

Peterborough County Watershed Plan Equivalent

Volume 2: Planning and Management Guidance

Prepared for: Peterborough County

Prepared by: Onterris Canada Inc. in association with Scheckenberger &
Associates and Grounded Solutions

July 2026

Version 1.0

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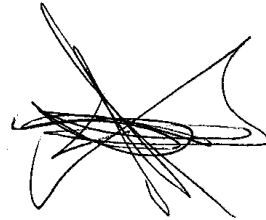
July 2026



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Version Control

Version	Date	Issue Type	Filename	Description
V0.1	16-Mar-2026	Draft	40848 PCWP Vol.2 2026-03-13 draft v0.1.docx	Issued to client for review
V0.2	27-Mar-2026	Revised Draft	40848 PCWP Vol.2 2026-03-27 draft v0.2.docx	Issued to Technical Advisory Committee for review
V0.3	03-Jun-2026	Revised Draft	40848 PCWP Vol.2 2026-06-03 draft v0.3.docx	Issued to client for review
V0.4	06-Jul-2026	Revised Draft	40848 PCWP Vol.2 2026-07-06 draft v0.4.docx	Issued to client for final review
V1.0	22-Jul-2026	Final	40848 PCWP Vol.2 2026-07-22 final v1.0.docx	Issued to client for release to Council and others

Preamble

This Watershed Plan is intended to be a “living document” which provides a basis for both sources of data / mapping and planning / management guidance that can be updated and adapted over time based on evolving circumstances and the outcomes of collaborative efforts.

This Watershed Plan (both Volumes 1 and 2) was developed between the fall of 2024 and the spring of 2026 based on the most current applicable data / mapping and the most current applicable policies / regulations / guidelines known and made available to the team. It is understood that both data / mapping sources and policies / regulations / guidelines will continue to be updated/change and may change after this Plan is finalized, and that moving forward, future work and studies, based on this Plan, should consider the most current and applicable sources of information, available at that time.

Inclusion of First Nations Historical Context in the Volume 1 Foreword

The Michi Saagiig historical / background context prepared by Gitiga Migizi, a respected Elder and Knowledge Keeper of the Michi Saagiig Nation was provided to the County as part of the feedback on Peterborough County’s Draft Watershed Plan by Curve Lake First Nation on April 22, 2026. It has been included in the Foreword to Volume 1 of this Watershed Plan, with Curve Lake First Nation’s permission, to recognize and share this context provided from the perspective of the peoples who have lived on these lands for thousands of years.

Note on the Pending Consolidation of Conservation Authorities in Ontario

On March 10, 2026, the Province announced a revised framework to merge Ontario’s 36 Conservation Authorities (CAs) into nine (9) Regional CAs. The transition timeframe to this framework is targeted for February 1, 2027.

For Peterborough County, this means there will be one Regional CA (i.e., Eastern Lake Ontario Regional Conservation Authority) instead of the current four CAs (i.e., Otonabee Conservation, Ganaraska Conservation, Crowe Valley Conservation Authority and Kawartha Conservation). However, for the purposes of this Watershed Plan, which was developed over 2025 and finalized in 2026, the references to the four CAs have been retained, as this transition was still in progress at the time of Watershed Plan completion.

Notably, only part of the County (i.e., the southwestern area largely overlapping with Ecoregion 6E) is under the jurisdiction of CAs. The northeastern part of the County (i.e., the area largely overlapping with Ecoregion 5E) remains outside the jurisdiction of any CA, and activities that may impact key environmental resources, including water (as well as fisheries, wildlife and forests) continues to be managed by the Province, currently through the Ontario’s Ministry of Natural Resources (OMNR). In addition, Parks Canada continues to actively manage water levels and flows through the Trent-Severn Waterway, with over a quarter of this waterway running through Peterborough County.

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Appendix A Comments on Draft Watershed Plan (Volumes 1 and 2) and responses
Appendix B General Terms of Reference for Subwatershed Studies in the County of Peterborough

Note: The recommendations in this Watershed Plan are found in Volume 2 and highlighted as in bold text in Section 9 and Section 10.

1 Introduction

In late 2024 Peterborough County (“the County”) retained a multi-disciplinary team led by Montrose Environmental Solutions Canada Inc. and supported by Scheckenberger & Associates and Grounded Solutions Services Ltd. (“the Consulting Team”) to assist in the development of the County’s first Watershed Plan.

Watershed planning can occur at various scales and corresponding levels of detail. The overall framework for, and guidance in, this Watershed Plan is provided at the tertiary watershed level (as shown in the third frame in Image 1). However, this Watershed Plan has also been developed with consideration for the more resolute quaternary watershed scale, as well.

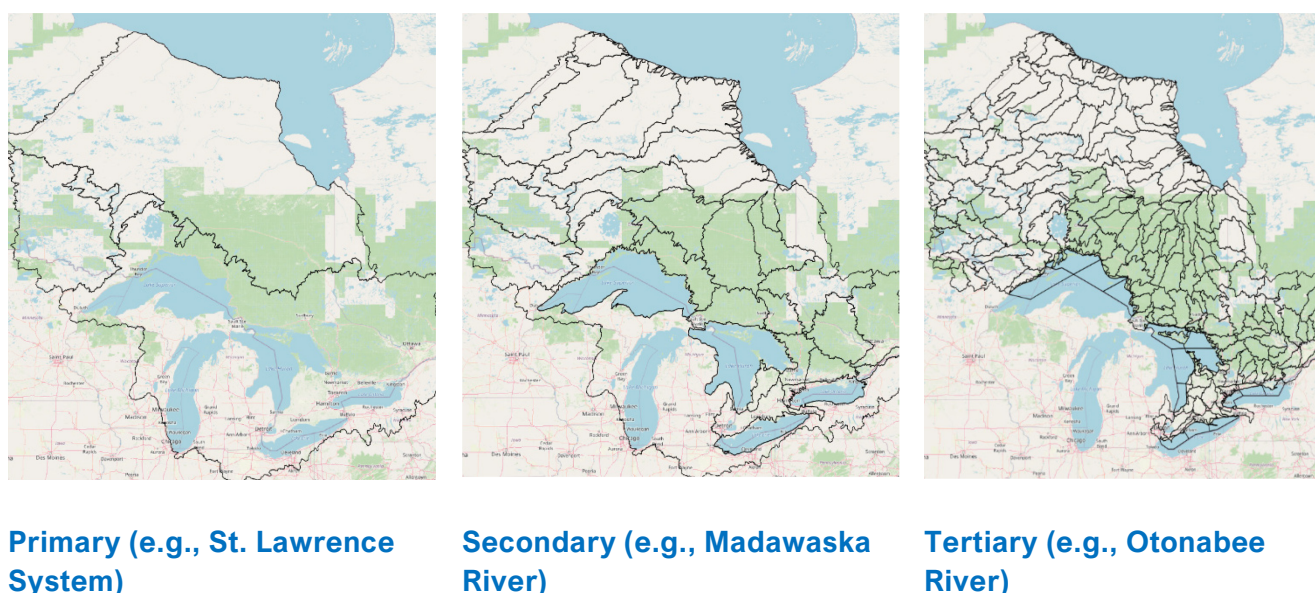


Image 1 Illustration of the Top three Levels of the Provincial Watershed Delineation Hierarchy

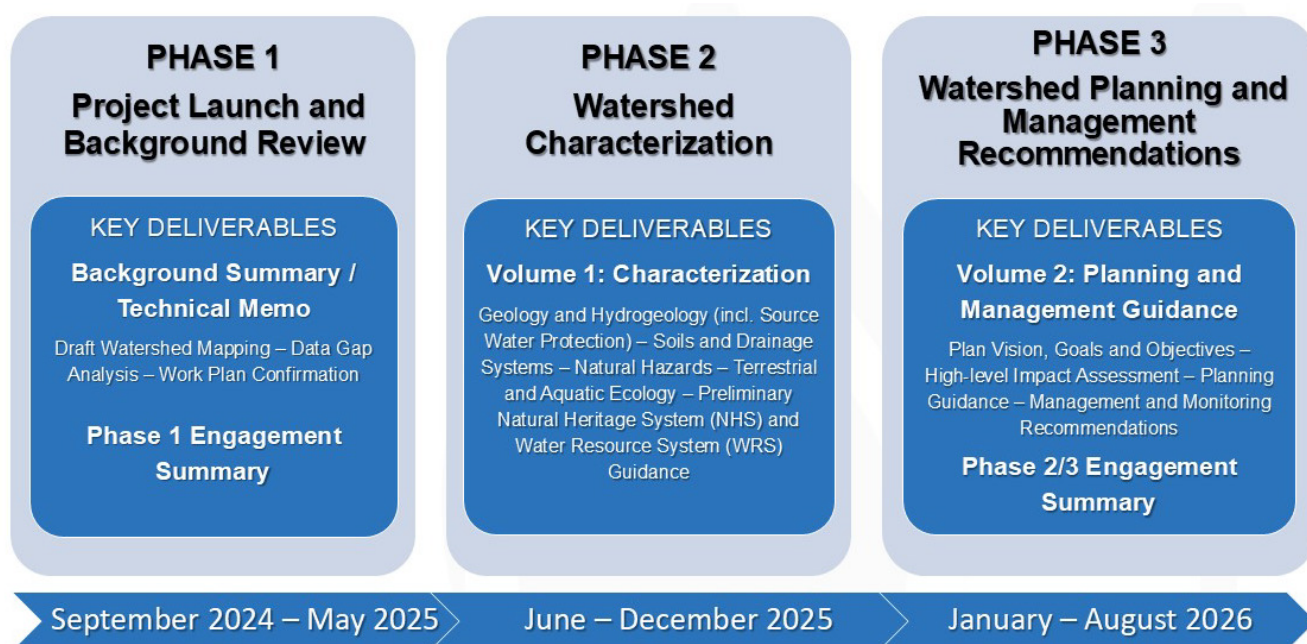
This Watershed Plan is referred to as an “Equivalent” due to the size of the Study Area (see Section 1.2) and its focus on using desktop data only at this stage. A Watershed Plan “Equivalent” focusses on the collection and analysis of available and relevant data and mapping, deferring area-specific modelling and field data collection to the quaternary scale watershed studies which will follow.

This Watershed Plan was identified as a strategic priority in the County’s 2023-2026 Strategic Plan to:

- Provide a framework for sustainable and science-based planning that will support the protection of the County’s valued natural heritage and water resources, and
- Provide high-level guidance to inform updates to the County’s and local municipality Official Plans in accordance with current provincial direction.

- Address the requirements related to watershed planning outlined in the 2024 Provincial Planning Statement (“PPS”) and current provincial guidance related to watershed planning (see Section 1.3)
- Provide a basis and framework for more detailed studies (including detailed modelling of the water-based systems and fieldwork) in priority quaternary watersheds in the future, and
- Inform sustainable growth, infrastructure planning, and restoration efforts on a County-wide and tertiary watershed scale.

The Watershed Plan has been conducted through three (3) phases and documented in two volumes as follows:



1. Peterborough County Watershed Plan Equivalent, Volume 1: Characterization (referred to herein as Volume 1 of the Watershed Plan) (including Figures 1 through 28, which are also referenced in this Volume 2), and
2. Peterborough County Watershed Plan Equivalent, Volume 2: Planning and Management Guidance (referred to herein as Volume 2 of the Watershed Plan).

An overview of the content in each of these volumes is provided in Section 1.4.

What is the purpose of the County's Watershed Plan?

1. To address the requirements of the 2024 Provincial Planning Statement (PPS) related to watershed planning and provide guidance related to natural heritage and water resource planning that also aligns with current provincial direction.
2. To provide a framework for sustainable and science-based planning that local Municipalities, Conservation Authorities and others can use to support targeted growth while also protecting the County's valued and diverse natural heritage and water resources.
3. To provide high-level planning and watershed management guidance to inform updates to the County's and local Municipality Official Plans, as well as the scope and scale of studies needed to inform and support growth.

How does the Watershed Plan support this purpose?

1. It consolidates and illustrates the most current available information on the extent and condition of natural heritage and water resources in the County (e.g., forests, wetlands, streams and groundwater etc.) and identifies key gaps in these data.
2. It provides high-level guidance and technical recommendations related to the policies and studies needed to advance sustainable growth with consideration for the County's unique and extensive biodiversity in a context of a changing climate.

1.1 Study Area

The Study Area for this Watershed Plan is the entire County of Peterborough. Peterborough County is a large upper tier municipality west of the Greater Toronto Area (i.e., over 8,000 km²) that has urban and urbanizing centres, extensive agricultural lands and even more extensive water and natural heritage resources (see Figure 6).

Biophysically, the County is broadly characterized by thousands of rivers and lakes with extensive shorelines, as well as extensive forests and wetlands. Physically, the County's natural resources are broadly shaped by the fact that the southern third of the County is south of the Canadian Shield and the top two-thirds are in the transition zone onto the Canadian Shield known as "the Land Between."

The Study Area includes eight (8) local area municipalities (see Figure 1) and overlaps with the jurisdiction of four (4) conservation authorities (see Figure 2), as follows:

Local Area Municipalities

- Municipality of Trent Lakes
- Township of Asphodel-Norwood
- Township of Cavan Monaghan
- Township of Douro-Dummer
- Township of Havelock-Belmont-Methuen
- Township of North Kawartha
- Township of Otonabee-South Monaghan
- Township of Selwyn

Local Conservation Authorities

- Crowe Valley Conservation Authority (CVCA)
- Ganaraska Conservation
- Otonabee Conservation
- Kawartha Conservation

The Study Area also overlaps with the Williams Treaties lands which impacted the following seven (7) First Nations, including two that have reservation lands within the County (see Figure 1 and Figure 2), as noted:

- Alderville First Nation
- Beausoleil First Nation
- Chippewas of Georgina Island First Nation
- Chippewas of Rama First Nation
- Curve Lake First Nation (CLFN)**
- Hiawathas First Nation**
- Mississaugas of Scugog Island First Nation

** With reservation lands within Peterborough County, as shown in Figures 1 through 3.

The City of Peterborough is not included in this study as it is a single tier municipality with its own Watershed Plan. However, the City of Peterborough is surrounded by the Study Area and has hence been engaged as part of this study.

In addition to the political boundaries and jurisdictions outlined above, the Study Area includes and focuses on the five (5) tertiary watersheds covering the County (see Figure 3) and the 26 quaternary watersheds within (see Figure 4), as described in more detail in Volume 1.

1.2 Provincial Watershed Planning Requirements and Guidance

As discussed in Volume 1 of the Watershed Plan, the Province requires planning authorities to use watershed-based assessments and planning to ensure growth and development can be advanced without negatively impacting natural and water resource systems. Where upper tier municipalities (like Peterborough County) are undertaking watershed planning, they must do so in partnership with their local Municipalities and First Nations, and in collaboration with their local conservation authorities.

The specific policies from the 2024 PPS that the County and its local area municipalities are required to comply with are outlined in Volume 1.

Furthermore, Ontario's Watershed Planning guidance document (Government of Ontario 2018) which is still in Draft format outlines the following seven components that are integral to watershed planning:

1. Water budgets, conservation plans, and surface and groundwater quantity considerations
2. Water quality of surface and ground water, nutrient loading, and assimilative capacity assessments
3. Consideration / identification of natural hazards (erosion, flooding, dynamic beach)
4. Climate change considerations
5. Interconnections with natural heritage features, areas, and systems, and the benefits of green infrastructure
6. Consideration of cumulative impacts, and
7. Analysis of land use and management scenarios.

The 2018 provincial guidance generally advocates for the following four steps, recognizing that some aspects of these steps can only be fully addressed with assessments at the quaternary (i.e., area-specific) watershed scale. The recommended steps are listed below with an indication of which requirements are being fulfilled by this Watershed Plan, and which will also need to be supplemented with further studies and policies.

1. Assessment of existing watershed conditions (e.g., characterization, data gaps): Provided in this Watershed Plan (Volume 1).
2. Setting the direction (e.g., vision, goals, and targets): Provided in this Watershed Plan (Volume 2) and to be supplemented with future quaternary watershed studies.
3. Implementing the direction (e.g., policies, servicing requirements): Provided in this Watershed Plan (Volume 2) and to be supplemented with future quaternary watershed studies and Official Plan policies.
4. Monitoring and Evaluation (e.g., evaluation against goals and targets, reporting): Provided in this Watershed Plan (Volume 2) and to be supplemented with future quaternary watershed studies.

The characterization in the Volume 1 report provides the technical background information necessary to inform planning for the "protection, restoration, or enhancement of the quality and quantity of water" provided in Volume 2. The outcomes and guidance of this Watershed Plan are also intended to inform area-specific management plans, provide a tertiary watershed-scale

framework for site-specific studies, and inform target setting through future more detailed quaternary-scale watershed plans.

1.3 Overview of Engagement

This Watershed Plan has been developed in partnership and collaboration with a Technical Advisory Committee (TAC)¹ comprised of the eight (8) local area municipalities in the County, the City of Peterborough, the two First Nations with reservations in the County (i.e., Hiawathas First Nation and Curve Lake First Nation), and the four conservation authorities whose jurisdictions overlap with the County. It has also been informed by input from other interested local First Nations and from a range of local agencies, institutions, utilities, lake and cottage associations, and other organizations.

Peterborough County's Watershed Plan study process has included two phases of engagement, as illustrated in Image 4:

- Phase 1 (spring 2025): To inform interested parties about the project, gather input to inform the background review and Study are characterization, and seek input on ideas for the vision.
- Phase 2/3 (spring 2026): To share and seek feedback on the Draft Watershed Plan (Volume 1 and Volume 2), with a greater emphasis on the draft Volume 2 planning and management guidance.



Image 4 Peterborough County Watershed Plan Equivalency Project Engagement

¹ The TAC was identified as part of project initiation by the County and consists of representatives from the County, all eight local area municipalities, the City of Peterborough, four local conservation authorities, and two First Nations with reservation lands in the County.

The feedback gathered and documented through the engagement sessions has:

- Helped ensure that the Consulting Team has the most current and relevant background data and sources to inform this Watershed Plan
- Informed the Vision and Goals for this Watershed Plan (outlined in Volume 2: Section 4), and
- Informed the planning and management guidance developed for this plan (as outlined in this Volume 2).

An overview of the outcomes of each of these phases is provided below. More details about the parties engaged and the feedback provided is available in the Phase 1 and Phase 2/3 Engagement Summaries available from the County and provided under separate cover.

1.3.1 Phase 1 (Project Launch and Background Review) Engagement

Prior to launching the first phase of engagement for this project, a workshop was held with the TAC in November 2024 to (a) inform them about the project and their key role, (b) present an overview of background information collected to date, and (c) seek assistance in identifying and filling data gaps.

As part of the Phase 1 engagement, a project web page was created early in 2025 and has been updated as a source of information for all interested parties over the course of this study. In addition, a suite of virtual workshops was offered over March 2025 to (a) introduce participants to the project, (b) present the preliminary findings of the background review, and (c) seek input on the background, as well as the vision and goals² for this Plan. These workshops included: an open presentation to County Council, a session with the TAC, a session with several local First Nations, and a session for governmental agencies, utilities companies, academic institutions, lake associations, land trusts and other community and environmental organizations.

The Phase 1 engagement resulted in some additional sources of potentially useful data and/or mapping to inform Volume 1 and the following feedback on priority areas and directions to include in the Watershed Plan vision and goals:

- The community expressed strong and widespread support for lake shoreline protection, restoration of shoreline health, and maintaining and improving water quality (including shoreline naturalization / health, septic health, etc.).
- The TAC expressed support for building / drawing on some of the language from the County's 2023-2026 Strategic Plan which was developed collaboratively with the local area municipalities.

² The vision and goals are a component of watershed plans outlined by the PPS (MMAH, 2024). See Section 1.4 for more information.

- The First Nations emphasized the importance of water as the “bloodline” of the people and suggested referring to the First Nations in Ontario Water Declaration (Chiefs of Ontario 2008). The First Nations participants also referred to the UN Declaration on the Rights of Indigenous Peoples (UNDRIP) as guiding Indigenous engagement in land use planning, specifically Article 25 (see below).

United Nations Declaration on the Rights of Indigenous Peoples (2007), Article 25

Indigenous peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard.

Additional notable comments included:

- Suggestions to look at neighbouring jurisdictions for planning tools for shoreline protection, which was identified as a gap in the County Official Plan by the TAC.
- Recognizing while the more intensive development pressure is in the south of the County there is still diffuse and ongoing development pressure along many of the shorelines throughout the County.
- The First Nations highlighting that the Provincially Significant Wetland (PSW) mapping and mapping of unevaluated wetlands is incomplete and does not account for the First Nations perspective that consider all wetlands “significant” irrespective of their size. Similarly, the First Nations highlighted that the Species at Risk in Ontario mapping / knowledge is incomplete and fails to incorporate Indigenous perspectives and knowledge.

1.3.2 Phase 2 (Watershed Characterization) and Phase 3 (Watershed Planning and Management) Engagement

The Phase 2/3 engagement, consisted of outreach to and a suite of virtual workshops offered over April 2026 to: (a) present the draft vision and goals, (b) present the key findings and suggested guidance from the Volume 1 and Volume 2 studies, and (c) seek input on the draft Watershed Plan direction and guidance. These workshops included: sessions with the TAC, local First Nations, and other identified stakeholders and interested parties (e.g., governmental agencies, utilities companies, academic institutions, lake associations, land trusts and other community and environmental organizations). Highlights of the feedback are noted below.

The Phase 2/3 Engagement Summary, available under separate cover, includes more details.

Williams Treaties First Nations

All Williams Treaties First Nations were invited to engage in the Watershed Plan development. Two local First Nations with reserves in the County were engaged as part of the Technical Advisory Committee (TAC) established for this Plan, and the five other Williams Treaties First Nations were invited to participate in separate First Nations workshops.

Curve Lake First Nation (CLFN) was one of the most actively engaged, providing a comprehensive review letter with many recommendations, including a suggestion that natural heritage ecological integrity be respected by not permitting development in Provincially Significant Wetlands (PSW) or Areas of Natural and Scientific Interest, and to ensure minimum 30 m buffers to all wetlands (see Appendix A). The First Nations also flagged pits and quarries in Ecoregion 5E as land use changes of concern.

Selected comments provided by CLFN and other Williams Treaties First Nations who participated in in Phase2/3 of the engagement for this Watershed Plan were as follows.

- Water is a being with its own rights – not a resource – from the Indigenous perspective.
- Growth should proceed only after subwatershed scale planning is completed.
- Wetlands, floodplains, and riparian zones should be preserved as natural flood storage.
- Maintain ecological connectivity, particularly of woodland and wetland complexes.
- Establish a Watershed Governance Table / Group.

Written comments provided by Williams Treaties First Nations on the Draft Watershed Plan, and responses to these comments from the consulting team, are provided in Appendix A. Verbal comments provided by Williams Treaties First Nations at the virtual workshops were documented and are summarized in the Engagement Summaries for this Plan.

Local Municipalities

All eight local municipalities were engaged as part of the TAC established for this Plan through a series of workshops and through draft deliverables shared with the TAC for review. At each workshop the consulting team presented information and updates related to the project, as well as draft Watershed Plan findings and recommendations for consideration.

Throughout the Watershed Plan development, local municipalities emphasized the need for the Watershed Plan to include rationale and policy guidance / support for watershed-based and natural heritage system planning and policies.

Specific comments provided by the local municipalities on the Draft Watershed Plan, and responses to these comments from the consulting team, are provided in Appendix A.

Local Conservation Authorities

All four local conservation authorities were engaged as part of the TAC established for this Plan through a series of workshops and through draft deliverables shared with the TAC for review. They also provided considerable data and mapping resources at the outset of this project that helped inform the characterization of the Study Area.

Selected comments provided by the Conservation Authorities by who participated in Phase 2/3 of the engagement for this Watershed Plan were as follows.

- There is a lack of knowledge regarding the sensitivity/capacity of many of the lakes in the Kawarthas as it relates to land use changes. There should be recommendations in this Plan to help fill those gaps.
- The County is a large jurisdiction with extensive and diverse water resources, and the importance of, and need for, partnerships to implement this Plan should not be underestimated.
- The technical expertise and capacity of Conservation Authorities should be leveraged to help support and implement this Plan. This includes their ability to support / inform watershed planning with data collection and analyses, including long-term water resources monitoring as well as erosion and flood mapping.

Written comments provided by the Conservation Authorities on the Draft Watershed Plan, and responses to these comments from the consulting team, are provided in Appendix A.

Lake and Cottage Associations, Other Local Organizations and Agencies

Representatives from more than 50 local agencies, institutions and community organizations (including many lake and cottage associations) were invited to engage in the Watershed Plan development, and representatives from more than 30 such groups participated in at least one of the virtual workshops offered.

Selected comments provided by those who participated in Phase 2/3 of the engagement for this Watershed Plan were as follows.

- Highlighted the availability of water quality data that have been, and in some cases continue to be, collected by local groups / associations and /or local institutions at their own expense.
- Strong support for lake shoreline protection, including restoration of shoreline health.
- Concerns about the increasing development pressures on many lakes and shorelines in the northern part and the County (i.e., Ecoregion 5E), and suggestions that in addition to considering the more concentrated growth pressures in the southern part of the County (i.e., Ecoregion 6E), that the Official Plan policy guidance also adequately address the pressures further north (i.e., Ecoregion 5E).
- Support for, and interest in, maintaining and improving lake water quality (including shoreline naturalization / health, septic health, etc.).

Written comments provided by community organizations on the Draft Watershed Plan, and responses to these comments from the consulting team, are provided in Appendix A. Verbal comments provided by representatives who participated in the virtual workshops were documented and are summarized in the Engagement Summaries for this Plan.

Volume 2 of the Watershed Plan includes a comment response matrix (see Appendix A) with all written comments received on the Draft Watershed Plan with responses from the consulting team, including a number of comments that are to be addressed as part of future more detailed and area-specific studies.

It is recommended that the comment-response matrix in Appendix A, (i) serve as a transparent record of the feedback received on this first high-level Watershed Plan, and (ii) be re-considered through future engagement as part of more detailed area-specific growth or development plans in the County, as appropriate. This is to help ensure that the feedback and insights gathered as part of this County-wide study are re-considered as part of more area-specific studies, as appropriate.

1.4 Watershed Plan Volume 1 and 2 Overview

As noted, this Watershed Plan has been delivered in two reports, Volume 1: Characterization and Volume 2: Planning and Management Guidance.

