





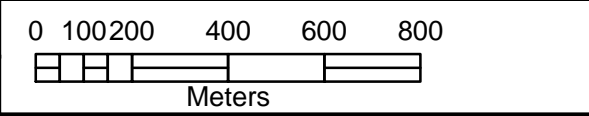


**KEY MAP**

**LEGEND:**

-  Study Area Boundary
-  SCUBE West Boundary
- Aquatic Resources**
-  Permanent Warmwater Fish Habitat (15m buffer Both Sides)
-  Indirect/Support Fish Habitat (15m buffer Both Sides)
-  Intermittent Warmwater Fish Habitat (15m buffer Both Sides)
-  Unclassified

**NOTES:**



**SCUBE WEST SUBWATERSHED STUDY**  
 Aquatic Resources – Opportunities and Constraints to Development

**FIGURE No. 3.18**

DATE: June 7, 2010



- 1) Aquatic Habitat and Fisheries Impact Assessment – Watercourses 5, 6, 7 and 9 (SNC Lavalin, December 1991).

This is an appendix of a Class EA document prepared for the Town of Stoney Creek in support of a proposed Master Drainage Plan for lands slated for industrial development within the drainage of Watercourse 7. A detailed assessment of habitat conditions is provided for each of the drainage features and some limited fish inventory work was completed in 1991. Both Watercourse 5 and 6 were considered to be permanent watercourses, while Watercourse 7 was assessed as an intermittent feature. Tributaries to these features were also considered to be intermittent.

- 2) Natural Heritage Assessment of Lands Bounded by Fruitland Road, Glover Road, Highway 8 and Barton Street, Draft Report (Dillon Consulting, 2009).

This is a Natural Heritage inventory of lands within the study area including Watercourses 5 and 6 completed in 2009, which was also used in support of a Class EA for modifications to Fruitland Road. The report also summarizes aquatic data collected for a previous Class EA on Watercourses 5 and 6.

- 3) Dillon Consulting Limited. 2007. The City of Hamilton Watercourse 5 & 6 Class Environmental Assessment Study Draft Report.

Detailed aquatic habitat inventories were completed on Watercourses 5 and 6 and their tributaries within the study area and downstream to Lake Ontario. It was noted that downstream of the study area, both watercourses have been significantly altered and include barriers that limit fish movement to and from the Lake. This report also provides an assessment of the condition and recommended treatment for these watercourses using a draft Headwater Streams Assessment Protocol (2008) developed by CVC/TRCA.

- 4) Appendix B of Watercourse 7 – Creek System Improvements Class EA (Philips Engineering Limited, September 2003)

This document provides some limited benthic invertebrate collection data that concludes that Watercourse 7 is impaired. In addition, the document references and includes the 1991 Lavalin report listed previously.

### **3.2.5.2 Fisheries Surveys**

All fisheries surveys and watercourse assessments on Watercourses 5.0, 6.0 and 7.0 were undertaken on May 25, 2009 by Dillon Consulting Limited and the results provided in Section



3.6 of the Natural Heritage Assessment of Lands Bounded by Fruitland Road, Glover Road, Barton Street and Highway 8 (Dillon Consulting, 2009). In addition to this field work, Dillon (2007) previously assessed sections of Watercourse 5.0 and 6.0.

### *3.2.5.3 Aquatic Constraints*

The streams in the Study Area have been field verified and identified as warmwater. A warmwater watercourse is defined as a watercourse, whether permanent, intermittent, or ephemeral, which supports or contributes to the support of fish habitat or species associated with warmwater such as carp, bass, warmwater benthic invertebrates, or have thermal characteristics of a warmwater stream such as designated by the Ministry of Natural Resources. Warmwater species that are best adapted to prefer or usually occur at water temperatures greater than 25° C (Hamilton Urban OP, 2009).

The classification of warmwater watercourses in the Study Area have been further divided into permanent, intermittent and ephemeral streams that provide direct, indirect or no fish habitat (Table 3.8; Figure 8.6). Fish habitat refers to spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes (Fisheries Act, 2007). Permanent and intermittent streams are a high and medium constraint to development, respectively.

Using Table 4 of the Interim Guidelines (CVC and TRCA, 2009), and the results from this study, environmental management recommendations can be determined for each drainage feature when applying the appropriate evaluation criteria. As such, the following habitat classifications and associated Management Recommendations were given to each of the watercourses in the Study Area:

#### *3.2.5.3.1 Watercourses 5, 6 and 7*

Based on the habitat classification descriptions (as per the Interim Guidelines), Watercourse 5.0 is classified as permanent fish habitat in the Study Area. Based on a review of the Interim Guidelines combined with the findings of this study, it is recommended that this feature be given a **Protection 2** Management Recommendation.

Although numerous barriers and obstructions exist on the system (e.g., downstream of Barton Street), the potential for direct habitat exists (should they be removed) and thus, it is believed that this level of protection is warranted.

According to the Interim Guidelines (CVC and TRCA, 2009), the Protection 2 Management Recommendation indicates the following general requirements for treatment of the watercourse:



**Table 3.8: Fish habitat identified in the study area of the SCUBE West Subwatershed Study**

Watercourse	Zone A		Zone B		Zone C	
	Fish Habitat	Flow	Fish Habitat	Flow	Fish Habitat	Flow
5.0	Indirect	Permanent	Indirect	Permanent	Not Assessed	Not Assessed
5.2	Indirect	Ephemeral	Indirect	Ephemeral	NA	NA
6.0	Indirect	Permanent	Indirect	Permanent	Not Assessed	Not Assessed
6.1	Indirect	Intermittent	NA	NA	NA	NA
6.2	Indirect	Intermittent	NA	NA	NA	NA
6.3	Not Fish Habitat	Ephemeral	NA	NA	NA	NA
7.0 - Upstream of Barton Street	Indirect	Intermittent	Indirect	Intermittent	Indirect	Intermittent
7.0 - Downstream of Barton Street	Direct	Permanent	Indirect	Intermittent	Indirect	Intermittent

- Preference is to maintain existing surface water source;
- Maintain external drainage or if catchment drainage has been previously removed due to diversion of SWM flows, restore lost functions through enhanced lot level controls (i.e., restore original catchment using clean roof drainage) as necessary;
- Replicate on-site surface water sources including wetland creation and incorporating extended detention outlets, if necessary;
- Use natural channel design techniques to replace and enhance existing habitat features only if features are easily replicated; Drainage feature must connect to downstream watercourse/habitat;
- Examine need to incorporate groundwater flows through infiltration measures (i.e., third pipes, etc.) to ensure no net loss and potential gain.

These watercourses should be protected within a minimum Vegetation Protection Zone of 15 m from each bank, consistent with Natural Heritage Reference Manual (2010) guidelines for warmwater watercourses.

### 3.2.5.3.2 Watercourse 5.2



Based on the habitat classification descriptions (as per the Interim Guidelines), this watercourse is classified as complex contributing fish habitat. However, as this tributary flows into a storm sewer and is isolated from downstream aquatic resources, it is recommended that this watercourse receive a **Mitigation 2** Management Recommendation.

According to the Interim Guidelines (CVC and TRCA, 2009), the Mitigation 2 Management Recommendation indicates the following general requirements for treatment of the watercourse:

- Replicate functions by lot-level conveyance measures (e.g., vegetated swales) connected to the natural heritage system, as feasible and/or Low Impact Development (LID) stormwater options;
- Replicate on-site flows and outlet flows at the top end of vegetated swales, bioswales, etc. to maintain feature functions.
- End of pipe measures, such as wet ponds or wetland features that replicate the predevelopment quantity and quality characteristics that support downstream fish populations

Typically these watercourses would be classified as level 2 or basic level of treatment according to the MOE Stormwater Management and Design Manual (2003), however, recent efforts are now underway to reduce phosphorus loading to Lake Ontario, in particular the nearshore zone. For this reason, it is recommended that these watercourses be classified as level 2 or enhanced level of treatment.

### ***3.2.6 Terrestrial Resources***

To characterize the terrestrial resources of the SCUBE West lands and identify opportunities and constraints to development, Aquafor Beech Limited summarized the preliminary results of an assessment of the natural heritage features undertaken by Dillon Consulting Limited. This study, currently ongoing, addresses the lands between Fruitland Road to the west, Glover Road to the East, Barton Street to the North and Highway 8 to the South. (See Figure 8.1)

Dillon Consulting Limited obtained background information on the terrestrial resources of the study area from a variety of sources, including the Hamilton Conservation Authority, the Natural Heritage Information Centre (NHIC), the Atlas of Mammals of Ontario (Dobbyn 1994), the Ontario Herpetofaunal Atlas (Oldham and Weller 2000); the Ontario Breeding Bird Atlas (2001-2005); the federal Species at Risk Act (SARA) Public Registry and the provincial species at risk (SAR) list (Dillon Consulting Limited 2009). As described in the following sections, this background information was supplemented by fieldwork.

#### ***3.2.6.1 Vascular Plants***

Dillon Consulting Limited assessed the botanical resources of the study area during the spring, summer and fall seasons, with surveys conducted on May 14 and 15, August 6 and 7 and September 10 and 11, 2009. In total, 194 flora species were identified within the study area



during the spring and early summer of 2009. Of these, 80 (41.2%) are listed as exotic or non-native species (Dillon Consulting Limited 2009). No plants observed are listed species under the federal *Species at Risk Act* or the provincial *Endangered Species Act*.

### **3.2.6.2 Vegetation Community Descriptions**

Dillon Consulting Limited determined the boundaries of natural and cultural vegetation communities through a review of aerial photography. These boundaries were further refined through on-site soil and vegetation studies, which took place on August 6-7, 2009. During field investigations, Dillon Consulting Limited characterized vegetation communities using the MNR's Ecological Land Classification System for Southern Ontario (Lee *et al.* 1998). Field data collection was undertaken in order to classify and map ecological communities to the vegetation level (Dillon Consulting Limited 2009).

Dillon Consulting Limited classified 11 distinct ELC communities within the limits of the study area to the vegetation level. These include the following:

- Fresh-Moist Green Ash Hardwood-Lowland Deciduous Forest (FODM7-2);
- Fresh-Moist Shagbark Hickory Deciduous Forest (FODM9-4);
- Fresh-Moist Oak – Hardwood Deciduous Forest (FODM9-6);
- Fresh-Moist Mixed Meadow (MEMM4);
- Bulrush Graminoid Mineral Meadow Marsh (MAMM1-15);
- Purple Loosestrife Forb Mineral Meadow Marsh (MAMM2-5);
- Reed Canary Grass Graminoid Mineral Meadow Marsh (MAMM1-3);
- Green Ash Mineral Deciduous Swamp (SWDM2-2);
- Willow Mineral Deciduous Swamp (SWDM4-1);
- Hawthorn (Dogwood/Buckthorn) Deciduous Shrub Thicket (THDM2-11);
- Native Deciduous Regeneration Thicket (THDM4-1);

Dillon Consulting Limited also identified study area vegetation units to the following ELC community level:

- Deciduous Woodlot (DECW)
- Forb Meadow (MEF);

Dillon Consulting Limited also identified the following cultural areas in the study area:

- Annual Row Crop (OAGM1);
- Vineyard (SAGM1);



- Orchard (SAGM2);
- Coniferous Plantation (TAGM1);
- Deciduous Plantation (TAGM3); and
- Hedgerow (H).

According to the NHIC, vegetation units surveyed in the Study Area are ranked S5 (Secure) in the province of Ontario (Dillon Consulting Limited 2009).

### **3.2.6.3 Wildlife**

#### *3.2.6.3.1 Mammals*

Information from the Atlas of the Mammals of Ontario (Dobbyn 1994) indicates that 22 mammal species have been observed in the vicinity of the Study Area, all of which are considered secure in Ontario. Of these, six were observed during field work (Dillon Consulting Limited 2009, See Appendix C).

#### *3.2.6.3.2 Birds*

Dillon Consulting Limited conducted breeding bird surveys in the Study Area on May 26 and 27 and June 22 and 23, 2009, with a total of 16 person-hours spent documenting the breeding bird community. Breeding bird surveys identified 52 species, with six additional species observed during other phases of field work, for a total of 58 bird species observed in the Study Area. Data from the Second Ontario Breeding Bird Atlas (BBA) indicates that a total of 103 bird species were found as possible, probable or confirmed breeders in atlas square 17PH08, which encompasses the Study Area (Dillon Consulting Limited 2009).

Fifteen of the bird species observed within the study area are considered area sensitive, while 23 are considered conservation priority species from the former Hamilton-Wentworth Region (which encompasses the Study Area) based on Appendix G – Master Priority Table for Southern Ontario (Couturier 1999).

The BBA data indicates that a total of five bird species at risk were found with breeding evidence in square 17PH08 including short-eared owl (*Asio flammeus*), common nighthawk (*Chordeiles minor*), chimney swift (*Chaetura pelagica*), redheaded woodpecker (*Melanerpes erythrocephalus*) and Canada warbler (*Wilsonia canadensis*). Two individuals of chimney swift (*Chaetura pelagica*), which is federally and provincially listed as Threatened, were observed during field work. These birds were observed foraging in the air over the John Knox Christian school grounds near the Highway 8-Jones Road intersection.

Additional breeding bird surveys were completed by Stantec Consulting Limited in 2012 to address avian species at risk within the Study Area. The report detailing the methodology and results of these surveys is found in Appendix K.



#### 3.2.6.3.3 *Herpetofauna*

Ontario Herpetofaunal Atlas information (Oldham and Weller 2000) indicates that 15 species of amphibian and 13 reptile species have been observed in the vicinity of the Study Area, including seven species at risk. Only one species of reptile was observed during field work, the eastern garter snake (*Thamnophis sirtalis sirtalis*). This is a common species and considered secure in Ontario (Dillon Consulting Limited 2009).

Dillon Consulting Limited conducted amphibian monitoring following the Marsh Monitoring Program protocol (Bird Studies Canada 1994). Monitoring was conducted at 5-12 stations on three different occasions during the spring breeding season according to calendar date and environmental conditions (i.e., temperature). In areas where appropriate habitat existed vernal pools were examined for egg masses and amphibian larvae, and if necessary, sampled with a dip net (Dillon Consulting Limited 2009).

Four amphibian species, all frogs, were observed during fieldwork. All four species are considered common to very common in the Province of Ontario and not evaluated as at risk by COSEWIC or COSSARO (Dillon Consulting Limited 2009). Locally, all species are considered as either *Common* or *Abundant* according to the Hamilton Natural Areas Inventory (Dwyer 2003).

Background review suggests the potential presence of species at risk herpetofauna in the Study Area. None of these species were observed during field work, and the preferred habitat for several of these species is not found within the Study Area. Based on the NHIC database, Ontario Herpetofaunal Atlas and field work, three species may possibly use portions of the Study Area as primary habitat or as a travel corridor including: Blanding's turtle, Jefferson salamander and the eastern milksnake (Dillon Consulting Limited 2009).

#### 3.2.6.3.4 *Invertebrates*

Dillon Consulting Limited recorded incidental observations of invertebrates encountered in the course of fieldwork, including Lepidoptera and Odonata.

No records for rare invertebrate species in or near the Study Area were indicated by NHIC Database information. Seven species of Lepidoptera and two species of Odonata were observed during field work. All of the invertebrates observed are considered secure in Ontario with the exception of the monarch butterfly, which is listed federally and provincially as Special Concern (Dillon Consulting Limited 2009).

### 3.2.7 *Opportunities and Constraints – Terrestrial Resources*

Dillon Consulting Limited used a NHS approach to evaluate terrestrial resources within the SCUBE West lands and to identify opportunities and constraints to development. Individual features were assigned a constraint ranking of high, medium or low based on guidance provided by the Provincial Policy Statement, Greenbelt Plan and/or the City of Hamilton Urban Official Plan (Dillon Consulting Limited 2009). Constraint rankings are defined as follows:



High Constraint areas are considered to be natural features with the highest quality habitat in the SCUBE West lands and have specific attributes which meet long-term protection requirements recommended by provincial or municipal legislation/policies (Dillon Consulting Limited 2009).

Medium Constraint areas are considered to be important natural features that should receive long-term protection to protect the diversity, connectivity and biodiversity of the NHS. Features assigned this constraint ranking are typically isolated remnant natural features that do not meet City of Hamilton criteria as Core Areas, but may provide important habitat and/or linkage opportunities (Dillon Consulting Limited 2009).

Low Constraint areas are considered to be of less importance to the long-term function of the recommended NHS and are not specifically protected by provincial or municipal policies or legislation (Dillon Consulting Limited 2009).

Dillon Consulting Limited also identified five potential Linkages in the eastern portion of the SCUBE West lands (i.e., east of Jones Road).

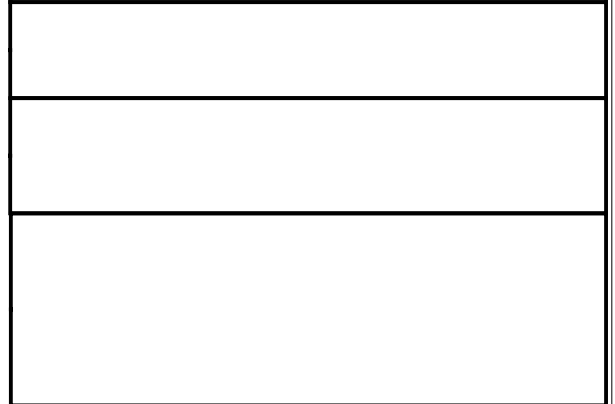
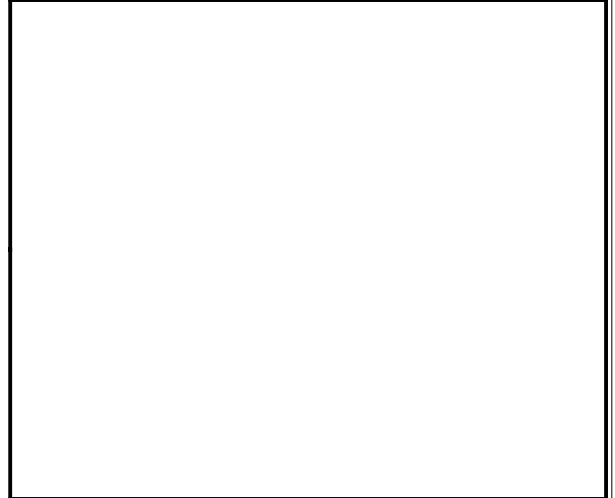
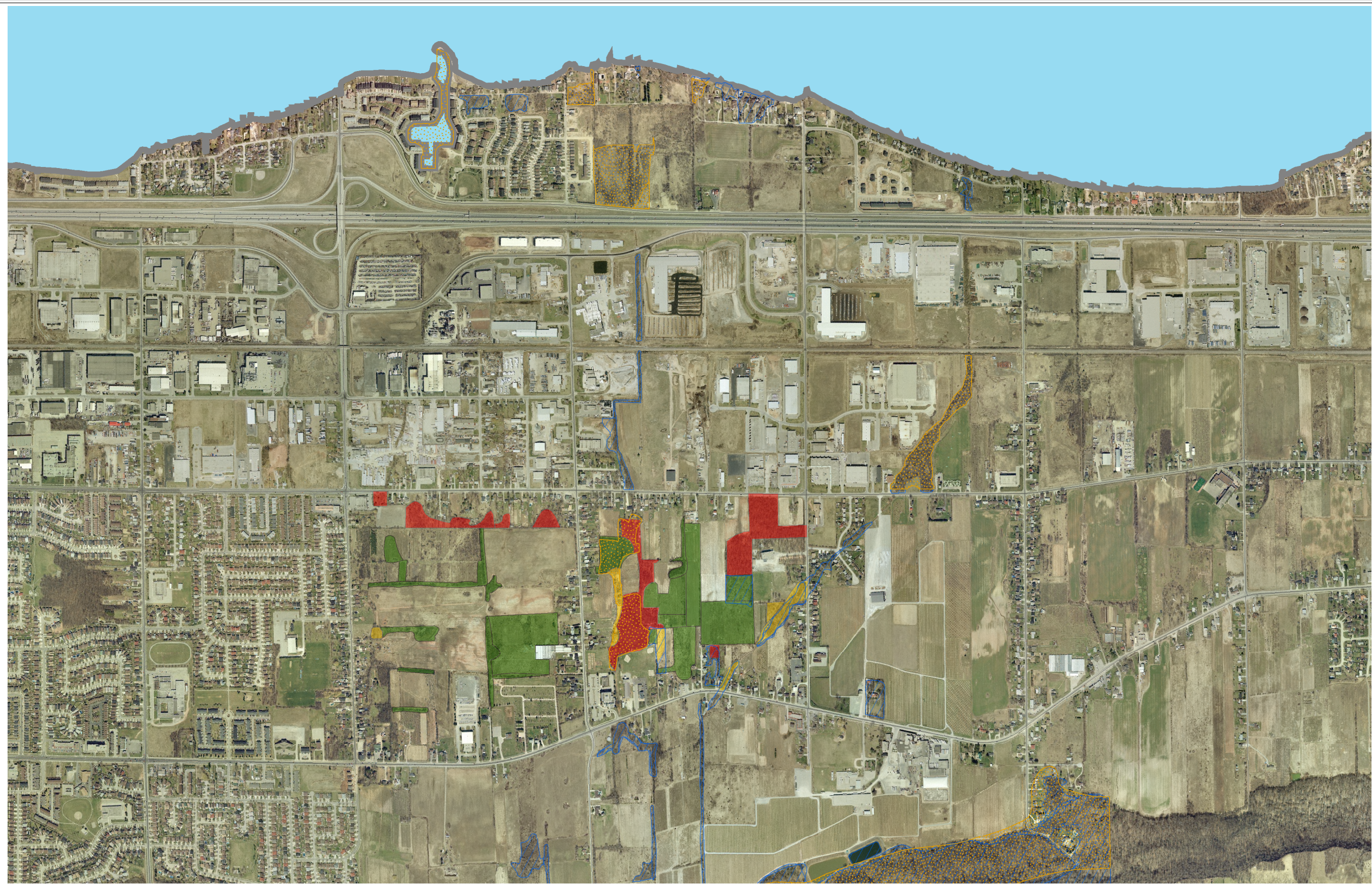
Table 3.9 summarizes the results of the Dillon Consulting Limited evaluation of the terrestrial resources of the SCUBE West lands. Figure 3.18 illustrates constraint areas and potential linkages.

The majority of high and medium constraint areas are located between Jones Road and Glover Road. One large block is located adjacent to Watercourse 6, a second is located immediately southwest of the intersection of Barton Street and Glover Road. Two smaller blocks of high constraint areas are located along Watercourse 7 between Highway 8 and Glover Road.

Few high and medium constraint areas are located between Fruitland Road and Jones Road. A block of high constraint area is located northeast of the intersection of Fruitland Road and Highway 8, east of Watercourse 5. A band of medium constraint area extends immediately south of, and parallel to, Barton Street.

The remaining SCUBE West lands are all considered to pose low constraint to development.







**Table 3.9: Summary of results of Dillon Consulting Limited Natural Environment Constraint Analysis.**

Category	Natural Feature	Constraint Level	Rationale
Urban Official Plan Core Areas (based on Provincial Policy Statement)	<ul style="list-style-type: none"> <li>Wetlands (evaluated and unevaluated)</li> <li>Fish Habitat</li> <li>Significant Woodlands</li> <li>Hazard Lands (e.g., floodplain)</li> </ul>	High	Municipally protected areas that are recognized for their ecological value, fish habitat and hazard mitigation function.
Urban Official Plan Linkage Areas (contiguous to natural features)	<ul style="list-style-type: none"> <li>Natural vegetation linkages, including woodlands, meadows, thickets and riparian areas (streams)</li> </ul>	Medium	Provide important ecological functions and services as well as function as ecological connections between Core Areas and other natural features, especially given their proximity to the urban environment.
Other Natural Vegetation Resources	<ul style="list-style-type: none"> <li>Other natural vegetation (woodlands &gt; 0.5 ha)</li> </ul>	Medium	Provide supportive ecological functions and services, especially given their proximity to the urban environment.
Urban/rural land use (non-naturalized)	<ul style="list-style-type: none"> <li>Agricultural lands</li> <li>Hedgerows</li> <li>Other cultural/developed land uses, such as cultural thickets/meadows, plantations, etc...</li> </ul>	Low	Recently modified communities with altered physiognomy, having lower biodiversity value than intact natural communities.

### **3.3 Summary of Existing Conditions, Constraints and Opportunities**

#### **3.3.1 Surface Water**

Based on the hydrologic and hydraulic assessment, future development constraints and opportunities related to surface water resources may be summarized as follows:

- No new development will be permitted within the potentially flood-susceptible lands defined by the Regulatory (100-year) Floodplain limits.
- Future development lands will require flood (quantity) control facilities to control post-development peak flows to pre-development levels in order to prevent increase to downstream flow rates and flood frequency.
- Source and conveyance control stormwater measures, where feasible, should be applied to preserve the existing hydrology and minimize increase in runoff volumes and flow rates.

#### **3.3.2 Groundwater Resources**

##### **Silt/Clay Till(Halton Till)**

Although the groundwater recharge potential for the majority of the developable SCUBE West lands are classified as “low”, future stormwater management planning should include measures, where feasible, to minimize changes to the existing groundwater recharge rate of approximately 100 mm per year. This will, in turn, help to minimize future increases in runoff rates.

##### **Sand/Gravel Deposit**

These granular soils, situated near the base of the Escarpment at the southeast corner of the subwatershed areas, represent a zone of high groundwater recharge potential. Given its function as a potential contributor of baseflow to stream reaches to the north, the existing recharge potential of approximately 200 mm per year from this feature should be protected through future source and conveyance control stormwater management measures which promote the infiltration of clean runoff.

#### **3.3.3 Fluvial Geomorphology**

One of the objectives of the sub-watershed study is to minimize erosion and ensure stability and health of the streams as future development occurs. Within the study area, existing erosion hazards were identified where mitigation should be considered, primarily along Watercourse 5 and 6. Because of the proximity of private structures at risk due to erosion, an engineered channel design will likely be necessary, as opposed to a natural approach. Future



stormwater management planning should include erosion control facilities to prevent impacts from future developments. Likely impacts include flood conveyance and increased erosive stresses.

#### ***3.3.3.1 Increase Riparian Corridor Width***

Each of the watercourses within the study area has been altered to a straightened planform alignment. This is done to increase developed landuse, however, these actions often have implications. Structures which line the narrow riparian corridor are at risk when the channel begins to retain a sinuous form through planimetric development. Where possible, the corridor width should be increased with extended boundaries where structures stand. This will negate the need for hardened channel linings which are currently found in disrepair through the study area. Where possible, the corridor should be vegetated with native species to provide binding strength to the banks and increase aquatic habitat health.

#### ***3.3.3.2 Reconnect Flood Plain Access***

At the downstream ends of the primary watercourses (typically upstream of the QEW) the channel has become entrenched with minimal floodplain relief. The low-slope conditions provide velocities and shear stress not likely to cause erosion, however, when flood flows occur and are completely contained within the channel, the increased depths will induce erosive stresses to exceed the critical thresholds of bed and banks.

#### ***3.3.3.3 Removal of Organic and Inorganic Debris***

Throughout the study area numerous areas are littered with organic and artificial debris. Removal of this material during development phases will improve aquatic habitat, locally reduce potential erosion impacts, and improve conveyance.

#### ***3.3.4 Aquatic Resources***

Watercourses 5, 6 and 7

Based on the habitat classification descriptions (as per the Interim Guidelines), Watercourse 5.0 is classified as permanent fish habitat in the Study Area. Based on a review of the Interim Guidelines combined with the findings of this study, it is recommended that this feature be given a **Protection 2** Management Recommendation.

Although numerous barriers and obstructions exist on the system (e.g., downstream of Barton Street), the potential for direct habitat exists (should they be removed) and thus, it is believed that this level of protection is warranted.

According to the Interim Guidelines (CVC and TRCA, 2009), the Protection 2 Management Recommendation indicates the following general requirements for treatment of the watercourse:

- Preference is to maintain existing surface water source;
- Maintain external drainage or if catchment drainage has been previously removed due to diversion of SWM flows, restore lost functions through enhanced lot level controls (i.e., restore original catchment using clean roof drainage) as necessary;
- Replicate on-site surface water sources including wetland creation and incorporating extended detention outlets, if necessary;
- Use natural channel design techniques to replace and enhance existing habitat features only if features are easily replicated; Drainage feature must connect to downstream watercourse/habitat;
- Examine need to incorporate groundwater flows through infiltration measures (i.e., third pipes, etc.) to ensure no net loss and potential gain.

These watercourses should be protected within a minimum Vegetation Protection Zone of 15 m from each bank, consistent with Natural Heritage Reference Manual (2010) guidelines for warmwater watercourses.

#### Watercourse 5.2

Based on the habitat classification descriptions (as per the Interim Guidelines), this watercourse is classified as complex contributing fish habitat. However, as this tributary flows into a storm sewer and is isolated from downstream aquatic resources, it is recommended that this watercourse receive a **Mitigation 2** Management Recommendation.

According to the Interim Guidelines (CVC and TRCA, 2009), the Mitigation 2 Management Recommendation indicates the following general requirements for treatment of the watercourse:

- Replicate functions by lot-level conveyance measures (e.g., vegetated swales) connected to the natural heritage system, as feasible and/or Low Impact Development (LID) stormwater options;
- Replicate on-site flows and outlet flows at the top end of vegetated swales, bioswales, etc. to maintain feature functions.
- End of pipe measures, such as wet ponds or wetland features that replicate the predevelopment quantity and quality characteristics that support downstream fish populations

Typically these watercourses would be classified as level 2 or basic level of treatment according to the MOE Stormwater Management and Design Manual (2003), however, recent

efforts are now underway to reduce phosphorus loading to Lake Ontario, in particular the nearshore zone. For this reason, it is recommended that these watercourses be classified as level 2 or enhanced level of treatment.

### ***3.3.5 Terrestrial Resources***

Dillon Consulting Limited used a NHS approach to evaluate terrestrial resources within the SCUBE West lands and to identify opportunities and constraints to development. Individual features were assigned a constraint ranking of high, medium or low based on guidance provided by the Provincial Policy Statement, Greenbelt Plan and/or the City of Hamilton Urban Official Plan (Dillon Consulting Limited 2009).

The majority of high and medium constraint areas are located in the eastern portion of the SCUBE West lands (i.e., between Jones Road and Glover Road). One large block is located adjacent to Watercourse 6, a second is located immediately southwest of the intersection of Barton Street and Glover Road. Two smaller blocks of high constraint areas are located along Watercourse 7 between Highway 8 and Glover Road. Dillon Consulting Limited also identified five potential Linkages in the eastern portion of the SCUBE West lands.

Few high and medium constraint areas are located between Fruitland Road and Jones Road. A block of high constraint area is located northeast of the intersection of Fruitland Road and Highway 8, east of Watercourse 5. A band of medium constraint area extends immediately south of, and parallel to, Barton Street (Figure 3.19).

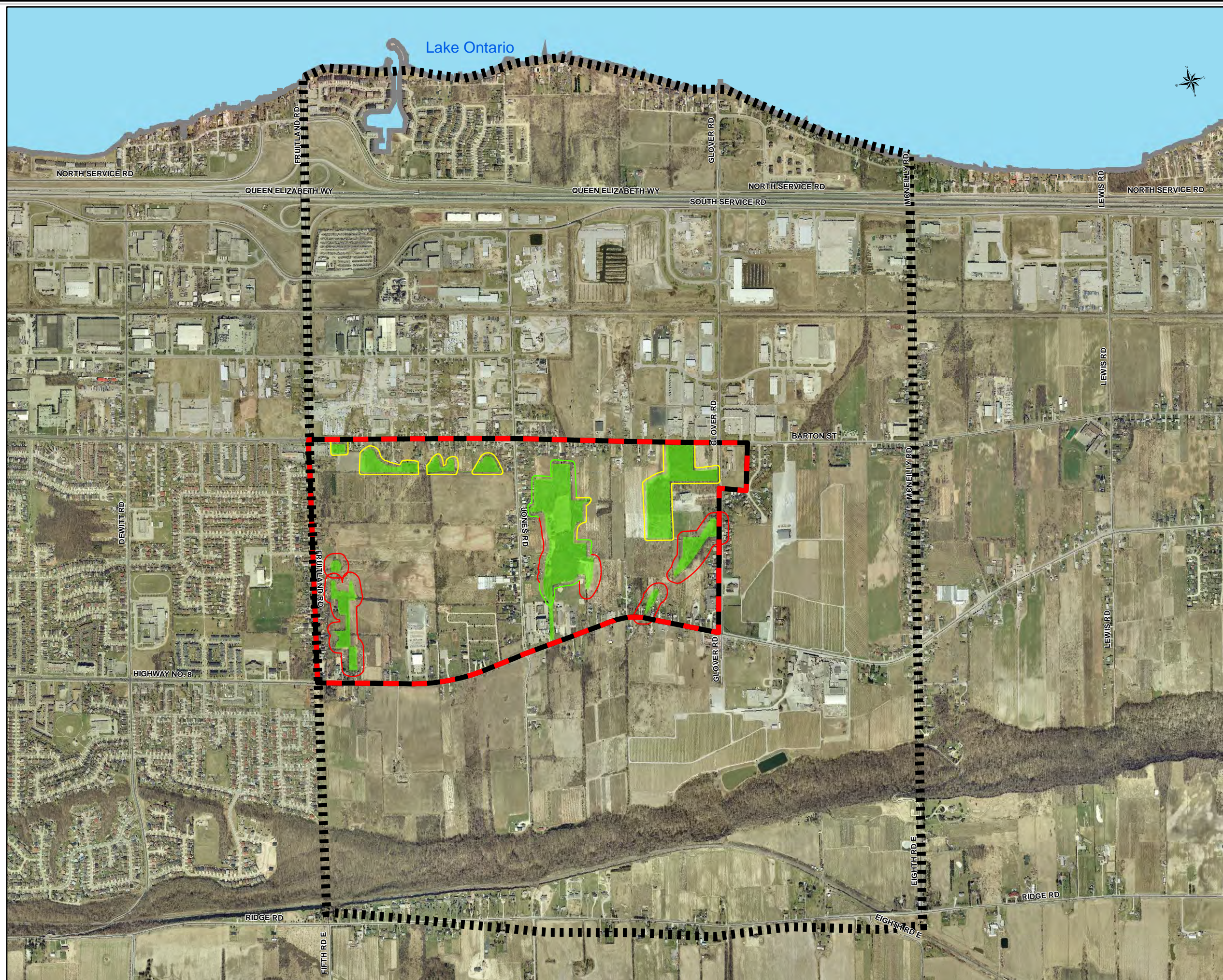
The remaining SCUBE West lands are all considered to pose low constraint to development.

The summary of SCUBE West Opportunities and constraints to development could be found in Figure 3.20.

### ***3.3.6 Natural Heritage System***

The development of the Natural Heritage System can be found in Chapter 8.





