Terms of Reference

Local Subwatershed Studies

October 2020

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1.0 INTRODUCTION

The Growth Plan for the Greater Golden Horseshoe (2019), along with other guiding documents, promote integrated land use planning processes which consider multiple factors when planning for communities and neighbourhoods. These factors include the natural and physical environment,

infrastructure needs, transportation, as well as socio-economic considerations. A cornerstone to contemporary planning, as recognized by the Growth Plan (2017), is the need for multi-disciplinary subwatershed studies which comprehensively establish a baseline characterization of the environmental conditions and natural systems and resources in a subject study area planned for growth developed on the basis of a subwatershed unit. This systems-based assessment involves an examination of the role of water (both surface and ground) in sustaining area resources, including creeks, wetlands, and other water-based features, including headwater drainage features. This baseline characterization, built on a period of field data collection and monitoring, then serves as the basis from which to examine and assess potential impacts due to planned urbanization. The impact assessment process includes a vetting of land use concept plans through an integrated and comprehensive planning exercise, that includes infrastructure studies such as Master Servicing (Water/wastewater) and Transportation Plans, which are advanced for consideration through a consultative process involving local (Caledon) and the Regional municipality (Peel), other provincial agencies, landowners, Indigenous groups, and the public. Once appropriately vetted, management and monitoring recommendations to implement the recommendations of the Subwatershed Study and related municipal Master Plans are translated into policy and strategies for community development.

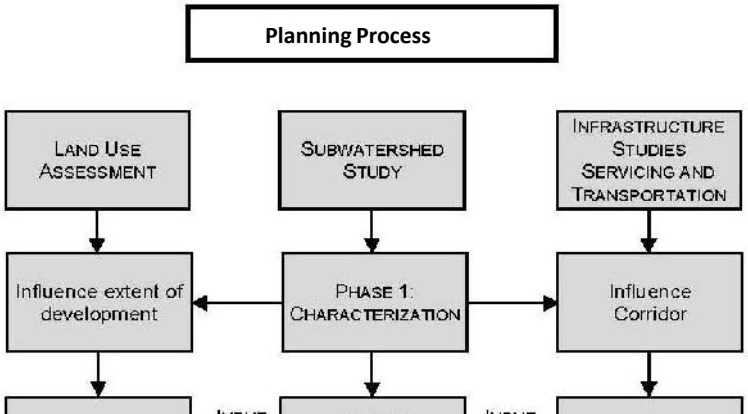
1.1 Study Area

*****TEXT TO BE ADDED, SPECIFIC TO THE SECONDARY PLAN AREA***

1.2 The Secondary Planning Process

This Section is meant to assist in the understanding of the context of the Local Subwatershed Study (Local SWS) in relation to the Secondary Planning Process. The relationship between the Secondary Planning process and the integrated Subwatershed Study and Infrastructure Planning Processes is presented in Figure 1.

Figure 1: Integrated Land Use, Subwatershed, and Infrastructure Study Process



The Secondary Plan, with the accompanying studies, supports the development of a community structure plan (with accompanying development policies). The Secondary Plan process and the related studies (i.e. Local Subwatershed Study, SWM Master Plan, Transportation Master Plan, Water and Wastewater Master Plans, Agricultural Impact Study, and Fiscal Impact/Asset Management Study) have been established to form a comprehensive and coordinated planning process that will meet the required approvals necessary under the Planning Act and the Environmental Assessment (EA) Act.

The Local SWS will provide the environmental base and context for the natural systems to support the infrastructure planning for the Secondary Plan Area. Combining the Planning Act and Municipal Class EA process permits the Municipality and Region to plan the community and its required infrastructure collaboratively in a holistic manner.

The concurrent infrastructure related studies, as part of the Secondary Plan, are intended to follow the Municipal Class EA Master Planning Process (Approach #2). The level of investigation, consultation, and documentation will be sufficient to address Phases 1 and 2 of the Class EA process to fulfill the requirements for Schedule A and B projects and establish in the documentation the basis for specific future investigations if Schedule C projects are identified. To ensure that these approaches are complete and consistent, the Region plans to retain a Project Manager to assist Regional and Municipal staff and the consulting teams to coordinate the studies, prepare required meeting notices and correspondence, and to assist in fully complying with requirements for public, stakeholder and agency consultation, as set out in the Planning Act and Class EA processes.

To facilitate consultation, a Technical Advisory Committee (TAC) will be formed comprising staff from the Region, the Municipality, Conservation Authority, various applicable Provincial representatives, landowner technical representatives, and the consulting team(s). For efficiency, it is anticipated that the same TAC will serve the Local SWS and all the infrastructure Master Planning studies, with timed items on shared meeting agendas. For specific and specialized matters, “sub TACs”, involving the specific professionals, will be used. The TAC will advise and assist in directing the development of the Secondary Plan and its component studies throughout the study process. The TAC will assist in ensuring that the

Secondary Plan evolves from the foundational basis of the Local Subwatershed Study to a Community Plan in a collaborative manner through the integration of the concurrent consultant studies.

Overall, the Secondary Plan will identify the community structure for the current urban area and expansion lands to ensure appropriate integration and consideration for development opportunities within the community. The Secondary Plan will include land use categories, a road/transit/cycling/trail and municipal servicing network, a natural heritage system and open space/major community facility requirements. The objective is to ensure that the new community neighbourhoods and employment areas in the current urban area and expansion lands are developed sustainably in the optimal location, meeting the objectives and requirements of the Growth Plan (2017), as implemented through the Regional Official Plan and the Municipal Official Plan.

As noted above, the environmental base for the Secondary Plan will be defined by the Local Subwatershed Study. The natural heritage system established through the Province and Regional Official Plan, refined through the Municipal Official Plan, will be further refined or confirmed through the Local Subwatershed Study.

