HANLON CREEK BUSINESS PARK CONSOLIDATED ENVIRONMENTAL IMPACT STUDY

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Report Title

Hanlon Creek Business Park – Consolidated Environmental Impact Study

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Report submitted on November 10, 2004

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1.0 Introduction

1.1 Study Area

In 1993, The City of Guelph annexed 1,489ha of land along its south and eastern boundary with the Township of Puslinch. A portion of this land was then designated by the City as Corporate Business Park and Industrial lands (called the 'Hanlon Creek Business Park'). The study area for this project is comprised of the lands between Downey Road and the Hanlon Expressway, and between Forestell Road and the south end of the Kortright subdivision along Teal Drive. The lands fall within Part Lots 16, 17, 18, 19 and 20 Concession 4 and Part Lots 16, 17, 18 and 19 Concession 5 in the former Geographic Township of Puslinch (now the City of Guelph). The lands are a mix of agricultural, meadow, woodland, forest, and provincially significant wetlands consisting of swamp, marsh, and thicket. Portions of the lands were designated as Provincially Significant Wetland.

The creek, wetlands and forested uplands in the study area are part of the much larger Hanlon Creek watershed. This watershed contains provincially significant wetlands (Hanlon Swamp, Hall's Pond Wetland), Environmentally Significant Areas (Speed River ESA, Hanlon Swamp ESA, Hall's Pond Wetland ESA), Areas of Natural and Scientific Interest (Paris-Galt-Moffat Moraine ANSI) and other unclassified natural areas. The wetlands in the study area are currently considered to be part of the Hanlon Swamp Wetland Complex and therefore are considered provincially significant.

This area encompasses a headwater tributary of Hanlon Creek. The tributary within the study areas was designated as Tributary A in the Hanlon Creek Watershed study.

1.2 Background

In 2000, an Environmental Impact Study for the proposed development of the Hanlon Creek Business Park was prepared by a team led by Totten Sims Hubicki Associates.

This EIS provided refined characterization of natural features and functions within the area, as well as information and analyses pertaining to hydrology and hydrogeology, servicing, heritage, etc. The EIS included a conceptual layout for the business park, including road network and lotting and assessed the potential impacts of the undertaking. The EIS was subsequently reviewed and approved by the GRCA (see November 9, 2000 letter from Natolochny to Hearne) as well as the City of Guelph and EAC Committee (see minutes of October 11, 2000).

Subsequent to completion of the EIS, further on-site investigations were completed including, review of vegetation boundaries and characterization by staff of the GRCA, on-site staking of the wetland boundary and the dripline of the deciduous woodlot south of Laird Road, review of the staked boundaries by staff of the GRCA and surveying of the staked boundaries. Staff of the GRCA (Wayne MacMillan) prepared a follow-up memo in October 2000, which provided recommendations regarding buffers that were consistent with those proposed in the original 2000 EIS. A brief Addendum letter report was prepared by Totten Sims Hubicki Associates in April 2001 which documented these refinements.

In 2002, the City of Guelph commissioned the firm of Green Scheels Pidgeon (GSP) to complete the subdivision land use and road layout design. As well, Totten Sims Hubicki Associates was retained to complete a servicing and preliminary servicing design for the Hanlon Creek Business Park.

A Second Addendum to the EIS was prepared in November 2002 based on the detailed characterization of the natural features documented in the EIS (with updates) and refinements to the layout of the undertaking. The treatment of the natural features, especially the buffers, remained consistent with the original EIS.

Additional refinements to our understanding of site conditions occurred including completion of a study of local hydrogeology completed by Waterloo Hydrogeologic (2004) entitled "*Hanlon Creek Business Park Hydrogeological Study*". In addition, further refinements of the proposed servicing of the lands was completed by Totten Sims Hubicki Associates and documented in a February 2004 report entitled "*Hanlon Creek Business Park Servicing Report*". Modifications to the Draft Plan of Subdivision

prepared by Green Scheels Pidgeon (2004) ensued. These changes and refinements to the proposed business park layout and subsequent information generated by other team members warranted a review and update of the EIS conclusions. This review and update to the report was detailed in the Third Addendum (February 2004).

The Third Addendum was circulated to staff of the GRCA, City of Guelph and presented to EAC in May 2004. A series of review comments were provided on this addendum, many of which related to the difficulties in following the analyses and agreements documented in the various EIS addenda. As a result it was agreed that a consolidated EIS would be prepared.

A brief summary of the evolution of the addenda and associated studies is provided below (see Table 1). This summary clarifies that original approaches to identifying and protecting the key (central) natural features and associated buffers have been maintained throughout over 4 years of study and design for the subject lands.

1.3 Report Structure

This consolidated EIS will reiterate the analyses used to arrive at the conclusions regarding the protection of these natural features, buffers, etc. The consolidated EIS will provide an updated analysis of the potential impacts of the proposed Business Park. In this way, the history of decisions and agreements associated with the undertaking are preserved, but at the same time provides the technical basis for these decisions in this updated report. The characterization of the natural features in the study area has built on the various investigations completed both before and during the study process. This includes a series of original field investigations completed in 2004, not previously reported on in earlier studies.

The Consolidated EIS is prepared as part of a package for submission and review, and although excerpts from these companion documents are included in the EIS, the reader is referred to these associated documents for further details:

GSP Group. 2004. Hanlon Creek Business Park Draft Plan of Subdivision. (September 2004)

Paradigm Limited .2004. Hanlon Creek Business Park Traffic Impact Study

Totten Sims Hubicki Associates. 2004. Hanlon Creek Business Park Servicing Report (September 2004).

Waterloo Hydrogeologic, Inc. 2004. Hanlon Creek Business Park Hydrogeological Study (September 2004).

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Table 1. Summary of Hanlon Creek Business Park Report History.

Document Title	Content	Associated Documents	Natural Heritage System & Constraints	Wetlands	Buffers
Totten Sims Hubicki Associates et al 2000. Hanlon Creek Business Park Environmental Impact Study. (August 2000).	EIS provided refined characterization of natural features and functions within the area, as well as information and analyses pertaining to hydrology and hydrogeology, servicing, heritage, etc. The EIS included a conceptual layout for the business park, including road network and lotting and assessed the potential impacts of the undertaking.	n/a	A three-tier constraint system was proposed that included features in which no development would occur, limited development areas and potential development areas. The NHS was based on protection of the central natural 'core' with some bulking up these features. Smaller, isolated wetlands were recommended for secondary consideration.	At the time of preparing the 2000 EIS, the wetlands associated with the study area had not been formally evaluated using the MNR Wetland Evaluation System. The EIS included a detailed analysis of the wetlands and recommended which wetland areas to be included in complex. Procedure was reviewed by staff of the MNR and accepted.	Buffers were recommended based on an iterative approach. Refinements to buffers recommended in the Hanlon Creek Watershed were detailed. Conclusions regarding buffers were reviewed and accepted (see Addenda #1). Staff of the GRCA participated in the EIS study in which buffers widths were examined and recommended.
Totten Sims Hubicki Associates. 2001. Hanlon West Business Park Environmental Impact Study. Addendum.	Further on-site investigations were completed including, review of vegetation boundaries and characterization by staff of the GRCA, on-site staking of the wetland boundary and the dripline of the deciduous woodlot south of Laird Road, review of the staked boundaries by staff of the GRCA and surveying of the staked boundaries.	GRCA. 2000. Memo from Wayne MacMillan re October 23, 2000 Site Visit.	This Addendum did not change the NHS and constraint level approach in the 2000 EIS.	The boundaries of the wetland were staked and reviewed by staff of GRCA. Staff of the GRCA agreed to the recommendations regarding treatment of the smaller wetlands vis-à-vis the	The GRCA provided a memo recommending buffers consistent with those recommended in the 2000 EIS.

				large central natural area.	
Totten Sims Hubicki Associates and Natural Resource Solutions Inc. 2002. Hanlon Creek Business Park Environmental Impact Study Addendum #2.	Green Scheels Pidgeon (GSP) completed the subdivision land use and road layout design. Totten Sims Hubicki Associates completed servicing and preliminary servicing design. Addendum included assessment of the potential impacts of the undertaking (esp. those features that differed from original EIS).	Green Scheels Pidgeon. 2002. Hanlon Creek Business Park Draft Plan of Subdivision. (July 16, 2002) Paradigm Limited. 2002. Hanlon Creek Business Park Traffic Impact Study Totten Sims Hubicki Associates. 2002. Hanlon Creek Business Park Preliminary Servicing and Stormwater Management Report (September 2002).	This Addendum did not change the NHS and constraint level approach in the 2000 EIS.	This Addendum was based on the wetland approach proposed in the original EIS and agreed to in Addendum #1.	This Addendum and associated studies/plans were based on the buffers proposed in the 2000 EIS
Natural Resource Solutions Inc. 2004. Hanlon Creek Business Park Environmental Impact Study Addendum #3.	Additional refinements to understanding of site conditions including completion of study of local hydrogeology. Further refinements of the proposed servicing of the lands were completed. Modifications to the Draft Plan of Subdivision. These changes and refinements to the proposed business park layout and subsequent information generated by other team members warranted a review and update of the EIS and Addenda impact analysis conclusions	Green Scheels Pidgeon. 2004. Hanlon Creek Business Park Draft Plan of Subdivision. (February 2004) Paradigm Limited .2004. Hanlon Creek Business Park Traffic Impact Study Totten Sims Hubicki Associates. 2004. Hanlon Creek Business Park Servicing Report (November 2003). Waterloo Hydrogeologic, Inc. 2004. Hanlon Creek Business Park Hydrogeological Study (November 2003).	This Addendum did not change the NHS and constraint level approach in the 2000 EIS.	This Addendum was based on the wetland approach proposed in the original EIS and agreed to in Addendum #1	This Addendum and associated studies/plans were based on the buffers proposed in the 2000 EIS

2.0 Study Methods

The natural features in the area have been documented and evaluated through several other studies in the past. Key documents reviewed for this work included:

- Totten Sims Hubicki Associoates, August 2000. Hanlon West Business Park Environmental Impact Study
- Totten Sims Hubicki Associates, March 2001. Hanlon West Business Park Environmental Impact Statement Addendum.
- Totten Sims Hubicki Associates, November 2002. Preliminary Stormwater Management Report & Environmental Impact Study Addendum #2.
- Totten Sims Hubicki Associates, February 2004. Environmental Impact Study Addendum #3.
- Planning and Engineering Initiatives Ltd. March 2003. Hanlon Creek State-of-the-Watershed Study.

Natural Resource Solutions Inc. (NRSI) conducted surveys on the subject lands to complete this Environmental Impact Study (EIS) and each of the above EIS documents. The data from previous reports has been compiled for the current study. Field surveys were completed in 1998, 1999, 2002, 2003, and 2004. During these site visits the following tasks were completed:

- Vegetation communities were mapped and described
- All species of vascular flora were recorded
- Breeding bird surveys were conducted (May and June 1999)
- Amphibian call surveys were conducted (evenings of April, 1999, as well as May 2000)
- All species of mammals, reptiles, and amphibians observed were recorded
- Aquatic habitat conditions were mapped and described.
- Fish communities were sampled.

NRSI undertook field surveys in 2004 to update and verify the findings of earlier studies. The vegetation communities were mapped on site using the Ecological Land Classification (ELC) system (Lee *et al*. 1998). Aerial photographs were used to

complete the vegetation mapping. Each vegetation community was recorded down to the ecosite and vegetation type level. 2004 field work took place on August 16, 23, 30, September 6 and September 30.

Observations of mammals, birds, and herpetofauna (reptiles and amphibians) were recorded during all field surveys.

The physical conditions of the watercourses and water bodies were described. The aquatic habitats were then divided into sections of stream (reaches) according to their physical qualities. Habitat characteristics and surrounding land features were described in detail for every reach. Lastly, the fish communities were sampled in multiple locations using a backpack electrofisher. The fish sampling goals were to sample in all habitat types and to continue sampling at each site until no new species were being captured.

The results of earlier and current field surveys have been integrated with background information sources to characterize the natural environment features in the area. The summary of existing conditions is included in Section 3 of this report.

3.0 Existing Conditions

3.1 Soils, Terrain and Drainage

The characteristics of the site drainage, topography and soils are documented in other studies, including:

- Hanlon West Business Park Environmental Impact Study. Final Report (TSH *et al.* 2000)
- Hanlon Creek Business Park Servicing Report (TSH 2004), and
- Hanlon Creek Business Park Hydrogeological Study Report (Waterloo Hydrogeologic Inc. 2004).

The following summary of site conditions has been extracted from these documents. For more details, the reader is referred to these documents.

The topography of the subject lands vary in elevation from 317.9 m in the central wetland at the northwest corner to 345.6 m at Forestell Road (TSH 2004). Much of the area is generally flat with small, gently rolling hills along Forestell Road and Phelan Drive in the south and southeast limits of the study area. North of Laird Road is flattest with one gently rolling hill near the northeast corner. Overall, the site drainage is northward (TSH *et al*. 2000). The main wetlands lie roughly in the centre of the study area surrounded by active or recently active agricultural lands. Typically, these fields represent the areas of higher elevation.

The study area is drained by three branches of Tributary A of the Hanlon Creek. The main tributary channel that drains the study area begins in the southern wetland, incorporates the ditch along the south side of Laird Road, flows under the road and through the central wooded area where it joins with the eastern tributary channel (referred to as Tributary A1 in this report). This eastern tributary channel begins in a tile drain system (within the fields along the east side of the study area) and appears at the surface, as a channel along the east edge of central wooded area.

Just downstream (north) of the confluence of the east and main branches, the creek flows into an on-line pond. Beyond the pond it enters another wooded area where the channel is somewhat less defined.

A third branch of the tributary drains the lands adjacent to Downey Road. This intermittent drain meets the main tributary near the northern boundary of the study area. The outflow of this area drains northward through the Kortright Subdivisions to join the Hanlon Creek, then generally west towards the Speed River located about 1.5 km west of the study area.

3.2 Geologic Setting

The study area is located on the northern base of the Paris Moraine, part of the regional Horseshoe Moraines physiographic feature. The Paris Moraine is generally comprised of the Wentworth Till, a stony sandy silt till deposit, which extends to about the southern edge of the study area. The moraine is reported to be generally “hummocky” and “hilly” in nature, ranging in elevation from about 330m to 345AMSL. The moraine forms a local ridge running east-west at the south limit of the study area.

A more recent deposit of outwash gravel covers the site area. The outwash gravel is generally flat, and occurs as a broad terrace trending east-west, and extending from the south limit of the study area northward to the Speed River and the edge of the City of Guelph. This outwash deposit ranges in elevation from about 320m to 330mAMSL (TSH 2000).

The outwash deposit was examined in some detail in the Aggregate Resources Inventory of Puslinch Township (OGS 1982). Site specific studies were also conducted in the southern portion of the study area, as a part of an aggregate resources inventory of the Crawley properties, by Geoconcepts Limited (1998). Based on these two assessments, the sand and gravel in the upper four metres is relatively coarse-grained and appears to be finer grained at depth. The water table is reported to vary from about 6.4m below surface at Forestell Road to 3.7m below ground surface near Laird Road.

Waterloo Hydrogeologic Inc. has since completed a hydrogeologic study of the subject lands (2004) and found that the shallowest depth groundwater in September 2003 was in the areas surrounding the creek and wetlands. In most of these areas, groundwater levels were less than 1.0m below ground surface. At different times of the year, specifically spring and late fall, the depth to groundwater is less. In fact, in April 2003, groundwater levels were above ground surface in three monitors (WHI 2004). Based on groundwater elevations WHI (2004) stated that: *" a portion of groundwater is discharging to this surface water system… The wetland and creek are interpreted to receive groundwater discharge from the shallow sand and potentially from the intermediate sand and gravel aquifer and the bedrock aquifer*".

3.3 Vegetation

3.3.1 Vascular Flora

A total of 270 species of vascular plants were observed in the study area during field surveys from 1998 to present. Many of these species are recorded from other reports (TSH 2000, 2001, 2002, 2004). A list of these species can be found in Appendix II of this report. The Hanlon Creek State of the Watershed study listed a total of 423 vascular plants reported from the watershed (PEIL 2003). Uncommon plant species in the Hanlon Creek Watershed were summarized in the Hanlon Creek State of the Watershed Study (PEIL 2003) and identified using a number of sources (see Table 2).

No provincially rare plant species have been reported from the study area.

The bolded plant species in Table 2 were observed in the central wetland area and large deciduous woodlot south of Laird Road. Based on published habitat preferences as listed in Table 2, the majority of these species would be expected to occur in the wetlands and/or along the creek.

Table 2. Uncommon Plant Species Recorded in the Study Area

(from PEIL 2003)

Scientific Name	Common Name	Status	Source*
Liparis lillifolia	Lily leaved Twayblade	Threatened	AA
Galearis spectabilis	Showy Orchis	Scarce	AA
Gentiana andrewsii	Closed Gentian	Occasional	AA
Osmunda claytoniana	Interrupted Fern	Rare	E
Solidago uliginosa	Bog Goldenrod	Occasional	E
Calamagrostis canadensis	**Canada Blue joint**	**Occasional**	**LGL**
Cinna arundinacea	Stout Woodgrass	Uncommon	LGL
Festuca rubra	Red Fescue	Uncommon	LGL
Hydrocotyle americana	Marsh Pennywort	Occasional	LGL
Ciracea alpine	Small Enchanter's Nightshade	Occasional	LGL
Cornus rugosa	Round leaved Dogwood	Rare	LGL
Scirpus cyperinus	Wool grass	Uncommon	OMNR
Thalictrum dasycarpum	Purple Meadow Rue	Scarce	OMNR
Cypripedium reginae	**Showy Lady's Slipper**	**Scarce**	**OMNR**
Platanthera sp			OMNR
Platanthera hyperborean	Northern Green Orchid	Municipally Rare	DB
Muhlenbergia mexicana	Muhyl Grass	Uncommon	OMNR
Panicum lanuginosum	Panic Grass	Uncommon	OMNR
Equisetum scirpoides	**Dwarf Scouring Rush**	**Unknown**	**OMNR**
Equisetum sylvaticum	Woodland Horsetail	Uncommon	DB
Malaxis monophyllos ssp.	White Adder's Mouth	Uncommon	OMNR
Bromus latiglumis	Tall Brome Grass	Occasional	OMNR
Ledum groenlandicum	**Labrador Tea**	**Municipally Rare**	**OMNR**
Spiranthes cernua	Nodding ladies' tresses	Rare	OMNR
Drosera rotundifolia	Round-leaved Sundew	Scarce	OMNR
Amerochis rotundifolia	Small Round-leaved Orchis	Rare	OMNR
Phegopteris connectilis	Long Beech Fern	Scarce	OMNR
Betula populifolia	Grey Birch	Scarce	LGL
Cephalanthus occidentalis	Buttonbush	Rare	LGL
Dryopteris X bootii	Boott's Wood Fern	Municipally Rare	LGL
Cyperus diandrus	Low Umbrella Sedge	Regionally Rare	OMNR
Coeloglossum viride	Long-bracted Orchid	Municipally Rare	DB (1914)

**Sources as per PEIL (2003)*
Municipally Rare - Don Britton, University of Guelph pers.comm.; Occasional – Wellington County (Eagles et al. 1976)
Regionally Rare - Central Region, OMNR (Riley 1989); Rare - Wellington County (Eagles et al. 1976); Scarce - Wellington County
(Eagles et al. 1976)
Threatened - provincially and nationally (Argus et al. 1982 - 1987); Uncommon - Wellington County (Eagles et al. 1976); Unknown
– Status Uncertain
AA = Alan Anderson; DB = Don Britton

Blue-joint grass (*Calamagrostis canadensis*) was recorded from the marsh (MAM3-1, ELC) in the northwest corner of the main portion of the Hanlon Creek PSW. Blue-joint grass is common and is provincially ranked as S5 (OMNR, 1998). Within Wellington County it was classified as Occasional in 1976 by Eagles *et al*.(1976); however, it is considered common within Wellington county by Riley (OMNR 1989). Blue-joint grass is extremely common across northern portions of Ontario where it shows little habitat preference (Dore and McNeill 1980). In southern Ontario, it can be found in swamps, bogs, ditches, and shorelines.