**LEGEND:**

- Study Area Boundary
- SCUBE West Boundary
- Recommended Setback**
- 10 m
- 15 m
- 30 m
- Terrestrial Resources**
- Natural Heritage

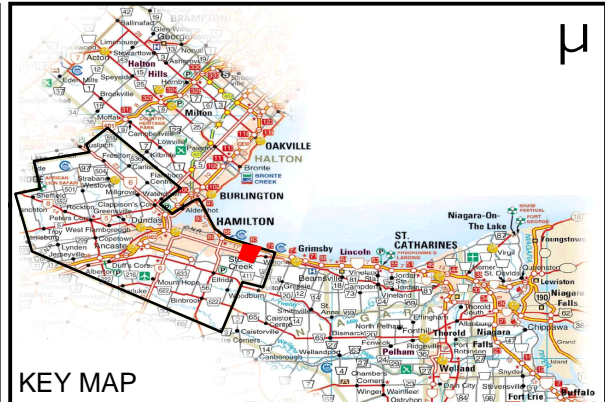
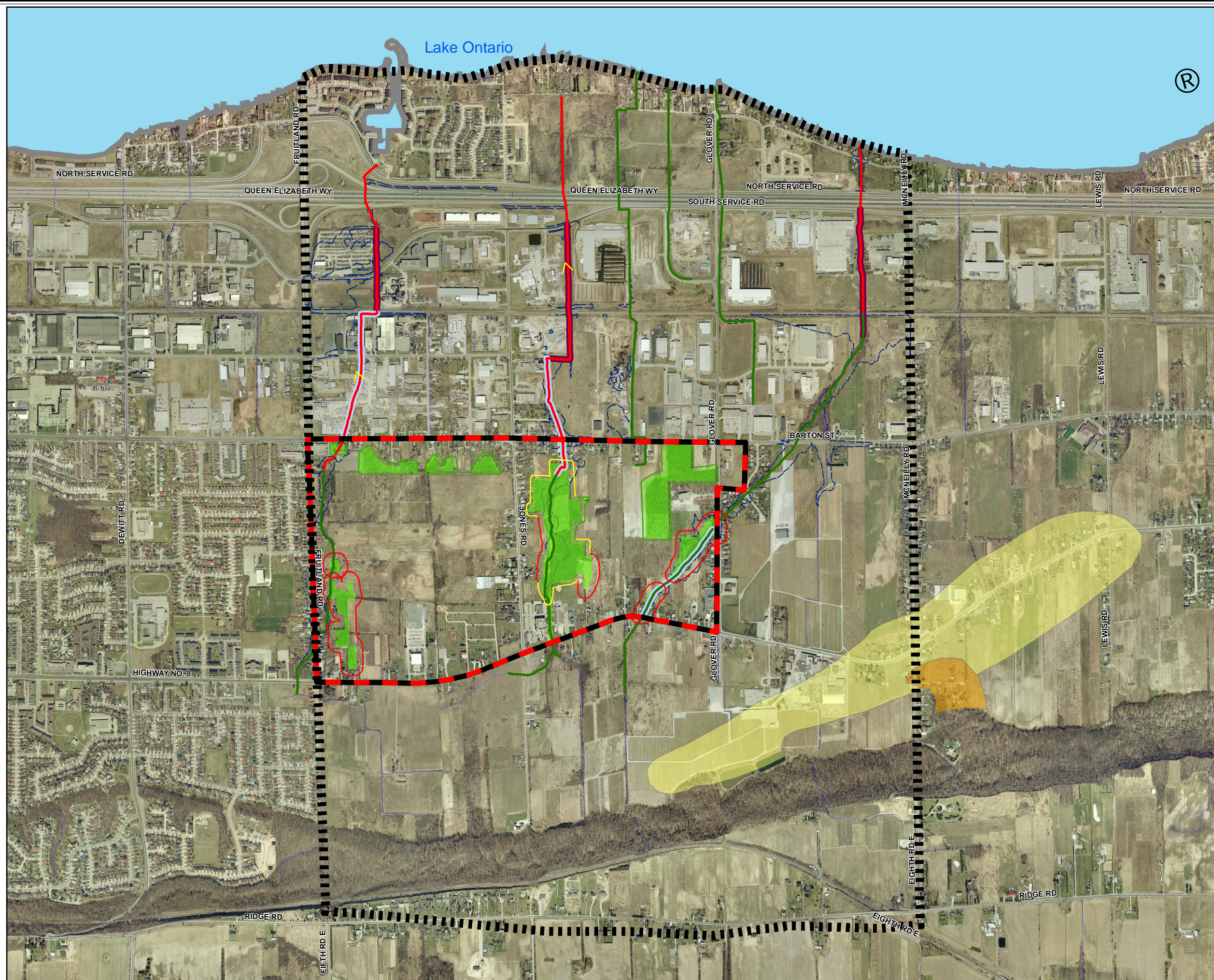
**NOTES:**

**SCUBE WEST SUBWATERSHED STUDY**  
 Terrestrial Resources – Opportunities and Constraints to Development

**FIGURE No. 3.20**

DATE: June 7, 2010





**KEY MAP**

**LEGEND:**

- Study Area Boundary
- SCUBE West Boundary
- Recommended Setback
  - 10 m
  - 15 m
  - 30 m
- Candidate Protected Corridors
  - Indirect/Support Fish Habitat
  - Intermittent Warmwater Fish Habitat
  - Permanent Warmwater Fish Habitat
- Fluvial Morphology
  - Reconnect Floodplain
  - Widen Riparian
  - Remove Organic Debris
- Terrestrial Resources
  - Natural Heritage
- Surface Water Resources
  - Regulatory Floodlines
- Groundwater Resources
  - Sand
  - Sand and Gravel

**NOTES:**



**SCUBE WEST SUBWATERSHED STUDY**

Summary of SCUBE West Opportunities and Constraints to Development

**FIGURE No. 3.21**

DATE: October, 2010



## 4 SUBWATERSHED GOALS AND OBJECTIVES

Subwatershed goals and objectives represent the “vision” for the subwatershed. Typically the goals focus on opportunities to ensure that the natural features within the watershed are sustained as land use changes and existing land use practices continue into the future. In this regard goals and objectives are established to protect, enhance and/or restore natural features in the long term. In general, protection refers to implementing measures which will ensure that further degradation of the feature does not occur. Enhancement measures are actions which, when implemented will improve upon the existing condition of a feature, providing for an overall healthier state. Restoration measures are actions that will restore a feature to a prior, healthier state. In most watersheds, restoration measures are the most difficult to achieve, while protection and enhancement measures are more easily implemented.

Subwatershed plans typically put forth an overall subwatershed goal and then specific environmental goals and objectives pertaining to, for example:

- groundwater resources;
- the hydrologic regime/flooding;
- surface water quality;
- erosion and stream morphology; and
- aquatic and terrestrial resources

Outlined below is the subwatershed goal and specific environmental goals and objectives. These goals and objectives were formulated after the natural features and functions of the study area were inventoried in Phase 1 of the study (refer to Section 4).

### Subwatershed Goal

*To identify natural environmental resources and to establish appropriate strategies for the protection, enhancement and restoration of these important features under present conditions and as land use changes occur.*

### Environmental Goals/Objectives

1. *Goal:* Ensure the groundwater recharge function provided by the soils of the study area is maintained in order to:

#### *Objectives*

- protect baseflows to the study area streams, such as the groundwater discharges to Watercourse 7;
- reduce stormwater runoff volumes; and
- protect groundwater quality.



2. *Goal:* Provide a safe hydrologic regime and stable stream systems which:

*Objectives*

- minimizes flood and erosion risks;
- restricts future development from flood prone areas; and
- promotes infiltration to reduce stormwater runoff volumes.

3. *Goal:* Protect the quality of surface water in streams to:

*Objectives*

- maintain healthy aquatic and terrestrial communities; and
- support reasonable human uses including body contact recreation, aesthetics.

4. *Goal:* Establish a healthy aquatic ecosystem which supports warmwater fisheries both within and downstream of the study area streams by:

*Objectives*

- protecting critical reaches with healthy fish communities;
- preserving and enhancing existing aquatic habitat;
- removal of barriers to fish migration
- protecting groundwater baseflows; and
- protecting/restoring natural streamside vegetation.

5. *Goal:* Establish a healthy terrestrial ecosystem by:

*Objectives*

- protecting and valued terrestrial features within the Niagara Escarpment Protection Area and Fifty Creek ESA;
- protecting the riparian woodlots and adjacent woodlots;
- preserving and enhancing hedgerows and other isolated riparian features;
- providing habitats suitable for native plant and animal communities; and
- enhancing terrestrial linkages along the Fifty Creek corridor between the Fifty Creek ESA and the Niagara Escarpment.

## **5 POTENTIAL IMPACTS FROM FUTURE DEVELOPMENT**

Environmental baseline conditions were defined in Section 4, and subwatershed goals and objectives were defined in Section 5. This chapter will review the potential impacts of future urban development on each of the subwatershed resources. This, in turn, will assist in the identification and selection of appropriate measures and management practices to mitigate these impacts and meet the selected objectives (Section 7).

Existing and proposed landuses within the SCUBE West study area were reviewed in Section 3. As was illustrated in Figure 2.2, the SCUBE West lands are proposed to be developed primarily as low and medium residential housing, with smaller supporting commercial and industrial uses. The future development lands are located primarily between Barton Street and Highway No. 8, from Fruitland Road to Glover Road. Portions of the proposed development lands drain to each of Watercourses 5, 6, and 7.

### **5.1 Surface Water Quality**

The protection of surface water quality within the study area watercourses was identified as a key objective of the study (Section 5, goal no.3). Water quality has a strong influence on the health of the existing fish communities, and also determines the suitability of water for drinking, recreation, fishing, wildlife and general aesthetics.

Stormwater runoff from urban sources typically contains elevated levels of contaminants such as sediment (i.e., suspended solids), nutrients (e.g., phosphorous, etc.), metals (e.g., copper, lead, zinc, etc.), and bacteria. Therefore, without controls, future urban development will result in increased pollutant loadings to the area streams. This, in turn, can contribute to degraded fish habitat and increased health risks associated with various recreation activities.

Various methods and levels of water quality control are specified in the MOE's Stormwater Management Planning Manual (2003). For the SCUBE West study area watercourses, Hamilton Conservation Authority requires "Level 2" or "normal" level of protection, defined as 70% long-term suspended solids removal.



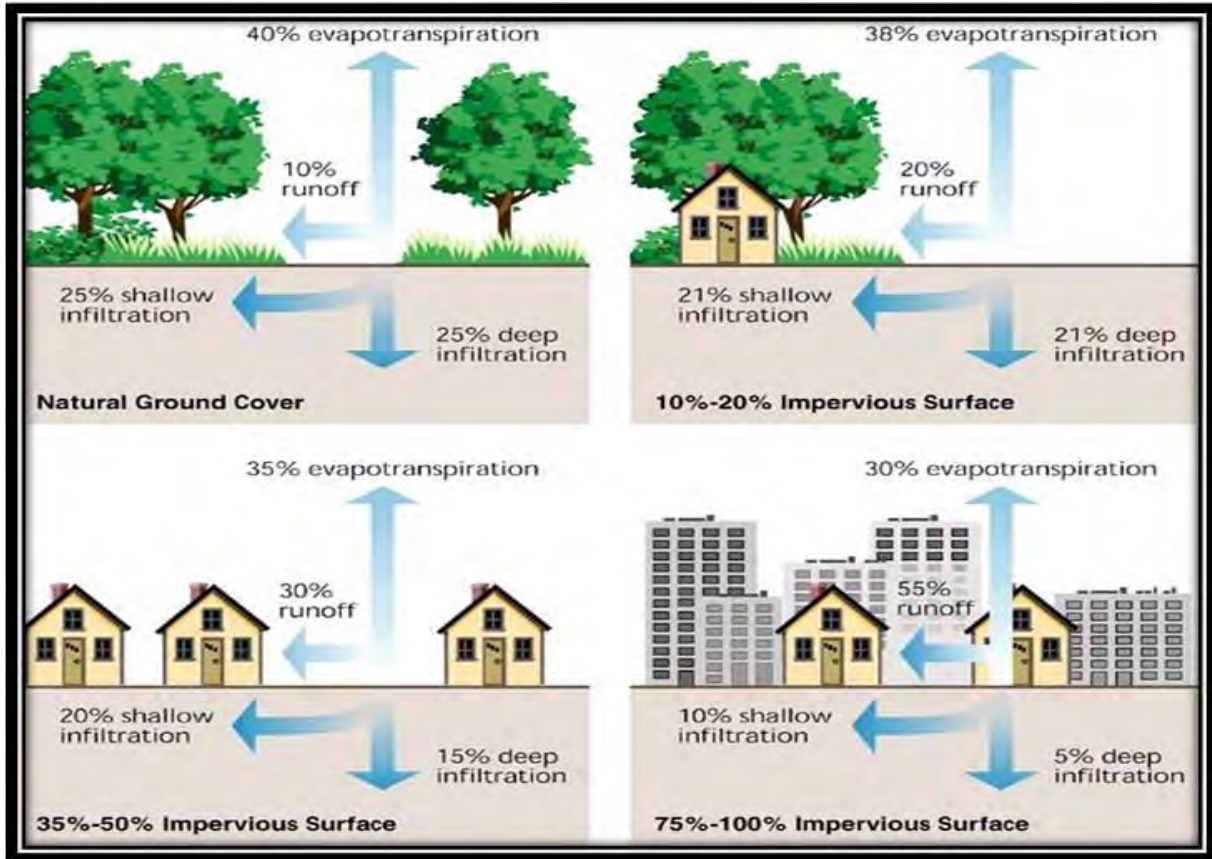
**Figure 5.1: Water Quality Impacts**

## **5.2 Groundwater Impacts**

As discussed in Section 3, sand and gravel deposits situated near the base of the escarpment near McNeilly Road represent a zone of high groundwater recharge potential and function as a potential contributor of baseflow to stream reaches to the north. The silt/clay soils throughout the remainder of the future development lands have a lower groundwater recharge potential. However, they cover a majority of the study area and therefore still contribute a large percentage of the annual groundwater infiltration. Maintaining the existing groundwater recharge volumes in the SCUBE study area was identified in Section 5 as a study objective (Section 5, goal no.1).

Without controls, the impervious surfaces associated with future urban development will reduce the capacity of the site to infiltrate rainfall events into the groundwater system, creating an increase in the volume of surface water runoff instead (Figure 5.2). This alteration to the water budget, in turn can contribute to increased rates of flooding, erosion, and pollutant loadings. The corresponding reduction in groundwater levels can also result in reduced supplies of clean, cool baseflows to area streams, thereby negatively impacting downstream fish communities.





**Figure 5.2: Water Budget Impacts of Development**

For the SCUBE study area, basic spreadsheet water balance calculations were completed to estimate the potential impacts of development on the amount of groundwater infiltration. Details are provided in Appendix D. Two general levels of development were considered:

- Residential development – assumed 50% impervious; and
- Employment lands development – assumed 80% impervious.

Based on the above, without stormwater controls, the estimated future annual infiltration deficit could range between 70 mm per year and 115 mm per year, depending on the soil and proposed future landuses, as summarized in Table 5.1.

**Table 5.1: Summary of Potential Groundwater Recharge Impacts**

Soils	Existing Annual Infiltration (mm/yr)	Future Annual Infiltration (without stormwater controls) (mm/yr)		Potential Deficit (mm/yr)
Silt/clay	114	Residential landuses (50% impervious)	57	57
		Employment landuses (80% impervious)	23	91
Sand/gravel	200	Residential landuses (50% impervious)	100	100

### 5.3 Flood and Erosion Impacts

With urbanization there is a typical hydrologic response from the developed land. This generally involves an increase in peak flow rates and runoff volumes, and a decrease in the time-to-peak flow. These effects commonly occur with increased impervious surface areas and improved stormwater drainage systems which are typical of the change from rural to urban land use. The increased runoff volumes and flow rates can result in increased rates of erosion and flooding (Figure 5.3).



**Figure 5.3: Flooding and Erosion Impacts**

Within the SCUBE West study area, several of the stream reaches located downstream of the future development lands have been classified as unstable with on-going erosion.

With respect to flooding impacts, the hydrologic model developed in Section 4 was modified to include future urban development within the SCUBE West study area. Future residential landuses were modelled with 50% imperviousness and future commercial and institutional landuses were modelled with 80% imperviousness. The flood flow estimates from the hydrologic model associated with the future uncontrolled landuse scenario were applied to establish the 100-year floodplain mapping through study area.

The floodplain mapping assessment undertaken for Watercourses No. 5 and 6 (Section 5.2.2.3) indicates that flooding is a concern downstream of the SCUBE West development lands, due in part to backwater and spills behind several roadway/railway crossings. The

floodplain extents were illustrated in Figure 3.9 and the flood flow rates were summarized in Table 3.3. The Dillon floodplain mapping study also reviewed a series of culvert replacements as a means to reduce the extent of the flooding and spills on Watercourses 5 and 6.

Floodplain mapping for Watercourse 7 was also illustrated in Figure 3.9. A 2003 Environmental Assessment Study for Watercourse 7 (Philips, 2003) recommended a combination of flood and erosion control storage together with capacity improvements, consistent with earlier Master Drainage Planning, between Lake Ontario and Barton Street using natural channel design techniques in order to mitigate existing flooding and erosion problems. The following is understood regarding the status of this proposed work:

- The QEW culvert has been upgraded;
- Channel works downstream of the QEW have been completed;
- Channel works for the stream reach from the QEW to just downstream of the CNR will be constructed shortly;
- Further works to upgrade the CNR culvert are planned for the future;
- Further channel works for the stream reach from the CNR to Barton Street are also planned for the future;
- No storage facilities have been constructed.

Given the existing erosion and flooding issues downstream of the SCUBE West development area, and given that most of the proposed capacity improvement along the downstream watercourse reaches are yet to be implemented and/or will not completely eliminate the existing flooding, it is understood that future urban development will require some form of control, to avoid aggravating the existing downstream problems.

#### **5.4 Aquatic and Terrestrial Resource Impacts**

Healthy aquatic and terrestrial ecosystems were identified as key objectives of the subwatershed study (Section 5, goal no. 4, 5). Human activities such as urban development may weaken or destroy aquatic habitats, fragment wildlife corridors, degrade water quality, increase streambank/channel erosion, increase sedimentation, reduce baseflows and increase storm flows.

Consequently, these activities can cause a reduction in the abundance and number of species represented in the fish community to the point where some watercourses no longer support fish. The disappearance of a species may result from a change in a single habitat requirement, for example, when riparian vegetation is removed, some species may disappear due to the resulting increase in stream temperature. On the other hand, several factors in combination may cause a species to disappear, for example, by reducing food supplies, overwintering habitat, or protective cover from predators.



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## 6 REVIEW AND EVALUATION OF SUBWATERSHED MANAGEMENT ALTERNATIVES

Environmental baseline conditions were defined in Section 4, and subwatershed goals and objectives were defined in Section 5. Section 6 outlined the potential impacts from future development. This chapter will review and evaluate alternative measures, referred to as Best Management Practices (BMP's), to mitigate the potential impacts and meet the selected objectives. The term Best Management Practice is defined as a measure that, when implemented will assist in protecting, enhancing, or restoring the environmental features.

### 6.1 Alternative Measures

In keeping with the Environmental Assessment process, several alternative techniques have been identified to address the potential environmental impacts resulting from the proposed future development lands within the SCUBE study area:

- Do nothing;
- Traditional Source Control Measures;
- Low Impact Development (LID) Source Control Measures;
- LID Conveyance Control Measures;
- End-of-pipe controls including wet ponds, wetlands, and dry ponds; and
- Stream Restoration.

The above alternative measures focus primarily on the development of a stormwater management strategy, which is the key component of an overall Subwatershed Strategy. A description of each of the above options is discussed in more detail below.

#### **Do Nothing**

This measure involves developing the SCUBE study area lands without stormwater management. This alternative would result in a substantial increase in runoff, flooding, erosion and also water quality degradation both within the future development lands and the lands downstream.

#### **Traditional Source Controls**

These measures are typically used at the "lot-level" within high-density forms of development such as commercial or industrial landuses. Rooftops, parking lots, or oversized storm sewers can be used to temporarily store rainfall from large storm events. The storm runoff is then released at controlled rates to avoid increased rates of erosion and flooding in the receiving streams. In terms of water quality control, oil-grit separator devices are commonly used to remove select pollutants and improve water quality before runoff is released from industrial or commercial development sites.



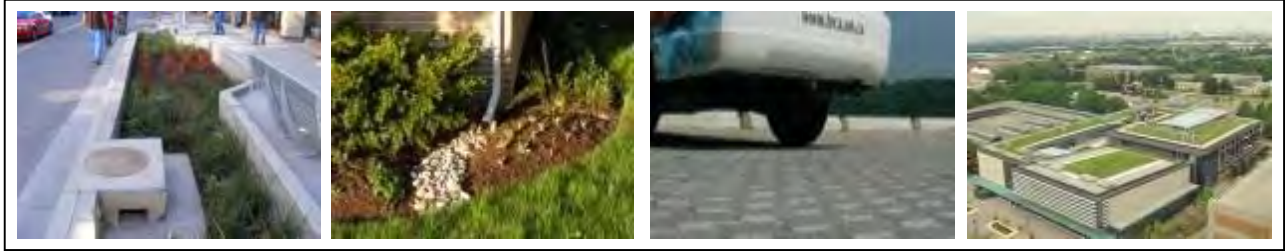
**Figure 6.1: Traditional Source Controls**

(Clockwise, from top left: Rooftop Storage, Parking Lot Storage, Oil-Grit Separator)

### **Low Impact Development (LID) Source Controls**

This technique involves addressing SWM using lot-level source controls that encourage the infiltration of water into the ground and reduce stormwater runoff. These systems can be integrated into the design of future urban developments and can include:

- Rainwater Harvesting;
- Green Roofs;
- Downspout Disconnection;
- Soakaway Pits,
- Bioretention and Special Bioretention:
- Compost Amendments;
- Tree Clusters;
- Filter Strips;
- Permeable Pavement.



**Figure 6.2: Example LID Source Controls**  
(from L to R: Bioretention, Downspout Disconnection, Permeable Pavement, Green Roofs)

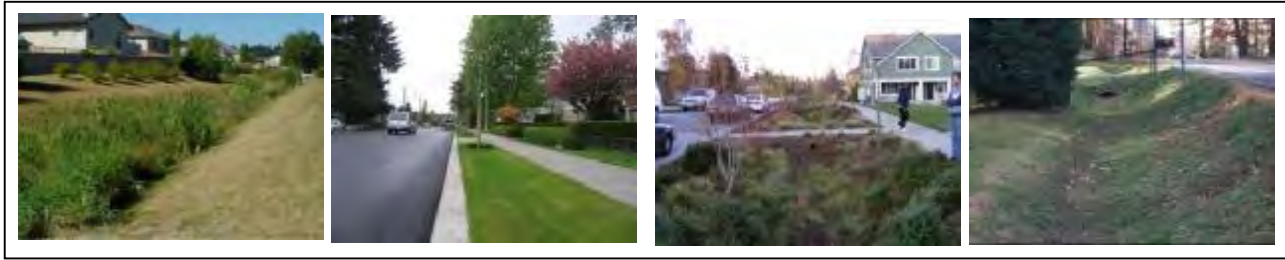
The suite of 9 landscape-based, decentralized, lot-level, micro-control Best Management Practices (BMP's) are collectively known as Low Impact Development (LID). There are many definitions that have been developed in an attempt to define Low Impact Development, with the most widely accepted definition being that used by the United States Environmental Protection Agency (EPA, 2007):

*Low Impact Development (LID) is a stormwater management strategy that seeks to mitigate the impacts of increased runoff and stormwater pollution. LID comprises a set of site design approaches and small scale stormwater practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater. These practices can effectively remove nutrients, pathogens and metals from stormwater, and they reduce the volume and intensity of stormwater flows.*

LID techniques mimic natural systems as rain travels from the roof to the stream by applying a series of practices across the entire development site before discharge to receiving water body. Real-world LID designs typically incorporate a series of LID BMP's in a 'treatment train' approach to provide integrated treatment of runoff from development sites. An example is provided in Figure 6.3.







**Figure 6.4: Example LID Conveyance Controls**  
(From L to R: Vegetated Channel, Subsurface Perforated Pipe, Bio-swale, Grass Channel)

### End-of-Pipe Controls

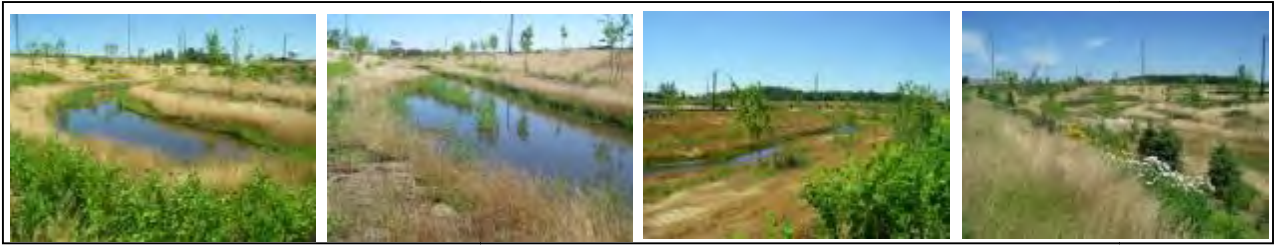
End-of-pipe measures involve addressing stormwater management using conventional stormwater facilities such as wet ponds, wetlands and dry ponds at the end of the flow conveyance system (Figure 6.5). These facilities may be utilized for any combination of erosion, water quantity and quality control applications.



**Figure 6.5: Example End-of-Pipe Controls**  
(clockwise from top left: Constructed Wetland, Dry Pond, Wet Pond)

### Stream Restoration

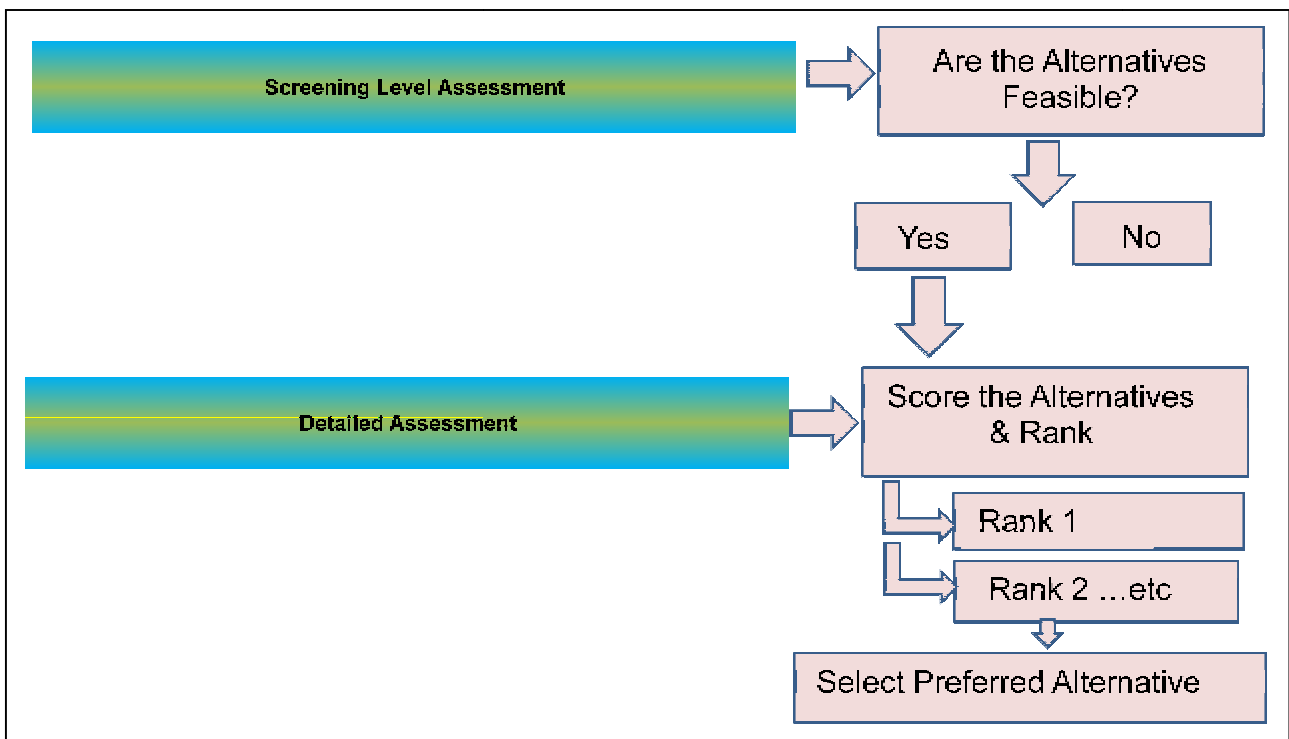
This option involves the replanting of floodplain and native stream side vegetation to improve stream corridor functions and water quality, slows runoff, moderates stream temperatures, reduces erosion and improves aquatic and terrestrial habitat conditions. It also includes the reconstruction of the stream's natural characteristics including morphology of the channel and its floodplain which may also improve fish habitat.



**Figure 6.6: Stream Restoration Examples**  
(From L to R: Created Channel, Wetland Feature, Linear Wetland, & Naturalize Corridor)

## 6.2 Evaluation of Alternative Measures

In order to ensure a transparent selection process (as part of the EA) that considers all possible alternatives, a two-phased evaluation process has been used to assess the alternative measures discussed in the previous Section. The two-phased approach (Figure 6.7) is composed of a screening level assessment followed by a detailed assessment.



**Figure 6.7: Evaluation Process Flow Chart**

### 6.2.1 Phase 1: Screening Level Assessment

The screening level assessment is intended as a coarse screening tool, used to review the stormwater measures that are feasible (and infeasible) for use in the SCUBE study area. To this end nine (9) screening level assessment criteria have been utilized to determine which



stormwater alternatives are to be carried forward to the more detailed assessment phase. The primary criteria include:

- 1) Technical feasibility;
- 2) Ability to meet targets for flooding,
- 3) Ability to meet targets for water quality,
- 4) Ability to meet targets for erosion and
- 5) Ability to meet targets for water balance;
- 6) Cost effectiveness;
- 7) Land requirements;
- 8) Public acceptance; and
- 9) Regulatory agency approval.

A description of the individual screening level assessment criteria and measures for assessment are provided in Table 6.1, and Table 6.2 presents the results of the screening level (Phase 1) assessment. As shown, the following techniques were found to meet the screening-level criteria and were carried forward to the detailed assessment:

- traditional source controls;
- LID source controls;
- LID conveyance control measures;
- end-of-pipe wet ponds; and
- stream restoration meet

As shown in Table 6.2, the “Do Nothing” option does not meet flooding, water quality, erosion, or water balance objectives and would also not be acceptable to regulatory agencies. End-of-pipe wetlands tend to be inconsistent with higher-density urban settings due to the relatively large land area requirements, while dry ponds rank poorly in several categories and are not generally favoured by the public or regulatory agencies. These techniques, together with the “Do Nothing” option, were not carried forward to the second, detailed assessment phase.

**Table 6.1: Primary Criteria used in Screening Level Assessment (Phase 1)**

<b>Criteria</b>	<b>Description of Criteria</b>	<b>Measures for Assessment</b>
Technical feasibility	<ul style="list-style-type: none"> <li>Ability of the SWM technique to be constructed given the known constraints.</li> </ul>	<p>The assessment of the individual stormwater control measures ranges from Excellent to Poor in its ability to meet the identified criteria.</p> <p>Stormwater management techniques that fail to meet primary criteria will be deemed to be an unacceptable option and will <u>not</u> be carried forward to the detailed assessment (scored NA – Not acceptable).</p>
Ability to meet targets for flooding	<ul style="list-style-type: none"> <li>Ability of the SWM technique to meet flood control criteria. Technique must control peak outflows for the site to pre-development rates for design storms with return period up to 100yrs.</li> <li>Cannot increase flooding risks to infrastructure and private property.</li> </ul>	
Ability to meet targets for water quality	<ul style="list-style-type: none"> <li>Ability of the SWM technique to meet water quality criteria as per Table 3.2 of the 2003 MOE Stormwater Management Manual.</li> </ul>	
Ability to meet targets for erosion	<ul style="list-style-type: none"> <li>Ability of the SWM technique to control water course erosion in accordance with the 2003 MOE Stormwater Management Manual.</li> </ul>	
Ability to meet targets for water balance	<ul style="list-style-type: none"> <li>Ability of the SWM technique to maintain the pre-development water balance and prevent adverse changes to site hydrology.</li> </ul>	
Cost effectiveness	<ul style="list-style-type: none"> <li>Cost effectiveness of the SWM technique in relation to the overall benefit and the collective criteria.</li> </ul>	
Land requirements	<ul style="list-style-type: none"> <li>A measure of the amount of land required to construct the SWM technique in relation to the overall benefit.</li> </ul>	
Public acceptance	<ul style="list-style-type: none"> <li>General public acceptance of the individual stormwater management technique.</li> </ul>	
Regulatory agency approval	<ul style="list-style-type: none"> <li>Ability of the SWM to meet the requirements of Municipal, Provincial, Federal agencies and the respective Conservation Authorities.</li> </ul>	

**Table 6.2: Phase 1 Screening-Level Evaluation Matrix**

	Technical Feasibility	Flooding	Water Quality	Erosion	Water Balance	Cost Effectiveness	Land Requirements	Public Acceptance	Regulatory Agency Approval	Overall
<b>Do Nothing</b>	E	NA	NA	NA	NA	E	E	NA	NA	NA
<b>Source Control Measures</b>										
Traditional Source Control (storage)	E	E	P	G	P	G	G	G	F	G
LID Source Control (infiltration / filtration)	E	P	E	E	E	P	F	G	E	G
<b>Conveyance Control Measures</b>										
LID Conveyance (infiltration / filtration)	E	F	G	G	G	G	G	G	G	G
<b>End-of Pipe Measures</b>										
Wet pond	E	E	G	F	P	G	F	E	E	G
Wetland	E	E	E	G	P	P	NA	G	G	NA
Dry Pond	E	E	P	G	P	G	F	NA	P	NA
<b>Stream Restoration</b>	G	P	G	E	F	P	G	G	E	G
	E=Excellent, G= Good, F = Fair, P=Poor, NA = Not Acceptable									



### **6.2.2 Phase 2: Detailed Assessment**

The stormwater management techniques carried forward from screening level assessment (traditional source control, LID source control, LID conveyance control, end-of-pipe wet ponds, and stream restoration) have been used to develop a set of ten (10) stormwater management alternatives for the SCUBE study area. The alternatives are made up of both individual approaches (e.g., traditional source control alone) and combinations of approaches (consistent with the MOE's treatment train approach to stormwater management). The ten (10) stormwater management alternatives include:

1. Traditional Source Controls only;
2. LID Source Controls only;
3. LID Conveyance Controls only;
4. End-of-pipe Wet Ponds only;
5. Combination of Traditional Source Controls and LID Source Controls;
6. Combination of Traditional Source Controls and LID Conveyance Controls;
7. Combination of LID Source Controls and LID Conveyance Controls;
8. Combination of LID Source Controls and end-of-pipe Wet Ponds;
9. Combination of LID Source Controls, LID Conveyance Controls and end-of-pipe Wet Ponds; and
10. Stream Restoration Measures

It should be noted that Alternative 10, Stream Restoration, is not intended as a stand-alone measure. Instead, it is common to all other alternatives as it is recommended as part of the Natural Heritage Strategy (Section 9). Therefore, it will be recommended regardless of which alternative is preferred.

The Detailed Assessment is a much more rigorous and thorough assessment of each alternative, and is based on a set of 19 evaluation criteria under 4 groupings, as described below:

#### **Physical and Natural Environment Criteria**

- Ability to meet targets for water balance and mitigate impacts to groundwater recharge and runoff volumes;
- Ability to meet criteria for flooding, water quality and erosion;
- Impact on terrestrial and aquatic habitat.

#### **Social, Economic and Cultural Environment Criteria**

- Impact on existing and proposed development;
- Aesthetic value;
- Potential benefit to the community and public acceptance;
- Coordination with proposed roadway design; and

#### **Technical Criteria**

- Level of service and proven effectiveness;
- Regulatory agency acceptance (Municipal, Provincial, Federal and Conservation Authority);

- Impact on existing infrastructure;
- Constructability; and
- Maintenance requirements.

**Financial Criteria**

- Capital costs;
- Operation and maintenance costs;
- Land requirements;
- Impact on property value; and
- Phasing considerations.

A description of the individual Phase 2-Detailed Assessment criteria and measures for assessment are provided in Table 6.3a-d. As shown, each stormwater management alternative is given a score of 1 (poor) to 4 (excellent) for each of the evaluation criteria. These scores are then applied and an aggregate score is assigned to each alternative. A matrix illustrating the results of the detailed assessment for each of the ten (10) stormwater management alternatives is presented in Table 6.4.