A fundamental objective of the Secondary Plan is to ensure the Municipality develops as a sustainable community. To achieve sustainability, the community will be developed based on the vision to be a compact, complete, healthy, and resilient community. The Secondary Plan will target an increased density of persons and jobs per net hectare for the existing community and identify an appropriate target density and land use configuration for the expansion lands.

1.3. Purpose & Objectives of the Local Subwatershed Studies

The purpose of the Local Subwatershed Studies is to assist in developing a sustainable development plan for the subject growth area in Caledon by ensuring protection and benefits to the natural and human environments. The Local Subwatershed Studies are intended to incorporate a natural heritage systems management approach that will protect, rehabilitate, and enhance the environment within the Secondary Plan Area, and the surrounding lands in the subwatershed. The broader watershed/subwatersheds may have existing downstream constraints beyond the identified Secondary Plan study area and, to the appropriate extent, these will have to be considered in establishing the management strategies based on the overall study objectives and ultimate targets.

The Local Subwatershed Studies will need to provide the following:

- Identify the location, extent, present status, significance, and sensitivity of the existing natural environment;
- Identify environmentally sensitive areas and hazard lands, including constraints and opportunities;
- Identify an environmental resource system(s) to protect, rehabilitate, and enhance the ecological function of the system within the Secondary Plan Area and local environs;
- Identify lands where development may be considered, and determine how existing and future land uses can be developed compatibly with natural features;
- Undertake a two-stage, iterative Impact Assessment based on an initial Preliminary Preferred

Land Use Plan (This inherently will require establishing an initial land use concept which will need to be tested and assessed, followed by a second refined land use concept developed through the feedback from the initial testing, including input from other technical studies and feedback from stakeholders);

- Provide direction on best management practices (BMPs) to manage impacts from the Secondary Plan (from an environmental and water management perspective);
- Provide direction on future infrastructure needs (from an environmental and water management perspective);
- Establish an implementation and management strategy and requirements for environmental systems monitoring;
- Support the Class Environmental Assessment process undertaken as part of the infrastructure planning for the Secondary Plan, specific to natural and water-based systems.

2.0 GENERAL SUMMARY OF THE SUBWATERSHED STUDY PROCESS

2.1 Local Subwatershed Studies – Scope and Approach

The Secondary Plan Work Program and related Studies will guide the development of the Secondary Plan area through a consultative, collaborative, and coordinated process to establish a compact, complete, healthy, and resilient community.

The Local Subwatershed Studies for the various Secondary Plan Areas in Caledon will describe the location, extent, sensitivity and significance of natural features and functions within the identified study area and evaluate the factors and influences that are important to their sustainability. The respective studies will establish goals and objectives for terrestrial and aquatic systems (i.e. natural heritage) and water resource systems in accordance with the Provincial Policy Statement, the Region's Official Plan, Municipal Official Plan, and the applicable Watershed Plans and Subwatershed Studies, including the Regional Scoped Subwatershed Study, 2021.. Using existing desktop information and studies and reconnaissance-level and detailed fieldwork , the respective studies will document existing conditions, assess potential impacts of existing and future development and recommend management strategies to manage and mitigate the predicted impacts, including comprehensive stormwater management strategies to protect, enhance and restore hydrologic functions. In conjunction with the concurrent development of the Secondary Plan, including Transportation and Servicing Master Plans (water, and wastewater), the Local Subwatershed Studies (including the Landscape Scale Analysis sub-component) will reflect and refine the Natural Heritage System in the Secondary Plan area and identify strategies to protect, enhance and restore ecological functions and promote compatible activities.

The Subwatershed Studies will be conducted in three (3) phases as follows:

Phase 1: Characterization and Integration

Phase 1 characterizes the resources associated with each subwatershed (and outlet) by study discipline (i.e., hydrology/hydraulics, groundwater, water quality, stream morphology, aquatic, and terrestrial ecology). Background and supplemental field data are to be assessed by each discipline, and then across disciplines, to:

a) establish the form, function and linkages of the environmental resources,
b) identify environmental constraints and opportunities related to terrestrial and aquatic habitat, features, and systems,
c) establish surface water and groundwater constraints and opportunities associated with flooding, erosion, water quality, water budgets, including recharge and discharge areas through new numerical tools (models) suitably calibrated to local conditions
d) establish criteria and constraints for management opportunities associated with the environmental features and systems.

From this work, preliminary "working" goals, objectives, and targets will be developed and refined over the study period for the respective subwatershed(s) in consultation with a Technical Advisory Committee (TAC), comprised of representatives from Caledon, Peel, CAs, and various Provincial agencies.

Phase 2: Subwatershed Impact Assessment

Phase 2 identifies stressors (past, present and future), describes (past, present) and predicts (future) impacts, and assesses these impacts against the preliminary goals, objectives, and targets developed as part of Phase 1. Future land use scenario(s) are evaluated based on input from the Land Use Team. For various disciplines (i.e. groundwater, hydrology, hydraulics and water quality) analytical tools are used to predict changes to existing conditions in relation to subwatershed-based targets. Information and analyses from previous background studies (i.e. Watershed Plan, Regional Scoped Subwatershed Study, Hydrologic Investigations, Tier 3 Studies, etc.) will be used to assist modelling future land use scenarios. For others (i.e., terrestrial and aquatic ecology) predictions will inherently be semi-quantitative, qualitative or conceptual, integrated with predictions from other subwatershed disciplines (i.e., hydrogeology, hydrology, hydraulics and water quality) and experience elsewhere including knowledge of habitat/biota interactions.

As noted earlier, the Subwatershed Impact Assessment process is expected to be a two-stage iterative process whereby an initial land use concept will be evaluated/tested against the preliminary targets, and the feedback from this initial test will then inform the establishment of a refined land use concept.

Phase 3: Management Strategies, Implementation, and Monitoring Plan

Phase 3 will use the findings of Phase 2: Impact Assessment (first and second iteration) to refine and finalize the evaluation of various land use scenarios and recommend a set of preferred management strategies, addressing the preferred land use designations and form, established through broader planning input to achieve the identified goals and objectives, and to establish the recommended strategies. An Implementation Plan will be prepared to offer guidance on: locations and types of SWM facilities, staging/phasing, future study requirements, monitoring, Environmental Assessment requirements, and general economics.