Volume 1 summarizes the presence and distribution of various above and below-ground environmental features, and their sensitivities based on the available data at the County-wide and tertiary watershed scales and specifically includes:

- A summary of the background review findings and gaps identified completed as part of the first phase of this project (Section 2)
- A description of the presence and distribution of various environmental features and their sensitivities across the County (i.e., the Study area) (Section 3), and
- A description of the presence and distribution of various environmental features and their sensitivities in each tertiary watershed in the County:
 - Otonabee River Tertiary Watershed (Section 4)
 - Trent River – Crowe River Tertiary Watershed (Section 5)
 - Gull River Tertiary Watershed (Section 6)
 - Kawartha Lakes Tertiary Watershed (Section 7)
 - North Lake Ontario Tertiary Watershed (Section 8)

Volume 2 of the Watershed Plan builds on the technical background in Volume 1 to inform the vision, goals and objectives for the Study Area and provide planning and management guidance to address the established objectives. Volume 2 includes, as it relates to natural heritage and water resources in Peterborough County at the watershed-equivalent scale:

- An overview of the planning context (Section 2)
- A vision, goals and objectives for the Study Area (Section 3)
- High-level guidance related to Natural Heritage System and Water Resource System identification (Section 4)
- Watershed-scale guidance related to water quantity and quality management, planning for climate change, natural hazard identification and management, and natural heritage and water resource system identification (Section 5)
- Land use impact and cumulative impact assessment guidance (Section 6)

- Guidance for prioritizing and scoping future subwatershed studies (Section 7)
- Guidance related to monitoring and adaptive management (Section 8)
- Opportunities for improving Official Plan policies (Section 9), and
- Opportunities for enhancing outreach and stewardship (Section 10).

Together, these two volumes comprise the County's first Watershed Plan.



Rotary Greenway Boardwalk (Credit: Township of Selwyn)

2 Planning Context

Peterborough County is a large upper tier municipality in southeastern Ontario whose planning framework is primarily established through the Planning Act and the supporting Provincial Planning Statement (PPS), last updated and approved in 2024. Both the County and its eight lower tier municipalities (see Section 1.1 and Figure 1) must be consistent with the PPS (see the most relevant policies outlined in Section 2.1 below) and any other applicable provincial plans and must also align with and consider a range of provincial and regional acts, policies and guidance documents.

Although the information in the Watershed Plan has been necessarily and appropriately presented using tertiary and quaternary watershed scale units, the ecoregional context should also be considered from an environmental planning perspective. In addition to watershed boundaries, which are based primarily on surface water drainage divides, Ontario is also divided by ecoregional boundaries based on local climate, geology, soil and vegetation conditions. The County of Peterborough is basically bisected by the transitional divide between Ecoregion 5E (which is on the Canadian Shield and includes the Municipalities of North Kawartha and Havelock-Belmont-Methuen) and Ecoregion 6E (which is on sedimentary bedrock / limestone and includes the Municipalities of Cavan Monaghan and Otonabee-South Monaghan) (see Figure 24). These broad ecoregional units have particular relevance from a natural heritage planning perspective since the biophysical and land cover differences between them are reflected in some provincial policies and guidance, including the PPS, as outlined in more detail in this section (see Table 1).

In Peterborough County, the only other provincial plan that applies in the Oak Ridges Moraine Conservation Plan (ORMCP) and only in the Township of Cavan Monaghan (see Section 2.2 below and Figure 29).

Also, directly relevant to this Watershed Plan, are the provincial documents and legislation:

- Watershed Planning in Ontario Guidance, Draft (2018), as outlined in Section 1.2
- Subwatershed Planning Guide, Draft (MECP 2022a), more applicable to future more area-specific studies
- Conservation Authorities Act, R.S.O. 1990 (Government of Ontario 2026) and related Source Water Protection Plans are also directly relevant to this Watershed Plan, as outlined in Section 2.3 and 2.4 below, and
- Municipal Act (2001), in part, as outlined Section 2.5 below.

In addition, there are also various federal and provincial environmental acts and policies that need to be considered as part of advancing planning and development for quaternary watershed scale, area-wide (e.g., Secondary Plans) and site-specific studies not described in this Watershed Plan. These include:

- Federal legislation and guidelines: Fisheries Act, Migratory Birds Convention Act, Species at Risk Act, and Canadian Water Quality Guidelines (MOEE, 1994)

- Provincial legislation and guidelines related to water resources: Environmental Protection Act, Lakes and Rivers Improvement Act, Ontario Water Resources Act, Nutrient Management Act, Clean Water Act, Safe Drinking Water Act, Provincial Water Quality Objectives, and Stormwater Management Planning and Design Manual (MOEE, 2023), and
- Provincial legislation and guidelines related to aquatic and terrestrial resources: Species Conservation Act (which replaced in the Endangered Species Act in January 2025), Natural Heritage Reference Manual (MNR 2010) (which remains the primary guidance document for implementing the natural heritage policies of the PPS), Ontario Wetland Evaluation System Southern Manual, 4th edition (MNRF 2022a), Significant Wildlife Habitat Technical Guide (MNR 2000) and Significant Wildlife Habitat Criteria Schedule for Ecoregions 5E and 6E (MNRF 2015a; MNRF 2015b).

At the regional scale, Peterborough County's Strategic Plan (2023-2026), Official Plan and current growth management guidance from the Growth Analysis Report (Hemson 2022) provide the overarching planning and land use guidance needing to be considered in this Watershed Plan, as outlined in Sections 2.6, 2.7 and 2.8 below.

2.1 Provincial Planning Statement

The Provincial Planning Statement (PPS; MMAH 2024) provides policy direction on matters of provincial interest related to land use planning and development. The PPS sets the policy foundation for regulating the development and use of land; it provides for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment. The PPS provides the minimum standard, and policy foundation, upon which the provincial plans build.

The PPS states:

- Large and fast-growing municipalities must undertake watershed planning for municipal services (smaller municipalities are encouraged), and
- Planning authorities must collaborate with Conservation Authorities to identify hazardous lands/sites and manage development.

The Province directs land use planning to be informed by watershed planning. The PPS identifies the watershed as an ecologically meaningful scale that enables a coordinated, integrated and comprehensive approach for dealing with planning matters within municipalities such as managing growth and development; economic development strategies; managing natural heritage and water resources; ecosystem, shoreline, watershed and Great Lakes related issues; and natural hazards. The Draft Watershed Planning in Ontario guidance document (Government of Ontario 2018), as outlined in Section 1.2, provides municipalities with watershed planning guidance to inform their land use planning activities.

The PPS also defines watershed planning as providing a framework for establishing comprehensive and integrated goals, objectives, and direction for the protection, enhancement, or restoration of

water resources, including the quality and quantity of water, within a watershed and for the assessment of cumulative, cross-jurisdictional, and cross-watershed impacts. Watershed planning evaluates and considers the impacts of a changing climate on water resource systems and is undertaken at many scales. It may inform the identification of water resource systems.

Notably, the 2024 PPS asserts that the policies in this document represent “minimum standards” and that “planning authorities and decision-makers may go beyond these minimum standards to address matters of importance to a specific community, unless doing so would conflict with any policy of the [PPS].”

2.1.1 Natural Heritage System Policies

The Provincial Planning Statement (2024) defines a Natural Heritage System (NHS) as:

“a system made up of natural heritage features and areas, and linkages intended to provide connectivity (at the regional or site level) and support natural processes which are necessary to maintain biological and geological diversity, natural functions viable populations of indigenous species, and ecosystems. These systems can include natural heritage features and areas, federal and provincial parks and conservation reserves, other natural heritage features, lands that have been restored or have the potential to be restored to a natural stage, areas that support hydrologic functions, and working landscapes that enable ecological functions to continue. The Province has a recommended approach for identifying natural heritage systems, but municipal approaches that achieve or exceed the objective may also be used.”

In the County of Peterborough, as shown in Figure 24 and Figure 29, the north and northeastern portion of the County are within Ecoregion 5E (i.e., on the Canadian Shield) while the south and southwestern portion of the County are within Ecoregion 6E (i.e., Mixedwood Plains). This means that these two regions are quite distinct from a biophysical perspective (as described in Volume 1 of this Watershed Plan). This distinction also has some planning implications because the PPS natural heritage policies (4.1.1 through 4.1.9) are consistent across Ecoregions 5E and 6E in many regards, but have several important differences.

As outlined in Table 1, municipalities in Ecoregion 5E must protect most of the same natural heritage features and areas using the same policy tests as in Ecoregion 6E (e.g., Provincially Significant Wetlands, Significant Wildlife Habitat, Areas of Natural and Scientific Interest, Fish Habitat, and habitat of Endangered and threatened species), with three notable exceptions. There is no requirement to identify a Natural Heritage System, Significant Woodlands or Significant Valleylands in the north / northeastern part of the County on the Canadian Shield. This is an important consideration for the Official Plan and policy direction, as discussed in Section 9 of this Volume 2 of the Watershed Plan.

Table 1 Comparison of Natural Heritage Policies in the Provincial Planning Statement for Ecoregion 5E (north/northeastern Peterborough County) and Ecoregion 6E (south/southwestern Peterborough County)

Policy	Ecoregion 6E	Ecoregion 5E
4.1.1	Natural features and areas shall be protected for the long term.	Same
4.1.2	The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of NHS, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.	Same
4.1.3	NHS shall be identified in Ecoregions 6E and 7E, recognizing that natural heritage systems will vary in size and form in settlement areas, rural areas, and prime agricultural areas.	Not applicable to Ecoregion 5E
4.1.4, 4.1.5.a)	Development and site alteration are NOT permitted in PSW	Same
4.1.5.b)	Development and site alteration are NOT permitted in Significant Woodlands ¹ <u>unless</u> no negative impacts on the feature and its functions has been demonstrated (e.g., through an EIS)	Not applicable to Ecoregion 5E
4.1.5.c)	Development and site alteration are NOT permitted in Significant Valleylands ² <u>unless</u> no negative impacts on the feature and its functions has been demonstrated (e.g., through an EIS)	Not applicable to Ecoregion 5E
4.1.5.d)	Development and site alteration are NOT permitted in SWH, <u>unless</u> no negative impacts on the feature and its functions has been demonstrated (e.g. through an EIS)	Same
4.1.5.e)	Development and site alteration are NOT permitted in ANSI, <u>unless</u> no negative impacts on the feature and its functions has been demonstrated (e.g., through an EIS)	Same
4.1.6	Development and site alteration are NOT permitted in Fish Habitat, <u>except</u> in accordance with provincial and federal requirements	Same
4.1.7	Development and site alteration are NOT permitted in E&T species habitat, <u>except</u> in accordance with provincial and federal requirements	Same
4.1.8	Development and site alteration are NOT permitted on adjacent lands to the features above, <u>unless</u> no negative impacts on the feature and its functions has been demonstrated e.g., through an EIS)	Same
4.1.9	Nothing in policy 4.1 is intended to limit the ability of agricultural uses to continue.	Same

NHS = Natural Heritage System, PSW = Provincially Significant Wetland, EIS = Environmental Impact Study, SWH = Significant Wildlife Habitat, ANSI = Areas of Natural and Scientific Interest, E&T = Endangered and Threatened

¹ Significant Woodlands: “to be identified using criteria and procedures established by the Province” (see Glossary, “Significant means ...”

² Significant Valleylands: “ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system” (see Glossary, “Significant means ...”

2.1.2 Water Resource System Policies

Section 4.2 of the PPS requires planning authorities to protect, improve or restore the quality and quantity of water by:

- a) using the watershed as the ecologically meaningful scale for integrated and long-term planning
- b) minimizing potential negative impacts (including cross-jurisdictional and cross-watershed impacts)
- c) identifying water resource systems
- d) maintaining linkages and functions of water resource systems (including interconnection to natural heritage systems and/or features and areas)
- e) implementing necessary restrictions on development and site alteration to protect both drinking water supplies and vulnerable surface and/or groundwater
- f) planning for efficient and sustainable use of water resources, and
- g) ensuring consideration of environmental lake capacity.

Notably, there are no distinctions between Ecoregion 5E and 6E for these policies which apply equally across all watershed that overlap with the County of Peterborough.

As noted elsewhere in this Watershed Plan, the identification of any Water Resource Systems (WRS) should be undertaken in collaboration with the Conservation Authority, local First Nations, and other agencies and institutions, as appropriate.

2.1.3 Natural Hazard Policies

Section 5.2 of the PPS requires planning authorities to identify natural hazards and manage development in these areas. Natural hazards specified include:

- Erosion hazards, whose limits are determined using considerations that include the 100-year erosion rate (the average annual rate of recession extended over a 100-year time span), an allowance for slope stability, and an erosion/erosion access allowance (e.g., meander belts, valley slopes, and large inland lakes).
- Flooding hazards, meaning inundation from major storms (as defined), including along rivers, streams and small inland lake systems
- Hazardous forest types for wildland fire, meaning forest types assessed as being associated with the risk of high to extreme wildland fire using risk assessment tools established by the Ontario Ministry of Natural Resources (MNR), as amended from time to time, and
- Hazardous sites, meaning property or lands that could be unsafe for development and site alteration due to naturally occurring hazards (e.g., unstable soils or unstable bedrock such as karst topography, which occurs in the County).

As noted elsewhere in this Watershed Plan, the identification of erosion and flooding hazards should be undertaken in collaboration with the Conservation Authority, local First Nations, and other agencies and institutions, as appropriate.

Natural hazards to be considered also include Special Policy Areas and Two-Zone Floodplain Management Areas of which there are one each in Peterborough County:

- Millbrook Special Policy Area, and
- Ouse River Norwood Two-Zone Special Policy Area.

Provincial natural hazard policies also require planning authorities to prepare for the impacts of a changing climate that may increase the risk associated with natural hazards.

2.2 Oak Ridges Moraine Conservation Plan

The Oak Ridges Moraine crosses through the south-west portion of Peterborough County covering the southwest corner of the Township of Cavan Monaghan, as shown in Image 2 (also see Figure 29).

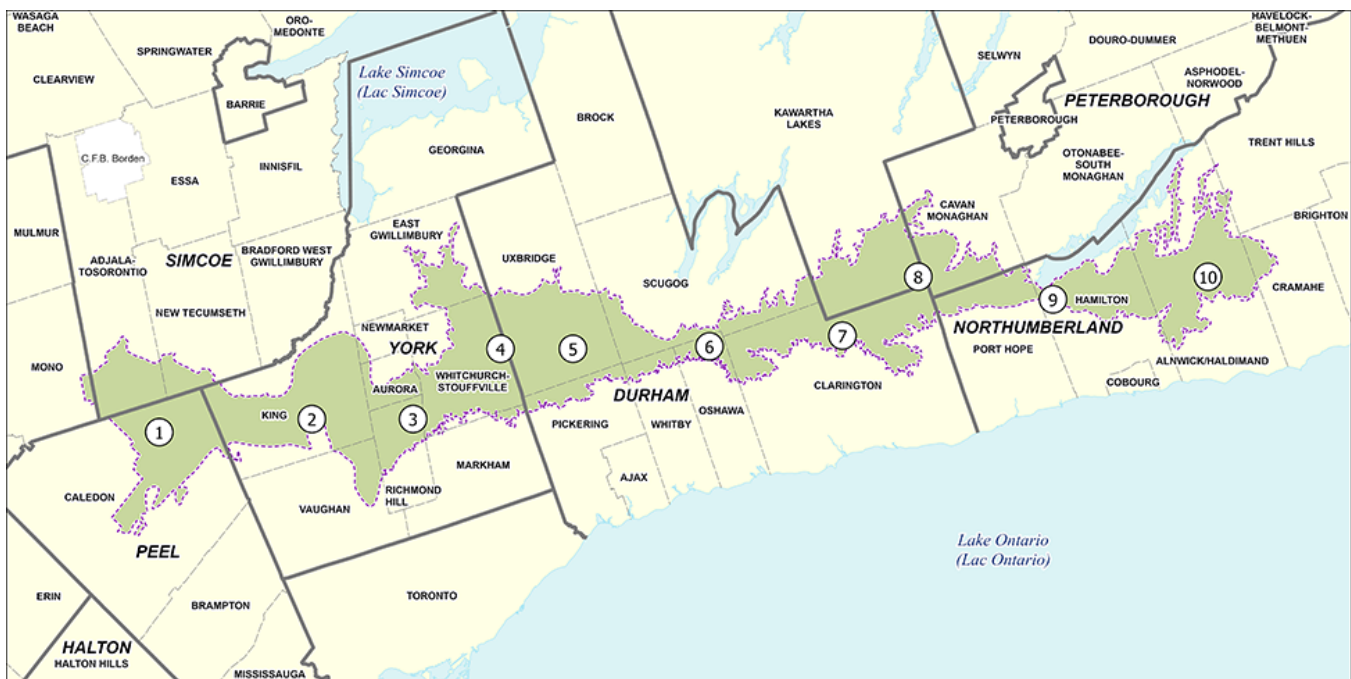


Image 2 Illustration of the Extent of the Oak Ridges Moraine Conservation Plan

The Oak Ridges Moraine Conservation Plan (ORMCP; MMA 2017a) is a land use and resource management framework designed to protect the ecological and hydrological integrity of the Oak Ridges Moraine, a vital landform in south-central Ontario. The ORMCP mandates municipalities to develop watershed plans that include water budgets, conservation strategies, and environmental monitoring programs. These plans aim to safeguard water quality and quantity, manage land and water use, and implement pollution prevention practices. By integrating watershed planning into

municipal official plans, the ORMCP ensures long-term protection of hydrological features and functions essential to regional ecosystems and communities.

2.3 Conservation Authorities Act

Substantive changes to the provincial *Conservation Authorities Act* (1990) were implemented between 2022 and 2024, curtailing their ability to provide natural heritage planning review and requiring them to focus on natural hazard delineation and regulation, and floodplain management.

In accordance with O. Reg 596/22, Conservation Authorities “shall not provide... a municipal program or service related to reviewing and commenting on a proposal, application or other matter made under a prescribed Act” (s. 21.1.1(1.1)). This means, with respect to natural heritage, they may no longer provide a program to offer peer review services to municipalities related to any prescribed acts, including the *Planning Act*. (as per O. Reg 686/21 which outlines their required programs and services).

In addition, under O. Reg. 41/24, the individual regulations which provided governance to each of the Conservation Authorities in Ontario were revoked and replaced by a single, new regulation. This regulation maintains the role of Conservation Authorities as a commenting/advisory agency on applications submitted pursuant to the Planning Act as it pertains to natural hazards, and as a permitting authority in its own right, regulating activities pursuant to the Conservation Authorities Act within wetlands, the areas of interference associated with wetlands, hazardous lands, river or stream valleys and other areas determined by the regulations (Conservation Ontario 2024).

Conservation Authorities with jurisdiction in the County (i.e., Crowe Valley Conservation Authority, Ganaraska Conservation, Otonabee Conservation and Kawartha Conservation) are required to provide mapping depicting the regulated areas within their respective jurisdictions and to share this information on their respective websites. At this time, consultation with the appropriate Conservation Authority listed above is required on all matters within the regulated areas including potential or confirmed wetlands, areas of interference or hazardous lands. Furthermore, with the imminent consolidation of the four local Conservation Authorities into a single regional body (i.e., Eastern Lake Ontario Regional Conservation Authority (ELORCA)) in early 2027 (see the Preamble to this Watershed Plan), Conservation Authorities are actively shifting their focus to enable them to have the resources and capacity to support the types of work that directly align with this Watershed Plan alongside their municipal partners (e.g., development and maintenance of Ecological Land Classification (ELC) mapping, continuous hydrologic models, and integrated surface and groundwater monitoring programs).

These initiatives are expected to benefit and support lower and upper tier municipalities by providing the needed technical information and guidance related to watershed and subwatershed planning specifically related to:

- Land use cover mapping
- Area-based and feature-based water balance assessments

- Improved flood forecasting and warning, and
- Natural asset management (required by regulation).

It is also important to note that the northern portion of the County is not covered by any Conservation Authority (see Figure 2). In these areas the primary regulatory agency is the provincial Ministry of Natural Resources (MNR) (e.g., as it relates to water, fish and wildlife protection). In addition, Parks Canada continues to actively manage water levels and flows through the Trent-Severn Waterway, with over a quarter of this waterway running through Peterborough County.

2.4 Source Water Protection Plans

Peterborough County falls under the Trent Conservation Coalition Source Protection Region (<https://trentsourceprotection.on.ca/>) which includes the Crowe Valley Source Protection Area, Ganaraska Region Source Protection Area, Kawartha-Haliburton Source Protection Area, Lower Trent Source Protection Area, and Otonabee-Peterborough Source Protection Area.

The Trent and Ganaraska Source Protection Plans, established under the Clean Water Act (2006) and approved on October 23, 2014, mandate that municipal Official Plans align with the Source Protection Plan policies as per Section 26 of the Planning Act.

Focusing on municipal drinking water supply, the provincially approved Source Protection Plan delineates key groundwater-related vulnerable areas. These include wellhead protection areas, highly vulnerable aquifers, and significant groundwater recharge areas.

Section 5 of Volume 1 of this Watershed Plan expands upon components of source water and available data and mapping for the Study Area.

2.5 Municipal Act

The Municipal Act (2001) defines the scope of municipal powers. Among other things, it includes a requirement for municipalities to adopt a policy which sets out how they will protect and enhance their tree canopy and natural vegetation (see Section 270.1) and also enables upper tier municipalities to develop and enact woodland and/or forest by-laws (Section 135) for woodlands of at least 0.5 ha on private and/or public lands, at their discretion. It also enables local area municipalities to develop and enact tree by-laws for smaller woodlands and/or individual trees on private and/or public lands, at their discretion.

In accordance with Section 270.1 of the *Municipal Act*, the County has a “Tree Canopy and Natural Vegetation Protection” policy which was approved on May 15, 2019. This policy guides the efforts, actions and decisions by staff and Council related to protecting and enhancing tree canopy and natural vegetation and includes policies that:

- Promote and encourage reforestation of valleylands, banks and steep slopes

- Support the maintenance and improvement of ecological linkages between and among natural heritage features and surface/groundwater features
- Require local Municipal Official Plans to designate and map significant natural heritage features when information becomes available through the County or OMNR, and
- Encourage tree cover and vegetation to be retained along shorelines, and support policies for a natural undisturbed buffer of a minimum width between the water's edge and any new development.

2.6 Peterborough County Strategic Plan

The vision statement presented in the Strategic Plan (Peterborough County 2022) was developed through an engagement process with a Technical Advisory Committee, that included member municipalities, Indigenous Communities and Conservation Authority representatives.

The Hope and Dream Statement developed in the Strategic Plan is as follows:

Peterborough County celebrates, preserves, and respects our diverse landscapes and vibrant beauty. Our communities continue to be safe, inclusive, and welcoming while providing opportunities to grow, prosper, relax, connect and disconnect.

The Vision Statement developed in the Strategic Plan is as follows:

Working together with our townships and service delivery partners to provide high quality municipal services to our communities.

This statement was supported by the following corporate values (Peterborough County 2022):

- Respect: We honour our commitment to the environment, history, culture, and one another.
- Responsible: We are accountable and efficient in our use and management of resources.
- Integrity: We are ethical, professional, and transparent. Our decisions are data-driven.
- Teamwork: We are collaborative and work for the betterment of all our communities.
- Customer-Centric: We embrace customer-focused service delivery. We foster a sense of community in our interactions.

The County's vision statement and identification of its corporate values provided a basis for the vision, goals and objectives of this Watershed Plan (see Section 3).

2.7 Peterborough County Official Plan

The County's Official Plan provides the framework for planning. The Official Plan must conform with provincial legislation (i.e., the Planning Act), as well as associated plans and policies, and guide future growth and development of its eight local Municipalities. The Official Plan, as it relates to this Watershed Plan, identifies several environmental components and interactions that must be addressed to support planning and development including: climate change, natural heritage

features, natural hazards, and water resources. As required by the PPS (2024), the County and its eight local Municipalities are committed to administering a watershed-based approach to land use planning and water management.

The County of Peterborough had updated its Official Plan in 2022 and was still waiting on approval from the Province when the 2024 PPS was released, along with other changes to the Planning Act, which required the County to make additional modifications. A new Official Plan to set the vision and direction for growth and development to the year 2051 was approved by Council and posted on the Environmental Registry of Ontario on July 10, 2025, for a 30-day review and comment period. At the time of drafting this Watershed Plan, discussions with the Province were still underway and approval of the Official Plan was still pending. This is the version reviewed for this Watershed Plan.

Due to legislative changes since the time the new Official Plan was originally adopted, the County sought feedback in early 2025 on proposed modifications to the Official Plan which would bring it into conformity with the new Provincial Planning Statement.

From a planning perspective, the County's Official Plan provides the planning framework and guidance for all lower tiers, including the Township of Cavan Monaghan which maintains its own Official Plan. In this role, the County's responsibilities related to this Watershed Plan include:

- Recognizing the importance of engaging with First Nations communities on planning matters that may affect their Constitution Act, Section 35 Aboriginal or treaty rights.
- Identifying and protecting water resource systems including ground water features, hydrologic functions, natural heritage features and areas and surface water features including shoreline areas, necessary for the ecological and hydrological integrity of the watershed (Policy 9.1).
- Developing and helping to implement policies for identifying and protecting natural heritage features and areas, the natural heritage system (NHS) and the water resource system (WRS).
- Protecting rural and agricultural lands, and natural heritage and water resources, by directing new development and employment uses primarily to existing settlement areas within the County (Official Plan Goals).
- Encouraging local Municipalities to participate, coordinate and carry out similar environmental management initiatives and practices to promote conservation, protection, sustainability and enhancement of natural systems, features and resources (Policy 6.1).
- Promoting orderly and efficient development in a manner which maintains a logical, efficient and cost-effective distribution of land uses and deployment of infrastructure (Official Plan Goals), including identifying areas where growth and development will be focused.

Section 9 of the Official Plan, Water Resources, includes the following objectives which are directly relevant to this Watershed Plan:

- Protect existing and future sources of drinking water from incompatible land uses.
- Maintain and wherever feasible, protect and enhance the quantity and quality of ground water and surface water.

- Minimize the potential for contamination including potential contamination from road salt on sources of municipal drinking water.
- Identify and protect water resource systems including ground water features, hydrologic functions, natural heritage features and areas and surface water features including shoreline areas, necessary for the ecological and hydrological integrity of the watershed.
- Protect 'at capacity' lakes from further development.
- Encourage public access to waterfront areas, where appropriate.

Land use planning is coordinated between the County and its lower tiers, with the County being responsible for guiding overall growth through its Official Plan and acting as the approval authority for development plans.

As stated in Policy 9.2, the County and local Municipalities are committed to implementing a watershed-based approach to land use planning and water management to support a comprehensive, integrated, and long-term approach to the protection, enhancement, or restoration of the quality and quantity of water within the watersheds in the Study Area (see Figure 3 and Figure 4).

The natural heritage, natural hazard and water resource policies in the current Official Plan (2025) were assessed in terms of potential gaps and opportunities to improve them to help advance the objectives of this Watershed Plan. This assessment is presented in Section 9 of this report.