**Table 6.3a-d**

**Table 6.3a: Description of the Physical and Natural Environment Criteria used in the Phase 2 Detailed Assessment**

Criteria	Description of Criteria	Measures for Assessment
Ability to meet targets for Water balance	<ul style="list-style-type: none"> <li>• Ability of the SWM alternative to mitigate undesired impacts to the pre-development water balance and prevent adverse changes to site hydrology (surface drainage, groundwater recharge, soils and geology).</li> </ul>	Scoring ranges from 4 if the potential to mitigate changes to the pre-development is high, to 1 if the potential to mitigate water balance changes are low and post-development changes are anticipated.
Ability to meet targets for Flooding	<ul style="list-style-type: none"> <li>• Ability of the SWM alternative to meet flood control criteria. Alternative must control peak outflows for the site to pre-development rates for design storms with return period up to 100yrs.</li> <li>• Cannot increase flooding risks to infrastructure and private property.</li> </ul>	Scoring ranges from 4 if the potential to meet flooding criteria is high, to 1 if the potential is low and downstream flooding is anticipated.
Ability to meet targets for Water quality	<ul style="list-style-type: none"> <li>• Ability of the SWM alternative to meet water quality criteria as per Table 3.2 of the 2003 MOE Stormwater Management Manual.</li> </ul>	Scoring ranges from 4 if the potential to meet water quality criteria is high, to 1 if the potential is low and water quality impacts are anticipated.
Ability to meet targets for Erosion	<ul style="list-style-type: none"> <li>• Ability of the SWM alternative to control water course erosion in accordance with the 2003 MOE Stormwater Management Manual.</li> </ul>	Scoring ranges from 4 if the potential to erosion criteria is high, to 1 if the potential is low and erosion impacts are anticipated.
Impact on terrestrial and aquatic habitat: Connectivity, Diversity and Sustainability	<ul style="list-style-type: none"> <li>• Potential for the SWM alternative to mitigate impacts to terrestrial and aquatic habitat.</li> <li>• Ability for the SWM alternative to provide opportunities for connectivity, diversity and sustainability for terrestrial and aquatic habitats.</li> </ul>	Scoring ranges from 4 if the potential to mitigate impacts to terrestrial and aquatic habitat and provide additional opportunities for connectivity, diversity and sustainability is high, to 1 if the potential is low and impacts are anticipated.



**Table 6.3b: Description of the Social and Cultural Environment Criteria used in the Phase 2 Detailed Assessment**

Criteria	Description of Criteria	Measures for Assessment
Impact on existing and proposed development	<ul style="list-style-type: none"> <li>Potential for the SWM alternative to be integrated with the existing and proposed land uses within the SCUBE study area.</li> </ul>	Scoring ranges from 4 if the potential for land use integration is high, to 1 if the potential is low.
Aesthetic value	<ul style="list-style-type: none"> <li>Potential for the SWM alternative to provide an aesthetic benefit to the existing and proposed community.</li> </ul>	Scoring ranges from 4 if the SWM alternative has potential aesthetic value, to 1 if the potential is low.
Potential benefit to community and public acceptance;	<ul style="list-style-type: none"> <li>Potential benefit to the community with respect to integration into natural areas, passive use areas, trails, as well as general public acceptance of the SWM alternatives.</li> </ul>	Scoring ranges from 4 if the potential for integration in public areas and public acceptance is high, to 1 if the potential for integration and public acceptance is low.
Coordination with proposed roadway design	<ul style="list-style-type: none"> <li>Potential for the proposed SWM alternative to be integrated into the proposed standard roadway cross-sections.</li> </ul>	Scoring ranges from 4 if the potential for integration with the proposed roadway design is high, to 1 if the potential for integration is low.

**Table 6.3c: Description of the Technical Criteria used in Phase 2 Detailed Assessment**

Criteria	Description of Criteria	Measures for Assessment
Level of service and proven effectiveness	<ul style="list-style-type: none"> <li>Degree to which the SWM alternative has been proven effective through scientific literature and long-term implementation and monitoring.</li> </ul>	Scoring ranges from 4 if the SWM alternative has been proven effective, to 1 if the alternative is unproven.
Regulatory agency acceptance	<ul style="list-style-type: none"> <li>General level of acceptance of the SWM alternative by the various regulatory agencies (Municipal, Provincial, Federal and CA)</li> </ul>	Scoring ranges from 4 if the SWM alternative is generally accepted by the various regulatory agencies, to 1 if the alternative is generally not accepted.
Impact on existing infrastructure	<ul style="list-style-type: none"> <li>Potential disruption to existing infrastructure (services, roads, etc)</li> </ul>	Scoring ranges from 4 if the potential for disruption is low, to 1 if the potential for disruption is high.
Constructability	<ul style="list-style-type: none"> <li>Degree of difficulty in constructing the SWM alternative given the existing site conditions and constraints.</li> </ul>	Scoring ranges from 4 if the general constructability is high, to 1 if it is low.
Maintenance Requirements	<ul style="list-style-type: none"> <li>Degree of anticipated future effort required to maintain the SWM alternative in good working order.</li> </ul>	Scoring ranges from 4 if the level of anticipated future maintenance is low, to 1 if the alternative requires extensive future maintenance.

**Table 6.3d: Description of the Financial Criteria used in the Phase 2 Detailed Assessment**

<b>Criteria</b>	<b>Description of Criteria</b>	<b>Measures for Assessment</b>
Capital costs	<ul style="list-style-type: none"> <li>The relative cost of constructing the SWM alternative.</li> </ul>	Scoring ranges from 4 if the relative cost is low, to 1 if the relative cost is high.
Operations and Maintenance Costs	<ul style="list-style-type: none"> <li>The relative cost of operating and maintaining the SWM alternative</li> </ul>	Scoring ranges from 4 if the relative cost of maintenance is low, to 1 if the relative cost is high.
Impacts on property value	<ul style="list-style-type: none"> <li>Potential impacts (positive or negative) to local property value, based on aesthetic benefits, potential land-use synergies and general economic incentives.</li> </ul>	Scoring ranges from 4 if the potential benefit to property value is high, to 1 if the potential benefit is low.
Phasing Considerations	<ul style="list-style-type: none"> <li>Degree to which the SWM alternative can be effectively implemented as per the proposed construction phasing plan.</li> </ul>	Scoring ranges from 4 if the potential to implement to SWM alternative as per the construction phasing plan is high, to 1 if the potential is low

**Table 6.4: Phase 2 Detailed Assessment Matrix for Selecting the Preferred Alternative**

Alternative #		Physical and Natural Environment					Social and Cultural Environments					Technical Criteria					Financial Criteria					Aggregate Score
		Water Balance	Flooding	Surface Water Quality	Erosion	Terrestrial & Aquatic Habitat	Existing Land Uses	Aesthetic Value	Benefit to Community & Public Acceptance	Coordination with proposed roadway design	Level of service-proven effectiveness	Regulatory agency acceptance	Impact on existing infrastructure	Constructability	Maintenance Requirements	Capital costs	Operations and Maintenance Costs	Land Requirements	Impacts on property value	Phasing Considerations		
	<b>Sole-measure Alternatives</b>																					
1	Traditional Source Controls Only	1	3	1	3	1	2	1	1	3	3	3	3	3	3	3	4	4	1	4	47	
2	LID Source Controls Only	3	1	3	2	3	3	3	3	3	2	2	3	2	3	2	3	3	3	4	51	
3	LID Conveyance Controls Only	2	1	2	2	3	2	2	2	2	3	2	2	2	3	2	3	2	2	2	41	
4	end-of-pipe Wet Pond Only	1	4	3	3	2	3	3	3	4	4	4	3	4	3	2	3	1	3	2	55	
	<b>Combined Source Control Alternatives</b>																					
5	Traditional Source Controls and LID Source Controls	3	3	3	3	3	3	3	3	4	3	2	4	3	2	2	2	3	3	4	56	
	<b>Combined Source &amp; Conveyance Alternatives</b>																					
6	Traditional Source & LID Conveyance Controls	2	3	2	3	3	2	2	2	2	3	2	3	3	2	2	2	3	2	2	45	
7	LID Source & LID Conveyance Controls	4	1	3	2	3	3	3	3	2	3	2	2	2	2	2	2	3	3	2	47	
	<b>Combined Source &amp; End-of-pipe Alternatives</b>																					
8	LID Source Controls & end-of-pipe Wet Pond	3	4	4	3	4	3	4	4	4	4	3	3	3	2	2	2	1	3	2	58**	
	<b>Combined Source, Conveyance and End-of-pipe Alternatives</b>																					
9	LID Source Controls, LID Conveyance Controls & end-of-pipe Wet Pond	4	4	4	4	4	3	4	4	4	4	3	2	2	2	1	1	1	3	1	55	
10*	Stream Restoration *	3	2	3	3	4	3	4	4	3	3	3	3	1	3	2	2	4	3	3	56*	

1 = Poor  
2 = Fair  
3 = Good  
4 = Excellent

\* Note - this alternative is not intended as a stand-alone measure. Instead, it is common to all other alternative as it is recommended as part of the Natural Heritage Strategy. Therefore, it will be recommended regardless of which alternative is preferred.

\*\*The preferred alternative for the SCUBE (West) study area is Option 8 – LID Source Controls in combination with end-of-pipe Wet Ponds, along with Stream Restoration measures.



### **6.3 Selection of the Preferred Alternative**

As shown in Table 6.4, the preferred alternative for the SCUBE West study area is Option 8, which consists of LID source controls combined with end-of-pipe wet ponds, along with stream restoration measures. This alternative ranks highly under the physical and natural environment criteria, and the social-cultural criteria. It also ranks relatively well under the technical criteria.

In terms of stormwater management objectives, the use of LID source controls as part of this strategy would provide water balance, water quality, and erosion benefits. And the use of wet ponds as part of the strategy would provide further water quality, erosion and flood control benefits. These benefits, together with the stream restoration component of the strategy, would also have a positive impact on the aquatic and terrestrial habitat of the study area.

It should be noted that the feasibility of an end-of-pipe stormwater pond is constrained somewhat by the size of the area it services. In general, the MOE Stormwater Management Planning Manual suggests that the service area for a stormwater pond should preferably be at least 10 hectares, and not less than 5 hectares. Through a review of the location of future development lands together with drainage patterns, it is understood that some future development sites may not be large enough to be serviced by a stormwater pond. In this case, as shown in Table 6.4, the next best alternative which does not include end-of-pipe ponds, is Option 5. Unlike Option 8, Option 5 uses traditional on-site source controls for water quality, erosion and flood control, rather than end-of-pipe stormwater ponds. Under Option 5, these traditional source controls are combined with LID source controls and stream restoration to provide additional water balance and water quality benefits, as well as aquatic and terrestrial habitat benefits.

Therefore, in summary, the preferred stormwater management strategy for the SCUBE lands is Option 8, however, Option 5 is a suitable alternate for special circumstances where the development/service area is less than 5 hectares:

#### **Preferred Stormwater Management Strategy (for sites > 5ha):**

- LID source controls;
- end-of-pipe wet ponds; and
- stream restoration.

#### **Alternate Stormwater Management Strategy (for sites < 5ha):**

- traditional source controls;
- LID source controls; and
- stream restoration

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## 7 STORMWATER MANAGEMENT STRATEGY AND TARGETS

Environmental baseline conditions for SCUBE West were defined in Section 4. The preceding sections outlined potential impacts from future development and identified a set of preferred stormwater management alternatives to meet the identified subwatershed goals and objectives. This chapter summarizes the overall Stormwater Management Strategy for SCUBE West, including the recommended control measures and stormwater targets to be applied.

### 7.1 Water Balance Targets

As noted in Section 6.2, without controls, the impervious surfaces associated with future urban development will reduce the capacity of the site to infiltrate rainfall events into the groundwater system, creating an increase in the volume of surface water runoff instead. For the SCUBE study area, basic spreadsheet estimates indicate that, without stormwater controls, the estimated future annual infiltration deficit could range between 57 mm per year and 100 mm per year, depending on the soil and proposed future landuses (Table 5.1).

In order to estimate infiltration targets to overcome these potential deficits and maintain existing groundwater recharge rates, further spreadsheet estimates were completed using a typical range of annual rainfall events. Details are provided in Appendix E, and indicate the following:

- To overcome the anticipated recharge deficit resulting from residential development within areas underlain by sand/gravel soils, future infiltration measures would be required to capture and infiltrate a volume of runoff equivalent to the first 2.5 mm *over the total catchment area*;
- To overcome the anticipated recharge deficits within areas underlain by silt/clay soils, future infiltration measures would be required to capture and infiltrate a volume of runoff equivalent to the first 1 mm to 2.5 mm *over the total catchment area*, for future residential and employment landuses, respectively.

The above groundwater recharge targets can be achieved by incorporating appropriate LID source control techniques within future urban development, as recommended as part of the preferred alternative (Section 7.3). As noted above, the LID techniques should be selected and designed to infiltrate target volumes ranging from 1 mm to 2.5 mm *over the total catchment area*. However, with lot-level source control techniques, groundwater recharge is typically accomplished by infiltrating runoff from only a portion of the site.

For example, runoff from residential roofs and rear yards may be used to maintain groundwater recharge through a variety of LID techniques. Assuming that the rooftops and rear lots account for approximately 50% of the development area, then the target infiltration depth *over the contributing area* would range from 3 mm to 7 mm for residential developments underlain by silt/clay soils, and sand/gravel soils, respectively. Example calculations are provided in Appendix E.

## 7.2 Water Quality Targets

The MOE Stormwater Management Planning Manual defines specific water quality control storage targets for stormwater facilities. The targets are based on:

- the type of facility (i.e., stormwater pond, infiltration facility, etc.);
- the landuse within the contributing area (in terms of an impervious component); and
- the level of control required.

Regarding the last point, the Hamilton Conservation Authority requires that stormwater management facilities provide “Level 2” or “normal” level of protection as defined in the MOE Manual (i.e., 70% long-term suspended solids removal). Regarding the first point, both the *preferred* and *alternate* stormwater management strategies (Section 7.3) offer various water quality control techniques which can be used to achieve the water quality control target.

### Wet Ponds

Wet ponds utilize a permanent pool of water for quality control by settling pollutants (i.e., suspended sediment) from stormwater runoff. A typical stormwater management pond was illustrated in Figure 6.5. In addition to providing water quality control, stormwater ponds may also provide temporary detention storage above the permanent pool to attenuate runoff, thereby lowering outflow rates for flood and erosion control. Flood and erosion control is discussed in Section 7.3.

To provide control for the anticipated future residential developments within the SCUBE study area, the MOE Stormwater Management Planning Manual indicates the following target storage volumes for Level 2 water quality control:

- residential development (approx. 50% impervious) - 105 m<sup>3</sup>/hectare, of which:
  - 65 m<sup>3</sup>/ha is permanent pool storage; and
  - 40 m<sup>3</sup>/ha is extended detention, or “active” storage.

For ponds which, in addition to providing water quality control, also provide erosion and/or flood control, the “active” water quality control storage requirement can be incorporated into the larger erosion/flood control extended detention storage requirements.

### Traditional Source Controls

For small development sites less than 5 hectares in size, the *alternate* stormwater management strategy (Section 6.3) recommends the use of traditional on-site controls to meet water quality targets. For example, within any small future developments sites, oil-grit separator devices may be used to treat stormwater runoff from parking lots and driveways where many urban pollutants tend to accumulate. These devices are also effective in trapping fuel and chemical spills that may take place in these areas.

### LID Source Controls

LID source controls are recommended primarily to achieve the water balance objectives (Section 7.1). However, many of the LID source control techniques also provide water



quality control benefits through the reduction of runoff volumes and/or filtration of runoff. Most substances within urban stormwater are in the form of suspended solids which can be filtered and trapped when stormwater infiltrates through a pervious media such as sand. Therefore, the use of LID source controls which promote infiltration for groundwater recharge, will also provide additional water quality benefits. By providing some water quality treatment at the source, LID techniques will help to reduce the maintenance requirements at other downstream treatment facilities such as stormwater ponds (sites > 5 hectares) and/or oil-grit separator devices (sites < 5 hectares).

### 7.3 Flood and Erosion Control Targets

As noted in Section 6.3, several of the stream reaches located downstream of the SCUBE West future development lands have been classified as being susceptible to erosion and flooding. Various downstream capacity improvements have been recommended, but most have yet to be constructed. Further, an Environmental Assessment Study for Watercourse 7 (Philips, 2003) also recommended that the proposed works be combined with erosion and flood control (quantity) storage. Therefore, it is understood that future landuse changes within SCUBE West will require storage facilities to detain the future urban runoff and gradually release it at flow rates which will not aggravate the existing downstream problems.

The necessary stormwater detention storage can be provided within the end-of-pipe stormwater ponds as recommended as part of the preferred stormwater strategy (Section 6.3), or within traditional on-site controls for small sites less than 5 hectares (*alternate* stormwater management strategy).

The hydrologic model used to estimate flow rates within the SCUBE study area (Section 3) was also applied to estimate storage requirements for future stormwater detention facilities. For this analysis, a design storm approach was applied. The SCS 6-hour storm distribution derived from the Mt. Hope gauge site that was used to develop flood flow estimates for floodplain mapping (Section 3.2) was also used in the stormwater facility sizing analysis.

The modelling steps used in the stormwater facility sizing analysis are summarized below:

- The hydrologic model was used to estimate the pre-development flows for catchments within the future development lands.
- The model was then adjusted to include proposed future development, assuming 50% imperviousness for residential lands.
- Reservoir routing was added to the model to simulate future stormwater facilities.
- For erosion control, outflows for the 2-year storm were controlled to pre-development rates, and outflows less than the 2-year storm were overcontrolled to minimize potential in-stream erosion from the most frequent storm events. On average, approximately 150 m<sup>3</sup>/ha of storage is required for erosion control.
- For flood (quantity) control, storage volumes were increased within the model reservoirs until the runoff rates for the 100-year storm events were controlled back to pre-development rates. On average, approximately 450 m<sup>3</sup>/ha of storage is required for flood control.

#### **7.4 Aquatic and Terrestrial Habitat**

The preceding Sections have outlined alternative stormwater management measures which would also provide direct benefit to the aquatic and terrestrial communities and their habitats. For example, water quality control measures were identified (Section 7.2) to minimize potential future impacts from urban pollutants. The aquatic communities would also benefit from the use of erosion control facilities (Section 7.3) which would reduce the potential for downstream erosion and related suspended solids loadings. In the case of a stormwater management pond with extended detention storage, the capture and gradual release of storm runoff may also benefit in terms of baseflows within the downstream creek reaches. Further baseflow and temperature benefits would also be provided with the LID measures to maintain groundwater recharge as identified in Section 7.1.

Further measures to protect the existing aquatic and terrestrial communities are identified as part of the Natural Heritage strategy, discussed in Section 8.

#### **7.5 Stormwater Management Strategy**

The Stormwater Management Strategy for the SCUBE West Study Area has been formulated through consideration of the proposed future urban development, its impact on the existing environmental resources of the area, together with input from the City, relevant agencies and the public. As outlined in the proceeding sections, the strategy consists of three key measures:

- Low Impact Development (LID) source controls;
- Wet ponds for catchment areas 5ha or more, *OR* traditional source controls for catchment areas of less than 5ha.
- Stream restoration.

The respective benefits and stormwater targets for each of these measures is outlined in Table 7.1.

In addition to the above, additional downstream works have been reviewed through other previous studies (Dillon, 2010 and Philips, 2003). These works include the following:

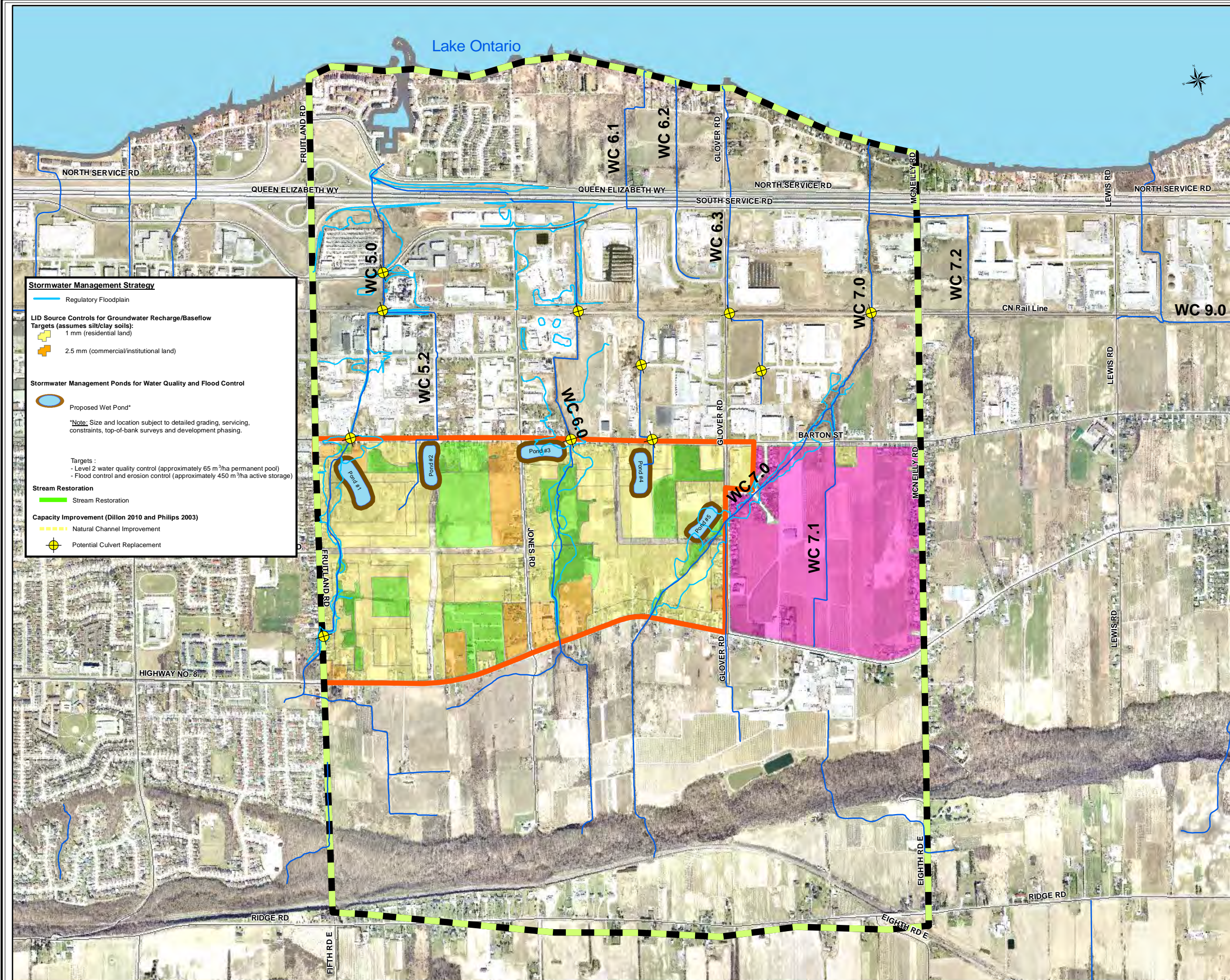
- For Watercourse 5, replacement of the following culvert structures:
  - Fruitland Road;
  - Barton Street;
  - CNR;
  - South Service Road;
  - Erosion control works from the QEW to the CNR crossing.
- For Watercourse 6, replacement of the following culvert structures:
  - Barton Street (Watercourse No. 6 and 6.1);
  - Arvin Avenue (Watercourse 6.1, and 6.3),
  - CNR(Watercourse No. 6, 6.1, and 6.3);
  - Erosion control works from the QEW to Barton Street

- For Watercourse 7:
  - Watercourse conveyance improvement through natural channel design;
  - Culvert replacement at the CNR crossing; and
  - Provision of flood and erosion control storage.

The above works are illustrated conceptually, together with the most up-to-date Regulatory floodplain limits in Figure 7.1. With respect to the stormwater ponds, it is noted that the illustrated locations of the ponds are conceptual in nature. Table 7.2 provides a summary of the conceptual sizing characteristics of the stormwater ponds. The ultimate location and size of any stormwater ponds will be dependent upon several factors to be examined during the future stages of development, including:

- Development phasing / timing;
- Land ownership;
- Topography and proposed subdivision grading;
- Road layouts / grades;
- Storm sewer outlets and elevations; and
- Stream corridor definition through future top-of-bank surveys and setbacks.





**KEY MAP**

**LEGEND:**

- Study Area Boundary
- SCUBE West Boundary

**Proposed Land Use**

- Residential
- Commercial/Institutional
- Parks/Open Space
- Rural

**NOTES:**

0 100 200 400 600 800 1,000  
Meters

**SCUBE WEST SUBWATERSHED STUDY**

Stormwater Management Strategy

**FIGURE No. 7.1**

DATE: May, 2013



**Table 7.1: Summary of Stormwater Management Strategy Components for the SCUBE West Lands**

<b>Components:</b>	<b>Groundwater Resources</b>	<b>Water Quality</b>	<b>Erosion/Flood Control</b>	<b>Aquatic/Terrestrial Resources</b>
<b>Low Impact Development (LID) Source Controls:</b>				
Targets:	- for areas of sand/gravel: 2.5 mm over catchment area - for areas of silt/clay soils: 1 mm (residential landuses, and 2.5 mm (commercial/institutional landuses)			
Benefits:	- maintain groundwater recharge rates;	- improved water quality through removal of suspended contaminants	- moderate reductions in stormwater runoff	- protect stream baseflows and improved water quality
<b>Wet Ponds (catchment area &gt; 5ha) and Traditional Source Controls (catchment area &lt;5ha)</b>				
Targets:		- Level 2 (normal) water quality control - residential landuses (50% impervious): 65 m <sup>3</sup> /ha permanent pool, 40 m <sup>3</sup> /ha active storage	- overcontrol of events up to 2-year storm for erosion control: approximately 150 m <sup>3</sup> /ha active storage; - post-to-pre runoff control for flooding: approximately 450 m <sup>3</sup> /ha active storage	
Benefits:		- improved water quality through settling and capture of suspended contaminants	- prevent increases in runoff rates which could otherwise worsen existing downstream erosion and flooding	- improved water quality
<b>Stream Restoration</b>				
Targets:				- re-planting streamside vegetation - removal of fish barriers
Benefits:		- potential reduction in erosion and sediment loadings with additional streamside vegetation	- potential reduction in erosion and sediment loadings with additional streamside vegetation	- improvements to fish and terrestrial habitat - reduced erosion and improved water quality; - moderates stream temperatures
<b>Capacity Improvements Recommended through Other Studies (Dillon, 2010. Philips, 2003)</b>				
Target / Works:			- culvert replacements (refer to Figure 6.1) - capacity improvements on Watercourse 7 through natural channel construction.	
Benefits:		- potential reduction in erosion and sediment loadings	- reduced flooding and erosion	- improvements to fish and terrestrial habitat through natural channel design (Watercourse 7) - reduced erosion and improved water quality;

**Table 7.2: Summary of Conceptual Stormwater Management Ponds**

<b>SWM Facility*</b>	<b>Catchment Area (ha)</b>	<b>Permanent Pool Storage (m<sup>3</sup>)</b>	<b>Active Flood/Erosion Control Storage (m<sup>3</sup>)</b>
Pond 1	39.8	2,587	16,830
Pond 2	24.5	1,593	11,180
Pond 3	26.4	1,716	11,500
Pond 4	26.5	1,723	11,850
Pond 5	21.1	1,372	9,330

\* Refer to Figure 7.1 for conceptual SWM Pond locations. Pond footprint areas shown assume 6% of catchment area.



## **8 NATURAL HERITAGE SYSTEM**

### **8.1 Introduction**

Section 2.1.2 of the 2005 Provincial Policy Statement (PPS) states that the diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features (Ministry of Municipal Affairs and Housing 2005). Accordingly, a key objective of the SCUBE Subwatershed Study is to provide a framework to guide the development of the lands subject to the Fruitland-Winona Secondary Plan so that their ecological processes, functions and significant natural features are protected, maintained and enhanced (City of Hamilton 2009).

The Province of Ontario provides technical guidance to implement the natural heritage policies of the PPS through the Natural Heritage Reference Manual (NHRM). The first edition of the NHRM, issued by the Ministry of Natural Resources (MNR) in 1999, recognizes the development of a natural heritage system as a comprehensive approach to defining and protecting natural heritage features and areas. The most recent edition of the NHRM, issued in 2010, places greater emphasis on planning for natural heritage systems and providing connectivity among natural heritage features and areas (MNR 2010).

The 2005 PPS defines a Natural Heritage System (NHS) as a system made up of natural heritage features and areas, linked by natural corridors which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species and ecosystems. These systems can include lands that have been restored and areas with the potential to be restored to a natural state (Ministry of Municipal Affairs and Housing 2005). The NHS approach is a useful method for the protection of natural heritage features and areas because it reinforces an understanding that the elements of the system have strong ecological ties to each other, as well as to other physical features and areas in the overall landscape. The NHS approach also addresses a number of important land use planning concerns, including biodiversity decline, landscape fragmentation and the maintenance of ecosystem health. The NHRM describes these planning concerns in greater detail and outlines the potential benefits of a NHS (MNR 2010).

### **8.2 NHS Identification**

Aquafor Beech Limited used a systems approach to identify a recommended NHS for the study area of the SCUBE Subwatershed Study. The systems approach identifies a NHS that includes core areas while ensuring that smaller, less significant natural areas or degraded lands between these areas are maintained or restored to provide a connected system of natural areas (City of Hamilton 2008, 2009). Briefly, the approach used by Aquafor Beech Limited involved the following steps:

- (1) Data from existing information sources and supplemental reconnaissance-level fieldwork was used to characterize the existing conditions of the study areas of the SCUBE West

Subwatershed Study and the SCUBE East Subwatershed Study (collectively, the SCUBE Subwatershed Study) with a particular emphasis on the four blocks of land added to the Urban Area of the City of Hamilton and under consideration for urban development, i.e. SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B).

- (2) A preliminary NHS for the study area of the SCUBE Subwatershed Study was identified based on Core Areas and Linkages as mapped by the City of Hamilton (2006, 2009).
- (3) The preliminary NHS was refined through further assessment. Aquafor Beech Limited divided the study area of the SCUBE Subwatershed Study into three Zones (Zones A, B and C) and applied a different level of assessment to each based on existing and potential future land uses.

This approach is described in greater detail below.

### **8.3 Study Area Characterization**

Aquafor Beech Limited obtained background information on the study area of the SCUBE Subwatershed Study from the City of Hamilton, Hamilton Conservation Authority and the MNR Niagara Area Office. Sources of background information reviewed by Aquafor Beech Limited include the following:

- City of Hamilton Rural Official Plan (City of Hamilton 2006)
- City of Hamilton Urban Official Plan (City of Hamilton 2009)
- Nature Counts Project: Hamilton Natural Areas Inventory (Dwyer 2003)
- Natural Heritage Information Centre (NHIC) database records of significant species and natural areas
- Records of birds observed in the study area of the SCUBE Subwatershed Study between January 2001 and March 2011 as documented by three databases maintained by Bird Studies Canada, including the Great Backyard Bird Count, eBird and the Ontario Breeding Bird Atlas (2001-2005)
- Species lists from the City of Hamilton's Natural Heritage Database for three areas defined by Dwyer (2003) as Devil's Punch Bowl Escarpment (STCK-76), Fifty Point Conservation Area (STCK-80) and Fifty Creek Valley (STCK-136)
- The Reptiles and Amphibians of the Hamilton Area. A Historical Summary and Results of the Hamilton Herpetofaunal Atlas (Lamond 1994)
- Natural Heritage Assessment of Lands Bounded by Fruitland Road, Glover Road, Barton Street and Highway 8, City of Hamilton (Dillon Consulting Limited 2010)

- City of Hamilton Watercourse 5 & 6 Class EA Study Draft Report (Dillon Consulting Limited 2007)
- Aquatic Habitat and Fisheries Impact Assessment – Watercourses 5, 6, 7, and 9. Final Report to the City of Stoney Creek Department of Engineering (SNC Lavalin 1991)
- Birds of Hamilton and Surrounding Areas (Curry 2006)

Additional reference materials used in the preparation of this report are listed in Section 7. For convenient reference, Aquafor Beech Limited compiled a consolidated list of species recorded from the study area of the SCUBE Subwatershed Study (Appendix G).

In developing the recommended NHS, Aquafor Beech Limited staff conducted supplemental reconnaissance-level fieldwork on April 6, 2011 to confirm existing conditions. Fieldwork focused on the four blocks of land added to the Urban Area of the City of Hamilton and under consideration for urban development, i.e. SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). Incidental wildlife observations were recorded and representative site photographs were taken. Altogether, Aquafor Beech Limited staff spent a total of approximately 22 person-hours in the field.

#### **8.4 City of Hamilton NHS**

During the preparation of its new Official Plan, the City of Hamilton identified the components of a municipal NHS consisting of Core Areas and Linkages. The City of Hamilton (2006, 2009) defines Core Areas as Key Natural Heritage Features, Key Hydrologic Features, and Local Natural Areas. The City of Hamilton (2006, 2009) defines Key Natural Heritage Features as:

- Significant habitat of endangered, threatened, and special concern species;
- Fish habitat;
- Wetlands;
- Life Science Areas of Natural and Scientific Interest (ANSIs);
- Significant valleylands;
- Significant woodlands;
- Significant wildlife habitat;
- Sand barrens, savannahs, and tallgrass prairies; and
- Alvars.

The City of Hamilton (2006, 2009) defines Key Hydrologic Features as:

- Permanent and intermittent streams;
- Lakes (and their littoral zones);



- Seepage areas and springs; and,
- Wetlands.

The City of Hamilton (2006, 2009) defines Local Natural Areas as:

- Environmentally Significant Areas as identified by the City of Hamilton;
- Unevaluated wetlands; and
- Earth Science Areas of Natural and Scientific Interest.

The City of Hamilton (2006, 2009) defines linkages as landscape areas that connect natural areas. Linkages may include the following:

- Woodland linkages (e.g. small woodlands);
- Other natural vegetation types (e.g. meadows, old field, thickets); and
- Streams and watercourses that connect Core Areas.

The City of Hamilton’s definitions of (i) woodland linkages and (ii) other natural vegetation types vary between the Urban and Rural Official Plans (Table 8.1).

**Table 8.1: City of Hamilton definitions of woodland linkages and other natural vegetation types.**

Term	Definition – Urban Official Plan	Definition – Rural Official Plan
Woodland linkage	Any natural or planted wooded area of any size or composition of 0.5 ha or more in size that either connects or lies within 100 m of a Core Area.	Any natural or planted wooded area of any size or composition that either connects or lies within 100 m of a Core Area.
Other natural vegetation types	Any meadow, thicket, or old field at least 0.5 ha in size that connects Core Areas or is situated within 100 m of a Core Area.	Any meadow, thicket, or old field that connects Core Areas or is situated within 100 m of a Core Area.

Aquafor Beech Limited used the Core Areas and Linkages identified by the City of Hamilton (2006, 2009) as the preliminary NHS for the study area of the SCUBE Subwatershed Study (Figure 8.1 and Figure 8.2). This preliminary NHS was subject to further review and refinement as described below.

## 8.5 Study Area Zones

In reviewing the preliminary NHS, Aquafor Beech Limited divided the study area of the SCUBE Subwatershed Study into three Zones (Zones A, B and C) and applied a different level of assessment to each based on existing and potential future land uses.

**Zone A** consists of the lands north of the Fruitland-Winona Secondary Plan Study Area. Much of Zone A is dedicated to urban land uses. Residential housing is the primary land use north of the Queen Elizabeth Way; south of the Queen Elizabeth Way industrial/commercial land uses predominate. The two largest blocks of undeveloped land in Zone A (Block A1 and Block A2) are located between Barton Street and the Canadian National (CN) rail line (Figure 8.3). Block A1, located between McNeilly Road and Lewis Road, consists of a mosaic of deciduous forest, cultural meadow, cultural savannah and agricultural land. Block A2, located between Lewis Road and West Avenue, consists of a mosaic of cultural meadow and agricultural lands although its western portion is currently being developed into an industrial park. Since large portions of Blocks A1 and A2 have received draft plan approval under the Planning Act, their natural features were not considered for incorporation in the refined NHS.