Phase 3 also involves the development of a long-term monitoring initiative that is to evaluate the effectiveness of the proposed management strategies by assessing whether the assumptions made at the Local SWS scale are appropriate and predictions made are sufficiently accurate. The feedback from monitoring will then be used through a process of adaptive management to determine if parts of the Local Subwatershed Study strategies and/or recommendations should be modified. . While the execution of the monitoring plan is not included within the scope of work for the Local Subwatershed Studies, the Local Subwatershed Studies are nevertheless to provide framework-level direction regarding the components, methods, duration, and key locations for the execution of the monitoring program, as part of future work. Further details on area specifics would need to be considered as part of future neighbourhood scale studies.

2.2 PHASE 1 – SUBWATERSHED CHARACTERIZATION AND INTEGRATION

2.2.1 Background Information Review/Gap Analysis/Work Plan Confirmation

Background Information Review:

During Phase 1, the Study Area will need to be characterized and preliminary mapping of constraints and opportunities will need to be developed. Information shall be obtained through three levels of investigation, including (i) review of desk-top secondary sources (compiling information from existing documents); (ii) reconnaissance-level fieldwork; and (iii) detailed fieldwork.

Existing desk-top information relevant to the Local Subwatershed Study Area will need to be reviewed. The Regional Scoped SWS has a comprehensive database and summary of the area studies relevant to these study areas and should be established as the starting point.

Gap Analysis:

Background data used to prepare the Local Subwatershed Study, will need to be documented listing its source and format (e.g. municipal report/agency website/personal communication). For map data, the map scale shall be specified. The list of source materials shall follow a generally accepted bibliographic format. The purpose of documenting the background data is to facilitate a "gap analysis" and identify methods preferred by which to appropriately address the information gaps in Phase 1.

A summary of each document from which information was used to prepare the Local Subwatershed Study will need to be prepared. For each source, a brief (single paragraph) review shall be produced, summarizing the source's content, and describing its relevance to the Local Subwatershed Study.

Work Plan Confirmation:

Once all of the background data have been collected, the need and requirements for obtaining additional information beyond that outlined in the core scope shall be determined, and a proposed program for collecting additional data shall be outlined to the TAC. This process allows for

collaborative consultation on the Work Plan. It will be important to receive final sign-off from the TAC prior to advancing the updated/refined work plan. Any budget implications (plus or minus) will need to be appropriately reviewed and approved by the Town of Caledon in advance of execution.

2.2.2. Hydrology and Hydraulics

Background information on the study area is to be collected from all available sources. Maps of the study area will be provided by the Municipality, Region, and Conservation Authority. For each subwatershed and associated outlet the physical features (e.g. subwatershed boundary, physiography, topography, soils, major watercourses, drainage swales, and wetland features) within the Secondary Plan Area shall be established. Any specific areas of interest shall be defined, identifying important implications on development potential, environmental features, and / or watercourse system function.

Hydrology:

A detailed hydrologic model (continuous) shall be selected for use in the Local SWS. The model(s) will need to be developed and calibrated for the subwatersheds' existing condition. The model shall be a continuous, deterministic, hydrologic model, approved by TAC**,** with a strong physical representation of surface runoff, baseflows, and surface and groundwater interaction. It will be necessary to justify the applicability and sufficiency of the proposed numerical model(s). The modeling should ensure the hydrologic and hydraulic features are quantified for each subwatershed within the study area. Future Municipal or Conservation Authority use of the model, and model results, will be considered as an asset.

It is recommended that as part of the review of background data, that the locations for streamflow gauges and rain gauges be identified. Field data for model calibration/validation should be collected between April and November inclusive. Once calibrated/validated the model is to be executed in both event and continuous mode to generate peak flows for a range of storms including 2, 5, 10, 25, 50, 100, 350 year and Regional Storm.

The results from the surface water model should be used to corroborate the water budget developed as part of the Hydrogeologic assessment.

The hydrologic modelling is to establish the baseline hydrology for the subwatershed systems. As noted, it is expected that the model(s) will be calibrated/validated based upon both historical rainfall and flow monitoring data, as well as new study data collected as part of this study. The exercise should meet the standards to provide a comprehensive understanding of the existing hydrologic conditions of the study area. The model shall be calibrated/validated to provide comparable flows at the subwatershed outlets to those determined in any previous watershed or drainage studies for the given watercourses. The model input parameters shall be compared to previous studies and modified to represent more detailed subwatershed modelling and shall be completed to the satisfaction of the TAC.

The Erosion potential assessment of receiving and downstream watercourse shall be carried out using continuous simulation of watercourse flows over a suitable period time, to evaluate the duration of critical flow exceedance, cumulative shear stress exceedance, or stream power based on the erosion thresholds established by the study stream morphologist and the associated guidance on the appropriate methodology.

Hydraulics:

The Study will involve preparation of a field inventory of creeks, road crossings (culverts and bridges), stormwater facilities, etc.. The current drainage systems and outlets shall be identified with drainage constraints and opportunities. The intent of hydraulic modelling is to define area hazards and system constraints.

For established and regulated watercourses located in the study area, hydraulic analyses shall be conducted. Flood lines shall be established for the Regulatory Event (i.e. greater of the Regional Storm event or 100 Year Storm) for existing conditions. For the creeks that have flood plain delineation, as identified in previous studies, the flood lines shall be updated to reflect the current limits of the flood hazard. The flood plain delineation should be based on hydraulic modelling, using the Hydrologic Engineering Centers River Analysis System (HEC-RAS) model from the U.S. Army Corps of Engineers, to generate the associated flood lines based on the peak flows established through the hydrologic analysis conducted for the subwatershed study. It is noteworthy that this study, while preparing preliminary floodlines for land use planning purposes, is not intended to be a formal floodline mapping study.