2.8 Peterborough County Urban Growth Analysis

The Growth Analysis Report prepared for the County (Hemson 2022) continues to be the primary source of growth-related analysis and guidance for Peterborough County. This study provided growth forecasts and allocations based on Provincial targets, focussing on settlement areas best positioned to accommodate growth (e.g., those with servicing capacity), as shown in Image 3.

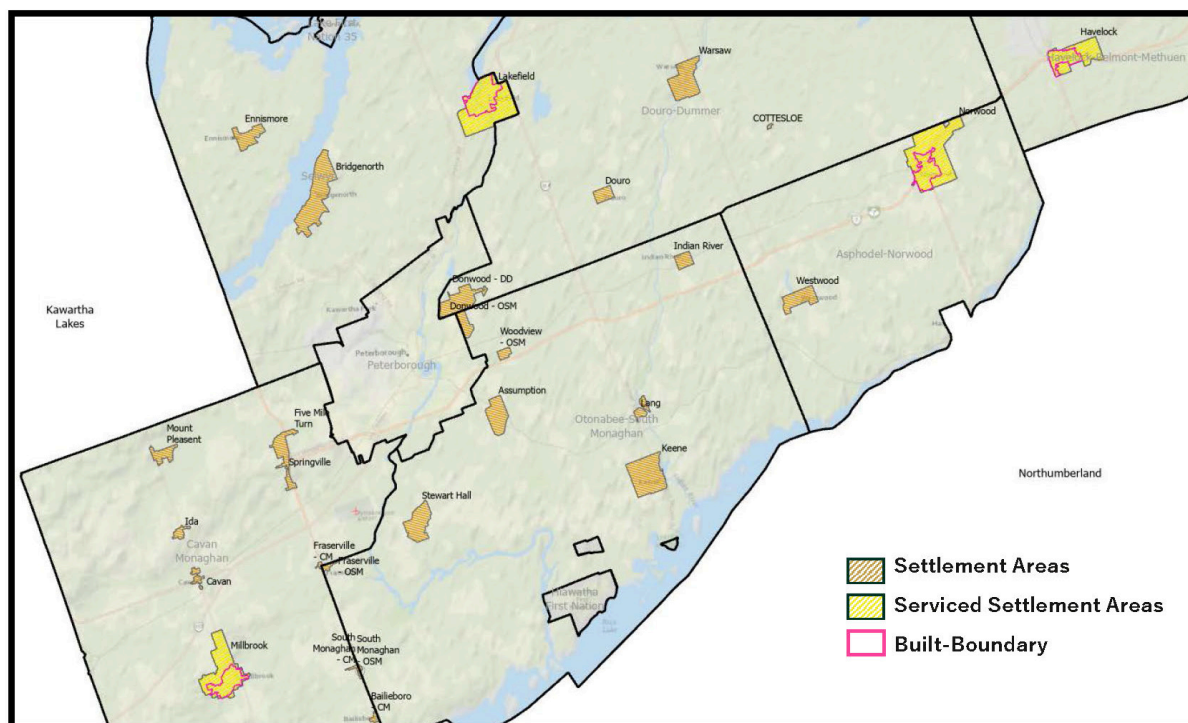


Image 3 Illustration of the Serviced Settlement Areas in the County (Source: Hemson 2022)

The County's population is expected to grow from 63,800 (2021 Census numbers) to 82,000 by 2051, with the employment base predicted to grow from 16,000 (2021 Census numbers) to 26,000 in 2051. As noted in the Hemson study, the County provides services related to paramedic care, long-term care, public works, waste management and arterial roads infrastructure while the lower tier municipalities are responsible for other local services, including the delivery of water and wastewater infrastructure.

Some key and relevant findings from that assessment of growth potential include the following:

- About 71% of population growth is forecast to occur in the Townships of Cavan Monaghan (34%), Selwyn (20%), and Asphodel-Norwood (16%) with the remaining growth (29%) forecast to be across the other five lower-tier municipalities, with Otonabee-South Monaghan (9%) and Havelock-Belmont-Methuen (6%) having the largest amounts.
- The County has four larger urban settlements that are serviced by municipal water and wastewater systems (i.e., Millbrook, Lakefield, Havelock, and Norwood) (see Image 3).
- Townships of Asphodel-Norwood, Havelock-Belmont-Methuen, and Selwyn all have sufficient greenfield area lands within their existing settlement boundaries, but Cavan Monaghan requires an additional 74.7 ha to meet its housing allocation. The study noted a need for a settlement boundary expansion of Millbrook to accommodate this additional development.
- Employment area supply in the County is considered sufficient to accommodate 11,374 jobs, however the distribution of current employment areas is not well-aligned with the demand. As such, additional employment lands need to be added in the Townships of Cavan Monaghan, Douro-Dummer; and Havelock-Belmont-Methuen.



Burleigh Falls (Credit: Parks Canada)

3 Vision, Goals and Objectives

The following vision, goals and objectives for the Study Area have been informed by:

- Input gathered through engagement with First Nations, local Municipalities, local conservation authorities, and local community groups and organizations (see Section 1.3)
- Consideration of the primary applicable strategies, policies and guidance documents (see Section 2), and
- A good understanding of the biophysical diversity, sensitivities and conditions (as presented and summarized in Volume 1).

The vision, goals, and objectives presented below are intended to align with the applicable provincial policies and plans, be appropriate for local conditions, and reflect the input gathered.

3.1 Vision Statement and Guiding Principles

The following vision and guiding principles are intended to reflect priorities, values and key issues at the tertiary watershed scale within the Study Area (i.e., Peterborough County).

It is recognized that the water resources in Peterborough County are regulated and managed in part by several different agencies at the provincial and federal levels (i.e., Conservation Authorities, MNR, Parks Canada and DFO). However, for ease of communication, the vision and principles refer to all of these organizations as “local agencies”.

Vision Statement for Peterborough County’s Watershed Plan

Peterborough County’s watersheds — spanning the Canadian Shield and Great Lakes–St. Lawrence Lowlands — are the ecological and cultural foundation of the region.

In partnership with the Williams Treaties First Nations, the local Municipalities, local agencies and the community, the County envisions climate-resilient watersheds where:

- forests, wetlands, aquifers, and living shorelines underpin healthy natural systems
- growth considers and respects hydrologic and ecological functions
- groundwater and surface water are managed at their sources, and
- collaborative stewardship promotes clean and abundant water today and for the future.

Guiding Principles for Peterborough County's Watershed Plan

1. **Watershed-based Planning:** Land use and infrastructure decisions shall be evaluated at the watershed and subwatershed scale, recognizing natural heritage and water resource systems as the ecological, cultural, and economic lifeblood of the area.
2. **Building Climate Resilience:** Forests, wetlands, floodplains, aquifer recharge areas, and shorelines are natural infrastructure supporting flood attenuation, water quality enhancement, drought resilience, carbon storage, and thermal regulation.
3. **Prioritizing Shoreline Protection:** Natural and naturalized shorelines across the County's extensive lake and river network provide critical and sensitive ecological transition zones that sustain water quality, support fish habitat, and limit adverse erosion and runoff.
4. **Surface Water–Groundwater Integration:** Water quantity and quality management should recognize the water resource system comprised of interconnected lakes, rivers, wetlands, and aquifers, protecting recharge areas and headwaters.
5. **Reconciliation and Indigenous Partnership:** Watershed stewardship in partnership with the Williams Treaties First Nations, including Curve Lake First Nation and Hiawatha First Nation, is key to respecting treaty rights and advancing reconciliation.
6. **Biodiversity and Ecological Connectivity:** Natural heritage features and areas within and across the transition between the Canadian Shield and the Great Lakes–St. Lawrence Lowlands shall be identified, protected and sustained to support species movement, genetic diversity, and ecosystem functions.
7. **Consider Cumulative Impacts:** Planning decisions should consider long-term, cumulative watershed effects of shoreline alteration, land use changes, stormwater runoff, and climate stressors.
8. **Adaptive Management and Shared Accountability:** The County and its municipal and agency partners will monitor, report, and make adaptive policy adjustments to ensure watershed resilience over time.

3.2 Goals and Objectives

In the context of watershed planning, “goals” represent the aspirational outcomes for a watershed, while “objectives” are actionable items and outcomes, either identified through the Watershed Plan or may be identified by the County and local area municipalities through future local subwatershed planning. The following goals and objectives are intended to set the framework for environmentally-based land use planning decisions to be made at the watershed and quaternary watershed and/or subwatershed scales, particularly as they relate to natural heritage and water resources, sustainable land use planning, climate resiliency and engagement.

These goals and objectives are intended to guide the Watershed Plan and to support the implementation of future quaternary watershed plans and/or subwatershed plans. Each objective is provided with some high-level implementation guidance in bullet form.

As noted in Volume 1 of the Watershed Plan, information gaps remain to be filled across the County to fully inform future quaternary watershed and/or subwatershed planning. Refinements to these goals and/or objectives may be appropriate in the future in response to new information and interpretation of same (e.g., gathered through ground truthing, monitoring programs, modelling, and/or outreach programs); thus, these goals and objectives should be considered as a “working” set subject to refinement.

3.2.1 Goal 1: Support Identification of a Natural Heritage System and Water Resource System

Objective 1.1 Complete the Technical Work to Identify a Natural Heritage System (NHS)

- Complete Ecological Land Classification mapping for the County to provide a consistent base for NHS mapping and analyses. These data are anticipated to be, based on their feedback, a resource that is available from the Conservation Authorities in the near future.
- Consider different criteria for identifying different NHS components the part of the County in Ecoregion 5E versus Ecoregion 6E where appropriate to reflect the unique biophysical characteristics, provincial policy and land use pressures in each of these ecoregions.
 - This exercise should build on the technical data and analysis developed for this Watershed Plan.
- Once information is ready to be translated into the Official Plan, engage with local First Nations, local area municipalities, local conservation authorities and community members/organizations.
- Confirm NHS components and criteria for identification and mapping for Ecoregion 5E and Ecoregion 6E in Peterborough County based on PPS-defined features and areas (e.g., significant wetlands, significant woodlands, significant wildlife habitat, fish habitat, areas of natural and scientific interest, significant valleylands and natural hazards).
- Identify information gaps or deficiencies including age, quality/accuracy and/or availability of data.

- Maintain contemporary and accurate mapping of the NHS, incorporating the most recent and available data sources as they become available (e.g., from aerial imagery analysis, field studies, conservation authorities mapping etc.) at the tertiary, quaternary and subwatershed scales.

Objective 1.2 Complete the Technical Work to Identify a Water Resource System (WRS)

- Add and update the relevant data sources using the best available information to keep the information and mapping of these components as current and accurate as possible.
- Collaborate with the local agencies (including Conservation Authorities, Parks Canada and MNR) to advance this work prior to translating the information into an Official Plan.
- Apply and delineate the WRS at the tertiary and quaternary-levels, and subwatershed scale, as appropriate, to establish a contemporary and accurate understanding of the watershed-based systems.
- Once information is ready to be translated into the Official Plan, engage with local First Nations, local area municipalities, local conservation authorities and community members/organizations.
- Confirm WRS components for Peterborough County, including key hydrologic features and key hydrologic areas, including sensitive karst systems.
- Identify information gaps or deficiencies including age, quality/accuracy and/or availability of data.
- Maintain contemporary and accurate mapping of the WRS, incorporating the most recent and available data sources as they become available (e.g., aerial imagery, field studies, modelling analysis etc.) at the tertiary, quaternary and subwatershed scales.

Objective 1.3 Identify, maintain and restore linkages between the WRS and the NHS

- As part of the NHS and WRS identification and mapping exercises, undertake an integrated approach to Identify key linkages within and between the WRS and the NHS to support functional connectivity to ensure a systems approach.
- Collaborate and/or engage with the local agencies (including Conservation Authorities, Parks Canada and MNR) to advance this work.
- Consider targets for maintaining and, where needed, restoring connectivity across the systems.
- Identify recommendations related to management of development along shorelines, opportunities to protect and enhance the NHS and WRS through agricultural practices, invasive species tracking and management, among others.

Objective 1.4 Map an NHS for the County's Official Plan

- Engage the local area Municipalities, local First Nations, local agencies and the community (as part of an Official Plan Amendment process).
- Map confirmed NHS elements based on the most current available mapping and agreed upon criteria (see Objective 1.1) for identification.

- Consider how best to maintain and share the mapping developed (e.g., creating a GIS dashboard for sharing with local partners, external stakeholders, etc.).

Objective 1.5 Map a WRS for the County's Official Plan

- Engage the local area municipalities, local First Nations and the community (as part of an Official Plan Amendment process).
- Collaborate and/or engage with the local agencies (including Conservation Authorities, Parks Canada and MNR) to advance this work.
- Map confirmed WRS elements based on the most current available mapping, including key hydrologic features, key hydrologic areas and functional considerations, such as appropriate recognition of human-made features, and their influence on components such as hazards (see Objective 1.2).
- Consider how best to maintain and share the mapping developed (e.g., creating a GIS dashboard for sharing with local partners, external stakeholders, etc.).

3.2.2 Goal 2: Protect Water Quality and Water Quantity

Objective 2.1 Develop a Water Budget for respective systems (building from the tertiary watershed scale)

- Review Source Water Protection Plans, preliminary identification and mapping of the WRS, and other available data sources to develop water budget in collaboration with local agencies (including Conservation Authorities, Parks Canada and MNR).
- Identify water quality and water quantity concerns (e.g., nutrient loading, pollution, well interference, water supply etc.).
- Identify best practices for water conservation and maintaining water quality to plan for efficient and sustainable use of water resources with consideration for (a) surface water features and areas, (b) groundwater features and areas.
- Provide best practices to enhance stormwater capture / infiltration.

3.2.3 Goal 3: Ensure Land Use Planning is Informed by Watershed Planning

Objective 3.1 Review growth scenarios to inform land use planning

- Review and prioritize identified future growth areas with consideration for potential impacts to water quality and/or quantity, natural heritage features and areas, among other considerations.
- Apply a hierarchical approach to assess prioritized locations where land use changes and growth are anticipated to have “low”, “medium” or “high” impacts on identified water resource and natural heritage features and areas.

Objective 3.2 Update the Official Plan with a “watershed-based” approach consistent with Provincial guidance

- Consider possible policy gaps in the County’s Official Plan and opportunities for addressing them through guidance from the Watershed Plan.
- Ensure future updates to the Official Plan point to the technical background (Volume 1) and guidance (Volume 2) in this Watershed Plan as a basis for managing growth through future quaternary-scale and/or subwatershed studies.
- Identify and develop recommendations for prioritizing information gap filling, and implementation priorities.
- Provide insights into best practices for managing impacts due to urbanization.

Objective 3.3 Support the use and integration of “low impact development” measures in land use and infrastructure planning

- Support use of low impact development measures for protecting, enhancing and restoring the WRS and natural heritage system including those related to shoreline management, flooding and erosion, vegetative buffers, water balance and water quality.
- Require consideration of green infrastructure solutions to help address land use planning impacts.

3.2.4 Goal 4: Protect Human Health and Safety and the Natural Environment

Objective 4.1 Work with local conservation authorities and agencies to identify and manage natural hazards

- Review available natural hazard data and mapping (e.g., floodplains, steep slopes, confirmed karst areas, etc.) to confirm mapping is current and consistent.
- Incorporate natural hazard mapping into WRS mapping (refer to Goal 1) where available.
- Identify flood vulnerable areas (e.g., based on existing floodline mapping as available).
- Use flood hazard mapping and associated models (where available) to assess flood risk levels for various transportation routes as a component of emergency management planning and municipal asset management plans.

Objective 4.2 Account for climate considerations

- Ensure potential impacts to the identified WRS and NHS components account for climate change using the best available information and tools at the appropriate scale.
- Summarize and consider lessons learned from other nearby communities (e.g., City of Peterborough)
- Provide recommendations for natural hazard management.
- Provide recommendations regarding climate change adjusted rainfall data.

Objective 4.3 Consider cumulative impacts

- Characterize the watershed to identify sensitivities and areas at risk in relation to anticipated impacts for select areas or site-specific development proposals.
- Overlay areas of existing development and proposed growth.
- Ensure area or site-specific studies take an integrated approach (i.e., consider findings from other disciplines), consider significant and/or sensitive water and natural resources in the adjacent lands, and consider existing development and other planned or anticipated developments in the adjacent lands.

3.2.5 Goal 5: Engage Others to Advance the Watershed Plan Vision

Objective 5.1 Enhance collaboration with local First Nations

- Reach out to local First Nations to explore interest in and/or potential opportunities for:
 - Collaboratively advancing information sharing related to watershed planning
 - Collaboratively advancing watershed stewardship in shared areas of interest, and/or
 - Supporting and respecting Indigenous perspectives on watershed management.

Objective 5.2 Continue and enhance collaboration with local Municipalities, agencies and non-governmental organizations on watershed matters

- Continue to support and partner with local Municipalities on subwatershed planning, stormwater management and land use planning consistent with the goals of this Watershed Plan.
- Reach out to local agencies (e.g., MNR, Parks Canada, local Conservation Authorities, etc.) to establish pathways for information sharing as it relates to planning and co-managing water-based and natural resources in the County.
- Reach out to governmental (including Conservation Authorities) and non-governmental organizations involved in invasive species management to establish pathways for information sharing as it relates to existing and potential invasive species threats, as well as monitoring and management support.

Objective 5.3 Enhance communications with external parties and organizations on watershed matters

- Develop and maintain a list of external parties and organizations with an interest in sharing information related to watershed planning in the County to broaden the County's ability to seek and share information related to water-based and natural resources in the County.
- Identify cost-effective opportunities to share information with external parties and organizations with an active interest in protecting water-based and natural resources in the County.

Objective 5.4 Support watershed-based outreach and stewardship led by external parties and organizations

- Identify and offer tangible tools to local stakeholders (e.g., development industry, businesses, environmental groups, agricultural community etc.) for advancing the Watershed Plan vision.
- Support existing and proposed local stakeholder initiatives (e.g., lake and cottage associations, agricultural community, utilities, aggregate industry, businesses, environmental groups, development industry) that advance the Watershed Plan vision, as capacity and resources permit.

3.2.6 Goal 6: Adaptively Manage and Monitor the Watershed

Objective 6.1 Work with partners to develop a watershed-based monitoring program(s)

- Develop local and holistic monitoring strategies to establish a monitoring framework for Peterborough County building from existing programs including provincial, Conservation Authority initiatives and others.
- Collaborate and/or engage with the local agencies (including Conservation Authorities, Parks Canada and MNR) to advance this work.
- Build on the information gathered through this Watershed Study (Volume 1) to:
 - Confirm key monitoring gaps, and
 - Identify key natural and water-based resource indicators which should be monitored as part of broad-scale growth planning (refer to Goal 5 for additional growth management objectives).

Objective 6.2 Scope future priorities and studies

- Establish guidelines and terms of reference for future quaternary-scale and subwatershed studies.
- Collaborate and/or engage with the local agencies (including Conservation Authorities, Parks Canada and MNR) to advance this work.
- Share available monitoring data with appropriate parties.
- Provide monitoring guidance for future studies required to support growth.

4 Guidance for Natural Heritage and Water Resources Planning

Both the PPS (MMAH 2024) and the Draft Provincial Watershed Planning guidance document (Government of Ontario 2018) recognize the importance of identifying both natural heritage systems (NHS) and water resource systems (WRS), and the interdependencies between them, to both characterize and manage the environmental sensitivities in a watershed at all scales. The County's Official Plan also recognizes, as one of its primary objectives, the need to provide "policies for identifying and protecting natural heritage features and areas, and the natural heritage system" and "prepare for the impacts of a changing climate through protection of an ... Natural Heritage System and Water Resource System". However, as a result of the recent series of changes to the planning framework in Ontario, including requirements related to NHS mapping (as outlined in Section 4.1), the County has NHS and WRS policies but no mapping of these systems in their current Official Plan.

The current provincial guidance nonetheless requires identification of a WRS for the entire County, identification of an NHS for the southern/southwestern portion of the County in Ecoregion 6E and identification and long-term protection of the various NHS components in Ecoregion 5E, and identification of the linkages and interdependencies between these systems and features and areas (see Section 2.1 of this Volume 2 of the Watershed Plan).

It is outside the scope of this Watershed Plan to provide recommended criteria for NHS and/or WRS identification and mapping for the County's Official Plan. However, building on the comprehensive data review completed as part of Volume 1, as well as the Consulting Team's experience elsewhere in southern Ontario, this document, Volume 2 provides, for both the NHS and WRS:

- Guidance to inform identification of these systems, in alignment with provincial criteria and criteria identified in the County's Official Plan, where available and applicable
- A summary of available existing data and/or mapping that could/should inform the identification of each system component within each tertiary watershed, as well as an identification of key data gaps, and
- An identification of high-level interactions and interdependencies between features and functions to be considered in quaternary-scale subwatershed studies.

While policies from the PPS related to the NHS and WRS (see Section 2.1) are separate, it is critical to recognize these systems as being interdependent at all scales, and as both including components related to natural hazards, which also require consideration. That is why this section discusses the NHS in Section 4.1, the WRS and related natural hazards in Section 4.2, and then guidance related to integration in Section 4.3.

4.1 Context for Natural Heritage System Mapping in the County

Direction from the Province related to the NHS and WRS, and particularly the NHS, has changed over the past few years and more than once, which has made it challenging for the County to ensure compliance with provincial direction related both to growth and the long-term protection of the vast, diverse and interconnected natural heritage and water resources within its boundaries. The process to date, and how the County has managed these changes can be summarized as follows (adapted from the County's website, last viewed in Feb. 2025):

- An NHS for the Greater Golden Horseshoe, including Peterborough County, was mapped by the Province using high level systems criteria for core areas (i.e., of at least 500 ha) and linkages (MNRF, 2018). While this NHS provided comprehensive systems-based mapping to support the long-term protection of the region's natural heritage and biodiversity (shown in Image 4), it did not (a) accurately map many of the existing land uses in Peterborough County or (b) provide the technical building blocks or details (e.g., criteria for identification of the specific and significant natural heritage PPS features and areas) to support area and site-specific implementation of the PPS policies.
- While municipalities were required by the Growth Plan for the Greater Golden Horseshoe (2020) (the driving legislation in place at that time) to incorporate the NHS as an overlay in their Official Plans, they could refine the mapping based on local data and considerations, in consultation with the Province, before implementing the new mapping through the County's Official Plan.
- In 2022, the County released a draft NHS map for the County Official Plan which refined the Provincial NHS mapping to more accurately reflect existing conditions and planned growth. For example, certain strategic areas (e.g., active aggregate operations) and areas identified by local Municipalities where development is concentrated or is anticipated in the short term, were excluded.
- This refined NHS put forward by the County was still under review with the Province when, in August 2024, the updated PPS replaced the Growth Plan for the Greater Golden Horseshoe (2020), thereby removing the requirements for municipalities to adopt the Provincial NHS.
- The County subsequently completed further updates to its Official Plan policies (in consultation with local area municipalities, First Nations and the community) to address requirements related to the latest changes in the planning framework and to set a vision and direction for growth to the year 2051.
- In July 2025 the County's new Official Plan, together with modifications endorsed by County Council, was posted to the Environmental Registry of Ontario (ERO) for review and comment. The comment period closed in August 2025, however the updated Official Plan is still awaiting Ministerial approval.

As of July 2026, County staff is awaiting Ministerial approval of the new Official Plan policies before moving forward with mapping and/or schedule changes, including mapping of the NHS and WRS.

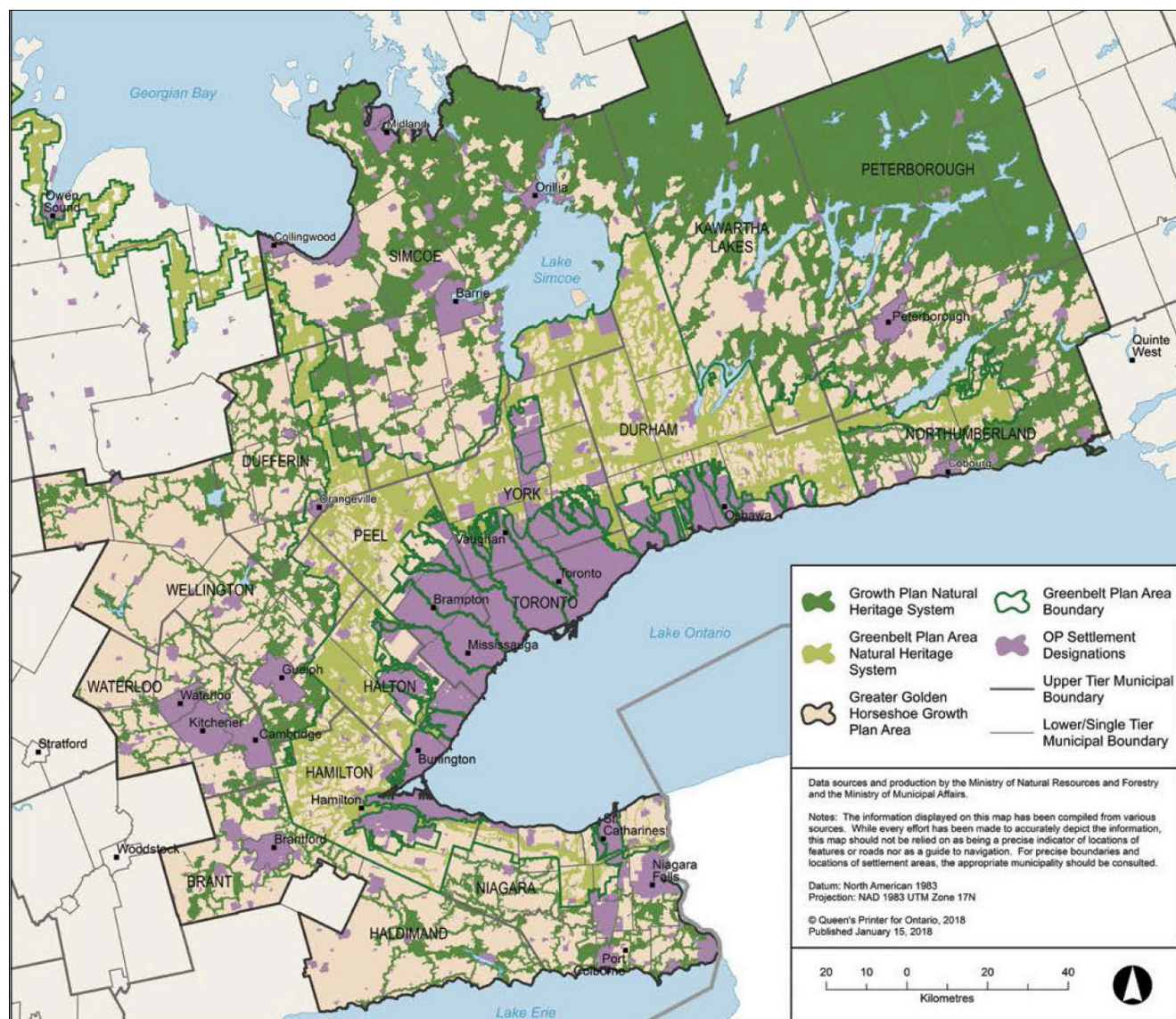


Image 4 Regional Natural Heritage System for the Greater Golden Horseshoe as originally mapped by the Province in 2018 (Source: MNR 2018)

Kawartha's Naturally Connected (KNC) NHS, which was completed in 2013, was a community-led planning initiative which included comprehensive science-based desktop work and analysis over 2011 with support and input from MNR and other agencies to develop a proposed NHS for the Kawartha Lakes Region (including the entire County).