3.1.2 Vegetation Communities

The study area for this project is comprised of the lands between Downey Road and the Hanlon Expressway, and between Forestell Road and the south end of the Kortright subdivision along Teal Drive. The lands are a mix of agricultural, meadow, woodland, forest, and provincially significant wetlands consisting of swamp, marsh, and thicket.

Vegetation communities found within the study area are described below and are shown on Figure 1.

Upland Communities

Fresh - Moist White Cedar Coniferous Forest (FOC4-1)

Pockets of this community are found in a number of locations along the perimeter of the psw boundary. Even-aged white cedar (*Thuja* occidentalis) make up more than 90% of the canopy with scattered white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), and apple (*Malus pumilla*). The shrub-sapling layer is extremely sparse, consisting of a few white ash, and riverbank grape (*Vitis riparia*). The ground layer is almost bare with occasional herb roberts (*Geranium robertum*), clumps of sensitive fern (*Onoclea sesnsibilis*), and coltsfoot (*Tussilago farfara*).

Figure 1. Study Area and Vegetation Communities.

Fresh – Moist White Cedar – Hemlock Conifer Forest Type (FOC4-2)

White cedar is the dominant tree in this community with a range of size classes (5 – 60cm dbh). Hemlock (*Tsuga canadensis*) (35cm dbh), yellow birch (*Betula alleghaniensis*), trembling aspen (*Populus tremuloides*), and white pine (*Pinus strobus*) are found throughout the canopy. The shrub – sapling layer is sparse with more cedar and black cherry, and bitter nightshade (*Solanum dulcamara*). The herbaceous layer is very sparse with scattered ferns and sedges and tansy ragwort (*Senecio jacobaea*).

Fresh – Moist White Cedar – Balsam Fir Coniferous Forest Type (FOC4-3)

White cedar (22 cm dbh) dominates but is mixed with balsam fir (*Abies balsamifera*) (12 cm dbh), and to a lesser extent, yellow birch (26 cm dbh). The shrub sapling layer is generally sparse and includes dwarf raspberry (*Rubus pubescens*), poisin-ivy (*Rhus radicans*), glossy and European buckthorn (*Rhamnus frangula and R. cathartica*), and virginia creeper (*Parthenocissus quinquifolia*). Scattered ferns make up the herbaceous layer.

Fresh – Moist Hemlock mixed Forest Ecosite (FOM6)

Found in the centre of the main wooded area north of Laird Road, this community is an unusual mix of tree species resulting from past land-use and cannot be readily classified beyond ecosite. Hemlock (40 cm dbh) is the main conifer although some balsam fir is present, mixed with scattered American beech (*Fagus grandifolia*) (80 cm dbh), black cherry (33 cm dbh), white elm (*Ulmus americana*), trembling aspen, red ash (*Fraxinus pennsylvanica*), and hawthorn (*Crataegus spp.*). The shrub - sapling layer is sparse, consisting mostly of ash and red elder (*Sambucus pubens*). The herbaceous layer is equally sparse with jack-in-the-pulpit (*Arisaema triphyllum*), woodland sedges (*Carex spp.*), and some strawberry (*Fragaria vesca*).

Dry – Fresh Sugar Maple Deciduous Forest Ecosite (FOD5)

This wooded area is situated in the southeast corner of the study area and covers a moderate-sized hill. Sugar maple (*Acer saccharum*)(44 cm dbh) are mixed with black cherry, trembling aspen and hawthorn. The understorey is dense with European buckthorn, and scattered red-osier dogwood (*Cornus*

stolonifera), red panicled dogwood (*Cornus foemina)*, nannyberry (*Viburnum lentago*), and choke cherry (*Prunus virginiana*). The herb layer is species poor with Canada goldenrod (*Solidago canadensis*), New England aster (*Symphotrichum novae-angliae*), and scouring–rush (*Equisetum sp.*).

Fresh – Moist Sugar Maple Deciduous Forest Ecosite (FOD6)

Sugar maple (33 cm dbh) is the main canopy species in this larger forest unit south of Laird road. Other species that are distributed throughout the canopy are black ash (*Fraxinus nigra*), yellow birch, and to a lesser extent white cedar, bur oak (*Quercus macrocarpa*), white ash, basswood (*Tilia americana)*, red ash, and black cherry. The shrub-sapling layer is abundant with alternate-leaved dogwood (*Cornus alternifolia*), and ash saplings. Virginia creeper, riverbank grape, poison-ivy, currant (*Ribes sp.*), and blue beech (*Carpinus* caroliniana) also occur in this layer. The herbaceous unit is rich with wild ginger (*Asarum canadense)*, yellowish enchanter's nightshade (*Circea lutetiana*) , sedges, herb roberts, ferns, avens (*Geum sp.*), jack-in-the pulpit, and false solomon's seal (*Smilacina racemosa*).

Fresh – Moist Lowland Deciduous Forest Ecosite (FOD7)

A small area along the north side of Laird Road on both the east and west sides of a small creek channel is lowland deciduous forest. Due to its small size and anthropogenic disturbance history evidenced by garbage and old apple trees, this community cannot be classified more specifically than the ecosite level. The canopy is made up of basswood (45 cm dbh), sugar maple (20 cm dbh), bur oak, black ash, hawthorn, apple, and European buckthorn. The shrub-sapling layer includes alternate-leaved dogwood, blue beech, river-bank grape, white elm, and choke cherry. Yellowish enchanter's nightshade is the dominant herbaceous species and is mixed with sensitive fern, buttercup (*Ranunculus sp.*), sedge species, scattered jack-in-the-pulpit, and a few white trillium (*Trillium grandiflorum*).

Another moist lowland deciduous forest is found to the east of the main woods and wetlands. This area is scattered with large silver maple (*Acer saccharinum*) (85 cm dbh), basswood, red ash, black ash, balsam poplar (*Populus*

balsamifera), and white cedar. The subcanopy and understorey is predominantly large European and glossy buckthorn (up to 6 m in height). Sensitive fern, sedges, spotted water hemlock (*Cicuta maculata*), and wood nettle (*Laportea canadensis*) are found in the herbaceous layer.

South of Laird Road in the western most wooded area is another lowland deciduous forest. This area has a canopy mix of basswood, red ash, black cherry, with white cedar and a couple of white pine. The understorey is predominantly populated by buckthorn and alternate-leaved dogwood. The ground cover includes yellowish enchanter's nightshade, sensitive fern, jack in-the-pulpit, and sedges.

Fresh – Moist Poplar Deciduous Forest Ecosite (FOD8-1)

This small forest area is situated along the north side of Laird ride in a shallow U–shape around a reed canary marsh (MAM2-2). Trembling aspen is dominant with an average dbh of 37cm. Basswood (44cm dbh) occurs with sugar maple black cherry (40cm dbh) and bur oak. The understorey has large blue beech (5m in height), glossy buckthorn, alternate-leaved dogwood, and choke cherry. The herbaceous layer consists of Solomon's seal, zigzag goldenrod (*Solidago flexicaulis*), mayapple (*Podophyllum peltatum*), avens, and woodland sedges.

South of Laird Road, this forest is predominantly trembling aspen (25cm dbh) in the canopy with smaller white cedar and buckthorns establishing a sub-canopy. Red-osier dogwood, Virginia creeper, and tartarian honeysuckle (*Lonicera tartarica*) are also found in the shrub layer. Herbaceous plants are predominantly reed canary grass (*Phalaris arundinaceae*), goldenrods, and asters..

White Pine Coniferous Plantation Type (CUP3-1)

A small section of white pine plantation exists south of Laird road. Situated on an old and now grown-in south facing forest edge, white pine 15 – 42cm dbh make-up the canopy. European buckthorn dominates the shrub – sapling layer, and herbaceous plants are sparse.

Dry - Moist Old Field Meadow Type (CUM1-1)

This community is also widely distributed throughout the study area. Tree cover varies by canopy closure and species. Shrubs are generally in clumps and thicket areas and include red-osier dogwood, high-bush cranberry (*Viburnum trilobum*), nannyberry, red panicled dogwood, and occasional willows (*Salix spp.*). The herbaceous layer is often weedy with non-species including smooth brome grass (*Bromus inermus*), orchard grass (*Dactylis glomerata*), thistles (*Cirsium spp.*), Queen Anne's lace (*Daucus carrota*), and burdock (*Arctium minus*). Common native species include goldenrods, asters, and fleabanes (*Erigeron spp.*). One native grass species, river-bank wild rye (*Elymus riparius)* was found along the east side of Hanlon Creek, immediately south of the pond.

Mineral Cultural Savannah Ecosite (CUS1)

This community is located on the east side of the main woods and wetlands. The canopy is comprised of white cedar up to 25cm dbh widely spaced or in pockets interspersed with white ash, yellow birch, and black walnut saplings (*Juglans nigra*). Shrubs include high bush cranberry, red-osier dogwood and buckthorn. The herbaceous layer is predominantly old field goldenrods and asters.

Wetland Communities

White Cedar - Conifer Organic Conifer Swamp Type (SWC3-2)

This large swamp area is a mix of white cedar (23cm dbh), balsam fir (16cm dbh), and tamarack (*Larix laricina*)(29cm dbh), with scattered black ash in the canopy (approximately 85% canopy closure). The understorey is young cedar and balsam fir trees. The ground is hummocky and covered mostly in moss species.

White Cedar Hardwood Mineral Mixed Swamp Type (SWM1-1)

This community is found in several locations throughout the study area. Canopy closure is variable but averages 65%. This vegetation type makes-up the majority of the wooded area north of the pond. White cedars (dbh 25cm) occur throughout the lowest and wettest areas as well as the more upland edges along the eastern portion of this community. The canopy is 80% closed and includes

balsam poplar, and black ash. Glossy buckthorn is frequent in the understorey with dwarf raspberry, several ferns, spotted touch-me-nots (*Impatiens capensis*), yellowish enchanter's nightshade, great lobelia (*Lobelia siphilitica*), and strawberry in pockets.

This swamp community is also found in the wooded areas north of and south of Laird Road. In these areas white cedar is the dominant tree species by basal area (up to 40%), mixed predominantly with black ash, and yellow birch. Also occurring in pockets are red maple (*Acer rubrum*), hemlock, trembling aspen, white elm, and basswood. Black ash and yellow birch with balsam fir and glossy buckthorn dominate the shrub-sapling layer. Poison- ivy is common throughout along with dwarf raspberry.

Black Ash Mineral Deciduous Swamp Type (SWD2-1)

Black ash (25cm dbh) make-up 45% of the canopy in this area along with yellow birch, red maple, and balsam fir. Much of the shrub layer is low (<1 m) dwarf raspberry, and bitter nightshade. Glossy buckthorn occur up to 2m in height, and currant are also commonly found in the understorey. The herbaceous layer is dense with spotted touch-me-nots, and includes ostrich fern (*Matteuccia struthiopteris*), purple stemmed aster (*Symphotrichum puniceum*), jack-in-the-pulpit, and sedges.

Silver Maple Mineral Deciduous Swamp Type (SWD3-2)

This community is found in two locations within the study area. The first is located north of the main channel of Tributary A near the northern boundary of the study area. In this area, the canopy is roughly 55% closed and is dominated by silver maple which range in size from 40cm to 1.1m dbh. Other canopy species include bur oak, white cedar, and hawthorns along the western edge. The understorey is dominated by white ash saplings and the two species of buckthorn. The herbaceous layer includes spotted touch-me-nots, yellowish enchanter's nightshade, garlic mustard (*Alliaria officinalis*), and fringed loosestrife (*Lysimachia ciliata*).

This community is also found as an isolated area in the northeast end of the study area. At this site, silver maple is the dominant canopy species mixed throughout with black ash, and black walnut and cedar around the perimeter. The shrub – sapling layer is sparse with occasional red-osier dogwood and elderberry. Bitter nightshade is abundant on the forest floor to 0.5m in height. Herbaceous plants include ferns, water hemlock, and large patches of cardinal flower (*Lobelia cardinalis*).

Willow Mineral Thicket Swamp (SWT2-2)

Willow thickets occur in a few locations in the study area. In one location, a few crack willows (*Salix fragilis*), trembling aspen, and bur oak make up the limited canopy. In another, black ash saplings, up to 10cm dbh are converting this thicket into a young deciduous forest swamp. The shrub-sapling layer is comprised of Bebb's willow (*Salix bebbiana*), heart-leaved willow (*Salix eriocephala*), slender willow (*Salix petiolaris*), red-osier dogwood, and glossy buckthorn. The herbaceous component is dominated by reed canary grass, with several rush (*Juncus spp.*) and sedge species, narrow-leaved goldenrod (*Euthamia graminifolia*), boneset (*Eupatorium perfoliatum*), blue vervain (*Verbena hastata*), and narrow-leaved cattail (*Typha angustifolia*).

Bluejoint Mineral Meadow Marsh Type (MAM2-1)

This marsh lies along the west side of the swamp, north of the pond. It is abundant with blue-joint grass (*Calamagrostis* canadensis), reed canary grass, and broad-leaved tussock sedges. The southern portion of this community has a few red-osier dogwoods, aster species, and swamp milkweed (*Asclepis incarnata*). It is lowest and wettest along the eastern edge with the swamp and highest along the hedgerow adjacent to the agricultural fields.

Reed Canary Grass Mineral Meadow Marsh (MAM2-2)

This community exists in a number of locations throughout the study area. In different areas, shrub and tree cover varies from none to less than 25% while the herbaceous layer is fairly uniform. In several areas, blue-joint grass can be found. One area is found along the north side of Laird Road roughly halfway between the Hanlon Expressway and Downey Road. Although it is a wetland, it

is not a part of the Hanlon Creek psw. The canopy is roughly 15% closed by bur oak, white cedar, red ash, and a solitary sugar maple. The shrub-sapling layer is sparse with scattered choke cherry, European buckthorn, glossy buckthorn, and elderberry (*Sambucus canadensis*). The herbaceous component is dominated by reed canary grass, with several aster and goldenrod species. A large hemlock snag adjacent to Laird road and a nearby unhealthy white cedar would suggest salt-spray from winter road maintenance.

It is also found in the north-west corner of the site along the main channel of Tributary A and the ephemeral feeder channel. A true pocket of reed canary grass mineral marsh exists on the north side of the main channel. Here the dominant species is reed canary grass mixed with scattered cattails, and a small willow shrub less than 2.0m in height. The main channel and smaller feeder channel are dominated by reed canary grass with scattered pockets of red-osier dogwood up to 2.5m (roughly 25% by cover) and a mix of herbaceous species including sedges, purple-stemmed aster, and narrow-leaved goldenrod. The shrub cover along or adjacent to the channels suggests that this area may also qualify as a red-osier mineral thicket swamp (SWT2-5).

Broad-leaved Sedge Mineral Meadow Marsh (MAM2-6)

This community is dominated by broad-leaved tussock sedges (*Carex spp*.) mixed with scattered rushes, large clumps of purple-stemmed aster, panicled aster (*Symphotrichum lanceolatum*), narrow-leaved goldenrod, rice cutgrass (*Leersia oryzoides*), bitter nightshade, and boneset. Red-osier dogwood, high bush cranberry, and elderberry are found in small pockets to heights of 2.5m.

Cattail Mineral Shallow Marsh Type (MAS2-1)

This community is found in a few locations south of Laird road. It is dominated by cattail, and mixed with spotted touch-me-not, reed canary grass, aster species, black bulrush (*Scirpus atrovirens*), and willowherb (*Epilobium spp.*). Elderberry and willows occur in pockets up to 3m in height.

3.4 Analysis of Small Wetland Areas

The wetland habitats form the central core of the natural areas within the study area. The wetlands occur in three basic locations in the landscape:

1. *Areas where surface water flows provide sufficient soil moisture to allow wetland plants to establish*. These areas are generally associated with the drainage ways, especially those south of Laird Road. In some locations along the west side of the large wetland core (north of Laird Road) damming of the normal seepage and creek flows has led to the creation of open marsh wetlands in place of the woods that were likely historically found in these areas. These wetlands are otherwise fairly limited in extent within the study area. Flows along the associated watercourse are the key soil moisture factor driving these systems.

2. *Areas where groundwater discharges at the surface*. These groundwater fed wetlands comprise the majority of the wetland areas, especially the large wooded wetlands both north and south of Laird Road. Groundwater discharge to these wetlands is the critical factor controlling the soil moisture and sustainability of these wetland areas.

3. *Areas where small depressions in topography intercept shallow water table*. This condition is typical of the small isolated wetlands found to the east and south of the large central wetland core. In these areas small depressions are generally sufficiently wet to preclude cultivation and allow for the establishment of wetland grasses and small shrubs. The dominance of grasses in these areas suggests that fluctuating soil moisture levels and periodic cultivation of these areas occurs.

The central portion of the wetland was mapped and described as a part of the provincially significant Hanlon Creek Swamp Complex.

A number of small wetland areas that are found within the study area are not contiguous to the central wetland core area. Many of these small wetland areas were not included in historic wetland mapping in the Watershed Plan and the MNR wetland mapping

available at the time of preparing the 2000 EIS and early addenda. As part of the 2000 EIS, the validity of incorporating these wetland areas within the complex was examined. The following section reiterates this analysis, which was submitted to the MNR for review, subsequently discussed with staff in 2004. The wetland areas were also reviewed in the field with GRCA staff in 2002.

Many of the small isolated wetland areas were not included in the complex by the Ministry of Natural Resources. The majority of these small pockets do not provide significant ecological value and are likely periodically cultivated. As well, most of the isolated areas are less than the minimum size used as a rule of thumb in determining whether to include the areas as part of a larger complex (2.0ha for separate wetland areas and 0.5ha for individual wetland communities). A summary of the small wetland areas is included in Table 8.

Table 3. Summary of Small Wetland Areas in the Study Area (from TSH 2000).