2.2.3. Hydrogeology

The goal of this Local Subwatershed Study with respect to hydrogeology is to establish a geological conceptual model for the study area, determining the key characteristics of the bedrock and overburden systems, in addition to their functions in terms of controlling groundwater movement, availability, and quality in the subwatershed study area. An integral component is to assess the interactions between the groundwater system and the surface water system, and to determine the overall role or function of these interactions in an ecosystem context. It is also important to have an understanding of the effects of future development on the local groundwater resource to assist in the need and implementation of techniques to address overall water balance. This subwatershed study will build on the understanding of the Scoped Subwatershed Study. The incorporation of additional field monitoring using new data and refined modelling tools will provide additional spatial and temporal insight on the groundwater system. The refined analysis will achieve the primary objectives and extend the understanding of the following key issues:

- Presence of potentially significant local recharge areas, linked with local discharge,
- Shallow depth to groundwater: strong upward gradient,

- Groundwater/surface water interaction,
- Dewatering issues,
- Seepage areas and
- Existing tile drainage.

In order to accomplish the above goals, any additional data provided to the Scoped Subwatershed Study will need to be reviewed prior to finalizing the groundwater field program. The groundwater field program is expected to include but not be limited to the following:

- Monitoring well installations with borehole logs,
- Drivepoint piezometers,
- Manual and continuous water level measurements,
- Groundwater and surface water chemistry,
- Hydraulic conductivity measurements and
- Spot baseflow measurements.

The refinement of the conceptual groundwater model provided in the Scope Subwatershed Study may include the following:

- Refine geologic interpretation and hydrostratigraphy including surficial geology and hydrogeologic parameters.
- Refined understanding of observed shallow groundwater conditions as they relate to response to storm events, upward gradient and potential impacts on infrastructure.
- Refine mapping and interpretations groundwater discharge areas (subwatershed scale and reach scale).
- Refinements to understanding of groundwater flow include contributions to and from areas outside the subwatersheds.

The baseline groundwater conceptual model and groundwater model analysis should incorporate observations and technical assessment from the hydrologic, terrestrial, aquatic and fluvial geomorphologic characterizations. These would include for example:

- Observations of seepage and discharge,
- Fish habitat,
- Phreatophytic observations,
- Streambed composition and
- Low flow analysis and water quality.

In turn the groundwater characterization should provide technical input to aid in confirming or guiding the characterization of the component subwatershed studies.

Field observations for groundwater discharge will be coordinated at the outset of the field program. In order to efficiently use the field resources, observations from all disciplines should be utilized, as it is expected that more field reconnaissance is carried out by terrestrial, aquatic and fluvial geomorphology in the course of their work.

2.2.4. Stream Morphology

Several objectives concerning aquatic habitat are intended to protect the morphological and fluvial character of the study area streams, with the intent (where feasible) to restore sinuosity, maintain physical habitat attributes (e.g. pools, riffles etc.), diversity and fluvial processes (e.g. bed load transport, energy reduction through sinuosity, etc.), and to prevent increases in erosion and deposition through the maintenance of the hydrological regime.

Available data for the subwatershed and other existing sources, is to be reviewed and confirm the need for updating the existing information. Reach delineations are to be confirmed and/or updated based on refined mapping and field investigations. Each reach is to be characterized using industry standards including the application methodology presented in *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (CVC and TRCA, 2014). A baseline morphologic assessment, according to stream characterization and flood /erosion considerations, is required including a detailed inventory of stream morphology observations. Through field-based observations of channel process and stability, sensitive and/or representative sites are to be selected to complete detailed field surveys for an erosion threshold analysis at the systems scale.

An erosion potential analysis is to be conducted, based on the erosion data collected to understand the erosion processes and to identify areas which are prone to erosion, or where existing structures may be at risk. This will be completed though desktop and field analyses. The erosion potential analysis is also to determine the threshold flows for erosion at strategic points in the subwatershed for input to the hydrologic assessment. Assessments will identify sites most sensitive to erosion, with reasonable details covering the entire study area.

An erosion hazard delineation will be completed for each watercourse reach. The valley setting will determine whether a meander belt (unconfined systems), or a long-term stable top of slope (confined systems) is delineated. These assessments and application of setbacks will conform to Provincial Policy and applicable Conservation Authority Regulations.
In addition, the Study Team's Stream Morphologist, along with others on the Study Team including aquatic and terrestrial ecologists and surface and groundwater specialists, are to conduct an assessment of the headwater drainage features (HWDF) in accordance with the TRCA/CVC 2014 protocol as referenced above. The assessment will need to involve multi-seasonal fieldwork and an

integrated interpretation of the data to establish current classification and future management (Phase 3). Any site-specific modifiers to the protocol will need to be vetted through the study's Technical Advisory Committee prior to finalizing and proposing management recommendations.

2.2.5. Aquatic Environment

Conduct an assessment of fisheries in the subwatershed study area. Detailed field assessments of the aquatic environments shall generally be undertaken in the areas of fish and riparian habitat, including areas immediately upstream and downstream of these habitat areas. Stream classifications based on the priority of the habitat type as well as cold, cool, and warm water designations shall be identified. An assessment of stream barriers and on-line ponds will need to be undertaken to determine potential impacts of development on aquatic resources. Where applicable, the criteria and considerations contained in Table 1 will form the basis for evaluating watercourses. The data collected will be used to ensure that future development will have no negative impacts on fish habitat or the ecological functions for which the area has been identified. Opportunities for enhancement of the aquatic environment shall also be identified.

When assessing species, status should include federal, provincial and local rankings. In addition, maps that identify the results of the aquatic investigations shall be provided. Areas of interest should be identified by comparing existing land uses to sensitive aquatic habitats.

Further, as noted above, the Study Team Aquatic Ecologist will need to support the HWDF assessment based on the "Evaluation, Classification and Management of Headwater Drainage Features Guidelines" (CVC & TRCA, January 2014).