The KNC NHS mapping was consistent with the applicable provincial policies and based on the most current desktop sources and analytical methods at the time. The KNC consortium identified a "Preferred Solution" (shown in Image 5) based on the identification and synthesis of aquatic core areas, terrestrial core areas, core area enhancement zones, potential core areas, corridors, riparian linkages and other selected adjacent natural areas.

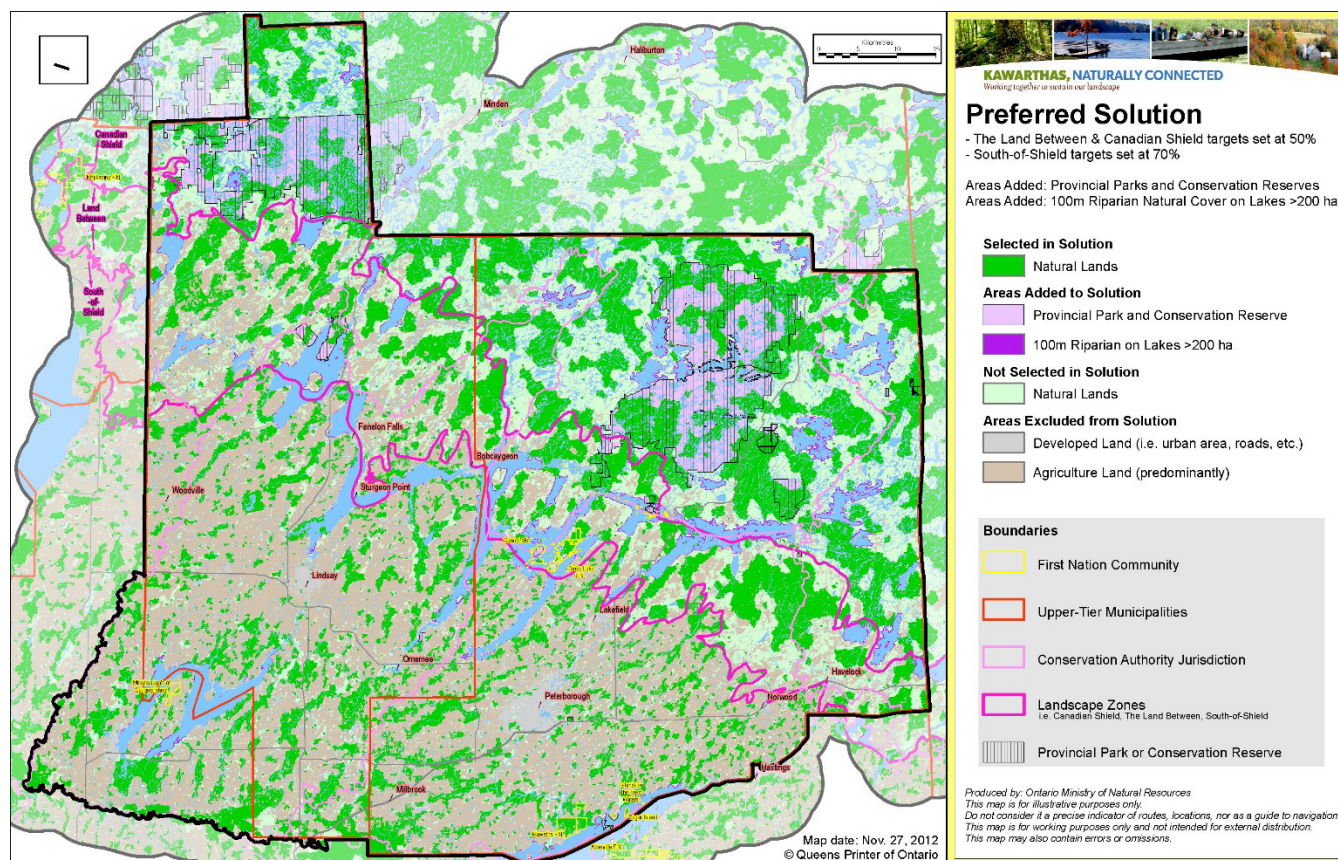


Image 5 Proposed Natural Heritage System for the Kawartha Lakes area as originally mapped by the Kawarthas Naturally Connected consortium (Source: MNR 2012)

Although the KNC NHS mapping was identified by the County as preferable to the NHS put forward by the Province (in 2018) at that time, it was not accepted by the Province due to insufficient coverage in areas of provincial interest.

Regardless of the Province's position, this initiative was widely accepted and supported by local organizations and remains a valuable resource and reference for guiding stewardship and potentially informing opportunities for maintaining and / or enhancing ecological connectivity across the County in the future.

Now that the Provincial NHS no longer needs to be the version that is applied, as noted above, County staff is planning on developing mapping of the NHS and WRS based on more current sources of data and based on components aligned with the current PPS following Ministerial approval of the new Official Plan policies.

4.2 Guidance for Developing a Natural Heritage System (NHS)

As noted in Section 2.1 of this Watershed Plan, the County extends over two Ecoregions: 6E (Mixedwood Plains) in the south/southwest and 5E (Ontario Shield) in the north/northeast (as shown on Figure 24). The divide between the two ecoregions is important in the context of policy applicability, specifically in terms of the PPS (as outlined in Section 2.1 of this Volume 2 of the Watershed Plan). The PPS requires:

- Maintenance and restoration of natural features and the connectivity between them, with regard for ecological functions, biodiversity and linkages to surface and groundwater features, and
- Protection of significant wetlands, significant wildlife habitat (SWH), Areas of Natural and Scientific Interest (ANSI), fish habitat, and species at risk (SAR) habitat for both ecoregions.

However, formal identification of, and criteria for, an NHS, significant woodlands and significant valleylands is not required for municipalities in Ecoregion 5E (see Figure 24).

As noted above, given that neither the KNC NHS (MNR, 2012) nor the Province's NHS (MNRF, 2018) were ever formally adopted into the County's Official Plan, there is now an opportunity for the County to build on the technical findings of this Watershed Plan and the associated planning guidance to develop an NHS based on the most current data that reflects the local context and priorities, and also aligns with the most current provincial guidance.

4.2.1 Approach for Identifying an NHS

It has long been accepted both by the scientific literature and the Province that a "systems-based" approach to natural heritage planning is preferable to a "features-based" approach (e.g., Riley and Mohr 1994; Puric-Mladenovic and Strobl 2012; Ontario Nature 2014; MNR 2010; MNRF 2017). A "systems-based" approach to NHS planning generally means identifying and protecting connected networks of core natural features, linkages and/or corridors connecting these cores, and potentially also including buffers to isolated natural areas, rather than focussing exclusively on individual features or areas. Key advantages of a systems-based approach include:

- Moving beyond "features-based" planning to recognize how different habitats (such as woodlands and wetlands, or wetlands and watercourses) are functionally connected to form a cohesive system
- Allowing the identification and protection of "core" high-quality natural features and linking them with ecological corridors to support plant and wildlife movement, and other ecological processes, and
- Supporting the identification of enhancement and/or restoration opportunities where they are most likely to strengthen the system against stressors (e.g., climate change, urbanization, habitat fragmentation), where possible and appropriate in the given land use context.

There is no standardized approach for developing a “systems-based” NHS, but well-established beneficial practices for identifying a NHS include ensuring that it is:

- Technically sound and data-driven: Utilize the best available data and, where possible, various sources of GIS-based mapping and analyses to inform the identification of features, core areas (including rare and common habitats, ensuring they are representative of the region), and linkages between them. These data should be based on a comprehensive understanding of the local biophysical context.
- Connected: Identification of functional linkages between core areas to allow for wildlife movement and species migration in policy and, ideally in mapping as well. In general, woodland corridors, wetland complexes, and riparian zones should be protected as part of a connected natural heritage system.
- Informed by meaningful engagement: Develop and confirm the approach and related criteria with careful consideration for diverse perspectives (including Council, municipal staff, First Nations, and members of the community), available local expertise (e.g., academic institutions), and local community values to ensure the plan is accurate, supported, and actionable.
- Aligned with, or going beyond, established provincial policies: For the County this means alignment with the PPS (MMAH 2024) and, in the Township of Cavan Monaghan, the ORMCP (MMA 2017a) as well as guidance in the provincial Natural Heritage Reference Manual (MNR 2010) at a minimum.

The PPS states that: “The Province has a recommended approach for identifying natural heritage systems, but municipal approaches that achieve or exceed the same objective may also be used”.

- Developed using an integrated landscape approach: This goes beyond providing functional connectivity between core natural features (e.g., woodlands, wetlands) via linkages and protecting cores from changes in adjacent land uses with vegetated buffer (called “vegetation protection zones” in the County Official Plan, 2025). It also means:
 - identifying linkages between terrestrial and aquatic features and areas, and surface and groundwater features (e.g., lake shorelines, creeks and baseflows provided to them, seepage areas)
 - considering natural hazards that intersect or overlap with terrestrial and aquatic components, and
 - enhancing NHS policies and in some cases mapping where appropriate to account for anticipated climate change, recognizing that interconnected systems are more resilient to environmental shifts. (Guidance related to climate change considerations is provided in Section 5 of this Watershed Plan Volume 2).

- Includes monitoring and can be responsive to adaptive management: Monitoring a jurisdiction the size of County's with such vast and diverse natural heritage features and areas is difficult. However, strategic and consistent long-term monitoring of targeted features and areas using transparent protocols that are easy to replicate can ensure that the NHS policies are functioning as intended. Such a monitoring framework should provide mechanisms to consistently collect data and assess it against established objectives or targets, allowing for adjustments based on new data and/or changing conditions. (Guidance for such a framework is provided in Section 8 of this Watershed Plan Volume 2).

Previous approaches used for the County and other nearby municipalities (e.g., MNR 2012; MNRF 2018) have been focussed on core areas, corridors and landscape-scale thresholds for cover with secondary consideration for the identified natural features in the area. While these approaches can create mapping products that are very ecologically robust, they do not provide products that clearly align with the specific natural features and areas identified in the PPS. This can make the application and review of Environmental Impact Studies (EIS), or comparable studies, required as part of the planning process, more challenging and subject to interpretation at the area or site-specific scale.

Notably, because the extensive woodland and wetland natural cover (see Figures 24, 26, and 27), high density of lakes and rivers (see Figures 15 and 16), plus several large areas of natural and scientific interest (ANSI) and provincial parks in the portions of the County that fall within Ecoregion 5E, mapping a system of natural cores and linkages may not be the most appropriate or effective approach in some or all of these municipalities, nor is it required in the PPS. If (and how) it makes sense to take some different approaches to the County's NHS in Ecoregion 5E versus Ecoregion 6E, will need to be considered as part of the process for advancing the NHS identification. The NHS components that will need to be considered, and mapping guidance related to each, is provided in Section 4.2.2.

In addition, the significance of old growth forest tracts in the County was highlighted by some participants of the engagement process for this Plan. An analysis of the available data to develop a preliminary map of these areas was outside the scope of this project. However, as recommended in this Watershed Plan (Section 9) the presence of old growth forest should be included as a criterion for woodland significance in the County's Official Plan to align with the current provincial guidance (MNR 2010).

As such, a priority next step for the County and its Local Municipalities for advancing watershed planning and protections include developing and implementing an approach to NHS identification, including mapping, that builds the system "from the ground up" based on the natural heritage features and areas considered significant in the County based on the most current and comprehensive data and mapping. As part of this process:

- Natural features and areas (as appropriate) should be identified (in policy and, where appropriate, in mapping) with minimum vegetation protection zones and functional ecological linkages between them to maintain and, where possible, enhance system connectivity, and

- There should be broad engagement with local First Nations, agencies, institutions and community organizations and members (including outreach to the former KNC NHS partners).

4.2.2 Identification of Natural Heritage System (NHS) Components

As outlined in Section 4.1, the County does not currently have an NHS or a WRS mapped in schedules to its Official Plan, and such mapping will not be developed until County staff has Ministerial approval of the new Official Plan policies. However, it is important to recognize that, irrespective of the status of the NHS mapping, that the County does have comprehensive natural heritage policies in place and even if an NHS is not mapped, the policies still apply and must be considered at the site development and impact assessment stages of the land use planning process (MNR, 2010).

Table 2 outlines the NHS components currently identified for the County and defined based on the applicable provincial and the County policies, along with additional key sources of implementation guidance where applicable. Opportunities for clarifying or strengthening some of the current natural heritage policies in the County's Official Plan that would support the objectives of this Watershed Plan are presented in Section 9.

Table 2 Summary of Current Natural Heritage System (NHS) Components Identified by the County

Component	Provincial Definition ⁽¹⁾	County Official Plan Definition ⁽²⁾	Additional Guidance for Identification
Provincially Significant Wetlands (PSW)	An area identified as provincially significant using evaluation criteria and procedures established by the Province, as amended from time to time.	As per the provincial definition	Ontario Wetland Evaluation System Southern Manual (OWES), 4th edition (MNR, 2022a)
Other Wetlands (i.e., Locally Significant, Non-significant)	None	Locally significant wetlands: (not defined) Non-significant Wetlands: Wetlands evaluated and not considered a PSW	OWES (MNR, 2022a) and Conservation Authority policies, as applicable
Areas of Natural and Scientific Interest (ANSI)	An area identified as provincially significant using evaluation criteria and procedures established by the Province, as amended from time to time.	As per the provincial definition	-
Significant Woodlands	An area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape	These are to be identified using criteria established by the Province.	Natural Heritage Reference Manual (MNR 2010)

Component	Provincial Definition ⁽¹⁾	County Official Plan Definition ⁽²⁾	Additional Guidance for Identification
	because of its location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history. These are to be identified using criteria and procedures established by the Province.	Ecoregion 5E: As per the PPS. Ecoregion 6E: Where woodlands cover 30% to 60% of land, a significant woodland is one that is 50 hectares in size or greater.	
Significant Valleylands	Ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area NHS.	As per the provincial definition	Natural Heritage Reference Manual (MNR 2010) and Conservation Authority policies, as applicable
Significant Wildlife Habitat (SWH)	Ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area NHS.	These are to be identified using criteria established by the Province.	Natural Heritage Reference Manual (MNR, 2010), Significant Wildlife Habitat Technical Guide (MNR 2000) and Significant Wildlife Habitat Criteria Schedules for Ecoregions 5E and 6E (MNR 2015b; MNR 2015a)
Fish Habitat	As defined in the Fisheries Act, means water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply, and migration areas.	As per the provincial definition	Fisheries Act (1985)
Habitat for Endangered and Threatened Species	Endangered species: means a species that is classified as “Endangered Species” on the Species at Risk in Ontario List, as updated and amended from time to time. Threatened species: means a species that is classified as “Threatened Species” on the Species at Risk in Ontario List, as updated and amended from time to time.	As per the provincial definition (Note: The County’s Official Plan needs to be updated to refer to the Species Conservation Act (2025), not the former Endangered Species Act (2007))	Species Conservation Act (2025)

Component	Provincial Definition ⁽¹⁾	County Official Plan Definition ⁽²⁾	Additional Guidance for Identification
Vegetation Protection Zones	A vegetated buffer area surrounding a key natural heritage feature or key hydrologic feature within which only those land uses permitted within the feature itself are permitted. The width of the vegetation protection zone is to be determined when new development or site alteration occurs within 120 metres of a key natural heritage feature or key hydrologic feature, and is to be of sufficient size to protect the feature and its functions from the impacts of the proposed change and associated activities that will occur before, during, and after, construction, and where possible, restore or enhance the feature and/or its function.	A vegetated buffer area surrounding a key natural heritage feature or key hydrologic feature.	Oak Ridges Moraine Conservation Plan (MMA 2017a) and Greenbelt Plan (MMA 2017b)
Natural Core Area	None	Provincially Significant Wetlands, Locally Significant Wetlands, non-evaluated wetlands, streams and a 30 m vegetative buffer surrounding these features	County Official Plan
Linkages ⁽³⁾	Intended to provide connectivity (at the regional or site level) and support natural processes which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species, and ecosystems.	As per the PPS	Natural Heritage Reference Manual (MNR 2010)

ELC = Ecological Land Classification; LIO = Land Information Ontario; MNR = Ministry of Natural Resources

- (1) All definitions are from the Provincial Planning Statement (MMAH 2024) except for “vegetation protection zones” which is from the provincial Greenbelt Plan (2017).
- (2) All terms and definitions from the County’s most current Official Plan, April 2025 consolidation, still before the Province.
- (3) The PPS Policy 4.2.2 states linkages are between and among natural heritage features and areas, surface water features and ground water features.

There has been resource extraction in Peterborough County (e.g., lumber, hydro power, aggregates) for over two centuries, but growth and development pressures have been relatively limited and incremental until recently. Growth forecasts to 2051 based on 2021 census data suggest the population is to increase by about 30% (i.e., from 63,800 to 82,000 people) and employment is to grow by over 60% (i.e., from 16,000 to 26,000 jobs) (Hemson 2022). To accommodate this growth and ensure negative impacts to the natural heritage (and water) resources are avoided and mitigated, it is important that:

- All natural heritage features and areas (and their functions) are, or can be, properly identified using the applicable technical and policy guidance
- The applicable policies ensure the identification of all natural features and areas considered significant in the County (based on transparent definitions and criteria where needed), with supporting mapping where available, and
- The applicable policies and any related implementation guidance support the protection of all significant natural features and areas, and their ecological functions.

The guidance in Table 3 is intended to help the County advance the technical aspects of the NHS identification, including its mapping. Having supporting mapping of the various NHS components and the overall NHS based on the best available data can facilitate the implementation of the existing policies as well as any updates to them. As outlined in this table, not all NHS features in the County can or should be mapped. Nonetheless, having NHS components and, where appropriate, the overall system mapped in conjunction with clear policies and criteria for identification can help ensure a more transparent approach to when an EIS or comparable study may be required, as well more consistent application of the policies.

Table 3 provides an overview of the available data sources and coverage for the current NHS components in the County based on the characterization work completed for Volume 1 of the Watershed Plan, noting key gaps where applicable. In almost all cases, the available mapping has been largely or entirely derived from desktop sources. While desktop analyses completed by skilled interpreters using current imagery and other tools is generally good, it is anticipated that these data invariably include some inaccuracies and irrespective will need to be field-verified at the area or site-specific scale, as part of future subwatershed studies and/or site-specific planning applications.

Table 3 Data and Mapping Sources and Guidance for Natural Heritage System (NHS) Components (1)

Component	Available Mapping Data and Coverage	Component-specific Comments and Guidance
Provincially Significant Wetlands (PSW)	MNR LIO mapping available County-wide (see Figure 26). ELC mapping (including wetlands) for select subwatersheds in Kawartha Conservation and Ganaraska Conservation jurisdictions.	Available PSW mapping (see Figure 26) should be included in NHS mapping, with a 30 m vegetation protection zone, in accordance with County policies. • There are extensive areas of unevaluated wetlands, particularly in Ecoregion 5E (see Figure 26). Unevaluated wetlands must be evaluated to determine if they are PSW, Locally Significant Wetlands (LSW) or Non-Significant Wetlands (NSW) as part of any

Component	Available Mapping Data and Coverage	Component-specific Comments and Guidance
	Conservation authority mapping of wetlands across portions of the County within Conservation Authority jurisdictions (see Figure 2).	planning application but may also be evaluated as part of a subwatershed study or another type of higher-level study.
Other Wetlands (i.e., Locally Significant Wetlands (LSW), Non-significant Wetlands (NSW))	MNR LIO mapping available County-wide (see Figure 26) but may be inaccurate or incomplete. ELC mapping (including wetlands) for select subwatersheds in Kawartha Conservation and Ganaraska Conservation jurisdiction. Conservation Authority mapping of PSW and other wetlands may also be inaccurate or incomplete.	Available mapping of Non-PSW and unevaluated wetlands (see Figure 26) should be included in NHS mapping, with a note that the status of unevaluated wetlands remains to be confirmed. A 30 m vegetation protection zone should be applied to confirmed LSW as well as unevaluated wetlands until their status is determined. - There are fairly extensive areas of evaluated Non-PSWs in the County, particularly in Ecoregion 6E, and extensive areas of unevaluated wetlands, particularly in Ecoregion 5E (see Figure 26). The distinction between LSW and NSW is currently unclear. This should be clarified in policy and the terminology used in any NHS mapping. - Unevaluated wetlands must be evaluated to determine if they are PSW, LSW or NSW as part of any planning application but may also be evaluated as part of a subwatershed study or another type of higher-level study.
Areas of Natural and Scientific Interest (ANSI)	MNR LIO mapping available County-wide (see Figure 25) considered fairly accurate and complete.	Available mapping of ANSI (see Figure 25) should be included in NHS mapping.
Significant Woodlands	KEY GAP: Mapping for Significant Woodlands has not been undertaken for the County. Significant Woodlands must be identified in mapping for municipalities in Ecoregion 6E, but not 5E. Available sources of data for identifying significant woodlands include; (a) generic “wooded areas” mapping from MNR LIO which is available County-wide , and (b) more refined ELC mapping (including types of woodlands) for select subwatersheds in Kawartha Conservation and Ganaraska Conservation jurisdictions.	KEY GAP: Significant Woodlands, at least for Ecoregion 6E, should be included in any NHS mapping developed for the County once developed. - Analyses, discussions and engagement are required to determine if relying on the provincial definition in Ecoregion 5E and the current criterion for Significant Woodlands in Ecoregion 6E (see Table 2) is still considered the most appropriate approach. - Cost effective GIS-based desktop tools for mapping and assessing current woodland and overall tree canopy cover are continuing to evolve and could be explored, potentially in partnership with others in the region.

Component	Available Mapping Data and Coverage	Component-specific Comments and Guidance
Significant Wildlife Habitat (SWH)	NHIC coverage is County-wide but limited to two (2) types of SWH (i.e., Wildlife Concentration Areas and Rare Plant Communities (1 km x 1 km squares)). There is no mapping for the remaining types (more than 30) of SWH in Ecoregion 5E or Ecoregion 6E.	Available mapping of SWH could be an appendix to the Official Plan for reference, but it is far too incomplete to be included as a schedule in the NHS mapping. Given the limited information and the fact that SWH is often associated with other NHS features (e.g., Significant Wetlands, Significant Woodlands), it is suggested that the County not attempt to map SWH but require its identification through area and/or site-specific study, as in the current Official Plan. This is a common approach among other municipalities.
Significant Valleylands	KEY GAP: Mapping for Significant Valleylands has not been undertaken for the County. Significant Valleylands must be identified in mapping for municipalities in Ecoregion 6E, but not 5E. Potential sources of data to be considered include an integrated consideration of available topographic mapping, soils drainage, hydrologic mapping, slope and floodplain hazard mapping (lacking in much of the County as shown in Figure 18 and Figure 23).	KEY GAP: Significant Valleylands, at least for Ecoregion 6E, should be included in any NHS policies and mapping developed for the County. Analyses, discussions and engagement with local conservation authorities and others are required to determine how these should be mapped for Ecoregion 6E and if it is appropriate or necessary to map them for Ecoregion 5E. Building on flooding and erosion hazards identified in the Water Resource System (see Table 4) is recommended.
Fish Habitat	MNR LIO mapping for aquatic resource thermal regimes (i.e., cold, cool, warm and unknown) is generally available for Ecoregion 6E but sparse in Ecoregion 5E (see Figure 28). DFO Aquatic Species at Risk mapping is available County-wide but may be incomplete.	Available mapping of Fish Habitat (see Figure 28) should be included in NHS mapping for Ecoregion 6E. KEY GAP: Lack of aquatic resource thermal regimes for most of Ecoregion 5E, with particular gaps noted for Nogies Creek subwatershed, including Bass Lake and Crystal Lake by Kawartha Conservation.
Habitat for Endangered and Threatened Species	Good coverage (about 95% of County has records for at least some species), Natural Heritage Information Centre (NHIC) records (1 km x 1 km squares).	Available mapping for Endangered and Threatened species may be considered at a high level for identify natural cores with a high degree of sensitivity, but this should not be used directly to map NHS components. For planning applications, this component must also be considered but species presence and extent of habitat typically needs to be field verified by qualified professionals and may also need to be confirmed in consultation with the appropriate provincial agency.

Component	Available Mapping Data and Coverage	Component-specific Comments and Guidance
Natural Core Areas	Could be mapped in alignment with the County's current Official Plan with the data sources for wetlands noted above (i.e., PSW, Locally Significant Wetlands, non-evaluated wetlands) plus available mapping for watercourses (i.e., streams) with a 30 m vegetative buffer surrounding these features.	Natural Core Areas could be mapped using the available mapping for PSW, LSW, unevaluated wetlands and watercourses). However, difference between LSW and NSW should first be clarified (as noted above).
Other natural features and areas	ELC mapping has been completed for select subwatersheds in Kawartha Conservation and Ganaraska Conservation jurisdictions. NHIC also has some mapping for ELC habitat types of provincial significance (e.g., sand barrens, savannahs, tallgrass prairies and alvars)	Analyses, discussions and engagement are required to determine if and how any additional natural features and areas should be mapped as part of the NHS for Ecoregion 6E and if it is appropriate or necessary to map them for Ecoregion 5E. Provincially significant habitats such as sand barrens, savannahs, tallgrass prairies and alvars protected by provincial legislation noted in the Conty's Official Plan should be considered.
Vegetation Protection Zones	Vegetation Protection Zones are mapped as buffers to existing identified features and has not been done for any current mapping sources. A range of different buffers were mapped as part of the high-level desktop mapping from the <i>Kawarthas, Naturally Connected</i> (KNC) study (MNR 2013), but these were based on features and areas mapping form over 15 years ago that needs to be updated.	Vegetation Protection Zones of 30 m should be applied to Natural Core Areas (i.e., PSW, LSW, unevaluated wetlands and watercourses) as per the current County Official Plan policies. However, the difference between LSW and NSW should first be clarified (as noted above). Consideration should also be given to applying Vegetation Protection Zones to other NHS components (e.g., Significant Woodlands).
Linkages	The KNC study (MNR 2013) mapping included identification of riparian linkages and enhancement areas, but it is based on older data sources The provincial NHS mapping (MNR, 2018) also included high-level mapping of cores and linkages.	The approaches used by KNC (MNR 2013) and the Province (MNR 2018) should be considered along with other available and appropriate precedents for identifying and mapping NHS linkages. Available mapping for Water Resource System components should also be considered. In general, woodland corridors, wetland complexes, and riparian zones should be protected as part of a connected natural heritage system.

