13 | • Pond not agreed upon |
| 14 | • Pond needed |
| 15 | • Pond needed |
| 16 | • Pond needed; intent is to control flows prior to release across Burnhamthorpe Road |
| 17 | • Pond needed |
| 17(a) | • Pond needed; potential to combine Pond 17 with Pond 17a; to be addressed at EIR stage |
| 18 | • Pond removed |
| 19 | • Pond not agreed upon |
| 20 | • Pond removed subject to confirmation that this pond is not needed to |

Table A

| | |
|---|---|
| | maintain the function of the wetland in Core 5; to be addressed at EIR stage. |
| 21 | • Pond not agreed upon |
| 22 | • Pond needed |
| 22(a) | • Pond not agreed upon |
| 23 | • Pond needed; intent is to control flows prior to release across Sixth Line |
| 24 | • Pond needed; intent is to control flows prior to release across Burnhamthorpe Road |
| 25 | • Pond needed; EIR must address drainage to the top of stream reach MOC-6 to preserve the function of this stream |
| 26 | • Pond removed; combined with Pond 27 |
| 27 | • Pond not agreed upon |
| 28 | • Pond removed; combined with Pond 27 |
| 29 | • Pond needed; intended to outlet to MOC-2 (to be confirmed at EIR stage); EIR must address drainage to the top of stream reach MOC-6 to preserve the function of this stream |
| 30 | • Pond not agreed upon |
| 30(a) | • Pond removed |
| 31 | • Pond not agreed upon |
| 32 | • Pond needed |
| 33 | • Pond not discussed (partially in core) |
| 34 | • Pond removed (same as Pond 29); to be resolved at EIR stage |
| 35 | • Pond needed on west side of stream JC-10a |
| 36 | • Pond needed on east side of stream JC-10a |
| 37 | • Pond removed; SWM approach to this area will be detailed as part of park plan |
| 38 | • Pond needed; location OK outside of 100 year floodline; outlet to JC-8, not to Button Bush wetland |
| 39 | • Pond needed |
| 40 | • Pond removed; drainage area is less than 5 hectares; to be confirmed at EIR stage; BMP approach can be used. |
| 41 | • Pond needed to outlet to J13 |
| 42 | • Pond needed |
| 43 | • Pond needed |
| 44 | • Pond needed |
| 45 | • Pond needed |

**Table A**

| | |
|---|---|
| 46 | • Pond needed |
| 47 | • Pond not agreed upon |
| 48 | • Pond needed; may also need pond on west side of JC-19; to be addressed at EIR stage |
| 49 | • Pond removed; drainage to Pond 51 |
| 50 | • Pond needed |
| 51 | • Pond shown; may be combined with Pond 56; to be addressed at EIR stage |
| 52 | • Pond needed – to outlet to stream JC-36, need to maintain same drainage area |
| 53 | • Pond removed on understanding that majority of lands in this area drain to Pond 52; balance of area likely small enough to use BMP approach |
| 54 | • Pond needed |
| 54(a) | • Pond not agreed upon |
| 55 | • Pond not agreed upon |
| 56 | • Pond not agreed upon |
| 57 | • Pond removed; not needed |
| 58 | • Pond removed; SWM approach to be addressed as part of EIR; BMP approach likely to be used due to drainage area size |
| 59 | • Pond removed; cemetery lands |
| 60 | • Pond needed; intent is to control flows prior to release across Trafalgar Road ; outlet to JC-10a; may need another pond on east side of Trafalgar Road; to be addressed at EIR stage |
| 61 | • Pond needed |

# B.10

**Changes to EIR Sub-catchment Boundaries**

# NORTH OAKVILLE SUBWATERSHED MANAGEMENT STRATEGY

**Mediation Item: Changes to EIR Subcatchment Boundaries (June 29, 2007)**

**Issue:**

Should additional subcatchment boundaries be added to Town's North Oakville Secondary Plan Appendix 7.2.

**Agreement:**

With respect to the boundaries numbered on the attached copy of Appendix 7.2:

a) Line 1 will be added;

b) Line 2 will be added;

c) Line 3 will be added with a footnote as follows: This EIR boundary separates EIR and FSS studies east and west of Sixth Line. The issue shared by both areas is the outlet of drainage from lands east of Sixth Line through lands west of Sixth Line and pond locations. Separate EIR/FSS studies may be completed for each subcatchment as long as whichever EIR/FSS proceeds first prepares a scoped drainage and stormwater management plan addressing drainage area boundaries, outlet elevation, outlet location and potential grading implications of outlet conditions as well as SWM control needs for both areas (conceptually only in area not proceeding first; FSS level of detail on area proceeding first).

d) Line 4 will be added with a footnote as follows: This EIR boundary separates EIR and FSS studies north and south of Burnhamthorpe Road. The issue shared by both areas is the outlet of drainage from lands north of Burnhamthorpe Road through lands south of Burnhamthorpe Road and pond locations. Separate EIR/FSS studies may be completed for each subcatchment as long as whichever EIR/FSS proceeds first prepares a scoped drainage and stormwater management plan addressing drainage area boundaries, outlet elevation, outlet location and potential grading implications of outlet conditions (i.e., potential stream relocation/lowering including consideration of possible alternative conditions relating to minimum interim requirements versus ultimate final conditions) as well as SWM control needs for both areas (conceptually only in area not proceeding first; FSS level of detail in area proceeding first).

e) Line 5 will be added; line 5a will be removed;

f) A modified line 6, as shown on Appendix 7.2, will be added with a footnote as follows: This EIR boundary separates EIR and FSS studies on either side of the Joshua's Creek. The EIR/FSS that proceeds first, (on either side of this line), is to prepare a scoped drainage and stormwater management plan addressing drainage area boundaries, outlet elevation, outlet location, potential grading implications of outlet conditions, potential stream relocation/lowering including consideration of possible alternative conditions (i.e., minimum interim requirements versus ultimate final conditions) and SWM control needs for both subcatchments (conceptually only in area not proceeding first; FSS level of detail in area proceeding first), as well as the potential new linkage east of Joshua's Creek and potential stream relocation into this linkage. As part of the assessment of

stream relocation into the linkage, the preservation of the function of the Joshua's Creek floodplain must be addressed.

With respect to the potential relocation of stream JC-9, this agreement, which specifies technical requirements, does not identify or assign responsibility to the Town of Oakville or any landowner(s) for the design, approvals or construction associated with such potential relocation.


NORTH OAKVILLE CREEKS SUBWATERSHED STUDY

August 2006

0
Meters

**Legend**

- Road
- Watercourse
- Secondary Plan Boundary
- Flow Nodes
- EIR Subcatchments
- Suggested Additions to Subcatchments

EIR Subcatchment Plan

Appendix 7.2

# B.11

**Temperature and Dissolved Oxygen**

# NORTH OAKVILLE SUBWATERSHED MANAGEMENT STRATEGY (WITHOUT PREJUDICE)

**July 12, 2007**

**Mediation Item: Stormwater Management – Temperature and Dissolved Oxygen Targets**

**Issue:**

The North Oakville Creeks Subwatershed Strategy indicates the need for water quality controls to protect the receiving watercourses. This issue pertains to Fourteen Mile and East Morrison Creeks. Of particular concern are the targets which are set for water temperature and dissolved oxygen (DO) for fisheries protection.

There is concern with regard to the ability to meet specific in-stream targets, particularly for temperature control. It is possible that the current in-stream water temperatures may be higher than the targets that have been set.

**Agreement:**

Targets for temperature and DO will be modified to relate to what exists in current in-stream conditions. As a result, the following is recommended and agreed.

- A conservative target of maximum daily temperature of 20°C will be adopted for the purposes of fisheries protection and applied to the stormwater management works associated with the lands draining to Fourteen Mile Creek (reaches 14W-1, 14W-1a, 14-2 and 14W-12) and East Morrison Creek (reach MOC-4). A conservative DO target of 6mg/l will also be adopted which is the Provincial Water Quality Objective (MOE, 1994) for cold water fisheries associated with a water temperature of 20°C.

- The existing temperature and DO regimes of these creeks have not yet been determined. It may be that existing maximum daily temperatures in the above-mentioned creeks already exceed 20°C and DO is below 6mg/l. If this is the case, it would be reasonable to develop targets based on the existing conditions. In other words, the targets would be to keep temperatures below the existing maximum daily temperature and DO above the existing concentrations.

- It is recommended that a temperature and DO monitoring program be established for these systems and that this monitoring begin prior to development to establish a baseline against which the recommended targets of 20°C and 6mg/l can be assessed and modified where appropriate.

- SWM facilities will incorporate measures to address temperature reduction where feasible and practical. It is agreed that there are limited measures available to be used for temperature reduction including pond, outfall and creek plantings, bottom draw outlets, pond configuration and outfall cooling trenches. The use of these measures, the specifics of which will be approved by the Town of Oakville and Conservation Halton, will be assessed during the EIR. Should post construction show that temperature targets are not being met where these types of measures are included in pond design, it is recognized that there may be very limited opportunities to further reduce temperatures. In these cases, the use of these types of measures will be reviewed to see that they are operating properly and

functioning as designed and if so, there will be no impact to pond assumption. In other words, best efforts use of acceptable measures for temperature reduction on SWM facilities is required.

- With respect to DO, Enhanced Level requirements for SWM facility design do not specifically address DO performance levels. Therefore, DO targets and monitoring are for the purposes of collecting data on the functioning of these facilities from a DO perspective. It will be analyzed to determine their function with respect to DO, but results will not impact pond assumption.

sent to OMB July 20/07
by P. Foran.

# NORTH OAKVILLE SUBWATERSHED MANAGEMENT STRATEGY

**Mediation Item: Changes to EIR Subcatchment Boundaries (June 29, 2007)**

**Issue:**

Should additional subcatchment boundaries be added to Town's North Oakville Secondary Plan Appendix 7.2.

**Agreement:**

With respect to the boundaries numbered on the attached copy of Appendix 7.2:

a) Line 1 will be added;

b) Line 2 will be added;

c) Line 3 will be added with a footnote as follows: This EIR boundary separates EIR and FSS studies east and west of Sixth Line. The issue shared by both areas is the outlet of drainage from lands east of Sixth Line through lands west of Sixth Line and pond locations. Separate EIR/FSS studies may be completed for each subcatchment as long as whichever EIR/FSS proceeds first prepares a scoped drainage and stormwater management plan addressing drainage area boundaries, outlet elevation, outlet location and potential grading implications of outlet conditions as well as SWM control needs for both areas (conceptually only in area not proceeding first; FSS level of detail on area proceeding first).

d) Line 4 will be added with a footnote as follows: This EIR boundary separates EIR and FSS studies north and south of Burnhamthorpe Road. The issue shared by both areas is the outlet of drainage from lands north of Burnhamthorpe Road through lands south of Burnhamthorpe Road and pond locations. Separate EIR/FSS studies may be completed for each subcatchment as long as whichever EIR/FSS proceeds first prepares a scoped drainage and stormwater management plan addressing drainage area boundaries, outlet elevation, outlet location and potential grading implications of outlet conditions (i.e., potential stream relocation/lowering including consideration of possible alternative conditions relating to minimum interim requirements versus ultimate final conditions) as well as SWM control needs for both areas (conceptually only in area not proceeding first; FSS level of detail in area proceeding first).

e) Line 5 will be added; line 5a will be removed;

f) A modified line 6, as shown on Appendix 7.2, will be added with a footnote as follows: This EIR boundary separates EIR and FSS studies on either side of the Joshua's Creek. The EIR/FSS that proceeds first, (on either side of this line), is to prepare a scoped drainage and stormwater management plan addressing drainage area boundaries, outlet elevation, outlet location, potential grading implications of outlet conditions, potential stream relocation/lowering including consideration of possible alternative conditions (i.e., minimum interim requirements versus ultimate final conditions) and SWM control needs for both subcatchments (conceptually only in area not proceeding first; FSS level of detail in area proceeding first), as well as the potential new linkage east of Joshua's Creek and potential stream relocation into this linkage. As part of the assessment of

stream relocation into the linkage, the preservation of the function of the Joshua's Creek floodplain must be addressed.

With respect to the potential relocation of stream JC-9, this agreement, which specifies technical requirements, does not identify or assign responsibility to the Town of Oakville or any landowner(s) for the design, approvals or construction associated with such potential relocation.

**NORTH OAKVILLE SUBWATERSHED MANAGEMENT STRATEGY (WITHOUT PREJUDICE)**

**July 12, 2007**

**Mediation Item: Stormwater Management – Temperature and Dissolved Oxygen Targets**

**Issue:**

The North Oakville Creeks Subwatershed Strategy indicates the need for water quality controls to protect the receiving watercourses. This issue pertains to Fourteen Mile and East Morrison Creeks. Of particular concern are the targets which are set for water temperature and dissolved oxygen (DO) for fisheries protection.

There is concern with regard to the ability to meet specific in-stream targets, particularly for temperature control. It is possible that the current in-stream water temperatures may be higher than the targets that have been set.

**Agreement:**

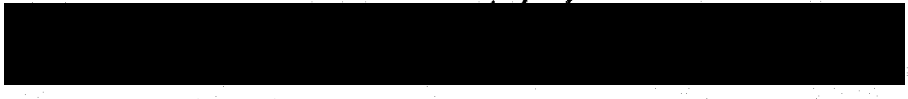
Targets for temperature and DO will be modified to relate to what exists in current in-stream conditions. As a result, the following is recommended and agreed.

- A conservative target of maximum daily temperature of 20°C will be adopted for the purposes of fisheries protection and applied to the stormwater management works associated with the lands draining to Fourteen Mile Creek (reaches 14W-1, 14W-1a, 14-2 and 14W-12) and East Morrison Creek (reach MOC-4). A conservative DO target of 6mg/l will also be adopted which is the Provincial Water Quality Objective (MOE, 1994) for cold water fisheries associated with a water temperature of 20°C.

- The existing temperature and DO regimes of these creeks have not yet been determined. It may be that existing maximum daily temperatures in the above-mentioned creeks already exceed 20°C and DO is below 6mg/l. If this is the case, it would be reasonable to develop targets based on the existing conditions. In other words, the targets would be to keep temperatures below the existing maximum daily temperature and DO above the existing concentrations.

- It is recommended that a temperature and DO monitoring program be established for these systems and that this monitoring begin prior to development to establish a baseline against which the recommended targets of 20°C and 6mg/l can be assessed and modified where appropriate.

- SWM facilities will incorporate measures to address temperature reduction where feasible and practical. It is agreed that there are limited measures available to be used for temperature reduction including pond, outfall and creek plantings, bottom draw outlets, pond configuration and outfall cooling trenches. The use of these measures, the specifics of which will be approved by the Town of Oakville and Conservation Halton, will be assessed during the EIR. Should post construction show that temperature targets are not being met where these types of measures are included in pond design, it is recognized that there may be very limited opportunities to further reduce temperatures. In these cases, the use of these types of measures will be reviewed to see that they are operating properly and



functioning as designed and if so, there will be no impact to pond assumption. In other words, best efforts use of acceptable measures for temperature reduction on SWM facilities is required.

- With respect to DO, Enhanced Level requirements for SWM facility design do not specifically address DO performance levels. Therefore, DO targets and monitoring are for the purposes of collecting data on the functioning of these facilities from a DO perspective. It will be analyzed to determine their function with respect to DO, but results will not impact pond assumption.

# B.12

**Monitoring**

NORTH OAKVILLE SUBWATERSHED
MANAGEMENT STRATEGY
(WITHOUT PREJUDICE)

**Mediation Item: Monitoring (July 26, 2007)**

**Issue:**

The subwatershed study included monitoring requirements for: A. erosion and sediment control B. stormwater management facilities, C. monitoring of modified streams, and D. monitoring of stormwater management works, municipal services and trails installed by a landowner within the Natural Heritage System. This summary is to provide the principles of monitoring for which the landowners/developers are responsible in respect of A, B, C, and D above. It does not include data collection or characterization that may be required as part of the Environmental Implementation Report.

**Agreement:**

**A. Erosion and Sediment Control (ESC)**

1. An ESC plan will be required to be submitted to the Town of Oakville. The plan must be reviewed and approved by the Town prior to any clearing and grading.
2. The ESC requirements will follow applicable approved guidelines and bylaws in effect at the time of development. Deliverables will include a site alteration design report, an existing site conditions survey plan, an ESC plan, and a schedule of monitoring and reporting.
3. The ESC plan will include inspection, sampling for total suspended solids at all outlets from the site, and reporting of results.
4. Remedial action to correct deficiencies of erosion and sediment control practices and facilities may be required based on either inspection or sampling results

**B. Stormwater Management Facilities**

1. Stormwater management (SWM) facilities constructed in the conveyance system and at the end-of-pipe will be included in the monitoring program, which applies to the period prior to the assumption of the facilities by the Town. The monitoring plan will include monitoring of the receiving system for the effectiveness of the stormwater management facilities at the location of the outfall for the purpose of water quality monitoring, and at a location or locations to be determined through the EIR for the purpose of erosion control. Monitoring will follow applicable approved guidelines in effect at the time of development. These guidelines will replace Appendix KK – Stormwater Pond Monitoring Protocol from the Subwatershed Study. The Town of Oakville and Conservation Authority will consult with the North Oakville landowners in the preparation of such guidelines. Monitoring requirements will be reflected in subdivision agreements.

2. Privately owned SWM facilities are not included in this mediation document and will be subject to site specific requirements at the time of application.
3. All SWM facilities to be assumed by the Town will be monitored by the owner for design conformance, maintenance of function and hydraulic performance. Monitoring and reporting requirements are to be reviewed and approved by the Town.
4. Facilities with water quality function(s) will be monitored by the owner for performance in meeting the specific pond design target for total suspended solids (80% removal). Total phosphorus and temperature sampling will also be required.
5. Facilities subject to Ontario Water Resources Act approval may be required to do additional monitoring as a condition of the Certificate of Approval.