Table 1: Aquatic Environment Inventory Requirements

Biophysical Inventory	**Inventory Requirements**
Fisheries Assessment	Electrofishing may be required. If required, MNRF Permits would need to be obtained. Acceptable protocols (i.e. Ontario Stream Assessment Protocol (OSAP)) should be followed.
Habitat Assessment	Assess watercourse habitat using acceptable protocols, i.e. the OSAP module.

Species at Risk Screening	Screening should include results from all available sources, i.e. Natural Heritage Information Centre, Ministry of Natural Resources and Forestry (MNRF), Municipal List and Conservation Authority database, and Fisheries and Oceans Canada (DFO) screening map.

2.2.6. Terrestrial Environment

Landscape Scale Screening

In order to better understand the ecological context of the proposed development area as part of the overall subwatershed , a review of the provincial and regional Natural Heritage System will be required, building upon the Regional Scoped SWS. The purpose of this review will be to generate information on the ecological context of the Study Area and its potential connectivity within the broader landscape. This Landscape Scale Screening will be helpful to identify terrestrial and wetland habitat connectivity, potential wildlife movements, and the ecological context of the Secondary Plan Area, in relation to the surrounding environs to help understand and to develop linkages between the ecological systems. This screening will rely on existing information sources.

Assessment of Terrestrial Resources

An assessment of terrestrial resources in the subwatershed shall be undertaken. The Natural Area Inventory information from the Conservation Authority and the Town of Caledon should be consulted prior to the initiation of field work. The data collected shall be used to ensure that future land-use planning and development is consistent with Section 2.1 of the Provincial Policy Statement and Region of Peel's Official Plan.

The criteria for evaluating the terrestrial features should include the following requirements. Depending on the vegetation community, Ecological Land Classification (ELC) results and habitats determined to be present in the study area, it may be appropriate to undertake targeted surveys for certain taxa or species, rather than rely solely on incidental observation. The Significant Wildlife Habitat Eco-Region 6E Criteria Schedules (MNR, 2015) should be used in conjunction with the Significant Wildlife Habitat Technical Guide when assessing Significant Wildlife Habitat.

Detailed field assessment of the terrestrial resources shall be provided to characterize the terrestrial environment and establish a baseline terrestrial environment for the Secondary Plan Area, including the proximity to, and the degree of linkage with other habitats. When assessing species, status should

include federal, provincial and local rankings. In addition, maps that identify natural heritage features and the results of the terrestrial investigations shall be provided. Opportunities for enhancement of the terrestrial environment shall build on those identified in the SABE scoped Subwatershed study, including confirmation of enhancement areas objectives and targets.

Table 2: Terrestrial Environment Inventory Requirements

Biophysical Inventory	**Inventory Requirements**
Vegetation Community Identification	Use Ecological Land Classification to classify vegetation communities according to Lee et al. (1998).
Botanical Inventory	3 season survey (spring, summer and fall) to identify species.
Native / Invasive Flora Survey	Determine the percentage of Native and Invasive Species in surveyed vegetation communities.
Evaluation of Unclassified Wetlands	Document species records and wetland community types consistent with methods used in the Ontario Wetland Evaluation System (OWES).
Breeding Bird Surveys	2 surveys at least 10 days apart; the first between May 24th and June 16th and the second between June 17th and July 10th using 10 minute point counts and area searches. Breeding evidence by species should be recorded according
Reptile Surveys	Use active searching or other commonly accepted MNRF protocols/methods (April- July and Sept.-Oct.)
Amphibian Breeding Surveys	3 surveys between April and June corresponding to specific nighttime temperatures of >5°C, >10°C and >17°C, according to the Marsh Monitoring Protocol. Salamander surveys are required using active searching and should be completed in spring in appropriate ponds to determine the presence of salamander breeding areas.

Incidental Wildlife Observations	Incidental sightings of all wildlife (mammals, birds, butterflies, dragonflies, damselflies, amphibians, and reptiles) should be recorded during site investigations
Species at Risk Screening	Screening should include results from all available sources, i.e. Natural Heritage Information Centre, wildlife atlases, MNRF Municipal List and Conservation Authority
Significant Wildlife Habitat Screening and Assessment	This assessment will include identifying candidate and confirmed Significant Wildlife Habitat and will utilize the MNR's *Significant Wildlife Habitat Technical Guide 2000)* and associated Criteria Schedules (MNRF 2015).

2.2.7. Surface Water Quality

Currently available background information shall be used to provide a preliminary understanding of the baseline water quality in the Secondary Plan Area and subwatershed. The existing datasets shall be reviewed to understand the existing water quality status proximate to the study area. The existing water quality status shall be assessed to provide the baseline reference, and identify any water quality concerns and constraints in the study area. Other studies such as the Conservation Authority's Source Water Protection work will have some relevant data to contribute to this understanding. The study will also locate existing SWM facilities and the respective catchment areas, as the baseline reference for stormwater management in terms of water quantity/ quality control.

Local water quality monitoring data are collected in order to characterize the surface water quality based upon the contributing land use, soils, and stormwater quality management practices during both wet (storm) and dry (baseflow) periods. Surface water quality monitoring at the same locations as the streamflow gauging in order to correlate the surface water quality with the study area hydrology. Surface water quality monitoring would need to be conducted between the months of April and December. Water quality grab sampling would be completed at each station for three (3) dry weather

events and capturing at least one (1) wet and one (1) dry event for each season. Two (2) grab samples would be obtained for each wet weather event, with the objective of characterizing the surface water chemistry during the onset of the storm with the first sample, and characterizing the surface water chemistry during the recession of the storm with the second sample. Grab sampling has been recommended over the use of automated samplers as prior experience with the use of automated samplers has demonstrated logistical issues related to the pre-determination of the sampling duration and interval, functional issues related to the "triggering" of the sampler and siting on a flat surface, as well as other issues related to protection against vandalism.