Zone A contains few remnant natural heritage features and areas; moreover, existing land uses provide limited opportunities for ecological restoration. Accordingly, in considering Zone A during the development of the recommended NHS, Aquafor Beech Limited focused on its watercourses, with a particular emphasis on maintaining, restoring or, where possible, improving the linkages they provide between Lake Ontario and lands upstream.

**Zone B** consists of the lands within the Fruitland-Winona Secondary Plan Study Area. The majority of the Zone B lands consists of the four blocks of land added to the Urban Area of the City of Hamilton and under consideration for urban development, i.e. SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). These lands largely consist of a mosaic of agricultural lands, cultural meadow and cultural thicket. A portion of Zone B consists of the Town of Winona. The rest of Zone B consists of two blocks of land (Blocks B1 and B2). Block B1 is bound by Barton Street to the north, Highway 8 to the south, Glover Street to the west and McNeilly Road to the east. Block B2 is located between the CN rail line to the north and Highway 8 to the south; it extends from about 250 m west of Fifty Road to the municipal boundary between the City of Hamilton and the Regional Municipality of Niagara (Figure 8.3). Blocks B1 and B2 are largely dedicated to agricultural land uses and both are designated under the Greenbelt Plan as Specialty Crop Area (Niagara Peninsula Tender Fruit and Grape Area). The Greenbelt Plan generally does not permit urban land uses within lands designated Specialty Crop Area. Specifically, Section 3.1.2 of the Greenbelt Plan states the following:

- Within Specialty Crop Areas, normal farm practices and a full range of agricultural, agriculture-related and secondary uses are supported and permitted.
- Lands within Specialty Crop Areas shall not be re-designated in municipal official plans for non-agricultural uses, with the exception of those uses permitted in the general [Greenbelt Plan] policies of Sections 4.2 to 4.6.
- Towns/Villages and Hamlets are not permitted to expand into Specialty Crop Areas.

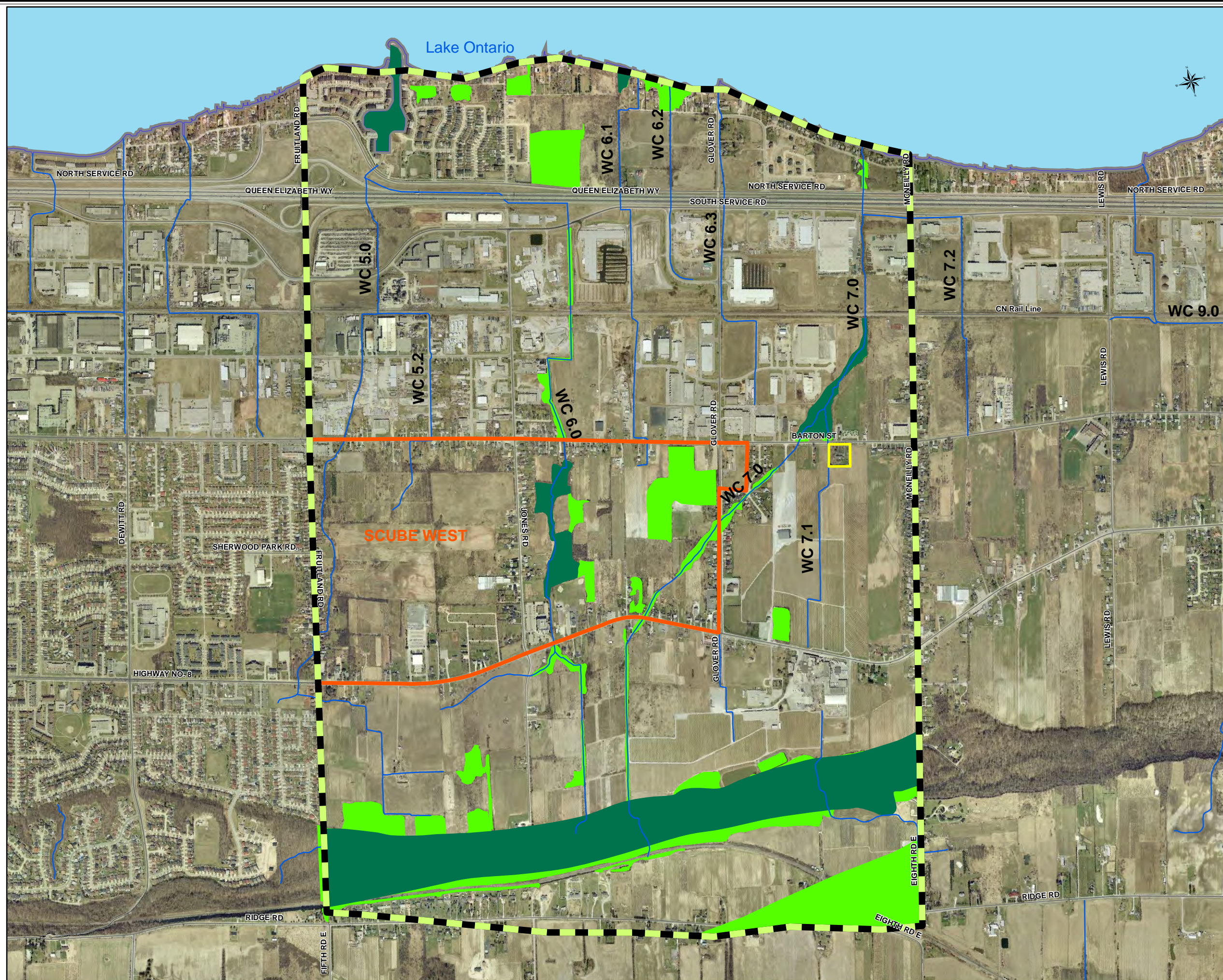
Zone B includes several remnant natural heritage features and areas; moreover, existing agricultural use and the prevalence of vacant lands (mostly cultural meadow or cultural thicket) provide considerable opportunities for ecological restoration. Accordingly, in refining the preliminary NHS identified by the City of Hamilton to develop the recommended NHS for the study area of the SCUBE Subwatershed Study, Aquafor Beech Limited focused its assessment on the lands of Zone B, with a particular emphasis on the four blocks of land added to the Urban Area of the City of Hamilton and under consideration for urban development, i.e. SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). Blocks B1 and B2 received less consideration as the potential for land use change within these lands is constrained by the policies of Section 3.1.2 of the Greenbelt Plan.

**Zone C** consists of the lands between those within the Fruitland-Winona Secondary Plan Study Area and the Niagara Escarpment. These lands are designated Escarpment Protection Area (EPA) under the Niagara Escarpment Plan. Policies associated with the EPA designation aim to maintain the remaining natural features and the open, rural landscape character of the Niagara Escarpment and lands in its vicinity. The EPA designation permits existing uses, agricultural operations, single dwellings, transportation and utility facilities as well as forest, wildlife and fisheries management. However, the EPA designation does not permit large scale residential, industrial, commercial or recreational development (Niagara Escarpment Commission 2010).

Zone C lands are largely in agricultural production and few natural heritage features and areas remain. As with Blocks B1 and B2, policy constraints limit the potential for land use change, however, in contrast to Zone A, existing land use does not greatly constrain future opportunities for ecological restoration. Accordingly, in considering Zone C during the development of the recommended NHS, Aquafor Beech Limited focused on its watercourses, with a particular emphasis on maintaining, restoring or, where possible, improving the linkages they provide between Niagara Escarpment and lands downstream. Aquafor Beech Limited also considered potential opportunities to enhance other linkages as defined by the City of Hamilton (i.e. woodland linkages or other natural vegetation types).

The development of the recommended NHS is described in greater detail below.





**KEY MAP**

**LEGEND:**

- Study Area Boundary - SCUBE West Subwatershed Study
- Land Under Consideration for Urban Development
- Core Areas
- Linkages
- Urban - Not Subject to Policies of Greenbelt Plan

**NOTES:**

0 100 200 400 600 800 1,000  
Meters

Preliminary Natural Heritage System  
SCUBE WEST

**FIGURE No. 8.1**

DATE: February 23, 2012





**LEGEND:**

- Study Area - SCUBE East Subwatershed Study
- Land Under Consideration for Urban Development
- Core Areas
- Linkages
- Urban – Not Subject to Policies of Greenbelt Plan

**NOTES:**

Meters



**Preliminary Natural Heritage System**

**SCUBE EAST**

**FIGURE No. 8.2**

DATE: February 23, 2012



## 8.6 Development of Recommended NHS

Aquafor Beech Limited reviewed and refined the preliminary NHS for the study area of the SCUBE Subwatershed Study to incorporate the following:

- Core Areas as defined by the City of Hamilton (2009) including Key Natural Heritage Features, Key Hydrologic Features and Local Natural Areas;
- Linkages as defined by the City of Hamilton (2009);
- Hazardous Lands as defined by the Hamilton Conservation Authority (2009);
- Preliminary vegetation protection zones, consistent with the minimum requirements of the City of Hamilton (City of Hamilton 2009); and
- Opportunities to enhance the attributes of Core Areas and Linkages.

This process is described in greater detail below.

### 8.6.1 Review and Refinement of Core Areas (*Key Natural Heritage Features*)

Aquafor Beech Limited reviewed and refined the preliminary NHS for the study area of the SCUBE Subwatershed Study to incorporate Key Natural Heritage Features as described below.

#### 8.6.1.1 *Significant Habitat of Endangered, Threatened and Special Concern Species (COSSARO)*

Within Zone B, the preliminary NHS was reviewed to address the protection afforded the habitat of species designated endangered, threatened or special concern by the Committee on the Status of Species at Risk in Ontario (COSSARO) including:

- the habitat of COSSARO-designated species protected by the Endangered Species Act (2007).
- the significant habitat of species designated endangered, threatened or special concern by COSSARO. By definition, such habitat constitutes a Key Natural Heritage Feature and a Core Area as established by the City of Hamilton's Urban Official Plan (City of Hamilton 2009).

The MNR Niagara Area Office provided Aquafor Beech Limited with a list of 42 COSSARO-designated species at risk known or suspected to occur in the City of Hamilton (Appendix H). Aquafor Beech Limited identified three other COSSARO-designated species at risk previously recorded in the City of Hamilton, including Cucumber Tree (*Magnolia acuminata*), Canada Warbler (*Wilsonia canadensis*) and Horned Grebe (*Podiceps auritus*). The MNR recommends that specific surveys be completed per MNR-specified protocols to determine whether COSSARO-designated species known or suspected to occur in the City of Hamilton are present



at the local (i.e. property-scale) level if potentially suitable habitat for the species is present (MNR 2010).

Accordingly, for each of the 45 COSSARO-designated species at risk known or suspected to occur in the City of Hamilton, Aquafor Beech Limited used background information and the results of previous studies to determine (i) the habitat requirements of the species, (ii) the availability of potentially suitable habitat for the species in Zone B, (iii) whether Zone B has been surveyed for the species per MNR-specified protocols and (iv) whether the species has been recorded in Zone B. Based on this information, Aquafor Beech Limited developed seven categories to characterize the occurrence in Zone B of each of the 45 COSSARO-designated species (Table 8.2).

**Table 8.2: Categories of occurrence assigned to COSSARO-designated species.**

Occurrence Category	Definition
1	The species is known to occur in Zone B.
2	The species does not occur in Zone B because all available evidence suggests that Zone B is located well beyond the distribution of the species.
3	The species does not occur in Zone B because suitable habitat is not present.
4	The species does not occur in Zone B – potentially suitable habitat was located but no specimens were observed during surveys completed per MNR-specified protocols.
5	The species does not occur in Zone B - no potentially suitable habitat was located and no specimens were observed during surveys completed per MNR-specified protocols.
6	The presence of the species in Zone B has not been assessed per MNR-specified protocols; specific surveys are not recommended because any potentially suitable habitat for the species is incorporated in the recommended NHS.
7	The presence of the species in Zone B has not been assessed per MNR-specified protocols; future surveys for the species are recommended to guide implementation of the recommended NHS.

Table 8.3 lists the 45 COSSARO-designated species at risk known or suspected to occur in the City of Hamilton and the occurrence category of each as assessed by Aquafor Beech Limited and North-South Environmental Incorporated.

**Table 8.3: Occurrence categories of 45 COSSARO-designated species at risk known or suspected to occur in the City of Hamilton as assessed by Aquafor Beech Limited or North-South Environmental Limited.**

Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
Plants	Endangered	American Ginseng	<i>Panax quinquefolius</i>	4	<p>COSEWIC (2000) describes American Ginseng habitat as follows:</p> <p>Rich, moist, undisturbed and relatively mature sugar maple-dominated deciduous woods in areas of circumneutral soil such as over limestone or marble bedrock. Colonies are often found near the bottom of gentle slopes facing south-east to south-west; a warmer microhabitat that is usually well-drained and species-rich. The forest canopy is dominated by sugar maple, white ash, bitternut hickory, and basswood.</p> <p>Potential habitat in Zone B is highly disturbed and no individuals were found during surveys completed by Dillon Consulting Limited (2010) and NRSI (2010). All potential American Ginseng habitat in Zone B is incorporated in the NHS.</p>
		Butternut	<i>Juglans cinerea</i>	7	<p>The Butternut Recovery Strategy (Environment Canada 2010) states the following:</p> <p>Butternut can tolerate a large range of soil types. It typically grows best on rich, moist, well-drained loams often found along stream banks but can also be found on well-drained gravelly sites, especially of limestone origin. Butternut is intolerant of shade and competition, requiring sunlight from above to survive but it has the ability to maintain itself as a minor component of forests in later successional stages. As a result, the species is typically scattered throughout a stand and occasionally, groups of butternuts can be found along forest roads, forest edges or anywhere sunlight is adequate to support regeneration through seed.</p> <p>Surveys completed by Dillon Consulting Limited (2010) and NRSI (2010) did not cover all potential Butternut habitat in detail; individual Butternut could be present in remnant hedgerows, forest edges, etc. Additional surveys for Butternut at subsequent planning stages are recommended.</p>
		Eastern Flowering Dogwood	<i>Cornus florida</i>	4	<p>Eastern Flowering Dogwood occurs in Hamilton according to Riley (1989) and Oldham (2009). No individuals were found during surveys of existing marginal habitat within Zone B completed by Dillon Consulting Limited (2010) and NRSI (2010). Eastern Flowering Dogwood habitat is protected under the Endangered Species Act (2007) based on the Act's general definition of habitat; MNR is currently considering draft habitat regulations for the species.</p>
		American Columbo	<i>Frasera caroliniensis</i>	7	<p>American Columbo grows in a wide variety of habitats. COSEWIC (2006) states that that American Columbo is found in</p> <p>primarily open deciduous forest, but also in open forest edges and dense shrub thickets. Threadgill <i>et al.</i> (1979) note its occurrence in a variety of habitats across its range, including deciduous, pine and red cedar forests, thickets, open meadows and grasslands. They note that it is most common in dry upland woods, but has also been collected from swampy areas. It has been collected on rocky hillsides throughout its range, but will grow on a wide variety of soils.</p> <p>American Columbo occurs in Hamilton according to Riley (1989) and Oldham (2009). No individuals were found during surveys completed by Dillon Consulting Limited (2010) and NRSI (2010). The disturbed character of potential habitat in Zone B makes occurrence(s) unlikely, however not all potential habitat has been thoroughly surveyed. Additional surveys for American Columbo at subsequent planning stages are recommended.</p>

Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
		Few-flowered Club-rush	<i>Trichophorum planifolium</i>	4	Few-flowered Club-rush habitat is protected under the Endangered Species Act (2007). For the purposes of the Act, Section 27 of Ontario Regulation 242/06 defines Few-flowered Club-rush habitat. This habitat is not present in Zone B.



Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
Plants	Endangered	Red Mulberry	<i>Morus rubra</i>	4	The Red Mulberry Recovery Strategy (Parks Canada 2011) describes Red Mulberry habitat as fresh (damp) to moist, well-drained, forested habitats, including floodplains, bottomlands, the slopes and ravines along the southern portion of the Niagara Escarpment and in swales on some western Lake Erie sand spits. Critical habitat for Red Mulberry as defined by Parks Canada (2011) is found only on Pelee Island. All potential habitat in Zone B is incorporated in the NHS.
		Spotted Wintergreen	<i>Chimaphila maculata</i>	3	Kirk (1987) describes suitable habitat for Spotted Wintergreen as dry-mesic oak-pine woods. Such habitat is not present in Zone B. No individuals were found during surveys completed by Dillon Consulting Limited (2010) and NRSI (2010).
		American Chestnut	<i>Castanea dentata</i>	4	COSEWIC (2004) states the following regarding American Chestnut habitat:  Typical habitat is an upland deciduous forest on acid to neutral, sandy soil. Common associates, in order of highest frequency, are red oak, black cherry, sugar maple, American beech, white ash, white oak, red maple and sassafras. White pine, hemlock, shagbark hickory and black oak are occasional associates.  Isolated deposits of sandy soils exist in Zone B within the southwest portion of SCUBE Central; no individuals were found during surveys completed by Dillon Consulting Limited (2010) and NRSI (2010). All potential American Chestnut habitat in Zone B is incorporated in the NHS.
		Cucumber Tree	<i>Magnolia acuminata</i>	5	COSEWIC (2010) states the following:  Cucumber Tree occurs in forests with rich, moist, medium to coarse-textured soils, sometimes near standing water in swampy woodlands but on slopes or rises above the saturated soils; regeneration occurs in forest openings or areas of partly open forest canopies. Typical sites alternate between swamps, especially Silver and Red Maple mineral deciduous swamps: SWD3-1, 3-2 and sometimes swamp thickets: SWT2-6, 2-9, 3-11, and more upland fresh to moist Sugar Maple deciduous or mixed forests: FOD 6-1, 6-3, 6-5, FOM6-1. These latter upland forests are often in headwater areas, especially in Niagara.  Dillon Consulting Limited (2010) and NRSI (2010) surveyed all wooded areas in Zone B; no individuals or suitable habitat as described by COSEWIC (2010) were found.
	Threatened	White Wood Aster	<i>Eurybia divaricata</i>	4	COSEWIC (2002) describes the habitat of White Wood Aster as follows:  Well-drained soils in open, dry deciduous forests dominated by sugar maple and American beech, but contain red, white and black oaks, shagbark hickory, basswood and Carolinian affiliates. It may be suggested that this plant also likes some disturbance, as it seems to grow along trails in the majority of the populations in Ontario.  White Wood Aster occurs in Hamilton according to Riley (1989) and Oldham (2009). All potential White Wood Aster habitat in Zone B is incorporated in the NHS.
Special Concern	Green Dragon	<i>Arisaema dracontium</i>	4	Potentially suitable habitat for Green Dragon consists of damp deciduous forests and along streams ( <a href="http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=251">http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=251</a> ). All potential Green Dragon habitat in Zone B is incorporated in the NHS.	

Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
		Broad Beech Fern	<i>Phegopteris hexagonoptera</i>	4	The habitat of Broad Beech Fern is described as shady moist areas of maple and beech forests ( <a href="http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=244">http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=244</a> ). The species occurs in Hamilton according to Riley (1989) and Oldham (2009). All potential Broad Beech Fern habitat in Zone B is incorporated in the NHS, although the highly disturbed nature of this potential habitat makes the occurrence of this species unlikely.
Mammals	Endangered	American Badger	<i>Taxidea taxus jacksoni</i>	7	<p>The habitat requirements of the American Badger are not well understood but the presence of soils suitable for burrowing appears to be important (<a href="http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=621">http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=621</a>). The MNR suggests that sandy or loamy soils provide suitable habitat (MNR 2011). The majority of Zone B lies within the Iroquois Plain, which is characterized by Queenston Shale bedrock overlain by a relatively thin (often less than 1 m deep) layer of silty clay till (Halton Till). A large isolated area of sand and gravel deposits extends from the southwestern portion of SCUBE Central to Zone C; within the study area of the SCUBE Subwatershed Study this area has the greatest potential to function as American Badger habitat.</p> <p>American Badger habitat is protected under the Endangered Species Act (2007). For the purposes of the Act, Section 24 of Ontario Regulation 242/06 defines American Badger habitat as follows:</p> <ol style="list-style-type: none"> <li>1. An American badger den that is being used by an American badger or was used by an American badger at any time during the previous 12 months.</li> <li>2. The area within five metres of the entrance of a den described in paragraph 1.</li> <li>3. A woodchuck burrow or Franklin's ground squirrel burrow that, <ol style="list-style-type: none"> <li>(i) is being used by a woodchuck or Franklin's ground squirrel or was used by a woodchuck or Franklin's ground squirrel at any time in the past, and</li> <li>(ii) is within 850 metres of a den described in paragraph 1.</li> </ol> </li> </ol> <p>Potential dens and Woodchuck burrows within the area of sand and gravel deposits in SCUBE Central should be surveyed for use by American Badger at subsequent planning stages.</p>
	Special Concern	Woodland Vole	<i>Microtus pennsylvanicus</i>	6	COSSARO assessed Woodland Vole on February 16, 2011 and confirmed its status as Special Concern.
Birds	Endangered	Acadian Flycatcher	<i>Empidonax vireescens</i>	5	
		Barn Owl	<i>Tyto alba</i>	7	<p>Barn Owl habitat is protected under the Endangered Species Act (2007). For the purposes of the Act, Section 24.1 of Ontario Regulation 242/06 defines Barn Owl habitat as follows:</p> <ol style="list-style-type: none"> <li>1. A nesting or roosting site that is being used by a barn owl or was used by a barn owl at any time during the previous 12 months.</li> <li>2. A barn, building or other structure, or a tree or other natural feature, on or in which a nesting or roosting site described in paragraph 1 is located.</li> <li>3. If a nesting or roosting site described in paragraph 1 is located on a tree or other natural feature, the area within 25 metres of the base of the tree or other natural feature.</li> <li>4. Those parts of the area within one kilometre of an area described in paragraph 1 or 2 that provide suitable foraging conditions for a barn owl.</li> </ol> <p>Additional surveys for Barn Owl at subsequent planning stages are recommended.</p>

Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
		Henslow's Sparrow	<i>Ammodramus henslowii</i>	5	
		King Rail	<i>Rallus elegans</i>	3	
		Prothonotary Warbler	<i>Protonotaria citrea</i>	5	



Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
Birds	Threatened	Bobolink	<i>Dolichonyx oryzivorus</i>	1	Bobolink habitat is protected under the Endangered Species Act (2007) based on the Act's general definition of habitat. MNR is currently developing a Recovery Strategy and a species-specific habitat regulation for the species (MNR 2011). Breeding bird surveys completed in 2012 by Stantec Consulting Limited concluded that Bobolink were not breeding in SCUBE West, and that habitat for Bobolink was marginal or unsuitable for breeding.
		Chimney Swift	<i>Chaetura pelagica</i>	1	Chimney Swift habitat is protected under the Endangered Species Act (2007) based on the Act's general definition of habitat. MNR is currently developing a Recovery Strategy and a species-specific habitat regulation for the species (MNR 2009). Additional surveys for Chimney Swift roosting and nesting sites were completed in 2012 by Stantec Consulting Limited concluded that Chimney Swift were not roosting or nesting in SCUBE West.
		Least Bittern	<i>Ixobrychus exilis</i>	3	
		Peregrine Falcon	<i>Falco peregrinus</i>	5	Peregrine Falcon habitat is protected under the Endangered Species Act (2007). For the purposes of the Act, Section 29 of Ontario Regulation 242/06 defines Peregrine Falcon habitat as follows:  <ol style="list-style-type: none"> <li>1. A natural cliff face on which a peregrine falcon is nesting or has nested at any time during the previous 15 years, excluding any part of the cliff face where the top of the cliff face is less than 15 metres above the base of the cliff face.</li> <li>2. The area within one kilometre of an area described in paragraph 1.</li> <li>3. An artificially created cliff face, such as a vertical or very steep rock cut in an open pit mine, on which a peregrine falcon is nesting.</li> <li>4. A nesting site on a building or other structure that is being used by a peregrine falcon or was used by a peregrine falcon at any time during the previous two years, and the area on the outside surface of the building or structure that is within 10 metres of the nesting site.</li> <li>5. An area that, <ol style="list-style-type: none"> <li>(i) is on or within 200 metres of a building or structure described in paragraph 4, and</li> <li>(ii) is habitually used by peregrine falcons.</li> </ol> </li> </ol>
		Cerulean Warbler	<i>Dendroica cerulea</i>	5	COSSARO assessed Cerulean Warbler on February 16, 2011 and revised its status from Special Concern to Threatened. The Species at Risk in Ontario List (Ontario Regulation 230/08) will be amended to reflect this change on June 8, 2011. This will result in the automatic protection of Cerulean Warbler habitat under the Endangered Species Act (2007) based on the Act's general definition of habitat.

Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
Birds	Special Concern	Bald Eagle	<i>Haliaeetus leucocephalus</i>	5	
		Black Tern	<i>Chlidonias niger</i>	3	
		Common Nighthawk	<i>Chordeiles minor</i>	5	
		Hooded Warbler	<i>Wilsonia citrina</i>	5	
		Louisiana Waterthrush	<i>Seiurus motacilla</i>	5	
		Red-Headed Woodpecker	<i>Melanerpes erythrocephalus</i>	5	
		Short-eared Owl	<i>Asio flammeus</i>	5	
		Yellow-breasted Chat	<i>Icteria virens</i>	5	
		Horned Grebe	<i>Podiceps auritus</i>	5	
		Canada Warbler	<i>Wilsonia canadensis</i>	5	

Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
Reptiles and Amphibians	Threatened	Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	7	<p>COSSARO assessed Jefferson Salamander on February 16, 2011 and revised its status from Threatened to Endangered. The Species at Risk in Ontario List (Ontario Regulation 230/08) will be amended to reflect this change on June 8, 2011.</p> <p>Jefferson Salamander is associated with deciduous or mixed woodlands. Terrestrial habitat must contain suitable microhabitat (e.g. leaf litter, downed woody debris, tree stumps and rodent burrows) for foraging and overwintering. Breeding occurs in ponds located in or in proximity to woodlands. Breeding ponds generally consist of vernal pools but other types of wetlands may be used. Some individuals migrate up to 1 km, but 90% of adults reside in suitable habitat within 300 m of their breeding pond. Migratory movements to and from breeding ponds may occur through a variety of habitats, including woodlands, plantations, agricultural fields and early successional areas (MNR 2010).</p> <p>Jefferson Salamander habitat is protected under the Endangered Species Act (2007). For the purposes of the Act, Section 28 of Ontario Regulation 242/06 defines Jefferson Salamander habitat as follows:  <b>In the City of Hamilton, the counties of Brant, Dufferin, Elgin, Grey, Haldimand, Norfolk and Wellington and the regional municipalities of Halton, Niagara, Peel, Waterloo and York,</b></p> <ul style="list-style-type: none"> <li>i. a wetland, pond or vernal or other temporary pool that is being used by a Jefferson salamander or Jefferson dominated polyploid or was used by a Jefferson salamander or Jefferson dominated polyploid at any time during the previous five years,</li> <li>ii. an area that is within 300 metres of a wetland, pond or vernal or other temporary pool described in subparagraph i and that provides suitable foraging, dispersal, migration or hibernation conditions for Jefferson salamanders or Jefferson dominated polyploids,</li> <li>iii. a wetland, pond or vernal or other temporary pool that, <ul style="list-style-type: none"> <li>A. would provide suitable breeding conditions for Jefferson salamanders or Jefferson dominated polyploids,</li> <li>B. is within one kilometre of an area described in subparagraph i, and</li> <li>C. is connected to the area described in subparagraph i by an area described in subparagraph iv, and</li> </ul> </li> <li>iv. an area that provides suitable conditions for Jefferson salamanders or Jefferson dominated polyploids to disperse and is within one kilometre of an area described in subparagraph i.</li> </ul> <p>Potentially suitable habitat in Zone B has not been surveyed for Jefferson Salamander. Additional surveys for Jefferson Salamander at subsequent planning stages are recommended.</p>
		Blanding's Turtle	<i>Emydoidea blandingii</i>	6	<p>Blanding's Turtles are aquatic and occur primarily in shallow water; adults are generally found in open or partially vegetated sites, whereas juveniles prefer sites with thick aquatic vegetation. During the active season an individual turtle may travel more than 6.5 km and use several connected lakes, rivers, streams, marshes, and/or ponds. Adult females nest in a variety of loose substrates including sand, organic soil and gravel. Overwintering occurs in slow flowing streams or permanent pools that average about 1 m in depth (COSEWIC 2005).</p> <p>The status of Blanding's Turtle in the City of Hamilton is unclear, but most populations appear to be small and in decline; 18 of 24 populations identified by the Hamilton Herpetofaunal Atlas were documented by single individuals and of these, six consisted of dead specimens (Lamond 1994). The records of Blanding's Turtle nearest to Zone B are from sites located approximately 5 km from the study area of the SCUBE Subwatershed Study.</p> <p>In the opinion of Aquafor Beech Limited, it is highly unlikely that the few small, disjunct wetlands within Zone</p>



Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
					B function as Blanding's Turtle habitat. However, the potential use by Blanding's Turtles of watercourses as movement corridors and/or overwintering sites cannot be wholly discounted.

Taxon	COSSARO Status	Common Name	Scientific Name	Occurrence Category	Comments
Reptiles and Amphibians	Threatened	Eastern Hognose Snake	<i>Heterodon platirhinos</i>	2	Lamond (1994) considers the Eastern Hognose Snake “a species of doubtful occurrence” and notes that there is no conclusive evidence that the species has ever occurred in the Hamilton area.
		Spiny Softshell	<i>Apalone spinifera</i>	3	
	Special Concern	Snapping Turtle	<i>Chelydra serpentina serpentina</i>	1	The Snapping Turtle is widespread in the City of Hamilton and several records occur from within the study area of the SCUBE Subwatershed Study, including two records located south of the Queen Elizabeth Way (Lamond 1994).
		Northern Map Turtle	<i>Graptemys geographica</i>	3	
		Eastern Milk Snake	<i>Lampropeltis triangulum</i>	1	The Eastern Milk Snake is widespread in the City of Hamilton and several records occur from within the study area of the SCUBE Subwatershed Study, including two records located south of the Queen Elizabeth Way (Lamond 1994). The species is difficult to locate because of their secretive behaviour (COSEWIC 2002). Consequently, although no individuals were encountered incidentally during surveys completed by Dillon Consulting Limited (2010) and NRSI (2010) it is premature to conclude that the species is not extant in Zone B. Accordingly, additional surveys for Eastern Milk Snake at subsequent planning stages are recommended.
Eastern Ribbon Snake	<i>Thamnophis sauritus</i>	3	Eastern Ribbon Snake is semi-aquatic and is most often found along the edges of shallow ponds, streams, marshes and other wetlands bordered by dense vegetation (Smith 2002). In Hamilton the species is characteristic of wetlands that are associated with large wooded areas; the Eastern Ribbon Snake record nearest to Zone B is from a site located above the Niagara Escarpment approximately 3 km from the study area of the SCUBE Subwatershed Study (Lamond 1994).  In the opinion of Aquafor Beech Limited, it is highly unlikely that the few small, disjunct wetlands remaining in Zone B function as Eastern Ribbon Snake habitat.		
Fish	Endangered	American Eel	<i>Anguilla rostrata</i>	3	
		Redside Dace	<i>Clinostomus elongatus</i>	3	
	Special Concern	Grass Pickerel	<i>Esox americanus vermiculatus</i>	3	
Insects	Special Concern	Monarch	<i>Danaus plexippus</i>	1	

In refining the preliminary NHS, Aquafor Beech Limited considered only the habitat requirements of COSSARO-designated species known to occur in Zone B (i.e. Category 1 species). No further consideration was given to the habitat requirements of those species that do not occur in Zone B (i.e. Category 2, 3, 4 and 5 species) or those whose habitat (e.g. wetlands) the City of Hamilton has already identified as a component of the municipal NHS (i.e. Category 6 species). Additional surveys at subsequent planning stages are recommended for COSSARO-designated species whose presence in Zone B has not been assessed per MNR-specified protocols (i.e. Category 7 species); survey results may require future refinement to the recommended NHS. Recommendations for additional surveys are described further below.

#### *8.6.1.1.1 Category 1 Species*

Aquafor Beech Limited identified five COSSARO-designated species that have previously been recorded in Zone B (i.e. Category 1 species). Of these, two species (Bobolink and Chimney Swift) are designated Threatened; the habitat of both species is protected under the provisions of the Endangered Species Act (2007) based on the Act's general definition of habitat:

An area on which a species depends, directly or indirectly, to carry on its life processes, including life processes such as reproduction, rearing, hibernation, migration or feeding and includes places that are used by members of the species such as dens, nests, hibernacula or other residences.

The other three species (Eastern Milk Snake, Snapping Turtle and Monarch) are designated Special Concern. The habitat of species designated Special Concern is not protected under the Endangered Species Act (2007). However, the significant habitat of species designated Special Concern is considered a Key Natural Heritage Feature and a Core Area as established by the City of Hamilton's Urban Official Plan (City of Hamilton 2009). The City of Hamilton (2009) defines the significant habitat of Threatened, Endangered and Special Concern species as follows:

The habitat, as approved by the Ministry of Natural Resources, that is necessary for the maintenance, survival and/or recovery of naturally occurring or reintroduced populations of species at risk and where those areas of occurrence are occupied or habitually occupied by the species during all or any part(s) of its life cycle.

Proposed measures to address the habitat of each of the five Category 1 species identified by Aquafor Beech Limited are discussed in greater detail below.

##### *8.6.1.1.1.1 Bobolink*

Bobolink was observed in the SCUBE West lands east of Jones Road during breeding bird surveys completed on May 26, May 27, June 22 and June 23, 2009 (Dillon Consulting Limited 2010). Two or three individuals were observed, but specific locality data and evidence of breeding were not recorded because, at the time, Bobolink was not designated a species at risk by either COSEWIC or COSSARO.



Bobolink was observed in the SCUBE Central lands east of Lewis Road and lands south of Highway 8 during breeding bird surveys completed by North-South Environmental Incorporated on May 26, June 7 and June 12, 2010. Specific locality data and evidence of breeding were recorded because at the time of the surveys Bobolink had recently been designated Threatened by COSEWIC. The species was subsequently designated Threatened by COSSARO in June, 2010.

The identification of Bobolink habitat for the purposes of the Endangered Species Act (2007) is not a simple matter. The potential for a given site to function as Bobolink habitat is determined by a variety of factors, including the site's size, management regime and the structure and composition of its vegetation (COSEWIC 2010). The regional setting in which the site is located also appears to play a role (e.g. Haire et al. 2000, Forman et al. 2002).

MNR is currently developing a Recovery Strategy and a species-specific habitat regulation for Bobolink (MNR 2011). In the absence of specific MNR guidelines, Aquafor Beech Limited retained North-South Environmental Incorporated to assist with the identification of Bobolink habitat for the purposes of the Endangered Species Act (2007). Appendix I provides the results of the North-South Environmental Incorporated review of Bobolink habitat. The review (i) describes Bobolink habitat requirements, (ii) assesses SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) as potential Bobolink habitat and (iii) provides management recommendations to protect Bobolink habitat within the study area of the SCUBE East Subwatershed Study.

Based on a review of background literature and consultation with MNR staff, North-South Environmental Incorporated recommends the following:

- Designate the entire portion of the SCUBE Central lands east of Lewis Road as an Area Specific Policy Area (ASPA) pending MNR development of a species-specific regulation for protection of Bobolink habitat (Figure 8.3).
- Promote agricultural practices that support Bobolink habitat in Zone C

Based on the results of the North-South Environmental Incorporated review, Aquafor Beech Limited assessed the potential for the portion of the SCUBE West lands where Dillon Consulting Limited (2010) recorded Bobolink (i.e. the lands located between Jones Road and Glover Road) to function as Bobolink habitat. In the opinion of Aquafor Beech Limited, this area has limited potential to function as Bobolink habitat. This assessment is based on the following considerations:

- The area consists of a mosaic of vegetation communities, the majority of which generally do not function as Bobolink habitat (e.g. orchard, vineyard, deciduous thicket and deciduous forest).
- The area includes several vegetation units that provide potentially suitable grassland habitat for Bobolink (e.g. meadow, meadow marsh); these vegetation units occur as three disjunct blocks and occupy a total of approximately 7 ha, which is below the typical minimum habitat requirements of Bobolink.