Area Number	Approx. Area (m2)	Description	Wetland Code(s)
1	1800	Roughly rectangular depression fed in part by broken tile drain in southwest corner Surrounded by ploughed fields Consists of two communities on organic soils: (i) fringe of silver maple dominated swamp with aspen, apple, basswood, cedar (ii) central open tussock sedge dominated marsh with marsh marigold, jewelweed, sensitive fern, black ash saplings	 -h,c,ts,ne,gc -ne,gc,ls
2	4700	Roughly rectangular depression with fairly deep organic soils Open silver maple overstorey with a few elms, cedar, black ash saplings, black walnuts Midstorey is limited with a few red osier dogwood shrubs and honey suckle Groundcover consists of sedges, grasses, sensitive fern, horsetails, water parsnip Surrounded by ploughed fields	-h,c,ts,ne,gc
3	900	Small triangular area of reed canary grass dominated wetland Scattered herbaceous species, low red osier dogwoods Adjacent to open aspen stand to west and ploughed fields to east	-ne,gc,ls
4	1000	Very small depression dominated by reed canary grass with a few scattered cattails Some low willow and balsam poplar saplings Surrounded by a fringe of upland field	-ne,gc,ls
5	2000	Reed canary grass dominated wetland with scattered raspberry and willow shrubs (especially in south portion) Surrounded by narrow fringe of upland field and ploughed fields	-ne,gc,ls
6	800	Balsam poplar and reed canary grass dominated depression Surrounded by ploughed fields	-h,ls,ne
7	8800	Long thin reed canary grass dominated depression Edge dominated by upland mixture of elm, hawthorn, willow shrubs, and aspen Numerous dead elm trees in eastern portion of wetland	-ne,gc,ls
8	225	Small reed canary grass dominated depression Fringe of low sandbar willows, and a couple large willows along east side Surrounded by ploughed lands	-ne,gc,ls
9	1350	Cattail and reed canary grass dominated depression, with willow shrub fringe Surrounded by ploughed fields	-re,ne,gc,ls
10	1800	Cattail dominated depression with willow and dogwood fringe Surrounded by ploughed fields Does not drain to Hanlon system	-re,ls
11	8400	Narrow band of cattail, sedges and grasses along drainage way Surrounded by ploughed fields Does not drain to Hanlon system	-re,ne,gc
12	4400	Consists of two communities: (i) reed canary grass dominated (ii) dogwood-willow shrub dominated swamp surrounded by ploughed fields	 -ne,gc,ls -ts,ne,gc
13	2000	Small wedge of cattail associated with roadside ditch	-re, gc
14	240	Small reed canary grass and cattail dominated depression in agricultural field	-ne,re

The characteristics of the small wetland areas were examined and compared to criteria laid out in the MNR wetland evaluation system to determine whether these areas would be included as part of the complex. The following is a brief discussion of the criteria with respect to the small wetlands:

Linear Distance

The MNR evaluation system sets a maximum separation distance between separate wetland areas within a complex. This distance is set at 750m measured in a straight-line distance between wetland areas.

All of the small wetland areas are within 750m of the central wetland.

Location in Watershed

The wetland evaluation system includes guidelines for complexing that suggests that complexes not extend across watersheds. This rule has been loosely adhered to in many locations in the province and some complexing across watershed boundaries in headwater areas is permitted under the evaluation system.

The majority of the wetland areas fall within the catchment basin of Tributary A, except two of the smaller areas along the west side of the study area near Downey Road.

Size

The wetland evaluation system set s a minimum wetland area of 2ha, but recognizes in wetland complexes that smaller areas could be included. Wetland community areas of 0.5ha are identified as minimum community areas.

All of the small wetland areas are less than 2ha, and many are less than 0.5ha.

Presence of Important Ecological/Hydrological Features or Functions

The wetland evaluation system suggests that inclusion of wetland areas that are less than 2ha in area should focus on those areas that contain some important feature or function.

The majority of the small wetland areas are depressions in farm fields which are periodically cultivated (depending on water table levels), and support simple, grass-dominated vegetation communities. They are isolated and do not appear to provide significant ecological or hydrological functions. A few of the wetland areas are driven by groundwater and support more mature woody vegetation.

Based on the above overview of the small wetland areas, it is suggested that two categories be used, as follows:

Wetland areas to be included in the complex
Wetland areas with some or all of the following characteristics are recommended to be included in the complex:

- Wetland areas larger than 0.5ha
- Wetland areas with groundwater discharge
- Wetland areas that support mature woody vegetation

The following wetland areas are therefore recommended for inclusion in the complex: 1, 2 and 7. This is consistent with the mapping of the complex by the MNR. Area 11 is one of the largest areas, but is not in the Hanlon watershed, and has been complexed by the MNR with the provincially significant Speed River Complex.

Wetland areas not included in the complex
Wetland areas with a combination of the following characteristics are not recommended to be included in the complex:

- Wetland areas less than 0.5ha
- Wetland areas that are shallow depressions in the fields
- Wetlands that are grass dominated communities with no other woody vegetation within or around them.

The following wetland areas are not recommended for inclusion in the wetland complex: 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, and 14.

A number of meetings with staff of MNR were held to clarify the wetland mapping and status. An initial meeting occurred on May 27, 2004 during which the small wetland areas identified in the 2000 EIS were reviewed. The inclusion or exclusion of these areas from the Hanlon Creek Wetland Complex was discussed and a number of small areas were identified that required further field investigation and discussion. A field review of these portions of the wetland was completed by David Stephenson (NRSI) and Ron Drabick (MNR) on June 13, 2004. The delineation of the wetland in several areas was refined and agreed upon. A follow-up meeting occurred on June 25, 2004, which was attended by members of the study team as well as Art Timmerman (MNR) and Martin Neuman (GRCA). At this meeting, agreement was reached on which of the small wetland areas should be included as part of the Hanlon Creek Wetland Complex. The agreement coincides with the recommendations of the 2000 EIS with the exception of the wetland adjacent to Downey Road (which is part of the separate Speed River Complex).

Although not recommended for inclusion in the complex, these wetland areas were recommended in the 2000 EIS to be considered as Constraint Level 2 areas for possible inclusion as lot-level features. A further discussion of the feasibility of retaining these wetlands is included in Section 6.3.

3.5 Wildlife

3.5.1 Birds

A total of 118 species of birds have been documented in the Hanlon Creek watershed in the Atlas of the Breeding Birds of Ontario (Cadman et al. 1987). Eighty species were recorded in the watershed during the field surveys for the watershed report (Marshall Macklin Monaghan Limited and LGL Limited 1992).

A total of 63 species of birds were recorded during the 1998 1999 and 2004 field visits. Breeding bird surveys were completed in May and June of 1999. A list of the species reported in the Watershed study as well as species observed during the present study is included in Appendix II.

The Hanlon Creek State of the Watershed study provides a summary of a number of the species reported in the background documentation are regionally or provincially significant (see Table 3). Suitable habitat for a number of these species is present within the study area. A total of 24 of the significant bird species were noted to exhibit some evidence of breeding in the study area based on field surveys in 1998 – 2004 (see bolded species in Table 3). None of these species is provincially rare, and the majority of them are noted as lower level of species of conservation concern (levels 2 – 4). Only 3 bird species with level 1 conservation concern were noted (brown thrasher, chestnut-sided warbler and savannah sparrow).

3.5.2 Mammals

A listing of mammal species reported from the Hanlon Creek watershed was included in the Watershed report. This listing was divided into three tiers based on rarity levels established in earlier documentation (University of Guelph 1972). A total of 28 species were included in this list. Studies of habitats to the north of the study area along Tributary A were completed in 1997 by Limnoterra Limited (1998). A total of 16 species of mammals were observed within the study area during the 1998 - 2004 field surveys. A list of these species is included in this report in Appendix III.

A list of significant mammal species reported from the watershed was included in the Hanlon Creek State of the Watershed report (PEIL 2003) (see Table 4).

Two of the significant species, little brown bat (*Myotis* lucifugus) and European hare (*Lepus europaeus*) were observed in the study area during the 1998 – 2004 field surveys (see bolded species in Table 4). A number of species were reported as 'rare' in the Hanlon Creek Watershed Plan, but many of these species are not currently considered to be rare at a provincial or regional level. For example, red fox (*Vulpes vulpes*) was noted as rare in the Watershed plan and was noted during the 1998 - 2004 field surveys. White-tailed deer (*Odocoileus virginianus*) have been noted to be fairly abundant throughout the Hanlon watershed, including the study area.

Table 4. Uncommon Bird Species in the Hanlon Creek Watershed (PEIL 2003).

Common Name	Scientific Name	Status*	Conservation Priority*
Green Heron	***Butorides virescens***	**S4B**	**Level 4**
Turkey Vulture	*Cathartes aura*	S4B	Level 3
Wood Duck	*Aix sponsa*	S5B	Level 4
American Black Duck	*Anas rubripes*	S5B	Level 2
Blue-winged Teal	*Anas discors*	S5B	Level 2
Northern Harrier	***Circus cyaneus***	**NAR S4B**	**Level 4**
Sharp-shinned Hawk	***Accipiter striatus***	**NAR NIAC S5B**	**Level 2**
Cooper's Hawk	*Accipiter cooperii*	NAR NIAC S4B	Level 3
Northern Goshawk	*Accipiter gentilis*	NAR NIAC S4	Level 2
Broad-winged Hawk	*Buteo platypterus*	S5B	Level 3
American Kestrel	***Falco sparverius***	**S5B**	**Level 2**
Ruffed Grouse	***Bonasa umbellus***	**S5**	**Level 3**
Virginia Rail	*Rallus limicola*	S4B	Level 1
Spotted Sandpiper	***Actitis macularia***	**S5B**	**Level 3**
Common Snipe	*Gallinago gallinago*	S5B	Level 2
Black-billed Cuckoo	*Coccyzus erythropthalmus*	S4B	Level 1
Long-eared Owl	*Asio otus*	S4	Level 1
Common Nighthawk	*Chordeiles minor*	S4B	Level 1
Alder Flycatcher	***Empidonax alnorum***	**S5B**	**Level 3**
Least Flycatcher	***Empidonax minimus***	**S5B**	**Level 3**
Eastern Phoebe	***Sayornis phoebe***	**S5B**	**Level 3**
Eastern Kingbird	***Tyrannus tyrannus***	**S5B**	**Level 3**
Horned Lark	***Eremophila alpestris***	**S5B**	**Level 3**
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	S5B	Level 2
Cliff Swallow	*Petrochelidon pyrrhonota*	S5B	Level 3
Barn Swallow	***Hirundo rustica***	**S5B**	**Level 3**
Black-capped Chickadee	***Poecile atricapillus***	**S5**	**Level 4**
Red-breasted Nuthatch	*Sitta canadensis*	S5B	Level 3
Brown Creeper	***Certhia Americana***	**S5B**	**Level 2**
Winter Wren	*Troglodytes troglodytes*	S5B	Level 3
Golden-crowned Kinglet	*Regulus satrapa*	S5B	Level 2
Gray Catbird	***Dumetella carolinensis***	**S5B**	**Level 4**
Brown Thrasher	***Toxostoma rufum***	**S5B**	**Level 1**
Chestnut-sided Warbler	***Dendroica pensylvanica***	**S5B**	**Level 1**
Pine Warbler	*Dendroica pinus*	S5B	Level 3
Black-and-white Warbler	*Mniotilta varia*	S5B	Level 3
Ovenbird	***Seiurus aurocapillus***	**S5B**	**Level 4**
Northern Waterthrush	*Seiurus noveboracensis*	S5B	Level 2
Scarlet Tanager	***Piranga olivacea***	**S5B**	**Level 2**
Eastern Towhee	*Pipilo erythrophthalmus*	S4B	Level 2
Field Sparrow	***Spizella pusilla***	**S5B**	**Level 3**
Vesper Sparrow	*Pooecetes gramineus*	S4B	Level 2
Savannah Sparrow	***Passerculus sandwichensis***	**S5B**	**Level 1**
Grasshopper Sparrow	***Ammodramus savannarum***	**S4B**	**Level 3**
Swamp Sparrow	*Melospiza Georgiana*	S5B	Level 1
White-throated Sparrow	*Zonotrichia albicollis*	S5B	Level 1
Bobolink	***Dolichonyx oryzivorus***	**S4B**	**Level 2**
Eastern Meadowlark	***Sturnella magna***	**S5B**	**Level 4**
Western Meadowlark	*Sturnella neglecta*	S4B	Level 2
American Goldfinch	***Carduelis tristis***	**S5B**	**Level 4**

Sources (from PEIL 2003):
Federal Conservation Status
NAR = Not At Risk. A species that has been evaluated and found to be not at risk.
Provincial Conservation Status
NIAC = Not In Any COSSARO Category. Any native species evaluated by COSSARO which does not currently meet criteria for assignment to a provincial risk category.

Provincial rarity ranks (Sranks)
S5 = Very common and demonstrably secure in Ontario.
S4 = Common and apparently secure in Ontario; usually with more than 100 occurrences in the province.
S3 = Rare to uncommon in Ontario; usually between 20 and 100 occurrences in the province; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances. Most species with an S3 rank a re-assigned to the watch list, unless they have a relatively high global rank.
S2 = Very rare in Ontario; usually between 5 and 20 occurrences in the province or with many individuals in fewer occurrences; often susceptible to extirpation.
S1 = Extremely rare in Ontario; usually 5 or fewer occurrences in the province or very few remaining individuals; often especially vulnerable to extirpation.
SZB = Breeding migrants/vagrants.
SE = Exotic; not believed to be a native component of Ontario's fauna.

Birds of Conservation Priority for Wellington County *(Couturier, 1999).*
Level 1 = Bird species of conservation concern for Wellington County (highest level of concern)
Level 2 = Bird species of conservation concern for Wellington County (greater than Level 3)
Level 3 = Bird species of conservation concern for Wellington County (less than Level 2)
Level 4 = Bird species of conservation concern for Wellington County (lowest level of concern)

Table 5. Significant Mammal Species Reported from the Hanlon Creek Watershed (PEIL 2003).

Common Name	Scientific Name	Status:	
Smoky Shrew	*Sorex fumeus*	S4S5	U
Hairy-tailed Mole	*Parascalops breweri*	S4	U
Star-nosed Mole	*Condylura cristata*	S5	U
Little Brown Bat	***Myotis lucifugus***	**S5**	**U**
European Hare	***Lepus europaeus***	**SE**	**U**
Eastern Chipmunk	*Tamias striatus*	S5	U to C
House Mouse	*Mus musculus*	SE	U
Meadow Jumping Mouse	*Zapus hudsonius*	S5	U
Long-tailed Weasel	*Mustela frenata*	S4S5	U

Sources (from PEIL 2003):
Conservation status of Wellington County mammals (Campbell, Cowcill and Martens, 1997).
U = Uncommon (4 - 9 records)
C = Common (10+ records)

3.5.3 Reptiles and Amphibians

A listing of reptile and amphibian species reported during the preparation of the Hanlon Creek Watershed Plan as well as species reported from the 10 x 10 km atlas square used in the Ontario Herpetofaunal Survey database was included in the Watershed Plan. Field surveys of reptiles and amphibians were completed in 1997 for the lands to the north of the study area (Limnoterra Limited 1998). Many of the species reported from the watershed study were also reported by Limnoterra Limited. A total of 9 species of reptiles and amphibians were observed during the 1998 - 2004 field surveys. A listing of these species compared to the composite list of species from the Watershed Plan and atlas square is included in this report in Appendix III.

A list of significant reptile and amphibian species reported from the watershed was included in the Hanlon Creek State of the Watershed report (PEIL 2003) (see Table 5).

No rare species of reptiles or amphibians were noted in the study area.

Table 6. Significant Reptile and Amphibian Species Reported from the Hanlon Creek Watershed (PEIL 2003).

Common Name	Scientific Name	Status*
Jefferson Salamander complex	*Ambystoma (jeffersonianum complex)*	THR? S2-S4? U & W - C
Pickerel Frog	*Rana palustris*	S4 U & W
Milk Snake	*Lampropeltis triangulum triangulum*	S5 U & W
Redbelly Snake	*Storeria o. occipitomaculata*	S5 U & W
Ribbon Snake	*Thamnophis sauritus septentrionalis*	S4? U & W

***Source (PEIL 2003):**
Conservation Status of Herpetofauna in the old Ministry of Natural Resources "Central Region" (Plourde et al., 1989).
A = Abundant (Any species that occurs in high numbers in Central Region)
C = Common (Any species that occurs in moderate numbers in Central Region)
W = Widespread (Any species that occurs throughout Central Region)

3.6 Aquatic Habitats

The following is a discussion that integrates a range of information types on the fisheries habitat within the study area. This includes information collected as part of the original 2000 EIS, subsequent Addenda, as well as more recent information on water temperatures, flows and habitats collected since the last Addendum.

3.6.1 Overview

In the Hanlon Creek Watershed Plan (1993), Tributary A was divided into 7 reaches of which all fall within the study area (only a portion of A5 is within the study area).

Reach A1 (called Tributary A1 in the EIS and Addenda) is located within the east side of the central wetland area north of Laird Road. The Hanlon Creek Watershed Plan shows this reach to be fairly short in length, but field examinations completed as part of this study found that the flows in this reach extend from as far south as Laird Road during some times in the year (this includes a shallow drainage tile running northward from Laird Road).

Reach A6 includes the ditch that drains the wetlands adjacent to Downey Road northward to the main branch. The ditch includes a swath roughly 1m in width of meadow grasses (esp. reed canary), but otherwise is in an area of active tilling. Intermittent flow has been observed in this reach and fish species have never been sampled..

Reaches A1 and A6 are tributaries to the main branch. In the Hanlon Creek Watershed Plan, the main branch was divided into five reaches. These reaches are all found north (downstream) of Laird Road because no aquatic work was done south of Laird Road during the Hanlon Creek Watershed Plan.

Reach A7 begins at Laird Road and continues north to the confluence with Reach A1. In the 2000 EIS it was noted that a flow barrier had been constructed within this reach for the purposes of creating a short causeway to the central upland area. This had created an impediment to flow that created open marsh habitats upstream of this causeway. This large open marsh area was described in the EIS as an opportunity to review the affects of the obstruction with possible removal.

Reach A2: from the confluence with Reach A1 to the online pond. This short section of watercourse flows from the confluence of A1 and A7 to the downstream portion of the online pond. The section is fairly straight and flows through open meadow habitats.

Reach A3 and A4 from the online pond to the confluence with Reach A6. A3 flows through a small swamp area, while A4 is found in open sedge dominated marsh. No fish sampling was conducted in this area as part of the Hanlon Creek Watershed Plan, nor the State of the Watershed Study. Reach A5: (in part) from the confluence with Reach A6 to the north property boundary. Only a very small portion of this reach falls within the study area. Like A4 it flows through dense sedge-dominated marsh. Beyond the northern limit of the study area this reach flows through the Kortright IV residential subdivision.

3.6.2 Flow Characteristics and Water Quality

The flow characteristics in the study area have been examined by field teams and monitored periodically since the study commenced in 1998/9. These observations combined with actual monitoring results and background information sources provide an understanding of the flow regime in this area.

The State of the Watershed Study noted that during the dry year of 2001, Tributary A had no flow in its lower reaches, but some flow in its upper reaches. This was presumed to be due to water 'percolating' back into the ground. The State of the Watershed Study recognized that lack of baseflow in Tributary A was a concern, and that flow re-establishment was recommended. Flow monitoring conducted by Totten Sims Hubicki in 2003 and 2004 also found periods when creek flows as high up as the confluence of the main branch and Tributary A1 had no flow. Table 6 provides a summary of flow monitoring results in the study area from the spring of 2004 through to the fall of 2004. This monitoring coincided with a fairly wet spring and summer and still showed periods of no flow above Laird Road.

The hydrogeological study found that the flows in the watercourses are a result of groundwater. Due to the permeable character of the upland soils, surface runoff contributions to the system from upland soils were concluded to be very low.. Water table monitoring conducted by Waterloo Hydrogeologic also noted that the water table fluctuated seasonally as well as depending on the characteristics of the year. This is consistent with the results of the flow monitoring as well as observations of residents living along the lower reaches of the main branch that no flows are periodically found in the system.

During wetter periods, especially in the spring when the water table is higher, portions of the lands have standing water. At these times the water table is near/at the level of the wetland surface and ponding water is found. This is especially noted along the east side of the study area, north of Laird Road. A shallow tile was historically installed though this area with two open catchbasin-like concrete structures along it. It is presumed that this tile was installed to route water off the land towards the main wetland. During field surveys on May 4, 2004 extensive areas of ponded water were noted throughout the open marsh habitats in this area.

South of Laird Road, less monitoring has occurred, and as noted above no investigations were completed in these areas during the Hanlon Creek Watershed Plan. The main branch flows northward through a trapezoidal ditch in a roughly straight line from the south before crossing under Laird Road. A berm is found, especially along the east side of this ditch with a number of culverts under it to allow water from the wetlands to the east to periodically flow to the creek (that is otherwise separated from these wetlands). A short section of ditch was also constructed between two areas of wetland south of Laird Road along the east side of the central wetland. This ditch is associated with a hedgerow, no flows have been observed in this channel during the course of this study.