The grab samples for each wet weather and dry weather event will need to be analyzed for the following contaminants:

- Oil and Grease
- Total Phosphorus
- Anions (Nitrate, Nitrite, Phosphate, Chloride)
- Ammonia
- Total Kjeldahl Nitrogen (TKN)
- Conductivity
- Total Solids (TS)
- Total Suspended Solids (TSS)
- BOD_5
- Dissolved Oxygen
- pH/alkalinity
- Salinity
- Total Coliforms/Fecal Coliforms/E. Coli
- PAH
- Metals (Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Se, Si, Ag, Na, Sr, Tl, Sn, Ti, W, U, V, Zn, Zr)
- Hardness as $CaCO_3$
- Turbidity

2.2.8. Phase 1 Report – Subwatershed Characterization and Integration

At the completion of Phase 1, the general characteristics of the subwatershed study area will have been identified and a clear understanding of the constraints and opportunities will have been developed. Constraints and opportunities mapping shall be developed, and a preliminary Natural Heritage System should be identified, building upon that identified in the Regional Scoped SWS. The Phase 1 Report will establish the general characteristics of the subwatersheds and the Secondary Plan Area, which will be the starting point from which the proposed land uses are to be developed.

The Phase 1 Report shall include:

- Summary of background literature and data reviewed;
- Subwatershed study area characterization including:

- a. Climate, landform, geology, and soils
- b. Hydrogeology/groundwater quantity and quality
- c. Surface water quantity and quality
- d. Stream geomorphology
- e. Aquatic and Terrestrial ecosystems

based on the findings of the:

(i) review of secondary sources (compiling information from existing documents);
(ii) reconnaissance-level fieldwork; and/or,
(iii) detailed fieldwork.

- Assessment of above identified features and functions to evaluate their significance
- Summary of the subwatershed study area major issues, concerns and constraints; and,

Summary of the opportunities for potential development and of the preliminary Natural Heritage System. The constraints and opportunities for potential future development shall be assessed based on the following considerations:

- High Constraint: Native vegetation communities with highly significant habitat attributes present and / or with severe slope constraints and / or located directly adjacent to a permanent watercourse. High constraint areas should be protected and enhanced within the Natural Heritage System.

- Medium Constraint: Native vegetation communities with moderately significant habitat attributes present and / or with moderate slope constraints and / or associated with imperfect drainage. May include successional communities. Features should be protected and integrated into potential development where feasible. If not developed, opportunities to enhance these features as part of the Natural Heritage System should be examined.

- Low Constraint: Cultural communities with limited significant habitat attributes present, no slope constraints and not associated with hydrological features and linkages. The features do not represent direct constraints to development and represent opportunities for potential development or for habitat restoration.

Note: It is expected that a Draft Table of Contents will be submitted for review and comment well in advance of the Draft Report submission. A minimum of three weeks should be allowed for submission of comments on all submitted deliverables, including Draft and Final Reports.

2.3. PHASE 2 – IMPACT ASSESSMENT

Based on the outcomes of Phase 1, including the review of background information sources and supplementary fieldwork, Phase 2 will require an iterative assessment of the potential impacts of future land use changes on the natural environment and water system within the study area. The findings from the Phase 1 Characterization and Integration work, completed by the various disciplines, along with the outcomes of the initial servicing and transportation needs, will be considered in an integrated manner in developing the preliminary preferred land use concept. A screening of the preliminary land use concepts is to be undertaken in Phase 1 to determine a preliminary preferred concept(s) for impact assessment in Phase 2.

The Phase 2 Impact Assessment work will be completed concurrently to the other component studies such as the Transportation Master Plan, and Water / Waste Water Master Servicing Plan, which will also be assessing the impacts and requirements of the preliminary preferred land use concept.

The intent of Phase 2 is to assess the impacts of the preliminary preferred land use concept and inform the preliminary establishment of initial management strategies which:

- protect the critical elements and systems of the subwatershed and local drainage system;
- prevent environmental degradation;
- provide adequate flexibility for integration with adjacent development and redevelopment areas;
- assist in the establishment of open space linkages;
- identify opportunities and constraints to development;
- provide a strategy to manage existing land uses;
- detail preliminary locations and areas for stormwater management (LID BMPs and end-of-pipe facilities); and
- identify restoration and enhancement opportunities.

In Phase 2, a detailed analysis shall be completed to assess the impacts of future land use changes in the Secondary Plan Area. Various options and practices for mitigating these impacts shall be reviewed and management strategies to create net benefit shall be advanced. As noted, the assessment of future land use changes is premised on a 2-stage iterative approach whereby the feedback from the initial assessment shall be provided to the TAC and the Land Use Prime Consultant.

The information from the Local SWS at this stage, will be considered along with the information from the concurrent transportation and servicing assessments to refine the preliminary preferred concept option(s) to eventually develop a preferred Secondary Plan.

The second iteration of impact assessment will be expected to be more scoped and focused on the specific changes to the land use and environmental impact management strategies. Hence the scope outlined in the following sections will need to be conducted twice, the first time will inherently be more complex and detailed than the second time. It is expected that the majority of the impacts and associated management and land use changes will have been captured as part of the first iteration.

2.3.1. Hydrologic and Hydraulic Analysis

Hydrology:

A hydrologic analysis shall be conducted for the initial future development land use concept to determine post- development flows, hydrographs and water balance (integrated with the groundwater

assessment).

The existing conditions hydrologic model shall be modified to reflect post-development conditions and executed continuously and in event mode to generate peak flows for all events ranging from 2, 5, 10, 25, 50, and 100 year, and the Regional Storm. As in the hydrologic analysis for existing conditions, the model results shall be reviewed by the TAC. The modelling will be used to determine the potential impacts on surface water, groundwater and water budgets. The Phase 2 Impact assessment hydrologic analysis will need to :

- Delineate a discrete drainage area plan based on potential future development;
- Calculate post-development flows for all event storms at predetermined locations, as per discretized drainage area plan and model schematic diagram within the study area. The post-development flows shall be compared to existing flows for all storm events at the hydrologic nodes of interest;
- Conduct the water budget assessment at the nodes of interest coordinated with the Groundwater modelling (see below).
- Identify constraints related to imperviousness and intensity of development. Assess the requirement and/or performance of proposed stormwater management facilities including the potential approach for Regulatory flow impact management per the details outlined in the Regional Scoped SWS;
- Assess the future discharge impacts on the local systems and the broader creek systems;

The future development impact assessment should evaluate the impacts on both runoff volumes and peak flow rates.