- All three vegetation blocks that provide potentially suitable grassland habitat for Bobolink are at least partly bordered by deciduous forest or hedgerows, the edges of which Bobolink typically avoid.
- The area is surrounded by residential, industrial, commercial and institutional land uses; Bobolink is not generally found in habitat surrounded by urban development.

In the opinion of Aquafor Beech Limited and North-South Environmental Incorporated, the designation of the entire portion of the SCUBE Central lands east of Lewis Road as an ASPA is sufficient to satisfy Endangered Species Act (2007) requirements to protect Bobolink habitat in the context of the Fruitland-Winona Secondary Plan Study Area. No other portions of the Fruitland-Winona Secondary Plan Study Area warrant protection as Bobolink habitat. However, in the absence of specific guidelines from MNR, the identification of the ASPA (i.e. the portion of the SCUBE Central lands east of Lewis Road) as Bobolink habitat for the purposes of the Endangered Species Act (2007) must be considered preliminary and subject to revision. It is also unclear whether the ASPA lands constitute significant Bobolink habitat as defined by the City of Hamilton (2009). Accordingly, Aquafor Beech Limited did not revise the preliminary NHS to incorporate the ASPA. Should the MNR confirm the ASPA (or any other lands) as Bobolink habitat for the purposes of the Endangered Species Act (2007) or as significant habitat as defined by the City of Hamilton (2009) Aquafor Beech Limited recommends that the NHS be revised to incorporate these lands as a Core Area.

Breeding bird surveys completed in 2012 by Stantec Consulting Limited concluded that Bobolink were not breeding in SCUBE West, and that habitat for Bobolink was marginal or unsuitable for breeding. Accordingly, habitat preservation for Bobolink (as in the ASPA mentioned above) is not needed. The Stantec report is located in Appendix K.

#### *8.6.1.1.1.2 Chimney Swift*

Chimney Swift habitat is difficult to characterize as adults spend much of the day foraging for insects in flight; the presence of the species in a given area largely depends on the availability of suitable nesting sites and the abundance of insects. Historically, Chimney Swift used large hollow trees as nesting and roosting sites. However, with European settlement of North America, the species adopted a variety of artificial structures (e.g. chimneys, barns, silos, abandoned buildings and wells) as nesting and roosting habitat. Of these, chimneys are the most abundant and most frequently used. The use of hollow trees now appears rare. As a result, the species is highly dependent on humans for habitat (COSEWIC 2007).

The presence of Chimney Swift in Zone B has been assessed per MNR-specified protocols during breeding bird surveys completed in 2012 by Stantec Consulting Limited. The report concluded that Chimney Swift were not nesting or roosting in SCUBE West. Accordingly, no management recommendations for Chimney Swift are warranted. The Stantec report is located in Appendix K.

#### 8.6.1.1.1.3 *Eastern Milk Snake*

The Eastern Milk Snake occurs throughout southern Ontario. The species uses a wide range of habitats, including suburban parks and gardens, hayfields, pastures, old fields, meadows, and deciduous, coniferous and mixed forests. In rural areas, the species is found in and around sheds, barns, abandoned buildings and anthropogenic debris (Cook 1984, Harding 1997, COSEWIC 2002). Little is known about the movement patterns of Eastern Milk Snakes in Canada, but their activity range is estimated to encompass approximately 20 ha and it is assumed that individuals migrate to and from hibernation sites (COSEWIC 2002).

The presence of Eastern Milk Snake in Zone B has not been assessed per MNR-specified protocols.

#### 8.6.1.1.1.4 *Snapping Turtle*

Snapping Turtles are aquatic and generally occur in habitats that provide slow-moving water, a soft mud bottom and dense aquatic vegetation such as ponds, sloughs, shallow bays and slow streams. Some individuals persist in heavily urbanized water bodies such as golf course ponds and irrigation canals. Females generally nest on sand and gravel banks along waterways, but may also use muskrat houses, abandoned beaver lodges and anthropogenic features such as road shoulders, railway embankments and gardens. Snapping turtles hibernate under water in lakes, marshes or small, continuously flowing streams (COSEWIC 2008).

The presence of Snapping Turtle in Zone B has not been assessed per MNR-specified protocols. However, Aquafor Beech Limited does not recommend additional surveys for this species because, if extant, Snapping Turtles are likely to be largely restricted to watercourses and immediately adjacent riparian areas and these features will be incorporated in the recommended NHS as Core Areas (e.g. permanent and intermittent streams), Linkages or Vegetation Protection Zones (see below).

#### 8.6.1.1.2 *Monarch*

Monarch habitat consists of open areas that support its larval host plant Milkweed (*Asclepias* spp.) and other wildflowers ([http://www.sararegistry.gc.ca/species/speciesDetails\\_e.cfm?sid=294](http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=294)). Such habitat is common in Southern Ontario and includes cultural meadows, roadsides and other disturbed lands. Accordingly, the designation of Monarch as Special Concern mainly reflects its vulnerability to the loss of overwintering areas in Mexico rather than habitat-related concerns in Ontario (COSEWIC 2010).

In the opinion of Aquafor Beech Limited, Monarch habitat in Zone B does not constitute significant habitat as defined by the City of Hamilton (2009). Accordingly, Aquafor Beech Limited did not revise the preliminary NHS to incorporate Monarch habitat.



#### *8.6.1.1.3 Category 7 Species*

Five species designated Endangered by COSSARO have not previously been recorded in the study area of the SCUBE Subwatershed Study but their potential presence in Zone B has not been per assessed per MNR-specified protocols. These species include American Columbo, Butternut, American Badger, Barn Owl and Jefferson Salamander.

The habitat of American Badger, Barn Owl and Jefferson Salamander and individual specimens of American Columbo and Butternut are protected by regulation under the Endangered Species Act (2007).

#### *8.6.1.2 Significant Habitat of Endangered, Threatened and Special Concern Species (COSEWIC)*

Within Zone B, the preliminary NHS was reviewed to address the protection afforded the significant habitat of species designated Endangered, Threatened or Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). By definition, such habitat constitutes a Key Natural Heritage Feature and a Core Area as established by the City of Hamilton's Urban Official Plan (City of Hamilton 2009).

All COSEWIC-designated species at risk previously recorded or potentially present in the study area of the SCUBE Subwatershed Study are also designated species at risk by COSSARO. As Aquafor Beech Limited recommendations address the significant habitat of COSSARO-designated species at risk, no further recommendations are required to address the protection afforded the significant habitat of COSEWIC-designated species at risk.

#### *8.6.1.3 Fish Habitat*

Within the study area of the SCUBE Subwatershed Study, the preliminary NHS was reviewed to confirm the inclusion of fish habitat as defined by the City of Hamilton (2009). Table 8.4 summarizes fish habitat identified in the study area of the SCUBE Subwatershed Study. Figure 8.5 and Figure 8.6 illustrate fish habitat within the study area of the SCUBE Subwatershed Study.

#### *8.6.1.4 Wetlands*

Within Zone B, the preliminary NHS was reviewed to confirm the inclusion of wetlands as defined by the City of Hamilton (2009):

Land such as swamp, marsh, bog, or fen (not including land that is being used for agricultural purposes and no longer exhibits wetland characteristics) that:

- (a) is seasonally or permanently covered with shallow water or has the water table close to or at the surface;
- (b) has hydric soils and vegetation dominated by water-tolerant plants; and
- (c) has been further identified according to evaluation procedures established by the Ministry of Natural Resources, as amended from time to time.
- (d) This includes provincially and locally significant wetlands (Greenbelt Plan, 2005)

The Ontario Wetland Evaluation System – Southern Manual (3rd Edition) requires that wetlands be 0.5 ha or larger to be evaluated (MNR 2003). As the City of Hamilton (2009) considers unevaluated wetlands to be Local Natural Areas (and therefore, by definition, Core Areas) Aquafor Beech Limited revised the preliminary NHS to incorporate any wetland 0.5 ha or larger not previously mapped as a Core Area.

**Table 8.4: Fish habitat identified in the study area of the SCUBE Subwatershed Study**

Watercourse	Zone A	Zone B	Zone C
5.0	Indirect Fish Habitat	Indirect Fish Habitat	Not Assessed
5.2	Indirect Fish Habitat	Indirect Fish Habitat	Not Applicable
6.0	Indirect Fish Habitat	Indirect Fish Habitat	Not Assessed
6.1	Indirect Fish Habitat	Not Applicable	Not Applicable
6.2	Indirect Fish Habitat	Not Applicable	Not Applicable
6.3	Not Fish Habitat	Not Applicable	Not Applicable
7.0	Upstream of Barton Street - Indirect Fish Habitat Downstream of Barton Street - Direct Fish Habitat	Indirect Fish Habitat	Indirect Fish Habitat
7.2	Indirect Fish Habitat	Not Applicable	Not Applicable
9.0	Upstream of QEW – Indirect Fish Habitat Downstream of QEW – Direct Fish Habitat	Not Applicable	Not Applicable
10.0	Direct Fish Habitat	Not Applicable	Not Applicable
10.1	Not Fish Habitat	Not Fish Habitat	Not Applicable
10.2	Not Fish Habitat	Not Fish Habitat	Not Applicable
11	Not Fish Habitat	Not Applicable	Not Applicable
12 (Fifty Creek)	Direct Fish Habitat	Direct Fish Habitat	Indirect Fish Habitat



Within the study area of the SCUBE West Subwatershed Study, Dillon Consulting Limited (2010) identifies nine vegetation units characterized by the Ecological Land Classification System for Southern Ontario as wetlands (Figure 8.4). Of these, five units form three discrete wetland blocks larger than 0.5 ha:

- Wetland 1 consists of two units (meadow marsh and deciduous swamp) and is located immediately east of Watercourse 5.
- Wetland 2 consists of a deciduous swamp unit located along Watercourse 6.
- Wetland 3 consists of two deciduous swamp units and is located along Watercourse 7.

The remaining four units are smaller than 0.5 ha:

- a deciduous swamp located along Watercourse 5 (Wetland 4).
- a meadow marsh located approximately 300 m east of Watercourse 5 (Wetland 5).
- a meadow marsh located approximately 150 m east of Watercourse 6 (Wetland 6).
- a deciduous swamp located along Watercourse 7.0 immediately downstream of Highway 8 (Wetland 7).

Accordingly, Aquafor Beech Limited revised the preliminary NHS to incorporate Wetlands 1, 2 and 3 as Core Areas. Natural Resources Solutions Incorporated does not identify any wetlands 0.5 ha or larger within the study area of the SCUBE East Subwatershed Study.

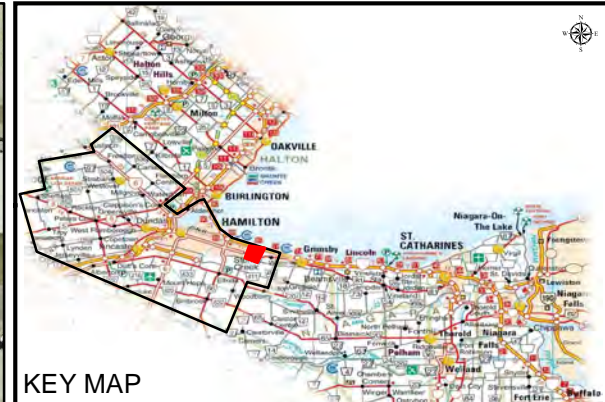
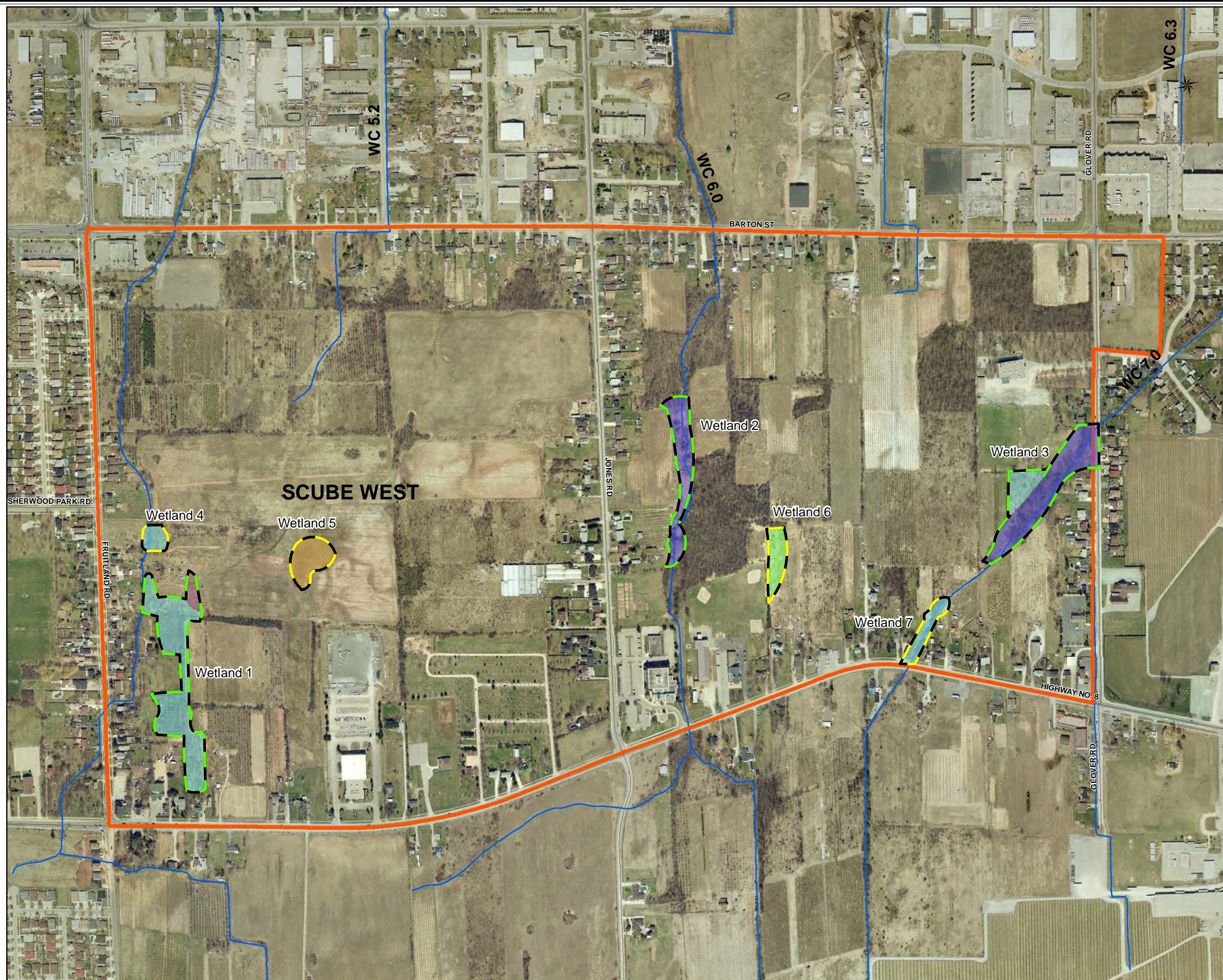
#### ***8.6.1.5 Life Science Areas of Natural and Scientific Interest (ANSI)***

The preliminary NHS was reviewed to confirm the inclusion of Life Science Areas of Natural and Scientific Interest (ANSI) as defined by the City of Hamilton (2009). No Life Science ANSI is present in the study area of the SCUBE Subwatershed Study.

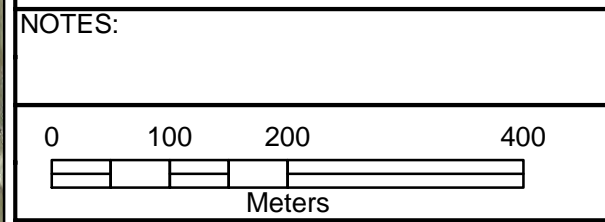
#### ***8.6.1.6 Significant Valleylands***

The preliminary NHS was reviewed to confirm the inclusion of Significant Valleylands as defined by the City of Hamilton (2009). No Significant Valleylands have been identified in the study area of the SCUBE Subwatershed Study by the City of Hamilton, Ministry of Natural Resources or Hamilton Conservation Authority.





- LEGEND:**
- Land Under Consideration for Urban Development
  - Wetlands Assessed as Core Areas
  - Wetlands Assessed as Not Core Areas
- ELC Vegetation Community**
- MAMM1-15 (Bulrush Graminoid Mineral Meadow Marsh)
  - MAMM1-3 (Reed Canary Grass Graminoid Mineral Meadow Marsh)
  - MAMM2-5 (Purple Loosestrife Forb Meadow Marsh)
  - SWDM2-2 (Green Ash Mineral Deciduous Swamp)
  - SWDM4-1 (Willow Mineral Deciduous Swamp)



Development of Natural Heritage System  
Wetlands

SCUBE WEST

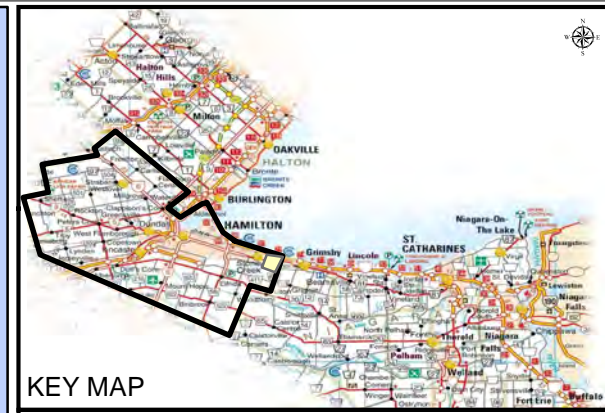
**FIGURE No. 8.4**

DATE: February 23, 2012





LAKE ONTARIO

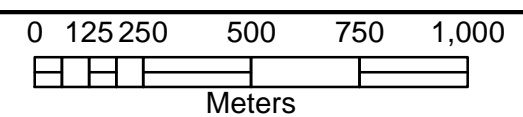


KEY MAP

LEGEND:

- Study Area - SCUBE East Subwatershed Study
- Land Under Consideration for Urban Development
- Urban - Not Subject to Policies of Greenbelt Plan
- Wetlands
- Pond

NOTES:

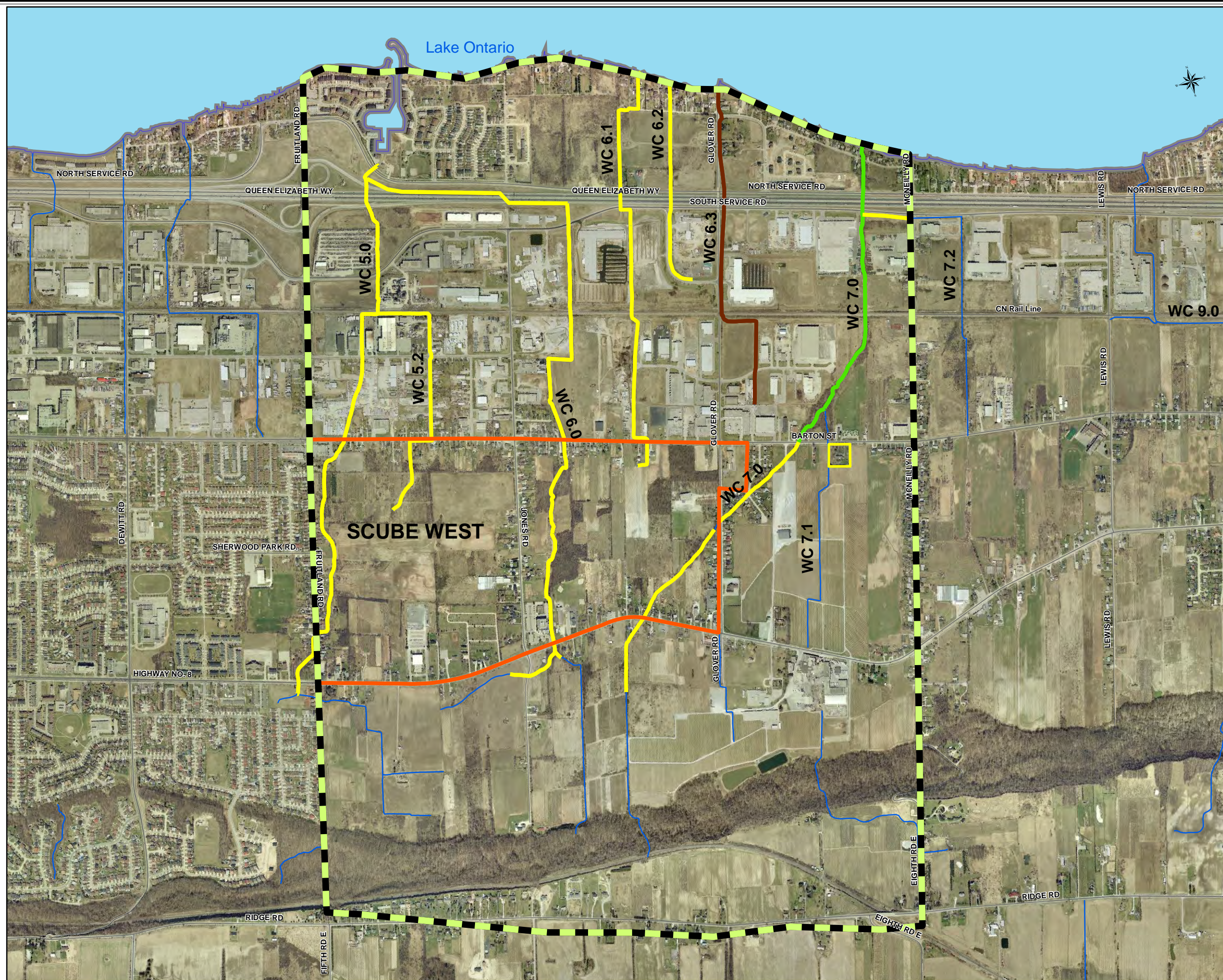


Development of Natural Heritage System  
Wetlands  
SCUBE East

FIGURE No. 8.5

DATE: February 23, 2012





**KEY MAP**

**LEGEND:**

- Study Area Boundary - SCUBE West Subwatershed Study
- Land Under Consideration for Urban Development
- Urban – Not Subject to Policies of Greenbelt Plan
- Direct Fish Habitat
- Indirect Fish Habitat
- Not Fish Habitat
- Not Assessed

**NOTES:**

0 100 200 400 600 800 1,000  
Meters

**SCUBE SUBWATERSHED STUDY**  
Development of Natural Heritage System  
Fish Habitat

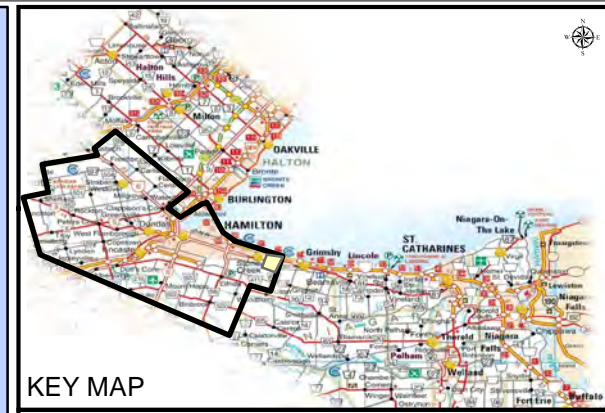
**FIGURE No. 8.6**

DATE: February 23, 2012





LAKE ONTARIO



- LEGEND:**
- Study Area - SCUBE East Subwatershed Study
  - Land Under Consideration for Urban Development
  - Urban – Not Subject to Policies of Greenbelt Plan
  - Potential Fish Barriers
  - 125 HCA Fish Collection Record
  - Direct Fish Habitat
  - Indirect Fish Habitat
  - Not Fish Habitat
  - Not Assessed

**NOTES:**



**SCUBE Subwatershed Study  
Development of Natural Heritage System  
Fish Habitat**

**FIGURE No. 8.7**  
DATE: February 23, 2012



### ***8.6.1.7 Significant Woodlands***

Within Zone B, the preliminary NHS was reviewed to confirm the inclusion of significant woodlands as defined by the City of Hamilton (2009). The City of Hamilton (2009) defines woodlands as follows:

Treed areas that provide environmental and economic benefits to both the private landowners and the general public, such as erosion prevention, hydrological and nutrient cycling, provision of clean air and the long-term storage of carbon, provision of wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products. Woodlands include treed areas, woodlots or forested areas.

The City of Hamilton (2009) defines significant woodlands as follows:

An area which is ecologically important in terms of:

- (a) Features such as species composition, age of trees, stand history;
- (b) Functionally important due to its contribution to the broader landscape because of its location, size, or due to the amount of forest cover in the planning area; and
- (c) Economically important due to site quality, species composition or past management history.



Significant woodlands must meet two or more of the following criteria:

Criterion	Description												
Size	<p>All woodlands that meet the minimum size criteria (below) are significant.</p> <table border="1"> <thead> <tr> <th>Forest Cover (By Planning Unit)</th> <th>Minimum Patch Size for Significance</th> </tr> </thead> <tbody> <tr> <td>&lt; 5%</td> <td>1</td> </tr> <tr> <td>5-10%</td> <td>2</td> </tr> <tr> <td>11-15%</td> <td>4</td> </tr> <tr> <td>16-20%</td> <td>10</td> </tr> <tr> <td>21-30%</td> <td>15</td> </tr> </tbody> </table>	Forest Cover (By Planning Unit)	Minimum Patch Size for Significance	< 5%	1	5-10%	2	11-15%	4	16-20%	10	21-30%	15
		Forest Cover (By Planning Unit)	Minimum Patch Size for Significance										
		< 5%	1										
		5-10%	2										
		11-15%	4										
		16-20%	10										
21-30%	15												
Interior Forest	Any woodland with interior forest habitat (100 metres from edge) is considered significant.												
Proximity/Connectivity	Woodlands that are located within 50 metres of a significant natural area, (defined as wetlands 0.5 hectares or greater in size, ESAs, PSWs, and Life Science ANSIs) are significant.												
Proximity to Water	Woodlands are considered significant if any portion is within 30 metres of any hydrological feature, including all streams, headwater areas, wetlands, and lakes.												
Age	Woodlands with trees of 100 years or more in age are significant. Age will be determined initially using FRI mapping and can be verified during the EIS.												
Rare Species	Any woodland containing threatened, endangered, special concern, provincially or locally rare plant or wildlife species is significant.												

Within the study area of the SCUBE West Subwatershed Study, Dillon Consulting Limited (2010) identified 10 vegetation units characterized by the Ecological Land Classification System for Southern Ontario as woodlot, plantation or forest (Figure 8.7). Of these, four units form two discrete woodland blocks (Woodland 1 and Woodland 2); each block is considered significant because it satisfies two or more City of Hamilton criteria for significance (Table 8.5).

Within the study area of the SCUBE East Subwatershed Study, Natural Resources Solutions Incorporated identified five vegetation units characterized by the Ecological Land Classification System for Southern Ontario as deciduous forest or cultural woodland (Figure 8.8). One of these units has since been removed; three of the remaining four units (Woodlands 3, 4 and 5) are considered significant because they satisfy two or more City of Hamilton criteria for significance (Table 8.5).

The incorporation of Woodlands 1-6 in the refined NHS was further reviewed based on City of Hamilton methodology. This review determined that the refined NHS should incorporate only Woodlands 2 and 5 as Core Areas, and Woodland 6 as a candidate Core Area.

Woodland 1 was not incorporated in the refined NHS as a Core Area because it consists of a linear feature with extensive edge habitat and is heavily disturbed. As such, it is unlikely to contribute significantly to the function of the refined NHS. Moreover, Woodland 1 provides little hydrologic function because it is oriented east-west and only a small portion abuts Watercourse 5.2.

Woodland 6 has been classified as a potential core area in the refined NHS. During the course of this study access to Woodland 6 was restricted and, accordingly, the ecological function of the woodland was not evaluated. It is therefore recommended that the ecological function of Woodland 6 be evaluated as a subsequent planning stage, pending full access to the property.

Woodlands 3 and 4 were not incorporated in the refined NHS as Core Areas because they are located within lands that have already received draft plan approval under the Planning Act.

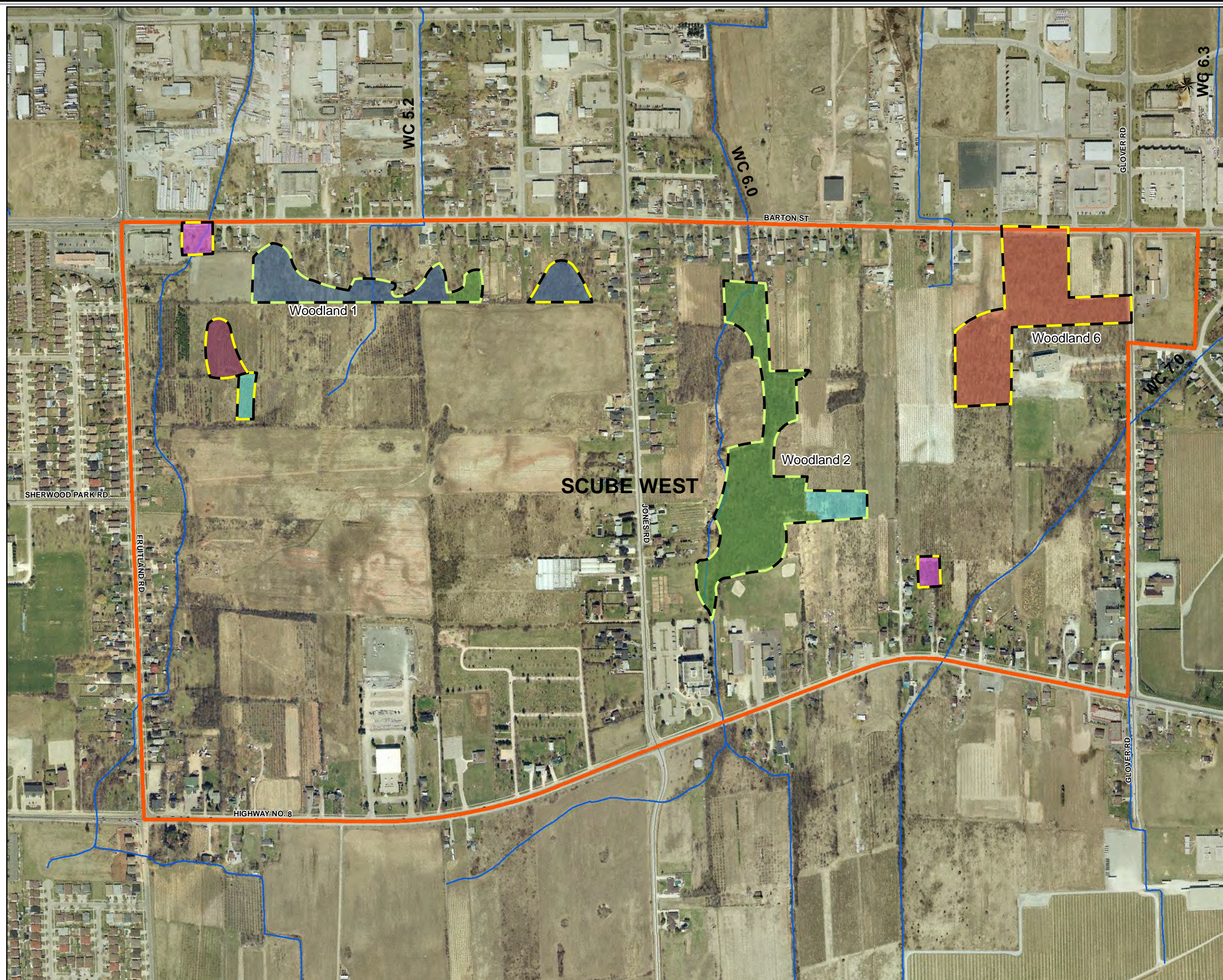
The preliminary NHS mapped by the City of Hamilton (2006, 2009) incorporates Woodland 5 as a Core Area but does not accurately reflect the boundaries of Woodland 2. Accordingly, Aquafor Beech Limited revised the preliminary NHS to incorporate Woodland 2 as shown by Figure 8.7 as a Core Area. Refinements to the preliminary NHS include the following:

- Reclassification of a vegetation unit characterized by Dillon Consulting Limited (2010) as thicket from Core Area to Linkage (see Section 6.4);
- Reclassification of a vegetation unit characterized by Dillon Consulting Limited (2010) as deciduous forest from Linkage to Core Area; and
- Incorporation of a vegetation unit characterized by Dillon Consulting Limited (2010) as deciduous plantation within Woodland 2.

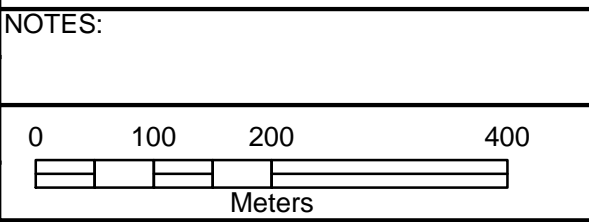
**Table 8.5: Significant woodlands as defined by the City of Hamilton (2009) within Zone B.**

Designation	Composition (ELC Units)	Significance Criteria Satisfied
Woodland 1	(1) Fresh-Moist Oak-Hardwood Deciduous Forest (FODM9-6) (2) Green Ash Hardwood Lowland Deciduous Forest (FODM7-2)	(1) Size – larger than 2 ha (2) Proximity to Water – bisected by Watercourse 5.2
Woodland 2	(1) Green Ash Hardwood Lowland Deciduous Forest (FODM7-2) (2) Deciduous Plantation (TAGM3)	(1) Size – larger than 2 ha (2) Proximity/Connectivity – located adjacent to Wetland 2 (3) Proximity to Water – Adjacent to Watercourse 6.0
Woodland 3	Deciduous Forest Ecosite (FOD)	(1) Size – larger than 2 ha (2) Proximity to Water – bisected by Watercourse 7.2
Woodland 4	Mineral Cultural Woodland (CUW1)	(1) Size – larger than 2 ha (2) Proximity to Water – adjacent to Watercourse 10.1
Woodland 5	Fresh-Moist Lowland Deciduous Forest (FOD7)	(1) Proximity/Connectivity – forms part of Fifty Creek Valley ESA (2) Proximity to Water – located along Fifty Creek (Watercourse 12)





- LEGEND:**
- Land Under Consideration for Urban Development
  - Woodlands Assessed as Core Areas
  - Woodlands Assessed as Not Core Areas
- ELC Vegetation Community**
- DECW (Deciduous Woodlot)
  - FODM7-2 (Green Ash Hardwood Lowland Deciduous Forest)
  - FODM9-4 (Fresh Moist Shagbark Hickory Deciduous Forest)
  - FODM9-6 (Fresh Moist Oak-Hardwood Deciduous Forest)
  - TAGM1 (Coniferous Plantation)
  - TAGM3 (Deciduous Plantation)



Development of Natural Heritage System  
Woodlands  
  
SCUBE WEST

**FIGURE No. 8.8**  
DATE: February 23, 2012



### ***8.6.1.8 Significant Wildlife Habitat***

Within Zone B, the preliminary NHS was reviewed to confirm the inclusion of Significant Wildlife Habitat as defined by the City of Hamilton (2009):

Areas where plants, animals and other organisms live and find adequate amounts of food, water, shelter and space needed to sustain their populations. Wildlife habitat is significant where it is ecologically important in terms of features, functions, representation, or amount and contributes to the quality and diversity of a Natural Heritage System. Significant wildlife habitat areas are defined as consisting of one or more of the following:

- (a) Critical habitat areas that provide for seasonal concentrations of animals;
- (b) Wildlife movement corridors;
- (c) Rare vegetation communities or specialized habitats for wildlife; and/or
- (d) Habitats for species of conservation concern including provincially and federally threatened, endangered, special concern species, and locally rare species.
- (e) MNR identifies criteria, as amended from time to time for the foregoing.