DFO = Department of Fisheries and Oceans, ELC = Ecological Land Classification; KNC = Kawarthas Naturally Connected; LIO = Land Information Ontario; MNR = Ministry of Natural Resources; NHIC = Natural Heritage Information Centre

(1) NHS components as identified and defined in Table 2.

4.3 Guidance for Developing a Water Resources System (WRS)

As outlined in Section 2.1.2, the PPS (MMAH 2024) requires that planning authorities identify water resource systems and maintain their linkages and functions including consideration for: ground

water features and areas, surface water features and areas (including shoreline areas), natural heritage features and areas, and hydrologic functions, necessary for the ecological and hydrological integrity of the watershed. Terrestrial and aquatic natural heritage features and areas to be considered are discussed in Section 4.2; the remaining WRS components are discussed in this section.

The County's Official Plan (Section 9) also recognizes the importance of water resources for sustaining local health, social and economic wellbeing. Integrating land management and the protection of WRS including key hydrologic features, key hydrologic areas, shorelines and associated natural heritage features helps ensure a healthy environment can be sustained.

Section 4.2 of the Draft Watershed Planning in Ontario (Government of Ontario 2018) document provides direction for the identification of the WRS, recommending that the system be identified as part of the watershed characterization process. The basic approach includes the following four steps:

1. Determine what information already exists and identify gaps
2. Undertake reviews or studies to identify water resource system features
3. Identify functions and interrelationships
4. Identify linkages to support connectivity

The identification and delineation of any WRS should be carried out in collaboration with local agencies, including Conservation Authorities where applicable, prior to translating the information into the Official Plan. As noted by the Conservation Authorities who participated in this Watershed Plan, they may already have many of these features mapped and identified as part of the development of hydrologic models used for floodplain mapping updates and/or flood forecasting activities.

To the extent possible, this structure has informed the approach in this Watershed Plan with gaps identified and guidance provided to fill these gaps and potentially enhance identification of the WRS in support of the planning process.

4.3.1 Approach for Identification of a Water Resource System (WRS)

The WRS, as defined in the PPS and County's Official Plan, is to be comprised of key hydrologic features (KHF) and key hydrological areas (KHA), with consideration for natural hazards. The following definitions of KHF and KHA are from the County's Official Plan (2025) and provide the components that need to be considered in addition to natural hazards, noting there is some overlap with the NHS:

- Key hydrologic features (KHF): Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.

- Key hydrologic areas (KHA): Significant groundwater recharge areas, highly vulnerable aquifers, groundwater discharge areas associated with wetlands and coldwater streams, and significant surface water contribution areas that are necessary for the ecological and hydrologic integrity of a watershed.

As with the recommended approach for identifying an NHS, well-established beneficial practices for identifying a WRS include ensuring that it is:

- Technically sound and data-driven: Utilize the best available data and, where possible, various sources of GIS-based mapping and analyses to inform the identification of features and areas.
- Connected: Identification of functional linkages between different WRS components, and between WRS and NHS components (discussed further in Section 4.4).
- Informed by meaningful engagement: Develop and confirm the approach and any related criteria for identification and mapping with careful consideration for diverse perspectives (including Council, municipal staff, First Nations, and members of the community), available local expertise (e.g., academic institutions), and local community values.
- Aligned with, or goes beyond, established provincial policies: For the County this means alignment with the PPS (MMAH, 2024), applicable source water protection guidance (TCC 2025a, b), and the most current sources of provincial guidance (e.g., related to natural hazards, headwater drainage features, etc.) at a minimum.

Natural Hazards – flood and erosion

The natural hazards of flooding and erosion are associated with components of the WRS (watercourses, valley slopes, floodplains) as well as the NHS (i.e., significant valleylands). Future work at the County, quaternary watershed, and/or subwatershed scale to integrate these systems as a comprehensive ‘Natural Environment System’ can provide a clearer understanding on the interdependencies and overlap between each system and their sensitivities, allowing for clear delineation and management of area constraints and sensitivities.

Natural hazards related to flooding and erosion have specific policy requirements in the PPS (2024) (see Section 2.1), are regulated by the local Conservation Authorities, and are identified for management in the County’s Official Plan. Notably, while flood hazards are captured in floodline mapping (where available), erosion hazards (i.e., meander belt and stable top of slope) are not captured as part of either system, even though they, like flood hazards, form constraints to development and land use management. Erosion hazards are associated with natural features of both the WRS (e.g., watercourses, floodplains, river valleys) and NHS (i.e., significant valleylands). In addition, regulatory setbacks for natural hazards are applied to the greatest of all hazards as a 15 m allowance (O. Reg. 41/24).

In the County, floodline mapping is currently limited to those lands within Kawartha Conservation, Otonabee Conservation, and Crowe Valley Conservation Authorities. Notably, Ganarska Conservation is currently undertaking floodline mapping for its jurisdiction within the County, which is expected to be completed by 2027. Additionally, Kawartha Conservation has mapped “regulated

slopes” which is assumed to be stable top of slope mapping (in accordance with the Technical Guide – River and Stream Systems: Erosion Hazard Limit, MNR, 2002), although it appears to have been derived by mapping certain slope angles rather than delineating the stable top of slope.

While these hazards are not explicitly identified as a component of either system (with the exception of regulated floodplain), they form constraints to development and should be incorporated into the broader environmental systems mapping.

Natural hazards should be considered to the extent possible with the other WRS components as part of Official Plan updates to ensure a comprehensive approach. Currently, both floodplain and erosion hazard mapping are lacking for most of the County, representing a key gap for current and future land use planning that will need to be filled as part of future subwatershed or other environmental studies.

It should be recognized that natural hazards can only be delineated at the desktop level and confirmed in the field through hydrologic and hydraulic modelling as part of subwatershed planning. Even at the more detailed subwatershed scale, there is potential that natural hazards as delineated may be considered preliminary and subject to confirmation and refinement at more resolute stages such as servicing planning or site plans. Watercourse and HDF identification should be done in partnership with the conservation authorities as they will be processing DEM data as part of their respective hydrologic analyses and metrics, such as drainage density, which among other outputs, is automatically calculated within the models.

As such, natural hazards should be delineated and confirmed in consultation with the Conservation Authorities at the subwatershed scale or finer to support development planning.

Headwaters are broadly defined in provincial policy and can include headwater drainage features (HDF) as well as land areas which support these features (e.g., headwater drainage areas).

Even though HDF mapping is not currently available, HDFs should still be explicitly identified and considered as components of the WRS (e.g., through quaternary-scale/subwatershed studies). HDF identification should be done, to the greatest extent possible, in partnership with the Conservation Authorities who should have these data available as part of their hydrologic analyses.

Specifically, HDF confirmed as a “protection” or “conservation” classification (ref. CVC/TRCA, 2014) should be included and mapped, while HDFs confirmed as “mitigation” features should have their hydrologic function assessed and mitigation plans developed accordingly.

Groundwater and surface water features and related hydrologic functions, as well as ecologically significant groundwater recharge areas (ESGRA) are also to be considered in watershed planning or equivalent study to determine which features must be included within the WRS. Information collected through these studies will confirm feature presence and support delineation or refinement of boundaries for features and areas, as appropriate.

4.3.2 Identification of a Water Resource System (WRS) Components

Below is a complete list of WRS components to be considered in Peterborough County based on consideration of the applicable policies, available data, and existing best practices within the Province.

Key Hydrologic Features (KHF)

- Permanent and intermittent streams and associated vegetation protection zones
- Inland lakes and their littoral zones (including associated vegetation protection zones)
- Seepage areas and springs and associated vegetation protection zones
- Wetlands and associated vegetation protection zones

Key Hydrologic Areas (KHA)

- Significant groundwater recharge areas (SGRA)
- Highly vulnerable aquifers (HVA)
- Significant surface water contribution areas
- Ground Water Features and Areas
- Recharge / discharge areas other than those captured as KHF and KHA
- Ecologically Significant Groundwater Recharge Areas (ESGRA)
- Water table (depth and elevation)
- Aquifer and unsaturated zones properties
- Surface water features and headwaters

Natural Hazards

- Floodplain, flood hazards and floodways
- Erosion hazards
- Shoreline areas

WRS components should be identified at a regional scale for groundwater components and confirmed at a subwatershed scale for surface water components and interconnected terrestrial features. Regardless of the scale of the study, the watershed boundary mapping should be confirmed and / or refined as needed.

Table 4 outlines the available data and key data gaps for the WRS components listed for Peterborough County and provides high-level implementation guidance related primarily to mapping each of these components.

Table 4 Data and Mapping Sources and Guidance for Water Resource System (WRS) Components

Component	Available Mapping Data and Coverage	Component-specific Comments and Guidance
Key Hydrologic Features (KHF)		
Permanent and intermittent streams	MNR LIO watercourses (permanent streams) (see Figure 14) mapping is available County-wide.	Available mapping of watercourses and waterbodies (see Figure 14) and wetlands (see Figure 26) should be included in WRS mapping for KHF with associated 30 m vegetation protection zones.
Inland lakes and their littoral zones	MNR LIO waterbodies (including inland lakes) (see Figure 14) is available County-wide. Littoral zones are captured superficially through the shoreline perimeter measure available County-wide (see Figure 17).	Available mapping of waterbodies (see Figure 14) should be included in WRS mapping for KHF with associated 30 m vegetation protection zones. Note: Applying a 30 m vegetation protection zone (as per the County's Official Plan) may roughly capture part of the littoral zones for inland lakes, but alternate approaches should also be considered.
Seepage areas and springs	Mapping for seepage areas and springs is not available.	Mapping for seepage areas and springs is a gap that will need to be filled through future area-specific and/or site-specific studies.
Wetlands	Yes, available County-wide (as addressed in Table 3)	See Table 3
Key Hydrologic Areas (KHA)		
Significant groundwater recharge areas (SGRA)	The Trent Region Source Protection Assessment Report (TCC 2025a,b) includes County-wide mapping for SGRA.	Available mapping of SGRA should be included in WRS mapping for KHA.
Highly vulnerable aquifers (HVA)	The Trent Region Source Protection Assessment Report (TCC 2025a,b) includes County-wide mapping for HVA (as mapped in Figure 21).	Available mapping of HVA (see Figure 21) should be included in WRS mapping for KHA.
Groundwater discharge areas associated with wetlands and coldwater streams ⁽¹⁾	The Trent Region Source Protection Assessment Report (TCC 2025a, b) has mapping for groundwater discharge areas County-wide (see Figure 20) that can be mapped in conjunction with County-wide wetlands mapping available from MNR LIO (see Figure 26). MNR LIO mapping for coldwater streams is generally available for Ecoregion 6E but sparse in Ecoregion 5E (see Figure 28).	Mapping for this WRS component could be done for much of Ecoregion 6E but should be done in the context of more comprehensive KHF mapping that includes SGRA and HVA.
Significant surface water contribution	This component has not been identified in the County.	GAP: Mapping for KHA is a gap that will need to be filled through future area-specific and/or site-specific studies.

Component	Available Mapping Data and Coverage	Component-specific Comments and Guidance
areas necessary for the ecological and hydrologic integrity of a watershed		
Significant Groundwater Recharge Areas (SGRA)	The Trent Region Source Protection Assessment Report (TCC 2025a,b) has mapping for groundwater recharge areas County-wide (see Figure 19). There is no mapping for Ecologically Significant Groundwater Recharge Areas (ESGRA) in the County.	Available mapping of SGRA (see Figure 19) should be considered in WRS mapping for the County.
Headwater Drainage Features (HDF) ⁽²⁾	Specific datasets for HDF are not available for the County, although some HDF are captured in the MNR LIO watercourses (intermittent streams) mapping available County-wide (see Figure 14).	Mapping for HDF is not required by provincial or County policies and is not available for the County. However, mapping of HDFs can be helpful in informing land use planning and is a gap that could be filled in consultation with the Conservation Authorities through future area-specific and/or site-specific studies.
Natural Hazards		
Shoreline areas necessary for ecological and hydrological integrity of watershed	Specific datasets for this component are not available for the County. Generic shoreline mapping is available. Figure 17 shows shoreline perimeter density mapping at the quaternary watershed scale.	In general, shoreline protection is recognized as important for the ecological and hydrological integrity of a watershed. Given the extent of shorelines in the County, it is likely not feasible to assess or map this component County-wide. As a generic mapping approach, 30 m from the limits of the shoreline flood hazard is recommended to be captured for this component. In addition, development and implementation of comprehensive policies to manage shoreline impacts is recommended.
Karst Features (as described in Volume 1)	Mapping of known, inferred and potential karst landscapes are mapped County-wide in the OGS karst layer (as shown in Figure 11).	Available mapping of known karst landscapes (see Figure 11) should be included in WRS mapping for the County. Mapped inferred and potential karst landscapes should be considered and assessed in more detail as part of future area-specific and/or site-specific studies.
Floodplain, flooding hazard, or floodways	Floodplain mapping is available for portions of Kawartha Region Conservation, most of Crowe Valley Conservation Authority (CVCA) and much of Otonabee Conservation in the County, as mapped in Figure 23. There is no	Available floodplain mapping (see Figure 23) should be included in WRS mapping for the County, with gaps noted as appropriate.

Component	Available Mapping Data and Coverage	Component-specific Comments and Guidance
	Conservation Authority for much of the Kawartha Lakes Tertiary Watershed (see Figure 2).	Floodplain mapping where lacking from the conservation authorities will need to be added as it becomes available or developed as part of future area-specific and/or site-specific studies.

Notes:

- (1) Other sources of data available County-wide that may be considered include: Water Table mapping and Potential Groundwater Discharge areas (from the ORM Groundwater Program), plus Potentiometric Surface. Hydrostratigraphic Units are only available for lands on Oak Ridges Moraine.
- (2) Headwater drainage features (HDF) classified as “conservation” or “protection” are likely classified as “intermittent streams” and therefore must be included in the WRS. However, HDF classified as “mitigation” do not need to be included. This is because they have a recognized function as part of the WRS by performing critical water quality and quantity functions, but may be managed (e.g., through land use or engineered methods) to replicate their function while removing the HDF from the landscape.

Available datasets that form components of KHF and KHA are included on a series of separate figures as compiled through Volume 1, as noted in Table 4.

4.3.3 Process of Refinement for the WRS

The components of the WRS, including natural hazards, cannot all be fully identified or mapped at the tertiary watershed scale and some need to be identified and/or refined through both the subwatershed study process and, depending on the level of detail of the subwatershed study, also potentially through other more site-specific environmental studies (described in more detail in Section 7.2). Notably, more detailed studies may occur as part of the subwatershed planning depending on the scope of work, available data, and timelines for completion.

4.4 Guidance for Natural Environment Systems Integration

As Tables 3 and 4 above show, there are several ways in which the WRS and NHS intersect in terms of both policies and mapping, as well as assessment. For example, significant wetlands are identified in their own right in the NHS, as part of Natural Core Areas in the NHS, as key hydrologic features in the WRS, and as potential receivers of groundwater discharge in the WRS. As such, key gaps and/or misalignment of data and coverage in the NHS can impact the accuracy and completeness of WRS mapping.

In general, terrestrial and aquatic features on the landscape support ecological process, health, biodiversity, habitat and habitat connections, while being sustained and supported by processes associated with the WRS (e.g., surface water corridors, water infiltration and recharge, groundwater discharge and seepage). Consequently, although Provincial and County policies identify these systems separately, it is imperative to consider and update mapping of features and areas associated with the WRS and the NHS in an integrated way, to inform the identification of sensitive features and areas.

The features, areas, and functions of the WRS and NHS are interdependent at various scales, from the site scale (e.g., water balance for localized wetland habitat) up to the catchment scale and beyond (e.g., land use conversion to impermeable surfaces, reducing infiltration and recharge, while increasing downstream flooding and erosion potential). As such, the NHS and WRS can be considered as a single “natural environment system” for the purpose of protecting and managing features and their interrelated processes. Land use planning should consider these interactions and interdependencies at the regional or subwatershed scale:

- so that existing conditions are characterized appropriately
- to evaluate combined and cumulative impacts, and
- to help understand and manage the complex system for the long-term protection and function of the natural environment, and to help ensure human health and safety.

For this Watershed Plan, potential system interactions are generalized into key elements (see Table 5) with general interactions assumed to occur at the tertiary and quaternary watershed scales. As described in Volume 1, several portions of the NHS and WRS cannot be mapped, in whole or in part, with the available data, and thereby require further study and assessment to confirm their presence and the scope and nature of their integration.

Table 5 Summary of Interactions and Interdependencies Between the Natural Heritage System and Water Resource System

Interaction / Interdependencies	Description	Environmental Indicators (or potential indicators) to be Identified and Assessed in Future Studies
Water Quality and Quantity - Groundwater Recharge - Groundwater Discharge - Flow Attenuation - Thermal Effects	Groundwater recharge is critical to maintaining the WRS, acting as a key input to the water balance, with local and regional scales. The NHS supports and interacts with this hydrologic function wherever natural cover occurs by promoting infiltration. Groundwater discharge areas (streams and wetlands), deliver cooled, filtered water to the surface and supporting both aquatic and terrestrial functions in the NHS. From a water quantity perspective, flow attenuation (surface and subsurface) slows the movement of water through the system, supporting natural functions and a healthy, balanced system, and reducing the magnitude and frequency of flood events (i.e. “flashy” systems). Flow attenuation also influences water quality, which affects both the WRS and NHS. Through surface water networks, higher drainage density and areas for retention reduce local and downstream erosion (e.g. floodplains, wetlands), provide opportunities for evapotranspiration, and opportunities to improve water quality through nutrient uptake and by limiting erosion of particles that may transport excess nutrients or contaminants (e.g. phosphorus bound to clay particles).	Presence of significant groundwater recharge areas (SGRA) Coldwater watercourses / streams Riparian vegetation protection zones (i.e., buffers) Soils Surficial Geology Karst (confirmed or potential) Drainage density Wetland areas and types Woodland areas and types
Vegetation Communities/Structure - Wetlands - Woodlands - Open natural areas - Terrestrial habitat and biodiversity	Areas with limited natural cover (including riparian cover and wetland vegetation) can result in increased water temperatures / warming effects. Maintaining or improving Infiltration also influences water temperature through cooling as it travels through the subsurface before discharging at the surface (watercourse/wetland). Wetlands are an important component of the WRS and NHS. They can act as points of groundwater recharge, groundwater discharge, provide flow attenuation (moderate downstream flow conditions), and support watercourse baseflow – particularly in smaller order / headwater features, wetland plants and fauna. Open natural areas such as grasslands, meadows, thickets and savannahs maintain permeable cover, encourage infiltration (often in drier, well drained soils), and provide flood retention.	Coldwater watercourses / streams and associated headwater and Wetland areas and types Woodland areas and types
Terrestrial Habitat - Significant Wildlife Habitat - Biodiversity and ecosystem functions	Several habitats depend on availability of sufficient water (quantity) of good quality (e.g. wetlands, vernal pools, ponds, coldwater streams, headwater drainage features) for permanent and seasonal habitat, and reproduction and growth. Vegetation communities and structure are influenced by and influence the types of habitat that may be present on the landscape. Alterations to influencing factors (direct or indirect) will impact the form, function, and availability of a variety of habitats and ecological functions. As influencing factors for wildlife habitat and terrestrial ecosystems are altered (e.g. flow regime, groundwater interactions, urbanization, climate change), there is potential for a loss of native species biodiversity, allowing for invasive species to enter the ecosystem and outcompete native populations. Which in-turn can lead to a loss of ecosystem function and impacts to water quality and quantity.	Soils Surficial Geology Drainage density Wetland areas and types Woodland areas and types Other vegetation communities (e.g., alvars, savannahs) Endangered and Threatened terrestrial species
Aquatic Habitat - Significant wildlife habitat - Thermal Regime - Substrate Composition - Benthic Invertebrates - Biodiversity and ecosystem functions - Species and habitat sensitivity	Temperature is major driver of ecological processes in aquatic habitats. In general, cooler temperatures associated with groundwater discharge along watercourses and in connected wetlands signify higher water quality (cleaner water) and support the presence and distribution of sensitive aquatic specie, including benthic invertebrates. Changes such as land use conversion (e.g. deforestation, urbanization), and climate change impact the delivery of cold or cool water, reduce vegetation cover, and degrade the geomorphic form of watercourses (i.e. enlargement, incision), directly and indirectly impacting habitats and the availability for sensitive and native aquatic organisms. As aquatic habitats are degraded, there is potential for a loss of native species biodiversity, allowing for invasive species to enter the ecosystem and outcompete native populations. Which in-turn can lead to a loss of ecosystem function and impacts to water quality and quantity.	Coldwater and coolwater watercourses / streams Riparian vegetation protection zones (i.e., buffers) Surficial geology Karst (confirmed and potential) Soils Interconnected wetlands Endangered and Threatened aquatic species

5 Guidance for Managing Land Use Impacts

Provincial watershed planning guidance (Government of Ontario 2018) for watershed plan equivalents (like this Watershed Plan) is that they establish a framework for future land use and resource planning. This section provides land use impact assessment and management guidance, including cumulative impacts management guidance where available and appropriate, for:

- Natural heritage features and areas (Section 5.1)
- Water resource features and areas (Section 5.2), and
- Drainage features (Section 5.3).

Changes in land use, such as the clearing of forests for aggregate resource extraction, draining wetlands and headwaters to accommodate agriculture, or the conversion of rural landscapes into built urban areas (to support employment, institutional, commercial and residential uses), fundamentally alters natural cover and connectivity, natural drainage patterns and linkages, and the overall natural water balance in watersheds.

As natural vegetation is removed or altered, evapotranspiration rates decline, and the ability of the landscape to store and slowly release water is diminished. In the County, these transformations can be particularly impactful due to the region's varied physiography and reliance on groundwater recharge zones (e.g., Oak Ridges Moraine) and surface water systems for ecological functions and municipal needs. For example, when porous soils are compacted or covered, stormwater is rapidly routed to streams and rivers, contributing to higher peak flows, increased erosion, and degraded water quality.

The following sub-sections provide insights regarding these systems, areas, and features as they relates to land use changes, which are to be considered in subsequent quaternary and/or subwatershed studies (see Section 7.2) to inform the future land use planning process.

5.1 Natural Heritage Features and Areas

In Ontario, natural heritage features and areas are protected through a layered system of provincial legislation (i.e., PPS, 2024 – as outlined in Section 2.1 of this Volume 2, *Species Conservation Act*, 2025), municipal planning controls (i.e., municipal official plan), Conservation Authority regulation, as they apply to natural hazards (including wetlands), and federal regulations (e.g., *Fisheries Act*).

As outlined in Section 2.7 and Section 4.1 of this Volume 2, the County currently has comprehensive policies for identifying the various natural heritage features and areas for protection which were still before the Minister for approval at the time of writing this Plan. However, as noted earlier, County staff is awaiting Ministerial approval of the new Official Plan policies before moving forward with mapping and/or schedule changes, including any mapping of the NHS within or outside of identified areas of future growth. Specifically, an NHS for the southern portion of the County falling within Ecoregion 6E is necessary to meet the requirements set out in the PPS. At the

County's discretion, the same or alternate criteria and approaches may be applied to natural features and areas in the Ecoregion 5E portions of the County, as long as these criteria and approaches also maintain or restore the diversity, connectivity and functions of these features and areas.

In general, having robust policies with supporting mapping that supports the identification and protection of an NHS, including linkages with a well-identified WRS, is one of the best tools available to municipalities in Ontario for informing land use planning on both a project-specific basis and cumulatively.

Building on the existing Official Plan policies and the assessment and guidance provided in Section 4 of this Volume 2 of the Watershed Plan, it is suggested that the County's NHS be comprised of:

- Natural Core Areas (including vegetation protection zones)
- Supporting Natural Features and Areas (including natural heritage features and areas assessed as being non-significant as well as potential restoration areas), and
- Linkages (identified with consideration for approaches taken in previous NHS mapping (MNR, 2012; MNRF, 2018) as well as other applicable precedents.

Recognizing the fundamental biophysical differences between the local Municipalities with lands in Ecoregion 5E and those with lands in Ecoregion 6E, as well as the differing requirements in the PPS (2024) and identified future growth areas being in Ecoregion 6E, it is further suggested that the County consider advancing an NHS, including mapping, for Ecoregion 6E first.

Recognizing the more diffuse threats and pressures presented by localized development and intensification on lakes throughout the County, shoreline policies should also be reviewed and enhanced.

Further guidance related to each of these topic areas is provided in the following sub-sections. This guidance is intended to inform pending updates to the County's Official Plan, particularly as it relates to NHS identification and mapping to support the long-term maintenance and (where applicable) enhancement of the County's natural heritage.

As noted in Section 4.2, this exercise should be undertaken with consideration for WRS features and areas mapping, including natural hazards, and should also be informed by input gathered through engagement.

Even once the County-wide updates are completed, the identification and delineation of all applicable NHS components will still need to be assessed and verified as part of quaternary-scale/subwatershed studies, and potentially through site-specific Environmental Impact Studies (EIS) as well, depending on the level of detail of the subwatershed study and the timing of the proposed development in relation to the subwatershed study.

5.1.1 Natural Core Areas

Natural Core Areas, as identified in the County's Official Plan, currently include provincially significant wetlands (PSW), locally significant wetlands (LSW), unevaluated wetlands and streams plus a 30 m vegetation protection zones around all those features.

These are generally the features afforded the highest level of protection as part of the broader NHS.

The County should consider expanding this category to add other natural heritage features and areas considered "significant" such as: significant valleylands, significant woodlands, fish habitat, confirmed significant wildlife habitat (SWH), and provincial areas of natural and scientific interest (ANSI). These are all specifically noted and afforded protection under the PPS (2024).

Significant Wetlands

Wetlands are lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case, the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants. The four major types of wetlands are swamps, marshes, bogs and fens. Notably, periodically soaked or wet lands being used for agricultural purposes, which no longer exhibit wetland characteristics, are not considered to be wetlands for the purpose of this Watershed Plan.

There are extensive areas of unevaluated wetlands, particularly in Ecoregion 5E (see Figure 26). Unevaluated wetlands must be evaluated to determine if they are PSW, LSW or Non-significant Wetlands (NSW) as part of any planning application and may also be evaluated as part of a subwatershed study or another type of higher-level study.