Hydraulics:

The existing hydraulic condition shall be reviewed in the context of the proposed development, with the land use changes, runoff increases and/or channel modifications. For those watercourses which may receive additional flow or perhaps require no controls, the study shall assess the impacts of the proposed development on watercourse water levels, flow velocities and water surface profiles for all storm events. Any potential erosion and/or flood risk concerns due to the proposed development shall be identified. Again, for any watercourses where flow would change, current flood line information shall be updated for post-development scenarios. The model results shall be reviewed and approved by the TAC.

The updated future land use flood lines (where changes are considered) are to be presented on the maps, with Regulatory Event flood line locations and cross sections identified with flood elevations. The overtopping depths, caused by the Regulatory Event, shall be assessed and documented on existing roads at all crossing structures. The flood plain maps should confirm the post-development flood levels are consistent with the current condition. Any changes in the flood inundation magnitude must be listed in inventory, with explanations of such changes. Any preliminary stormwater management strategies, required to match the post-development flows to existing conditions, shall be identified.

2.3.2. Hydrogeology

The hydrogeology analysis shall examine the impact of future development and land use changes on groundwater systems. An impact analysis is to be completed to evaluate the sensitivity of the groundwater flow system to changes in land use resulting from a potential reduction in recharge. Impacts are expected to include a decrease in the water table elevation, changes to stream flow (e.g. baseflow/groundwater discharge) and the potential degradation of groundwater quality. The hydrogeological component of the subwatersheds investigation shall:

- Ensure the groundwater sensitive areas are recognized and protected from future urbanizing and disturbances;
- Within the water balance assessment, update the overall groundwater budget model along with the surface water components for both existing and future scenarios; The water budget for the study area shall estimate precipitation, evapo-transpiration, runoff and infiltration, in addition to the groundwater recharge and discharge; and
- Take into account any relevant needs within the Source Water Protection Plan.

Integration with the hydrologic modelling and consistency of the various input parameters is required. It is understood the hydrologic and groundwater analysis may have some differences in the physical representation. The potential limitations should be reflected in the overall impact assessment.

The groundwater impact assessment should be integrated with the ecological component impact assessments as it relates to the groundwater function for discharge or water table depth.

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2.3.3. Stream Morphology and Erosion Analysis

Erosion hazards as mapped and confirmed through Phase 1 will need to be evaluated against the proposed landuse plan to ensure that area watercourses are protected from encroachment by development, but also to ensure that risk to property and infrastructure is minimized. Where realignments are proposed, and provided there is sufficient rationale, realignment alternatives should be evaluated through an integrated process with other members of the Study Team to maintain flood conveyance, habitat requirements, and linkages. Any realignment will require that appropriate erosion hazards and setbacks are delineated and mapped.

The continuous erosion analysis (see hydrologic assessment above) for the existing conditions shall be updated with the future development scenarios. Erosion potential for the study area shall be estimated by applying erosion thresholds to the existing channel / bank conditions using the post-development flows. This analysis is to be completed for the same cross sections that were assessed as part of the detailed geomorphological assessment. Appropriate mitigation measures shall be recommended for sections showing a significant increase in erosion potential. Erosion thresholds shall

be used to establish discharge rates for stormwater management systems for the proposed development to ensure there is no increase in downstream erosion. This process will involve determination of the impacts without mitigation and then defining the necessary levels of control in an iterative manner to ensure downstream systems are appropriately protected.

Based on the results presented in Phase 1, identify which watercourses and headwater drainage features in the proposed development area are stable and have sufficient conveyance capacity, and which watercourses and headwater drainage features need restoration or alteration through natural channel design approaches. Stream morphology shall be assessed downstream of future development areas, with a focus on the existing and potential erosion concerns. Existing and future development impacts shall be evaluated with the development strategy indicated to limit the negative impacts, while accommodating opportunities to restore and improve the existing channel status. This will need to consider those watercourses and HWDFs which are to remain on the landscape versus those which can be removed subject to appropriate management practices.

For areas of new development, the size of the channel block necessary to allow natural channel design to occur shall be determined. The sizing will include the meander belt, hydraulic criteria, fisheries setbacks and Natural Heritage System planning, and all buffers and setbacks. The natural channel design information on which the preliminary assessments are made, shall be documented for use at the next stages of planning (i.e. neighbourhood scale). The natural channel design strategy must clearly define that all channel blocks have the ability to convey flows associated with the Regulatory event. As noted, the size determination should be made based on stream morphology, in addition to the considerations of aquatic and terrestrial features and setbacks. The determination of which watercourses and HWDFs are to be maintained and which are to be considered for relocation or removal, needs approval of the TAC. The Conservation Authority and MNRF and others will ultimately need to be consulted for any recommended channel works.

2.3.4. Aquatic Environment

Assess the potential impacts of future land uses on the aquatic resources. Recommendations shall be identified for improvement of aquatic habitat, including in-stream, stream bank and flood plain habitat enhancement, removal of barriers and on-line ponds, and retrofitting existing altered habitats. The assessment shall relate physical characteristics and processes of the aquatic environment to biological communities. The assessment shall also identify and protect appropriate buffers/setbacks, and linkage of these habitats, which reflect the specific stream sensitivity and required buffer functions.

Detailed assessment shall be generally focused on the significant areas identified in Phase 1 and areas immediately downstream of proposed new developments. Considerations should be given to Low Impact Development approaches. Along with the Stream Morphologist, the Aquatic Ecologist must consider HWDF management.