**C. Monitoring of Modified Streams**

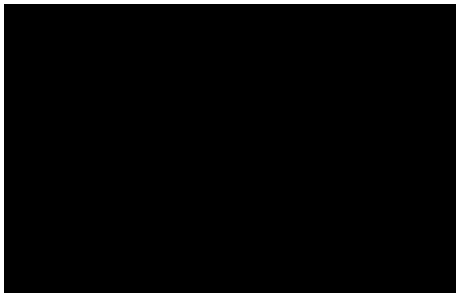
1. A multidisciplinary monitoring program approved by the Town and Conservation Halton will be implemented for all stream modifications. The monitoring program will be implemented by the proponent of the stream modification.

2. Notwithstanding Principle C 1, additional monitoring associated with Department of Fisheries and Oceans approvals under the federal Fisheries Act may be required and shall be the responsibility of the proponent.

**D. Monitoring in Relation to Stormwater Management Works, Municipal Services and Trails Installed by an Owner within the Natural Heritage System**

In addition to items A. B. and C. above:

1. A monitoring program will be implemented for all municipal services such as roads, watermains, sanitary sewers, stormwater management works or trails within the Natural Heritage System;
2. A monitoring program approved by the Town and Conservation Halton is to be developed based on the natural features and functions potentially affected by the specific works noted above;
3. The details of the monitoring program are to be included in the EIR. and,
4. The monitoring program will be implemented by the landowners installing the stormwater management works, municipal services and trails.



# B.13

**EIR/FSS Terms of Reference**

NORTH OAKVILLE SUBWATERSHED
MANAGEMENT STRATEGY
(WITHOUT PREJUDICE)

August 3, 2007

**Mediation Item: Environmental Implementation Report and Functional Servicing Plan Terms of Reference**

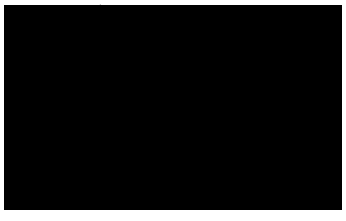
**Issue:**

The North Oakville Creeks Subwatershed Strategy prepared by the Town of Oakville included an outline of study requirements for the preparation of an Environmental Implementation Report (EIR) required in support of draft plans of subdivision. The North Oakville Management Inc. (NOMI) Subwatershed Study also included an outline of study requirements for an EIR and a Functional Servicing Study (FSS) required in support of draft plans of subdivision. The suggested study components in each of these documents differed in the scope and level of detail.

To address these differences several working sessions were held with representatives of the Town, the Town's SWS consultants, Conservation Halton and NOMI SWS consultants to discuss and agree upon specific study requirements for both a EIR and FSS.

**Agreement:**

The attached North Oakville Environmental Implementation Report and Functional Servicing Study Terms of Reference, dated August 2, 2007, were prepared to provide one comprehensive EIR/FFS terms of reference document. The content of these terms of reference are agreed to by the Town, Conservation Halton and NOMI representatives.



TOWN OF OAKVILLE

# NORTH OAKVILLE
# ENVIRONMENTAL IMPLEMENTATION REPORT and
# FUNCTIONAL SERVICING STUDY

## *TERMS OF REFERENCE*

**AUGUST 2, 2007**

# TABLE OF CONTENTS



**Figures:**

# NORTH OAKVILLE
# ENVIRONMENTAL IMPLEMENTATION REPORT AND
# FUNCTIONAL SERVICING STUDY
# TERMS OF REFERENCE

## 1.0 INTRODUCTION

### 1.1 Background

The North Oakville Creeks Subwatershed Study, including addenda (NOCSS) provides the Management Strategy for the North Oakville Secondary Plan area. The limits of this area are illustrated in Figure 1.1.1, and include the lands north of Dundas Street to the Highway 407 corridor and from Tremaine Road east to Ninth Line. The Management Strategy and associated North Oakville Secondary Plan provide direction for land development within the North Oakville lands.

Integral to these documents is the goal of preserving a sustainable Natural Heritage System (NHS) for maintaining landscape diversity within an urban context. In accordance with this goal, the NOCSS was completed, providing recommendations with respect to the management approach for natural heritage/open space and stream systems. There are certain lands, including watercourses, that are restricted from development and others that have specified limitations or constraints. The Management Strategy and associated North Oakville Secondary Plan also outline requirements with regard to stormwater management, land use policies and servicing.

The NOCSS is divided into four sections, which follow the four phases of a subwatershed management approach:

i) Characterization
ii) Analysis
iii) Management Strategy
iv) Implementation

The Management Strategy for North Oakville is outlined in the last two NOCSS sections: Management Report and Implementation. In the Implementation Report, the processes to be followed as well as implementation details are outlined including the need for an Environmental Implementation Report (EIR) and a Functional Servicing Study (FSS) in support of future Draft Plans of subdivision (Draft Plans). A general overview of the planning/implementation framework is illustrated in Figure 1.1.2, which indicates how the EIR/FSS fits within this process.

### 1.2 Purpose

The purpose of the EIR is to characterize and analyse the natural heritage features and functions and to determine and address the potential impacts of a proposed development application, including servicing requirements, on the NHS. The purpose of the FSS is to identify servicing requirements related to sanitary, water, stormwater, roads and site grading.

Further, the purpose of both the EIR and FSS is to provide a link between the Management Report, Implementation Report, the Secondary Plan, and the Draft Plan submissions for future development applications.

It is recognized that the approach to servicing will, in large part, be guided by conditions within the NHS, including cores, linkages and stream corridors. In addition, the characteristics of these areas may require

the use of measures to protect the function of the NHS from impacts (i.e., prevention of changes to the surface water and groundwater systems to maintain flows to the NHS). As a result, the EIR and FSS must be integrated and may be produced as a joint document.

It is intended that this document provides the Terms of Reference for completion of an EIR and FSS. The EIR/FSS document sets out the study requirements and obligations, including monitoring, for works installed in the secondary plan area, including the NHS. These are the obligation of the landowner proponent who proposes the development or proposes to install the works. In some cases, the Town or the Region may be the proponent of certain works in the secondary plan area or in the NHS. In this latter instance, the study requirements and obligations, including monitoring, are the proponent Town's or the proponent Region's as the case may be and the obligations are not the landowner's obligation.

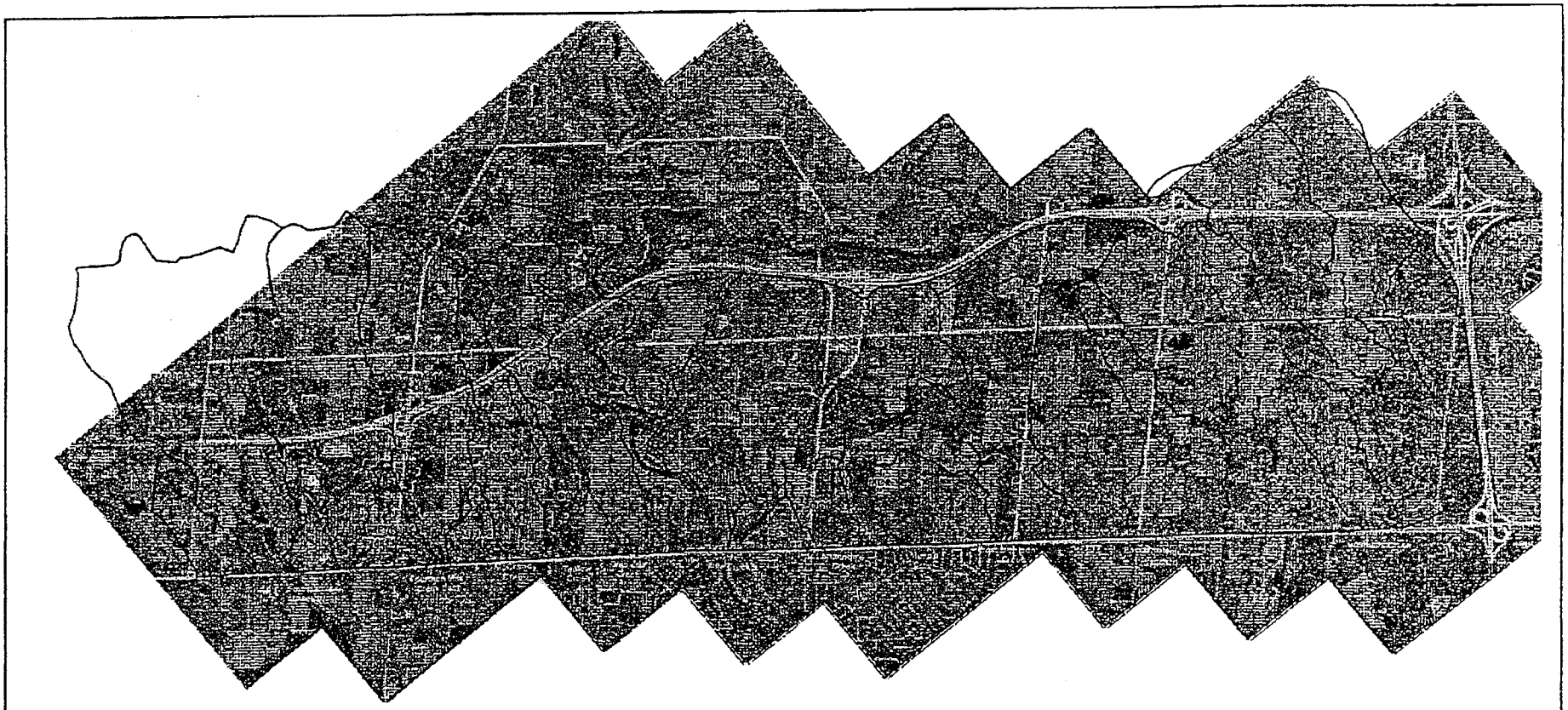
The preparation of an EIR/FSS is to assist in the development of a Draft Plan. It is to ensure that the requirements of the Subwatershed Strategy and Secondary Plan are met and that the site characteristics are understood in sufficient detail to provide the information necessary for processing of the Draft Plan and to provide conditions of approval. These studies also will support agencies' approvals.

If the Draft Plan does not conform to the Secondary Plan, other planning approvals may be required

The objectives to be fulfilled by the EIR and FSS are to:

- Demonstrate how the subwatershed requirements set out in the NOCSS Management Report (including targets), the Implementation Report, and Secondary Plan are being fulfilled in all proposed Draft Plans;
- Provide sufficient level of conceptual design to ensure that the various components of NHS and infrastructure can be implemented as envisaged in the NOCSS and Secondary Plan and to ensure that the Draft Plans are consistent with this conceptual design;
- Ensure servicing requirements as determined in the FSS for the areas external to the Draft Plan are adequate;
- Identify details regarding any potential development constraints or conflicts and how they are to be resolved;
- Provide any further implementation details as needed;
- Streamline the Draft Plan approval process; and,
- Facilitate the development of Draft Plan conditions.

The EIR/FSS Terms of Reference are broken down into sections to discuss the overall approach, and details of the studies needed, including monitoring.



NORTH OAKVILLE CREEKS SUBWATERSHED STUDY

0 500 1,000
Meters

August 2006

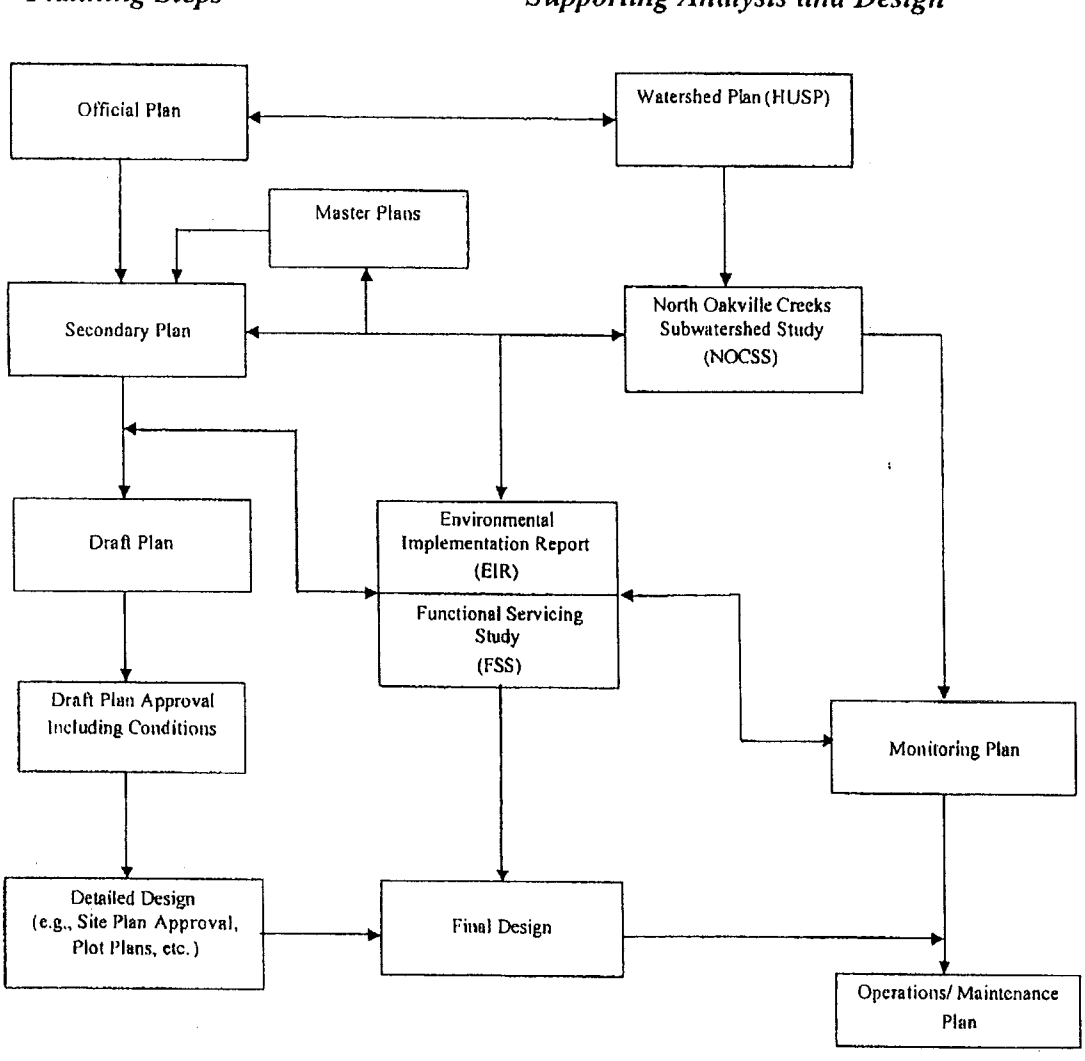
Legend
- Road
- Watercourse
- Secondary Plan Boundary
- EIR Nodes
- EIR Subcatchments

EIR Subcatchment Plan

Figure 7.4.2

**Figure 1.1.2**

**OVERVIEW OF SUBWATERSHED PLANNING IMPLEMENTATION FRAMEWORK**



# 2.0 APPROACH

## 2.1 Overview

The EIR/FSS is to demonstrate how the proposed development will meet the requirements set out in the Management Strategy and Secondary Plan. To do this, comprehensive technical analyses and design concepts will be necessary as part of the EIR/FSS. It is the intention of these Terms of Reference to indicate how the analyses, design concepts and related reports are to be prepared.

## 2.2 Agencies

It is intended that the EIR/FSS, and subsequent Draft Plans, will be reviewed by the following agencies as related to their respective jurisdictions:

- Town of Oakville
- Region of Halton
- Conservation Halton

The above noted agencies will be the primary contact groups for the EIR/FSS submissions. Depending upon the conditions related to the EIR subcatchment area, it may be decided by one or more of the agencies, primarily Conservation Halton and the Town of Oakville, that input and approval will be needed from the Ministry of Natural Resources (MNR) and/or Department of Fisheries and Oceans (DFO). This input will be coordinated by the Town and Conservation Halton. It is understood that proponents can liaise with the agencies as necessary as part of this process. Input from DFO is anticipated in the review of conceptual and final design on any sections of streams where fish habitat compensation is required.

## 2.3 Study Areas

It is intended that the EIR be carried out on a subcatchment basis, which forms the study area for the EIR. The EIR subcatchments are illustrated on Figure 1.1.1. The study area for the FSS will focus on the proposed development area for the intended Draft Plans (referred to as "proposed development area" in subsequent sections of this document). It is recognized that consideration will likely be required beyond the FSS study area to ensure that servicing can be provided for neighbouring areas.

Each EIR/FSS will be evaluated to ensure that the flows outletting from each area are managed in a manner that will properly protect the receiving stream(s), in accordance with the NOCSS Management Strategy. Carrying out the EIR based on the specified subcatchments will address the following:

- Preservation of drainage areas to the various stream branches within the subwatersheds; and,
- Provide for meeting target flows, water quality and erosion targets for the various receiving points along the streams.

In some cases, the study area for the NHS system (cores and linkages, and streams) may extend beyond the subcatchment, as discussed in Sections 3.2 and 3.3.

It is recognized that the EIR subcatchment areas do not correspond to land ownership boundaries and that it may be difficult to ensure the cooperation of landowners to carry out an EIR/FSS within the specific

study subcatchment. Every effort should be made to facilitate cooperation between landowners to carry out the EIR/FSS within the EIR subcatchment. If more than one landowner within an EIR subcatchment is active in the EIR/FSS process, only one EIR study will be permitted (i.e., no concurrent EIR studies for the same area). Subsequent development in the EIR subcatchment area will require the preparation of a separate FSS and an update of the EIR, to conform to the findings and recommendations of all previous EIR/FSS studies. In the event that this concurrent joint report cannot be accomplished, it is recognized that consideration will be given to permitting a modified approach. In that event, certain conditions will need to be met to ensure that the requirements of the Management Strategy and Secondary Plan are met and that any proposed development does not place any undue restrictions on other lands within the EIR subcatchment area not included in the study.