The policy distinction between LSW and NSW in the County's Official Plan is currently unclear. This should be clarified in policy and in the terminology used in the Official Plan and any NHS mapping. It is suggested that LSW be considered Natural Core Areas, while NSW be considered Supporting Natural Features.

Unevaluated wetlands, in all cases, must be evaluated to determine if they are PSW, LSW or NSW as part of any planning application, but may also be evaluated as part of a subwatershed study or another type of higher-level study. While it is a good precautionary approach to map unevaluated wetlands as part of Natural Core Areas, it should be understood that their status may change once they are assessed in more detail at a local scale. In all cases, unevaluated wetlands should be treated as significant until formally assessed.

Wetlands are to be assessed by trained evaluators using the Ontario Wetland Evaluation System (OWES), Southern Manual, 4th Edition (MNRF 2022a) in Ecoregion 6E and the Northern Manual, 2nd Edition (MNRF 2022b) in Ecoregion 5E.

Significant Woodlands

The Province (PPS, 2024) defines significant woodlands as: “An area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history”. It also states that: “These are to be identified using criteria and procedures established by the Province”.

The County’s Official Plan defaults to the definition above and adds that where woodland cover is 30% to 60%, a significant woodland is one that is at least 50 hectares in size.

Overall woodland cover in Peterborough County is approximately 53% based on the available woodlands mapping (see Figure 27), but there are some significant differences in coverage between the quaternary watersheds, as shown in Table 6.

Table 6 **Wooded Area Coverage by Quaternary Watershed**

Tertiary Watershed	Quaternary Watershed	% Wooded Area Coverage ^{1,2}
Gull River	Birchbark Lake - Irondale River	78
	Farquhar Lake - Irondale River	79
	Goose Lake - Burnt River	77
Kawartha Lakes	Bobcaygeon River	62
	Burleigh Falls Dam - Lower Buckhorn Lake	32
	Deer Bay Creek	69
	Eels Creek	82
	Mississagua River	72
	Nogies Creek	82
	Omeme Dam - Pigeon River	26
	Pigeon Lake - Gannon Narrows	60
	Stony Lake - Katchewanooka Lake	55
North Lake Ontario Shoreline	Ganaraska River	95
Otonabee River	Cavan Creek	29
	Hastings Lock 18 Dam - Trent River	17
	Indian River	33
	Lock 19 - Otonabee River	26
	Otonabee River Outlet	23
	Ouse River	43
Trent River – Crowe River	Chandos Lake - Crowe River	71
	Cordova Lake Dam - Crowe River	78
	Crowe Bay Dam - Trent River	36

Tertiary Watershed	Quaternary Watershed	% Wooded Area Coverage ^{1,2}
	Crowe Lake - Crowe River	54
	Kasshabog Lake - North River	67
	Paudash Lake Dam - Crowe River	80
	Round Lake - North River Outlet	73

¹ Where a watershed extends outside the County boundary, this value represents the wooded area coverage for the portion of the watershed that is within the County

² Inclusive of treed areas, hedgerows, and plantations as delineated by MNR and sourced from LIO; data set was last updated on July 10, 2018.

Given this context, and further growth being anticipated in the County, discussions and engagement are required to determine if relying on the provincial definition for significant woodlands in Ecoregion 5E is adequate and if the current size and percent cover threshold for Ecoregion 6E are considered appropriate and adequate.

It is recommended that careful consideration be given to building on the provincial definition with more specific and explicit criteria for significant woodlands with consideration for all levels of woodland cover and other criteria, provided the available provincial guidance (OMNR, 2010). Notable and potentially relevant guidance for identifying significant woodlands from the Natural Heritage Reference Manual (OMNR 2010) includes the following criteria for consideration:

- Significance should be ascribed to woodlands whose size is
 - 2 ha in size or larger where woodland cover is less than about 5%
 - 4 ha in size or larger where woodland cover is about 5-15%
 - 20 ha in size or larger where woodland cover is about 15-30%
 - 50 ha in size or larger where woodland cover is about 30-60%, and
 - factors other than size should be considered where woodland cover is above 60%.
- Significance should be ascribed to woodlands with interior habitat (as calculated 100 m inwards from the feature edge) for:
 - Any interior habitat where woodland cover is less than about 15%
 - 2 ha or more of interior habitat where woodland cover is about 15-30%
 - 8 ha or more of interior habitat where woodland cover is about 30-60%, and
 - 20 ha or more of interior habitat where woodland cover is above 60%.
- Significance should be ascribed to woodlands located close to (e.g., 50 m) another significant natural feature (e.g., PSW, fish habitat, SWH, ANSI) or a hydrological feature (e.g., stream, lake).
- Significance should be ascribed to woodlands considered “old growth” (e.g., woodlands with 10 or more native trees/ha greater than 100 years old).

- Significance should be ascribed to woodlands containing one more vegetation community (e.g., >0.5 ha) of provincial significance (i.e., with a provincial ranking of S1, S2, or S3 as ranked by NHIC) or as supporting confirmed significant wildlife habitat.
- Rare Species: woodlands supporting confirmed habitat of threatened, endangered, special concern, or provincially or locally rare plant, lichen, or wildlife species.

Cost effective GIS-based desktop tools for mapping and assessing current woodland and overall tree canopy cover are continuing to evolve and could be explored, potentially in partnership with others in the region. Having an accurate and comprehensive base map of woodland cover in the County will allow for different criteria, or combinations of criteria, to be applied and assessed.

Significant Valleylands

Mapping for Significant Valleylands has not been undertaken for the County but should, at least for Ecoregion 6E, be included in any NHS policies and mapping developed for the County.

Valleylands are defined in the PPS (2024) as natural areas that occur in a valley or other landform depression that has water flowing through or standing for some period of the year, while significance is to be determined based on their ecological importance in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area.

Analyses, discussions and engagement with local Conservation Authorities and others are required to determine how these should be mapped, potentially including more specific criteria for their identification in Ecoregion 6E. Considering and building on flooding and erosion hazards identified in the Water Resource System (see Table 4) is recommended.

It is also recommended that careful consideration be given to building on the provincial definition with more specific and explicit criteria for significant valleylands with consideration for the available provincial guidance from the Natural Heritage Reference Manual (MNR 2010). Key guidance from this source includes considering:

- Surface water functions, recognizing the significance of the “water/sediment conveyance function” of watercourses (e.g., Areas of water conveyance from catchment areas of 50 ha or greater)
- Groundwater functions, including areas that make an important contribution to infiltration in the County and areas of groundwater release (i.e., springs, seepages, wetlands)
- Areas with well-defined valley morphology and distinctive geomorphic landforms (e.g., oxbows, bottomlands, terraces, deltas, exposed soil strata or eroding slopes along riverbanks or valley walls)
- Degree of naturalness (e.g., proportion of valleyland with natural vegetation cover greater than 25%, valleylands with riparian vegetation cover on 30 m or greater on each side of a surface water feature)

- Supporting community and species diversity and rarity (e.g., vegetation communities with a provincial ranking of S1, S2, or S3 as ranked by NHIC, presence of seasonally important wildlife habitats).

In addition, Ontario Regulation 41/24 under the *Conservation Authorities Act* prohibits development activities in areas within a Conservation Authority's jurisdiction including hazardous lands, wetlands, river or stream valleys, shorelines, and inland lakes. There is an opportunity to align significant valleylands policies and (where the data exist) mapping with these regulations and protection of these areas.

Significant Wildlife Habitat (SWH)

A significant wildlife habitat (SWH) is one that is ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system. These are to be identified using criteria established by the Province.

SWH captures a broad and diverse range of specialized habitats and in Peterborough County, as in most municipalities, is not mapped except for a few specialized categories. Broad categories include habitats of seasonal concentrations of animals, rare vegetation communities or specialized habitat for wildlife, habitats of species of conservation concern, and animal movement corridors.

Availability and coverage of SWH data and mapping are limited in both types and extent in the County with records of only a few of the more than 30 types of SWH (e.g., colonially nesting bird habitat, mixed wader nesting colonies, deer overwintering habitat) and only in some areas. Given the limited information and the fact that SWH is often associated with other NHS features (e.g., Significant Wetlands, Significant Woodlands), it is suggested that the County not attempt to map SWH but require its identification through area and/or site-specific study, as in the current Official Plan. This is a common approach among other municipalities.

One type of SWH that could potentially be mapped is provincially significant habitats such as sand barrens, savannahs, tallgrass prairies and alvars protected by provincial legislation noted in the County's Official Plan.

Irrespective, SWH must be considered and screened for as part of subwatershed studies and/or more site-specific EIS based on the requirements outlined in the Significant Wildlife Habitat Technical Guide (MNR 2000) and criteria schedules for Ecoregions 5E and/or 6E (MNRF 2015a; MNRF 2015b), as appropriate.

Areas of Natural and Scientific Interest (ANSI)

MNR identifies two types of ANSI based on scientific surveys of the Province's ecodistricts: life science and earth science. Life science ANSI are significant representative segments of Ontario's biodiversity and natural landscapes, including specific types of forests, valleys, prairies, savannahs, alvars and wetlands, their native plants and animals, and their supporting environments. Earth science ANSI are geological in nature, consist of some of the most significant representative examples of the bedrock, fossils and landforms in Ontario, and include examples of ongoing geological processes.

In Peterborough County, a total of 48 ANSI has been identified by MNR, with most of them being life science ANSI confirmed as provincially significant (see Figure 25), but also including a few confirmed earth science ANSI and some candidate ANSI still to be confirmed. These are, and should remain, protected in the County's Official Plan and should be added to NHS mapping where undertaken.

Fish Habitat

Fish habitat is defined in the federal Fisheries Act as "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply, and migration areas", and includes fish, shellfish (e.g., mussels), and crustaceans. Fish habitat may include headwater streams, watercourses, wetlands, ponds, and lakes.

County-wide coverage for aquatic/fisheries data is moderate to good as the Province's LIO mapping covers systems throughout the County with no major gaps observed in Ecoregion 6E. However, this mapping contains significant gaps in Ecoregion 5E and, in some cases, is based on data that are out of date, and so subwatershed-specific fisheries reports and more current Conservation Authorities data should also be used to supplement the broader data coverage, with field studies needed to fill any remaining gaps as part of area or site-specific planning. As an example, Kawartha Conservation shared that for its area of jurisdiction (e.g., Nogies Creek subwatershed, including Bass Lake and Crystal Lake), fisheries related data, such as taxa lists and areas of habitat sensitivity, are limited and out-of-date.

The protection of fish and fish habitat is a federal responsibility and is administered by the Department of Fisheries and Oceans Canada (DFO). Under the Fisheries Act, no one may carry out any work or undertaking that results in the harmful alteration, disruption or destruction (HADD) of fish habitat, unless DFO or its delegated authority had authorized such impacts. Although fish habitat can be identified on a preliminary basis with existing data and mapping, a formal review of fish habitat by DFO only occurs only when a project that proposes work or undertakings in or near water has been defined and moves to the implementation stage. As the lead for planning matters in Ontario for the protection of fish habitat, MNR provides technical guidance to planning authorities to promote good planning and ensure that fish habitat is proactively protected through the planning process.

Habitat of Threatened or Endangered Species

The *Species Conservation Act* (2025), passed as part of Ontario's Bill 5, replaces the *Endangered Species Act* (2007) with a new framework prioritizing "registration-first" approvals related to listed endangered and threatened species to streamline development.

Mapping for endangered and threatened species (i.e., within 1 km x 1 km squares) is available for more than 95% of the County, but is assumed to contain gaps and, in some cases, is based on older data. Available mapping for Endangered and Threatened species should be considered at a high level for identify natural cores with a high degree of sensitivity, but this should not be used directly to map NHS components.

For planning applications, available data must be considered but species presence and extent of habitat typically needs to be field verified by qualified professionals and may also need to be confirmed in consultation with the appropriate provincial agency as part of area or site-specific planning. Ultimately, any confirmed significant habitats for endangered and threatened species should be protected through the planning process in accordance with the applicable regulations, and be captured within a mapped NHS where applicable.

Vegetation Protection Zones

Vegetation protection zones (also called buffers) are a commonly used and often a primary mitigation measure for the management of natural heritage features in areas where habitats are fragmented and/or in close proximity to existing or proposed build land uses. They are not features in their own right, but are typically applied to natural features identified for protection to minimize or mitigate impacts associated with development in the adjacent lands.

Vegetation protection zones are defined simply by the County's Official Plan as an area surrounding a key natural heritage feature or key hydrologic feature. These areas are typically vegetated, or designed to become vegetated, ideally with native and self-sustaining species.

In the County's current Official Plan:

- Outside of *settlement areas/rural settlements*, *development* and *site alteration* is not permitted within any wetland or within the 30 m *vegetation protection zone* surrounding the wetland
- Within *settlement areas/ rural settlements development* (including the creation of new lots) is not permitted within any wetland or within the 15 m *vegetation protection zone*, and
- Where a Natural Heritage Evaluation and/or EIS recommends an alternative vegetation protection zone and is supported through peer review, the recommended alternative is to be implemented recognizing that this additional level of study takes into consideration the specifics of the site.

Direction on vegetation protection zone widths for all NHS features should be established through quaternary, subwatershed or comparable studies. Generally, at this stage, minimum widths should be established to ensure planning through subsequent stages accommodates these requirements.

As some detailed land use information may not be known at the stage of subwatershed planning, confirmation or refinement of vegetation protection zone widths and design may be permitted through further stages (e.g., an EIS). However, minimum widths should generally be upheld.

Permitted activities within vegetation protection zones (e.g., trails) should be informed by feature significance and sensitivity and the feature's role in long-term ecosystem function, and may also be determined through the subwatershed process.

5.1.2 Supporting Natural Features and Areas

Analyses, discussions and engagement are required to determine if and how any additional natural features and areas could or should be mapped as part of the NHS for Ecoregion 6E, and they could or should be considered in Ecoregion 5E.

Natural features and areas that should be considered include:

- Wetlands, woodlands or valleylands assessed against the established criteria and determined to be non-significant but still contributing to the overall function and resilience of the NHS
- Potential enhancement or restoration areas (see precedents such as the KNC NHS, MNR, 2012)

In the County's current Official Plan, in limited circumstances within settlement areas and rural settlements, a wetland compensation strategy may be utilized for non-significant wetlands, provided it can be demonstrated through the mitigation hierarchy approach that it is required. This approach is generally aligned with other precedents that are emerging and the County may want to consider developing or adopting natural heritage compensation guidelines (e.g., as available from Lake Simcoe Region Conservation Authority, Essex County) to support the proper implementation of this policy.

Enhancement areas or restoration areas provide opportunities to improve the form and/or function of the NHS. These can be achieved through multiple means, including, for example:

- Improving the shape of features and areas of the identified NHS by filling 'bays', 'inlets' or 'holes' within a feature in the system and creating or increasing interior habitat area, and/or
- Where features occur in close proximity to one another, enhancement opportunities may exist to connect features by naturalizing the intervening land.

5.1.3 Linkages

Linkages are a critical component of a functional NHS and are the features and areas which connect isolated components of the NHS and should be identified and applied at the regional (i.e., County) and local (e.g., subwatershed) scales, as per the County's Official Plan and the PPS (2024). Woodland corridors, wetland complexes, and riparian zones should be protected and sustained through linkages that provide connectivity where it is lacking in a Natural Heritage System.

The KNC study (MNR 2012) mapping included identification of riparian linkages and enhancement areas while the provincial NHS mapping (MNRF 2018) also included high-level mapping of cores and linkages. These approaches, as well as other applicable precedents such as the ORMCP, should be considered in the development and implementation of linkage policies and mapping in the County, particularly in Ecoregion 6E where the natural cover is more fragmented and under increasing development pressures. For example, valleylands with continuous natural vegetation corridors that are 100 m wide or greater are considered significant for their linkage functions at a local scale (MNR 2010), while the Province identified regional-scale NHS linkages in the Greater Golden Horseshoe that were 500 m wide (MNRF 2018).

5.1.4 Other Notable Data and Gaps

Reasonably current Ecological Land Classification (ELC) for southern Ontario (Lee et al. 1998) mapping is available for the subwatersheds in the Kawartha Conservation and Ganaraska Conservation's jurisdictions. However, the remainder (i.e., most) of the Study Area does not currently have ELC coverage.

ELC remains the current standard for southern Ontario and has been in place for nearly 30 years. It would be helpful to have this mapping completed, at least for the lands in Ecoregion 6E, to provide a technical basis to inform NHS policies and mapping on this part of the County. If it is not feasible to undertake this work on a County-wide basis across the Ecoregion 6E lands, comprehensive ELC mapping should be required as part of future subwatershed studies and EIS. If it is feasible to undertake this work on a County-wide basis across the Ecoregion 6E lands, ELC mapping as part of future subwatershed studies and EIS should be more focused on an update and refinement exercise, likely informed by at least some field verification.

As noted by the Conservation Authorities, the utility of ELC mapping extends beyond land use planning and also provides important baseline data that informs the development of accurate hydrologic models used in floodplain mapping updates. As such, updated ELC mapping on a County-wide basis would also support the Conservation Authorities in the creation and updates of hydrologic models and floodplain mapping for the County.

County-wide coverage for breeding bird, turtle, snake and amphibian data available through various wildlife atlases is fairly comprehensive and available across the entire County. Nonetheless, it is anticipated that as part of future subwatershed studies and EIS, review of the available data at the area or site scale will be required, and assessments would likely need to be informed by at least some targeted field assessments completed at the appropriate time of year, under the appropriate weather conditions and at frequencies prescribed by established protocols.

5.2 Water Resource System

Urbanization negatively affects both surface water and groundwater systems. Without proper management, increased impervious cover from land development can elevate the risk of overland flooding and erosion within receiving drainage features, both on-site and downstream. It can also

degrade surface water quality, aquatic and terrestrial habitat, and alter groundwater recharge patterns, potentially affecting groundwater quality and levels.

The Stormwater management (SWM) guidance summarized in Section 6.1 provides recommendations for future development that should be incorporated into local or site plan studies. However, establishing more refined criteria for land use planning requires higher-level assessments, such as future watershed (tertiary) or subwatershed (quaternary or smaller) studies. These studies must first confirm and / or refine the watershed / subwatershed boundaries and watercourse mapping, then characterize existing conditions, evaluate potential impacts, and identify appropriate mitigation measures. The following section outlines the framework needed to develop flood control, erosion control, water quality, and water budget management recommendations to support subsequent high-level planning initiatives.

5.2.1 Flood Control

Establishing high-level flood control criteria using broad-scale future land use plans is essential to support the development of preliminary SWM criteria and mitigation recommendations that will be used as a guide for future studies. The background review indicates that no stormwater management sizing criteria (i.e., unitary sizing values) have been established for the tertiary or quaternary watersheds to support SWM planning for future developments. Given that no previous studies currently exist, the following section outlines a general framework for developing flood control criteria applicable to future watershed (tertiary) and subwatershed (quaternary)-scale planning studies.

The County and Local Municipalities should collaborate with the Conservation Authorities, First Nations and other agencies as applicable to expand and maintain rainfall and streamflow gauges within, and downstream of, future development areas to enable future calibration of hydrologic models to the actual system responses and to use this information to develop unitary discharge rates for use in planning management strategies for future growth areas.

At this high-level planning stage, flood control assessments are typically completed using a multi-disciplinary, conceptual modelling approach. The multi-disciplinary approach ensures that existing natural features on the landscapes (e.g., natural heritage system, headwater drainage features, etc.) are identified and conceptual control locations established to ensure runoff contributions are maintained at these locations. It is understood that during more detailed land use planning and design stages, SWM facility siting will be identified considering the more urbanized overland drainage system (i.e., mix of headwater drainage features, roads and watercourses). Furthermore, a treatment train approach may be implemented to mimic the existing hydrologic conditions and incorporate lot-level, conveyance, and end-of-pipe controls. Treatment train principles are described further in the subsequent water budget subsection (MECP 2022b Draft).

To develop flood control criteria, consideration for both the existing and future hydrologic conditions is required. Future conditions modelling at this stage is conceptual and generally completed at the tertiary (watershed) or quaternary (subwatershed) scale to capture system responses beyond the boundary of the development area. Within each model domain, comparison

points are identified to evaluate how peak flows and hydrograph characteristics may change between the two land use scenarios. These points typically include major road crossings, confluence locations, and previously identified flood damage centres. By comparing existing and future conditions at these key points, potential system-wide impacts can be assessed and used to inform appropriate control criteria.

Preliminary flood control criteria can be developed using unitary rating curves, which define both unitary storage and discharge requirements. Unitary discharge values are typically set to ensure the future conditions model is controlled to existing condition peak flows at the relevant control points, while unitary storage volumes are established to achieve the necessary attenuation of these flows on a per impervious hectare basis. An iterative approach is required to developing unitary rating curves and they can often be rolled up to the large watercourse systems, as the hydrologic conditions, such as soils type, slope and land use, are generally consistent across the contributing areas. These rating curves can then be used as a basis for future studies at which point they can be refined based on more detailed land use planning. Based on guidance from the conservation authorities, there may be a need to identify regulatory controls for the Regional Storm Event, specifically where sensitive receivers have been identified downstream. Furthermore, the established SWM criteria should consider the influence of climate change on peak flows, where controls should be assessed based on climate-adjusted events.

A robust set of flood control criteria relies on well-calibrated existing conditions hydrologic models. Establishing and maintaining rainfall and streamflow gauges within and downstream of future development areas enables calibration to actual system response, improving confidence in the resulting criteria, particularly unitary discharge rates. Many floodplain mapping models, which often serve as the foundation for watershed and subwatershed modelling, rely on conservative parameter assumptions in the absence of calibration data. While suitable for hazard delineation, such assumptions may not accurately represent true system behaviour when used to establish flood control requirements. Using uncalibrated or poorly calibrated models can lead to criteria that either over-control or under-control flows. Under-control poses the greatest risk by allowing higher peak flows than existing conditions, potentially exacerbating flooding and erosion issues downstream. Therefore, calibration using reliable streamflow data is a critical step in developing appropriate and defensible flood control criteria.

5.2.2 Erosion Control

In a similar manner to developing flood control criteria, erosion control criteria can also be identified using broad-scale future land use plans. The unitary sizing approach parallels the method used for flood control, focusing on unitary-based controls, but requires integration with a fluvial geomorphic assessment. As noted in Section 4.2, no geomorphic assessments have been completed within the County and no erosion thresholds currently exist. Thus, at this time, erosion-related sizing criteria cannot be established until further geomorphic studies are undertaken.

As noted above for flood management assessments, the County and Local Municipalities should collaborate with the Conservation Authorities, First Nations and other agencies as applicable to expand and maintain rainfall and streamflow gauge networks to collect long-term continuous

streamflow data to characterize streamflow conditions to support the preparation of future subwatershed studies to facilitate growth planning.

Also noted in Section 4.2, the minimum requirement of providing erosion control is considered as providing quantity control for the 25 mm event, detained for a minimum of 24 hours. This broad guidance does not account for the geomorphic condition of the receiving watercourses and is considered insufficient to guide future management needs. The following section outlines a framework for establishing extended detention criteria to mitigate erosion impacts and support future studies.

As part of future watershed or subwatershed-scale studies, erosion threshold assessments should be completed for select receiving watercourses to inform early-stage SWM planning. This requires, at a minimum, an understanding of the watercourses' critical shear stress, critical discharge, and critical velocity.

Hydrologic simulations using long-term continuous streamflow data are required to characterize streamflow conditions. Typically, these simulations cover the most recent 30+ years of climate data and rely on rain gauge data with a collection timestep of 15 minutes or less. The continuous model is generally derived from the calibrated existing conditions model used for peak flow assessments, with soil parameters adjusted to reflect any available hydrogeologic information (e.g., groundwater modelling outputs, monthly or annual water balance estimates).

Using the simulated continuous streamflow data at each erosion threshold location, together with the findings of the fluvial geomorphic assessment, an understanding of existing erosive conditions can be established. This assessment may include consideration of a watercourse's:

- Total duration of exceedance
- Total number of exceedance events
- Cumulative effective work index
- Volume of erosive flows

The future conditions continuous simulations can then be used to evaluate the erosive impacts to receiving watercourses without extended detention controls. These simulations can be updated to incorporate extended detention criteria required to mitigate those impacts.

The extended detention criteria developed through this process can serve as a foundation for future detailed studies. As future work identifies specific SWM facility locations or outlet points, localized geomorphic assessments will be required to validate or refine the established criteria to ensure alignment with observed site conditions.

5.2.3 Water Budgets

Management recommendations to maintain groundwater recharge rates between the existing and future land use condition, application of Low Impact Development Best Management Practices (LID

BMPs) will be required. The implementation of LID BMPs will require infiltration of clean runoff (e.g., rooftop runoff) and pre-treatment of surface runoff from paved surfaces (e.g., roads, parking lots) to maintain the quality of infiltrated surface runoff and align with the established existing water budget.

Conservation Authority development permits may include requirements for water budget and infiltration targets (such as requirements for LID measures) in those areas where wetland removal and / or potential wetland hydrologic impacts are anticipated in relation to proposed land use changes. Such permits would typically be required to demonstrate no impacts to downstream regulated features (e.g., wetlands, watercourse) and associated flooding and erosion hazards will not be adversely impacted.

The draft LID SWM Guidance Manual (MECP 2022b) identifies a runoff volume control target (RVCT) that manages the 90th percentile runoff which is approximately 27 mm for the County – this is also a requirement of municipal Consolidated Linear Infrastructure Environmental Compliance Approvals (CLI ECA). The Province advocates for a hierarchical approach to managing this quantum on a Priority basis starting with retention, followed by filtration and finally using conventional techniques. Based on several Southern Ontario watershed and subwatershed studies, capture rates (retention) ranging from 2 to 15 mm per impervious hectare are generally sufficient to maintain the existing conditions water balance for relatively impermeable to moderately permeable soils, respectively. A pre-development water balance should be completed on a broad scale to establish the general criteria required to maintain the local water balance under development conditions.

The siting and sizing of infiltration-based LID BMPs should consider a holistic assessment of the existing groundwater conditions, to ensure that the depth to groundwater is sufficient to promote infiltration and that infiltration locations may be targeted to high volume recharge areas. While setting a minimum capture target is being used in numerous communities (i.e., Hamilton, Burlington, Mississauga, Toronto etc.), establishing the quantum of the value varies. It is suggested that the County consider setting a minimum capture value but in doing so it should review values set/used in neighbouring communities (including the City of Peterborough) and engage with the development community.

5.2.4 Water Quality Control

SWM water quality control targets are determined based on the facility type, contributing land use (i.e., level of imperviousness), and the required level of treatment. SWMF volume requirements should follow the MOE (2003) SWM Guidelines and assume an 'Enhanced' level of treatment (i.e., 80% TSS removal) achieved through a treatment train approach per MECP 2022b Draft.