Water quality, including temperature, monitoring has occurred as part of the Hanlon Creek Watershed Plan, State of the Watershed Study and the EIS process. The 2000 EIS documented water quality impairment, especially resulting from agricultural lands and use. The ponding of waters, both on the main branch as a result of the causeway and on Tributary A1 as a result of high water table in open marsh habitats, was reviewed in light of possible water temperature impacts. This is especially notable in light of the temperature-sensitive coldwater fish species and habitats associated with Tributary A1 (see Section 3.6.4 for species lists). The 2000 EIS noted that the ponding of water along the main branch was creating larger marshes and was a likely cause of the absence of brook trout in the main branch. Substrates, especially in the lower portion of Reach A7 include good quality gravels and cobbles for potential trout use.

Temperature monitoring throughout the east side of the area (north of Laird Road) was completed on May 4, 2004 to further investigate early spring flow and temperature characteristics (i.e. during high water table periods) and supplement other monitoring efforts being undertaken at the larger study area scale. It was found in this area that two flow paths were available to the headwaters of A1. The first consists of what was likely the original path that follows a longer path through open marsh and cedar swamp to flow along the east side of the main wetland area and discharge to A1. The second flow path consists of the tile that was installed running under the farm fields east of the main wetland and discharging to the main wetland at what is now the headwaters of A1. It was found that ponding of the waters in the open marsh areas nearer to Laird Road had resulted in water temperatures that were considerably higher than those within the main wetland area (10°C compared to 5°C). The cooling influence of flowing water through the shaded upland and wetland vegetation in the longer original flow path appeared to have a considerable influence on the water temperatures. In the case of the tile, it was found that water temperatures were not substantially reduced and discharge temperatures at the headwater of A1 were basically the same as water temperatures in the open ponded waters to the south.

A subsequent visit on May 21, 2004, repeated this investigation. This coincided with a warm spell where air temperatures of approximately 22°C were recorded. Some ponding of water was noted in the open marsh areas, but this was considerably reduced compared to the earlier May visit. Water temperatures were considerably higher throughout the system compared to May 4th. On the later May visit the ponded waters in the open marsh were approximately 18°C. At the discharge of the tile at the main wetland, water temperature was found to be 14.5°C, while the temperature in the other flow path was 12.6°C. A groundwater seep further downstream was found to have water temperatures of 8.2°C, but this input had little affect on overall temperature.

During the May 21, 2004 temperature monitoring, the affects of the open marsh areas along the main channel were noted. Water temperatures gradually increased in flows through the marsh (increasing from 12.6 to 15.1°C). At the confluence of the main branch with A1, water temperature differences were noted (15.1°C in main branch compared to 11.9°C in A1). Below the confluence there was a slight decrease in temperature in the main branch due to mixing, but after flowing through the online pond

and open sedge marshes, water temperatures increased again to 15.2°C in the open marsh in the north portion of the property. A similar pattern was observed during mid-August 2004 temperature monitoring. Temperatures were noted to increase through the marsh along the main branch from 15.4 to 18°C.

The recent hydrogeologic and field investigations have provided additional information upon which to understand the relationship between creek flows, groundwater and wetlands. Previously it was presumed that the tile that runs through the farmlands east of the main wetland and discharges at the edge of the wetland area was the sole headwaters of Tributary A1. This was significant because of the known trout use of this tributary. There are a number of locations where water in this flow path is exposed to sunlight. During periods of high water table, ponding of water in the marshes in this area occurs and results in substantial warming, with little temperature reductions through the tile before discharging to the wetland. A second flow path from these marshes due west through a series of treed and open wetland areas enters the edge of the wetland, flows north along the east side of the main wetland to merge with the flows coming in from the tile. These flows occur over a broad wetland area with abundant shading and organic soils.

During periods of lower water table, ponding of surface waters in this portion of the study area is reduced. Tributary A1 is then fed by tile discharges from the east as well as flows through the wetlands from the south. Simultaneous flow volumes have not been recorded at these discharge points, but visual estimates suggest that these two sources can contribute roughly equivalent volumes during this time. Field observations later in the season suggest that flows from this wetland flow path are considerably reduced, and that the tile contributes a greater percent of the volume to the tributary.

Table 7. Dissolved Oxygen and Temperature.

Tributary A Main Branch			21-May-04			11-Aug-04		
	UTM nad83							
Station	Easting	Northing	Time	Temp C	D.O. mg/l	Time	Temp C	D.O. mg/l
A - 1	562696	4815324	10:26	12.4	8.38	13:52	15.1	8.21
A - 2	562678	4815450	10:34	12.6	8.71	14:12	15.3	8.25
A - 3	562616	4815479	10:44	12.7	8.7	14:21	15.3	8.50
A - 4	562547	4815486	10:55	12.6	8.07	14:33	15.4	8.35
A - 5	562478	4815511	11:03	13.7	7.12	14:37	15.4	8.33
A - 6	562442	4815547	11:22	13.9	7.36	14:42	16.3	6.78
A - 7	562413	4815589	11:28	14.1	7.81	14:50	17.1	6.76
A - 8	562445	4815671	11:42	15.1	7.44	15:00	18.0	6.78
A - 9	562480	4815782	12:03	15.1	5.5	15:13	17.9	6.34
A - 10	562534	4815821	12:10	15.1	5.68	15:22	18.0	6.35
A - 11	562532	4815849	12:14	13.4	7.18	15:25	13.7	8.55
A - 12	562520	4815914	12:21	13.6	8.46	15:35	15.1	8.54
A - 13	562477	4815986	12:30	14.4	10.46	15:48	18.4	11.19
A - 14	562446	4816060	12:40	14.2	9.49	16:00	18.2	9.30
A - 15	562375	4816131	12:51	15.2	8.89	16:10	18.6	6.80
Tributary A1			**21-May-04**			**11-Aug-04**		
	UTM nad83							
Station	Easting	Northing	Time	Temp C	D.O. mg/l	Time	Temp C	D.O. mg/l
A1 - 1	562549	4815833	13:12	11.9	8.74	16:28	12.2	8.88
A1 - 2	562609	4815792	13:20	11.7	8.38	16:36	11.8	7.99
A1 - 3	562722	4815780	13:30	13.2	8.69	16:42	13.1	8.91
A1 - 4	562757	4815786	13:34	11.7	8.76	16:51	11.7	8.35
A1 - 5	562757	4815786	13:40	8.2	8.08	16:45	10.0	7.96
A1 - 6	562799	4815761	13:44	14.5	8.79	16:53	13.3	9.19
A1 - 7	562754	4815772	13:54	12.6	7.22	16:49	13.4	9.00
A1 - 8	562769	4815722	14:05	12.6	7.29	16:59	15.4	7.40
A1 - 9	562815	4815653	14:10	11.5	8.21	17:05	13.7	7.10
A1 - 10	562868	4815589	13:30	9.2	5.4	17:10	13.3	4.84
A1 - 11	563003	4815617	14:45	18.3	8.9	17:15	dry	dry
A1 - 12	563074	4815408	14:55	15.7	7.42	17:20	19.8	5.85
A1 - 13	563231	4815439	15:05	13.2	5.54	17:30	19.3	5.80
			21-May-04 Air Temperature: 22 Cloud Cover: 90%			**11-Aug-04** Air Temperature C: 23 Cloud Cover: 80%		

Table 8. Flow Monitoring Results (TSH 2004).

Location ID	Description	Parameter	Month/Year							
			Oct-03	**Nov-03**	**Mar-04**	**Apr-04**	**May-04**	**Jun-04**	**Jul-04**	**Aug-04**
1	ditch on McCrawley Property	Area (m^2)	NW	0.231	0.215	0.308	0.223	0.198	0.186	0.087
		Velocity (m/s)		0.051	0.159	0.107	0.100	0.143	0.076	0.085
		Flow (m^3/s) VxA	NF	*0.012*	*0.034*	*0.033*	*0.022*	*0.028*	*0.014*	*0.007*
		Water/Air Temp (^oC)	-	-	-	-	-	-	-	10/17
3	ditch along south of Laird Rd	Area (m^2)	NW	0.023	0.029	0.034	0.038	0.049	0.027	NW
		Velocity (m/s)								
		Flow (m^3/s) VxA	NF	NF	NF	NF	NF	NF	NF	NF
		Water/Air Temp (^oC)	-	-	-	-	-	-	-	-
4	ditch along south of Laird Rd (~45 m west of Location #3)	Area (m^2)	NW	0.105	0.125	0.171	0.183	0.116	0.072	0.030
		Velocity (m/s)			0.151	0.131	0.120	0.083	0.059	0.044
		Flow (m^3/s) VxA	NF	NF	*0.019*	*0.022*	*0.022*	*0.010*	*0.004*	*0.0013*
		Water/Air Temp (^oC)	-	-	-	-	-	-	-	12/16
7	Tile drainage outlet	Area (m^2)	-	-	-	-	0.054	0.042	0.044	0.026
		Velocity (m/s)	-	-	-	-	0.450	0.400	0.160	0.180
		Flow (m^3/s) VxA	-	-	-	-	*0.024*	*0.011*	*0.0071*	*0.0046*
		Water/Air Temp (^oC)	-	-	-	-	-	-	-	12/16
5a	online pond - inlet	Area (m^2)	-	-	-	-	0.090	0.077	0.059	0.031
		Velocity (m/s)	-	-	-	-	0.800	0.850	0.520	0.570
		Flow (m^3/s) VxA	-	-	-	-	*0.072*	*0.066*	*0.031*	*0.018*

		Water/Air Temp (^{o}C)	-	-	-	-	-	-	-	11/17
5b	online pond - outlet	Area (m^2)	-	-	-	-	0.602	0.505	0.230	0.161
		Velocity (m/s)	-	-	-	-	0.120	0.190	0.130	0.130
		Flow (m^3/s) VxA	-	-	-	-	*0.072*	*0.096*	*0.030*	*0.021*
		Water/Air Temp (^{o}C)	-	-	-	-	-	-	-	12/17
6	south of Teal Drive at intersection of creeks	Area (m^2)	0.218	1.690	3.682	1.754	0.819	0.647	0.283	0.149
		Velocity (m/s)				0.137	0.530	0.600	0.160	0.226
		Flow (m^3/s) VxA	NF	NF	NF	*0.240*	*0.434*	*0.388*	*0.045*	*0.034*
		Water/Air Temp (^{o}C)	-	-	-	-	-	-	-	13/17

Note: NF = No Flow NW = No Water
Note: Location 1, 3, 4 and 6 are the same ID numbers as from the EIS (2000) Report Figure 2.5.

On September 30, 2004, biologists from NRSI obtained temperature data for the main branch of the creek south (upstream) of Laird Road. Water and air temperatures were taken at 5 locations and are summarized in Table 9.

Table 9. Temperature Data for Main Branch South of Laird Road.

Station	Reach	Approx. Time	Water Temp. (°C)	Air Temp. (°C)
A-16	R-1	12:00	12	18
A-17	R-3	11:30	13	14
A-18	R-4	11:00	10	14
A-19	R-5	10:30	10	13
A-20	R-5	10:00	10	13

3.6.3 Fish Habitat

The study area was divided into 15 aquatic habitat reaches. These aquatic habitat reaches are defined by the flow, riparian zone, canopy cover, channel conditions, habitat features, and channel substrate. Habitat characterization was conducted on August 11 and September 30 2004 by aquatic biologists from Natural Resource Solutions Inc. See Figure 2 for reach locations.

Table 10. Habitat Reach Numbering with HCWP Reaches.

Habitat Reaches	Hanlon Creek Watershed Plan Reaches
R-1	
R-2	
R-3	
R-4	
R-5	
R-6	A7
R-7	A2
R-8	A2
R-9	A3
R-10	A3
R-11	A4
R-12	A1
R-13	A1
R-14	A1
R-15	A6
	A5

Figure 2. Stream Reaches in Study Area.

The first reach is called R-1 and starts south of Laird Road at the uppermost extent of the main channel. Note that the main channel is known as 'Tributary A' in the Hanlon Creek Watershed Plan. Reach 1 continues downstream until it reaches a culvert at a farm crossing just downstream of two minor tributaries (R-2 and R-3). While the water in this reach was flowing, the relatively large cross-sectional area of the channel created very slow water velocities and the water appeared to be still. A vegetated riparian zone is present and is greater than 5m wide, although agricultural activity was adjacent to this buffer. Canopy cover is greater than 50%, and the previously channelized watercourse has naturalized a great deal over time. Habitat features include pools and abundant aquatic vegetation, some of which appear to be watercress. Reach R-1's substrate is composed of silt and muck, and is very soft.

Reach 2 (R-2) is a minor tributary to the main channel on the south side of Laird Road. Entering the downstream end of R-1 from the west, there was standing water at the downstream end only. At the time of observation, the water appeared to be a result of backwater from the main channel. A vegetated buffer greater than 5m occurs on either side and is adjacent to agriculture. The channel appears natural and canopy cover is greater than 50%. The substrate is mucky and habitat features are created by vegetation.

Reach 3 (R-3) is another minor tributary to the main channel on the south side of Laird Road. This tributary enters R-1 from the east just downstream of R-2's confluence. Water was flowing in this channel during the September 2004 field survey, although very minimally. The vegetated riparian zone is greater than 5m wide. Canopy cover is greater than 50% and the reach is separated from agriculture by more than 100m. No habitat features exist in the channel and substrate is made up of silt and muck.

Reach 4 (R-4) is south (upstream) of Laird Road on the main channel. It begins at the culvert under the farm crossing at the downstream end of R-1 and continues downstream through a section containing substrate of sand, gravel and cobble. The reach ends where the cobble substrate transitions to exclusively silt, clay and muck. Water was flowing through this reach, and while the channel appears natural in many respects, it has obviously been channelized at some point in the past. A vegetated

riparian zone is greater than 5m wide and the canopy cover was greater than 50%. There is more than a 100m separation from agriculture, though there is an old field on the west side. It comes within 5m of the creek and therefore makes up part of the vegetated riparian zone as well. Habitat features include woody debris and the cobble substrate material.

Reach 5 (R-5) begins at the downstream end of R-4 and continues downstream to Laird Road. Substrate is composed of silt, clay and muck with occasional pieces of cobble toward the downstream end of the reach. Water was flowing and the channel was braided in sections. The vegetated riparian zone is greater than 5m wide and canopy cover is greater than 50%. Vegetation consists of trees along the upstream section as well as grasses and shrubs along the downstream section. An old field is present along the west side of the channel. The channel appears natural, but its mostly straight trajectory indicates that it was likely channelized at some point in the past. The reach is separated from agriculture by more than 100m. Habitat features include limited woody debris and terrestrial vegetation.

Reach 6 (R–6) starts at Laird Road and flows downstream (main channel) until the confluence. This reach has many sections where the creek is choked with vegetation and is braided. The only significant difference this section of creek may encounter is the canopy cover. Reach R-6's substrate is made up of fine material including sands, silts, and detritus. Habitat throughout this reach consists of woody debris and vegetation. Canopy cover is provided by a mature white cedar stand.

Reach 7 (R-7) is located from the confluence downstream to the pond inflow. This section is characterized by its cobble, gravel dominated substrate. Habitat includes, riffle, pool, woody debris, vegetation, and undercut banks. This reach is in its natural state with meanders and canopy cover provided by shrubs and tall grasses. Channel substrate is made up of boulder, cobble, gravel, and silt. There was a defined channel with good flow through the extent of this reach.

Reach 8 (R-8) is the online pond located in the middle of the study area. There is heavy siltation within this pond. Aquatic vegetation has taken over the pond providing the only

habitat and water depth is minimal due to siltation. The canopy cover is limited to the shorelines where it is provided by trees and shrubs.

Reach 9 (R-9) is downstream of the online pond and is very similar to that of Reach 2. The channel substrate consists of boulder, cobble, gravel, sand, and silt. Habitat is provided by aquatic vegetation, boulders, woody debris, undercut banks, riffles and pools. There is a defined channel which appears to be in its natural state.

Reach 10 (R-10) continues downstream from Reach 4 to the edge of the white cedar stand. The substrate composition changed from that of the previous reach. Canopy cover and the vegetated riparian zone remain constant with more than 50% canopy cover and a riparian zone greater than 5m wide. The channel substrate however consists of silt, muck and fine materials. Habitat is provided by woody debris.

Reach 11 (R-11) continues downstream from the cedar stand. The riparian zone resembles that of a meadow with little to no large trees. Canopy cover is provided by small shrubs and vegetative grasses. The channel appears to be natural but is lacking natural meanders. Limited habitat is provided by vegetation. The channel substrate consists of muck, silt, and fine material.

Reach 12 (R-12) ends at the confluence of the main branch and tributary A1. R-7 originates from underground and flows through the cedar stand to the confluence. The substrate of this reach is made up of fine materials including; silt, sand and muck. Habitat features include undercut banks, woody debris, and pools. There is a side tributary that originates from a tile drain where the substrate consists of cobble, gravel and sand.

Reach 13 (R-13) flows from Laird Road downstream to Reach 7. There are portions of this reach that flow underground. The remaining reach has no defined channel and is choked by vegetative grasses. The channel substrate is silt and muck. There is little to no fish habitat throughout this reach.

Reach 14 (R-14) flows from Laird Road upstream to where it originates from a tile drain. This reach is a ditch running alongside of Laird Road. Fish were observed in this

section. Channel substrate consists of silt and muck, while habitat is provided by aquatic vegetation.. There is no meander through this reach, with no riffles, runs, or pools.

Reach 15 (R-15), referred to as Reach A-6 in the Hanlon Creek Watershed Plan, drains the wetlands adjacent to Downey Road northward to the main branch. The confluence is just within the study area boundary at the downstream end of Reach 11 (R-11). The 2000 EIS concluded that no fisheries habitats were found in this ditch. This was subsequently agreed to by the GRCA. The reach was inspected again by aquatic biologists of Natural Resource Solutions Inc. on September 30, 2004. The channel was found to be dry, confirming again that the reach does not contain fish habitat.

3.6.4 Fish Community

Fish sampling was conducted in this area in 1991 and documented in the Hanlon Creek Watershed Plan. Northern redbelly dace *(Phoxinus eos)*, blacknose dace *(Rhinichthys atratulus)*, creek chub *(Semotilus atromaculatus)*, white sucker *(Catostomus commersoni)*, brook stickleback *(Culaea inconstans)*, pumpkinseed *(Lepomis gibbosus)* and mottled sculpin *(Cottus bairdi)* were found in Reach A2.

Reach A1 was also sampled during the Hanlon Creek Watershed Plan and was the only location within Tributary A in which brook trout were found. In addition to brook trout *(Salvelinus fontinalis)*, blacknose dace, creek chub and white sucker were found based on the 1991 sampling.

During the Hanlon Creek State of the Watershed Study, an electro-fishing unit was used to sample fish at the confluence of A1 and A2. Blacknose dace and brook stickleback were found at this location in 2001.

Table 11 is a summary of fish species from the vicinity of the study area from the Watershed Study.

Table 11. Fish Species Reported from Reaches A1 and A2 in the HCWP.

Reach and Common Name	Scientific Name
A1 brook trout	*Salvelinus fontinalis*
A2 northern redbelly dace	*Phoxinus eos*
A1/2 blacknose dace	*Rhinichthys atratulus*
A1/2 creek chub	*Semotilus atromaculatus*
A1/2 white sucker	*Catostomus commersoni*
A2 brook stickleback	*Culaea inconstans*
A2 pumpkinseed	*Lepomis gibbosus*
A2 mottled sculpin	*Cottus bairdi*

Bluntnose minnow *(Pimephales notatus)* was recorded elsewhere in the Hanlon system (Tributary E). Brook trout and mottled sculpin are normally found in streams with cold water and high water quality. In addition, brook stickleback and white sucker prefer streams with cool water but are tolerant of a wide range of conditions. The other species reported from the study area are tolerant to warm water streams, except the pumpkinseed that prefers slow-moving warm water in ponds or lakes.