Various scenarios could arise where the proposed development (Draft Plan areas of participating owners) does not correspond to the EIR subcatchment area boundary. Anticipated scenarios and the approach that should be used for each are outlined in the following items. These are presented as examples and do not include all potential scenarios:

i) The proposed development is in the upstream portion of the EIR subcatchment.
- EIR/FSS will need to indicate how land will be serviced on an interim and final basis;
- If the existing receiving watercourse is used as an outlet, assumptions as to the final outlet conditions are to be indicated. The submission must demonstrate how drainage from upstream lands including stormwater management systems, will be conveyed to a suitable outlet without placing undue restrictions on the serviceability of adjacent lands;
- If a proposed stormwater management (SWM) facility is downstream of the proposed development, an interim facility may be provided, with a long-term approach indicated, in the event that a permanent facility is not constructed;
- If stream modifications extend beyond the limits of the proposed development area (e.g., lowering or relocations), they also must be addressed conceptually;
- Conceptual design of trunk services within the EIR subcatchment must be prepared, including appropriate allowances for connections to areas external to the Draft Plan and/or EIR subcatchment, demonstrating servicing viability without placing undue restrictions on external areas (e.g., considering sewer depths and grading); and,
- Street and land use patterns outside of the proposed Draft Plan are to be provided as per the Secondary Plan with input from the Town of Oakville.

ii) The proposed development is in the downstream portion of the EIR subcatchment.
- EIR/FSS will need to indicate how land will be serviced/graded on an interim and final basis;
- If SWM facility is located in the proposed development area and is to service the upstream portion of the subcatchment, the facility is to be sized for the entire upper subcatchment, based on the land use from the Secondary Plan with input from the Town of Oakville;
- If stream modifications extend beyond the limits of the proposed development area (e.g., lowering or relocations), they also must be addressed conceptually;
- Conceptual design of trunk services within the EIR subcatchment are to be prepared, including appropriate allowances for connections to areas external to the Draft Plan and/or EIR subcatchment, demonstrating servicing viability without placing undue restrictions on external areas (e.g., considering sewer depths and grading); and,
- Street and land use patterns outside of the proposed Draft Plan are to be provided as per the Secondary Plan, with input from the Town of Oakville.

iii) The proposed development is within the majority of the EIR subcatchment with minor portions outside.
- Consideration will be given to minor adjustments in subcatchment boundaries with the conditions that the adjustments would not put undue restrictions on the servicing of adjacent subcatchments and demonstrate no negative impacts to flooding, erosion and the NHS; and,
- If no change in subcatchment boundary is proposed, consideration is to be given to how development in the adjacent subcatchment is to be serviced. Conceptual drainage patterns are to be developed and profiles generated to ensure that the area can be serviced.

## 3.0 STUDY REQUIREMENTS

Studies are required for the EIR/FSS in the areas of:

- Land Use
- Cores and Linkages
- Stream Systems, Fish, and Fish Habitat
- Grading, Drainage and SWM
- Hydrogeology
- Sanitary, Water, Roads
- Trails

The specific study requirements are outlined in the following sections.

### 3.1 Land Use

The proposed land use, road patterns and servicing layout are to be provided through the EIR/FSS submission. The EIR/FSS submission should reflect the Secondary Plan land uses. Further land use details will be provided in the corresponding Draft Plans. If the EIR subcatchment extends beyond a particular Draft Plan, land use details in those areas must reflect the Secondary Plan, with input from the Town of Oakville.

The land use map for the portions of the EIR subcatchment area that are outside the limits of the Draft Plan will include details for the following to demonstrate the Draft Plan context with regard to the rest of the subcatchment:

- Land use designations
- Natural heritage system (cores, linkages and stream corridors)
- Major roads
- Major services
- SWM Blocks
- Trails

Planning input to the EIR/FSS is needed to demonstrate the logical coordination of land uses, road connections and open space linkages and features for the Draft Plan(s), lands extending beyond the limits of the Draft Plan(s), and potentially beyond the limits of EIR subcatchment area.

## 3.2 Cores and Linkages

### *3.2.1 Introduction*

The following section summarizes the study requirements for cores and linkages in the EIR/FSS. The NOCSS and current approaches to natural heritage planning strongly recommend that certain study components be completed at a larger ecologically based study area than the proposed development area (i.e. the EIR subcatchment boundaries or beyond). On the other hand, certain impact assessments require details that are only available at the Draft Plan level of detail. As such, the following discussion of the Terms of Reference is divided into two components.

- Study components that must be completed at the EIR subcatchment area level or beyond: This level of study is required since many ecological processes and features extend beyond the limits of a single Draft Plan and require analysis based on ecological study boundaries in order to understand the factors that drive the sustainability of the ecosystem; and
- Study components that require Draft Plan level of detail in order to be completed: This level of study focuses on detailing the potential impacts of proposed land use changes on the natural features and functions. As such, details regarding the proposed undertaking must be available in order to understand the sources of, and potential mitigation of, potential impacts.

In cases where an entire EIR subcatchment area is covered by participating landowners, the two levels of detail can be integrated. In cases where a Draft Plan(s) for only a portion of the lands within a particular EIR subcatchment area is being advanced, it is critical that proponents have regard for the varying levels of detail at each level.

### *3.2.2 Cores*

**EIR Subcatchment Area Level of Detail:**

- Confirm limits of EIR subcatchment and FSS study area based on overlap of Draft Plan(s) with subcatchments, extent of cores, especially those that extend beyond subcatchment boundary (for linkages see below);
- Delineate core boundaries based on NOCSS and present the boundaries on recent aerial photographs;
- Assemble background information on natural environment features and functions within the core(s) from the NOCSS and other secondary sources, including features, functions and management recommendations;
- Conduct preliminary field review of features to confirm limits and character of vegetation communities (e.g. roadside review or similar using recent aerial photographs); and,
- Identify any effect of other works (i.e. road crossings, servicing, SWM etc.) and associated requirements related to cores and linkages.

**Draft Plan Level of Detail:**

- Complete appropriate seasonal field surveys of the limits of woodlands, wetlands and other habitats associated with the core(s), generally within 50m of vegetation community boundaries that define the limit of the core;

- Apply the buffers to the natural features based on the NOCSS recommendations, to define the boundaries of the core;
- Stake and survey the boundaries of core areas including limit of buffers based on guidance provided in NOCSS;
- These staked core boundaries are to be confirmed in the field by staff of Conservation Halton, Town of Oakville and Ministry of Natural Resources (at the discretion of Conservation Halton);
- Identify limits of grading adjacent to a core, and assess the impacts of any grading adjacent to the core(s), and detail mitigative measures and/or management recommendations, where needed;
- Detail the proposed drainage characteristics of lands adjacent to core and assess any impacts associated with drainage to the natural features, functions and management recommendations;
- Detail stormwater management facilities proposed adjacent to the core(s) and assess the impacts of construction and operation of the stormwater management facility on core features, functions and management recommendations;
- Where a SWM pond is permitted within a core, stake and survey the limit of stormwater management pond block overlap with the core boundary (as per NOCSS). This is to be reviewed in the field by agencies as noted above, and the impacts of construction and operation of the stormwater management facility on core features, functions and management recommendations assessed;
- Identify all services, utilities etc. proposed to be located adjacent to or within cores and assess the potential impacts of these facilities on core features and functions;
- In cases where a core is crossed by a road installed by a proponent, provide information respecting the road characteristics and identify potential impacts to features and functions within the core, (including delineation of features) and protective measures;
- Detail location, type and size of crossing structures from a wildlife movement (ecopassage) perspective;
- Detail any restoration measures within the core that may be triggered by proponent proposals to encroach into cores (road crossings, SWM);
- Detail mitigative measures and assess potential residual impacts of proponent works within the cores and any proponent grading or works adjacent to the cores. Provide evidence that alternative methods and measures for minimizing impacts have been considered; and,
- Develop a plan for monitoring the mitigative measures noted above, based on liaison with agency staff (Conservation Halton, Town of Oakville).

### *3.2.3 Linkages*

**EIR Subcatchment Area Level of Detail:**

- Confirm limits of EIR subcatchment and FSS study area based on the overlap of Draft Plan(s) with subcatchments, and extent of linkages (i.e. identify cases in which linkages extend beyond limits of subcatchment and include these areas within study);
- Delineate linkage areas based on NOCSS and present the boundaries on recent aerial photographs;
- Assemble background information on natural environment features within linkages from NOCSS and other secondary sources;
- Conduct a preliminary field review of features to confirm limits and character of vegetation communities within linkages (e.g. roadside review or similar as well as recent aerial photographs);

- Review stream corridor assessment to ensure that any proposed proponent modifications to stream corridors (locations, widths, etc.) that may influence linkages are identified;
- Show linkage limits in conjunction with conceptual subcatchment-level stream corridor on plans.

**Draft Plan Level of Detail:**

- Delineate and describe any natural features (e.g., hedgerows, wetlands etc.) that are to be incorporated into the linkage, and stake and survey as necessary;
- Identify means by which these features will be protected during development/construction process;
- Identify the boundaries of linkage areas, and confirm them in the field with staff of Conservation Halton, Town of Oakville and Ministry of Natural Resources (at the discretion of Conservation Halton);
- Identify limits of grading, and assess any impacts of re-grading within linkage and adjacent to the protected features within linkage;
- Detail the drainage characteristics of lands adjacent to natural features within linkages to be retained (if any), and assess any impacts associated with drainage to the natural features;
- In cases where a linkage is crossed by a road(s) installed by a proponent, detail the road characteristics and identify potential impacts to features within the linkage (if any) including delineation of features and protective measures, detail location, type and size of crossing structures from a wildlife movement (ecopassage) perspective;
- Identify the limit to which a stormwater management pond overlaps with linkage boundary (as per NOCSS), to be reviewed in the field by agencies as noted above;
- In linkages which include stream corridors, it may be necessary to stake and survey the linkage (and the SWM pond overlap) at this time;
- Detail any restoration/naturalization measures within the linkage when proponent intrusion has occurred.
- Detail mitigative measures and assess potential residual impacts of proponent works/intrusions; and,
- Develop a monitoring plan of the mitigative measures noted above, based on liaison with agency staff (Conservation Halton, Town of Oakville).

## 3.3 Stream Systems, Fish Habitat and Fish Communities

### *3.3.1 Introduction*

The Natural Heritage System for North Oakville includes protection and enhancement of high and medium constraint streams, which are identified as red and blue streams respectively in the Secondary Plan. This approach identified the "provision of a corridor system for streams that have been identified as having environmental characteristics or watershed functions that require protection and/or enhancement to meet the watershed goals and objectives" (NOCSS, Management Report Section 6.3.2).

The stream corridors identified in the NOCSS and Secondary Plan were developed using the concept of riparian corridor identification. The classification was based upon the stream characteristics and related processes considering the role of adjacent lands. This approach then identified the streams to be protected as well as the width of neighbouring lands, or corridor widths that need to be protected. This classification was developed in conjunction with the Department of Fisheries and Oceans and

Conservation Halton, who conducted field surveys with representatives of the Town of Oakville subwatershed team.

The corridors have been identified in the Management Strategy and Secondary Plan as well as the conceptual width requirements. It is the intent that the corridor widths of the red and blue streams, and the end points of the reach delineations are to be refined as part of the EIR/FSS study. The factors to be considered in the refinement of the stream systems and corridor widths include:

- Regulatory floodplain;
- Fluvial geomorphologic requirements;
- Stable slope top of bank;
- Fish and fish habitat protection requirements;
- Preservation of hydrogeologic functions;
- Edge of any identified terrestrial features;
- Hydrologic Features "A"; and
- Setback and buffer requirements.

The following sections present a summary of the EIR/FSS study requirements for the development of North Oakville with respect to the streams component of the NHS.

### *3.3.2 Existing Conditions and Constraint Mapping*

The following tasks must be undertaken by the proponent in order to fulfill the requirements of the EIR/FSS:

- Describe the proposed land use change and associated servicing issues;
- Confirm limits of EIR subcatchment area based on the NOCSS;
- Assemble and review all relevant materials pertaining to the stream system of the NHS including the Secondary Plan and NOCSS and other studies;
- Compile existing conditions and constraints (from existing data) and display on recent aerial photographs to delineate the stream system of the NHS; and,
- Review and summarize factors leading to the identification of the corridor constraint level from a natural heritage perspective.

### *3.3.3 Detailed Studies*

The following sections summarize the detailed study requirements for:

- Corridor Width Delineation
- Fish and Fish Habitat
- Stream Modification and Rehabilitation

#### *3.3.3.1 Corridor Width Delineation*

Through the NOCSS, stream corridor widths were developed on a broad scale and, as such, are subject to refinement during the EIR/FSS stage. **Figures 6.3.15a, 6.3.15b** and **6.3.15c** in the Management Report of

NOCSS and an Appendix of the Secondary Plan provide illustrations clarifying the stream corridor delineation process. The corridor is defined considering the factors outlined in Section 3.3.1.

Specifically, the following tasks must be completed by the proponent in order to fulfill the EIR/FSS requirements:

a) Geomorphology:

- Confirm delineation and potential refinement of stream reaches as outlined in the NOCSS;
- On a reach basis, conduct an historic evaluation of changes in land use and channel configuration over time utilizing a series of historic aerial photographs or mapping that extend from the earliest (i.e., 1930's to 1950's) to most recent coverage available;
- Based on the results of the historic evaluation, quantify the 100-year erosion rate on a reach basis;
- Delineate meander belt width on a reach basis, following *Belt Width Delineation Procedures* (PARISH Geomorphic Ltd., 2004). It should be noted that factors affecting the ultimate stream corridor width include degree of channel confinement, type of valley system (i.e., major or minor valley), channel position relative to the valley wall and proposed servicing modifications;
- As per **Figures 6.3.15a** and **6.3.15b**, apply the 100-year erosion rate to each side of the belt width as a factor of safety (in lieu of an historic evaluation, a factor of safety represents 10% of the meander belt width on each side (total of 20%) or as determined through a 100-year erosion rate of channel bends that define the belt width); and,
- Perform field investigations, including rapid geomorphic assessment, to confirm desktop analysis, with respect to the 100-year erosion rate and meander belt width on a reach-by-reach basis.

b) **Regulatory Floodplain**

- The floodplain will be defined for all medium and high constraints streams, which are identified as red and blue streams respectively in the Secondary Plan;
- The floodplain calculations shall be based on the applicable Provincial Technical Guidelines (i.e., Technical Guide – River & Stream Systems: Erosion Hazard Limit, Ministry of Natural Resources & Watershed Science Centre, 2002). It is intended that the Regulatory Floodplain would be determined through this process. Further the calculations should include consideration of:
  - Flow rates based on Regional Storm (existing or future land use, as appropriate (see Section 3.4.4)) or 100-year flood event, whichever is greater;
  - Stream corridor hydraulic properties (i.e. roughness), based on existing and planned ultimate conditions;
  - Where alteration of any existing floodplains is proposed, demonstrate the preservation of floodplain stage-storage-discharge in accordance with directions in the NOCSS; and
  - Field surveys to provide cross-sections and an invert profile to provide for updated regulatory floodlines to Conservation Halton specifications.
- A full range of return period flood levels will be calculated for the purpose of maintenance of riparian storage calculations, SWM facility and outlet design, etc.

c) Geotechnical

- As per **Figure 6.3.15a** and in fulfillment of Conservation Halton's *Policies, Procedures and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document* (2006), a site specific study must be completed to determine the toe erosion allowance on a reach basis for confined river systems;
- As per **Figure 6.3.15a** and in fulfillment of Conservation Halton's *Policies, Procedures and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document* (2006), a geotechnical stable slope assessment must be completed to determine the 'stable slope top of bank' in a confined setting. The stable slope line is to be drawn from the limit of the toe allowance;
- As per **Figure 6.3.15b**, if a stream within an unconfined corridor will be lowered for servicing such that the valley depth becomes greater than or equal to 2 metres, then geotechnical stable slope design must be incorporated (refer to **Figure 6.3.15a**);
- The physical (or geographical) 'top of bank' of valley features greater than or equal to 2 metres in height, will be established in the field in conjunction with Conservation Halton and Town of Oakville staff, and the applicant. The top of bank, as staked in the field, will represent the limit of the physical top of bank. When staking the limit of the physical top of bank, staff of Conservation Halton will require that the applicant's surveyor be in attendance during the site walk; and,
- Based on the results of the geotechnical stable slope assessment, identify the greater of the 'stable slope top of bank' and the 'physical top of bank'.

d) Fish Habitat Setback

- Identify any relevant fish habitat setbacks, on a reach basis. These setbacks are to be based on the fisheries buffers recommended in the NOCSS Management Report, and as confirmed through the studies outlined in Section 3.3.3.2;
- With respect to Species at Risk, fish habitat setbacks will be identified on a reach basis with reference to NOCSS, and through discussions with relevant agencies; and,
- As per **Figures 6.3.15a and 6.3.15b**, these fish habitat setbacks are to be applied to the bankfull channel, or unless otherwise specified in the NOCSS Management Report.

e) Valleylands Setback

- Determine the nature of the valley setting (major or minor) on a reach basis. Major valley system refers to the Sixteen Mile Creek valley system, and the balance of the valley systems in North Oakville are minor systems;
- In confined river systems, a 15 metre setback must be applied to the stable slope top of bank for major valley systems and a 7.5 metre setback must be applied to the stable slope top of bank for minor valley systems;
- In unconfined river systems, a 15 metre setback must be applied on both sides of the meander belt allowance for major valley systems and a 7.5 metre setback must be applied on both sides of the meander belt allowance for minor valley systems; and
- In some cases, the Regulatory Floodline may define the corridor width. Floodplain modifications (subject to the approval of Conservation Halton) may alter the location of the floodline in which case the setback would be applied to the altered floodline.

It should be noted that, as per Figure 6.3.15c, the final corridor width determined on a reach basis for confined river systems represents the greater of the meander belt width plus factor of safety plus major/minor valley system setback OR the stable slope top of bank plus toe erosion allowance plus major/minor valley system setback. If servicing modifications are proposed within the identified land use change, the proponent must be cognizant of the implications of channel deepening which may result in a reclassification of degree of stream confinement.