2.3.5. Terrestrial Environment

The Study Team is to investigate potential land use impacts on the terrestrial features. Appropriate buffers/setbacks should be identified in order to protect the natural heritage features and functions from disturbance. In addition, potential linkages (natural areas that ecologically connect core areas) shall be identified and protected. Linkages are important in reducing the potential adverse impacts of habitat fragmentation on natural areas. The management strategies shall be documented regarding the protection of these sensitive resources and functions. Linkage and buffer alternatives, should be presented in maps to:

- Identify successional habitat that are restoration areas within the Natural Heritage System;

- Identify habitat features that will be retained as part of the Natural Heritage System due to their quality.

The assessment shall generally focus on the sensitive areas identified in Phase 1 and areas in the immediate vicinity of new developments. Where a continuous ELC-defined vegetation community extends beyond the subject areas, the assessment shall generally address the entire community, including portions beyond the study area boundaries.

2.3.6. Surface Water Quality

The successful consultant shall investigate potential land use impacts and develop strategies to maintain or enhance in-stream water quality. Actions to address existing point and non-point sources of pollution resulting in degraded water quality shall be developed. Best Management Practices (BMPs) for urban stormwater management shall be recommended for all new development to address stormwater quality. The proposed BMPs shall be in accordance with the requirements of the MECP and the Municipality including the Provincial guidance which focuses on a treatment train approach using LID BMPs.

2.3.7. Phase 2 Report - Impact Assessment

At the completion of the Phase 2 1st Iteration and 2nd Iteration Stages, Reports will need to be prepared (i.e. one for each iteration) outlining the results of the Impact Assessment. These Reports shall be submitted to document the results of the impact assessment and the preliminary evaluation of the stormwater management options and recommended subwatershed management strategies as they relate to the proposed development. The water (surface/ground) modelling input and output files shall be appended to this report. In addition, constraints and opportunities present in the study area, in terms of urban expansion, environment impacts and protection, shall be clearly documented with GIS maps for the associated locations.

Note: It is expected that a Draft Table of Contents will be submitted for review and comment well in advance of the Draft Report submission. A minimum of three weeks should be allowed for submission of comments on all submitted deliverables, including Draft and Final Report

2.4. PHASE 3 – MANAGEMENT, IMPLEMENTATION, AND MONITORING PLAN

Phase 3 shall set the framework for implementation and monitoring of the preferred subwatershed's management strategy building from the results of the second iteration land use impact assessment. A Management, Implementation, and Monitoring Plan shall be developed, which sets out the requirements for phasing, financing, operation of facilities, and monitoring to ensure the future development(s) are in compliance with the approved Local Subwatershed Study and Secondary Plan Policies. The Phase 3 work will be completed concurrently with the land use planning work, when a preferred community structure plan has been determined. The findings of this study will provide a technical framework for future infrastructure works, and support the future development proposals in accordance with the approved Secondary Plan.

Watercourse management recommendations will be made at the reach scale and based on an integrated characterization of feature constraints, with site-specific opportunities presented as appropriate. Similarly, headwater drainage feature management recommendations will be based on the outcome of the TRCA/CVC (2014) guidelines with reach-scale recommendations. Deviations from the recommendations of the HDF guidelines will require that site modifiers are identified to justify changes in the management recommendation. Management recommendations and opportunities are to be developed in consultation with the Study's TAC, with agreement prior to study conclusion.

Phase 3 will provide the detailed subwatershed management strategy for the proposed development, based on the evaluation of a range of subwatersheds management options through Phase 2, based on the preliminary subwatershed goals, objectives and targets, established in Phase 1. The scope for additional studies will also be identified that are to be completed in support of future Block Plans, Draft Plans of Subdivisions or Condominium, and Site Plans as required, to meet the objectives and targets of this Subwatershed Study. The Subwatershed Study is to identify preliminary locations for logical blocks or sheds for consideration as part of future neighbourhood plans.

Groundwater

Management strategies are required that will reflect the local and functional linkages of sensitive recharge and discharge areas, the potential groundwater quantity impacts on the private wells and groundwater quality degradation.

Groundwater management strategies should include technical input (quantitative and qualitative) into the following:

- Determination or refinement of hydrogeologically sensitive areas relating to both recharge and discharge.
- Potential location and function of Stormwater Management facilities and other BMPs.
- Planning and policy recommendations for groundwater quantity and quality protection.

Phase 3 shall outline the agencies/organizations that are responsible for carrying out the various recommendations, and specify when in the development process the various recommendations need to be initiated. Phase 3 shall include:

- Timing and Phasing recommendations for the construction of any required facilities with respect to the future development; these recommendations will inherently need to consider the influence of other infrastructure as well;

- Asset Management Strategies such as:
    - A Phasing and Funding strategy for the construction and maintenance of the facilities;
    - A monitoring program to ensure compliance with the subwatersheds study, and a strategy for corrective actions which may be necessary based on results of the monitoring program;
    - Recommendations for future studies;

- An Adaptive Management and Monitoring Plan to monitor the subwatershed's response to land use change and suggest adaptive responses where impacts are being observed;

- Assist Secondary Plan Consultant with developing policies for consideration in the Secondary Plan;

- Time frame for the review/update of the Local Subwatershed Plan;

The Management, Implementation, and Monitoring Plan shall also recommend the phasing of development, and address climate change considerations, particularly demonstrating compliance with Peel Region's Climate Change Master PlanThis will permit changes to recommend mitigation measures and management strategies for future phases of the development, in the case results of monitoring from the initial phases suggest that changes are warranted.

Note: It is expected that a Draft Table of Contents will be submitted for review and comment well in advance of the Draft Report submission. A minimum of three weeks should be allowed for submission of comments on all submitted deliverables, including Draft and Final Report

Demonstrated knowledge of the Ontario and Federal Environmental Assessment process, and specifically the Municipal Class Environmental Assessment process, will also be a valuable asset.