Zone B has limited potential to function as Significant Wildlife Habitat as it is dominated by agricultural land use and common culturally influenced habitats. The NHIC has no records of Significant Wildlife Habitat from within the larger study area of the SCUBE Subwatershed Study and none was identified by Dillon Consulting Limited (2010) or Natural Resources Solutions Incorporated during surveys of SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B).

If present in Zone B, Significant Wildlife Habitat is most likely located within the Core Areas of the preliminary NHS as revised above. However, to ensure the inclusion of Significant Wildlife Habitat in the refined NHS, Aquafor Beech Limited further assessed the potential presence in Zone B of Significant Wildlife Habitat as defined by MNR (2000). In the opinion of Aquafor Beech Limited, the following seven types of Significant Wildlife Habitat are potentially present in Zone B:

- Landbird migratory stopover areas
- Raptor winter feeding and roosting areas
- Migratory butterfly stopover areas
- Habitat for area sensitive species
- Forests providing a high diversity of habitats
- Amphibian woodland breeding ponds
- Habitats for species of conservation concern

Each of these seven types of Significant Wildlife Habitat is discussed in greater detail below.

#### *8.6.1.8.1 Landbird migratory stopover areas*

The MNR (2000) describes landbird migratory stopover areas as follows:

Stopover areas must provide a variety of different habitat types ranging from open fields to large woodlands, to provide abundant food and cover for the diversity of different species during migration. In addition, raptors will use updrafts along cliff faces to assist in migration during spring and fall. Many of the best sites are found within 2 km of Lake Ontario and Lake Erie.

Zone B consists of a variety of habitat types, including cultural meadows, wetlands, cultural thickets and remnant deciduous woodlands. As it is located between the Lake Ontario shoreline and the cliffs of the Niagara Escarpment, Zone B has the potential to function as a landbird migratory stopover area. While SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B) have been surveyed for breeding birds, these areas have not been surveyed in the spring or fall to assess their potential function as a landbird migratory stopover area.

#### *8.6.1.8.2 Raptor winter feeding and roosting areas*

The MNR (2000) describes raptor winter feeding and roosting areas as follows:

Open fields, including hayfields, pastures, and meadows that support large and productive small mammal populations (mice, voles) are important to the winter survival of many birds of prey. Such fields usually have a diversity of herbaceous vegetation that provides food for mammals. Scattered trees and fence posts provide perches for hunting birds. Windswept fields in more open areas that are not covered by deep snow are preferred by raptors because hunting prey is easier. The best roosting sites will likely be found in relatively mature mixed or coniferous woodlands that abut these windswept fields. Some species, such as northern harriers and short-eared owls, roost in large grassy fields. Some feeding and roosting sites support many birds, especially in years when northern species are numerous. In areas with few remaining forested areas, woodlots with dense conifer cover may support numerous roosting birds, especially long-eared owls. Highway corridors appear to attract many hunting raptors throughout the year, because these areas are open and the vegetation is relatively low, making hunting easier. As with waterfowl nesting habitat, protection of large areas of potentially suitable habitat will increase the probability of including significant raptor winter feeding and roosting areas within a Natural Heritage System.



The MNR (2000) further notes the following:

- Raptors frequently hunt over large areas and, as winter progresses, prey populations decline. Therefore, it is important to protect sites that are large enough to support wintering raptors for the entire winter. The best sites should be at least 25-30 ha in size.
- The land use of a site should be noted. Sites that are most likely to remain unchanged for several years are preferred. Cattle pastures often remain unchanged for many years; whereas hay fields can be cultivated and different crops planted that make the site unsuitable. Sites that are least disturbed are preferred and sites that are part of a rural landscape are preferred to those surrounded by urban development.

Portions of Zone B have the potential to function as raptor winter feeding areas, including the cultural meadows of SCUBE West and SCUBE East (Parcel B) and much of SCUBE Central. However, these areas are generally less than 25 ha in size and are surrounded by urban development. Larger areas of similar habitat are located in Zone C; these lands are designated Escarpment Protection Area under the Niagara Escarpment Plan, and, as such, are intended to maintain their rural landscape character. Accordingly, in the opinion of Aquafor Beech Limited, the hayfields, pastures, and cultural meadows of Zone C lands are more likely than those of Zone B to constitute Significant Wildlife Habitat as raptor winter feeding and roosting areas.

#### *8.6.1.8.3 Migratory butterfly stopover areas*

The MNR (2000) describes migratory butterfly stopover areas as follows:

In the fall, during the southward migration, some species of butterflies (Monarchs) stop to feed, rest, or wait for inclement weather conditions to pass before they attempt to cross Lake Ontario, Lake Erie, and Lake Huron. Preferred stopover areas provide an abundance of preferred nectar plants, as well as places for shelter and sunning. Potential stopover areas include fields and other open areas within 5 km of Lake Ontario, Lake Erie, or Lake Huron shorelines.

Zone B is located within 5 km of the Lake Ontario shoreline and includes a number of open areas that provide butterfly nectar plants, such as cultural meadows and meadow marsh. Accordingly, portions of Zone B may function as a migratory butterfly stopover area.

#### *8.6.1.8.4 Habitat for area sensitive species*

The MNR (2000) describes habitat for area sensitive species as follows:

Some wildlife species require large areas of suitable habitat for their long-term survival. This seems to be particularly true for larger mammalian carnivores such as gray wolf, lynx, and fisher. On a smaller scale, many birds require substantial areas of suitable habitat for successful breeding and their populations decline when habitat becomes fragmented and reduced in size. Over time, competitive species, predators, and nest parasites (primarily the brown-headed cowbird) reduce productivity of these birds...

The larger and least fragmented forest stands within a planning area will support the most significant populations of forest-area sensitive birds. Forests should cover about 30% of the regional landscape to provide minimal conditions for these species and there should be several large woodlands (30 to 100+ ha) present to provide enough suitable forest-interior bird nesting habitat. Forests comprised of a mainly closed canopy of large trees and a variety of vegetation layers tend to support a greater diversity of species because of the broader range of habitats they provide...

For area-sensitive grassland bird species, large grassland areas are required as they are more likely to be buffered from disturbance, more likely to increase the distance of nesting habitat to woody edges (thereby reducing nest predation and parasitism), and provide more opportunities for nesting. An endangered species in Ontario, the Henslow's sparrow, appears to prefer tall-grass fields of at least 30 ha. Sufficient habitat is required for several breeding pairs before the habitat will be used, although one pair of birds may only use an area of 1 to 2 ha in size. Even more common grassland species such as bobolinks, savannah sparrows, and grasshopper sparrows are more abundant as breeding birds in grasslands of at least 10 ha. Grasslands with a variety of vegetation structure, density, and composition tend to support a greater diversity of grassland nesting birds because different species require different nesting habitat.

Protecting significant woodlands as suggested in the Natural Heritage Section of the Provincial Policy Statement, will also maintain some critical habitat for area-sensitive forest species. The significant woodland component is closely linked to this important significant wildlife habitat. The largest, least-disturbed grasslands might also be identified for their value to area-sensitive grassland species and provision of further landscape diversity. Each planning area should protect representative examples of these habitats.

Nine species recorded from Zone B are considered by MNR (2000) to be area sensitive. Bobolink is discussed in detail in Section 6.1.1.1. As specific locality data is unavailable for most records of the other eight species, Aquafor Beech Limited used background information and the results of previous studies to determine (i) the habitat requirements of these species and (ii) the availability of potentially suitable habitat for these species in Zone B. Table 8.6 summarizes the results of this assessment.

The refined NHS incorporates all but one of the woodlands in Zone B that have the potential to function as habitat for area sensitive forest species. However, the refined NHS does not identify Woodland 6, the largest remaining woodland in SCUBE West, as a core area because it does not satisfy City of Hamilton criteria as a Significant Woodland. Rather, Woodland 6 has been



identified as a candidate core area. As property access to the woodland was not granted during the course of this Study it is recommended that the woodland be investigated during subsequent planning stages, such as the secondary plan stage, to determine the ecological function and planning status of the woodland. Accordingly, the area of natural vegetation which links the south of Woodland 6 to the natural heritage features associated with Watercourse 7, has been marked as a candidate linkage area. Should it be determined that Woodland 6 is a core area, the area of natural vegetation immediately south of Woodland 6 will qualify as a linkage.

In the opinion of Aquafor Beech Limited, the area in Zone B with the greatest potential to function as habitat for area sensitive grassland species is the portion of SCUBE Central east of Lewis Road. This area provides the largest block of grassland habitat (approximately 10 ha) in Zone B; surveys completed by North-South Environmental Incorporated in 2010 document its use by 10 individuals of three different area sensitive grassland species, including five Savannah Sparrows, three Bobolink and two Eastern Meadowlarks. However, the potential of this area to function long term as habitat for area sensitive grassland species is uncertain because:

- it is near the minimum size threshold required by several species;
- its suitability for some species may be degraded by the urbanization of adjacent lands; and
- it would require regular management (e.g. removal of trees and shrubs) to maintain suitable grassland habitat.

In the opinion of Aquafor Beech Limited, the cultural meadows of Zone C have greater potential to function long term as habitat for area sensitive grassland species because these areas:

- are as large or larger than similar grassland habitats in Zone B;
- abut fewer urban land uses and so are subject to less disturbance (e.g. predation by cats);
- are more likely to be regularly subject to activities (e.g. haying) that will maintain suitable grassland habitat; and
- are designated Escarpment Protection Area (EPA) under the Niagara Escarpment Plan, and, as such, are more likely to be maintained because the EPA designation does not permit large scale residential, industrial, commercial or recreational development.

As previously discussed in Section 8.6.1.1.1.1, North-South Environmental Incorporated recommends that the entire portion of the SCUBE Central lands east of Lewis Road be designated an Area Specific Policy Area (ASPA) pending MNR development of a species-specific regulation for protection of Bobolink habitat. Should the MNR confirm the ASPA as Bobolink habitat, Aquafor Beech Limited recommends that the NHS be revised to incorporate these lands as a Core Area. The potential incorporation in the refined NHS of other areas of cultural meadow within Zone B is considered further in Section 8.6.4 (Review and Refinement of Linkages) and Section 8.6.6 (Enhancement of Core Areas and Linkages).

Aquafor Beech Limited notes that breeding bird studies completed in 2012 by Stantec Consulting Limited (see Appendix K) concluded that Bobolink were not breeding within SCUBE West, and that potential habitat in the area was either marginal or unsuitable for Bobolink.

**Table 8.6: Area sensitive species recorded from Zone B.**

Species	Habitat Requirements	Availability of Potentially Suitable Habitat in Zone B
<p>American Redstart <i>Setophaga ruticilla</i></p>	<p>Primarily a species of deciduous understory and woodland edges. Preferred habitat includes open and semi-open deciduous and mixed forests; tends to avoid fully mature forests (OBBA 2007).</p>	<p>The revised NHS incorporates the largest areas of potentially suitable forest habitat in Zone B, including Woodland 1 (primarily mid-aged Green Ash Forest as well as deciduous plantation) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut). The revised NHS does not incorporate Woodland 6, which consists of less suitable mature Shagbark Hickory forest, as a core area. Rather, the revised NHS includes Woodland 6 as a potential core area. The status of Woodland 6 is to be determined at a subsequent planning stage.</p>
<p>Blue-gray Gnatcatcher <i>Poliophtila caerulea</i></p>	<p>In Ontario, this species favours open-canopied, deciduous swamp and floodplain forests. It nests in a variety of deciduous woodlands, often in close proximity to water and at the edges of openings (OBBA 2007).</p>	<p>The revised NHS incorporates all deciduous swamps identified in Zone B (Wetlands 1, 2, 3, 4 and 7) as well as the largest areas of deciduous woodland in close proximity to water, including Woodland 1 (mid-aged Green Ash Forest and deciduous plantation adjacent to Watercourse 6.0) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut adjacent to Fifty Creek).</p>
<p>Hairy Woodpecker <i>Picoides villosus</i></p>	<p>Large blocks of mature deciduous forest are preferred; small isolated woodlots do not provide desirable habitat and the species becomes uncommon in landscapes dominated by farm, suburban or urban habitats (OBBA 2007).</p>	<p>The revised NHS incorporates two of the largest areas of potentially suitable forest habitat in Zone B, including Woodland 1 (primarily mid-aged Green Ash Forest as well as deciduous plantation) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut). However, the revised NHS does not incorporate Woodland 6 (mature Shagbark Hickory forest), as a core area. The revised NHS includes Woodland 6 as a potential core area. The status of Woodland 6 is to be determined at a subsequent planning stage. Woodland 6 may provide potentially suitable habitat for Hairy Woodpecker; however, the species was not recorded in Woodland 6 by Dillon Consulting Limited (2010).</p>
<p>Ovenbird <i>Seiurus aurocapillus</i></p>	<p>Breeds in the interior of larger tracts of mature deciduous and mixed forest (OBBA 2007).</p>	<p>The revised NHS incorporates two of the largest areas of potentially suitable forest habitat in Zone B, including Woodland 1 (primarily mid-aged Green Ash Forest as well as deciduous plantation) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut). However, the revised NHS does not incorporate Woodland 6 (mature Shagbark Hickory forest), as a core area. Rather, the revised NHS includes Woodland 6 as a potential core area. The status of Woodland 6 is to be determined at a subsequent planning stage. Woodland 6 may provide potentially suitable habitat for Ovenbird; however, the species was not recorded in Woodland 6 by Dillon Consulting Limited (2010).</p>
<p>Scarlet Tanager <i>Piranga olivacea</i></p>	<p>Prefers mature deciduous forests, especially those dominated by larger trees. May also occur in mixed forests and younger deciduous habitats (OBBA 2007).</p>	<p>The revised NHS incorporates two of the largest areas of potentially suitable forest habitat in Zone B, including Woodland 1 (primarily mid-aged Green Ash Forest as well as deciduous plantation) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut). However, the revised NHS does not incorporate Woodland 6 (mature Shagbark Hickory forest). Woodland 6 may provide potentially suitable habitat for Scarlet Tanager; however, the species was not recorded in Woodland 6 by Dillon Consulting Limited (2010). The revised NHS includes Woodland 6 as a potential core area. The status of Woodland 6 is to be determined at a subsequent planning stage.</p>



Species	Habitat Requirements	Availability of Potentially Suitable Habitat in Zone B
<p>Savannah Sparrow <i>Passerculus sandwichensis</i></p>	<p>In southern Ontario this species breeds primarily in grassy meadows, pastures, cultivated fields (especially alfalfa) and along roadsides. Habitat often includes scattered small trees or shrubs (OBBA 2007). More abundant as breeding birds in grasslands of at least 10 ha (MNR 2000). NatureServe Explorer (2011) and references therein note the following:</p> <ul style="list-style-type: none"> <li>• Savannah Sparrow may occupy small (less than 5 ha) areas of suitable habitat (Potter 1972);</li> <li>• Jones and Vickery (1997) suggest that minimum grassland size is 8-16 ha;</li> <li>• In Illinois, Herkert (1991) found no Savannah Sparrows on grasslands less than 10 ha in size;</li> <li>• Incidence of Savannah Sparrow increased with area and reached 50% at about 10 ha in Maine (Vickery et al. 1994) and 40 ha in Illinois (Herkert 1994).</li> <li>• Wiens (1969) noted that most breeding territories are located in the center of grassland habitats, away from cultivated fields and fence lines;</li> <li>• Sample (1989) found a negative correlation between abundance and percent shrub cover.</li> </ul>	<p>Large areas of cultural meadow exist throughout Zone B but most are bisected by roads, hedgerows or other habitat types into blocks less than 10 ha in size.</p>
<p>Eastern Meadowlark <i>Sturnella magna</i></p>	<p>Prefers native grasslands but will nest in pastures and cultivated fields, particularly those in alfalfa and hay. Also uses old fields and meadows, often overgrown with shrubs. Prefers dry habitat to wet and tall grass to short. Occasionally will use other areas such as golf courses or sand dunes (OBBA 2007). More abundant as breeding birds in grasslands of at least 10 ha (MNR 2000). NatureServe Explorer (2011) and references therein suggest that minimum grassland size is 6-8 ha (Jones and Vickery 1997).</p>	<p>Large areas of cultural meadow exist throughout Zone B but most are bisected by roads, hedgerows or other habitat types into blocks less than 10 ha in size. Stantec Consulting Limited completed breeding bird surveys in 2012 and concluded that Eastern Meadowlark was not breeding within SCUBE West. The report is located in Appendix K of this document.</p>
<p>Grasshopper Sparrow <i>Ammodramus savannarum</i></p>	<p>Prefers drier, sparsely vegetated grasslands, particularly rough or unimproved pastures, at least 30 ha in size and supporting varying amounts of forb and shrub growth. Will occasionally use cultivated hay fields and cereal crops (OBBA 2007). More abundant as breeding birds in grasslands of at least 10 ha (MNR 2000). NatureServe Explorer (2011) and references therein note the following:</p> <ul style="list-style-type: none"> <li>• In Colorado, Grasshopper Sparrows were about three times more abundant in interior grasslands than in areas less than 200 m from suburban development (Bock et al. in press).</li> <li>• In Minnesota tallgrass prairie, nest depredation and Brown-headed Cowbird brood parasitism decreased farther from woody edges, and nest depredation rates were lower on large (130-486 ha) than on small (16-32 ha) grasslands (Johnson and Temple 1990).</li> </ul>	<p>Large areas of cultural meadow exist throughout Zone B but most are bisected by roads, hedgerows or other habitat types into blocks less than 10 ha in size.</p>

#### 8.6.1.8.5 *Forests providing a high diversity of habitats*

The MNR (2000) describes forests providing a high diversity of habitats as follows:

Forests with a variety of vegetation communities and dominant tree cover are most likely to have the highest diversity of plant and wildlife species. Complexes of upland and wetland habitats also may have high diversity.

Many species of wildlife such as squirrels, and cavity-nesting birds like pileated woodpeckers, barred owls, and wood ducks use large trees with hollow cavities to bear and raise young. These trees can also provide resting or loafing habitat for mammals like raccoon and porcupine. Older forest stands usually have more cavity trees and support a higher diversity of species than young stands. Best sites contain a mix of large and small tree cavities. Cavities in living trees are generally better than those in dead trees because they last longer. Some tree species make better cavity trees than others do. For example, species such as red pine or white birch break down very quickly and are of limited use for cavities.

Very tall trees, such as white pine, that grow above the main canopy (supercanopy trees), provide important habitat for birds of prey, that may use these trees for nests, roosts, and hunting perches.

Forests with numerous vertical layers of vegetation also contribute greatly to site diversity because of the many microhabitats they provide for wildlife. In addition, an abundance of ground structure such as large fallen logs and leaf litter further enhances a site's ability to support wildlife. Fallen logs are essential habitat for some salamanders, members of the weasel family, certain woodpeckers, and many invertebrate species.

The NHS as revised above incorporates as Core Areas most forested areas within Zone B because they constitute Significant Woodlands or Wetlands as defined by the City of Hamilton (2009). However, the NHS does not include as a Core Area the Shagbark Hickory deciduous forest located in the vicinity of the intersection of Barton Street and Glover Road (Woodland 6) because it does not satisfy City of Hamilton criteria as a Significant Woodland. As a conservative measure, Woodland 6 has been identified as a candidate Core Area. As property access to the woodland was not granted during the course of this Study it is recommended that the woodland be investigated during subsequent planning stages, such as the secondary plan stage, to determine the ecological function and planning status of the woodland. Accordingly, the area of natural vegetation which links the south of Woodland 6 to the natural heritage features associated with Watercourse 7, has been marked as a candidate linkage area. Should it be determined that Woodland 6 is a core area, the natural area immediately south will qualify as a linkage

#### 8.6.1.8.6 *Amphibian woodland breeding ponds*

The MNR (2000) describes amphibian woodland breeding ponds as follows:

These ponds are used for breeding by several species of frogs and salamanders. Such water bodies may be small and ephemeral but nevertheless, important to local amphibian populations, especially if they provide the only suitable habitat in the area.

The best breeding ponds are unpolluted, and contain a variety of vegetation structure, both in and around the edge of the pond, for egg-laying and calling by frogs. The best adjacent habitats are closed-canopy woodlands with rather dense undergrowth that maintains a damp environment. Moist fallen logs are another important habitat component required by salamanders. Sites with several ponds and/or ponds close to creeks are especially valuable.

As noted above, the refined NHS incorporates as Core Areas most forested areas within Zone B except for the Shagbark Hickory deciduous forest located in the vicinity of the intersection of Barton Street and Glover Road (Woodland 6). As mentioned above in Section 8.6.1.8.5, the status of Woodland 6 is to be investigated at a subsequent planning stage.

#### 8.6.1.8.7 *Habitats for species of conservation concern*

A number of locally rare species previously recorded from Zone B are also designated Endangered, Threatened or Special Concern by COSEWIC and/or COSSARO. These species are not considered further as their habitat is addressed by Aquafor Beech Limited recommendations for COSEWIC- and/or COSSARO-designated species at risk.

Twenty-seven locally rare species not designated species at risk by COSEWIC and/or COSSARO have previously been recorded from Zone B. As specific locality data is unavailable for most records of these species, Aquafor Beech Limited used background information and the results of previous studies to determine (i) the habitat requirements of these species and (ii) the availability of potentially suitable habitat for these species in Zone B. Table 8.7 summarizes the results of this assessment.

Zone B does not provide potentially suitable habitat for three of the 27 locally rare species, including Tickle Grass (*Agrostis hyemalis*), Black-crowned Night Heron (*Nycticorax nycticorax*) and Yellow-rumped Warbler (*Dendroica coronata*). The specimen of Tickle Grass previously recorded from Zone B was likely misidentified, while the records of the latter two species likely represent incidental observations. Zone B does provide potentially suitable habitat for the other 24 locally rare species. However, the extent to which the revised NHS incorporates this habitat, and the availability of other areas of potentially suitable habitat beyond Zone B, vary from species to species. Accordingly, the 24 locally rare species can be divided into the following three categories:

Category 1 – the revised NHS incorporates most of the vegetation communities in Zone B that provide potentially suitable habitat for these species.

Category 2 – the revised NHS incorporates few of the vegetation communities in Zone B that provide potentially suitable habitat for these species; however, the same vegetation communities occur in Zone C and immediately adjacent lands and have similar or greater potential to function as habitat for these species.

Category 3 - the revised NHS incorporates some of the vegetation communities in Zone B that provide potentially suitable habitat for these species; however, the same vegetation



communities occur in Zone C and immediately adjacent lands and have similar or greater potential to function as habitat for these species. These species may also use anthropogenic habitat, such as suburban yards, orchards, agricultural lands and/or industrial parks. Such habitat is located in throughout the study area of the SCUBE Subwatershed Study.

Table 8.8 classifies the 24 locally rare species based on the above three categories.

**Table 8.7: Locally rare species not designated species at risk by COSEWIC and/or COSSARO recorded in Zone B.**

Taxon	Species	Habitat Requirements	Availability of Potentially Suitable Habitat in Zone B
Plants	Blue Beech <i>Carpinus caroliniana</i>	Typically an understory tree located in moist woods and swamps. NHIC (2011) indicates the species is common and widespread nationally (N5) and provincially (S5); local rarity is most likely due to the relative rarity of this species' habitat in the greater landscape.	The revised NHS incorporates all deciduous swamps identified in Zone B (Wetlands 1, 2, 3, 4 and 7) as well as the largest areas of deciduous woodland in close proximity to water, including Woodland 1 (mid-aged Green Ash Forest and deciduous plantation adjacent to Watercourse 6.0) and Woodland 5 (lowland deciduous forest adjacent to Fifty Creek).
	Eastern Few-fruited Sedge <i>Carex oligocarpa</i>	Occurs in mesic or dry-mesic deciduous forests, usually in calcium-rich loams on rocky slopes above streams. Sensitive to disturbance. ( <a href="http://labs1.eol.org/pages/1123782?category_id=17">http://labs1.eol.org/pages/1123782?category_id=17</a> )	The revised NHS incorporates the largest, least disturbed deciduous woodlands near streams in Zone B, including Woodland 1 (Green Ash Forest/deciduous plantation adjacent to Watercourse 6.0) and Woodland 5 (lowland deciduous forest adjacent to Fifty Creek). However, the revised NHS does not incorporate the largest woodland in SCUBE West, Woodland 6 (mature Shagbark Hickory forest). The revised NHS includes Woodland 6 as a candidate Core Area. The status of Woodland 6 is to be determined at a subsequent planning stage
	Hardstem Bulrush <i>Schoenoplectus acutus var. acutus</i> (previously <i>Scirpus acutus</i> )	This species is most often found in calcareous to brackish marshes, slow streams, fens, and lakes; it is often emergent in water up to 1.5 m deep (Flora North America Vol. 23 Pages 48-49). NHIC (2011) indicates that the species is common and widespread nationally (N5) and provincially (S5); local rarity is most likely due to the relative rarity of this species' habitat in the greater landscape.	The revised NHS incorporates most areas of habitat in Zone B that are potentially suitable for this species except Watercourse 5.2 and two small areas of meadow marsh in SCUBE West – Wetland 5 and Wetland 6.
	Perfoliate Bellwort <i>Uvularia perfoliata</i>	This species occurs in deciduous forests and thickets with acid-neutral soils (Flora North America Vol. 26 Pages 148, 150).	Dillon Consulting Limited (2010) completed spring surveys of suitable habitat in SCUBE West and found no occurrences of this species. However, potentially suitable habitat for this species is present in SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). The revised NHS incorporates Woodland 5, the largest area of deciduous forest in SCUBE East (Parcel B). Areas of cultural savannah, cultural thicket and cultural woodland which may provide suitable habitat for this species are located in SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). The revised NHS generally does not incorporate these habitats (see Sections 6.1.9 and 6.4).
	Prickly Rose <i>Rosa acicularis</i>	Typically found in open woodlands, meadows, open rocky areas, and thickets. May also occur in hedgerows (Voss 1985).	The revised NHS incorporates two of the largest areas of potentially suitable woodland habitat in Zone B, including Woodland 1 (primarily mid-aged Green Ash Forest as well as deciduous plantation) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut). However, the revised NHS does not incorporate Woodland 6 (mature Shagbark Hickory forest). The revised NHS includes Woodland 6 as a candidate Core Area. The status of Woodland 6 is to be determined at a subsequent planning stage  Meadows, thickets and hedgerows which may provide suitable habitat for this species are located in SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel A). The revised NHS incorporates only a few of these features (see Section 6.11).
	Spearscale <i>Atriplex patula</i>	Spearscale can occur in a variety of habitats including waste places. It is sometimes considered weedy, but is mostly intolerant of salinity and shade.	Potentially suitable habitat for the species exists throughout Zone B.

Taxon	Species	Habitat Requirements	Availability of Potentially Suitable Habitat in Zone B
	Tickle Grass <i>Agrostis hyemalis</i>		Specimen reported by Dillon Consulting Limited (2010) is most likely a misidentification/mislabelling of <i>A. scabra</i> or <i>A. hyemalis</i> var. <i>tenuis</i> . The only occurrence of <i>A. hyemalis</i> in Ontario is on Pelee Island.



Taxon	Species	Habitat Requirements	Availability of Potentially Suitable Habitat in Zone B
Birds	American Kestrel <i>Falco sparverius</i>	Typical habitat includes open country, including grasslands, forest edges and clearings. In recent decades, the species has increasingly taken to nesting in cities, favouring not only green spaces but also industrial parks (OBBA 2007).	Potentially suitable habitat for the species exists throughout Zone B.
	American Redstart <i>Setophaga ruticilla</i>	Primarily a species of deciduous understory and woodland edges. Preferred habitat includes open and semi-open deciduous and mixed forests; it tends to avoid fully mature forests (OBBA 2007).	The revised NHS incorporates the largest areas of potentially suitable forest habitat in Zone B, including Woodland 1 (primarily mid-aged Green Ash Forest as well as deciduous plantation) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut). The revised NHS does not incorporate Woodland 6, which consists of less suitable mature Shagbark Hickory forest. The revised NHS includes Woodland 6 as a candidate Core Area. The status of Woodland 6 is to be determined at a subsequent planning stage.
	Belted Kingfisher <i>Ceryle alcyon</i>	Areas in the vicinity of streams, rivers, and lakes (OBBA 2007).	There are no lakes in Zone B. With the exception of Watercourse 5.2, the revised NHS incorporates all watercourses in Zone B and the vegetation communities immediately adjacent to these watercourses, including Wetlands 1, 2, 3, 4 and 7 and Woodlands 2 and 5.
	Black-crowned Night-heron <i>Nycticorax nycticorax</i>	Within the City of Hamilton the Black-crowned Night-heron is a fairly common summer resident and very uncommon winter resident. Breeding is uncommon and occurs in restricted locations. In Hamilton, Black-crowned Night Heron is found in various locations mostly around Hamilton Harbour (Curry 2006).	Potentially suitable habitat for the species does not exist in Zone B.
	Blue-gray Gnatcatcher <i>Poliophtila caerulea</i>	In Ontario, this species favours open-canopied, deciduous swamp and floodplain forests. It nests in a variety of deciduous woodlands, often in close proximity to water and at the edges of openings (OBBA 2007).	The revised NHS incorporates all deciduous swamps identified in Zone B (Wetlands 1, 2, 3, 4 and 7) as well as the largest areas of deciduous woodland in close proximity to water, including Woodland 1 (mid-aged Green Ash Forest and deciduous plantation adjacent to Watercourse 6.0) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut adjacent to Fifty Creek).
	Clay-coloured Sparrow <i>Spizella pallida</i>	Open shrubland, second-growth abandoned fields and young evergreen plantations (Hughes 2001).	Potentially suitable habitat for the species exists throughout Zone B. A small (approximately 0.5 ha) immature coniferous plantation is located in SCUBE West; the revised NHS does not incorporate this vegetation unit.
	Eastern Bluebird <i>Sialia sialis</i>	Found in a variety of habitats including agricultural lands, forest clearings, old fields, golf courses and large lawns (Hughes 2001). Will nest in almost any area with short vegetation as long as suitable nest cavities are available (OBBA 2007).	Potentially suitable habitat for the species exists throughout Zone B.
	Grasshopper Sparrow <i>Ammodramus savannarum</i>	Prefers drier, sparsely vegetated grasslands, particularly rough or unimproved pastures, at least 30 ha in size and supporting varying amounts of forb and shrub growth. Will occasionally use cultivated hay fields and cereal crops (OBBA 2007).	Large areas of cultural meadow exist throughout Zone B but most are bisected by roads, hedgerows or other habitat types into blocks less than 10 ha in size.

Taxon	Species	Habitat Requirements	Availability of Potentially Suitable Habitat in Zone B
	<p>Hairy Woodpecker <i>Picoides villosus</i></p>	<p>Large blocks of mature deciduous forest are preferred; small isolated woodlots do not provide desirable habitat and the species becomes uncommon in landscapes dominated by farm, suburban or urban habitats (OBBA 2007).</p>	<p>The revised NHS incorporates two of the largest areas of potentially suitable forest habitat in Zone B, including Woodland 1 (primarily mid-aged Green Ash Forest as well as deciduous plantation) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut). However, the revised NHS does not incorporate Woodland 6 (mature Shagbark Hickory forest). The revised NHS includes Woodland 6 as a candidate Core Area. The status of Woodland 6 is to be determined at a subsequent planning stage. Woodland 6 may provide potentially suitable habitat for Hairy Woodpecker; however, the species was not recorded in Woodland 6 by Dillon Consulting Limited (2010).</p>
	<p>Herring Gull <i>Larus argentatus</i></p>	<p>Beaches, lakes, farmland and garbage dumps (Hughes 2001).</p>	<p>There are no beaches or lakes in Zone B. Farmland exists throughout Zone B.</p>
	<p>Mourning Warbler <i>Oporornis philadelphia</i></p>	<p>Prefers fairly open, early successional habitats with a dense understory. Breeds in recently disturbed and regenerating coniferous and mixed forests, including hydro rights-of-way and roadsides (OBBA 2007).</p>	<p>No conifer or mixed forest is present in Zone B. However, a variety of open, early successional habitat (i.e. cultural thicket, cultural savannah and cultural woodland) exists throughout Zone B.</p>
	<p>Northern Mockingbird <i>Mimus polyglottos</i></p>	<p>Habitat includes suburban gardens, orchard and woodland edges, hedges and thickets (Hughes 2001).</p>	<p>Potentially suitable habitat for the species exists throughout Zone B.</p>
	<p>Orchard Oriole <i>Icterus spurius</i></p>	<p>Orchards, hedgerows, open woods, cemeteries, golf courses, oak savannahs, and open riparian forests are all used as breeding habitat, especially if water is nearby (OBBA 2007).</p>	<p>Potentially suitable habitat for the species exists throughout Zone B. With the exception of Watercourse 5.2, the revised NHS incorporates all watercourses in Zone B and the vegetation communities immediately adjacent to these watercourses, including Woodlands 2 and 5.</p>
	<p>Purple Martin <i>Progne subis</i></p>	<p>Breeds near human settlements where nest houses are provided, especially near water and large open areas. In eastern North America it has nested almost exclusively in nest boxes for more than 100 years (Brown 1997).</p>	<p>Potentially suitable habitat for the species exists throughout Zone B. With the exception of Watercourse 5.2, the revised NHS incorporates all watercourses in Zone B and the vegetation communities immediately adjacent to these watercourses.</p>
	<p>Red-bellied Woodpecker <i>Melanerpes carolinus</i></p>	<p>Mature deciduous forest with high basal areas, many large-diameter trees and snags (OBBA 2007).</p>	<p>The revised NHS incorporates two of the largest areas of potentially suitable forest habitat in Zone B, including Woodland 1 (primarily mid-aged Green Ash Forest as well as deciduous plantation) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut). However, the revised NHS does not incorporate Woodland 6 (mature Shagbark Hickory forest). The revised NHS includes Woodland 6 as a candidate Core Area. The status of Woodland 6 is to be determined at a subsequent planning stage. Woodland 6 may provide potentially suitable habitat for Red-bellied Woodpecker; however, the species was not recorded in Woodland 6 by Dillon Consulting Limited (2010).</p>
	<p>Scarlet Tanager <i>Piranga olivacea</i></p>	<p>Prefers mature deciduous forests, especially those dominated by large trees, but may also occupy mixed forests and younger deciduous habitats (OBBA 2007).</p>	<p>The revised NHS incorporates two of the largest areas of potentially suitable forest habitat in Zone B, including Woodland 1 (primarily mid-aged Green Ash Forest as well as deciduous plantation) and Woodland 5 (lowland deciduous forest dominated by Crack Willow and Black Walnut). However, the revised NHS does not incorporate Woodland 6 (mature Shagbark Hickory forest). The revised NHS includes Woodland 6 as a candidate Core Area. The status of Woodland 6 is to be determined at a subsequent planning stage. Woodland 6 may provide potentially suitable habitat for Scarlet Tanager; however, the species was not recorded in Woodland 6 by Dillon Consulting Limited (2010).</p>

Taxon	Species	Habitat Requirements	Availability of Potentially Suitable Habitat in Zone B
	<p>Turkey Vulture <i>Cathartes aura</i></p>	<p>Forages over mixed farmland, open woodland and swamps. Nests in caves, cliffs and hardwood forests (Hughes 2001). Frequently observed along the Niagara Escarpment, which attracts the species with its thermals and ready accessibility of numerous nest sites (OBBA 2007).</p>	<p>Potentially suitable foraging habitat for the species exists throughout Zone B. Nesting is more likely to occur along the Niagara Escarpment than within Zone B.</p>
	<p>White-throated Sparrow <i>Zonotrichia albicollis</i></p>	<p>Openings and edges in coniferous and mixed forests (OBBA 2007).</p>	<p>No coniferous or mixed forest is present in Zone B. However, a variety of open, early successional habitat (i.e. cultural thicket, cultural savannah and cultural woodland) exists throughout Zone B.</p>
	<p>Yellow-rumped Warbler <i>Dendroica coronata</i></p>	<p>Prefers mature coniferous and mixed coniferous-deciduous forests, including conifer plantations. It is a generalist and will use whatever conifer species is present (OBBA 2007).</p>	<p>No coniferous or mixed forest is present in Zone B. A small (approximately 0.5 ha) immature coniferous plantation is located in SCUBE West; the revised NHS does not incorporate this vegetation unit.</p>
<p>Amphibians</p>	<p>Red-spotted Newt <i>Notophthalmus viridescens viridescens</i></p>	<p>Adults and larvae occur in permanent and semi-permanent water bodies, including ponds, small lakes, marshes, ditches and quiet portions of streams; the terrestrial eft stage occurs in moist forests and other upland habitats (Conant and Collins 1998).</p>	<p>The revised NHS incorporates all potential habitat for this species within Zone B except for two small areas of meadow marsh in SCUBE West – Wetland 5 and Wetland 6.</p>



**Table 8.8: Categories of 24 locally rare species. See text above for clarification.**

Category 1	Category 2	Category 3
Blue Beech	Perfoliate Bellwort	Spearscale
Eastern Few-fruited Sedge	Prickly Rose	American Kestrel
Hardstem Bulrush	Clay-coloured Sparrow	Eastern Bluebird
American Redstart	Grasshopper Sparrow	Herring Gull
Belted Kingfisher	Mourning Warbler	Northern Mockingbird
Blue-gray Gnatcatcher	White-throated Sparrow	Orchard Oriole
Hairy Woodpecker		Purple Martin
Red-bellied Woodpecker		Turkey Vulture
Scarlet Tanager		
Red-spotted Newt		

The refined NHS incorporates most of the vegetation communities in Zone B that provide potentially suitable habitat for Category 1 species. However, the refined NHS does not incorporate Woodland 6, the largest remaining woodland in SCUBE West. Woodland 6 has the potential to function as habitat for a number of locally rare species previously recorded from Zone B, such as Eastern Few-fruited Sedge, American Redstart and Red-bellied Woodpecker. During the course of this study access to Woodland 6 was restricted and, accordingly, the ecological function of the woodland was not evaluated. Pending further investigation, Woodland 6 has been classified as a potential core area in the refined NHS. It is recommended that the ecological function of Woodland 6 be evaluated as a subsequent planning stage, pending full access to the property. Accordingly, the area of natural vegetation which links the south of Woodland 6 to the natural heritage features associated with Watercourse 7 has been marked as a candidate linkage area. Should it be determined that Woodland 6 is a core area, the natural area immediately south will qualify as a linkage.