**f) Forested Stands within Stream Corridors**

The presence of forested stands within stream corridors was not used as a factor directly affecting stream corridor widths in the NOCSS. However, preservation of forested stands within stream corridors is generally preferred, and recommendations were provided in the NOCSS for forest preservation within stream corridors. For the purposes of an EIR/FSS, the following tasks must be completed:

- Use a combination of aerial photographs, ground-truthing, and ELC mapping to determine the extent of forested cover within potential stream corridor(s) (as defined by other factors discussed in this section of the Terms of Reference);
- Identify the characteristics of forested stands and their relationship to the stream corridor (including potential implications, if any, on stream corridor width/location); and,
- Identify forested stands within the stream corridor(s) and measures to be used to protect and/or manage them as appropriate.

*3.3.3.2 Fish and Fish Habitats*

**Introduction:**

The following section summarizes the study requirements for fish and fish habitats in the EIR/FSS. An assessment of fish habitat throughout the EIR subcatchment area will be required. This will provide the context and ensure that connectivity to fish habitats throughout the subcatchment are understood and addressed as required by DFO. On the other hand, certain impact assessments require details that are only available at the Draft Plan level of detail, especially those associated with proposed stream modifications. As such, the following discussion of the Terms of Reference is divided into three components.

- Study components that must be completed at the EIR subcatchment area level or beyond: This level of study is required to assess fish habitats that extend beyond the limits of a single Draft Plan and require analyses based on subcatchment boundaries in order to understand the factors that drive the sustainability of the aquatic ecosystem;
- Study components that require Draft Plan level of detail in order to be completed: This level of study focuses on detailing the potential impacts of proposed land use changes on the fish habitats. As such, details regarding the proposed undertaking must be available in order to understand the sources of, and potential mitigation of, potential impacts; and,
- Study components that focus on cases of proposed modifications to streams.

**EIR Subcatchment Area Level of Detail:**

- Carry out the work necessary to refine, map and describe stream reaches on an EIR subcatchment area basis to compare this mapping to mapping done for the NOCSS Characterization Report, and present findings on recent aerial photographs to determine any changes to channel alignment or location relative to the NOCSS;
- Assemble background information on fish and fish habitats from the NOCSS and other secondary sources;
- Conduct a preliminary field review (e.g. roadside review or similar as well as recent aerial photographs) of aquatic habitat factors leading to the classification of aquatic habitat (i.e., critical, important, marginal) as defined in the NOCSS and confirm the aquatic habitat designation of each stream on a reach basis;
- Identify reaches with critical, important or marginal aquatic habitat targeted for rehabilitation measures (to identify compensation opportunities); and,
- Compile aquatic habitat management recommendations on a reach basis as identified in the Management Strategy.

**Draft Plan Level of Detail:**

- Prepare detailed habitat mapping for all streams that contain fish habitat, which potentially may be impacted by the proposed development (e.g., road crossings, SWM outfalls, compensation reaches, etc.). Confirm location and map important habitat structure including in-stream vegetation, boulders, undercut banks, riffles, pools, runs, and woody debris;
- Identify any habitat features supporting critical life stages of fish or other aquatic biota and describe potential impacts to this habitat. Indicate how impacts to these critical habitats will be mitigated so as not to affect the form or function of these habitats;
- Additional fish sampling may be necessary to fill information gaps, as determined in consultation with Conservation Halton;
- Detail the proposed drainage characteristics of lands adjacent to fish habitats and assess any impacts associated with drainage;
- Detail proposed works (e.g., stormwater management facilities, road crossings, grading) adjacent to the fish habitats and assess/predict the impacts of construction and operation of the works, considering channel length and form, riparian buffers, flow volume and duration, water quality and water temperature;
- Detail mitigative measures and assess potential residual impacts of any works in or adjacent to fish habitats. Provide evidence that alternative methods and measures for minimizing impacts have been considered; and,
- Identify buffers from stream reaches for use in identifying stream corridor widths (see Section 3.3.3.1 d).

**Modified Stream Reaches:**

- Complete fish and fish habitat studies required for proposed stream modifications (see Section 3.3.3.3 below).

*3.3.3.3 Stream Modification/Rehabilitation Measures*

Stream rehabilitation opportunities have been identified in the Management Strategy and are illustrated in **Figure 6.3.13 (NOCSS).** **Section 6.3.4.2 (Table 6.3.4)** of the Management Report identifies enhancement recommendations for stream rehabilitation and **Section 6.3.4.6** (NOCSS) outlines considerations for stream relocation.

Stream modification may occur under circumstances such as the following:

- Stream reach rehabilitation
- Stream reach relocation and/or lowering
- Road and infrastructure crossings
- Construction of SWM outfalls

It should be noted that authorization by the DFO will be required for any watercourse alteration resulting in a Harmful Alteration, Disruption or Destruction (HADD) of fish habitat and may be required for rehabilitation and for elimination of some low constraint streams. Consultation with DFO, in conjunction with Conservation Halton is required.

Where modifications are proposed by a proponent for medium constraint streams, it will be necessary to demonstrate that the newly constructed stream will maintain and where possible enhance existing channel form, function and aquatic habitat. The established riparian corridor width must also be maintained on a reach basis. Reconstructed channels should incorporate "natural channel design" elements and should transition effectively with downstream receiving waters. Specifically, the following requirements must be fulfilled as part of the EIR/FSS:

- Perform 'rapid' field assessments to determine channel sensitivity and identify dominant processes (e.g., aggradation, widening, planform adjustment). During this assessment any existing erosion sites or infrastructure will be mapped and evaluated for rehabilitation or removal;
- Conduct a detailed field investigation of the reach requiring modification or an appropriate reference reach (channel relocation) in order to determine existing aquatic habitat features, stream geometry and channel morphology;
- Confirm the extent of all fish habitat with DFO during preparation of the EIR/FSS;
- Prepare a fish habitat compensation plan that clearly demonstrates how modified reaches will achieve a net gain in fish habitat and meet the 'no net loss in fish habitat productivity' as required by Section 35(2) of the Fisheries Act;
- Illustrate the extent of any features supporting critical life stages of fish or other aquatic biota and clearly demonstrate how the proposed compensation will replace the form and function of this habitat;
- Quantify existing aquatic habitat features (e.g., number and linear extent of pools, riffles, runs) for use in ensuring that the proposed compensation plan adequately replaces the type and extent of existing habitats;
- Use a combination of aerial photographs, ground-truthing, and ELC mapping to determine the extent of wetland cover for each Hydrologic Feature 'A';
- Identify the form and function of each Hydrologic Feature 'A' and document its ecological and hydrologic relationship to the watercourse (e.g., does the feature represent an online pond or wetland);
- Identify how the ecological and hydrological relationships of the Hydrologic Feature 'A' is considered in the proposed stream modification;
- Develop preliminary design concepts based on the principles of "natural channel design";

- Review hydraulic modeling to confirm 2-year flow conditions, regulatory flood levels and any potential impacts of modifications on regulatory floodlines;
- Based on the foregoing, identify the recommended modification to the watercourse in the form of conceptual drawings;
- Clearly demonstrate how the proposed modification measures meet the management recommendations identified in the Management Strategy;
- Consider construction approach and timing of conceptual design; and
- Identify and detail mitigation requirements related to road crossings.

Design submission requirements will be specified by the review agencies and generally will include the following:

- Plans and elevations;
- Restoration details including conceptual landscape plans, planform, profile, cross-sections and typical treatments;
- Erosion and sediment control requirements;
- Design brief; and
- Monitoring Plan for proponent modifications, including any DFO requirements.

## 3.4 Grading, Drainage, Stormwater Management

### *3.4.1 Introduction*

A major element of the EIR/FSS involves the development of a preliminary grading, stormwater servicing and stormwater management plans. This is to address the overall serviceability of the lands, to determine the grading required to service the lands, and to ensure integration with neighbouring lands, cores, linkages and receiving watercourses.

### *3.4.2 Topography and Grading*

The following additional work will be needed to upgrade existing information and provide the additional details required to develop grading and servicing plans:

- Topographic mapping that meets Town of Oakville and Conservation Halton requirements, if any;
- Detailed survey information is to be obtained for any proposed watercourse crossings, core or linkage crossings for services, including roadways; and
- Collection of field information to further delineate and quantify topographic depressions as identified in the NOCSS study.

### *3.4.3 Preliminary Grading and Drainage Plan*

- Use updated topographic mapping and survey work to refine the EIR subcatchment boundaries;
- Prepare a preliminary grading plan for the proposed development area, and a conceptual grading plan for the EIR subcatchment as necessary, to ensure servicing functionality. It is recognized that the level of detail for the EIR subcatchment will be more conceptual than within the proposed development area;

- A drainage and servicing plan for the EIR subcatchment area is to be developed identifying the storm drainage network, including conceptual designs of storm trunk sizes and profiles, SWM facilities (see Section 3.4.5) and the major and minor system;
- Potential conflicts with the ability to protect the NHS are to be identified and mitigation proposed. Examples include:
  - Any increase or decrease in drainage area to a NHS feature. It is intended that existing drainage characteristics (e.g., flow volumes, form and location) be maintained. Some minor flexibility in this may be possible provided that the feature and its functions are protected;
  - Change in grades adjacent to a NHS feature that could impact surface drainage or groundwater conditions;
  - Location of underground services adjacent to a NHS feature that would influence groundwater levels and impact the feature (i.e., wetland).
- Grading and servicing details in support of stream lowering and/or relocation to be undertaken by a proponent are to be provided.
- Lowering of existing culverts at Dundas Street may need to be considered. The lowering of red streams is not permitted, however this may apply to blue streams and any other crossings. If proposed by a proponent, details of any lowering are to be provided, as detailed in Section 3.3.3.3; and,
- A conceptual approach to erosion and sediment control is to be provided to the satisfaction of the Town.

### *3.4.4 Water Resources-Related Analyses*

Analysis and/or modeling are required for the following components:

- Hydrology and SWM facility analyses:
  - Water quantity
  - Water quality and water balance
  - Erosion control
  - Topographic depressions
- Development or refinement of floodline mapping (see Section 3.3.3.1 b)
- Flow analysis for drainage system design (sewer sizing in accordance with municipal standards)

Guidance to the analysis required to address the hydrology and SWM facility analyses is presented in the following subsections.

#### a) Water Quantity

*Hydrology Modeling*

The approach to modeling for hydrology related to SWM sizing for flood and erosion control is to be determined in consultation with the Town of Oakville and Conservation Halton, as an initial step in the EIR/FSS. Consideration of impacts to existing downstream online facilities will need to be addressed in the EIR/FSS. It is intended that flexibility be provided in the selection of a modeling approach; however, the approach is to follow commonly accepted practices.

The modeling of predevelopment conditions to establish unit flow rate targets for quantity (flood) control (2-year through Regional Storm flows) purposes has been completed as part of NOCSS. Further

modeling of predevelopment conditions is not required for this purpose. SWM ponds are to be sized to meet unit flow rate targets.

*Regional Storm Control*

The NOCSS recommends that stormwater management targets include control of the peak flow to predevelopment levels for the 2-year to 100-year return period events and the Regional Storm. With the exception of Joshua's Creek, where control of the Regional Storm event is required, future land use development applicants may carry out an investigation of the potential increase to flood risk to confirm if Regional Storm controls are necessary. Existing stream crossings and online control structures should be field verified by the proponent and reflected in the modeling as part of the Regional storm control analysis. This analysis is to include the increase in risk to life as well as the potential for flood risk to private, Municipal, Regional, Provincial and Federal property under Regional Storm conditions. If the study finds, and the Town and Conservation Halton concur in that finding, that no increase in risk occurs to downstream landowners or public uses, the Town in conjunction with Conservation Halton will conclude, subject to consideration of any other relevant factor within their respective mandates, that control at the Regional Storm level is not required. Evaluation of risk may include, but is not limited to:

- All development within North Oakville for the watershed under consideration;
- The potential increase in flood risk for the entire downstream watercourse to its outlet at Sixteen Mile Creek;
- The examination of potential increase to flood risk related to the:
  - Potential increase in flood elevations;
  - Potential increase in flood velocities;
  - Potential for the foregoing increases to adversely affect all landowners including individuals, municipal agencies, provincial agencies (MTO, MOE, etc.) and federal agencies;
  - Potential for the foregoing increases to adversely affect all land uses including road crossings, private access road, parks, storm sewer outlets, etc.; and,
  - Potential for the implementation of mitigation measures to address any increase in risk as an alternative to the requirements to control Regional Storm flows.

It is understood that not all increases in flood velocity or flood elevation will necessarily lead to an increase in risk.

The final approach with respect to this issue may have a significant impact on the SWM quantity related results for the EIR/FSS.

If it is determined, by the Town of Oakville, in conjunction with Conservation Halton, that it is not necessary to control peak flow rates, under Regional Storm conditions, to pre-development levels, then post development flow rates for the Regional Storm will need to be calculated through modeling as part of this study. These flow rates will then be used to determine flood elevations and associated flood lines for regulatory purposes. The modeling will be carried out to the satisfaction of the Town of Oakville and Conservation Halton.

**b) Water Quality and Water Balance**

The NOCSS recommends meeting MOE's Enhanced Level of protection (Level 1) for phosphorus control and fishery protection in sizing stormwater management facilities for water quality control. It is an

objective of the Town that there be no-net increase in phosphorus loadings as a result of development. This objective will be met with the use of enhanced Level SWM ponds and as a result, there is no requirement to further analyze phosphorus loadings during development approvals.

The NOCSS also recommends the use of a hierarchy of stormwater controls with preference for source control (site level), then conveyance system control, followed by end-of-pipe control. In addition, where feasible, the use of infiltration measures, including the diversion of drainage to pervious surfaces as well as designed infiltration facilities, surface retention, and storage is encouraged, to help maintain pre-development water balance conditions (see also Section 3.5 Hydrogeology). The implementation of the foregoing would be subject to best efforts to meet water balance objectives, including reduced runoff volumes and maintenance of groundwater levels, and the hierarchy of SWM controls. The examples presented in NOCSS Appendix AA – Test Catchment Design Case and Appendix LL – Analysis of Treatment-Train Design for Water Quality Control reflect both the hierarchy of measures (treatment-train approach) and the use of infiltration measures in the design.

Should the proponent wish to further analyze SWM pond sizing to account for the use of a variety of SWM measures (i.e., potential to reduce pond sizes), the above noted appendices present procedures for the following cases:

- In the case where Enhanced Level water quality ponds are to be used, calculations to support a reduced level of imperviousness will be acceptable as a basis for sizing the water quality pond where source or conveyance controls also are used to provide surface storage/retention or infiltration in permanent locations;
- In the case where an Enhanced Level water quality SWM pond is not proposed but rather a combination of source, conveyance system, and/or end-of-pipe facilities are proposed, then calculations of the combined efficiencies of the facilities should be carried out to support the design, with a view to achieve a combined performance of 80% TSS removal and/or 65% TP removal, as required by an Enhanced Level of protection; and,
- For serviced lands with a drainage area of less than 5ha, where the size of drainage area limits the feasibility of end-of-pipe facilities for SWM, the use of lot and/or conveyance type of SWM measures will be needed to meet SWM requirements. It is recognized that it may be difficult to meet the enhanced level of SWM needed to provide for the water quality control target. In that event, it must be demonstrated that every reasonable effort has been made to provide an approach that would meet the water quality target. If it is agreed by the Town of Oakville and Conservation Halton that enhanced level of control cannot be provided for in the serviced area, it must be demonstrated that the enhanced level of control, as well as other SWM targets are being met within the overall EIR subcatchment area that contains this particular serviced area.

**c) Erosion Control SWM Facility Sizing**

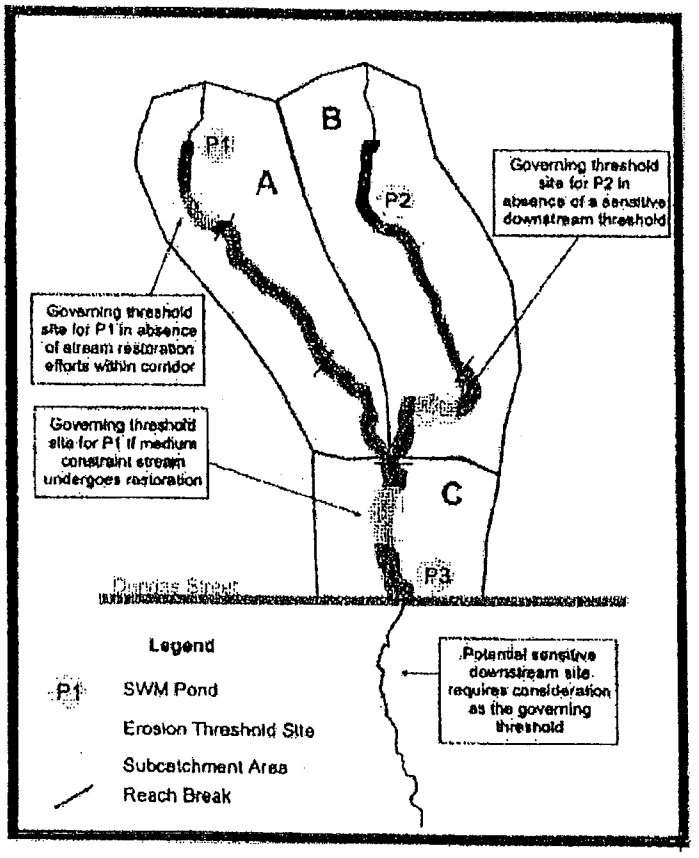
In order to ensure that the receiving channels will not experience higher than normal rates of erosion, a threshold flow needs to be incorporated into the design of each SWM facility. Analysis in support of SWM facility sizing must include erosion threshold analysis and continuous hydrologic modeling to ensure that appropriate extended detention storage is provided.