Most recently, electrofishing was conducted by two biologists from Natural Resource Solutions Inc. on August 31, and September 30, 2004. Qualitative fish sampling was done with the Halltech model 1 backpack. Five stations (HAN E1 to HAN E5) were sampled within the study area to identify the fish community composition. A summary of fish species recorded in each site is included in Table 12. In addition to the species found in the previous studies, central mudminnow *(Umbra limi)* and fathead minnow *(Pimephales promelas)* were found at multiple sampling stations.

Table 12. August and September 2004 Fish Sampling Results.

Station	Species	Number
HAN E1	Brook Stickleback Central Mudminnow	34 3
HAN E2	Brook Stickleback Central Mudminnow	3 11
HAN E3	White Sucker Central Mudminnow Brook Stickleback Blacknose Dace Fathead Minnow	1 22 12 2 2
HAN E4	Pumpkinseed Blacknose Dace Brook Stickleback Central Mudminnow	2 9 17 10
HAN E5	Brook Stickleback Central MudminnowWhite SuckerFathead Minnow	4203

Station HAN E1 is located just downstream from Laird Road in the cedar stand. The reach sampled was 25 – 30m in length and the substrate consisted of silts and fine material. The moderate instream cover was provided by woody debris and overhanging vegetation from the shoreline. Canopy cover was provided by a dense cedar stand and shoreline grasses. Water temperature was 13^{o}C and air temperature was 17^{o}C at 9:50 am. The sampling duration was 600 shocking seconds. All habitats were sampled within the 30m section including pools, woody debris, and overhanging vegetation.

Station HAN E2 is located in Reach A1 just downstream from the tile drain. Fish sampled at this location include brook stickleback and central mudminnow. Habitat was provided by woody debris and undercut banks. The substrate consisted of fine material including silts and sands. Water and air temperatures were taken at 10:40am. Water temperature was 13^{o}C and air temperature was 18^{o}C. The electrofishing duration was 512 seconds. All habitats were sampled within the 30m section including pools, woody debris, and undercut banks.

Station HAN E3 is located from the pond downstream 30m. Part of the pond was also sampled in this reach. Habitat was provided by aquatic vegetation including watercress, woody debris, riffles, pools, and undercut banks. The substrate consisted of cobble, gravel, sands and silts. There was an abundance of central mudminnows found in the aquatic vegetation of the pond. Water temperature was 16^{o}C, and air temperature was 21^{o}C at 11: 45am. Electrofishing duration of this reach was 616 seconds. All habitats were sampled within the 30m section.

Station HAN E4 is located from the pond upstream (main branch) past the confluence of tributary A1 and A. The substrate consisted of cobble, gravel, sands and fine material. Water temperature upstream of the confluence (main branch) was 15^{o}C. Downstream of the confluence the water temperature was 13^{o}C. Air temperature was 21^{o}C. All temperatures were recorded at 13:45. Dense habitat cover was provided by woody debris, overhanging vegetation, aquatic vegetation, cobble, and undercut banks. All of these habitats were sampled. The electrofishing duration was 479 seconds.

Station HAN E5 is located upstream (south) of Laird Road. The area sampled covered a short distance upstream of the two minor tributaries that enter from the east and west. The substrate consisted of silt and muck, and dense cover was provided by aquatic vegetation that grew abundantly in the still, ponded water. Herbaceous vegetation provided moderate shoreline cover. At 13:00, water temperature was 12°C and air temperature was 20°C. The electrofishing duration was 225 seconds. Fish species captured include many brook stickleback, white sucker and mudminnows as well as two fathead minnows.

3.6.5 Current Impacts to Aquatic Habitat

The current extent of high quality coldwater habitats within the study area is fairly limited. The eastern branch of the creek (Reach A1), north of Laird Road, appears to be the only suitable area for brook trout spawning. Outside of this area, a number of human-induced characteristics limit the quality of the aquatic habitats. Key impediments to fisheries include removal of riparian vegetation, ditching of portions of the channel, as well as the creation of flow impediments (such as downstream of Laird Road at the rudimentary horse trail crossing). High nutrients and low baseflows also affect the

current state of the aquatic habitats. Water quality analyses conducted during the Hanlon Creek Watershed study found that nutrient levels in Tributary A were high, especially nitrates. This was attributed to fertilizer application. High sediment loads were also noted in Tributary A.

3.7 Ecological Linkages

The central core of wetland and upland woods provides a diversity of habitats, but the lack of linkages to other large habitat blocks, for example to the east of the site, as well as river corridors along the Hanlon Creek and Speed River was seen as a constraint to wildlife in the area. The creek corridor for Tributary A continues north from the study area through the Kortright IV development area. Some provisions were made for connectivity during the development of these lands (including retention of riparian habitats for restoration along the creek, provision of culverts under roadways), but the dimensions of this connectivity will limit the feasibility of creating a continuous wooded connection to the lower portions of the main Hanlon Creek and the Speed River.

A review of the mobility of the wildlife species reported from the study area was conducted based on typical species' life histories. The TRCA (2003) prepared a summary of wildlife species mobility, and that ranking showed that the majority of wildlife species were either unrestricted or mobile with the use of 'stepping stones' hedgerows. Few species found with the study area, with the exception of some of the reptiles and amphibians, were categorized as mobile but requiring contiguous habitats for movement. Populations of mobile species, for example deer, were noted to be high, suggesting that the mobile species that do not require high quality ecological movement corridors are sustaining themselves despite the lack of linkages.

The Hanlon Creek State of the Watershed study summarized the status of the linkages identified as part of the Hanlon Creek Watershed Study (PEIL 2003). In this summary it was noted that the linkage functions of the area were limited (except for the linkage to the north associated with the tributary). A secondary linkage associated with a possible westward linkage north of Laird Road (to the Speed River) was noted.

4.0 Natural Environment Opportunities and Constraints

The Hanlon Creek Watershed Plan identified a number of important natural features and functions within the study area and recommended measures for their retention.

Specific recommendations contained within the Watershed Plan that have a bearing on constraint identification are as follows:

- recommended preservation of Tributary A wetland complex
- recommended use of buffer areas
- restoration of a primary ecological linkage from Tributary A to the lower Hanlon Creek valley
- preservation of the headwater woodlands and wetlands on Tributary A
- restoration of a secondary ecological linkage from Tributary A from the lower Hanlon Creek
- restoration of a secondary ecological linkage from Tributary A to the Speed River

Section 2.3.2 of the Watershed Plan identifies the following overall goal:

"*To restore, protect and enhance water quality and associated aquatic resources and supplies*", specifically:

- less nutrients
- minimize erosion and sedimentation
- maintain and restore vegetative canopy
- use of BMPs to restore, rehabilitate or enhance water quality
- ensure baseflow function of stormwater management facilities
- implement selected habitat improvement (i.e. improve channel morphology)
- removal of selected debris obstructions

The recommendations of the Watershed Plan were reviewed for guidance, and site specific analyses were completed to provide a greater level of detail to guide land use decisions. The identification of enhancement and protection measures (such as

setbacks) was iterative, taking into account not only the characteristics of the natural features, but also the nature of the proposed undertaking.

In the 2000 EIS and subsequent addenda, it was recommended that emphasis be placed on preserving the central area of wetlands and woods and that this central area would be 'bulked' up in terms of enhancements. The central core area was identified based on the following:

- included a diversity of habitat types including mature and immature communities, such as the main wetland and upland wooded stands,
- supported connectivity between the wetland and upland habitat blocks by a combination of direct linkages as well as by proximity. The identification of this interconnected core offset the limited connectivity available for these habitats to other habitats located outside the study area. Key to this was the recommendation in the EIS for the closure of Laird Road through the central natural area.
- included a range of open country habitats including open fields, thicket and immature treed areas
- provided for setbacks/buffers from the creek
- included setbacks around the perimeter of the core (see below).

Outlying features were typically considered of secondary importance in this regard.

Based on liaison with staff of the City and the Grand River Conservation Authority, it was decided that constraint levels would be identified. These levels were defined and delineated then provided to other team members to guide the layout and design of features such as lot pattern, road network and stormwater management. These constraints have continued to be used to guide and review alternative road networks, land use patterns and servicing options.

The following recommendations for treatments for indirect protection of habitats were provided in the EIS (TSH 2002):

- maintain and respect identified groundwater discharge areas
- maintain pre-development infiltration rates

- do not interfere with groundwater flows to the wetlands or watercourse
- seek opportunities to improve water quality, re-establish riparian vegetation, realign or modify channel geometry.

The approach to identifying constraints to development within the study area was based on a balance of recommendations contained within the Hanlon Creek Watershed Pan, as well as site-specific conclusions regarding the character and function of natural resources in the study area. This approach also considered potential enhancement opportunities within the area.

Based on the Watershed Plan as well as the findings of the present study the following key points were used to direct the identification of constraints and enhancement opportunities:

Terrestrial and Wetland Habitats

Overview:

- the study area contains a portion of the provincially significant Hanlon Creek Swamp Complex
- the delineation of the wetlands differs from the wetland boundaries in the watershed study as well as subsequent MNR wetland mapping (1994). Examination of the boundaries of the wetland has been completed resulting in some revisions to boundaries
- the high diversity of biological habitat types in the watershed has resulted in a high diversity of wildlife and plant species. This high diversity coupled with the large areas of natural habitat and natural corridors provides habitat for some rare plant and wildlife species. The natural habitats within the study area are not as large and are somewhat isolated from the remainder of natural habitats in the Hanlon watershed.

Limitations

The following current characteristics of the natural features in the study area create limitations to the quality, function or sustainability of the natural resources in the area:

- discontinuities in habitat linkages
- historic drainage of the wetlands
- limited amount of early succession upland habitats
- small isolated wetland pockets
- fragmentation of habitats from roads and fields
- lack of large wooded blocks

Rehabilitation and Enhancement Opportunities:

- restoration of discontinuities in habitat linkages with plantings, especially woody riparian vegetation (see discussion below for aquatic resources)
- maintenance of groundwater balance into wetlands
- identification and preservation of vegetated setbacks from the wetlands where warranted
- examination of feasibility of restoring continuity of habitats ("bulking up" central core habitats)

Aquatic Habitats

Overview:

- documented brook trout spawning occurs in east branch of Hanlon Creek, north of Laird Road
- areas south of Laird Road presently unsuitable for brook trout and limited baseflow, and degraded water quality provides limited fish habitat

Limitations:

The following current conditions appear to limit aquatic habitat quality:

- fragmentation of aquatic habitats
- degraded water quality
- presence of on-line pond
- areas lacking riparian cover
- historic construction of drainage ditches and straightening of creek

- flow obstructions at Laird Road and horse trail crossing appear to create impediments to flow and result in creation of extensive marsh areas with ill-defined channels

Rehabilitation and Enhancement Opportunities:

- improve the connectivity of habitat to encourage fish movement
- improve water quality with respect to nutrient and pesticide/fertilizer inputs
- remove on-line pond
- re-establish riparian canopy
- improve habitat diversity by 'naturalizing' artificially modified reaches of channel
- review the debris and culvert obstructions with possible removal

A Natural Heritage System, consisting of a series of constraint zones was developed to include aquatic, wetland and terrestrial features. The locations of the Constraint Zones are shown in the EIS.

Constraint Level 1

Features within Constraint Level 1 are those that require the highest level of protection. As such these areas would be considered to be unsuitable for development. The central core area includes the Constraint Level 1 features. In cases where development activities in these areas are unavoidable, extensive mitigation measures are anticipated. The following features were recommended for inclusion in Constraint Level 1:

- central wetland areas are small wetland areas that are part of the complex (see discussion below)
- mature upland woods
- all perennial watercourses

Constraint Level 2

Features within Constraint Level 2 were those that provide some ecological benefit, especially to Constraint Level 1 features. These features are expected to be able to withstand some development and mitigation measures are expected to

readily preserve these features. The central core area included some of these features such as immature treed stands and setbacks from the Constraint level 1 features. These areas were considered zones within which development may occur subject to completion of detailed analyses of potential impacts (especially impacts to adjacent Level 1 features). The following features were recommended for inclusion in Constraint Level 2:

- small isolated wetlands that are not part of the complex
- dry ditches/intermittent watercourses (outside wetlands)
- upland immature treed areas
- setbacks from wetlands, woodlands and watercourse (see discussion below on Setbacks).

Constraint Level 3

This final category included the remaining areas within the study area. Development is anticipated to occur in these areas subject to adherence to overall goals and targets set for the study area (for example, infiltration targets, sediment and erosion control, etc.).

4.1 Enhancement/Recharge Areas

As part of the development of the concept plan in the EIS, a number of factors were considered including the opportunities to enhance existing natural features and linkages, as well as groundwater recharge. Open areas associated with the central portions of the natural area were recommended for retention as successional habitats. These areas were seen to provide additional habitat diversity as well as potential linkages between other wooded and wetland habitats. The enhancement areas were in some cases found surrounded (or almost surrounded) by wetland and woodlands and development of these small inclusions was not recommended. In other cases, the enhancement areas were located along the outside edges of setbacks. These included areas where wooded edges extended beyond the setbacks recommended for wetlands, as well as in areas where additional setback could be beneficial to provide trail linkages, smooth out setback boundaries, etc. The enhancement areas were also seen as areas for potential groundwater recharge.

5.0 Buffers

5.1 Buffer Guidelines

The Hanlon Creek Watershed Plan includes recommended setbacks (buffers) as well as tabular summaries of the rationale and importance of buffers. The reader is referred to the Watershed Plan for a discussion of these matters. In terms of setting specific setback dimensions to guide the layout of development within the study area, it was concluded that the generalized approach adopted at the watershed level required some refinement. This refinement was warranted not only as a result of the more detailed assessment of the natural features within the study area, but also a recognition that setback dimensions are as much a function of the features that they are intended to protect as they are of the character and use of the buffer and the nature of the proposed undertaking. For example:

- in addition to providing a vegetative buffer around a natural feature, setback areas may be used for other compatible uses such as restoration of ecological linkages, trials and periodic maintenance vehicle access, stormwater management ponds, etc. The width of the setback must therefore consider the additive requirements of providing protection as well as accommodating these other uses.

- consideration of the current sensitivity of the natural feature that requires a buffer often drives the setback dimensions. Typical examples of buffer widths include 30m from coldwater streambanks or provincially significant wetlands and 15m from other watercourses and wetlands. The nature of the wetland vegetation is an important consideration. Wooded swamp habitats are generally more sensitive to impacts from adjacent land development (for example, from wind exposure effects such as windthrow, stem breakage). As well, the water balance within the established swamps generally exhibits less fluctuation and hence these areas are more sensitive to modifications to water regime. The marsh communities which have established on lands that experience ongoing water level fluctuations are more tolerant to water regime variations.

- land development activities that include creation of bare slopes, extensive impermeable surface, foundations, subsurface services, etc. are more likely to have a wider zone of influence on neighbouring soil moisture and erosion conditions. Therefore these types of developments require a greater mitigation as well as larger setback dimensions from natural features. Landscaped areas would be far less likely to create impacts and would therefore require narrow setbacks.

To provide guidance to the layout of development within the study area dimensions for the setbacks were required despite the fact that the width of the setback should also take into account the character of the development. In this regard a number of working guidelines were established to guide setback dimensions in the study area, as follows:

- setbacks from swamp communities were recommended to be a minimum of 30m
- setbacks from marsh communities were recommended to be a minimum of 15m
- setbacks from the perennial portions of the creek were recommended to be 30m and 15m around ditches and intermittent reaches
- in locations where setbacks would include pedestrian trials or vehicle access routes, the setback would include a minimum 15m setback from the edge of the natural feature to the closest edge of the trail or access road, as well as a setback between the trail/road and the edge of the setback (primarily for screening)
- setbacks around mature woods would be beyond the dripline of the woods

These setbacks would be measured from the edge of the feature (i.e. wetland edge or streambank) and would represent the limit of the lot line. Therefore the setbacks would be located off of the proposed lots and would become part of the open space area.

5.2 Setback Implementation Process

Since the decisions regarding locations and sizes of stormwater management facilities and the required access for maintenance of these facilities as well as preliminary recommendations regarding possible pedestrian trail routes were required to produce the setbacks, the approach to defining setbacks was iterative. This iterative process took a number of steps as follows:

- preparation of maps showing limits of Constraint Level 1 areas, as well as Constraint Level 2 areas (minus setbacks)
- preparation of conceptual plans showing possible layout of roads and lots as well as locations and sizes of stormwater management facilities
- identification of possible pedestrian trail routes and access routes
- identification of variable width setbacks around features
- revisions to layout of roads, lots and stormwater management facilities

5.3 Final Buffer Determination

The setbacks shown on the Draft Plan are based on the staked boundaries which were reviewed in the field by staff of the GRCA prior to being surveyed in. Some revisions to these boundaries have resulted from MNR field review of the wetland limits.

Staff of the GRCA participated in the original EIS study in which buffers widths were examined and recommended. The EIS was subsequently reviewed and approved by the GRCA (see November 9, 2000 letter from Natolochny to Hearne) as well as the City of Guelph and EAC Committee (see minutes of October 11, 2000). Staff of the GRCA (Wayne MacMillan) prepared a follow-up memo in October 2000, which provided recommendations regarding buffers that are consistent with those proposed in the original EIS. On this basis, these buffers have been shown on the proposed Draft Plan of Subdivision.

The Draft Plan depicts the most recent information on wetland limits.

5.4 Buffer Enhancement Recommendations

Enhancement plantings have been proposed along the edges of the central natural area to act as vegetative buffer and to provide a number of other benefits, including:

- Enhancement of existing habitat linkages through revegetation of existing habitat breaks as well as making linkage habitats wider. This focuses on the creation of, or supplementing existing wooded riparian habitats associated with the creek.
- Provision of buffers and setbacks to enhance wetland, aquatic and terrestrial habitats. Natural succession and plantings can be used to create native vegetation zones around some of the retained wetland and woodland areas, as well as along the creek.
- Provision of open habitats for foraging as well as nesting, etc for species that prefer open areas.

The detailed planting plans will be provided as part of the Environmental Implementation Report (EIR).

Based on the existing characteristics of the natural features, the proposed plan, a series of enhancement planting approaches have been conceptually identified. These are described below. The relative amounts and locations of these planting types would be refined at the EIR stage.

The locations of these generalized planting/enhancement areas are shown on Figure 3.

A ‘buffer smoothing’ plan was prepared and provided to the GRCA on June 22, 2004. This plan high-lighted where buffer areas have been smoothed (i.e. extended beyond the recommended dimensions based on the surveyed wetland limits).

The Draft Plan is based on the ‘smoothed’ buffers.

Table 13. Summary of Approaches to Buffer Enhancement Plantings.