The refined NHS incorporates few of the vegetation communities in Zone B that provide potentially suitable habitat for Category 2 species (i.e. cultural meadow, cultural thicket and cultural woodland). However, Zone C and the immediately adjacent lands to the east between Highway 8 and the Niagara Escarpment consist of a similar mosaic of cultural vegetation communities and agricultural land as is found in SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). In the opinion of Aquafor Beech Limited, the cultural vegetation communities of Zone C and the immediately adjacent lands to the east have similar or greater potential to function long term as habitat for Category 2 species because they:

- are as large or larger than those of Zone B;
- abut fewer urban land uses and so are subject to less disturbance (e.g. predation by cats);

- are more likely to be regularly subject to activities (e.g. haying) that will maintain suitable early successional habitat; and
- are designated Escarpment Protection Area (EPA) under the Niagara Escarpment Plan, and, as such, are more likely to be maintained because the EPA designation does not permit large scale residential, industrial, commercial or recreational development.

The refined NHS incorporates some of the vegetation communities in Zone B that provide potentially suitable habitat for Category 3 species (e.g. riparian forest) but not others (e.g. cultural thicket). However, Zone C and the immediately adjacent lands to the east between Highway 8 and the Niagara Escarpment consist of a similar mosaic of cultural vegetation communities and agricultural land as is found in SCUBE West, SCUBE Central, SCUBE East (Parcel A) and SCUBE East (Parcel B). In the opinion of Aquafor Beech Limited, the cultural vegetation communities of Zone C and the immediately adjacent lands to the east have similar or greater potential to function long term as habitat for Category 3 species because they:

- are as large or larger than those of Zone B;
- abut fewer urban land uses and so are subject to less disturbance (e.g. predation by cats);
- are more likely to be regularly subject to activities (e.g. haying) that will maintain suitable early successional habitat; and
- are designated Escarpment Protection Area (EPA) under the Niagara Escarpment Plan, and, as such, are more likely to be maintained because the EPA designation does not permit large scale residential, industrial, commercial or recreational development.

In the opinion of Aquafor Beech Limited, no further measures to protect the habitat of Category 3 species are warranted, as these species use a range of anthropogenic habitat, including suburban yards, orchards, agricultural lands and industrial parks and such areas are located throughout the study area of the SCUBE Subwatershed Study.

#### ***8.6.1.9 Sand barrens, savannahs and tallgrass prairies***

The preliminary NHS was reviewed to confirm the inclusion of sand barrens, savannahs and tallgrass prairies as defined by the City of Hamilton (2009). Sand barrens and tallgrass prairies are not present in the study area of the SCUBE Subwatershed Study (City of Hamilton 2009). However, Natural Resources Solutions Incorporated identified two vegetation units characterized by the Ecological Land Classification System for Southern Ontario as Cultural Savannah (CUS1). One unit is located in Block A1, the other in SCUBE Central (Figure 8.9).

The City of Hamilton (2009) defines savannah as follows:

Land (not including land that is being used for agricultural purposes or no longer exhibits savannah characteristics) that:

- (a) has vegetation with a significant component of non-woody plants, including tallgrass prairie species that are maintained by seasonal drought, periodic disturbances including fire, or both;
- (b) has from 25 per cent to 60 per cent tree cover;
- (c) has mineral soils; and,
- (d) has been further identified, by the Ministry of Natural Resources or by any other person according to evaluation procedures established by the Ministry of Natural Resources, as amended from time to time.

In the opinion of Aquafor Beech Limited, the two vegetation units identified by Natural Resources Solutions Incorporated consist of mid-successional regenerating agricultural lands and do not constitute savannah as defined by the City of Hamilton (2009). Accordingly, Aquafor Beech Limited did not revise the preliminary NHS to incorporate these units as Core Areas.

#### ***8.6.1.10 Alvars***

Within Zone B, the preliminary NHS was reviewed to confirm the inclusion of alvars as defined by the City of Hamilton (2009). Alvars are not present in the study area of the SCUBE Subwatershed Study (City of Hamilton 2009).

#### ***8.6.2 Review and Refinement of Core Areas (Key Hydrologic Features)***

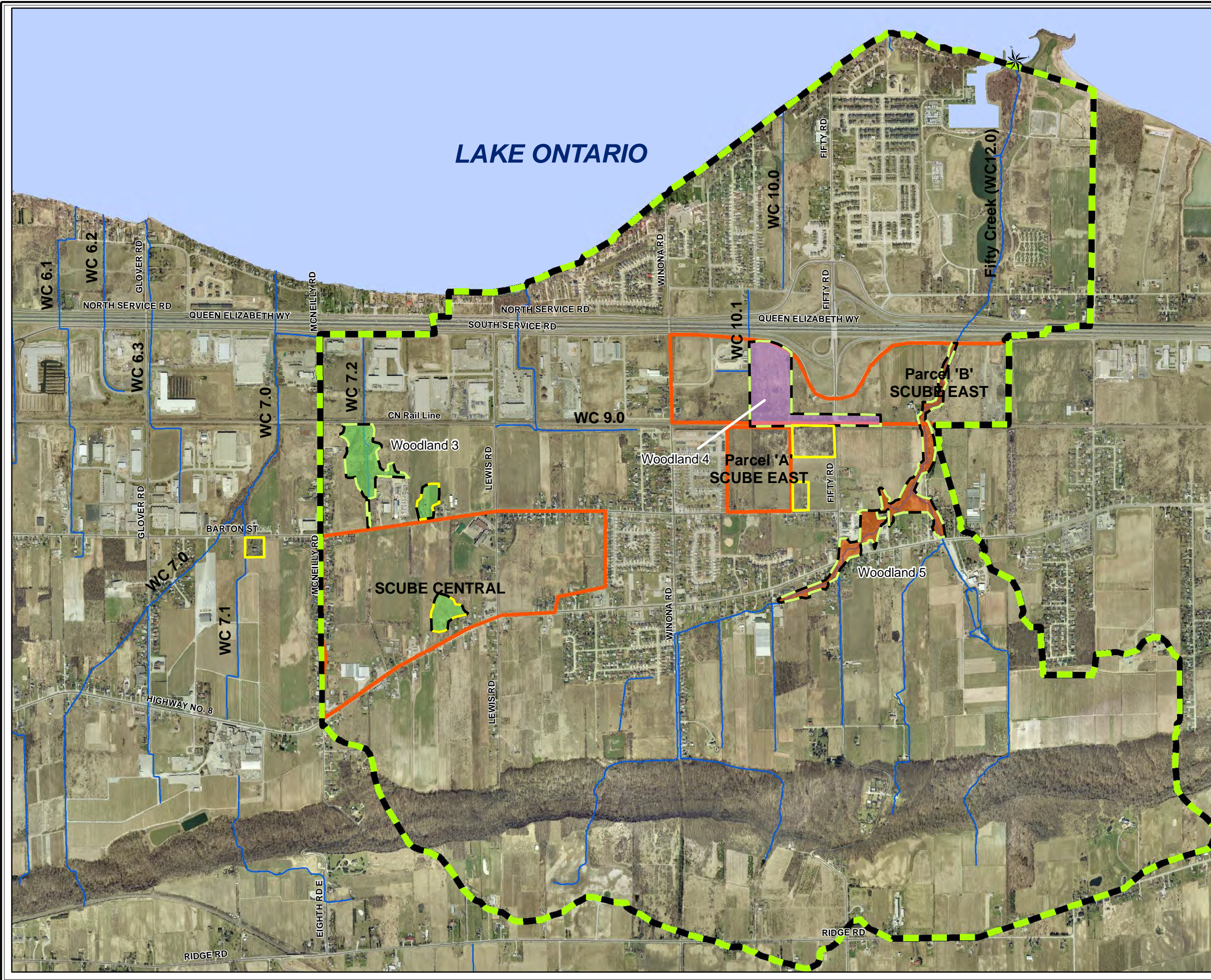
Aquafor Beech Limited reviewed and revised the preliminary NHS for the study area of the SCUBE Subwatershed Study to incorporate all Key Hydrologic Features as defined by the City of Hamilton (2009), including (i) permanent and intermittent streams, (ii) lakes (and their littoral zones) and (iii) wetlands. No seepage areas and/or springs have been identified in the study area of the SCUBE Subwatershed Study.

#### ***8.6.3 Review and Refinement of Core Areas (Local Natural Areas)***

Aquafor Beech Limited reviewed the preliminary NHS for the study area of the SCUBE Subwatershed Study to confirm the inclusion of all Local Natural Areas as defined by the City of Hamilton (2009) including (i) Environmentally Significant Areas as identified by the City of Hamilton, (ii) unevaluated wetlands and (iii) Earth Science Areas of Natural and Scientific Interest.

Two City of Hamilton-designated Environmentally Significant Areas are located within the study area of the SCUBE Subwatershed Study, including Devil's Punch Bowl Escarpment ESA (ESA 54) and Fifty Creek Valley ESA (ESA 80). The preliminary NHS incorporates both. No Earth Science Areas of Natural and Scientific Interest are located within the study area of the SCUBE Subwatershed Study.





- LEGEND:**
- Study Area - SCUBE East Subwatershed Study
  - Land Under Consideration for Urban Development
  - Urban - Not Subject to Policies of Greenbelt Plan
  - Woodlands Assessed as Core Areas
  - Woodlands Assessed as Not Core Areas
- ELC Vegetation Community**
- CUW1 (Mineral Cultural Woodland)
  - FOD4 (Dry-Fresh Deciduous Forest)
  - FOD7 (Moist Lowland Deciduous Forest)

**NOTES:**

0 125 250 500 750 1,000  
 Meters



**Development of Natural Heritage System  
 Woodlands  
 SCUBE EAST**

**FIGURE No. 8.9**  
 DATE: February 23, 2012



#### **8.6.4 Review and Refinement of Linkages**

Within Zone B, the preliminary NHS, as revised above, was reviewed to confirm the inclusion of Linkages as defined by the City of Hamilton (2009).

Aquafor Beech Limited reviewed vegetation units characterized by Dillon Consulting Limited (2010) or Natural Resources Solutions Incorporated (2007) using the Ecological Land Classification System for Southern Ontario and identified one Woodland Linkage (Woodland Linkage 1) and 17 Linkages of other natural vegetation types (Table 8.9) not previously mapped by the City of Hamilton (2009). Figure 8.10 and Figure 8.11 illustrate these Linkages.

The incorporation of Woodland Linkage 1 and the 17 Linkages of other natural vegetation types in the refined NHS was reviewed based on City of Hamilton methodology. Woodland Linkage 1 was not incorporated in the refined NHS because it is located more than 30 m from Watercourse 5.0 and does not provide a significant riparian linkage function. Table 8.10 describes the extent to which the 17 Linkages of other natural vegetation types were incorporated in the refined NHS. This review also resulted in the incorporation in the refined NHS of two wetland units as Linkages of other natural vegetation types, including the following:

- Wetland 4, a deciduous swamp located along Watercourse 5.0 immediately downstream of Wetland 1 (Figure 8.4).
- Wetland 7, a deciduous swamp located along Watercourse 6.0 immediately downstream of Highway 8 (Figure 8.4).

The incorporation in the refined NHS of Wetlands 4 and 7 as Linkages of other vegetation types reflects the limited amount of riparian wetland remaining in SCUBE West.

Aquafor Beech Limited also identified two areas in SCUBE West that do not satisfy the City of Hamilton (2009) definition of Linkage but are shown as such in the preliminary NHS (Figure 8.1). These areas include the following:

- an irregularly-shaped area located immediately north of Highway 8 and west of Watercourse 7.0 that incorporates portions of vegetation units characterized by Dillon Consulting Limited (2010) as deciduous woodlot and rural property. The deciduous woodlot does not constitute a Woodland Linkage because it is less than 0.5 ha in size; the remaining portion does not constitute a Linkage of other vegetation type because it does not consist of natural vegetation.
- a mature Shagbark Hickory deciduous forest unit located in the vicinity of the intersection of Barton Street and Glover Road. This vegetation unit (Woodland 6) is the largest remaining woodland in SCUBE West but does not constitute a Woodland Linkage because it does not connect or lie within 100 m of a Core Area (Figure 8.10).

Accordingly, Aquafor Beech Limited removed the former area from the preliminary NHS. The latter area, Woodland 6, has been included in the revised NHS as a candidate Core Area. During the course of this study access to Woodland 6 was restricted and, accordingly, the ecological function of the

woodland was not evaluated. It is recommended that the ecological function of Woodland 6 be evaluated as a subsequent planning stage, pending full access to the property. Accordingly, the area of natural vegetation which links the south of Woodland 6 to the natural heritage features associated with Watercourse 7, has been marked as a candidate linkage area. Should it be determined that Woodland 6 is a core area, the natural area immediately south will qualify as a linkage.



Table 8.9: Linkages of other natural vegetation types as defined by the City of Hamilton (2009) within Zone B.

Designation	Composition (ELC)	Location
Linkage 1	Fresh-Moist Mixed Meadow (MEMM4)	SCUBE West
Linkage 2	Fresh-Moist Mixed Meadow (MEMM4)	SCUBE West
Linkage 3	Fresh-Moist Mixed Meadow (MEMM4)	SCUBE West
Linkage 4	Native Deciduous Regeneration Thicket (THDM4-1)	SCUBE West
Linkage 5	Fresh-Moist Mixed Meadow (MEMM4)	SCUBE West
Linkage 6	Forb Meadow (MEF)	SCUBE West
Linkage 7	Hawthorn (dogwood/buckthorn) Deciduous Scrub Thicket	SCUBE West
Linkage 8	Hawthorn (dogwood/buckthorn) Deciduous Scrub Thicket	SCUBE West
Linkage 9	Hawthorn (dogwood/buckthorn) Deciduous Scrub Thicket	SCUBE West
Linkage 10	Mineral Cultural Meadow (CUM1-1)	Block A
Linkage 11	Mineral Cultural Meadow (CUM1-1)	SCUBE East (Parcel A)
Linkage 12	Grey Dogwood Cultural Thicket (CUT1-4)	SCUBE East (Parcel A) and Block B2
Linkage 13	Mineral Cultural Meadow (CUM1-1)	SCUBE East (Parcel B)
Linkage 14	Mineral Cultural Meadow (CUM1-1)	SCUBE East (Parcel B)
Linkage 15	Mineral Cultural Meadow (CUM1-1)	SCUBE East (Parcel B)
Linkage 16	Mineral Cultural Meadow (CUM1-1)	SCUBE East (Parcel B)
Linkage 17	Mineral Cultural Meadow (CUM1-1)	SCUBE East (Parcel B)

**Table 8.10: Linkages of other natural vegetation types as defined by the City of Hamilton (2009) within Zone B.**





Designation	Incorporated in Refined NHS?	Rationale
Linkage 1	No	Does not provide a significant riparian linkage function as it is located more than 30 m from Watercourse 5.0.
Linkage 2	Only portions within 30 m of Watercourse 5.0	Portions of Linkage 2 located within 30 m of Watercourse 5.0 contribute to its hydrologic function. Remaining portions were not incorporated in the refined NHS because they do not contribute significantly to the hydrologic function of Watercourse 5.0.
Linkage 3	No	Does not provide a significant riparian linkage function as it is located more than 30 m from Watercourse 5.0.
Linkage 4	Yes	
Linkage 5	Yes	
Linkage 6	No	Does not provide a significant riparian linkage function as it is located more than 30 m from Watercourse 6.0; does not provide significant habitat.
Linkage 7	No	Vegetation provides low-quality habitat that does not promote plant or wildlife movement along Watercourse 6.0.
Linkage 8	No	Does not provide a significant riparian linkage function as it is located more than 30 m from Watercourse 6.0 and Watercourse 7.0; habitat is disturbed and is not considered significant.
Linkage 9	No	Vegetation is disturbed and does not promote plant or wildlife movement along Watercourse 6.0 or Watercourse 7.
Linkage 10	No	Located within lands that have already received draft plan approval under the Planning Act.
Linkage 11	No	Located within lands that have already received draft plan approval under the Planning Act.

Designation	Incorporated in Refined NHS?	Rationale
Linkage 12	No	Located within lands that have already received draft plan approval under the Planning Act.
Linkage 13	No	Located within lands that have already received draft plan approval under the Planning Act.
Linkage 14	No	Located within lands that have already received draft plan approval under the Planning Act.
Linkage 15	No	Located within lands that have already received draft plan approval under the Planning Act.
Linkage 16	No	Located within lands that have already received draft plan approval under the Planning Act.
Linkage 17	No	Located within lands that have already received draft plan approval under the Planning Act.

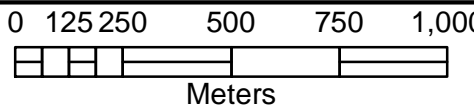




**LEGEND:**

-  Study Area - SCUBE East Subwatershed Study
-  Land Under Consideration for Urban Development
-  Cultural Savannah
-  Urban - Not Subject to Policies of Greenbelt Plan

**NOTES:**



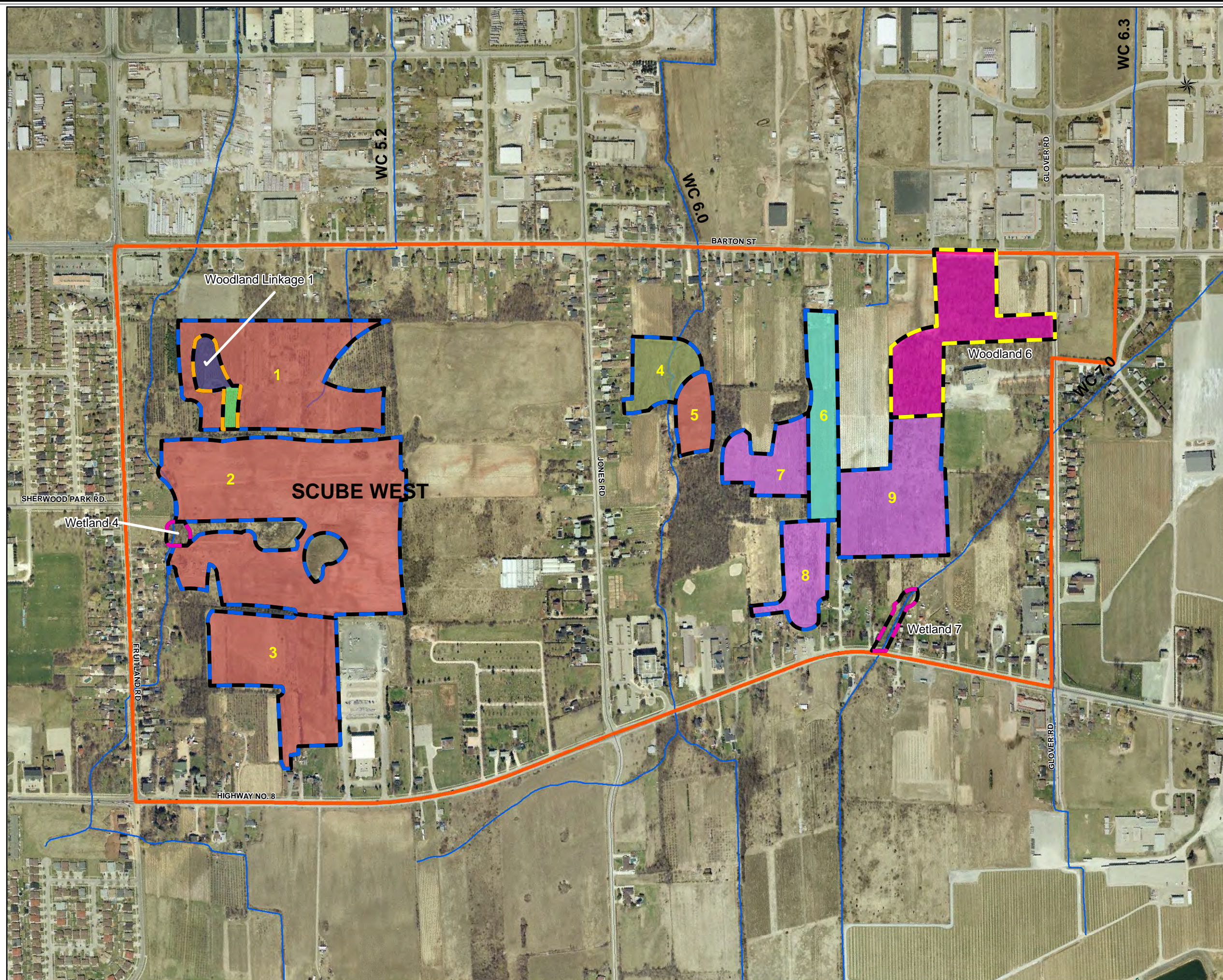

**Development of Natural Heritage System  
Sand Barrens, Savannahs and  
Tallgrass Prairies**

**SCUBE EAST**

**FIGURE No. 8.10**

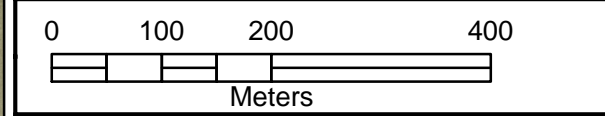
DATE: February 23, 2012





- LEGEND:**
- Land Under Consideration for Urban Development
  - Assessed as Woodland Linkage
  - Woodland Assessed as Not Core Areas
  - Linkage of Other Natural Vegetation Type
  - Assessed as Linkage of Other Natural Vegetation Type
- ELC Vegetation Community**
- FODM9-4 (Fresh Moist Shagbark Hickory Deciduous Forest)
  - MEF (Forb Meadow)
  - MEMM4 (Fresh-Moist Mixed Meadow)
  - TAGM1 (Coniferous Plantation)
  - TAGM3 (Deciduous Plantation)
  - THDM2-11 (Hawthorn (dogwood/buckthorn))
  - THDM4-1 (Native Deciduous Regeneration Thicket)

**NOTES:**



Development of Natural Heritage System Linkages

SCUBE WEST

**FIGURE No. 8.11**

DATE: February 23, 2012



### **8.6.5 Hazardous Lands**

Within Zone B and the immediately downstream lands where Watercourse 7.0 extends through a remnant area of deciduous forest, the preliminary NHS, as revised above, was further refined to incorporate hazardous lands as defined by Hamilton Conservation Authority (2009). This includes (i) lands within the flood plain of the Regulatory Flood as previously determined by Aquafor Beech Limited and (ii) lands within the erosion hazard limit as approximated by a preliminary meander belt assessment (Appendix J). Final erosion hazard limits are to be determined through future studies.

### **8.6.6 Vegetation Protection Zones**

Within Zone B, the preliminary NHS, as revised above, was further refined to incorporate preliminary vegetation protection zones consistent with the minimum requirements of the City of Hamilton Official Plan (Table 8.11). The widths of these preliminary VPZ are to be reviewed at a subsequent planning stage and may be increased based on the recommendations of an approved Environmental Impact Statement. Figure 8.12 and Figure 8.13 illustrate the NHS as recommended by Aquafor Beech Limited and the associated vegetation protection zones.

### **8.6.7 Enhancement of Core Areas and Linkages**

The recommended NHS was reviewed to identify opportunities to enhance the attributes of constituent Core Areas and Linkages by restoring/creating natural cover (e.g. tree planting). Attributes of Core Areas considered for enhancement include size, completeness, shape and potential for connectivity. Attributes of Linkages considered for enhancement include ecological function, scale, and crossing opportunities. A full list of the attributes of Core Areas and Linkages considered for enhancement is provided by Tables 3-2 and 3-3 of the NHRM, respectively (MNR 2010).

Aquafor Beech Limited identified a number of opportunities to enhance the watercourses within the study area of the SCUBE Subwatershed Study. Table 8.12 outlines these opportunities. Opportunities to enhance the terrestrial elements of the NHS within Zone B are described below.



**Table 8.11: City of Hamilton minimum vegetation protection zone requirements; adapted from City of Hamilton (2009).**

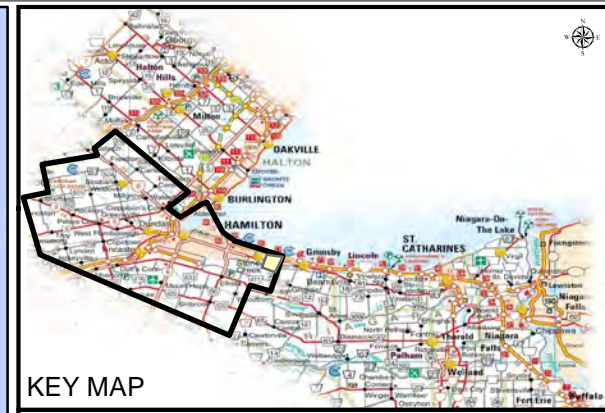
Core Area	Vegetation Protection Zone (VPZ) Requirements
Coldwater Watercourse	30 m VPZ on each side of the watercourse, measured from the bankfull channel.
Critical Fish Habitat	30 m VPZ on each side of the watercourse, measured from the bankfull channel.
Warmwater Watercourse	15 m VPZ on each side of the watercourse, measured from the bankfull channel.
Important/Marginal Fish Habitat	15 m VPZ on each side of the watercourse, measured from the bankfull channel.
Provincially Significant Wetlands	30 m VPZ, measured from the boundary of the wetland, as approved by the Conservation Authority or MNR.
Locally Significant Wetlands	30 m VPZ, measured from the boundary of the wetland, as approved by the Conservation Authority or MNR.
Unevaluated wetlands > 2 ha in size	30 m VPZ, measured from the boundary of the wetland, as approved by the Conservation Authority or MNR.
Unevaluated wetlands ≤ 2 ha in size	30 m VPZ, unless an Environmental Impact Statement recommends a more appropriate VPZ.
Woodlands	10 m VPZ, measured from the edge (drip line) of the woodland.
Significant woodlands	15 m VPZ, measured from the edge (drip line) of the significant woodland.
ANSI	Life and Earth Science ANSIs require a 15 m VPZ.
Valleylands	As required by the relevant Conservation Authority.

**Table 8.12: Opportunities to enhance the watercourses within the study area of the SCUBE Subwatershed Study.**

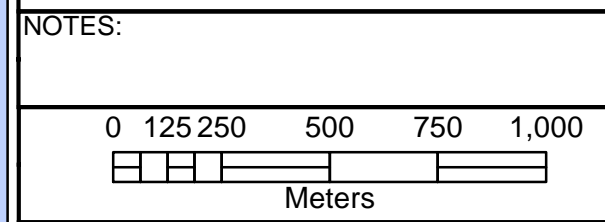
Watercourse	Zone A	Zone B	Zone C
5.0	<ul style="list-style-type: none"> <li>• To the extent possible, extend riparian areas and increase their degree of naturalness through the removal of invasive, exotic species and the planting of native species.</li> <li>• Assess the feasibility of mitigating the barrier to fish movement at the QEW culvert. Consider culvert replacements at the CNR and South Service Road crossings to improve water quality and the possibility of fish migration</li> <li>• Secure banks and improve aquatic habitat through riparian plantings at erosion points.</li> <li>• Consider opportunities to reconnect flood plain access upstream of the QEW per Section 3.2.4.4.2 of the SCUBE West Subwatershed Study: Phase 1 and Phase 2 Final Report.</li> <li>• Incorporate riparian habitat enhancements with recommended stream restoration works between Arvin Avenue and the QEW.</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• The existing culvert at the proposed east-west road crossing south of Barton Street should be replaced; the use of an open-bottom culvert should be considered to facilitate fish passage.</li> <li>• Secure banks and improve aquatic habitat through riparian plantings at erosion points.</li> <li>• Assess the feasibility of replacing the deteriorated culvert at Barton Street and Fruitland Road.</li> <li>• Incorporate riparian habitat enhancements with planned relocation of Watercourse 5.0 within Zone B.</li> </ul>	<ul style="list-style-type: none"> <li>• Riparian habitat corridor and linkage enhancements to improve downstream aquatic habitat, bank stability, stream shading and wildlife linkages. Potential enhancement opportunities to be investigated include: <ul style="list-style-type: none"> <li>○ A minimum 15 m natural vegetation protection zone should be applied to each bank of the sinuous channel;</li> <li>○ Revegetate riparian areas with the objective to restore 50-75% of the corridors with self-sustaining woody vegetation.</li> </ul> </li> </ul>
6.0	<ul style="list-style-type: none"> <li>• To the extent possible, extend riparian areas and increase their degree of naturalness through the removal of invasive, exotic species and the planting of native species.</li> <li>• Heavily eroded banks between the QEW and the CN rail line would benefit from riparian plantings. Assess the feasibility of culvert replacements at the CNR crossing to improve water quality and the possibility of fish migration.</li> <li>• Consider opportunities to reconnect flood plain access upstream of the QEW (SCUBE West Subwatershed Study: Phase 1 and Phase 2 Final Report, Section 3.2.4.4.2).</li> <li>• Incorporate riparian habitat enhancements with recommended stream restoration works between the QEW and Barton Street.</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Assess opportunities to improve the ecological function of Watercourse 6.0 through plantings along its east bank immediately downstream of Highway 8.</li> <li>• Secure banks and improve aquatic habitat through riparian plantings at erosion points.</li> <li>• Assess the feasibility of replacing the deteriorated culvert at Barton Street</li> </ul>	<ul style="list-style-type: none"> <li>• Riparian habitat corridor and linkage enhancements to improve downstream aquatic habitat, bank stability, stream shading and wildlife linkages. Potential enhancement opportunities to be investigated include: <ul style="list-style-type: none"> <li>○ Widen watercourse corridor to allow channel to retain sinuous form;</li> <li>○ A minimum 15 m natural vegetation protection zone should be applied to each bank of the sinuous channel;</li> <li>○ Revegetate riparian areas with the objective to restore 50-75% of the corridors with self-sustaining woody vegetation.</li> </ul> </li> <li>○</li> </ul>

Watercourse	Zone A	Zone B	Zone C
7.0	<ul style="list-style-type: none"> <li>Riparian plantings along erosion points on the west bank between the QEW and Barton Street would improve aquatic habitat and increase bank stability.</li> <li>Assess the feasibility of eliminating the grade control structure at the CN rail line to increase the possibility of fish migration upstream.</li> <li>Incorporate riparian habitat enhancements with planned channel capacity improvements between the QEW and Barton Street.</li> </ul>	<ul style="list-style-type: none"> <li>The existing culvert at the proposed east-west road crossing upstream of Glover Road should be replaced; the use of an open-bottom culvert should be considered to facilitate fish passage.</li> <li>The City of Hamilton should explore opportunities to encourage stewardship of watercourses. Potential measures include providing support for the purchase of riparian plantings and facilitating the development/distribution of educational/interpretive materials.</li> </ul>	<ul style="list-style-type: none"> <li>Riparian habitat corridor and linkage enhancements to improve downstream aquatic habitat, bank stability, stream shading and wildlife linkages. Potential enhancement opportunities to be investigated include: <ul style="list-style-type: none"> <li>Widen watercourse corridor to allow channel to retain sinuous form;</li> <li>A minimum 15 m natural vegetation protection zone should be applied to each bank of the sinuous channel;</li> <li>Revegetate riparian areas with the objective to restore 50-75% of the corridors with self-sustaining woody vegetation.</li> </ul> </li> </ul>
9.0	<ul style="list-style-type: none"> <li>Incorporate a minimum 15 m wide vegetation protection zone along each side of the proposed channel improvements along the West Tributary of Watercourse 9.</li> <li>Assess the feasibility of eliminating the barrier to fish movement at the QEW.</li> </ul>	NOT APPLICABLE	NOT APPLICABLE
Fifty Creek	<ul style="list-style-type: none"> <li>Assess the feasibility of eliminating the barrier to fish movement at the QEW.</li> </ul>	<ul style="list-style-type: none"> <li>To the extent possible, enhance 30 m VPZ with riparian plantings throughout Zone B.</li> </ul>	<ul style="list-style-type: none"> <li>Riparian habitat corridor and linkage enhancements to improve downstream aquatic habitat, bank stability, stream shading and wildlife linkages. Potential enhancement opportunities to be investigated include: <ul style="list-style-type: none"> <li>Widen watercourse corridor to allow channel to retain sinuous form;</li> <li>A minimum 15 m natural vegetation protection zone should be applied to each bank of the sinuous channel;</li> <li>Revegetate riparian areas with the objective to restore 50-75% of the corridors with self-sustaining woody vegetation.</li> </ul> </li> <li>Assess the feasibility of eliminating the barrier to fish movement at the Highway 8 east tributary crossing.</li> </ul>





- LEGEND:**
- Study Area - SCUBE East Subwatershed Study
  - Land Under Consideration for Urban Development
  - Assessed as Linkages of Other Natural Vegetation Type
  - Urban – Not Subject to Policies of Greenbelt Plan
- ELC Vegetation Community**
- CUM1-1 (Mineral Cultural Meadow)
  - (Grey Dogwood Cultural Thicket)



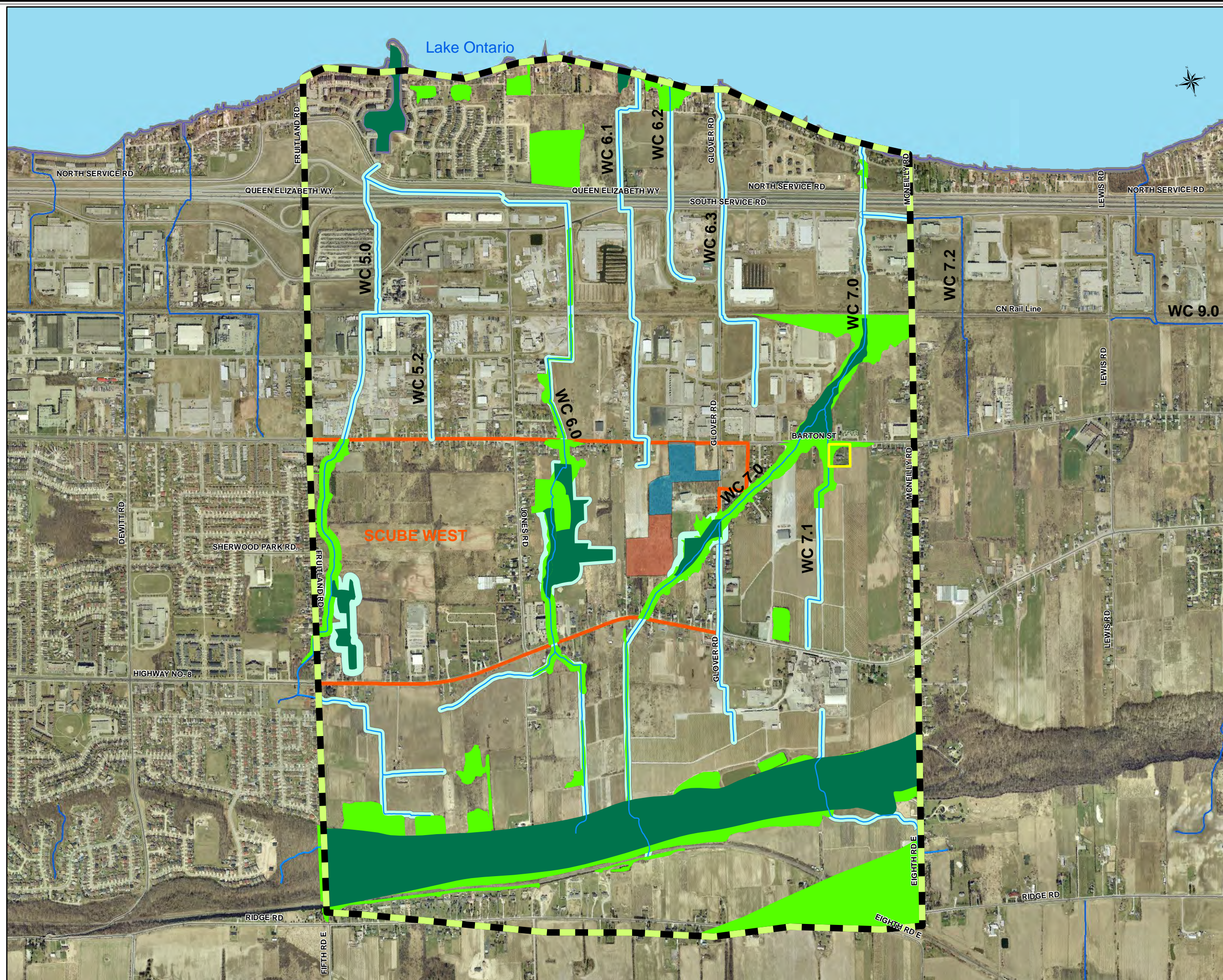
**Development of Natural Heritage System Linkages**

**SCUBE EAST**

**FIGURE No. 8.12**

DATE: February 23, 2012





**KEY MAP**

**LEGEND:**

- Study Area Boundary - SCUBE West Subwatershed Study
- Land Under Consideration for Urban Development
- Urban - Not Subject to Policies of Greenbelt Plan
- Core Areas
- Linkage
- Vegetation Protection Zone (15 Meter Buffer)
- Watercourse
- Candidate Core Area
- Candidate Linkage

**NOTES:**

0 100 200 400 600 800 1,000  
Meters

Recommended Natural Heritage System

SCUBE WEST

**FIGURE No. 8.13**

DATE: February 23, 2012



#### **8.6.7.1 Wetlands Associated with Watercourse 5**

Two wetlands (Wetlands 1 and 4) are associated with Watercourse 5.0. Wetland 1 is a Core Area and consists primarily of deciduous swamp with a small lobe of meadow marsh extending from its northeast corner. Wetland 4 is a Linkage of Other Natural Vegetation Type and consists of a small block of deciduous swamp located approximately 50 m downstream of Wetland 1. Wetlands are not widely represented in SCUBE West, and as such those that form part of the recommended NHS should be protected from potential negative effects of future development. To this end, Aquafor Beech Limited recommends three enhancement measures as described below.