Erosion thresholds were broadly characterized in **Section 5.8 (Table 5.8.5)** of the NOCSS Analysis Report. A more detailed determination of erosion thresholds is required at the EIR/FSS stage. These thresholds are meant to be integrated into a stormwater management system design in such a manner that existing channel erosion or aggradation is not exacerbated. Specifically, the following requirements must be fulfilled as part of the EIR/FSS:

- Confirm reach delineation work completed for the NOCSS using best available mapping and aerial photography;
- Determine if erosion thresholds previously identified in the NOCSS apply to the EIR subcatchment area;
- Confirm the location of SWM ponds within and downstream of the identified EIR subcatchment area;
- Conduct rapid geomorphic assessments on a reach basis to verify desktop analyses and identify areas most susceptible to erosion;
- Perform detailed field investigation(s) along the most geomorphologically sensitive reach(es) to quantify channel geometry and identify active geomorphic processes;
- Apply multiple analytical methods (e.g. critical shear, stream power and permissible velocity models) to the field data in order to calculate an erosion threshold in terms of the point at which sustained flows will tend to entrain and transport sediment using data collected during the detailed field investigation(s);
- Select an appropriate defining threshold based on model convergence and compatibility with indicators of active processes (e.g., widening and entrenchment) as identified through the field investigation;
- Perform an analysis of pre and post development conditions using a continuous hydrologic model on a subcatchment area basis to identify erosion control sizing for SWM facilities. Specifically, the frequency and duration of time (expressed as hours) that the erosive threshold flow is exceeded, in the pre-development condition, is to be matched in the post-development condition (i.e., results are within approximately 5% of the pre-development conditions.[1] Before a 5% increase is accepted, work needs to be completed as to the likely effects and implications of this nominal increase to determine whether further mitigation, modeling refinement or monitoring is warranted); and,
- Clearly illustrate how the proposed development scenario meets erosion control criteria as established in the NOCSS.

It should be noted that, while the erosion threshold assessment is conducted on a single subcatchment area basis, the proponent must be aware that areas downstream need to be considered when selecting the most sensitive reach, as depicted in Figure 3.4.1.

*Figure 3.4.1: A Hypothetical Example Illustrating Relevant Erosion Threshold Procedures in the Context of Subcatchment Areas*




**Note:** The most sensitive reach for SWM P1 is highlighted in the shaded area downstream of the pond. However, an assessment of downstream reaches beyond the subcatchment boundary is required in order to ensure that no additional impacts are created. Moreover, if restoration of the medium constraint stream is anticipated, then an analysis of downstream reaches would be required to determine the governing threshold for SWM P1. As discussed in the previous text, the governing threshold could be located downstream of Dundas Street (beyond the boundary of the EIR Subcatchments), depending on the relative sensitivity of stream conditions. In this example, the shaded area in Subcatchment A would govern as the most sensitive reach for SWM P1. Also, in the event that the shaded area downstream of SWM P1 was so unstable that erosion threshold targets could not be met, this reach could be restored and enhanced and the threshold for Subcatchment C then would apply.

d) Topographic Depressions

In North Oakville, there are a number of topographic depression areas that are poorly drained. The characteristics of this topography have an impact on the response characteristics of the area during precipitation and runoff events. Consequently, NOCSS requires, as part of the EIR/FSS, that the storage within the topographic depressions be refined and checked against the storage within proposed SWM ponds in the EIR subcatchment area to verify that the SWM pond storage accounts for the depression storage. Thus, the SWM ponds volume must be equal to or greater than the original depression storage volume.

In general, the NOCSS hydrologic model incorporates depression storage to establish unit area target flow rates. The calculation and comparison of depression storage to SWM storage is intended as a check to ensure that the existing condition peak flow rates do not increase as a result of land development. The principle behind this approach is to ensure that the hydrologic analysis and SWM approach reflects the existing site conditions that include a number of topographic depressions, and the natural depression storage is maintained in the SWM system.

This approach is not to include artificially created storage such as that created by embankments or dug facilities. Although the topographic depressions are illustrated in NOCSS, referred to as pits, ponds and depressions, the existing mapping does not provide for accurate delineation of these depressions.

The more detailed mapping and other relevant investigations of the EIR/FSS are to be used to confirm the existence, nature (natural or artificial), and storage volume of these depressions.

To ensure that the storage volume of the depression storage areas is maintained, the calculated depression volume is to be compared to the SWM pond volume of the proposed SWM facility within the same subcatchment drainage area. If the depression storage volume is less than or equal to the SWM facility volume, no additional analysis or change to the SWM facility design is required. In the event that depression storage is greater than the SWM facility volumes, the SWM facility volume (as noted in the following points) is to be adjusted to be equal to the depression storage volume.

Calculations and volume comparisons shall be done as follows:

- 2-year event: Calculate the 2-year depression storage volume and compare this volume to the water quality (extended detention and permanent pool) volume in the SWM facility.
- 100-year event or Regional Storm (whichever is applicable): Calculate the 100-year or Regional Storm depression storage volume and compare it to the total storage volume (permanent and active storage) in the SWM facility (up to 100-year or Regional Storm event).

### *3.4.5 SWM Plan*

A SWM plan is to be developed as part of the EIR/FSS to demonstrate how the targets as specified in the Management Strategy are to be met. It is intended that SWM is to be provided through a combination of "Best Management Practices" (BMP), which may range from at-source controls to end-of-pipe solutions. The preliminary location of SWM ponds is illustrated in the Management Strategy; however, flexibility on the final location is anticipated.

In developing the overall SWM Plan, a treatment train approach is to be applied in evaluating the effectiveness of BMPs. Consultation with the Town of Oakville and Conservation Halton will be required in the selection of measures and their effectiveness.

The use of BMPs for stormwater management (in addition to SWM ponds) can reduce the size of the ponds. The measures are to be evaluated in their ability to retain water on-site and thereby maintain existing condition water balance where feasible based on site soil conditions, and protect water quality in relation to the NOCSS recommendations (i.e. phosphorus control, temperature control, suspended solids reduction).

Preliminary design details for the SWM ponds will be required as part of the EIR/FSS including:

- SWM pond block sizing, including preliminary grades, design water levels (pond and receiving body outlet), storage volumes and maintenance access provisions;
- Cross-section details;
- Pond profile including inlet and outlet;
- Landscaping provisions as per Conservation Halton guidelines; and
- Monitoring plan to the satisfaction of the Town.

## 3.5 Hydrogeology

### *3.5.1 Introduction*

The NOCSS prepared in support of the Secondary Plan for the North Oakville area included recommendations for more detailed hydrogeological investigations as part of the EIR/FSS in support of proposed Draft Plans.

The purpose of the detailed hydrogeological study is to characterize existing hydrogeological conditions, quantify potential groundwater-related impacts and determine the need for, and nature of, any mitigation measures required to protect the hydrogeological features and functions within the EIR subcatchment area.

### *3.5.2 Technical Requirements*

The EIR must address the entire EIR subcatchment area within which the proposed development area is located. Therefore, in addition to site investigations specific to the proposed development area, it may be necessary to secure access to adjacent properties or road allowances to investigate areas of the EIR subcatchment area outside the proposed development area.

The level of detail must be sufficient to support submission of Draft Plans of subdivision. The methodology to complete the study requirements is at the discretion of the consultant, but must conform to generally accepted groundwater engineering and hydrogeologic practices.

Boreholes and groundwater observation wells must be distributed such that the groundwater conditions are defined for the proposed development area and the EIR subcatchment area. Any specific on-site features are to be investigated.

a) Geology and Hydrogeology

- Provide an overview of the regional geological setting;
- Drill boreholes to determine the site-specific geology (stratigraphy and depth to bedrock). The number of boreholes will depend upon the sizes of the EIR subcatchment area and the proposed development area, the background data available, and the geological complexity of the area;
- Collect soil samples from each borehole and test for grain-size to characterize the soil types and to assist in determining soil hydraulic conductivity;
- Relate the local geological data to the regional geological setting;
- Establish a network of groundwater observation wells to determine the depth to the water table and vertical and horizontal groundwater gradients;
- The number of monitoring wells to be installed will depend upon the EIR subcatchment area and the proposed development area sizes, the complexity of drainage, the number of environmental features, the locations of groundwater divides, and the background data available. Where available, existing observation wells may be used;
- Survey all monitoring locations for coordinates and geodetic elevation;
- Map the groundwater flow conditions (including vertical and horizontal flow components);
- Conduct bail-down, slug, or other appropriate field tests to confirm well function and assess the hydrogeological characteristics of stratigraphic units (e.g. *in situ* hydraulic conductivity);
- Provide estimates of groundwater flux;
- Monitor groundwater levels in all observation wells (data included in the EIR/FSS should be related to the regional groundwater elevation data and be sufficient to document the response of the shallow groundwater to climatic conditions throughout the year). A minimum of one water table observation well should be equipped with a datalogger to continuously record water levels. The data must be corrected for barometric response;
- Monitor surface water baseflows (non-storm event flows; minimum of 3 days post precipitation event) upstream and downstream in all identified watercourses. These data will be used to assist in establishing the groundwater contribution to stream flow and infiltration as part of the water balance assessment;
- Collect a sufficient number of groundwater and surface water samples for laboratory analysis of major ion chemistry to establish the background water quality across the area. These data will be used to assist in the assessment of groundwater/surface water interactions and to establish baseline pre-development conditions;
- Map groundwater discharge areas and identify any areas along stream corridors for recharge/discharge function protection; and,
- Complete a water balance analysis to determine the pre-development (based on existing conditions) and post-development (based on the proposed land use plan) interflow and deep recharge volumes. The water balance should utilize the longest and most continuous local daily climate data and a soil-moisture balance approach (e.g., Thornthwaite and Mather) with daily or monthly calculations reported on an average annual basis. Surface water flow data should be used to validate the existing conditions water balance where possible.

**b) Requirements for Proposed Development Plan**

- Determine the infiltration deficit (pre to post development) for the proposed development area and the EIR subcatchment area;
- Identify hydrogeological opportunities and constraints to maintaining the water balance (i.e., to reduce the infiltration deficit);

- Identify the type, location and size of infiltration or storage measures that may be feasible for use based on the site specific geological and hydrogeological conditions;
- Evaluate opportunities for augmenting groundwater infiltration through appropriate and practical Best Management Practices (e.g., as outlined in the MOE Stormwater Management Planning and Design Manual 2003) to balance, or at least in part, make up the post-development infiltration deficit;
- If pre-development infiltration cannot be maintained, predict the impact of this change on the flows in local streams and on the local water table and recommend mitigation measures as required;
- Identify areas where hydrogeological conditions may affect construction (e.g., high water table, requirements for dewatering, etc.), and recommend control and mitigation measures, if warranted; and,
- Evaluate the potential for impacts from proposed underground services on shallow groundwater conditions adjacent to cores, linkages and stream corridors. If the potential for negative impact exists, mitigative measures are to be recommended.

### 3.6 Sanitary, Water, Roads

Analyses and details must be provided for the servicing of a specific development application. In addition, it will be necessary to provide conceptual designs of trunk services within the EIR subcatchment (conceptually only in areas not part of the proposed development area; FSS level of detail in the proposed development area) including appropriate connections to external areas, demonstrating servicing viability without placing undue restrictions on external areas (e.g., considering sewer depths and grading). Sufficient analysis is necessary to ensure that external lands can be serviced to meet Town and Region standards.

The FSS will build upon and implement, as applicable, recommendations of the Master Servicing Plan for the North Oakville East area, prepared as background to the Secondary Plan, and any applicable Master Servicing Plans prepared by the Region of Halton. The following tasks are to be undertaken.

- Compile information from the NOCSS and the Secondary Plan specific to the proposed development area including design criteria, environmental designations, road locations and design levels, etc. and undertake an information gap analysis to determine additional information needs, if any;
- Review detailed information on the proposed land uses of the development application, with respect to population, housing form, road pattern, open space components, and hard surfaces to provide input to engineering analysis;
- Complete a sanitary servicing assessment to:
  - determine the servicing requirements based on future system wastewater flows;
  - recommend a preferred sanitary servicing option considering external and internal infrastructure, and potential phasing;
  - provide interim servicing solutions where feasible;
  - assess site specific infrastructure locations and designs for crossings of streams, linkages and cores;
  - make recommendations on preferred crossing locations, construction practices, and mitigative measures to minimize impacts to the NHS; and,
  - determine consistency with Region of Halton Master Servicing Plan and explain differences;
- Complete a water servicing assessment to:
  - determine the servicing requirements based on future system demands;

- identify a preferred water servicing option considering external and internal infrastructure, pressure districts and potential phasing;
- assess site specific infrastructure locations and designs for crossings of streams, linkages and cores;
- make recommendations on preferred crossing locations, construction practices, and mitigative measures to minimize impacts to the NHS; and,
- determine consistency with Region of Halton Master Servicing Plan and explain differences.

- Complete a road design assessment to:
  - compile the road design requirements and road locations as identified in the Master Servicing Plan and the Secondary Plan;
  - identify local road system within the proposed development area;
  - assess site specific road locations and designs for crossings of streams, linkages and cores; and,
  - make recommendations on preferred crossing locations and configurations, road design standards, and mitigative measures to minimize impacts to the NHS (e.g., ecopassages).

## 4.0 MONITORING

It will be necessary to detail environmental monitoring requirements as part of the EIR/FSS, in support of Draft Plans of subdivision, in accordance with applicable directions in NOCSS.

## 5.0 REPORTING REQUIREMENTS

A detailed report is to be prepared integrating the analysis, findings and recommendations covered in the study Terms of Reference.

# B.14

**Flow Rates Hydrology**

**NORTH OAKVILLE SUBWATERSHED**
**MANAGEMENT STRATEGY**
**(WITHOUT PREJUDICE)**
**July 4, 2007**

**Mediation Item: Flow Rates/Hydrology**

**Issue:**

The existing condition peak flow rates for North Oakville are to be used as targets for water quantity control in sizing stormwater management facilities. The peak flowrates identified in the North Oakville Creeks Subwatershed Study (NOCSS) are different than those provided in the North Oakville East Subwatersheds Study prepared by North Oakville East Landowners. It is intended that the peak flowrates attached be used as targets in the form of a unit area flowrate (flow per hectare of drainage area).

A consistent, agreed upon value is required, since this will provide the target peak flow value for sizing stormwater management facilities for flood protection purposes.

**Agreement :**

Meetings to discuss this issue have resulted in the following agreements:

1. There is agreement on the approach used to calculate the unit area flows for existing conditions. The Town's revised GAWSER model of existing conditions (dated June 21, 2007) provides the agreed upon unit flow rates presented on the attached table.

2. We have agreement that separate unit area flow targets will be used for each Subwatershed.

3. The agreed upon unit area flows will be used for existing condition flow targets and, as such, additional existing condition flood flow modelling will not need to be undertaken during either EIR, FSS or final design submissions related to development. Similarly, existing condition peak flowrates can be taken from the current model results (presented on the attached table), and new modeling is not needed for the corresponding determination of existing condition floodlines, where SWM ponds are used to control Regional Storm flows to existing levels. There is one exception to this as outlined in the Joshua Creek floodplain agreement dated May 31, 2007, which involves a situation where further hydrologic modeling will be carried out to refine the Regional Storm peak flood flow rates. (Floodlines will need to be updated at the EIR stage to reflect more detailed topographic mapping). If a landowner demonstrates to the satisfaction of the Town and Conservation Halton, that it is not necessary to provide SWM controls for the Regional Storm for a specific subwatershed, in accordance with the NOCSS and the Secondary Plan, then the EIR in support of development within that subwatershed must include updated hydrologic modelling to determine the post development Regional Storm flow for purposes of establishing Regional Storm floodlines.

4. It is recognized that the drainage areas will be refined during the EIR study stage when more detailed topographic mapping is available. This will result in some change to drainage areas which will be reflected in the final existing condition flows through the use of unit area flows.

5. It is agreed that a change to the East Morrison Creek drainage area boundary should be made in the Subwatershed Study.