Planting Type	Focus	Needs	Possible Species
1	Creation of stable new edge on west and southwest exposures Areas of existing closed canopy	- Larger caliper and dense plantings of trees - Some limited conifer and dense shrub plantings	· Sugar maple, white ash, white pine · Red panicled dogwood, chokecherry, highbush cranberry, elderberry
2	Infilling open spaces to bulk up narrow woodland 'fingers' and stretches of watercourse with limited woody cover.	Moderately dense plantings of deciduous trees and shrub mixtures	· Sugar maple, white ash, ironwood, beech, shagbark hickory, black cherry, white pine · Elderberry , chokecherry, highbush cranberry
3	Shrub transition with scattered mixed deciduous trees	a. dry exposed areas b. wetter, low area	a. Red panicled dogwood, cranberry, serviceberry, sumac · scattered basswood, ash b. red osier dogwood, highbush cranberry · scattered white ash, sugar maple, elm
4	Areas of open upland meadow, existing agricultural lands	Herbaceous vegetation cover to stabilize existing exposed soils and create meadow habitats	· suitable seed mixtures (as per GRCA recommended mixtures)
5	Buffer areas around cedar dominated and silver maple dominated wetlands especially where swamp areas are currently not buffered	Moderately dense plantings of coniferous and deciduous trees and shrub mixtures	· red osier dogwood, highbush cranberry · cedar, scattered white ash, sugar maple, elm
6	Buffer areas around marsh areas	Plantings of open meadow habitats with scattered shrubs and trees	· suitable meadow seed mixtures · red panicled dogwood, cranberry, serviceberry, sumac · scattered white ash, sugar maple, cedar
7	Areas between trails and adjacent natural areas with the objective to create a dense screen/barrier	Moderately dense to dense plantings of coniferous and deciduous shrub mixtures and trees	· red osier dogwood, highbush cranberry · cedar, scattered white ash, sugar maple, elm
8	Stormwater conveyance swales and berms	Dense plantings of herbaceous species and open meadow habitats with scattered shrubs and trees	· suitable wet meadow seed mixtures · red panicled dogwood, cranberry, serviceberry, sumac · scattered white ash, sugar maple, cedar

Figure 3. Conceptual Planting/Restoration Areas.

6.0 Impact Analysis

6.1 Overview of Proposed Undertaking

Details of the proposed undertaking are contained in companion documents to this EIS:

- Draft Plan of Subdivision 23T-03501, prepared by GSP Group (November 2004)
- Stormwater Management Report, prepared by Totten Sims Hubicki Associates (November 2004)

The Hanlon Creek Business Park totals approximately 271.64ha, of which approximately 63.70ha is identified as open space (natural area and associated buffers). The Draft Plan of Subdivision is shown overlain on the planting/enhancement plan on Figure 3 and a reduced version is included in this report in Appendix IV. This plan shows the extent of surveyed wetland boundaries, woodlot dripline south of Laird Road, as well as buffers from the natural features.

The preparation of the November 2004 Draft Plan is the culmination of a detailed process of discussions and analyses of a range of issues. The development is based on the concept outlined in the 2000 EIS, except in certain locations where analyses have indicated a number of key features that required re-design. This re-design triggered further review of the natural features, the constraints and buffers recommended in the 2000 EIS, with special emphasis on the overall goals stated in the original EIS.

The proposed undertaking consists of a mixture of Corporate Business Park and Business Park blocks located along a series of internal roads. Roads A and D form a 'ring road' around the central natural area, with other roads located to access other developable lands. The Plan shows a new interchange at Laird Road and the Hanlon Expressway which is a separate Ministry of Transportation undertaking.

6.2 Approach to Impact Assessment

As noted above, the preparation of the Draft Plan and Servicing/Stormwater Management strategy for these lands is the culmination of many years of analysis, review and discussion. Various iterations of the Draft Plan and Servicing Plans, especially the Stormwater Management Plan have been prepared, but all have been based on the natural environment opportunities and constraints outlined earlier in this report. The buffer dimensions recommended in the 2000 EIS have been maintained throughout this process.

For the purposes of this report, the following discussion of impacts is divided into:

- Direct impacts associated with disruption or displacement caused by the actual proposed 'footprint' of the undertaking.

- Indirect impacts associated with changes in site conditions such as drainage and water quantity/quality.

- Induced impacts associated with impacts after the development is constructed such as subsequent demand on the resources created by increased habitation/use of the area and vicinity.

- Cumulative impacts associated with the spatial and temporal implications of this proposal in conjunction with other undertakings in the area.

6.3 Direct Impacts

The approach to identifying and delineating Constraint Areas, discussed in Section 4.0 above, was aimed at avoiding direct impacts from development on important natural features. The designation of the constraint levels, has been used to guide the layout of the development in such a way that direct displacement of natural features is minimized.

Since the delineation of the natural features, especially the surveyed wetland boundaries, have continued to be the basis for the Plan, many direct impacts to natural features have been avoided.

The following is a discussion specific to the setbacks recommended in the Hanlon Creek Watershed Plan:

Sector 18

Sector 18 in the Hanlon Creek Watershed Plan corresponds to the eastern side of the wetland, north of Laird Road to the northern limit of our study area. The setback recommended in the HCWP for this area was 30m to protect wetland vegetation and for nutrient and salt influx considerations. Historic tile drainage has had an influence on the groundwater flow in this area, but groundwater continues to play a key role in the groundwater upwelling in the eastern branch of Tributary A. A detailed review of contributions was completed. Setbacks were determined to be only one of several factors required to maintain the relationship to the wetlands. This is addressed by way of a setback between the lots and the wetlands of approximately 30m and in some locations of even greater setbacks.

Sector 19

Sector 19 corresponds to the eastern side of the wetland south of Laird Road and around the southeastern tip of the wetland. In this area the Hanlon Creek Watershed Plan recommend setbacks ranging from 30 to 50m. The dimensions were based in part on protecting waterfowl habitat in the wetlands. Waterfowl use and habitat in this area were found to be limited.

A range of wetland habitats are found through this sector. Adjacent to Laird Road is a small semi-circular wetland area with a mixture of reed canary and swamp. The wetland is surrounded by a fringe of upland vegetation. A setback of 15m to the lot line was recommended in this area.

A similar wetland area is found to the south, but this grades into a dense mature cedar-dominated swamp area. While in the south a finger of shrub dominated

wetland protrudes to the southeast. Setbacks from the mature cedar-dominated swamp and lot lines are recommended to be approximately 30m.

The setback from the shrub dominated wetland was recommended for lesser setbacks in the 2000 EIS. A minimum 15m setback has been recommended.

Sector 20

Sector 20 includes the upland woodland south of Laird Road. The Hanlon Creek Watershed Plan recommended a 15m setback to protect the woodlot edge. The lands up to, and in some cases under, the dripline are currently ploughed. In this case root zone protection is less of an issue, but ensuring space for root growth of the edge trees and provision of plantings to create an interface between the woods and neighbouring development were recommended in the EIS. A 10m setback is used consistent with the guidelines for completing EIS in the Carolinian Zone prepared in February 2003 at the GRCA.

Road design standards required that the proposed Road 'D' west of the woods, would overlap within the dripline. See a detail discussion of this in Section 6.3.3.

Sector 21

Sector 21 corresponds to the west side of the wetland north of Laird Road. At the time of preparing the Hanlon Creek Watershed Plan this area was dominated by marsh and setbacks of 30 to 100m were recommended. During the field work undertaken for the EIS, this marsh had been ploughed, but it had re-established as a simple reed canary –dominated system by the time the second Addendum was prepared. A setback between the marsh and lot lines of 30m is recommended.

Sector 22

Sector 22 corresponds to the western side of the wetland to the northern limit of our study area. In this area the Hanlon Creek Watershed Plan recommended a setback of 120m to protect sensitive marsh and wet meadow vegetation from nutrient influx and encroachment.

Setbacks of 30m were recommended in the 2000 EIS along this sector which included the stable woodland edges.

Some limited loss of hedgerow and open field vegetation will occur due to road and building layout as well as stormwater management facilities and regrading.

Three key overlaps with natural features are proposed, as discussed.

6.3.1 Creek Crossing of Road A

The construction of the new roadway (Road A) will require a crossing of the creek. This location of this crossing has been selected to coincide with a reach of the creek that is currently devoid of woody riparian vegetation. As well, the online pond in this area has been noted to result in warming of the flows in the creek.

The location allows for an efficient treatment of the crossing and online pond since both can be dealt with at the same time. By way of the crossing design it is anticipated that the online pond will be removed and the channel restored. This will achieve the two objectives of the 2000 EIS (i) that the road crossing be located in an area where impact to the creek would be minimized, and (ii) removal/restoration of the online pond.

The design of this crossing is anticipated to occur at the subdivision stage and must consider the use of a bridge or culvert designed to accommodate flows as well as impacts to the aquatic resources. The design of this crossing structure will require an authorization under the federal Fisheries Act. Utilities such as water and sanitary sewer may be located within the road allowance and crossing of the creek of these utilities will be detailed and considered at the same time as the road crossing.

6.3.2 Realignment of Downey Road Drainage

The current alignment of the intermittent drainage way in the northwest corner of the study area (running diagonally from Downey Road), crosses proposed lots and is proposed to be re-aligned to follow closer to Downey Road. No fish habitat is found in this drainage way, but details regarding the approach to re-alignment and re-

establishment of the ditch will occur at the subdivision stage and must take into account maintenance of flows from this headwater tributary and possible enhancement.

The ditch was historically constructed to drain the wetlands adjacent to Downey Road (north of Laird Road) towards the north into Tributary A. Prior to the construction of this ditch it is anticipated that flows from this area would have run south and east towards the main wetland near Laird Road. No fisheries habitat was found in any portion of this ditch on field surveys in 2004, including near its confluence with the main branch.

Staff of the GRCA have recognized that no fish habitat is found within the drainage feature. Some concerns have been expressed regarding the contribution of the flows from this ditch to the main channel, as well as the potential for increased salt discharge to the channel.

Currently this ditch conveys water from the wetland adjacent to Downey Road as well as some drainage from adjacent lands. This includes lands currently subjected to possible salt accumulation from road salt use. Salt is a soluble substance that once entering surface water is not readily removed. Even salts that adhere to vegetation would be picked up the next time surface water flows are available.

A number of scenarios for treating this ditch discharge were reviewed:

1. Routing the flows to the southeast to the main wetland. This flow pattern would mimic pre-development of the lands, but would also allow for discharge of any salt contained in the flows to the main wetland and channel.

2. Routing the flows to the east towards the main channel. The channel characteristics in this area are considered to be of high quality for restoration as trout habitat and addition of runoff and salts are not recommended.

3. Routing the flows to the north. The discharge of this ditch is proposed to be directed to a stormwater management pond. This allows for some treatment of the water in this ditch prior to discharge to Tributary A.

The third option was selected as the preferred alternative. This not only routes the flows through a stormwater management pond, but also mimics the current discharge location of the flows and also avoids discharge of these possibly salt laden flows further upstream where more sensitive trout habitat occurs (or could be restored).

6.3.3 Overlap of Road D with Woodland and Wetland South of Laird Road

The alignment of Laird Road is based on "*providing functional traffic connection to Laird Road west of Downey Road, a safe turn radius, and avoiding the existing gas easement*".

In the original 2000 EIS a number of recommendations were put forth, chiefly aimed at enhancing the central natural core area. One of the primary recommendations included the closure of Laird Road to traffic. As part of the protection, it was decided that closure of Laird Road should be reviewed and that a new roadway would be built to direct traffic from Puslinch Township to the Hanlon Expressway. The closure of Laird Road would provide greater benefit to the overall core wetland feature by providing an opportunity to integrate the environmental features that are now separated by the existing Laird Road.

Laird Road is currently the link connecting the Hanlon Expressway to Puslinch Township on the west side of Downey Road. The link is a vital component of the road network, in particular for trucks that use Laird Road to bring gravel from the pits in Puslinch Township to the City of Guelph and surrounding area via the Hanlon Expressway.

Within the planning and development of the HCBP, the closure of Laird Road would mean that an alternate link would be required to maintain the Puslinch to the expressway connection. The City of Guelph initiated the Class Environmental Assessment process to evaluate various options for Laird Road and to ensure that the public had an opportunity to comment on the process. The Class Environmental Assessment for the relocation of Laird Road was undertaken as a Schedule "B" Class EA.

The planning process for the HCBP must meet the demands and requirements of the Planning Act. The requirements of Planning Act include many of the same requirements as designated under the Environmental Assessment Act. Section A.2.9 of the Municipal Class EA guidelines *recognizes the desirability of co-ordinating or integrating the*

planning processes and approvals under the EA Act and the Planning Act, as long as the intent and requirements of both Acts are met. As such, the Class EA requirements for the relocation of Laird Road was completed incorporated into the planning requirements for the development of the HCBP.

As part of the Class EA process various alternate alignments of Road D were developed and evaluated considering impacts on wetlands and woodlots, stormwater management requirements geometrics and lot development. These alternatives included;

- "Do-Nothing" option of leaving the existing Laird Road open in its existing condition. The option would eventually require the upgrading of Laird Road to accommodate the proposed future increase in traffic.
- Connection of the re-aligned Street D to connect to Forestall Road. This alternative was rejected because of public concern and because it did not offer a direct connection from west of Downey Road to the Hanlon Expressway.
- Connection from the Hanlon Expressway following an alignment south of the wetlands and then connecting to the existing Laird Road west of Downey Road.
- The new alignment was developed based on traffic studies, capacity/turn lanes and criteria for the connection to the future Hanlon interchange. The new alignment would provide a connection between the Hanlon and Downey Road as it is the major access to the aggregate pits in Puslinch Township

The Class EA for this project was initiated with the March 1, 2004 Notice of Public Meeting that was distributed to the public. The first Public Information Centre for the Class EA was held in April 2004.

The preferred alternative for the location of Road D (third alternative listed above) is illustrated in Drawing 21872-05 and was selected for the following key considerations:

1. The realignment of Laird Road would provide a more convenient access to develop the parcels of land south of the wetland complex than the retention of the existing road.

2. As a result of the realignment the intersection at Downey would be modified and will be signalized to meet city standards and Puslinch concerns for safety. (There were a number of fatal collisions in recent years at this intersection.)
3. The proposed location of Road 'D' will intrude into two areas of environmental concern. A small section of the woodlot south of Laird will have to be removed along the new Right of Way. A small wetland pocket noted as a satellite wetland in the Hanlon Creek EIS will also be crossed within the Road 'D' Right of Way. The wetland pocket was noted within the Hanlon Creek EIS as an area that should be saved if the lot level conditions and grading allowed for inclusion into the lot fabric. The EIS acknowledged that it could be removed if grading or site conditions could not accommodate saving the feature.

These two impacts were considered when comparing the alignment of the alternative to leaving Laird Road open. It was concluded that the intrusion into the woodlot and wetland pockets would be a more acceptable impact. There will be mitigation measures required to protect the exposed woodlot after construction. The proposed details will be included at the detailed design stage of the project.

The proposed re-alignment is described within the subdivision as Road 'D'. Road 'D' (re-aligned Laird Road) will ultimately function as a major arterial roadway through the subdivision. It is intended that the ultimate design of Road 'D' will be a 4 lane arterial roadway within a 30m right-of-way from Downey Road to Road 'A'. However, Road 'D' will be constructed a 2 lane local roadway within the subdivision limits until traffic warrants expansion to the ultimate arterial road design. The re-alignment of Laird Road to a 2 lane local roadway is being conducted under the guidance of the Environmental Assessment (EA) Act.

This Class EA is being integrated with the planning requirements for the development of the Hanlon Creek Business Park and as such, is being conducted under the guidance of the Planning Act. The Notice of Completion of this Class EA will be advertised with the Notice for the Official Plan Amendment required under the Planning Act for the relocation of Laird Road. The final notification to agencies and the public, shall advise the agencies and the public of the ability to appeal the Planning Act decision to the Ontario Municipal Board.

Based on the surveyed dripline of this woodlot compared to the road right-of-way, the road would intrude approximately 20m into the woodlot. The location of the overlap is a corner of the woods next to the gas easement.

The woodlot consists of mature deciduous woods with a stable edge documented by a mixture of tree species (such as basswood, aspen, sugar maples and beech). Removal of the stable edge can expose interior portions of the woods to the effects of sunlight and wind exposure as well as invasion of non-native plant species typical of open habitats. Although portions of the existing edge have been impacted in the past due to logging, the restoration of the edge along the roadway is recommended (see Section 5.0). The restoration is envisioned to consist of a mixture of native tree and shrub plantings focused on providing a 'seal' for the edge of the stand.

Significant tree loss is not envisioned with his overlap. However, impacts to trees to be retained must also be controlled. The following recommendations re provided to maximize tree retention in this area:

- Prior to any land clearing or regarding, the limit of construction is to be delineated with fencing which is to be maintained throughout the construction period
- Regarding, fill storage or other material storage is not to occur within the dripline of trees to be retained
- Any limbs or roots of trees to be retained that are disrupted during construction are to be pruned using appropriate arboriculture techniques

6.3.4 Retention of Small Wetlands

Several low wetland communities are dispersed through the open portions of the site. A total of 14 small wetland areas were mapped (see discussion in Section 3.4). O fthese areas, 3 (#1, 2 and 7) were recommended for inclusion in the Hanlon Creek Wetland Complex and 1 (#11) was included in the Speed River Wetland Complex. The remaining isolated wetland areas were identified but were not included in the complexes by the Ministry of Natural Resources. Although not recommended for inclusion into the wetland complex, it was recommended that the wetland pockets be kept as potential

landscaping features wherever possible. If it were not feasible to feasible to incorporate the features into the lot when developed, then they could be removed.

Drainage outlets from these wetland areas were not observed. Reports on groundwater resources suggest that the wetlands intercept the water table, indicating a substantial groundwater influence on the wetland soil moisture conditions. It is anticipated that the soil moisture levels in these areas are less affected by the collection of surface runoff from neighbouring lands. Considerable water level fluctuations occur in these wetlands during the several field visits. These water regime fluctuations are reflected in tolerant herbaceous vegetation found in these wetlands.

The analyses completed focused on the hydrogeology and stormwater management of the lands has detailed the approaches to maintenance of the groundwater conditions on the lands post development. Since the water balance of the isolated wetlands result from interception of the water table, the water regime in these depressions will continue to provide wetland habitats post-construction.

Lot level regrading is a significant issue associated with the retention of these areas. In order to achieve effective lot drainage and to route stormwater to appropriate collection and treatment features, some areas of regrading are inevitable. The regrading is less of an issue with maintenance of water balance, since the water regime of these small features is driven by interception with the water table, but the depths of fill on the lands the need for very steep slopes, and the location of the small wetlands relative to the lot boundaries may severely limit the retention of these wetlands.

Infiltration targets for the lots may also influence the ability to retain these wetlands, since infiltration is not likely to occur in these depressions, retention of these on a lot will negatively affect the amount of infiltration (compared to the lot if it had been uniformly filled).

In cases where the small wetland is located close to the lot boundary, these types of features are most likely to have some retention opportunities as they are not at risk from buildings, etc. On specific lots the location of the wetland relative to the building

envelope and associated outdoor storage, parking areas etc. will also be a factor limiting the retention of the wetlands.

Drawing 21872-12 in the TSH Servicing Report illustrates the proposed localized grading adjacent to the wetland pockets. Based on comparisons of the existing grdes and locations of the wetlands to the grades required for these lands, none could be readily saved. Wetland number 6 may be saved depending on the development of the Block and if it can be incorporated into the grading of the lots. It is anticipated that the majority of the remaining 9 isolated pockets will be removed because of grading issues. The actual grading of the Blocks will be reviewed at Site Plan Approval to determine if any more of the isolated wetland can be protected during and after development.

6.4 Indirect Impacts

For the purposes of the analysis of potential indirect impacts, the following discussion is divided to the following:

1. Closing of Laird Road
2. Sediment and erosion
3. Changes to groundwater and surface water flow patterns
4. Changes to water quality

Indirect impacts to the natural resources from tree loss and the potential disruption of stable woodlot edges as well as potential impacts to potential habitat linkages have been examined and do not appear to be of concern based on the proposed layout.

6.4.1 Closing of Laird Road

During the preparation of the conceptual plan in the EIS, one guiding objective was the retention of the main natural area and to investigate the feasibility of closing Laird Road. The intent of this closing was to allow for the ultimate removal of the roadbed and restoration of the creek in the vicinity of the road culvert.