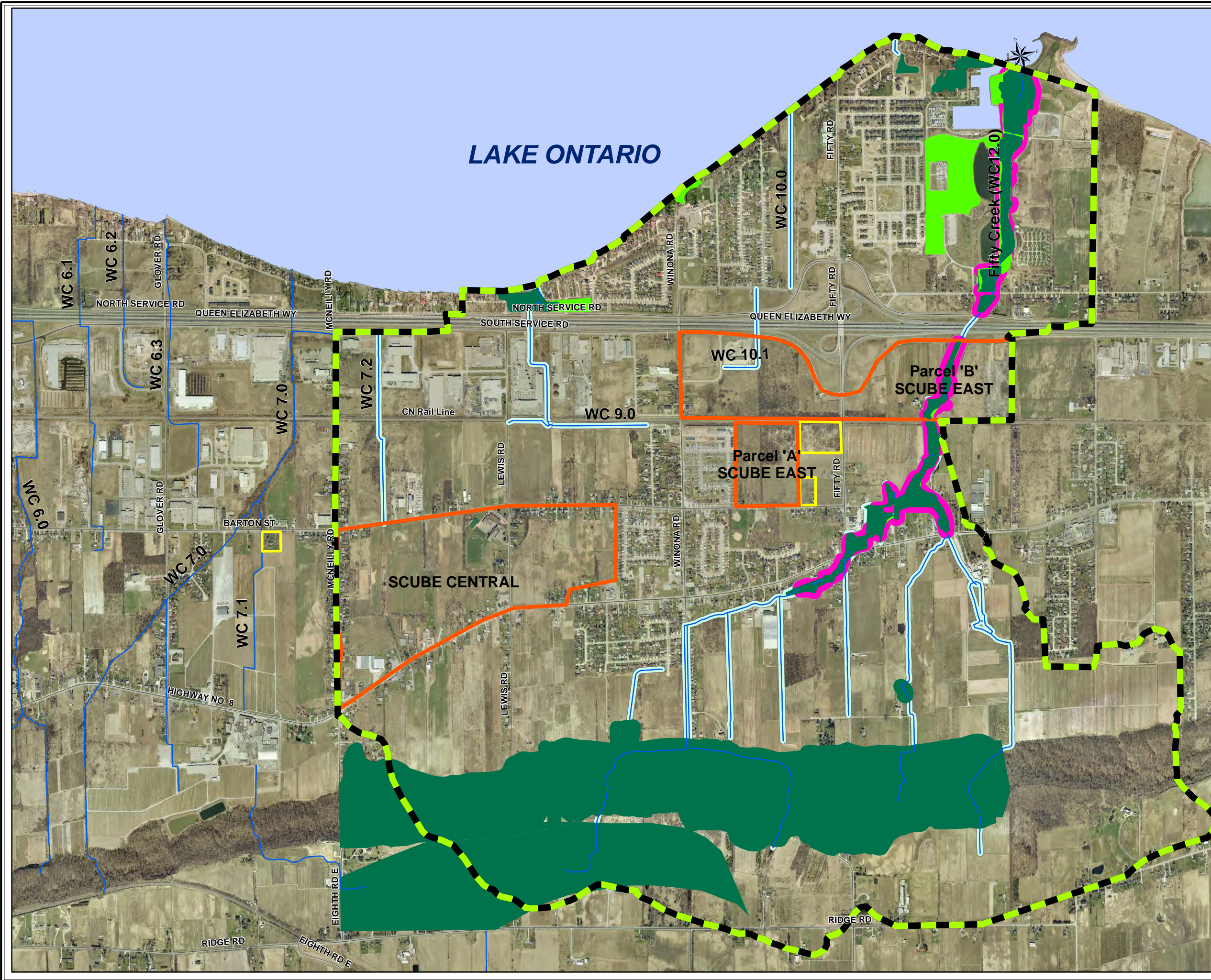
- (1) The northern and southern portions of Wetland 1 are connected by a narrow corridor approximately 30 m wide. Aquafor Beech Limited recommends that enhancement plantings be used to widen this corridor and consolidate Wetland 1 as a single wetland block.
- (2) To increase the diversity of adjacent habitats, Aquafor Beech Limited recommends that active restoration be used to convert the cultural meadow located between the two northern lobes of Wetland 1 to thicket or woodland.
- (3) Fruitland Road is proposed to be realigned to the east of Wetland 1 in the future. Consequently this Core Area will be bound to the east and west by roads and possibly other urban development. The swamp and marsh communities that comprise Wetland 1 likely support Western Chorus Frog (*Pseudacris triseriata*, Carolinian population) and the light and noise from future land uses have the potential to disrupt the breeding patterns of this species. To enhance the edge habitat of Wetland 1 and attenuate light and noise from existing (i.e. residential housing) and future land uses, Aquafor Beech Limited recommends that wet-tolerant native evergreen trees such as Eastern White Cedar (*Thuja occidentalis*) be planted in parallel offset rows approximately three-four trees deep as a component of a vegetated buffer to Wetland 1.

#### **8.6.7.2 Core Areas Associated with Watercourse 6**

Woodland 2 is a Core Area located adjacent to a number of different habitat types including thicket (Linkage 4), meadow (Linkage 5), deciduous swamp (Wetland 2) and Watercourse 6.0. The proximity of Woodland 2 to these other habitat types increases its significance to wildlife; the NHRM (MNR 2000) and the Significant Wildlife Habitat Technical Guide (MNR 2000) both note that areas containing a diversity of habitats and/or having a diversity of habitat types in close proximity are more valuable than those that are uniform or removed from dissimilar habitats. Accordingly, Woodland 2 is the focus of several proposed enhancements.

Two pinch points link the three forest lobes that together comprise Woodland 2. Pinch Points A and B (Figure 8.14) are located adjacent to the northeast and southeast corners of Linkage





**KEY MAP**

**LEGEND:**

- Study Area - SCUBE East Subwatershed Study
- Land Under Consideration for Urban Development
- Urban – Not Subject to Policies of Greenbelt Plan
- Core Areas
- Linkage
- Vegetation Protection Zone (30 Meter Buffer)
- Vegetation Protection Zone (15 Meter Buffer)
- Watercourse

**NOTES:**

0 125 250 500 750 1,000  
Meters

**Recommended Natural Heritage System**

**SCUBE EAST**

**FIGURE No. 8.14**

DATE: February 23, 2012



5, respectively. As described below, the planting of native trees and shrubs in these areas would reduce the edge-interior ratio of Woodland 2 and also improve opportunities for wildlife movement. Plantings could include but are not necessarily limited to forest nucleation pods and banded buffer plantings.

Pinch Point A consists of a narrow strip of trees that connects the northern and middle lobes of Woodland 2. To facilitate wildlife movement, a portion of the meadow west of Pinch Point A (Linkage 5) should be reforested so that the forested connection between the two lobes is a minimum of 30 m wide. The majority of the meadow community would remain intact and continue to provide habitat for wildlife. Similarly, a portion of the thicket east and west of Pinch Point B (Linkage 7) should be reforested to connect the outer edges of the middle and southern lobes of Woodland 2. Additional forest-thicket interface exists further north at Linkage 4, and it is not anticipated that the habitat value of the NHS in the vicinity of Watercourse 6.0 would be adversely affected by the replacement of a small area of thicket with a forest community. In addition to decreasing its edge-interior ratio, recommended enhancement plantings at Pinch Points A and B would increase the forested area of Woodland 2 and make the immediate areas more attractive for north-south wildlife movement. Common edge effects such as adverse microclimate conditions due to wind and sunlight, and infiltration of exotic species would also be locally minimized.

A second Core Area, Wetland 2, is located along Watercourse 6.0. A vineyard and orchard currently abut the western edge of Wetland 2. These anthropogenic habitats provide some buffer function to Wetland 2. However, if the lands east of Jones Road are subject to further urban development, Aquafor Beech Limited recommends that enhanced buffers be established along the entire western edge of Wetland 2.

Lastly, woody riparian plantings should be installed along Watercourse 6 from Highway 8 downstream to Woodland 2 to establish a buffer (vegetation protection zone). Ideally the vegetation protection zone would be 15 m wide on either side of the watercourse, however, given the existing development in the vicinity of this portion of Watercourse 6, the 15 m width may not be attainable. Species selection should account for the potential impacts of salt spray from Highway 8.

### ***8.6.7.3 Wetlands Associated with Watercourse 7***

One Core Area (Wetland 3) and one Linkage of Other Natural Vegetation Type (Wetland 7) are associated with Watercourse 7.0. Wetland 3 consists primarily of Willow deciduous swamp; a small lobe of Green Ash deciduous swamp extends from its western edge. Immediately downstream of SCUBE West, Watercourse 7.0 extends through a residential area; further downstream, between Barton Street and the CN rail line, Watercourse 7.0 flows through a deciduous forest community.

Aquafor Beech Limited recommends enhancement of the floodplain surrounding Wetland 3 and the riparian areas of Watercourse 7 between Highway 8 and Glover Road through the use of site-specific plantings. Enhancement plantings should consist of native trees and shrubs.



Enhancement plantings between Highway 8 and Wetland 3 should encompass Wetland 7 and be wide enough to function ecologically as a riparian corridor, as connected habitat patches are more valuable than disjunct habitat patches (MNR 2010). Aquafor Beech Limited also recommends that the lands within the floodplain adjacent to Wetland 3 be subject to restoration consisting of nucleation pods planted in a gradient of concentration from the edge of Wetland 3 (higher concentration) outwards to the limits of the floodplain (lower concentration). Such a planting density gradient would mimic patterns of natural succession, providing habitat diversity within the ecotone and enhancing its potential use by wildlife (MNR 2000). Recommended riparian plantings would have the added benefit of improving water quality and enhancing aquatic habitat.

#### ***8.6.7.4 SCUBE Central***

Given the current uncertainty surrounding the identification of Bobolink habitat for the purposes of the Endangered Species Act (2007), specific enhancement/restoration measures are not recommended for SCUBE Central at this time.

#### ***8.6.7.5 Woodland 5***

A single Core Area (Woodland 5) is located within SCUBE East. Woodland 5 consists of deciduous forest that extends along Fifty Creek from Lake Ontario to immediately south of Highway 8. The edge-interior ratio of Woodland 5 is relatively high. Core areas with a low edge-interior ratio are more valuable ecologically than those with a high ratio (MNR 2010). Accordingly, Aquafor Beech Limited recommends restoration of portions of Woodland 5 to improve (i.e. reduce) its edge-interior ratio.

Reforestation efforts within Woodland 5 appear to have already taken place between South Service Road and the CN rail line. Further reforestation efforts are not recommended in the adjacent cultural meadow to the east (Linkage 17) due to the presence in this area of Eastern Meadowlark, a nationally and provincially Threatened grassland species. Instead, reforestation efforts should be concentrated in canopy gaps and along forest edges south of the railroad tracks and west of Bridgman Lane. It is worth noting that buffer plantings along forest edges would likely fill a substantial portion of the exterior forest edges recommended above for reforestation. To save costs and minimize disruption of sensitive habitat, reforestation efforts within Woodland 5 could also be coordinated with riparian habitat enhancement within the 30 m VPZ associated with Watercourse 7.

Aquafor Beech Limited also recommends investigation of opportunities to enhance connectivity between the southern limit of Woodland 5 and the Niagara Escarpment. Linkages should be built on wildlife movement pathways associated with existing hedgerows and watercourses, and should be enhanced through continuous tree and shrub plantings to a minimum total width of 30 m. To the extent possible, these linkages should incorporate other areas of retained natural vegetation.

#### **8.6.7.6 Watercourses 5 and 6**

Watercourses 6 and 7 originate in the escarpment and drain north, ultimately draining to Lake Ontario. Upstream of Barton Street, both Watercourses exhibit a more natural form than downstream reaches where historical channel adjustments such as straightening, hardening and entrenchment have resulted in unstable channel conditions and highly degraded aquatic habitat. To help stabilize downstream reaches and improve aquatic habitat, Aquafor Beech Limited recommends stream restoration and riparian plantings on Watercourses 5 and 6 downstream of Barton Street. These works are intended to contribute to the enhancement of these watercourses so that they can function as direct fish habitat.

The proposed stream restoration works should include reconnecting flood plain access upstream of the QEW in areas of channel incision and mitigating any barriers to fish movement, both natural and anthropogenic. Also, native riparian plantings in extended riparian areas consisting of native woody vegetation will help increase the degree of naturalness while stabilizing eroded banks and improving water quality, stream shading and aquatic habitat.

#### **8.6.7.7 Barriers to Fish Movement**

Proposed watercourse restoration works and riparian plantings are intended to contribute to watercourse enhancement through the creation of direct fish habitat. However, if there are barriers to fish migration to upstream reaches, the enhancement works will not create direct habitat, but simply contribute to direct downstream habitat. Removal of barriers to fish migration is essential to converting indirect fish habitat to direct fish habitat.

Aquafor Beech Limited identified three culverts within the study area of the SCUBE East Subwatershed Study that represent a barrier to fish passage (Figure 8.6):

- Watercourse 9 – QEW culvert
- Fifty Creek – QEW culvert
- Fifty Creek (East Tributary) – Highway 8 culvert

Fifty Creek is classified direct fish habitat from Highway 8 downstream to Lake Ontario even though the QEW culvert acts as a barrier to fish migration, restricting the movement of fish from Lake Ontario to upstream reaches and segregating existing upstream populations. Removal or mitigation of this barrier would help facilitate the migration of fish to upstream reaches, improving aquatic habitat and population diversity while stabilizing population dynamics throughout Fifty Creek. Upstream of Highway 8, the East Tributary of Fifty Creek is classified indirect fish habitat. Removal or mitigation of the Highway 8 culvert may help facilitate fish migration upstream of Highway 8, converting indirect fish habitat to direct fish habitat.

Watercourse 9 is also classified indirect fish habitat upstream of the QEW, functioning to support direct fish habitat downstream. As with Fifty Creek, removal or mitigation of the barrier to fish migration at the QEW may help improve aquatic habitat by facilitating fish migration and populating upstream reaches.



#### **8.6.7.8 Zone C Riparian Habitat Enhancements**

The Subwatershed Strategy recommends the enhancement of riparian habitat along Watercourses 5.0, 6.0, 7.0 and Fifty Creek between the Niagara Escarpment and Highway 8.

The objective of the recommended riparian habitat enhancements is to improve the ability of headwater reaches of Watercourses 5.0, 6.0, 7.0 and Fifty Creek to function as linkages between the Niagara Escarpment and Core Areas of the recommended NHS within Zone B, particularly the Fifty Creek Valley Environmentally Significant Area. Recommended enhancements will improve opportunities for wildlife movement and enhance downstream aquatic habitat through increased bank stability and stream shading.

Site-specific restoration/planting plans should be prepared by a qualified professional (e.g. botanist, ecologist or landscape architect) to guide recommended riparian habitat enhancements. These may include restoration/enhancement plantings and/or the control of invasive species. The development of restoration/planting plans should be informed by the findings of the SCUBE Subwatershed Study. However, restoration/planting plans should also reflect new information derived from future studies and changes in COSEWIC/COSSARO status designations. Site-specific restoration/planting plans should account for the habitat requirements of species at risk and/or species of conservation concern, if present. Restoration/planting plans should also include recommendations to monitor the establishment/survival of enhancement plantings. Where possible, efforts should be made to incorporate adjacent natural areas into enhanced watercourse corridors.

### **8.7 Natural Heritage System Management**

#### **8.7.1 Trails**

The Fruitland-Winona Secondary Plan draft preferred land use option identifies a conceptual trail network that includes the following:

- The Barton Street Pedestrian Promenade (BSPP) - a City of Hamilton-owned multi-use pathway located along the south side of Barton Street that is to connect public spaces such as schools and City Parks. Where possible, the BSPP is to encourage connections with adjacent natural areas, streets and trails.
- A multi-purpose pedestrian trail link that is to extend east of Jones Road to connect proposed Collector Road B and proposed Collector Road C (hereafter, Trail A).

It is anticipated that the City of Hamilton will complete an Environmental Impact Statement (i) to assess any proposed connection between the BSPP and elements of the SCUBE NHS and (ii) to determine the exact location, design and construction material requirements for

Trail A. To guide the trail identification process, Aquafor Beech Limited recommends the following:

- Trails should avoid Core Areas of the SCUBE NHS.
- Per Section 2.5.14 of the City of Hamilton Urban Official Plan, trails should avoid the Vegetation Protection Zones associated with the Core Areas of the SCUBE NHS.
- The City of Hamilton should survey existing informal trails in and adjacent to the SCUBE NHS. Existing informal trails should generally be closed. Those in the vicinity of formal trails should be actively restored; others should be allowed to naturalize through passive regeneration.
- If desirable, existing informal trails should be formalized, provided that they are located in ecologically suitable locations.
- Trails should avoid confirmed and potential habitat for species at risk and locally rare species; consideration should be given to the incorporation of enhanced buffers where trails extend within 120 m of such habitat.
- The trail footprint should be kept to a minimum. Standard construction best management practices should be employed to minimize potential impacts to adjacent natural features; the timing of trail construction should also consider wildlife activities (e.g. nesting) that may be sensitive to human disturbance.

Aquafor Beech Limited does not support trails that would negatively impact the natural features or ecological functions of the SCUBE NHS. The Core Areas and Linkages located along Watercourse 6.0 comprise the single largest block of retained natural habitat within SCUBE West. To avoid fragmenting this block, Aquafor Beech Limited recommends that Trail A avoid its deciduous forest and wetland communities altogether. Ideally, Trail A would cross Watercourse 6.0 immediately upstream or downstream of Woodland 2. Alternatively, Aquafor Beech Limited recommends that Trail A cross Watercourse 6.0 immediately north of Wetland 2 and extend east through Woodland 2 along the interface of Linkages 4 and 5.

To minimize the potential impacts of future trail use on the SCUBE NHS, Aquafor Beech Limited further recommends the following:

- Trails should be well marked.
- Waste disposal bins should be provided in the vicinity of the trail.
- Interpretive signage (i.e. stay on marked trail, no dumping of yard waste) should be used to encourage the public to protect the SCUBE NHS.

### **8.7.2 Road Crossings**

The Fruitland-Winona Secondary Plan draft preferred land use option identifies two new road crossings of watercourses within SCUBE West. Collector Road B is proposed to cross Watercourse 5.0 approximately 30 m north of Wetland 4. Collector Road C is proposed to



cross Watercourse 6.0 midway through Wetland 3. These proposed crossing locations are considered in greater detail below.

For the location of the proposed road crossing of Watercourse 5.0, Aquafor Beech Limited notes the following:

- No significant and/or sensitive aquatic habitat is present at the proposed crossing location.
- The riparian habitat at the proposed crossing location consists of a disturbance-tolerant cultural meadow community; woody vegetation is generally lacking.
- Watercourse 5.0 has previously been disturbed in the vicinity of the proposed road crossing location and is currently conveyed beneath an existing farm land through a steel pipe approximately 1.5 m in diameter.
- Watercourse 5.0 is relatively straight at the proposed road crossing location; this configuration should permit location of the crossing structure perpendicular to the direction of flow.

Although significant and/or sensitive aquatic habitat is not present at the location of the proposed road crossing of Watercourse 7.0, Aquafor Beech Limited notes the following:

- The proposed crossing bisects a relatively significant/sensitive deciduous swamp (Wetland 3).
- The proposed crossing is located upstream of a previously disturbed reach of Watercourse 7.0 where it is currently conveyed beneath an existing pedestrian crossing through a corrugated steel pipe culvert approximately 60 cm in diameter.
- Watercourse 7.0 is relatively straight at the proposed road crossing location; however, the existing channel would need to be realigned to set the crossing structure perpendicular to the direction of flow.

Wetlands are not widely represented in SCUBE West and as such those that form part of the SCUBE NHS should be protected from the potential negative effects of future development to the extent possible. Accordingly, Aquafor Beech Limited recommends the following:

- To the extent possible, the proposed road crossing of Watercourse 5.0 should be located as far north of Wetland 4 as possible to avoid potential indirect impacts. Such impacts could include the loss of wetland vegetation from changes in hydrology or contamination of the wetland by salt spray.
- The location of the proposed road crossing of Watercourse 7.0 should be reconsidered. Aquafor Beech Limited recommends that Collector Road C intersect Glover Road north of Wetland 3. This option would require Collector Road C to extend across the cultural thicket at the southern limit of Woodland 6 but would avoid fragmentation of Wetland 3. A second, less preferable option would be for Collector Road C to cross Watercourse 7.0 immediately upstream of Wetland 3. This option would also avoid fragmentation of Wetland 3, but would largely nullify efforts to improve connectivity between Wetland 3

and Wetland 7 through the recommended enhancement of the floodplain between Highway 8 and Glover Road.

- Should the location of the currently proposed road crossing of Watercourse 7.0 be confirmed, the feasibility of installing wildlife crossing structures for amphibians and other terrestrial mesofauna should be explored to mitigate impacts (i.e. wildlife road mortality and habitat fragmentation).

The structures required for the proposed road crossings will be determined at the detailed design stage. The type of crossing structure to be used will be based on site-specific conditions. From a hydraulics perspective, watercourse crossings should have adequate openings to convey design flows with the required freeboard and clearances without increasing floodwaters in the existing channel upstream of the structure and without increasing the erosion and scour potential downstream.

### **8.7.3 Stewardship**

Aquafor Beech Limited recommends that the City of Hamilton develop educational materials to encourage local stewardship of the SCUBE NHS. In particular, Aquafor Beech Limited recommends that City of Hamilton prepare an education brochure to distribute to residents within the planning area of the Fruitland-Winona Secondary Plan. Such brochures should:

- Emphasize the importance of conserving retained natural areas in urbanizing landscapes.
- Provide an overview of the significant natural heritage features and functions of the SCUBE NHS.
- Provide specific recommendations to residents to promote environmental stewardship. Topics to be addressed could include (i) the proper means to dispose of organic and hazardous waste; (ii) recommended measures to avoid recreational impacts (e.g. stay on designated trails), (iii) examples of encroachment and their potential impact on retained natural areas, (iv) the importance of keeping cats indoors and dogs on a leash; (v) the use native species rather than invasive exotics in landscaping; and (vi) the proper use of pesticides.
- Outline the environmental responsibilities of the City of Hamilton, developers and local residents.
- Promote opportunities for resident participation in the management and restoration of retained natural areas.
- Provide contact information for sources of additional information and support for stewardship efforts, such as the Hamilton-Halton Watershed Stewardship Program and the Hamilton Landowner Stewardship Council.

Opportunities to restore and enhance natural areas exist throughout the SCUBE Subwatershed. In the interest of long-term environmental recovery and sustainability, Aquafor Beech Limited encourages the City of Hamilton, Hamilton Conservation Authority and other relevant agencies to engage communities, organizations and other interest groups in



support of Stewardship projects throughout the Subwatershed. Opportunities to engage community partners such as the Hamilton-Wentworth Stewardship Council, ReLeaf Hamilton, the Hamilton Naturalists Club, and the Field and Stream Rescue Team should be investigated. Aquafor Beech Limited has identified three stewardship initiatives that would be beneficial to the recovery, enhancement and long-term sustainability of the SCUBE Subwatershed:

- 1) Encourage landowners to avoid cutting grass to the edge of a watercourse and to help maintain naturally vegetated riparian areas. Healthy riparian areas will help maintain aquatic habitat health and water quality while providing habitat for terrestrial animals and birds.
- 2) Enhance aquatic habitat by eliminating anthropogenic debris, particularly old tires, water barrels, picnic tables and garbage bags from Watercourse 6 between Barton Street and Highway 8.
- 3) Remove anthropogenic debris from the Fifty Creek Wetland Complex. Removing debris from within this wetland will eliminate barriers to fish movement and prevent the leeching of chemicals into the natural environment.

## **9 PUBLIC CONSULTATION**

The notice of Study commencement and Public Information Centre were published in the Hamilton Spectator in early June 2010.

The Public Information Centre was held on June 24, 2010 at Stoney Creek Municipal Office – Council Chambers (777 Highway No.8, Stoney Creek, Hamilton) from 6:00 p.m. to 8:00 p.m. The purpose of the open house was to define existing conditions, present evaluation criteria together with the alternatives and to present the recommended strategy. The open house consisted of display boards. Senior staff from the consulting team and the City were in attendance. A copy of the display panels are provided in Appendix F.

In total about 80 people attended the open house which was held in concert with the Secondary Plan open house. Only five comment sheets were returned and these are included in Appendix F. Throughout the course of the open house City staff, together with staff from the consultant provided responses to questions and clarifications raised by the public during the open house.



## 10 SUMMARY AND CONCLUSIONS

The City of Hamilton is in the process of preparing the Fruitland-Winona Secondary Plan in support of future urban development within the Stoney Creek Urban Boundary Expansion (SCUBE) area. This study, termed the SCUBE West Subwatershed Study, is one of two subwatershed studies undertaken in support of the development of the Fruitland-Winona Secondary Plan. The study area of the SCUBE West Subwatershed Study is located within the community of Stoney Creek and is bound by Lake Ontario to the north, the Niagara Escarpment to the south, Fruitland Road to the west and McNeilly Road to the east.

This Subwatershed Study is being undertaken in three phases:

1. Establish existing environmental conditions;
2. Evaluate future impacts and select, from a set of alternatives, a recommended management plan; and
3. Develop an implementation plan

This Report covers Phase 1 and Phase 2 of the Subwatershed Study process.

### Phase 1 – Establish Existing Environmental Conditions

The existing environmental resources within the study area were defined in order to identify key features and functions, to establish baseline conditions for the assessment of potential impacts from future urban development, and to identify development constraints and potential future opportunities. A summary of the key environmental features and functions is provided below.

- The rainfall-runoff response of the study area watercourses were assessed through a field monitoring program and hydrologic modelling. Streamflow and rainfall data were collected and used to calibrate a hydrologic model for Watercourses 5, 6, and 7. The model was then used to estimate flood flow rates at key locations within the watersheds for the 2-year through 100-year return periods. Hydraulic modelling developed as part of a separate study (Dillon, 2010) and updated as part of this Subwatershed Study, was then used to delineate flood hazard lands. The regulatory floodplains represent constraints to future development.
- Little background information is available to characterize the water quality for the study area streams (Stantec, 2010). However, based on typical conditions found in other areas with similar land uses, Watercourses 5, 6, and 7 are expected to have elevated levels of nutrients and bacteria, and locally high levels of metals and chlorides near the QEW corridor.
- The geology of the area is variable, consisting mainly of silt till, with an isolated band of sand near the base of the Escarpment. A water budget assessment was undertaken, and groundwater recharge rates were estimated at approximately 114 mm per year and 200 mm per year for the silt/clay, and sandy soils, respectively. In order to maintain the existing groundwater recharge rates and potential contributions to stream baseflows, it was recommended that stormwater management planning for future development include infiltration measures
- The existing stream morphology of the watercourses was reviewed and characterized. Existing erosion hazards were identified along stream reaches downstream of the

proposed future development lands, some of which were in close proximity to existing structures. Therefore, it is recommended that future stormwater management planning include erosion control facilities to prevent further negative impacts.

- The existing fisheries resources of the study area include both direct and indirect warmwater fish habitat within permanent, intermittent and ephemeral stream reaches downstream of the future development lands. It was recommended that the stream reaches classified as direct or indirect fish habitat be protected with a minimum Vegetation Protection Zone of 15 m from each stream bank.
- Terrestrial resources of the study area include agricultural areas comprised primarily of orchards and vineyards and also natural and cultural vegetation communities ranging from deciduous forests to meadow marsh and mixed meadows. A number of Class 2 and Class 3 terrestrial features were identified for protection by the Stoney Creek Open Spaces and Natural Environment System. Field investigations and further background reviews were also completed to inventory the vegetation communities, mammals, birds, amphibians, and invertebrates of the area. This review identified five bird species and seven reptile species classified as at risk.

#### Phase 2 - Evaluate Future Impacts, Review and Select A Recommended Management Plan

Subwatershed goals and objectives were defined for the various environmental resources within the study area. The potential impacts of proposed future urban development on these resources were then evaluated. Potential impacts include the following:

- Decreased groundwater recharge rates and corresponding increase in runoff volumes;
- Increased pollutant loadings and reduced water quality;
- Potential increased rates of erosion and flooding along downstream creek reaches;
- Weakened or destruction of aquatic habitats through degraded water quality, increased erosion, and reduced baseflows;
- Loss or weakening of terrestrial resources through fragmentation of wildlife corridors.

Alternative measures, referred to as Best Management Practices (BMP's), were reviewed to mitigate these potential impacts and meet the selected objectives. Consistent with the Environmental Assessment approach for the study, a wide range of alternatives were reviewed, screened and evaluated against various physical, social, technical and financial criteria.

Through the evaluation process, a preferred stormwater management strategy for the SCUBE West lands was selected, comprising a combination of the following:

- LID source controls for water balance as well as associated water quality and erosion benefits. The identified targets include:
  - Silt/clay soils - capture and infiltrate the first 1 mm over the catchment area for residential landuses, and 2.5 mm for commercial/institutional landuses;
  - Sandy soils - capture and infiltrate the first 2.5 mm over the catchment area.
- End-of-pipe wet ponds for Level 2 or "normal" water quality control, as well as post-to-pre runoff control for flooding and erosion. Targets for the proposed residential development within the Secondary Plan Area include:
  - 65m<sup>3</sup>/ha of permanent pool storage;
  - Approximately 450 m<sup>3</sup>/ha of active storage for erosion and flood control.
- stream restoration to benefit aquatic and terrestrial resources.

It was also recognized that the feasibility of end-of-pipe stormwater ponds is constrained somewhat by the size of the area it services. Therefore, for small catchment areas, less than 5 hectares in size, an alternative strategy was recommended in which traditional source controls would be applied in place of wet ponds.

In addition to the above, additional downstream works have been reviewed through other previous studies (Dillon, 2010 and Philips, 2003). These recommended works include:

- For Watercourse 5:
  - Culvert upgrades at Fruitland Road, Barton Street, CNR, and South Service Road;
  - Erosion control works from the QEW to the CNR crossing.
- For Watercourse 6,:
  - Culvert upgrades at Barton Street (Watercourse No. 6 and 6.1), Arvin Avenue (Watercourse 6.1, and 6.3), CNR(Watercourse No. 6, 6.1, and 6.3);
  - Erosion control works from the QEW to Barton Street
- For Watercourse 7:
  - Culvert upgrade at CNR;
  - Watercourse conveyance improvement through natural channel design; and

The Study also provided recommendations with respect to the Natural Heritage System. Aquafor Beech Limited used a systems approach to identify a recommended NHS for the study area of the SCUBE Subwatershed Study. The systems approach identifies a NHS that includes core areas while ensuring that smaller, less significant natural areas or degraded lands between these areas are maintained or restored to provide a connected system of natural areas.

Consistent with the Environmental Assessment approach for the study, the preliminary recommended Stormwater Management and Natural Heritage Strategies that comprise the results for the SCUBE West Subwatershed Study were presented to the public at an Open House event. Here, City staff and Study Team consultants provided responses to questions and clarifications raised by the public.

### Phase 3 – Develop an Implementation Plan

Although this current study covers only Phase 1 and Phase 2 of the Subwatershed Study process, a future Phase 3 Report will be prepared dealing with implementation of the Subwatershed Study results. In general, this third phase is anticipated to cover the following:

- review and selection of appropriate types of LID measures to be applied;
- design guidance for the proposed LID measures;
- design guidance for the proposed stormwater management ponds;
- review of the future report requirements for subsequent design phases of development;
- policy recommendations; and
- recommendations with respect to funding responsibility.



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