[redacted]

## REVISED TARGET UNIT AREA PEAK FLOW RATES 07.06.27
## EXISTING LAND USE

Confidential and without Prejudice

| Location | Culvert No. | Drainage Area | Regional Storm | 100 year storm | 50 year storm | 25 year storm | 10 year storm | 5 year storm | 2 year storm |
|---|---|---|---|---|---|---|---|---|---|
| | | ha. | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| **14 Mile Creek** | | | | | | | | | |
| Dundas St. W. | FM-D2 | 46.56 | 2.50 | 1.04 | 0.92 | 0.80 | 0.62 | 0.51 | 0.31 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.054 | 0.022 | 0.020 | 0.017 | 0.013 | 0.011 | 0.007 |
| | FM-D3 | 11.71 | 0.76 | 0.36 | 0.32 | 0.28 | 0.23 | 0.19 | 0.12 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.065 | 0.031 | 0.027 | 0.024 | 0.020 | 0.016 | 0.010 |
| | FM-D4 | 423.70 | 20.96 | 8.39 | 7.42 | 6.49 | 5.09 | 4.17 | 2.62 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.049 | 0.020 | 0.018 | 0.015 | 0.012 | 0.010 | 0.006 |
| | FM-D5 | 339.99 | 18.73 | 7.56 | 6.60 | 5.68 | 4.35 | 3.43 | 2.01 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.055 | 0.022 | 0.019 | 0.017 | 0.013 | 0.010 | 0.006 |
| | FM-D6 | 16.91 | 0.88 | 0.36 | 0.32 | 0.28 | 0.23 | 0.19 | 0.12 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.052 | 0.021 | 0.019 | 0.017 | 0.014 | 0.011 | 0.007 |
| | FM-D6a | 26.23 | 1.38 | 0.57 | 0.50 | 0.44 | 0.34 | 0.28 | 0.18 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.053 | 0.022 | 0.019 | 0.017 | 0.013 | 0.011 | 0.007 |
| | FM-D7 | 247.92 | 11.96 | 4.63 | 4.07 | 3.54 | 2.75 | 2.23 | 1.36 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.048 | 0.019 | 0.016 | 0.014 | 0.011 | 0.009 | 0.005 |
| | FM-D8 | 8.45 | 0.66 | 0.37 | 0.33 | 0.29 | 0.23 | 0.19 | 0.12 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.078 | 0.044 | 0.039 | 0.034 | 0.027 | 0.022 | 0.014 |
| | FM-D9 | 18.58 | 1.47 | 0.86 | 0.76 | 0.67 | 0.54 | 0.44 | 0.28 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.079 | 0.046 | 0.041 | 0.036 | 0.029 | 0.024 | 0.015 |
| **McCraney Creek** | | | | | | | | | |
| Dundas St. W. | MC-D1 | 126.46 | 6.43 | 2.60 | 2.31 | 2.02 | 1.59 | 1.31 | 0.83 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.051 | 0.021 | 0.018 | 0.016 | 0.013 | 0.010 | 0.007 |
| **Taplow Creek** | | | | | | | | | |
| Dundas St. W. | TC-D1 | 33.61 | 1.64 | 0.64 | 0.57 | 0.50 | 0.39 | 0.32 | 0.21 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.049 | 0.019 | 0.017 | 0.015 | 0.012 | 0.010 | 0.006 |
| **Glen Oak Creek** | | | | | | | | | |
| Dundas St. W. | GO-D1 | 47.16 | 2.34 | 0.93 | 0.83 | 0.73 | 0.58 | 0.48 | 0.31 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.050 | 0.020 | 0.018 | 0.015 | 0.012 | 0.010 | 0.007 |
| **West 16 Mile Creek Tribs.** | | | | | | | | | |
| Dundas St. W. | SM-D1 | 87.97 | 3.58 | 1.24 | 1.09 | 0.95 | 0.73 | 0.59 | 0.36 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.041 | 0.014 | 0.012 | 0.011 | 0.008 | 0.007 | 0.004 |
| | SM-D1a | 12.53 | 0.81 | 0.38 | 0.34 | 0.30 | 0.24 | 0.20 | 0.13 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.065 | 0.030 | 0.027 | 0.024 | 0.019 | 0.016 | 0.010 |
| | SM-D2 | 8.01 | 0.52 | 0.24 | 0.22 | 0.19 | 0.15 | 0.13 | 0.08 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.065 | 0.030 | 0.027 | 0.024 | 0.019 | 0.016 | 0.010 |
| **East 16 Mile Creek Tribs.** | | | | | | | | | |
| Sixteen Mile Creek | ---- | 383.10 | 16.86 | 6.28 | 5.48 | 4.70 | 3.58 | 2.82 | 1.64 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.044 | 0.016 | 0.014 | 0.012 | 0.009 | 0.007 | 0.004 |
| **Osenego Creek** | | | | | | | | | |
| Dundas St. W. | OC-D1 | 43.93 | 2.63 | 1.20 | 1.06 | 0.94 | 0.74 | 0.62 | 0.40 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.060 | 0.027 | 0.024 | 0.021 | 0.017 | 0.014 | 0.009 |
| **Shannon's Creek** | | | | | | | | | |
| Dundas St. W. | SC-D1 | 84.37 | 3.81 | 1.39 | 1.23 | 1.06 | 0.82 | 0.66 | 0.40 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.045 | 0.016 | 0.015 | 0.013 | 0.010 | 0.008 | 0.005 |

## REVISED TARGET UNIT AREA PEAK FLOW RATES 07.06.27

## EXISTING LAND USE

Confidential and without Prejudice

| Location | Culvert No. | Drainage Area | Regional Storm | 100 year storm | 50 year storm | 25 year storm | 10 year storm | 5 year storm | 2 year storm |
|---|---|---|---|---|---|---|---|---|---|
| | | ha. | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| **Munn's Creek** | | | | | | | | | |
| Dundas St. W. | MC-D1 | 29.99 | 2.01 | 0.99 | 0.88 | 0.77 | 0.62 | 0.51 | 0.33 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.067 | 0.033 | 0.029 | 0.026 | 0.021 | 0.017 | 0.011 |
| | MC-D4 | 59.61 | 3.19 | 1.31 | 1.16 | 1.02 | 0.80 | 0.67 | 0.43 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.054 | 0.022 | 0.019 | 0.017 | 0.013 | 0.011 | 0.007 |
| **West Morrison Creek** | | | | | | | | | |
| Dundas St. E. | MW-D3 | 226.38 | 10.93 | 4.26 | 3.77 | 3.30 | 2.59 | 2.13 | 1.35 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.048 | 0.019 | 0.017 | 0.015 | 0.011 | 0.009 | 0.006 |
| **East Morrison Creek** | | | | | | | | | |
| Dundas St. E. | ME-D2 | 313.94 | 13.67 | 5.18 | 4.58 | 4.00 | 3.14 | 2.57 | 1.62 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.044 | 0.016 | 0.015 | 0.013 | 0.010 | 0.008 | 0.005 |
| **Joshua's Creek** | | | | | | | | | |
| Dundas St. E. | JC-D1 | 962.74 | 50.06 | 20.58 | 18.18 | 16.02 | 12.57 | 10.35 | 6.53 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.052 | 0.021 | 0.019 | 0.017 | 0.013 | 0.011 | 0.007 |
| | JC-D2 | 111.80 | 5.68 | 2.21 | 1.95 | 1.69 | 1.31 | 1.07 | 0.65 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.051 | 0.020 | 0.017 | 0.015 | 0.012 | 0.010 | 0.006 |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Table 5.4.1 - Hydrologic Cycle, Return Peirod Peak Flow Rates** | | | | | | | | | | |
| 2 | 07.06.26 | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | **Location** | **Culvert** | **GAWSER** | **Land Use** | **Reg.** | **100 year** | **50 year** | **25 year** | **10 year** | **5 year** | **2 year** |
| 5 | | **No.** | **Hyd. No.** | | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** |
| 6 | | | | | | | | | | | |
| 7 | ***14 Mile Creek*** | | | | | | | | | | |
| 8 | Dundas St. W. | FM-D1 | 1101 | Existing | 1.20 | 0.56 | 0.50 | 0.44 | 0.35 | 0.29 | 0.19 |
| 9 | | | | | | | | | | | |
| 10 | Dundas St. W. | FM-D2 | 1102 | Existing | 2.50 | 1.04 | 0.92 | 0.80 | 0.62 | 0.51 | 0.31 |
| 11 | | | | | | | | | | | |
| 12 | Dundas St. W. | FM-D3 | 1103 | Existing | 0.76 | 0.36 | 0.32 | 0.28 | 0.23 | 0.19 | 0.12 |
| 13 | | | | | | | | | | | |
| 14 | Highway 407 | FM-1 | 1001 | Existing | 7.32 | 2.93 | 2.59 | 2.27 | 1.79 | 1.48 | 0.94 |
| 15 | | | | | | | | | | | |
| 16 | Highway 407 | FM-2 | 1002 | Existing | 1.65 | 0.71 | 0.63 | 0.55 | 0.43 | 0.36 | 0.23 |
| 17 | | | | | | | | | | | |
| 18 | Burnhamthorpe Rd. W. | FM-B1 | 0031 | Existing | 4.44 | 1.67 | 1.47 | 1.28 | 1.00 | 0.81 | 0.50 |
| 19 | | | | | | | | | | | |
| 20 | Highway 407 | FM-3 | 2019 | Existing | 5.95 | 2.31 | 2.05 | 1.79 | 1.40 | 1.14 | 0.71 |
| 21 | | | | | | | | | | | |
| 22 | Highway 407 | FM-4 | 1004 | Existing | 0.30 | 0.09 | 0.08 | 0.06 | 0.04 | 0.03 | 0.01 |
| 23 | | | | | | | | | | | |
| 24 | Dundas St. W. | FM-D4 | 2034 | Existing | 20.96 | 8.39 | 7.42 | 6.49 | 5.09 | 4.17 | 2.62 |
| 25 | | | | | | | | | | | |
| 26 | Highway 407 | FM-5 | 1005 | Existing | 1.57 | 0.59 | 0.51 | 0.44 | 0.33 | 0.25 | 0.13 |
| 27 | | | | | | | | | | | |
| 28 | Highway 407 | FM-6 | 1006 | Existing | 1.83 | 0.69 | 0.60 | 0.51 | 0.38 | 0.29 | 0.15 |
| 29 | | | | | | | | | | | |
| 30 | Burnhamthorpe Rd. W. | FM-B2 | 0071 | Existing | 2.58 | 1.02 | 0.91 | 0.79 | 0.62 | 0.52 | 0.33 |
| 31 | | | | | | | | | | | |
| 32 | Burnhamthorpe Rd. W. | FM-B3 | 0073 | Existing | 3.42 | 1.34 | 1.17 | 1.01 | 0.77 | 0.61 | 0.36 |
| 33 | | | | | | | | | | | |
| 34 | Highway 407 | FM-7 | 2048 | Existing | 8.68 | 3.48 | 3.05 | 2.65 | 2.05 | 1.64 | 0.99 |
| 35 | | | | | | | | | | | |
| 36 | Highway 407 | FM-8 | 1008 | Existing | 0.39 | 0.15 | 0.13 | 0.10 | 0.07 | 0.04 | 0.01 |
| 37 | | | | | | | | | | | |
| 38 | Dundas St. W. | FM-D5 | 2061 | Existing | 18.73 | 7.56 | 6.60 | 5.68 | 4.35 | 3.43 | 2.01 |
| 39 | | | | | | | | | | | |
| 40 | Highway 407 | FM-9 | 1009 | Existing | 2.74 | 1.01 | 0.89 | 0.78 | 0.60 | 0.49 | 0.30 |
| 41 | | | | | | | | | | | |
| 42 | Dundas St. W. | FM-D6 | 1110 | Existing | 0.88 | 0.36 | 0.32 | 0.28 | 0.23 | 0.19 | 0.12 |
| 43 | | | | | | | | | | | |
| 44 | Dundas St. W. | FM-D6a | 2367 | Existing | 1.38 | 0.57 | 0.50 | 0.44 | 0.34 | 0.28 | 0.18 |
| 45 | | | | | | | | | | | |
| 46 | Highway 407 | FM-10 | 1010 | Existing | 4.04 | 1.62 | 1.43 | 1.26 | 0.99 | 0.82 | 0.52 |
| 47 | | | | | | | | | | | |
| 48 | Highway 407 | FM-11 | 1011 | Existing | 0.51 | 0.24 | 0.21 | 0.18 | 0.14 | 0.11 | 0.06 |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Table 5.4.1 - Hydrologic Cycle, Return Peirod Peak Flow Rates | | | | | | | | | | |
| 2 | 07.06.26 | | | | | | | | | | |
| 3 | | | | | Reg. | 100 | 50 | 25 | 10 | 5 | 2 |
| 4 | Location | Culvert | GAWSER | Land Use | | year | year | year | year | year | year |
| 5 | | No. | Hyd. No. | | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| 6 | | | | | | | | | | | |
| 49 | | | | | | | | | | | |
| 50 | Dundas St. W. | FM-D7 | 2475 | Existing | 11.96 | 4.63 | 4.07 | 3.54 | 2.75 | 2.23 | 1.36 |
| 51 | | | | | | | | | | | |
| 52 | Dundas St. W. | FM-D8 | 1112 | Existing | 0.66 | 0.37 | 0.33 | 0.29 | 0.23 | 0.19 | 0.12 |
| 53 | | | | | | | | | | | |
| 54 | Dundas St. W. | FM-D9 | 1113 | Existing | 1.47 | 0.86 | 0.76 | 0.67 | 0.54 | 0.44 | 0.28 |
| 55 | | | | | | | | | | | |
| 56 | ***McCraney Creek*** | | | | | | | | | | |
| 57 | Highway 407 | FM-12 | 1012 | Existing | 1.75 | 0.74 | 0.65 | 0.57 | 0.45 | 0.37 | 0.23 |
| 58 | | | | | | | | | | | |
| 59 | Dundas St. W. | MC-D1 | 2085 | Existing | 6.43 | 2.60 | 2.31 | 2.02 | 1.59 | 1.31 | 0.83 |
| 60 | | | | | | | | | | | |
| 61 | ***Taplow Creek*** | | | | | | | | | | |
| 62 | Dundas St. W. | TC-D1 | 1115 | Existing | 1.64 | 0.64 | 0.57 | 0.50 | 0.39 | 0.32 | 0.21 |
| 63 | | | | | | | | | | | |
| 64 | ***Glen Oak Creek*** | | | | | | | | | | |
| 65 | Dundas St. W. | GO-D1 | 1116 | Existing | 2.34 | 0.93 | 0.83 | 0.73 | 0.58 | 0.48 | 0.31 |
| 66 | | | | | | | | | | | |
| 67 | ***West 16 Mile Creek Tribs.*** | | | | | | | | | | |
| 68 | Dundas St. W. | SM-D1 | 2392 | Existing | 3.58 | 1.24 | 1.09 | 0.95 | 0.73 | 0.59 | 0.36 |
| 69 | | | | | | | | | | | |
| 70 | Dundas St. W. | SM-D1a | 1117 | Existing | 0.81 | 0.38 | 0.34 | 0.30 | 0.24 | 0.20 | 0.13 |
| 71 | | | | | | | | | | | |
| 72 | Dundas St. W. | SM-D2 | 1118 | Existing | 0.52 | 0.24 | 0.22 | 0.19 | 0.15 | 0.13 | 0.08 |
| 73 | | | | | | | | | | | |
| 74 | Highway 407 | SM-1 | 1020 | Existing | 5.01 | 1.81 | 1.59 | 1.38 | 1.07 | 0.86 | 0.52 |
| 75 | | | | | | | | | | | |
| 76 | Highway 407 | SM-2 | 1021 | Existing | 1.67 | 0.70 | 0.62 | 0.54 | 0.42 | 0.34 | 0.20 |
| 77 | | | | | | | | | | | |
| 78 | Highway 407 | SM-3 | 1022 | Existing | 0.58 | 0.28 | 0.24 | 0.21 | 0.16 | 0.12 | 0.07 |
| 79 | | | | | | | | | | | |
| 80 | ***East 16 Mile Creek Tribs.*** | | | | | | | | | | |
| 81 | Neyagawa Blvd. | ESM-NG3 | 2124 | Existing | 6.96 | 2.90 | 2.57 | 2.25 | 1.77 | 1.47 | 0.94 |
| 82 | | | | | | | | | | | |
| 83 | Neyagawa Blvd. | ESM-NG2 | 2128 | Existing | 8.80 | 6.49 | 3.07 | 2.66 | 2.06 | 1.66 | 1.01 |
| 84 | | | | | | | | | | | |
| 85 | Sixteen Mile Creek | --- | 2137 | Existing | 16.86 | 6.28 | 5.48 | 4.70 | 3.58 | 2.82 | 1.64 |
| 86 | | | | | | | | | | | |
| 87 | Burnhamthorpe Rd. W. | ESM-B14 | 2914 | Existing | 2.47 | 1.11 | 0.97 | 0.84 | 0.65 | 0.52 | 0.31 |
| 88 | | | | | | | | | | | |
| 89 | **Osenego Creek** | | | | | | | | | | |
| 90 | Dundas St. W. | OC-D1 | 2143 | Existing | 2.63 | 1.20 | 1.06 | 0.94 | 0.74 | 0.62 | 0.40 |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Table 5.4.1 - Hydrologic Cycle, Return Peirod Peak Flow Rates** | | | | | | | | | | |
| 2 | 07.06.26 | | | | | | | | | | |
| 3 | | | | | **Reg.** | **100 year** | **50 year** | **25 year** | **10 year** | **5 year** | **2 year** |
| 4 | **Location** | **Culvert No.** | **GAWSER Hyd. No.** | **Land Use** | | | | | | | |
| 5 | | | | | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| 6 | | | | | | | | | | | |
| 91 | | | | | | | | | | | |
| 92 | **Shannon's Creek** | | | | | | | | | | |
| 93 | Dundas St. W. | SC-D1 | 2146 | Existing | 3.81 | 1.39 | 1.23 | 1.06 | 0.82 | 0.66 | 0.40 |
| 94 | | | | | | | | | | | |
| 95 | **Munn's Creek** | | | | | | | | | | |
| 96 | Dundas St. W. | MC-D1 | 2177 | Existing | 2.01 | 0.99 | 0.88 | 0.77 | 0.62 | 0.51 | 0.33 |
| 97 | | | | | | | | | | | |
| 98 | Dundas St. W. | MC-D4 | 2174 | Existing | 3.19 | 1.31 | 1.16 | 1.02 | 0.80 | 0.67 | 0.43 |
| 99 | | | | | | | | | | | |
| 100 | **West Morrison Creek** | | | | | | | | | | |
| 101 | Sixth Line | MW-S2 | 2149 | Existing | 7.88 | 2.97 | 2.62 | 2.29 | 1.79 | 1.47 | 0.92 |
| 102 | | | | | | | | | | | |
| 103 | Dundas St. E. | MW-D3 | 2154 | Existing | 10.93 | 4.26 | 3.77 | 3.30 | 2.59 | 2.13 | 1.35 |
| 104 | | | | | | | | | | | |
| 105 | **East Morrison Creek** | | | | | | | | | | |
| 106 | Bunhamthorpe Rd. E. | ME-B1 | 2160 | Existing | 0.99 | 0.49 | 0.43 | 0.38 | 0.30 | 0.25 | 0.16 |
| 107 | | | | | | | | | | | |
| 108 | Trafalgar Road | ME-T5 | 2165 | Existing | 2.72 | 1.27 | 1.13 | 0.99 | 0.78 | 0.65 | 0.42 |
| 109 | | | | | | | | | | | |
| 110 | Trafalgar Road | ME-T1 | 2170 | Existing | 7.55 | 3.07 | 2.72 | 2.38 | 1.88 | 1.54 | 0.98 |
| 111 | | | | | | | | | | | |
| 112 | Dundas St. E. | ME-D2 | 2171 | Existing | 13.67 | 5.18 | 4.58 | 4.00 | 3.14 | 2.57 | 1.62 |
| 113 | | | | | | | | | | | |
| 114 | **Joshua's Creek** | | | | | | | | | | |
| 115 | Highway 407 | J - 5 | 1041 | Existing | 1.36 | 0.66 | 0.59 | 0.52 | 0.41 | 0.34 | 0.22 |
| 116 | | | | | | | | | | | |
| 117 | Highway 407 | J - 6 | 1042 | Existing | 0.20 | 0.14 | 0.13 | 0.11 | 0.09 | 0.07 | 0.05 |
| 118 | | | | | | | | | | | |
| 119 | Highway 407 | J - 7 | 1043 | Existing | 0.14 | 0.10 | 0.09 | 0.08 | 0.06 | 0.05 | 0.03 |
| 120 | | | | | | | | | | | |
| 121 | Highway 407 | J - 8 | 1044 | Existing | 1.40 | 0.73 | 0.65 | 0.57 | 0.45 | 0.38 | 0.24 |
| 122 | | | | | | | | | | | |
| 123 | Highway 407 | J - 9 | 1045 | Existing | 2.03 | 0.92 | 0.81 | 0.72 | 0.57 | 0.47 | 0.30 |
| 124 | | | | | | | | | | | |
| 125 | Highway 407 | J - 11 | 1046 | Existing | 3.38 | 1.27 | 1.13 | 0.99 | 0.78 | 0.65 | 0.42 |
| 126 | | | | | | | | | | | |
| 127 | Bunhamthorpe Rd. E. | JC-B1 | 2255 | Existing | 0.83 | 0.40 | 0.35 | 0.31 | 0.25 | 0.21 | 0.13 |
| 128 | | | | | | | | | | | |
| 129 | Bunhamthorpe Rd. E. | JC-B2 | 2252 | Existing | 1.69 | 0.76 | 0.68 | 0.60 | 0.47 | 0.39 | 0.25 |
| 130 | | | | | | | | | | | |
| 131 | Bunhamthorpe Rd. E. | JC-B4 | 2238 | Existing | 7.31 | 2.98 | 2.65 | 2.33 | 1.85 | 1.54 | 1.00 |
| 132 | | | | | | | | | | | |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Table 5.4.1 - Hydrologic Cycle, Return Peirod Peak Flow Rates** | | | | | | | | | | |
| 2 | 07.06.26 | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | **Location** | Culvert | GAWSER | **Land Use** | **Reg.** | **100** | **50** | **25** | **10** | **5** | **2** |
| 5 | | **No.** | **Hyd. No.** | | | **year** | **year** | **year** | **year** | **year** | **year** |
| 6 | | | | | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| 133 | Bunhamthorpe Rd. E. | JC-B7 | 2215 | Existing | 11.33 | 5.50 | 4.90 | 4.30 | 3.40 | 2.83 | 1.81 |
| 134 | | | | | | | | | | | |
| 135 | Bunhamthorpe Rd. E. | JC-B9 | 2225 | Existing | 1.96 | 0.82 | 0.72 | 0.63 | 0.50 | 0.42 | 0.26 |
| 136 | | | | | | | | | | | |
| 137 | Bunhamthorpe Rd. E. | JC-B10 | 2222 | Existing | 5.33 | 2.24 | 1.99 | 1.75 | 1.38 | 1.15 | 0.73 |
| 138 | | | | | | | | | | | |
| 139 | Dundas St. E. | JC-D1 | 2275 | Existing | 50.06 | 20.58 | 18.18 | 16.02 | 12.57 | 10.35 | 6.53 |
| 140 | | | | | | | | | | | |
| 141 | Dundas St. E. | JC-D2 | 2278 | Existing | 5.68 | 2.21 | 1.95 | 1.69 | 1.31 | 1.07 | 0.65 |