Based on further analysis, it was concluded that the existing residential lots found on Laird Road would remain and would therefore require road access. Based on current city requirements, the length of the roadway required to access the existing residence closer to the Hanlon would be beyond a length (300m) that required a second access to this lot. Therefore the Draft Plan shows the section of Laird Road between the two existing residences as closed, but not removed. The roadbed will remain with existing culverts, but it will be topped with turf stone or similar surface treatment to allow for emergency vehicle access. The infrequent traffic along this roadbed will allow for herbaceous plants species to establish on the roadbed, but safety requires that woody species be controlled in the area. Mobile wildlife are anticipated to readily cross this feature. Utility crossings of the creek along Laird Road may be required depending on phasing and will require review in terms of approach to construction, location, impacts etc at the design stage.

6.4.2 Sediment and Erosion

Although much of the area proposed for the development has historically been cleared, in order to grade and construct the new lots, roads and other features, areas of bare soil will be exposed.

Typical sediment control measures are anticipated for this development with no impacts anticipated to natural features. Setbacks between the rear lot lines and the wetland edges or watercourse has been established at 15 to 30m (greater in some cases), and therefore it is not expected that runoff would reach these natural areas. The slopes in the area are generally flat and are not anticipated to create significant erosion concerns.

In cases where stormwater management facilities are located within the setback, sediment and erosion control measures will be required in this area to ensure that no runoff to the wetlands or creek occurs. No-touch zones have been identified and will be used. These consist of a minimum of 10m around wetland limits or 1m outside the dripline of upland woodlands or fringes (which ever is greatest).

Sediment and erosion control plans will be required for the proposed road crossing of the creek and the re-alignment of the ditch in the northwest corner of the study area.

6.4.3 Changes to Groundwater and Surface Water Flow Patterns

This section of the impact analysis focuses on the potential changes to the flow patterns and quantity of groundwater and surface water flows that currently supply the creek and wetland.

The proposed buildings, etc. will be placed on relatively flat lots with roadside ditches and stormwater management. The surface water flows are anticipated to follow existing grades as well as infiltration of groundwater. This approach will be used throughout the study area. The percent imperviousness for the development is anticipated to be high, emphasizing the need for suitable stormwater management techniques.

The small vegetated berms constructed along the downslopes along some of the stormwater management facilities will assist in creating infiltration opportunities for runoff from these areas.

Lot-level infiltration opportunities will be maximized by directing surface runoff to vegetated areas. Small infiltration galleries consisting of subsurface granular areas should be constructed to receive surface runoff from impervious surfaces.

The wetlands in portions of the study area (especially those dominated by cedar) appear to be primarily dependant on groundwater flows. These groundwater flows may be influenced by on-site development to an extent, but are also affected by more regional groundwater characteristics (see discussion under Cumulative Impacts). The proposed undertaking with recommended mitigation is not anticipated to have a significant impact on groundwater or surface water flow patterns and volumes. Assuming that recommendations with respect to sediment control and infiltration opportunities are maximized, no impacts on the wetlands or creek are anticipated.

The 2004 Servicing Report prepared by TSH, stated that infiltration is a key ‘driver’ of the water balance within the wetlands and that any reductions in infiltration from the proposed development would be mitigated using appropriate stormwater management control. The location of infiltration is noted by TSH to also be an important factor for consideration and specifically state that specific issues are:

- *“no decrease in recharge conditions across the site,*

- *maintenance of the baseflow provided by the tile drain, to the east, tributary,*
- *maintenance of recharge to the east tributary through diffuse stormwater infiltration to the east of the tributary."*

A groundwater balance was completed to address the above issues and determine if the proposed development could be designed in a manner such that pre-development recharge rates could be maintained or exceeded post-development. TSH (2004) provide an analysis of the water balance and conclude that on-site controls can be used and would provide a more uniform distribution of the groundwater recharge throughout the area.

6.4.4 Water Quality

Existing water quality in the creek has been found to have high levels of nutrients and pesticides from agricultural sources. The recommendations for stormwater management quality have been provided to enhance this existing condition. Implementation of these measures in conjunction with vegetated setbacks from the wetlands and creek and establishment of vegetated landscapes associated with lots are anticipated to improve current degraded water quality.

TSH (2004) reiterated that the 2000 EIS recommended enhanced protection from stormwater management facilities and provided the following criteria that were used to design the stormwater management facilities:

- *"All facilities will be designed to be in conformity with the Stormwater Management Planning and Design Manual, March 2003 by the Ministry of the Environment,*
- *Ponds will be designed and sized based on the individual runoff catchment areas,*
- *Ponds will be designed to meet the enhanced protection level (formerly described as Level 1 protection),*
- *Ponds will be designed to the following:*
- *Permanent pool storage is 210 m3/ha*
- *Extended detention storage is 40 m3/ha*

- *Ponds will be designed using criteria for "wet" ponds and "hybrid" ponds. The preferred design for the SWM facility is a hybrid pond but the final design will be determined at the detailed design stage of the project,*
- *SWM facilities will be designed so that post development flows do not exceed pre-development flows,*
- *All outlets from the SWM facilities will be designed to promote infiltration of treated runoff,*
- *The facilities are to be municipally owned and to be located on separate blocks of land within the development area. All SWM faculties shall have municipally owned road way easements to provide vehicular access for maintenance and monitoring."*

The maintenance of the groundwater regime will ensure that flows into the wetlands and watercourses are maintained at pre-development levels. The layout of the blocks in the vicinity of Tributary A1 has been selected to preserve the existing two flow paths and their relative contributions will be maintained as well.

Mitigation Measures for Increased Temperature in SWM Facilities.

Section 4.4 of the Stormwater Management Planning and Design Manual (MOE March 2003) outlines the mitigation measures for increased temperatures in SWM facilities. The MOE recognize that urbanization usually causes a temperature increase in stormwater runoff. The increase in temperature of runoff from wetland style ponds is about 3.4^0C and in Wet ponds is 5.1^0C. The Manual recommends the following measures to reduce the thermal impacts:

1. Pond Configuration: Increase length to width ratios to reduce open water areas that cannot be shaded by riparian vegetation.
2. Riparian Planting Strategies: Plantings along the shoreline fringes and flood fringe zones will help shade the ponds
3. Bottom-draw Outlets:Drawing water from lower elevations in the permanent pools (i.e. below the top 1m of water)
4. Subsurface trench outlet: Outlet to subsurface trenches filled with clear stone to transfer heat to the stones. The length of the stone trench should be maximized.

5. Night Time release: Outlet from ponds at night allows water to be cooled by night time temperatures. There could be as much as a 5^0 C fluctuation in temperature.
6. Outlet Channel Design: Outlet runoff can be directed over rocks for cooling. Plantings adjacent to the outlet can shade the runoff.

Based on this discussion negative impacts to the fisheries associated with Tributary A1 are not anticipated. Monitoring of the performance of the stormwater management facilities, as well as fisheries and other hydrology and hydrogeology characteristics will be incorporated that integrates the recommendations of the Hanlon Creek Watershed Plan, the State of the watershed Study , as well as site specific items.

6.4.5 Locations of Stormwater Management Ponds Relative to Natural Areas

Recently concerns have been raised by a number of agencies regarding the proximity of stormwater management facilities with natural areas. The main concern relates to the attraction of wildlife to sites of potential contamination. On the other hand, it is recognized that storm ponds need to be proximal to their discharge features (in this case wetlands) and that typical landscaping and/or naturalization of the ponds and berms will create some habitat.

In this case much of the runoff entering the ponds will have been directed to flow over considerable lengths of vegetated swale. Access has been provided to each pond and it is anticipated that monitoring will be required to ensure pond function as well as contaminant levels. Maintenance of the ponds, for example removal of excess/contaminated sediments, will be triggered by this monitoring. As such, it is anticipated that the stormwater management facilities can be integrated with the core natural areas.

The 2000 EIS included a conceptual SWM pond location analysis. At that time it was presumed that infiltration opportunities existed associated with pond locations around the perimeter of the central wetland area. Based on this, up to 10 ponds were proposed around the central wetland. More recent hydrogeological investigations have revealed that these locations are not suitable for infiltration. The SWM pond locations were

reviewed and a total of 6 locations selected. In order to rout runoff top these ponds a network of swales will also be required. These two components are discussed below.

Ponds

The 2004 Stormwater Management Report prepared by TSH, details the pond layout etc. The following is a brief discussion of the ponds.

Pond 1 (Block 55) and Pond 2 (Block 54)

These two SWM ponds flank the main channel near the northern boundary of the site. Both border open sedge dominated wetlands and will discharge to these features. As discussed above regarding the Downey Road ditch, the flows from this intermittent channel will be routed to the western of these two facilities. These two ponds follow the setbacks/no-touch zone guidelines.

Pond 3 (Block 63)

This is a small SWM pond located north of Laird Road to receive runoff from a small development parcel. The pond is setback from the wetland approximately 15m and no intrusions into the dripline of the upland woods found along the wetland margin is anticipated. The discharge of this pond will be towards the creek channel near Laird Road where the vegetation is quite immature and open.

The placement of the stormwater management pond in this location is preferred over a building lot, as it can provide vegetated features that can be incorporated into the neighbouring natural areas to potentially ‘bulk up’ an existing narrowed area.

Pond 4 (Block 68)

This pond is located south of Laird Road near the eastern side of the contral natural area. These lands are currently tilled and restoration around the future storm pond is envisioned to provide an enhanced naturalized area. This feature provides a potential restored connection between the main wetland area and the smaller wetland area south of Laird Road. The pond is setback from the wetland edge as well as the fringe of upland vegetation.

Pond 5 (Block 73)

This SWM pond is located adjacent to a narrow drainage way between the woodland south of Laird Road and the main channel. The pond will not intrude into the wetland in this area. These lands are currently tilled and restoration around the future storm pond is envisioned to provide an enhanced naturalized area.

Pond 6 (Block 75)

This SWM pond is proposed to be located adjacent to the existing narrow wetland area. This wetland is part of the provincially significant Speed River Wetland Complex. As noted above, these lands are currently tilled and restoration. The pond is setback from the wetland edge n around the future storm pond is envisioned to provide an enhanced naturalized area.

Swales

Previous strategies for lot grading and drainage included many lots draining from back to front with fewer draining via split lot drainage to both the front and back. Review comments on the previous versions of the Servicing Study and EIS provided by the GRCA noted concerns about routing virtually all surface water to storm facilities and the potential for impacts on local wetland soil moisture levels. The revisions to lot grading address this concern in part. The modifications to the proposed grading and the updated stormwater management pond locations require that a series of ditches be constructed along the rear of many of the lots. The extent of the drainage swales are shown on plans prepared by TSH (2004). These drainage ways will prevent lot runoff from entering the wetland directly and will convey the runoff along these shallowly sloped and vegetated ditches to stormwater management ponds. This was an approach recommended in all previous versions of the EIS and Addenda to address concerns related to the proximity of developments to wetlands where steep slopes are found.

Two aspects of the proposed swales are discussed below:

<u>Proximity of the ditches to the wetlands</u>

The ditches have been laid out to avoid intrusions into the wetlands. However, to allow for the ditches to be downslope of the proposed lots and to positively drain,

these features are proposed to be located within the wetland setbacks. The details of the ditches are included in TSH (2004).

The swales will not intrude into the wetlands. The potential influences on drainage are also discussed below. Due to the proximity of the construction to the wetlands, care must be exercised in terms of sediment and erosion control measures (see Recommendations section). The no-touch zones recommended for use (i.e. 10m from wetlands or 1m from upland driplines) have been used in the layout of these swales.

Indirect influences of the drainage on the wetlands

The construction of the swales has been based on the City's design requirements as well as consideration of site-specific characteristics, especially the relationship of the swale to the water table and nearby wetlands.

Based on these designs, it is not anticipated that the construction and operation of the proposed swales will influence the soil moisture within the neighbouring wetlands. It is anticipated that the long runs of some of the flows in these swales will allow for maximum contact with vegetation as well as some infiltration of flows into the soils.

6.5 Induced Impacts

Induced impacts are described as those that are not directly related to the construction or operation of the facilities in question, but rather arise as a result of the use of the natural areas as a result of the development. The simplest example, is increased use of a natural area by residents, feral domestic wildlife, and unauthorized trail/pathway construction.

Once the development is completed, subsequent use of the natural areas by residents, employees or their pets is difficult to control. Education of residents with respect to the values and implications of the neighbouring natural areas is one tool that can be used. A system of authorized trails has been recommended that can also be used to focus any

pedestrian use of the natural areas onto properly constructed, laid out and maintained trails. Plantings of native trees and shrubs can be used to discourage human intrusion into sensitive areas (for example along the watercourse banks).

6.6 Cumulative Impacts

The lands in the vicinity of the subject property have historically undergone considerable modification resulting from agricultural uses and are anticipated to change due to residential development (especially on lands to the north). Numerous land use changes have, and continue to, occur on lands that are downstream of the study area. Attempts to assess aspects of development were included in portions of the Hanlon Creek Watershed Plan. Cumulative impacts may arise as a result of the following:

- Spatial crowding
- Temporal crowding
- Spatial lags
- Temporal lags
- Shared impact linkages

In order to evaluate the potential for cumulative impacts resulting from this development, it is necessary to look beyond the boundaries of the site to the lands that currently receive drainage from the site as well as other neighbouring lands. This approach looks at the character and potential changes that are occurring or may occur in the future on lands within the catchment basin of Tributary A.

The following are brief discussions of each of these potential sources of cumulative impacts.

Spatial Crowding

Spatial crowding occurs when more than one proposal will occur in close proximity to others, such that there is potential for relatively minor impacts from each undertaking to add up (or combine) since they overlap. Future re-construction of the interchange of Laird Road at the Hanlon Expressway is proposed. The layout of this interchange has

been taken into account in the layout of the proposed lots and road network for the study area.

No additional undertakings are known that will overlap with the proposed development. Therefore the potential for spatial crowding impacts is not seen as significant at this site.

Temporal Crowding

Temporal crowding of impacts can occur when phases of a development or different developments overlap in time. Although it is anticipated that development of the lands within the study area will occur over time, as demands arise and landowners progress through the subdivision and site plan stages, the current study has been completed to guide these developments in terms of environmental concerns, impact mitigation. Many design details will be determined at the subdivision stage, but adherence to the targets and design/layout guidelines recommended in this report should avoid significant impacts from temporal crowding.

Therefore the potential for temporal crowding is not seen as significant for this proposal.

Spatial Lags

Spatial lags occur in cases where potential impacts are not found for some distance from the proposed undertaking. An example of this is when groundwater upwellings are affected by changes in land use in the vicinity of recharge areas some distance away.

Based on the analysis of natural features and groundwater resources, no impacts from spatial lags are anticipated.

Temporal Lags

Cumulative impacts that arise from temporal lags are those that occur after time has elapsed between the source of the impact and the possible effect. An example of this is when compounds released change to some more problematic compound after some time of exposure to the environment.

No cumulative impacts from temporal lags are anticipated to result from this development.

Shared Impact Linkages

Shared impact linkages are similar to spatial and temporal crowding, but focus on cases where more than one development, that may not actually overlap in time or space, affects the same component of the ecosystem. An example of this is when one land use change affects the breeding grounds of a species, while a second development affects the over-wintering habitat of the same species.

The concept of shared impact linkage is reflected in current approaches to watershed planning and in terms of Hanlon Creek is seen as an important consideration. Although no significant impacts to the creek or wetlands are anticipated, other developments within the subwatershed of Tributary A must be considered. The proposed developments for the lands to the north of the study area have been prepared, reviewed and approved.

The study area includes the majority of Tributary A catchment basin, and therefore the potential land use decisions within the drainage basins that feed this system are for the most part covered by this study.

The potential for cumulative impacts arising from the proposed business park is not anticipated.

6.7 Summary

The preparation of the November 2004 Draft Plan and Servicing Plans are the culmination of a detailed process of discussions and analyses of a range of issues. The approach to identifying and delineating Constraint Areas, discussed above, was aimed at avoiding direct impacts from development on important natural features. The designation of the constraint levels, has been used to guide the layout of the development in such a way that direct displacement of natural features is minimized. Since the delineation of the natural features, especially the surveyed wetland boundaries, have continued to be basis for the Plan, many direct impacts to natural features have been avoided.

The construction of the new roadway (Road A) will require a crossing of the creek. The proposed location allows for an efficient treatment of the crossing and online pond since both can be dealt with at the same time. By way of the crossing design it is anticipated that the online pond will be removed and the channel restored.

The current alignment of the intermittent drainage way in the northwest corner of the study area (running diagonally from Downey Road), crosses proposed lots and is proposed to be re-aligned to follow closer to Downey Road. No fish habitat is found in this drainage way. The discharge of this ditch is proposed to be directed to a stormwater management pond. This allows for some treatment of the water in this ditch prior to discharge to Tributary A. This not only routes the flows through a stormwater management pond, but also mimics the current discharge location of the flows and also avoids discharge of these possibly salt laden flows further upstream where more sensitive trout habitat occurs (or could be restored).

The proposed location of Road 'D' will intrude into two areas of environmental concern. A small section of the woodlot south of Laird will have to be removed along the new Right of Way. A small wetland pocket will also be crossed within the Road 'D' Right of Way. The wetland pocket was found to not be a part of the Hanlon Creek Wetland Complex.

It was concluded that the intrusion into the woodlot and wetland pockets would be a more acceptable impact. There will be mitigation measures required to protect the exposed woodlot after construction. The proposed details will be included at the detailed design stage of the project.

A number of isolated wetland areas have been identified that were not included in the complex by the Ministry of Natural Resources. Although not recommended for inclusion into the wetland complex, it was recommended that the wetland pockets be kept as potential landscaping features wherever possible. It is anticipated that the majority of the isolated wetland pockets will be removed because of grading issues. The actual grading of the Blocks will be reviewed at Site Plan Approval to determine if any more of the isolated wetland can be protected during and after development.

During the preparation of the conceptual plan in the EIS, one guiding objective was the retention of the main natural area and to investigate the feasibility of closing Laird Road. The intent of this closing was to allow for the ultimate removal of the roadbed and restoration of the creek in the vicinity of the road culvert. Based on further analysis, it was concluded that the existing residential lots found on Laird Road would remain and would therefore require road access. Therefore the Draft Plan shows the section of Laird Road between the two existing residences as closed, but not removed. The roadbed will remain with existing culverts, but it will be topped with turf stone or similar surface treatment to allow for emergency vehicle access. The infrequent traffic along this roadbed will allow for herbaceous plants species to establish on the roadbed, but safety requires that woody species be controlled in the area. Mobile wildlife are anticipated to readily cross this feature.

Typical sediment control measures are anticipated for this development with no impacts anticipated to natural features. Setbacks between the rear lot lines and the wetland edges or watercourse has been established at 15 to 30m (greater in some cases), and therefore it is not expected that runoff would reach these natural areas. The slopes in the area are generally flat and are not anticipated to create significant erosion concerns. In cases where stormwater management facilities are located within the setback, sediment and erosion control measures will be required in this area to ensure that no runoff to the wetlands or creek occurs. No-touch zones have been identified and will be used. These consist of a minimum of 10m around wetland limits or 1m outside the dripline of upland woodlands or fringes (which ever is greatest).

The proposed buildings, etc. will be placed on relatively flat lots with roadside ditches and stormwater management. The surface water flows are anticipated to follow existing grades as well as infiltration of groundwater. This approach will be used throughout the study area. The percent imperviousness for the development is anticipated to be high, emphasizing the need for suitable stormwater management techniques. Lot-level infiltration opportunities will be maximized by directing surface runoff to vegetated areas.