Facility design requirements include locating water quality facilities outside the 25-year floodplain and ensuring they outlet above the 2-year flood elevation. Bottom-draw outlets are recommended to mitigate thermal impacts. Thermal mitigation measures are important to maintain habitat for aquatic organisms that depend on cold water inputs, and may be sensitive to the warming effect of inappropriately managed urban runoff. Additional water quality control measures may be required based on site-specific conditions identified in future studies (e.g., protection of coldwater habitat supporting Redside Dace).

5.2.5 SWM Practices including Low Impact Development Measures

Considering the requirements and guidance outlined in the preceding sections, a range of stormwater management technologies and practices can be applied to achieve a treatment train approach that meets anticipated criteria for flood control, erosion control, water quality protection, thermal mitigation, and water budget maintenance. A summary of select SWM practices is provided in Table 7.

Table 7 Summary of Select SWM Practices

Control Type	SWM Practices
Flood and Erosion Control	End-of-pipe facilities (i.e. wetlands, wet ponds, hybrid facilities, dry ponds), source controls (i.e. underground tanks, pipe storage, surface storage in parking lots, rooftop storage), and LID infiltration/evapotranspiration BMPs
Water Quality	Wet end-of-pipe facilities (i.e. wetlands, wet ponds, hybrid facilities), vegetated technologies (i.e. grassed swales, buffer strips, etc.), oil/grit separators, bioswales/biofilters, and infiltration trenches
Thermal Mitigation	LID infiltration/evapotranspiration BMPs, urban terrestrial canopy (also NHS), facility shading (includes orientation and length/width ratio), facility cooling trenches, facility bottom draws, concrete sewer system, underground storage facilities, green & white roofs, and floating islands
Water Budget (Infiltration)	Bioswales/biofilters, infiltration trenches, rain gardens, bump-outs, rain barrels, increased topsoil thickness, perforated pipes/exfiltration systems, exfiltration tanks

The selection of appropriate technologies and practices will be determined through future detailed studies (e.g., quaternary and subwatershed plans and local drainage studies), based on the existing land use conditions within each contributing drainage area, and subject to approval by the respective municipality and Conservation Authority.

Given the Provincial emphasis on a treatment train approach, it is anticipated that LID BMPs will form a central component of the overall SWM strategy to manage impacts from development. These measures help maintain groundwater recharge, reduce erosive conditions in receiving watercourses, and better replicate the natural hydrologic cycle. In addition to supporting treatment train objectives, LID BMPs are well suited for smaller drainage areas (i.e., less than 5 hectares) that are not large enough to accommodate end-of-pipe facilities.

A variety of LID BMPs and source control practices may be incorporated into the SWM plan. Each LID measure provides distinct functional benefits, allowing selection of measures that align with site-specific conditions and management objectives. Selected LID measures and their functional benefits are summarized in Table 8.

Table 8 LID Stormwater BMPs and Stormwater Source Control Practices

Practice	Flood Control	Erosion Control	Quality Control	Runoff Volume Reduction	Water Budget (Infiltration) and Thermal Mitigation
Rooftop Storage	X				
Parking Lot Storage	X				
Amended Topsoil		X	X	X	X
Green Roofs		X	X	X	
Oil/Grit Separators			X		
Rainwater Harvesting		X		X	
Pervious Pipes		X	X	X	X
Oversized Pipes	X				
Permeable Pavement		X	X	X	X
Soakaway Pits		X	X	X	X
Infiltration Trenches		X	X	X	X
Bump-outs		X	X	X	X
Grassed Swales			X		
Biofilters/Bioswales		X	X	X	X

5.3 Lakes and Shorelines

Peterborough County is known for its extensive and numerous lakes and associated shorelines, and interconnecting rivers and streams. Although there is not generally large-scale development outside of the designated settlement areas, those engaged noted diffuse but increasing pressures to develop and/or intensify existing developments around various lakes and shorelines. For this reason, some planning guidance specifics for lakes and shorelines has been included in this Watershed Plan. Much of this guidance has been adapted from the recently drafted Lakefield South Subwatershed Management Plan for the Township of Selwyn, as it includes information and planning guidance appropriate for other parts of the County as well.

5.3.1 Shoreline Development and Setback Planning Guidance

Some beneficial practices as it relates to land use planning and management along shorelines of inland lakes in Ontario include:

- **Development Setbacks and Hazard Management:** Enforcing strict setbacks for new development whereby development avoids the greater of: 1) natural hazards (flooding and erosion plus Regulatory allowance; or 2) 30 m or more from the high-water mark.
- **Protection of Natural Shorelines:** Prioritizing maintenance of high-quality natural vegetative cover and restoring naturalized riparian areas (e.g., maintenance of 40% natural cover in the Lake Simcoe Protection Plan).

- **Shoreline Alteration Controls:** Establishing controls for vegetation removal, dredging, placing fill, or building hard engineering structures (e.g., concrete walls), and preferring natural stabilization techniques over hard shoreline structures.
- **Back-lotting and Intensification Concerns:** Policies to limit "back-lotting" (i.e., developing multiple rows of houses behind the shoreline) to prevent overdevelopment of waterfront-adjacent lands.
- **Climate Change Integration:** New shoreline management plans, such as for the Central Lake Ontario region, incorporate consideration of future climate change impacts, including a hierarchy of approaches: Avoid, Accommodate, Protect, and Retreat.

Additional policy directions from the Lakefield South Subwatershed Management Plan for the Township of Selwyn include:

- Encouraging the preservation of naturally vegetated shorelines in order to minimize the potential for destruction to the shoreline and littoral zone, minimize visual impact on the waterbody, maintain wildlife habitats and corridors, improve water quality, and ensure adequate protection from changes in water level and flooding.
- Local Municipalities exploring opportunities to increase public waterfront access where settlement areas abut major waterbodies and shorelines (with the exception of Julian Lake in North Kawartha)
- Ensuring new lots are set back from the natural hazard (erosion or flood), or at least 30 m from the high-water mark of all lakes and limiting the disturbance of native soils and removal of shoreline vegetation.
- Ensuring new development on existing lots and septic systems are setback 30 m from the high-water mark of all waterbodies, if feasible, and where it is not, ensuring the new development is set as far back from the high-water mark as the lot permits.

5.3.2 Sensitive Waterbodies Planning Guidance

In addition, beyond the growth pressures anticipated in and around the identified growth areas (as outlined in Section 2.8 of this Volume 2 of the Watershed Plan), expansion and intensification of existing shoreline development has been increasing, particularly around some lakes in Ecoregion 5E, and is expected to continue for all accessible lakes into the foreseeable future, although the rate of increase and variability around different lakes is not known.

A study of land cover changes within 120 m of the lakes in the City of Kawartha Lakes between 1998 and 2018 undertaken by Kawartha Conservation found that:

- From 1988 to 2018, development increased by approximately 68% on average (range: 0% to 342% increase) along the shorelines of these lakes, and
- As of 2018, development occupied approximately 45% on average (range: 28% to 55%) of the shoreline land area along 120m of each lake.

In general, the Conservation Authorities have indicated that there is a lack of knowledge regarding the sensitivity and capacity of many of the lakes in the Kawarthas and beyond due to watershed land use changes and development (see Appendix A).

The County's current Official Plan (2025 consolidation) seeks to bridge this gap by specifying three categories of lakes: (1) 'highly' sensitive lakes, (2) 'moderately' sensitive lakes, and (3) lakes with special policies, as listed below.

(1) 'Highly' sensitive lake trout lakes determined to be 'at capacity' based on tests and studies reviewed by the Province and listed in the County's Official Plan are as follows:

- Havelock-Belmont-Methuen: Sharpe's Bay (in Jacks Lake)
- North Kawartha: Gilmour Bay (in Chandos Lake) • Cherry Lake • Cox Lake • Eels Lake (West) • Long Lake • Loucks Lake • McGee Lake • Stoplog Lake • Triangle (Silver) Lake • Little Anstruther Lake • Sucker Lake • Buzzard Lake • Tallon Lake • Sharpe's Bay (in Jacks Lake)
- Trent Lakes: Beaver Lake • Pencil Lake • Fortescue Lake • Crystal Lake • Cavendish Lake • Bottle Lake • Concession Lake • Salmon Lake

(2) 'Moderately sensitive' trout lakes listed in the County's Official Plan are as follows:

- North Kawartha: Anstruther Lake • Rathburn Lake
- Trent Lakes: Catchacoma Lake • Gold Lake • Mississauga Lake

The County's Official Plan (2025 consolidation) also specifically identifies a number of other lakes which have "special policies" as a result of lake assessments, lake capacity studies, lake water quality and quantity monitoring, and/or subwatershed studies.

- North Kawartha: Julian Lake, Lasswade Lake
- Trent Lakes: Picard Lake, White Lake, Trounce/Birch Bark Lake, Pigeon Lake

The County's Official Plan (2025 consolidation) includes the following policies.

- For 'highly sensitive' lakes:
 - Existing lots of record may be issued a building permit
 - Creation of new lots or the construction of an additional residential unit is prohibited on lakes 'at capacity' and applies to all lands within 300 m of the ordinary high-water marks of capacity reached lakes, regardless of their land use designation
 - The creation of new lots may be considered by the approval authority in consultation with the Province where it can be demonstrated that specified conditions exist (e.g., drainage of the proposed lot flows into a separate, non-sensitive watershed as a result of the physical features of the property), and
 - Lakes determined to be 'at capacity' by the Province in the future may be subject to these policies without the need for an Official Plan Amendment.

- ‘Moderately sensitive’ lakes have limited capacity for additional development or site alterations and creation of new lots within 300 m of the ordinary high-water mark requires a site-specific Lake Impact Assessment to be prepared by a qualified professional.

Peterborough County is exceptionally rich in lakes and rivers (as described in more detail in Volume 1), including many waterbodies considered sensitive to impacts from land use changes. Although there is some provincial guidance for assessing the sensitivity and capacity of inland lakes, such guidance is currently lacking for warmwater bodies, which is considered a key gap.

In addition, there are many lakes for which lake assessments, lake capacity studies, lake water quality and quantity monitoring, and/or subwatershed studies to assess sensitivity and identify management needs have not been completed or were done and are now outdated.

Furthermore, current provincial guidance only applies to lakes on the Canadian Shield (i.e., in Ecoregion 5E) containing Lake Trout (e.g., Crystal Lake) (see the provincial [Lakeshore Capacity Assessment Handbook](#)) and not the shallower warmwater managed lakes (e.g., Pigeon Lake, Bass Lake, Sandy Lake, Buckhorn Lake, etc.).

As such, the County and local Municipalities should review and update existing policies for sensitive lakes in consultation with local First Nations, agencies and the community, and with input from qualified professionals as needed to ensure a comprehensive approach to lake protection.

Options for this include, but are not limited to:

- New special policy areas and / or amend existing special policy areas based on new or updated information, including Lake Capacity Studies that specifically assess phosphorous levels and sensitivities
- Enforcing strict setbacks for new development (e.g., 30 metres or more from the high-water mark)
- Ensuring new development on existing lots and septic systems are setback 30 m from the high-water mark of all waterbodies, if feasible
- Prioritizing maintenance of high-quality natural vegetative cover and restoring naturalized riparian areas
- Establishing controls for vegetation removal, dredging, placing fill, or building hard engineering structures (e.g., concrete walls), and preferring natural stabilization techniques over hard shoreline structures
- Considering applicability of some of the policies in the Rideau Canal and Trent--Severn Waterway: Policies for In-Water and Shoreline Works and Related Activities (Government of Canada 2007), and
- Considering providing more guidance as it relates to determining lake capacity.

There should also be consideration for mechanisms to coordinate and advance the completion of both lake assessments and related management plans, with a particular focus on lakes identified as

‘sensitive’ in areas with known and / or anticipated growth pressures, including expansion and intensification of shoreline development.

5.4 Drainage Features

An overview of management guidance for watercourses (including rivers, streams and creeks) and headwater drainage features (HDF) is outlined below. This management guidance is to be applied to subsequent planning studies such as subwatershed studies focused on the quaternary and subwatershed scales. The guidance outlined below is generic and should be adapted to local watercourses and HDFs based on fieldwork and local scale modelling.

HDF identification should be done in partnership with the Conservation Authorities who should have these data available to inform their hydrologic analyses.

5.4.1 Feature Classification and Management Approaches

Surface water features include watercourses, drains (e.g., municipal or otherwise), and HDFs of a watershed-based system. The characterization of surface water features determines the role of the feature within the water resource system (WRS), the sensitivity of the feature to changes in hydrologic regime due to potential development, ecological impacts, and identification of fluvial erosion hazards.

Watercourses and HDF have been defined in Volume 1 of this Watershed Plan based on the guidance document “Evaluation, Classification and Management of Headwater Drainage Features Guidelines” (TRCA and CVC 2014), O. Reg. 41/24 (Government of Ontario 2024a), and professional experience. The definitions are provided below for reference.

- **Watercourses:** Permanent to intermittent flowing drainage features with a defined bed and banks or sides (O. Reg. 41/24; Government of Ontario 2024a). They exhibit clear evidence of active channel processes including planform, profile, and material sorting, with evidence of a balance between erosion and deposition throughout the reach. They are often second-order or greater features but may be first order when verified by the evaluating practitioner(s). Watercourses are regulated features by the Conservation Authorities Act.

- **Headwater Drainage Features (HDFs):** Non-permanently flowing drainage features that do not have naturally defined bed, banks, or sides. Headwater drainage features may also include anthropogenically modified channels that result in features with defined bed and bank (i.e., a drainage feature dug/cut into the land surface) or that develop seasonally (e.g., as spring freshet concentrates flows in depressions, causing channel development into surfaces that lack vegetation cover). HDF are generally first order and zero order intermittent and ephemeral channels, swales and connected headwater wetland, but do not include rills or furrows. They are not typically identified as a regulated feature, and fish may or may not be found within the feature. While not typically regulated, the features are an important part of the surface drainage network and require appropriate management consideration. Setbacks or buffers for HDF that are to remain on the surface as part of the connected drainage network should be determined appropriately through consultation with the local regulatory agencies and municipalities.

Watercourse features are regulated by Conservation Authorities, while HDF are not generally regulated. However, there may be cases where HDF are regulated, as determined in consultation with the Conservation Authorities. Notably, watercourse regulation does not necessarily preclude modification (e.g., realignment or enhancement), however substantial rationale is typically required to meet the requirements of regulatory agencies.

Classification of watercourses and HDF in the drainage network should be assessed and quantified at the subwatershed study stage to identify opportunities and constraints, and to identify appropriate management strategies in the context of any proposed land use changes. Based on the current functional processes driving ecological health, hydrologic, and fluvial geomorphic traits at a reach or site-specific scale, management recommendations need to be made to determine future requirements for protection, mitigation, and/or enhancement opportunities.

An integrated multi-disciplinary approach is recommended to assess the key characteristics and functions of watercourses and HDF through the development of a watercourse constraint ranking and application of a Headwater Drainage Feature Assessment (i.e., CVC/TRCA, 2014). These assessments require detailed analysis carried out through a combination of desktop assessment, watercourse reach walks, and minimum three-season assessments. Constraint rankings can then be developed based on current conditions and management options can thereby be evaluated based on the constraint classification. The following sections provide general guidance on the options and factors related to the different constraint rankings for watercourses and HDF.

Example Approach for Watercourse Constraint Rankings and Recommended Management

These assessments benefit from multi-disciplinary expertise in surface water, fluvial geomorphology, fisheries ecology, and terrestrial ecology. Based on the integrated characterization of a reach, a constraint ranking can be determined and the associated management strategies established. For watercourses, there are generally three constraint rankings:

- **High Constraint Watercourse Description:** These corridors contain a defined active channel with well-developed channel morphology (i.e., riffle-pool), material sorting, floodplain development, high ecological value, have large contributing drainage areas, and/or a well-defined valley. These corridors offer both form and function and have been identified as ‘no touch’ reaches that must be maintained undisturbed in their present condition (this relates to both plan geometry and profile).
- **High Constraint Watercourse Management Options:** These are high-quality systems that should not be relocated and replicated. Management options include:
 - **Do nothing:** Corridors remain where they are in the landscape. Delineate meander belt or erosion hazard corridor depending on valley classification, and confirm regulatory setbacks.
 - **Minor adjustments:** Channel adjustments may be permitted at select locations given sufficient rationale (e.g., addressing an immediate high-risk erosion hazard, or a critical servicing issue). Natural channel design to be implemented for any adjustments.
 - **Rehabilitation:** Degraded (channelized and straightened) portions of a reach may be realigned using natural channel design, assuming realignment does not negatively impact rehabilitation.
- **Medium Constraint Watercourse Description:** These reaches have well-defined morphology (defined bed and banks, evidence of erosion/sedimentation, and sorted substrate). They maintain geomorphic function, have some ecological value and have potential for rehabilitation. In many cases, these reaches exhibit evidence of geomorphic instability or environmental degradation due to historic modifications and/or land use practices.
- **Medium Constraint Watercourse Management Options:** They must remain open but they can be realigned using natural channel design. Management options include:
 - **Do nothing:** leave the corridors in their present condition and develop outside of their boundaries.
 - **Enhance existing conditions:** Maintain the location of the corridor but enhance the existing conditions (e.g., bank stabilization, re-establish a meandering planform, connect channel to functioning floodplain).
 - **Re-locate/realign and enhance existing conditions:** Reaches that have undergone extensive straightening and modification for agricultural drainage purposes (for instance) are not as sensitive to relocation and would benefit from enhancements such as the re-establishment of a meandering planform with functioning floodplain and development of a riffle-pool morphology. If these reaches are re-located, the corridor width associated with each reach must, at a minimum, be maintained.
- **Low Constraint Watercourse Description:** These reaches consist of ephemeral headwater systems that lack defined bed and banks (form) but still perform a geomorphic function through the conveyance of flow and sediment. These systems typically require three season HDF assessments to verify their status as a watercourse or an HDF (as defined above). Reaches confirmed as “watercourses” are typically re-classified as medium constraint features.

- Low Constraint Watercourse Management Options: Management options for these reaches include:
 - Do nothing: Leave the drainage feature intact and develop the surrounding lands, with a minimal setback (note a corridor width is not prescribed for these systems).
 - Combination of stormwater management and open conveyance techniques: The function of HDF can be mimicked/replicated through the combined implementation of stormwater management techniques with sufficient maintenance of open conveyance systems (such as backyard swales to meet drainage density targets). A corridor width is not prescribed for these systems.
 - Open conveyance techniques: The function of the HDF is replicated entirely through a system of open conveyance techniques (e.g., backyard swales, drainage ditches).

It should be noted that, within some reaches, constraints associated with other disciplines (e.g., terrestrial ecology) may inform the overall constraint ranking. However, in no case is the net rating lower than the geomorphic rating.

The selected management strategies described above are then incorporated within the overall management strategy.

Example Approach for HDF Constraint Rankings and Recommended Management

Similar to watercourse constraint rankings, HDF constraint rankings and management recommendations are determined based on the integration of surface water, fluvial geomorphology, fisheries ecology, and terrestrial ecology assessments of current conditions. Based on the integrated characterization of a given reach the constraint ranking can be determined and the associated management strategies established. For HDF there are generally four constraint rankings as outlined in Table 9.

Table 9 Headwater Drainage Feature Constraint Rankings and Management Recommendations
(Adapted from TRCA and CVC 2014)

Constraint Ranking	Characteristics of HDF Constraint Classification	Management Recommendations
Protection (Important Functions)	• Offer important functions to both the upstream and downstream connected reaches and surrounding environment • Can exhibit: perennial drainage through seeps or springs, have woody riparian cover, offer permanent fish habitat, offer amphibian breeding habitat and or provide habitat to SAR	• Protect and/or enhance the existing feature and its riparian zone corridor, and groundwater discharge or wetland • Maintain hydroperiod • Incorporate shallow groundwater and baseflow protection techniques such as infiltration treatment • Use of natural channel design techniques or wetland design to restore and enhance existing habitat features, if necessary, realignment not generally permitted • Design and location of the stormwater management system to avoid impacts to the feature

Constraint Ranking	Characteristics of HDF Constraint Classification	Management Recommendations
Conservation (Valued Functions)	- Offer valued functions to both the upstream and downstream connected reaches as well as to the surrounding environment - Can exhibit: seasonal fish habitat with woody riparian cover, and/or amphibian breeding habitat	- Maintain, relocate, and/or enhance as open drainage feature with a riparian corridor - Maintain or replace onsite flows using mitigation measures and/or wetland creation, if necessary - Maintain or replace external flows - Use of natural channel design techniques to maintain or enhance overall productivity of the reach - Drainage feature must connect to downstream - Maintain surface linkage functions
Mitigation (Contributing Functions)	- Offer contributing functions to both the upstream and downstream connected reaches as well as to the surrounding environment - Can exhibit: meadow vegetation within riparian corridor and contributing (i.e., sediment and nutrient transport through feature) fish habitat	- Replicate or enhance functions through enhanced lot level conveyance measures, such as well-vegetated swales (herbaceous, shrub and tree material) to mimic online wet vegetation pockets, or replication through constructed wetland features connected to downstream - Replicate onsite flow and outlet flows at the top end of the system to maintain feature functions with vegetated swales, bioswales, etc. - Replicate functions by lot level conveyance measures (e.g., vegetated swales) connected to the Natural Heritage System, as feasible, and/or Low Impact Development (LID) stormwater options
No Management Required (Limited Functions)	- Offer limited functions to both the upstream and downstream connected reaches as well as to the surrounding environment - Typically have no/or minimal flow, are within cropped land that is annually ploughed and cultivates with no riparian vegetation and do not offer fish or amphibian habitat	- The feature that was identified during desktop pre-screening has been field verified to confirm that no feature and/or functions associated with headwater drainage features are present on the ground and/or there is no connection downstream - No management recommendations required

Best practices dictate that HDF with a ‘protection’ and ‘conservation’ constraint ranking are required components of the WRS. While HDF ranked as ‘mitigation’ are not considered protected features, hence their function(s) on the landscape should be addressed in a manner that maintains their hydrologic functions.

5.4.2 Erosion Hazard Corridors

Delineation and implementation of erosion hazard corridors that contain erosion and regulatory setbacks on the planning landscape minimizes potential interaction between the natural and built environments and therefore reduces risk to infrastructure and the public. Such risks can include

property losses due to channel erosion and evolution. A secondary benefit of the channel corridor is the protection that it provides to surrounding riparian vegetation and continuity of terrestrial habitat, as part of a natural heritage system. Development within a channel corridor is strictly limited to specific low impact and localized uses, such as trails or necessary road crossings; disturbance to the riparian habitat is therefore minimized. Maintaining riparian vegetation ensures resiliency of the fluvial system as proper vegetative support reduces bank erosion and widening and improves aquatic habitat. The channel corridor is comprised of the more conservative of erosion hazard limit or regulatory setbacks, as determined by the Conservation Authority or the MNR.

Delineation of erosion hazard corridors are intended to define the anticipated spatial limits of natural meander and migration tendencies of watercourses, and/or the long-term stable top of slope setback along defined valley walls and required regulatory setbacks. By defining the erosion hazard corridor, it is assumed that natural channel and/or valley slope processes are contained within it, limiting risk to adjacent infrastructure and property. Therefore, minimal interference with natural geomorphic channel and/or valley slope adjustment processes is necessary in the future to protect the public.

Should a medium constraint watercourse be modified by relocation or realignment, the erosion hazard corridor should be updated to reflect the new meander belt or stable-top-of-slope and associated setbacks. The updated erosion hazard corridor would then need to be incorporated into the NHS. This would be completed through subwatershed studies.

5.4.3 Erosion Thresholds and SWM

Channel erosion is a necessary natural process; however anthropogenic pressures, such as uncontrolled stormwater runoff, accelerate and exacerbate natural erosional processes, resulting in loss of property, threats to infrastructure and environmental degradation (e.g., smothering of fish nests (redds) through excessive deposition or increased mobility of substrate materials).

Geomorphic analyses are completed of watercourses situated within the impact zone of potential stormwater outfall locations from new or existing developed areas (or of stormwater management facilities) to assess the ability of the receiving watercourse to accommodate additional flow due to an altered landscape and associated flow regime. Erosion thresholds are quantified to identify the flow rate at which sediment entrainment and/or transport will begin that could destabilize a channel bed; these flow rates are used to guide the design of stormwater management systems (volumes, discharge rates and draw-down periods) with respect to erosion control. Best management practice targets should limit rates of erosion to pre-development conditions.

5.4.4 Channel Length, Sediment Supply and Enhancements

Watercourse length and sinuosity should be maintained at a minimum or restored to historical conditions if previously straightened. The length of a watercourse is important, as it impacts geomorphic processes and functions such as sediment dynamics and stream power. Reduced stream length is often associated with an increase in sediment transport which can exacerbate

erosion and overwhelm downstream reaches filling pools. Significant justification would need to be provided where a channel length cannot be maintained between pre- and post- development conditions.

Historically, subwatershed scale studies have established drainage density targets that can be applied to maintain stream length. However, a feature-by-feature evaluation of watercourses and HDF to determine the appropriate management strategies that maintain or enhance the function of each feature (as outlined in Section 5.2.1) provides a more comprehensive approach and is recommended wherever possible.

When possible, watercourses should be enhanced through the removal of barriers to the movement of water, sediment, and fish (e.g., debris jams, dams, weirs), provided their functional value is not greater than the ecological and geomorphological value of their removal (e.g. grade control, power generation, essential transportation). In the case of grade control weirs, opportunities to replace these structures with natural channel design features should be explored. See Section 6.1.1 for further discussion and County-specific context.

5.4.5 Road Crossing Considerations

Road crossings over watercourses are often required to support urbanization and an important consideration in terms of impacts to watercourses and valley functions. A poorly sited road crossing can result in negative impacts to the channel and higher risk to the structure itself (e.g., cause perched conditions, exacerbate erosion). There are several factors which should be considered when identifying the most appropriate location for a road crossing.

The TRCA's (2015) "Crossing Guideline for Valley and Stream Corridors" provides a summary of road crossing location assessments. For a large development area, TRCA (2015) indicates that it is important to minimize the number of times that the proposed road network crosses the subject watercourse. This will reduce impacts to the watercourse reach, channel corridor, continuity of the natural heritage system and linkage to the water resource system. Road crossings should not be located within close succession to each other; providing an adequate distance between crossings allows for an area of potential adjustment if there are negative impacts to the watercourse related to the crossing structure, which will also minimize the risks of compromising any additional structures located downstream.