# NORTH OAKVILLE SUBWATERSHED MANAGEMENT STRATEGY (WITHOUT PREJUDICE)

**Mediation Issue: Flow Rates/Hydrology (May 31, 2007)**

**Issue:**

The existing condition peak flow rates for North Oakville are to be used as targets for water quantity control in sizing stormwater management facilities. The peak flow rates identified in the North Oakville Creeks Subwatershed Studies are different than those provided in the North Oakville East Subwatersheds Study prepared by North Oakville East Landowners. It is intended that the peak flow rates attached be used as targets in the form of a unit area flow rates (flow per hectare of drainage area).

A consistent, agreed upon value is required, since this will provide the target peak flow value for sizing stormwater management facilities for flood protection purposes.

**Agreement:**

Meetings to discuss this issue have resulted in the following:

1. There is conditional approval on the approach used to calculate the unit area flow rates for existing conditions subject to final technical agreement by each party (see item 7).

2. We have agreement that separate unit area flow rate targets will be used for each Subwatershed.

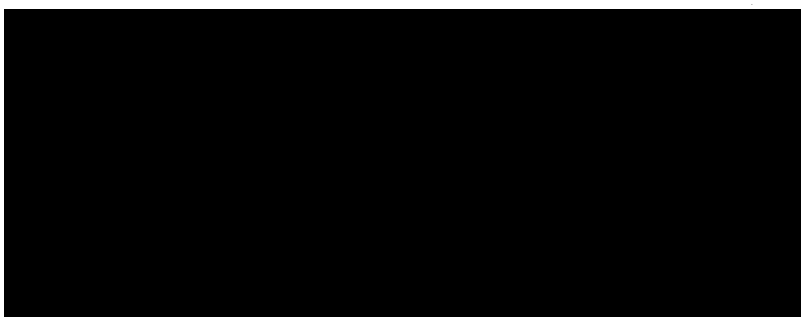
3. The agreed upon unit area flow rates will be used for existing condition flow targets and, as such, existing condition flows will not need to be recalculated during either EIR, FSS, or final design submissions related to development. These flow rates can be also used for floodline calculations as long as the SWM ponds are designed to control Regional Storm Flows to existing levels. However, floodlines will need to be updated at the EIR stage to reflect more detailed topographic mapping.

4. If it is determined, by the Town of Oakville, in conjunction with Conservation Halton, that it is not necessary to control peak flow rates, under Regional Storm conditions, to pre-development levels, then post development flow rates for the Regional Storm will need to be calculated through modelling at the EIR stage. These flow rates will then be used to determine flood elevations, and associated floodlines for regulatory purposes. The modelling approach will be carried out in accordance with the EIR Terms of Reference and to the satisfaction of the Town of Oakville, and Conservation Halton.

5. It is recognized that the drainage areas will be refined during the EIR study stage when more detailed topographic mapping is available. This will result in some change to drainage areas that will be reflected in the final existing condition flows through the use of unit area flow rates.

6. It is agreed that a change to the East Morrison Creek drainage area boundary should be made in the Subwatershed Study.

7. The Town will review and revise the hydrology model, as appropriate, to address subcatchment routing and provide revised hydrology model and unit flow rates to NOMI consultants by June 30, 2007. Upon NOMI's agreement, these revised unit flow rates will be the finalized unit flow rates for existing conditions.



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**NORTH OAKVILLE SUBWATERSHED**
**MANAGEMENT STRATEGY**
**(WITHOUT PREJUDICE)**
**July 4, 2007**

**Mediation Item: Flow Rates/Hydrology**

**Issue:**

The existing condition peak flow rates for North Oakville are to be used as targets for water quantity control in sizing stormwater management facilities. The peak flowrates identified in the North Oakville Creeks Subwatershed Study (NOCSS) are different than those provided in the North Oakville East Subwatersheds Study prepared by North Oakville East Landowners. It is intended that the peak flowrates attached be used as targets in the form of a unit area flowrate (flow per hectare of drainage area).

A consistent, agreed upon value is required, since this will provide the target peak flow value for sizing stormwater management facilities for flood protection purposes.

**Agreement :**

Meetings to discuss this issue have resulted in the following agreements:

1. There is agreement on the approach used to calculate the unit area flows for existing conditions. The Town's revised GAWSER model of existing conditions (dated June 21, 2007) provides the agreed upon unit flow rates presented on the attached table.

2. We have agreement that separate unit area flow targets will be used for each Subwatershed.

3. The agreed upon unit area flows will be used for existing condition flow targets and, as such, additional existing condition flood flow modelling will not need to be undertaken during either EIR, FSS or final design submissions related to development. Similarly, existing condition peak flowrates can be taken from the current model results (presented on the attached table), and new modeling is not needed for the corresponding determination of existing condition floodlines, where SWM ponds are used to control Regional Storm flows to existing levels. There is one exception to this as outlined in the Joshua Creek floodplain agreement dated May 31, 2007, which involves a situation where further hydrologic modeling will be carried out to refine the Regional Storm peak flood flow rates. (Floodlines will need to be updated at the EIR stage to reflect more detailed topographic mapping). If a landowner demonstrates to the satisfaction of the Town and Conservation Halton, that it is not necessary to provide SWM controls for the Regional Storm for a specific subwatershed, in accordance with the NOCSS and the Secondary Plan, then the EIR in support of development within that subwatershed must include updated hydrologic modelling to determine the post development Regional Storm flow for purposes of establishing Regional Storm floodlines.

4. It is recognized that the drainage areas will be refined during the EIR study stage when more detailed topographic mapping is available. This will result in some change to drainage areas which will be reflected in the final existing condition flows through the use of unit area flows.

5. It is agreed that a change to the East Morrison Creek drainage area boundary should be made in the Subwatershed Study.

[redacted]

**NORTH OAKVILLE SUBWATERSHED**
**MANAGEMENT STRATEGY**
**(WITHOUT PREJUDICE)**
**July 4, 2007**

**Mediation Item: Flow Rates/Hydrology**

**Issue:**

The existing condition peak flow rates for North Oakville are to be used as targets for water quantity control in sizing stormwater management facilities. The peak flowrates identified in the North Oakville Creeks Subwatershed Study (NOCSS) are different than those provided in the North Oakville East Subwatersheds Study prepared by North Oakville East Landowners. It is intended that the peak flowrates attached be used as targets in the form of a unit area flowrate (flow per hectare of drainage area).

A consistent, agreed upon value is required, since this will provide the target peak flow value for sizing stormwater management facilities for flood protection purposes.

**Agreement :**

Meetings to discuss this issue have resulted in the following agreements:

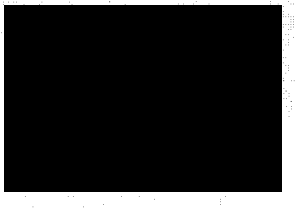
1. There is agreement on the approach used to calculate the unit area flows for existing conditions. The Town's revised GAWSER model of existing conditions (dated June 21, 2007) provides the agreed upon unit flow rates presented on the attached table.

2. We have agreement that separate unit area flow targets will be used for each Subwatershed.

3. The agreed upon unit area flows will be used for existing condition flow targets and, as such, additional existing condition flood flow modelling will not need to be undertaken during either EIR, FSS or final design submissions related to development. Similarly, existing condition peak flowrates can be taken from the current model results (presented on the attached table), and new modeling is not needed for the corresponding determination of existing condition floodlines, where SWM ponds are used to control Regional Storm flows to existing levels. There is one exception to this as outlined in the Joshua Creek floodplain agreement dated May 31, 2007, which involves a situation where further hydrologic modeling will be carried out to refine the Regional Storm peak flood flow rates. (Floodlines will need to be updated at the EIR stage to reflect more detailed topographic mapping). If a landowner demonstrates to the satisfaction of the Town and Conservation Halton, that it is not necessary to provide SWM controls for the Regional Storm for a specific subwatershed, in accordance with the NOCSS and the Secondary Plan, then the EIR in support of development within that subwatershed must include updated hydrologic modelling to determine the post development Regional Storm flow for purposes of establishing Regional Storm floodlines.

4. It is recognized that the drainage areas will be refined during the EIR study stage when more detailed topographic mapping is available. This will result in some change to drainage areas which will be reflected in the final existing condition flows through the use of unit area flows.

5. It is agreed that a change to the East Morrison Creek drainage area boundary should be made in the Subwatershed Study.



## REVISED TARGET UNIT AREA PEAK FLOW RATES 07.06.27
## EXISTING LAND USE

Confidential and without Prejudice

| Location | Culvert No. | Drainage Area | Regional Storm | 100 year storm | 50 year storm | 25 year storm | 10 year storm | 5 year storm | 2 year storm |
|---|---|---|---|---|---|---|---|---|---|
| | | ha. | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| **14 Mile Creek** | | | | | | | | | |
| Dundas St. W. | FM-D2 | 46.56 | 2.50 | 1.04 | 0.92 | 0.80 | 0.62 | 0.51 | 0.31 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.054 | 0.022 | 0.020 | 0.017 | 0.013 | 0.011 | 0.007 |
| | FM-D3 | 11.71 | 0.76 | 0.36 | 0.32 | 0.28 | 0.23 | 0.19 | 0.12 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.065 | 0.031 | 0.027 | 0.024 | 0.020 | 0.016 | 0.010 |
| | FM-D4 | 423.70 | 20.96 | 8.39 | 7.42 | 6.49 | 5.09 | 4.17 | 2.62 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.049 | 0.020 | 0.018 | 0.015 | 0.012 | 0.010 | 0.006 |
| | FM-D5 | 339.99 | 18.73 | 7.56 | 6.60 | 5.68 | 4.35 | 3.43 | 2.01 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.055 | 0.022 | 0.019 | 0.017 | 0.013 | 0.010 | 0.006 |
| | FM-D6 | 16.91 | 0.88 | 0.36 | 0.32 | 0.28 | 0.23 | 0.19 | 0.12 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.052 | 0.021 | 0.019 | 0.017 | 0.014 | 0.011 | 0.007 |
| | FM-D6a | 26.23 | 1.38 | 0.57 | 0.50 | 0.44 | 0.34 | 0.28 | 0.18 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.053 | 0.022 | 0.019 | 0.017 | 0.013 | 0.011 | 0.007 |
| | FM-D7 | 247.92 | 11.96 | 4.63 | 4.07 | 3.54 | 2.75 | 2.23 | 1.36 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.048 | 0.019 | 0.016 | 0.014 | 0.011 | 0.009 | 0.005 |
| | FM-D8 | 8.45 | 0.66 | 0.37 | 0.33 | 0.29 | 0.23 | 0.19 | 0.12 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.078 | 0.044 | 0.039 | 0.034 | 0.027 | 0.022 | 0.014 |
| | FM-D9 | 18.58 | 1.47 | 0.86 | 0.76 | 0.67 | 0.54 | 0.44 | 0.28 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.079 | 0.046 | 0.041 | 0.036 | 0.029 | 0.024 | 0.015 |
| **McCraney Creek** | | | | | | | | | |
| Dundas St. W. | MC-D1 | 126.46 | 6.43 | 2.60 | 2.31 | 2.02 | 1.59 | 1.31 | 0.83 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.051 | 0.021 | 0.018 | 0.016 | 0.013 | 0.010 | 0.007 |
| **Taplow Creek** | | | | | | | | | |
| Dundas St. W. | TC-D1 | 33.61 | 1.64 | 0.64 | 0.57 | 0.50 | 0.39 | 0.32 | 0.21 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.049 | 0.019 | 0.017 | 0.015 | 0.012 | 0.010 | 0.006 |
| **Glen Oak Creek** | | | | | | | | | |
| Dundas St. W. | GO-D1 | 47.16 | 2.34 | 0.93 | 0.83 | 0.73 | 0.58 | 0.48 | 0.31 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.050 | 0.020 | 0.018 | 0.015 | 0.012 | 0.010 | 0.007 |
| **West 16 Mile Creek Tribs.** | | | | | | | | | |
| Dundas St. W. | SM-D1 | 87.97 | 3.58 | 1.24 | 1.09 | 0.95 | 0.73 | 0.59 | 0.36 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.041 | 0.014 | 0.012 | 0.011 | 0.008 | 0.007 | 0.004 |
| | SM-D1a | 12.53 | 0.81 | 0.38 | 0.34 | 0.30 | 0.24 | 0.20 | 0.13 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.065 | 0.030 | 0.027 | 0.024 | 0.019 | 0.016 | 0.010 |
| | SM-D2 | 8.01 | 0.52 | 0.24 | 0.22 | 0.19 | 0.15 | 0.13 | 0.08 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.065 | 0.030 | 0.027 | 0.024 | 0.019 | 0.016 | 0.010 |
| **East 16 Mile Creek Tribs.** | | | | | | | | | |
| Sixteen Mile Creek | — | 383.10 | 16.86 | 6.28 | 5.48 | 4.70 | 3.58 | 2.82 | 1.64 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.044 | 0.016 | 0.014 | 0.012 | 0.009 | 0.007 | 0.004 |
| **Osenego Creek** | | | | | | | | | |
| Dundas St. W. | OC-D1 | 43.93 | 2.63 | 1.20 | 1.06 | 0.94 | 0.74 | 0.62 | 0.40 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.060 | 0.027 | 0.024 | 0.021 | 0.017 | 0.014 | 0.009 |
| **Shannon's Creek** | | | | | | | | | |
| Dundas St. W. | SC-D1 | 84.37 | 3.81 | 1.39 | 1.23 | 1.06 | 0.82 | 0.66 | 0.40 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.045 | 0.016 | 0.015 | 0.013 | 0.010 | 0.008 | 0.005 |