The proposed development is not anticipated to have a significant impact on groundwater or surface water flow patterns and volumes. Assuming that

recommendations with respect to sediment control and infiltration opportunities are maximized, no impacts on the wetlands or creek are anticipated.

Existing water quality in the creek has been found to have high levels of nutrients and pesticides from agricultural sources. The recommendations for stormwater management quality have been provided to enhance this existing condition. Implementation of these measures in conjunction with vegetated setbacks from the wetlands and creek and establishment of vegetated landscapes associated with lots are anticipated to improve current degraded water quality.

Runoff entering the ponds will have been directed to flow over considerable lengths of vegetated swale. Access has been provided to each pond and it is anticipated that monitoring will be required to ensure pond function as well as contaminant levels. Maintenance of the ponds, for example removal of excess/contaminated sediments, will be triggered by this monitoring. As such, it is anticipated that the stormwater management facilities can be integrated with the core natural areas. The placement of the stormwater management ponds can provide vegetated features that can be incorporated into the neighbouring natural areas to potentially 'bulk up' an existing narrowed area.

The proposed grading and the updated stormwater management pond locations require that a series of ditches be constructed along the rear of many of the lots. These plans show the ditches along virtually all wetland areas. These drainage ways will prevent lot runoff from entering the wetland directly and will convey the runoff along these shallowly sloped and vegetated ditches to stormwater management ponds. This was an approach recommended in all previous versions of the EIS and Addenda to address concerns related to the proximity of developments to wetlands where steep slopes are found.

The ditches have been laid out to avoid intrusions into the wetlands. However, to allow for the ditches to be downslope of the proposed lots and to positively drain, these features are proposed to be located within the wetland setbacks. The swales will not intrude into the wetlands. The no-touch zones recommended for use (i.e. 10m from wetlands or 1m from upland driplines) have been used in the layout of these swales.

Based on these designs, it is not anticipated that the construction and operation of the proposed swales will influence the soil moisture within the neighbouring wetlands. It is anticipated that the long runs of some of the flows in these swales will allow for maximum contact with vegetation as well as some infiltration of flows into the soils.

Once the development is completed, subsequent use of the natural areas by residents, employees or their pets is difficult to control. Education of residents with respect to the values and implications of the neighbouring natural areas is one tool that can be used. A system of authorized trails has been recommended that can also be used to focus any pedestrian use of the natural areas onto properly constructed, laid out and maintained trails. Plantings of native trees and shrubs can be used to discourage human intrusion into sensitive areas (for example along the watercourse banks).

The lands in the vicinity of the subject property have historically undergone considerable modification resulting from agricultural uses and are anticipated to change due to residential development (especially on lands to the north). Numerous land use changes have, and continue to, occur on lands that are downstream of the study area. Attempts to assess aspects of development were included in portions of the Hanlon Creek Watershed Plan. The concept of shared impact linkage is reflected in current approaches to watershed planning and in terms of Hanlon Creek is seen as an important consideration. Although no significant impacts to the creek or wetlands are anticipated, other developments within the subwatershed of Tributary A must be considered. The proposed developments for the lands to the north of the study area have been prepared, reviewed and approved.

The study area includes the majority of Tributary A catchment basin, and therefore the potential land use decisions within the drainage basins that feed this system are for the most part covered by this study.

7.0 Recommendations

The following recommendations are provided to ensure that any potential impacts are minimized:

- Sediment and erosion control measures must be installed prior to, and maintained during, construction. Areas of bare soil should be revegetated as soon as feasible to prevent erosion of soils.

- In areas where stormwater facilities are located in proximity to wetlands, the use of minor grading to direct surface runoff away from the wetland is recommended. This generally consists of the slope of the course leading to a very shallow swale created by a low ridge of topsoil. The vegetated swale is configured to direct surface runoff along the swale back away from the wetland edge

- Existing areas of natural vegetation are to be retained wherever possible. In order to maximize the retention of trees and other areas of vegetation, the following recommendations are provided:
  - trees and other areas of vegetation to be retained should be identified and delineated with temporary fencing located beyond the dripline of trees, to ensure that vehicle movement or material storage does not disrupt vegetation (especially tree root zones)
  - any limbs or roots of trees to be retained which are damaged during construction should be pruned using appropriate arboricultural techniques.

- Maintenance of machinery during construction should occur at a designated location away from the wetlands or other natural features on-site.

- Any areas of bare soil that arise should be graded and re-vegetated as soon as possible to avoid gullying and erosion.

- Plantings of woody species along the edges of drainage ways as well as other strategic locations should be considered to maximize protection of these features

from erosion, as well as unauthorized entry (especially of vehicles). Plantings of native tree species on currently unvegetated portions of the site is recommended to enhance site conditions.

Monitoring recommendations are provided separately in Section 8.0.

8.0 Monitoring Plan

8.1 Background

The EIS included the following monitoring activities:

Prior to Construction

- Preparation of landscape plans for wetland edges, setbacks and vegetated berms
- On-site inspections of the following to ensure proper installation
    - sediment and erosion control measures
    - tree saving measures, such as fences installed beyond the dripline of trees to be retained.

During Construction

- Periodic monitoring of the above measures to ensure maintenance and effectiveness
- Pruning of any limbs or roots (of trees to be retained) disrupted during construction
- Maintenance of vegetated setbacks from wetlands and creeks
- Fuelling of machinery to be done at designated location away from the wetland and watercourse
- Storage of machinery and material, fill, etc. to be done in designated areas
- Equipment movement though natural areas and setbacks to be controlled.

Post Construction

- Plantings along setbacks and watercourse to consist of a mixture of native woody tree and shrub species with native groundcover
- Effective stormwater management, anticipated for a timeline of 2 years after substantial 80% buildout

Additional monitoring recommendations have been provided in the servicing and groundwater reports (see TSH 2004, Waterloo Hydrogeologic 2004). As well, the monitoring provided as part of the Hanlon Creek State of the Watershed Report (Planning & Engineering Initiatives 2003) is also recommended for consideration in this area.

8.2 Consolidated Monitoring Plan

The following is a consolidated summary of monitoring recommended for the Hanlon Creek Business Park. This monitoring brings together a number of "tiers" of monitoring required to address:

1. monitoring recommended by the City's Hanlon Creek State of the Watershed Report,
2. site –specific issues,
3. surveys and monitoring required to address the crossing of Tributary A by Road 'A', and relocation of the swale along Downey Road, and
4. other pre, and during construction monitoring deemed by our team to be required based on past experience with this type of undertaking elsewhere as well as within the City of Guelph.

Integrate this multi-level monitoring is recommended to better explain the inter-relationships between these various activities and to explore possible efficiencies in completing this work as a package rather than piece-meal.

The following program was developed to specifically deal with natural environment issues. For additional details regarding some of the surface and groundwater monitoring the reader is referred to the separate reports prepared by Waterloo Hydrogeologic and Totten Sims Hubicki.

8.2.1 Monitoring Recommended in the HCSWS

The recommended monitoring plan for the Hanlon Creek Watershed is summarized in Table C2.1 of the Hanlon Creek State-of-the-Watershed Study (HCSWS) report (PEIL 2003). Overall, the monitoring outlined by the Hanlon Creek State-of-the-Watershed study is a long-term monitoring program of 5-year monitoring frequency to determine watershed health. Specific development-triggered monitoring is not addressed in the HCSWS. As such, the proposed development does not appear to directly trigger any monitoring under the HCSWS, but it is anticipated that the 5-year watershed monitoring horizon would coincide with development or post-development monitoring for this

project. The aquatic and terrestrial resource monitoring requirements of the HCSWS Recommended 5 year Monitoring Program pertinent to the Hanlon Creek Business Park are summarized below and Recommended Actions for this project are outlined.

Surface Water Resources:

Indicator – Stream Temperature

HCSWS Recommendation: Streamflow temperature monitoring at 5 or 6 established sites. None of the sites recommended for monitoring in the HCSWS are in the Hanlon Creek Business Park study area. Hobo-type equipment was recommended, to be placed with data loggers/probes set to record data at 15 minute intervals during spring, summer, and fall months (May through mid-October).

Recommended Action: Although actual HCSWS monitoring stations are not located within the study area, some monitoring of surface and groundwater resources will be required to assess the potential for impacts to the stream (especially Tributary A1). Selection of monitoring stations should consider the findings of the temperature and flow monitoring presented in this report. At a minimum the following stations are recommended:

- North property limit
- Confluence of main branch and Tributary A1
- Tile discharge to Tributary A1
- Laird Road crossing

Aquatic Resources:

Indicator – Fish Communities

HCSWS Recommendation: Sample fish at 15 sites annually in late August (methods outlined in Table C2.1 and within the report text). One fish sampling site appears to be in the Hanlon Creek Business Park study area.

Recommended Action: Conduct fish sampling as outlined at the fish sampling site that is in the Hanlon Creek Business Park study area in conjunction with fisheries work required to address Tributary A1 monitoring as well as permitting of Tributary A crossing and Downey Road swale relocation.

Indicator – Benthic Invertebrates

HCSWS Recommendation: Benthic invertebrate samples taken at 7 sites annually in late August, which coincide with fish sampling (methods outlined in Table C2.1 and within the report text). No invertebrate sampling sites appear to be in the Hanlon Creek Business Park study area.

Recommended Action: Conduct benthic invertebrate sampling as outlined, at the fish sampling site that is in the Hanlon Creek Business Park study area.

Terrestrial Resources:

The four key terrestrial resource indicators and related measures outlined below were "*selected primarily because of their ability to reflect physical and environmental policy related changes affecting natural heritage resources in the watershed from the time of preparation of the HCWS in 1992 to the year 2000*" (B-32, PEIL 2003).

The challenge with the terrestrial monitoring outlined in the HCSWS is that the resource indicators and measures are based on a watershed-level scale and a 5-year monitoring frequency. In general these indicator measures do not translate well to development monitoring or to a sub-area within the larger HCSWS study area. In addition, if comparisons are to be made with the Hanlon Creek Business Park study area, data for it will need to be differentiated or extracted from the HCSWS data, particularly if the HCSWS is to provide the baseline for monitoring.

Indicator – State of the Natural Heritage System (Terrestrial Resources)

The measures and indicators recommended in the HCSWS focus on watershed-wide analyses and for the most part this montoring is recommended to occur separate from the proposed Hanlon Creek Business Park.

Measure #1 – Greenspace Quantity

"*Greenspace quantity can be evaluated by determining the type and extent of natural habitat present in a watershed and by quantifying the degree to which spatial and temporal changes have occurred over time. This requires comparing habitat data for at least two points in time*" (B-34, PEIL 2003).

HCSWS Recommendation:

a. Habitat type – Determine habitat types in watershed.
b. Habitat extent – Determine extent of habitat types in watershed. Determine overall greenspace quantity & contrast changes in greenspace quantity in watershed.
c. Habitat status - Contrast proportional representation of habitat types in watershed. Identify presence of forest interior habitat.

Recommended Action: It is recommended that this watershed-level monitoring be conducted separately from the proposed undertaking.

Measure #2 – Greenspace Quality

HCSWS Recommendation:

a. Naturalness – The "extent to which native plant and wildlife species are represented in the watershed and is expressed as the proportion native to exotic species" (B-36, PEIL). "The current watershed flora should be used for monitoring of this measure in the future" (B-37, PEIL 2003).
b. Extent of Forest Interior Habitat – Forest interior is "habitat that supports cool, moist and shaded (interior) conditions" and "an arbitrary distance of 100 m from the forest edge has become the generally accepted threshold distance (TRCA, 2000)…for the purposes of this study we have used the 100 m threshold" (B-37, PEIL 2003).

Recommended Action: It is recommended that this watershed-level monitoring be conducted separately from the proposed undertaking.

Measure #3 – Greenspace Connectivity

"The current study identifies local-scale linkages that remain in the landscape by identifying linear habitat features that can potentially provide connections between core areas, as well as inter-watershed scale linkages" (B-39, PEIL).

HCSWS Recommendation:

a. Number of connections – number of linkages/corridors that extent beyond watershed boundary; number of linkages/corridors present within the watershed.
b. Barriers and effectiveness to facilitate movement of biota and genetic exchange - length and width of individual linkages/corridors; continuity of individual linkages/corridors (i.e. gaps present); habitat structure & type of linkage/corridor; actual or potential use of linkage/corridor by wildlife (analysis of species in core

habitats); ability of linkage/corridor to meet basic needs of target species or group of species.

Recommended Action: It is recommended that this watershed-level monitoring be conducted separately from the proposed undertaking.

Indicator – Watershed Biodiversity (Terrestrial Resources)

Measure #1 – Habitat Diversity

HCSWS Recommendation:

"*Habitat diversity was considered the rate of habitat turnover within the watershed as a function of changing land use…determined by examining the number of distinct habitat types identified in 1991 and comparing it to year 2000 values using the GIS habitat data sets generated for calculating greenspace availability*" (P-42, PEIL 2003).

Recommended Action: It is recommended that this watershed-level monitoring be conducted separately from the proposed undertaking.

Measure #2 – Plant Species Diversity

HCSWS Recommendation:

Plant species diversity was defined as the "*number of vascular plant species present within the watershed as a whole. Insufficient data is available on the species composition of individual communities to allow for determination of alpha diversity in the traditional sense*" (B-43, PEIL 2003).

Recommended Action: It is recommended that this watershed-level monitoring be conducted separately from the proposed undertaking.

Measure #3 – Wildlife Species Diversity

HCSWS Recommendation:

Wildlife diversity was defined as the number of birds, mammals, reptiles, amphibians and other organisms present within the watershed.

Recommended Action: It is recommended that this watershed-level monitoring be conducted separately from the proposed undertaking.

Indicator – Natural Heritage System (NHS) Integrity (Terrestrial Resources)

"*NHS Integrity can be evaluated by assessing the degree to which the "ideal NHS" has been maintained through the protection of Constraint areas and other measures, by contrasting what was originally proposed with what actually transpired on the ground*".

A number of the measures listed for this indicator relate to adherence of the development layout and process to recommendations presented in the HCWP. As well a number of measures can relate to the implementation of the design, layout etc. (i.e. pre and during construction).

Measure #1 – Status of Constraint Type 1 & 2 Lands

HCSWS Recommendation: No actual 'measures' provided in the HCSWS, but protection and encroachment/development impacts were described for Constraint Type 1 Lands (Natural Core Areas) and Constraint Type 2 Lands (2a. Buffers to PSWs 2b.Corridors and Linkages). Discussion of the cumulative impacts was also made.

Recommended Action: As recommended in the 2000 EIS and noted above, pre and during construction monitoring is recommended specifically:

Prior to Construction

- On-site inspections of the following to ensure proper installation
    - sediment and erosion control measures
    - tree saving measures, such as fences installed beyond the dripline of trees to be retained.

During Construction

- Periodic monitoring of the above measures to ensure maintenance and effectiveness
- Pruning of any limbs or roots (of trees to be retained) disrupted during construction
- Maintenance of vegetated setbacks from wetlands and creeks
- Fuelling of machinery to be done at designated location away from the wetland and watercourse
- Storage of machinery and material, fill, etc. to be done in designated areas
- Equipment movement though natural areas and setbacks to be controlled.

Measure #2 – Zoning Compliance with Adopted NHS

HCSWS Recommendation:

"*To measure the degree to which existing zoning designations comply with what was envisioned by the NHS, the original HCWS was superimposed on a City zoning map (dated 2000). Areas were categorized according to their level of conformity or non-conformity, based on zoning designations considered compatible with the intent of the Constraint Type 1&2 lands*" (B-50, PEIL 2003).

Recommended Action: This measure relates to the Draft Plan adherence to the HCWS which is detailed in this EIS. No further monitoring is required.

Measure #3 – Compliance with City EIS Guidelines and HCWS

HCSWS Recommendation:

"*All EIS reports made available to the study team were reviewed and assessed*" for a number of criteria (B-51, PEIL 2003).

Recommended Action: This measure relates to the content of the EIS. No further monitoring is required.

Measure #4 – Short-Term Ecological Monitoring – Encroachment Impact Analysis

HCSWS Recommendation:

"*To assess the extent of encroachment related impacts, buffer areas for key portions of Hanlon Creek NHS were examined in the field…Observed impacts were categorized by type, photographed and the location of the encroachment was noted*" (B-51, PEIL 2003).

"*Short-term ecological monitoring was based on observations of readily detectable changes to habitat and biophysical conditions along the boundaries of the NHS*" (B-52, PEIL 2003). It appears that no areas within the Hanlon Creek Business Park study area were examined for encroachment since no development had occurred.

Recommended Action: This measure relates to the installation and maintenance of buffers. As recommended in the 2000 EIS and listed above, pre-construction installation of protective fences and during construction monitoring of the buffer areas is recommended. Post construction monitoring of the maintenance of the buffer and associated plantings is recommended to occur as part of the standard development process. One year after monitoring of any plantings is recommended.

Measure #5 – Long-Term Ecological Monitoring – Permanent Vegetation & Wildlife Sampling Plots.

HCSWS Recommendation:

Long-term vegetation and wildlife monitoring permanent plots were established to facilitate and standardize long-term monitoring for the watershed (five permanent plots and 15 permanent point counts). Recommended monitoring frequency for the permanent plots is 5 years. "*Vegetation sampling was designed to capture long-term variation in vegetation composition and structure and should be sampled by a qualified botanist or ecologist on a 5-year cycle*" (B-53, PEIL 2003). ELC methodology and data cards used should be re-used so results can be compared. "*Wildlife monitoring was conducted to assess the presence and absence of breeding birds and other incidental wildlife…data be collected by a qualified wildlife biologist using identical sampling methods on a 5 year cycle*" (B-53, PEIL 2003). For watershed level studies, the focus is typically on birds and, if time and resources permit, amphibians (B-33 PEIL 2003). Three bird/amphibian monitoring points and one vegetation long-term monitoring points are within the Hanlon Creek Business Park study area.

Recommended Action: This monitoring should occur as part of the watershed-wide monitoring program separate from the proposed Hanlon Creek Business Park.

Indicator – Status of Natural Heritage Implementation Strategies

Measure #1 – Status of HCWS Recommendations

HCSWS Recommendation:

"*The City and GRCA were consulted to determine the current status of each of the applicable Plan recommendations and the status of the recommendations was noted as a) complete b) incomplete or c) no longer applicable*" (B-53, PEIL 2003). 11 recommendations were reviewed. Of these, the 'Terrestrial Monitoring Strategy' is applicable to the Hanlon Creek Business Park study area. This recommendation included "*Annual reconnaissance by a qualified biologist for protected areas adjacent to ongoing development*" and "*More comprehensive assessment a 5 yr intervals with air photos and bird/vegetation surveys*" (B-55, PEIL 2003).

Recommended Action: The status of the recommendations should be continually monitored at the watershed level independent of the proposed undertaking.

2. Site –Specific Monitoring

The reader is referred to the specific recommendations provided in the hydrogeological and stormwater management reports.

3. Surveys and Monitoring to Address the Crossing of Tributary A and Relocation of the Swale along Downey Road

As noted in this report, detailed surveys will be required in support of the design of the crossings of the main branch (Road 'A'). The details of this work should be developed in conjunction with staff of the GRCA. Additional surveys are not deemed necessary for the relocation of the Downey Road swale.

4. Other During-Construction Monitoring

The monitoring recommendations provided in the 2000 EIS are supported.

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APPENDIX I

STUDY TEAM MEMBERS

APPENDIX II

PLANT SPECIES RECORDED FROM THE STUDY AREA

APPENDIX III

WILDLIFE SPECIES REPORTED FROM THE STUDY AREA

APPENDIX IV

REDUCED VERSIONS OF NOVEMBER DRAFT PLAN (GSP Nov 2004) AND SWM POND AND CONTRIBUTING AREAS PLAN (TSH 2004)