## REVISED TARGET UNIT AREA PEAK FLOW RATES 07.06.27
## EXISTING LAND USE
Confidential and without Prejudice

| Location | Culvert No. | Drainage Area | Regional Storm | 100 year storm | 50 year storm | 25 year storm | 10 year storm | 5 year storm | 2 year storm |
|---|---|---|---|---|---|---|---|---|---|
| | | ha. | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| **Munn's Creek** | | | | | | | | | |
| Dundas St. W. | MC-D1 | 29.99 | 2.01 | 0.99 | 0.88 | 0.77 | 0.62 | 0.51 | 0.33 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.067 | 0.033 | 0.029 | 0.026 | 0.021 | 0.017 | 0.011 |
| | MC-D4 | 59.61 | 3.19 | 1.31 | 1.16 | 1.02 | 0.80 | 0.67 | 0.43 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.054 | 0.022 | 0.019 | 0.017 | 0.013 | 0.011 | 0.007 |
| **West Morrison Creek** | | | | | | | | | |
| Dundas St. E. | MW-D3 | 226.38 | 10.93 | 4.26 | 3.77 | 3.30 | 2.59 | 2.13 | 1.35 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.048 | 0.019 | 0.017 | 0.015 | 0.011 | 0.009 | 0.006 |
| **East Morrison Creek** | | | | | | | | | |
| Dundas St. E. | ME-D2 | 313.94 | 13.67 | 5.18 | 4.58 | 4.00 | 3.14 | 2.57 | 1.62 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.044 | 0.016 | 0.015 | 0.013 | 0.010 | 0.008 | 0.005 |
| **Joshua's Creek** | | | | | | | | | |
| Dundas St. E. | JC-D1 | 962.74 | 50.06 | 20.58 | 18.18 | 16.02 | 12.57 | 10.35 | 6.53 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.052 | 0.021 | 0.019 | 0.017 | 0.013 | 0.011 | 0.007 |
| | JC-D2 | 111.80 | 5.68 | 2.21 | 1.95 | 1.69 | 1.31 | 1.07 | 0.65 |
| | Flow rate / Area ($m^3/s/ha$) | | 0.051 | 0.020 | 0.017 | 0.015 | 0.012 | 0.010 | 0.006 |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Table 5.4.1 - Hydrologic Cycle, Return Peirod Peak Flow Rates** | | | | | | | | | | |
| 2 | 07.06.26 | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | **Location** | **Culvert** | **GAWSER** | **Land Use** | **Reg.** | **100** | **50** | **25** | **10** | **5** | **2** |
| 5 | | **No.** | **Hyd. No.** | | | **year** | **year** | **year** | **year** | **year** | **year** |
| 6 | | | | | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| 7 | ***14 Mile Creek*** | | | | | | | | | | |
| 8 | Dundas St. W. | FM-D1 | 1101 | Existing | 1.20 | 0.56 | 0.50 | 0.44 | 0.35 | 0.29 | 0.19 |
| 9 | | | | | | | | | | | |
| 10 | Dundas St. W. | FM-D2 | 1102 | Existing | 2.50 | 1.04 | 0.92 | 0.80 | 0.62 | 0.51 | 0.31 |
| 11 | | | | | | | | | | | |
| 12 | Dundas St. W. | FM-D3 | 1103 | Existing | 0.76 | 0.36 | 0.32 | 0.28 | 0.23 | 0.19 | 0.12 |
| 13 | | | | | | | | | | | |
| 14 | Highway 407 | FM-1 | 1001 | Existing | 7.32 | 2.93 | 2.59 | 2.27 | 1.79 | 1.48 | 0.94 |
| 15 | | | | | | | | | | | |
| 16 | Highway 407 | FM-2 | 1002 | Existing | 1.65 | 0.71 | 0.63 | 0.55 | 0.43 | 0.36 | 0.23 |
| 17 | | | | | | | | | | | |
| 18 | Burnhamthorpe Rd. W. | FM-B1 | 0031 | Existing | 4.44 | 1.67 | 1.47 | 1.28 | 1.00 | 0.81 | 0.50 |
| 19 | | | | | | | | | | | |
| 20 | Highway 407 | FM-3 | 2019 | Existing | 5.95 | 2.31 | 2.05 | 1.79 | 1.40 | 1.14 | 0.71 |
| 21 | | | | | | | | | | | |
| 22 | Highway 407 | FM-4 | 1004 | Existing | 0.30 | 0.09 | 0.08 | 0.06 | 0.04 | 0.03 | 0.01 |
| 23 | | | | | | | | | | | |
| 24 | Dundas St. W. | FM-D4 | 2034 | Existing | 20.96 | 8.39 | 7.42 | 6.49 | 5.09 | 4.17 | 2.62 |
| 25 | | | | | | | | | | | |
| 26 | Highway 407 | FM-5 | 1005 | Existing | 1.57 | 0.59 | 0.51 | 0.44 | 0.33 | 0.25 | 0.13 |
| 27 | | | | | | | | | | | |
| 28 | Highway 407 | FM-6 | 1006 | Existing | 1.83 | 0.69 | 0.60 | 0.51 | 0.38 | 0.29 | 0.15 |
| 29 | | | | | | | | | | | |
| 30 | Burnhamthorpe Rd. W. | FM-B2 | 0071 | Existing | 2.58 | 1.02 | 0.91 | 0.79 | 0.62 | 0.52 | 0.33 |
| 31 | | | | | | | | | | | |
| 32 | Burnhamthorpe Rd. W. | FM-B3 | 0073 | Existing | 3.42 | 1.34 | 1.17 | 1.01 | 0.77 | 0.61 | 0.36 |
| 33 | | | | | | | | | | | |
| 34 | Highway 407 | FM-7 | 2048 | Existing | 8.68 | 3.48 | 3.05 | 2.65 | 2.05 | 1.64 | 0.99 |
| 35 | | | | | | | | | | | |
| 36 | Highway 407 | FM-8 | 1008 | Existing | 0.39 | 0.15 | 0.13 | 0.10 | 0.07 | 0.04 | 0.01 |
| 37 | | | | | | | | | | | |
| 38 | Dundas St. W. | FM-D5 | 2061 | Existing | 18.73 | 7.56 | 6.60 | 5.68 | 4.35 | 3.43 | 2.01 |
| 39 | | | | | | | | | | | |
| 40 | Highway 407 | FM-9 | 1009 | Existing | 2.74 | 1.01 | 0.89 | 0.78 | 0.60 | 0.49 | 0.30 |
| 41 | | | | | | | | | | | |
| 42 | Dundas St. W. | FM-D6 | 1110 | Existing | 0.88 | 0.36 | 0.32 | 0.28 | 0.23 | 0.19 | 0.12 |
| 43 | | | | | | | | | | | |
| 44 | Dundas St. W. | FM-D6a | 2367 | Existing | 1.38 | 0.57 | 0.50 | 0.44 | 0.34 | 0.28 | 0.18 |
| 45 | | | | | | | | | | | |
| 46 | Highway 407 | FM-10 | 1010 | Existing | 4.04 | 1.62 | 1.43 | 1.26 | 0.99 | 0.82 | 0.52 |
| 47 | | | | | | | | | | | |
| 48 | Highway 407 | FM-11 | 1011 | Existing | 0.51 | 0.24 | 0.21 | 0.18 | 0.14 | 0.11 | 0.06 |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Table 5.4.1 - Hydrologic Cycle, Return Peirod Peak Flow Rates** | | | | | | | | | | |
| 2 | 07.06.26 | | | | | | | | | | |
| 3 | | | | | **Reg.** | **100** | **50** | **25** | **10** | **5** | **2** |
| 4 | **Location** | **Culvert** | **GAWSER** | **Land Use** | | **year** | **year** | **year** | **year** | **year** | **year** |
| 5 | | **No.** | **Hyd. No.** | | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| 6 | | | | | | | | | | | |
| 49 | | | | | | | | | | | |
| 50 | Dundas St. W. | FM-D7 | 2475 | Existing | 11.96 | 4.63 | 4.07 | 3.54 | 2.75 | 2.23 | 1.36 |
| 51 | | | | | | | | | | | |
| 52 | Dundas St. W. | FM-D8 | 1112 | Existing | 0.66 | 0.37 | 0.33 | 0.29 | 0.23 | 0.19 | 0.12 |
| 53 | | | | | | | | | | | |
| 54 | Dundas St. W. | FM-D9 | 1113 | Existing | 1.47 | 0.86 | 0.76 | 0.67 | 0.54 | 0.44 | 0.28 |
| 55 | | | | | | | | | | | |
| 56 | ***McCraney Creek*** | | | | | | | | | | |
| 57 | Highway 407 | FM-12 | 1012 | Existing | 1.75 | 0.74 | 0.65 | 0.57 | 0.45 | 0.37 | 0.23 |
| 58 | | | | | | | | | | | |
| 59 | Dundas St. W. | MC-D1 | 2085 | Existing | 6.43 | 2.60 | 2.31 | 2.02 | 1.59 | 1.31 | 0.83 |
| 60 | | | | | | | | | | | |
| 61 | ***Taplow Creek*** | | | | | | | | | | |
| 62 | Dundas St. W. | TC-D1 | 1115 | Existing | 1.64 | 0.64 | 0.57 | 0.50 | 0.39 | 0.32 | 0.21 |
| 63 | | | | | | | | | | | |
| 64 | ***Glen Oak Creek*** | | | | | | | | | | |
| 65 | Dundas St. W. | GO-D1 | 1116 | Existing | 2.34 | 0.93 | 0.83 | 0.73 | 0.58 | 0.48 | 0.31 |
| 66 | | | | | | | | | | | |
| 67 | ***West 16 Mile Creek Tribs.*** | | | | | | | | | | |
| 68 | Dundas St. W. | SM-D1 | 2392 | Existing | 3.58 | 1.24 | 1.09 | 0.95 | 0.73 | 0.59 | 0.36 |
| 69 | | | | | | | | | | | |
| 70 | Dundas St. W. | SM-D1a | 1117 | Existing | 0.81 | 0.38 | 0.34 | 0.30 | 0.24 | 0.20 | 0.13 |
| 71 | | | | | | | | | | | |
| 72 | Dundas St. W. | SM-D2 | 1118 | Existing | 0.52 | 0.24 | 0.22 | 0.19 | 0.15 | 0.13 | 0.08 |
| 73 | | | | | | | | | | | |
| 74 | Highway 407 | SM-1 | 1020 | Existing | 5.01 | 1.81 | 1.59 | 1.38 | 1.07 | 0.86 | 0.52 |
| 75 | | | | | | | | | | | |
| 76 | Highway 407 | SM-2 | 1021 | Existing | 1.67 | 0.70 | 0.62 | 0.54 | 0.42 | 0.34 | 0.20 |
| 77 | | | | | | | | | | | |
| 78 | Highway 407 | SM-3 | 1022 | Existing | 0.58 | 0.28 | 0.24 | 0.21 | 0.16 | 0.12 | 0.07 |
| 79 | | | | | | | | | | | |
| 80 | ***East 16 Mile Creek Tribs.*** | | | | | | | | | | |
| 81 | Neyagawa Blvd. | ESM-NG3 | 2124 | Existing | 6.96 | 2.90 | 2.57 | 2.25 | 1.77 | 1.47 | 0.94 |
| 82 | | | | | | | | | | | |
| 83 | Neyagawa Blvd. | ESM-NG2 | 2128 | Existing | 8.80 | 6.49 | 3.07 | 2.66 | 2.06 | 1.66 | 1.01 |
| 84 | | | | | | | | | | | |
| 85 | Sixteen Mile Creek | --- | 2137 | Existing | 16.86 | 6.28 | 5.48 | 4.70 | 3.58 | 2.82 | 1.64 |
| 86 | | | | | | | | | | | |
| 87 | Burnhamthorpe Rd. W. | ESM-B14 | 2914 | Existing | 2.47 | 1.11 | 0.97 | 0.84 | 0.65 | 0.52 | 0.31 |
| 88 | | | | | | | | | | | |
| 89 | Osenego Creek | | | | | | | | | | |
| 90 | Dundas St. W. | OC-D1 | 2143 | Existing | 2.63 | 1.20 | 1.06 | 0.94 | 0.74 | 0.62 | 0.40 |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Table 5.4.1 - Hydrologic Cycle, Return Peirod Peak Flow Rates** | | | | | | | | | | |
| 2 | 07.06.26 | | | | | | | | | | |
| 3 | | | | | **Reg.** | **100** | **50** | **25** | **10** | **5** | **2** |
| 4 | **Location** | **Culvert** | **GAWSER** | **Land Use** | | **year** | **year** | **year** | **year** | **year** | **year** |
| 5 | | **No.** | **Hyd. No.** | | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** | **$m^3/s$** |
| 6 | | | | | | | | | | | |
| 91 | | | | | | | | | | | |
| 92 | **Shannon's Creek** | | | | | | | | | | |
| 93 | Dundas St. W. | SC-D1 | 2146 | Existing | 3.81 | 1.39 | 1.23 | 1.06 | 0.82 | 0.66 | 0.40 |
| 94 | | | | | | | | | | | |
| 95 | **Munn's Creek** | | | | | | | | | | |
| 96 | Dundas St. W. | MC-D1 | 2177 | Existing | 2.01 | 0.99 | 0.88 | 0.77 | 0.62 | 0.51 | 0.33 |
| 97 | | | | | | | | | | | |
| 98 | Dundas St. W. | MC-D4 | 2174 | Existing | 3.19 | 1.31 | 1.16 | 1.02 | 0.80 | 0.67 | 0.43 |
| 99 | | | | | | | | | | | |
| 100 | **West Morrison Creek** | | | | | | | | | | |
| 101 | Sixth Line | MW-S2 | 2149 | Existing | 7.88 | 2.97 | 2.62 | 2.29 | 1.79 | 1.47 | 0.92 |
| 102 | | | | | | | | | | | |
| 103 | Dundas St. E. | MW-D3 | 2154 | Existing | 10.93 | 4.26 | 3.77 | 3.30 | 2.59 | 2.13 | 1.35 |
| 104 | | | | | | | | | | | |
| 105 | **East Morrison Creek** | | | | | | | | | | |
| 106 | Bunhamthorpe Rd. E. | ME-B1 | 2160 | Existing | 0.99 | 0.49 | 0.43 | 0.38 | 0.30 | 0.25 | 0.16 |
| 107 | | | | | | | | | | | |
| 108 | Trafalgar Road | ME-T5 | 2165 | Existing | 2.72 | 1.27 | 1.13 | 0.99 | 0.78 | 0.65 | 0.42 |
| 109 | | | | | | | | | | | |
| 110 | Trafalgar Road | ME-T1 | 2170 | Existing | 7.55 | 3.07 | 2.72 | 2.38 | 1.88 | 1.54 | 0.98 |
| 111 | | | | | | | | | | | |
| 112 | Dundas St. E. | ME-D2 | 2171 | Existing | 13.67 | 5.18 | 4.58 | 4.00 | 3.14 | 2.57 | 1.62 |
| 113 | | | | | | | | | | | |
| 114 | **Joshua's Creek** | | | | | | | | | | |
| 115 | Highway 407 | J - 5 | 1041 | Existing | 1.36 | 0.66 | 0.59 | 0.52 | 0.41 | 0.34 | 0.22 |
| 116 | | | | | | | | | | | |
| 117 | Highway 407 | J - 6 | 1042 | Existing | 0.20 | 0.14 | 0.13 | 0.11 | 0.09 | 0.07 | 0.05 |
| 118 | | | | | | | | | | | |
| 119 | Highway 407 | J - 7 | 1043 | Existing | 0.14 | 0.10 | 0.09 | 0.08 | 0.06 | 0.05 | 0.03 |
| 120 | | | | | | | | | | | |
| 121 | Highway 407 | J - 8 | 1044 | Existing | 1.40 | 0.73 | 0.65 | 0.57 | 0.45 | 0.38 | 0.24 |
| 122 | | | | | | | | | | | |
| 123 | Highway 407 | J - 9 | 1045 | Existing | 2.03 | 0.92 | 0.81 | 0.72 | 0.57 | 0.47 | 0.30 |
| 124 | | | | | | | | | | | |
| 125 | Highway 407 | J - 11 | 1046 | Existing | 3.38 | 1.27 | 1.13 | 0.99 | 0.78 | 0.65 | 0.42 |
| 126 | | | | | | | | | | | |
| 127 | Bunhamthorpe Rd. E. | JC-B1 | 2255 | Existing | 0.83 | 0.40 | 0.35 | 0.31 | 0.25 | 0.21 | 0.13 |
| 128 | | | | | | | | | | | |
| 129 | Bunhamthorpe Rd. E. | JC-B2 | 2252 | Existing | 1.69 | 0.76 | 0.68 | 0.60 | 0.47 | 0.39 | 0.25 |
| 130 | | | | | | | | | | | |
| 131 | Bunhamthorpe Rd. E. | JC-B4 | 2238 | Existing | 7.31 | 2.98 | 2.65 | 2.33 | 1.85 | 1.54 | 1.00 |
| 132 | | | | | | | | | | | |

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **Table 5.4.1 - Hydrologic Cycle, Return Peirod Peak Flow Rates** | | | | | | | | | | |
| 2 | 07.06.26 | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | **Location** | **Culvert** | **GAWSER** | **Land Use** | **Reg.** | **100** | **50** | **25** | **10** | **5** | **2** |
| 5 | | **No.** | **Hyd. No.** | | | **year** | **year** | **year** | **year** | **year** | **year** |
| 6 | | | | | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ | $m^3/s$ |
| 133 | Bunhamthorpe Rd. E. | JC-B7 | 2215 | Existing | 11.33 | 5.50 | 4.90 | 4.30 | 3.40 | 2.83 | 1.81 |
| 134 | | | | | | | | | | | |
| 135 | Bunhamthorpe Rd. E. | JC-B9 | 2225 | Existing | 1.96 | 0.82 | 0.72 | 0.63 | 0.50 | 0.42 | 0.26 |
| 136 | | | | | | | | | | | |
| 137 | Bunhamthorpe Rd. E. | JC-B10 | 2222 | Existing | 5.33 | 2.24 | 1.99 | 1.75 | 1.38 | 1.15 | 0.73 |
| 138 | | | | | | | | | | | |
| 139 | Dundas St. E. | JC-D1 | 2275 | Existing | 50.06 | 20.58 | 18.18 | 16.02 | 12.57 | 10.35 | 6.53 |
| 140 | | | | | | | | | | | |
| 141 | Dundas St. E. | JC-D2 | 2278 | Existing | 5.68 | 2.21 | 1.95 | 1.69 | 1.31 | 1.07 | 0.65 |