On a local, site-specific scale there are several risk factors which need to be considered for the individual crossings with respect to geomorphic function. These risk factors would be used to assess the appropriateness of potential crossing locations and determine appropriate structure spans and alignments:

- **Channel Size:** The potential for lateral channel movement and erosion tends to increase with stream size. HDFs tend to exhibit low rates of lateral migration due to the stabilizing influence of vegetation on the channel bed and banks, and smaller flow rates. Erosive forces in active watercourses tend to exceed the stabilizing properties of vegetation and result in higher migration rates.

- **Valley Setting:** Watercourses with wide, flat floodplains and low valley and channel slopes tend to migrate laterally across the floodplain over time. Watercourses that are confined in narrow, well-drained valleys are less likely to erode laterally but are more susceptible to downcutting and channel widening, particularly where there are changes in upstream land use and associated hydrologic regime. Typically, the classification of the valley will fall into one of three categories: confined, partially confined, and unconfined.
- **Meander Belt Width:** The meander belt width represents the maximum expression of the meander pattern within a channel reach. Therefore, this width/corridor covers the lateral area that the channel could potentially occupy over time. This value is used by regulatory agencies for corridor delineation associated with natural hazards and associated setbacks; the meander belt width is typically of a similar dimension to the Regulatory floodplain. The use of the meander belt width to inform structure sizing has been established as a criterion by some regulatory agencies and represents a very conservative approach which is also often intended to reduce habitat fragmentation from a terrestrial environmental perspective.
- **Meander Amplitude:** The meander amplitude and wavelength of a channel planform are important parameters to ensure that channel processes and functions can be maintained within the crossing. For the purposes of this protocol, the meander amplitude of the watercourse would be measured in the vicinity of the crossing and used as a guide to determine the relative risk to the structure. The number of meander wavelengths to be considered is both dependent on the scale of the watercourse and the degree of valley confinement.
- **Rapid Geomorphic Assessment (RGA) Score:** An RGA score is essentially a measure of the stability of the channel. Channels that are unstable tend to be actively adjusting and thus are sensitive to the possible effects of the proposed crossing. Accordingly, there is more risk associated with unstable channels. The RGA score defines three levels of stability: 0-0.20 is stable; 0.21-0.40 is moderately stable; >0.40 is unstable.
- **100-year Migration Rates:** Using historical aerial photographs, migration rates may be quantified (where possible) for each crossing location. A higher migration rate indicates a more unstable system and higher geomorphic risk. Ideally, watercourse crossing structures should be aligned perpendicular to, and centered on, a straight section of channel, or at an appropriate skew that would not affect channel processes. In terms of sizing, the structure would ideally span the meander belt width to accommodate the downstream migration of meander features. In many cases, however, the costs prohibit such structure sizes. From a geomorphic perspective, larger structures are favored to minimize the long-term risk and maintenance associated with natural channel adjustment.

Ultimately, the design of proposed road crossing designs must follow the guidelines developed by regulatory bodies to minimize impact on the watercourses and channel corridors (e.g., TRCA 2015).

6 Guidance for Water, Natural Hazard, and Climate Change Management

Provincial watershed planning guidance (Government of Ontario 2018) for watershed plan equivalents (like this Watershed Plan) is that they establish a framework for future land use and resource planning. This section focuses on the “water” aspects of this framework and outlines management guidance and associated beneficial practices at the tertiary watershed scale for stormwater management quantity and quality (Section 6.1), natural hazards (Section 6.2) and climate change management as it relates to flooding erosion (Section 6.3).

The County is primarily anticipating future development (growth) in the four serviced settlement areas listed below with the quaternary watersheds that overlap with this planned growth noted and shown in Figure 29):

- Havelock (Crowe Lake – Crowe River, Round Lake – North River Outlet, and Crow Bay Dam – Trent River)
- Lakefield (Lock 19 – Otonabee River and Stony Lake – Katchewanooka)
- Millbrook (Otonabee River Outlet)
- Norwood (Ouse River)

The County’s current growth analyses (Hemson 2022) also indicates that remaining growth in the County is expected to largely be mainly in the Townships of Otonabee-South Monaghan and Havelock-Belmont-Methuen. The following guidance is largely intended for these jurisdictions and their associated tertiary and quaternary watersheds.

6.1 Stormwater Management Guidance (Quantity/Quality)

Relevant environmental issues identified in Volume 1 of this Watershed Plan, as well as other watershed monitoring and/or previous legacy studies are summarized in this section for further consideration as part of future quaternary watershed plans and/or subwatershed plans (as outlined in Section 7.2).

The primary data sources for this review included current watershed plans, as applicable for the quaternary watersheds in the Study Area, applicable regional level studies, mapping provided by the County and area Conservation Authorities as well as the related policy and technical guidance.

The section which follows focuses on water management (surface and ground) for both quantity and quality.

6.1.1 Water Quantity

Land use changes can significantly influence a system’s hydrologic regime if not properly managed. Urbanization increases impervious surface areas, which in turn leads to higher runoff volumes,

more frequent erosive conditions, and reduced infiltration rates. The following section outlines the existing water quantity guidance within the County of Peterborough as it relates to flood control, erosion control, and water budget management.

Flood Control

Watershed and subwatershed-scale hydrologic and hydraulic models are essential tools for evaluating system-based impacts associated with land use changes. These models help assess potential effects both within areas undergoing change and throughout downstream receiving systems. By characterizing these impacts, the models support the development of appropriate flood control criteria for the relevant watershed (tertiary) or subwatershed (quaternary or smaller).

Volume 1 of this Watershed Plan concluded that hydrologic models suitable for peak flow assessment are largely lacking across the County. However, as noted, the County's Official Plan specifies that future growth will be directed to four primary settlement areas serviced by municipal water and wastewater systems (i.e., Havelock, Lakefield, Millbrook, and Norwood) where hydrologic and hydraulic studies have been completed for all except Havelock in the Trent–Crowe River watershed.

Since hydrologic models are a fundamental input to floodplain mapping and flood risk assessments used to establish flood control criteria, the scale and available detail of existing models and the extent of their calibration must be carefully considered. Although hydrologic models (to establish flow regimes – peak flows and runoff volumes) are available for three of the four planned growth areas (i.e., all except Havelock, see Volume 1: Characterization Section 2.2.2 and Figure 42), the applicability of these models, in terms of their overall scale and ability to assess the impacts associated with future development scenarios must be evaluated. In many cases, refinement of the existing models is required to ensure that they are suitable for developing appropriate SWM criteria and recommendations. Model updates also provide an opportunity to incorporate more recent land use data, improve calibration, and/or validate the models against more recent climate data. Where no suitable models exist, new models must be developed to assess existing conditions and future impacts and to establish quaternary-level SWM control criteria.

With the available hydrologic models, the quantifiable impacts resulting from urbanization can be assessed through peak flow analysis to evaluate changes in flood risk both at the scale of the development area and also in the downstream (offsite) receivers. These impact assessments can then support the development of unitary release rates and volumetric sizing criteria for SWM facilities that guide high-level management requirements to mitigate these impacts. Consideration for existing flood damage centres (buildings and homes/businesses at risk) downstream of the planned development areas should also be considered as part of the established control criteria. These broad criteria can be refined through future, more detailed (local) studies, as development planning studies progress. In the absence of appropriate hydrologic models, there is limited ability to establish flow control and sizing criteria, reducing the ability to provide robust management recommendations and fully understand potential impacts both within the development area and downstream.

Existing Water Quantity Control Guidelines

Based on a review of applicable stormwater management (SWM) guidelines from the local conservation authorities and municipalities within the County of Peterborough, general best practices relating to water quantity controls have been established, including in the City of Peterborough which is outside this Study Area, and include the following.

- Post-development peak flows must not exceed pre-development peak flows (noting a few exceptions to this quantity control requirement for select subwatersheds were identified by GRCA (2014) whose jurisdiction is limited to the southernmost edge of the County).
- Quantity control measures should align with recommendations from the *Stormwater Management Planning and Design Manual* (MOE 2003).
- Quantity control infrastructure cannot be located within the Regulatory or the 100-year floodplain, or other natural heritage areas (GRCA 2014).
- On-line flood control facilities are not permitted (GRCA 2014).
- SWM control outlets should be placed above the receiving watercourse's 100-year flood level, with an outlet above the Regional Storm flood level preferred (Peterborough County 2025).
- Redevelopment and infill development should provide measures to improve quantity control (Otonabee Conservation 2025).
- Development should be setback from any wetland boundary by at least 30 m, where feasible (Otonabee Conservation 2025, CVCA 2024).
- All stormwater outlet channels into regulated features will require natural channel design elements to be incorporated (Otonabee Conservation 2025).
- Otonabee Conservation shares Standard Stormwater Management Criteria (2025) when pre-consulting for new or redevelopment.

Notably, Conservation Authorities (such as Otonabee Conservation) have been working on comprehensive stormwater management and other engineering report submission guidelines which could serve as a basis or starting point in the development of a more comprehensive set of requirements further to this Watershed Plan.

Per the County's Official Plan (2025), subwatershed plans or equivalent will be used to inform further SWM Plans for large-scale development and will consider an existing conditions assessment to inform a cumulative impacts assessment to assess how extreme weather events will exacerbate these impacts and the identification of appropriate adaptation strategies. Flood control guidance that is applicable to subwatershed plans or equivalent is provided in Section 7.2.

Flood Control Structures

Flood control structures can play a role in flood hazard management in providing flow attenuation to reduce flood risks downstream. The Dam Safety Guidelines (CDA 2013) and the Safety Reviews for Dam Owners (MNR 2011) require that Hazard Potential Classifications be identified for every dam as dam failures can result in loss of life, loss of significant infrastructure and/or result in significant

downstream flooding. Dams with ‘High’ and ‘Significant’ hazard potential require more detailed Dam Safety Reviews to be completed and updates to be undertaken on a regular basis. Dams are to be inspected in accordance with their specific operation and maintenance schedules and that maintenance be carried out as required.

Table 10 summarizes the 82 dams within the County which are owned by various government agencies and private groups. The federal dams are part of the Trent-Severn Waterway within the Otonabee River and Kawartha Lakes Tertiary Watersheds. A review and assessment of these federally owned dams is not included within the scope of this study. For the remaining dams their hazard potential needs to be identified and Dam Safety Reviews completed as appropriate.

Table 10 Dams within Peterborough County

Tertiary Watershed	Ownership						Totals
	Federal	Ontario Power Generation	Provincial	Conservation Authority	Municipal	Private*	
Otonabee River	8	2	2	5	4	23	44
Trent River – Crowe River	-	-	9	3	1	-	13
Gull River	-	-	-	-	-	-	-
Kawartha Lakes	17	-	4	-	-	4	25
North Lake Ontario Shoreline	-	-	-	-	-	-	-
Totals	25	2	15	8	5	27	82

Source: GeoHub 2025

* Private dam number and location is estimated based on available data and likely underrepresents private dams.

Notably, the 2026 River and Stream Systems: Flooding Hazard Limit and Technical Bulletin - Special Flooding Hazard Conditions in River and Stream Systems (currently posted at: <https://ero.ontario.ca/notice/026-0329>) addresses the technical requirements for how flood control structures will need to be built, operated and maintained to be considered for determining flood hazard mapping.

The extent of the impacts of dams on flooding, fish passage, and water temperatures is relatively unknown within the County’s tertiary watersheds. Further study is recommended to assess the broader impacts (i.e., environmental, social, financial, etc.) of all dams inclusive of privately-owned dams within the County. Dams owned by Conservation Authorities, municipal governments, or others, could be targeted through Environmental Assessments to better understand function and utility relative to ecology, social functions/value and flow impacts.

The effects of inherent and unaccounted for storage associated with dams is an important adaption to climate change in the development of floodplain mapping. The dams within the County could provide flood control storage which should be further investigated under climate change scenarios. A thorough understanding of the impacts of this storage over a range of flows conditions up to and

including the Regulatory flow could help quantifying the resiliency of the County's watersheds against changing rainfall patterns and intensity.

Based on a review of the relevant guidelines from the local conservation authorities and municipalities within the County of Peterborough, general guidance relating to water control structures (i.e., dams) has been established. Water control structures are generally not permitted, even for the purposes of mitigating flood hazards, however some exceptions to this guidance applies within the Otonabee River Watershed. Water control structures facilitating approved renewable energy projects may be permitted but are subject to specific policies to ensure they result in no adverse hydraulic or fluvial impacts, and impacts to the system's hydrologic function (i.e., water quantity and quality) are avoided or managed through best practices.

Erosion Control

Fluvial geomorphic studies provide an understanding of the existing erosive conditions within both tertiary and quaternary watersheds. The information identified can be used to locate erosion prone receivers that may be more sensitive to land development impacts (i.e., require more extensive erosion control criteria), identify existing problem areas (i.e., erosion/stability) and recommend capital works or further monitoring studies. Furthermore, studies which establish watercourse-specific erosion thresholds can be considered as part of hydrologic studies to determine baseline erosion conditions through continuous modelling.

From the background review materials, no geomorphic assessments have been completed within the County and no existing erosion thresholds have been established. This data gap limits the ability to establish appropriate erosion control and extended detention volumetric sizing for receivers.

Based on a review of the SWM guidelines from the local conservation authorities and municipalities within the County of Peterborough, general beneficial practices relating to erosion control include the following:

- Minimum requirement that runoff from a 25 mm 4-hour Chicago storm is detained for 24 hours, unless identified otherwise (GRCA, 2014; LTRCA, 2020)
 - Note: Foster Creek and West Gage Creek have alternative criteria based on a 48-hour detention time and flow restrictions to a downstream erosion threshold limit, respectively, and
- For development sites < 2 ha, erosion control is normally not required (LTRCA, 2020)

This level of guidance is considered insufficient to inform future management requirements for County's developing areas. A framework for future studies to establish criteria is further detailed in Section 7.2.

Water Balance and Budget

Maintaining a balanced post development water budget is a critical aspect of managing the impacts to the hydrologic system due to urban development, encompassing both surface water and

groundwater processes and their interactions. A water budget accounts for how precipitation (rainfall and snowmelt) is partitioned into runoff, infiltration, or evapotranspiration within a given area. This approach helps determine how much water can be allocated for human use while still protecting ecological and hydrological needs. The assessment follows a tiered structure: Conceptual, Tier 1, Tier 2, and Tier 3, each increasing in detail and complexity.

The conceptual water budget (TCC 2007) provided a broad overview of hydrologic conditions, while the Tier 1 analysis refined water budget estimates at the subwatershed scale, assessed uncertainty, and identified surface and groundwater stress level. For the Peterborough County Watershed Plan, the key water quantity findings are from the Trent Assessment Report (TCC 2025a). The Trent Assessment Report covered Peterborough County and was last updated in June 2025. The Assessment Report consolidates all previous technical studies and threat analyses and forms the scientific basis for policy development.

Table 11 summarizes the stress criteria as part of the tiered water budget assessment, while Table 12 presents the overlap between tertiary and quaternary watersheds, and Tier 1 water balance watersheds. Table 13 presents the results from the surface water and groundwater future demand scenario of the water quantity stress assessment.

Any Tier 1 subwatersheds flagged as significant or moderate stress level underwent Tier 2 analysis using detailed numerical models. Crowe 4 (i.e., subwatershed associated with Havelock municipal groundwater supply system) was the only Tier 1 subwatershed flagged for Tier 2 analysis, after which it was assigned low groundwater stress level. As a result, no Tier 3 studies were required within the County, and no water quantity threats were identified in the Trent River watershed. Kawartha Lakes East – 5 (within Stony Lake - Katchewanooka Lake Quaternary watershed) was assigned moderate groundwater stress as part of the Tier 1 assessment, however no Tier 2 or 3 follow up analyses has been completed (Table 12).

Landscape scale groundwater vulnerability assessment (highly vulnerable aquifers (HVA)) and significant groundwater recharge area (SGRA) delineations are also summarized in TCC (2025a). These include an uncertainty analysis resulting from combining extrapolated calibrated model results, regional geologic mapping, with interpolated regional groundwater datasets. For the Havelock subwatersheds, the HVA and SGRA were re-assessed using the groundwater model developed as part of the Tier 2 analysis, and these re-assessed lands were incorporated into the overall mapping coverage.

As part of future quaternary or subwatershed studies within Peterborough County, these landscape scale analyses should be revisited to determine system specific management requirements. A data gap exists with the delineation of SGRA, which necessitates landscape scale groundwater recharge estimates. The recharge estimates used in the TCC (2025a) analysis, extrapolated simulated groundwater recharge from the YPDT-CAMC regional groundwater model, which only intersects a very small portion of the County. Recharge estimates were assigned to specific Quaternary surficial geologic deposits, and then using the OGS surficial geologic mapping, extrapolated to the rest of the County where no regional groundwater model is available.

In addition, it is recommended that in future quaternary or subwatershed studies in Peterborough County, that the landscape scale groundwater analysis is extended to ecologically significant groundwater recharge areas (ESGRA), which leverage groundwater model results to determine which groundwater recharge areas are not just significant from a water supply perspective, but an ecological perspective (e.g., groundwater recharge areas which contributes to downstream ecological receptors such as watercourses and wetlands). A particle tracking-based methodology for this analysis is outlined in TRCA (2019).

Collectively, these water quantity studies provide a detailed understanding of the County's existing water budget and available water resources under current land uses. They also help identify targets and areas that may be sensitive to hydrologic changes. The stress levels classifications highlight areas that may be more vulnerable to development impacts versus those with greater hydrologic resilience. However, it is important to note that all proposed growth areas are expected to be serviced by municipal water, meaning they are not anticipated to place additional demand on local wells, Permits to Take Water, or irrigation supplies.

The primary hydrologic impacts of urban growth relate to changes in the local water cycle, specifically alterations to runoff, infiltration, and groundwater recharge. Lands identified as HVA, SGRA, or other drinking water threat areas (e.g., Intake Protection Zones (IPZ)) under the Trent Region Source Protection Plan (TCC 2025b) must be managed according to their policies. These policies address both water budget considerations, such as maintaining recharge or infiltration through on-site controls, and contaminant risk management, consistent with the Conservation Authorities Moraine Coalition guidelines (Ogilvie *et. al.*, 2005) and the *Nutrient Management Act* (Government of Ontario 2024b). Incorporating both water quantity and quality management measures into the development approval process will help reduce impacts on the local water budget and support the protection of drinking water sources.

Table 11 Summary Table of Stress Criteria

Stress Level	Trigger (Common Thresholds)	Notes
Low	Water demand <10% of supply	No advanced modelling required.
Moderate	>10% average day demand (groundwater or surface water); >25% max day (Tier 2 groundwater)	Requires Tier 2 numerical modelling.
Significant	>50% demand, or Tier 3 modelling shows municipal supply risk	Requires Tier 3 municipal-level risk assessment.

Table 12 Tier 1, Tertiary, and Quaternary Watersheds

Tertiary Watershed	Quaternary Watersheds	Tier 1 Water Balance Watershed ^
Gull River	Birchbark Lake - Irondale River	Burnt River - 4
	Farquhar Lake - Irondale River	Burnt River - 4
	Goose Lake - Burnt River	Burnt River - 1 Burnt River - 3
Kawartha Lakes	Bobcaygeon River	Northern Kawartha Lakes-West - 1 Northern Kawartha Lakes-West - 3
	Burleigh Falls Dam - Lower Buckhorn Lake	Kawartha Lakes-East - 4 Northern Kawartha Lakes-West - 6
	Deer Bay Creek	Kawartha Lakes-East - 4
	Eels Creek	Kawartha Lakes-East - 2
	Mississagua River	Kawartha Lakes-East - 4
	Nogies Creek	Northern Kawartha Lakes-West - 1
	Omemee Dam - Pigeon River	Southern Kawartha Lakes-West - 3
	Pigeon Lake - Gannon Narrows	Northern Kawartha Lakes-West - 1 Northern Kawartha Lakes-West - 6
	Stony Lake - Katchewanooka Lake	Kawartha Lakes-East - 1 Kawartha Lakes-East - 2 Kawartha Lakes-East - 3 Kawartha Lakes-East - 4 Kawartha Lakes-East - 5
North Lake Ontario Shoreline	Ganaraska River	Not Applicable
Otonabee River	Cavan Creek	Rice Lake
	Hastings Lock 18 Dam - Trent River	Ouse River - 1 Ouse River - 2 Ouse River - 3 Rice Lake
	Indian River	Ouse River - 1
	Lock 19 - Otonabee River	Kawartha Lakes-East - 3 Rice Lake
	Otonabee River Outlet	Rice Lake
	Ouse River	Ouse River - 2
Trent River – Crowe River	Chandos Lake - Crowe River	Crowe River - 3
	Cordova Lake Dam - Crowe River	Crowe River - 3
	Crowe Bay Dam - Trent River	Lower Trent - 1 Ouse River - 3
	Crowe Lake - Crowe River	Crowe River - 1 Crowe River - 3 Crowe River - 4 Crowe River - 5
	Kasshabog Lake - North River	Crowe River - 1
	Paudash Lake Dam - Crowe River	Crowe River - 3
	Round Lake - North River Outlet	Crowe River - 1

^ These subwatersheds were delineated as part of the Trent Region Source Protection Plan (TCC 2025b) and do not fully align with the quaternary watershed boundaries. The numbers are part of the naming convention used for these subwatersheds.

Table 13 Water Quantity Stress Levels by Tier 1 Watersheds

Tier 1 Water Balance Watershed [^]	Tier 1/2 Surface Water Stress Level ^{^^}	Tier 1/2 Groundwater Stress Level ^{^^^}
Burnt River - 1	Low	Low
Burnt River - 3	Low	Low
Burnt River - 4	Low	Low
Crowe River - 1	Low	Low
Crowe River - 2	Low	Low
Crowe River - 3	Low	Low
Crowe River - 4	Low	Low
Crowe River - 5	Low	Low
Northern Kawartha Lakes-West - 1	Low	Low
Northern Kawartha Lakes-West - 3	Low	Low
Northern Kawartha Lakes-West - 6	Low	Low
Southern Kawartha Lakes-West - 3	Low	Low
Kawartha Lakes-East - 1	Low	Low
Kawartha Lakes-East - 2	Low	Low
Kawartha Lakes-East - 3	Low	Low
Kawartha Lakes-East - 4	Low	Low
Kawartha Lakes-East - 5	Low	Moderate
Rice Lake	Low	Low
Ouse River - 1	Low	Low
Ouse River - 2	Low	Low
Ouse River - 3	Low	Low
Lower Trent - 1	Low	Low

[^] see Table 12 for the relationship between Tier 1 Watersheds and Quaternary/Tertiary Watersheds

^{^^} based on Stress Level in "Future Demand Scenario" from Table 3.3-9 (TCC 2025)

^{^^^} based on Annual Stress Level in "Future Demand Scenario" from Table 3.3-11 (TCC 2025)

6.1.2 Water Quality

Surface and groundwater quality data function as a measure to evaluate watershed health, specifically the condition of the surface water and groundwater systems. Routine monitoring of select parameters over time can provide insights into potential impacts relating to anthropogenic changes in the watershed.

Source Water Protection

The County of Peterborough is located within the Trent Conservation Coalition Source Protection Region and is subject to the policies of the Trent Source Protection Plan. As such, the County has been mandated to provide direction through the following land use planning policies to ensure that developments within the County do not negatively impact municipal drinking water sources. Policies

in the Trent Source Protection Plan apply within vulnerable areas which have been identified in the County's Official Plan. In addition, there are other vulnerable areas defined under the *Clean Water Act*, 2006.

The County and local Municipalities are required to include zones and/or mapping and zone provisions within their comprehensive Zoning By-Laws to identify vulnerable areas and implement the approved Trent Source Protection Plan and this Plan.

In addition, the following land use activities are prohibited in vulnerable areas where they constitute a future significant drinking water threat (unless otherwise stated in the Trent Source Protection Plan)

- The application or storage of agricultural source material
- The management of agricultural source material
- The application, handling, or storage of non-agricultural source material
- The application, handling, or storage of commercial fertilizer
- The application, handling or storage of pesticide
- The handling or storage of road salt
- The storage of snow
- The handling or storage of fuel
- The handling or storage of dense non-aqueous phase liquid
- The handling or storage of an organic solvent
- The use of land as livestock grazing or pasturing land, an outdoor confinement area, a farm-animal yard
- Waste disposal sites, and
- The establishment and operation of a liquid hydrocarbon pipeline.

New or expanding land use activities are not to be permitted within vulnerable areas (unless it can be demonstrated that the activities do not pose a significant drinking water threat), existing land uses which present a significant drinking water threat activity must be managed pursuant to the Trent Source Protection Plan, and land use activities that may pose a significant drinking water threat may need a Risk Management Plan.

The water quality assessment for the Trent Source Protection Region (TCC 2025) evaluated the vulnerability of both groundwater and surface water systems, focusing on municipal wells and intakes. Groundwater vulnerability was determined for 31 existing and one planned municipal well system using 3-D groundwater flow modelling and vulnerability indices, resulting in wellhead protection areas with assigned vulnerability scores. For 15 municipal surface water intakes, Intake Protection Zones (IPZs 1, 2, and 3) were delineated using travel-time analyses, field studies, and modelling, with the highest vulnerability scores occurring in IPZs 1 and 2. As part of Appendix 2 of TCC (2025), "Policy Applicability Maps" were generated for each municipal drinking water systems

to outline activities within the vicinity of wellhead protection areas and intake protection zones where policies apply. Table 14 summarizes all the municipal drinking water systems within Peterborough County.

Landscape-scale groundwater vulnerability mapping showed high vulnerability in northern Precambrian regions and more variable conditions in southern Paleozoic areas, while significant groundwater recharge areas were identified and assigned vulnerability scores based on aquifer susceptibility. No drinking water quality issues were reported within Peterborough County, while the TCC (2025) identified 1,662 significant drinking water threats across the entire Trent Region, though no past-activity conditions were found to pose significant threats.

Table 14 Municipal Drinking Water Systems within Peterborough County

Municipal Drinking System Name	Municipal Drinking System Source	Local Groundwater Model Available (reference)	Planned Growth Area	Tertiary Watershed
Alpine Village	Groundwater	Yes – Alpine Village (2011)	No	Kawartha Lakes
Buckhorn Lake Estates	Groundwater	Yes - Buckhorn (2011)	No	
Lakefield	Low	-	Yes	Otonabee River
Peterborough	Low	-	No	
Landsdowne (Planned)	Groundwater	-	No	
Crystal Springs	Groundwater	Yes - Rice Lake (2010)	No	
Millbrook	Groundwater	Yes - Rice Lake (2010)	Yes	
Kenneth Heights	Groundwater	Yes - Rice Lake (2010)	No	
Norwood	Groundwater	Yes - Norwood (2011)	Yes	
Havelock	Groundwater	Yes - Havelock (2010)	Yes	Trent River -Crowe River

General Best Practices for Surface Water Quality

Based on a review of the water quality control guidelines from the local conservation authorities and municipalities within the County, plus the City of Peterborough, general best practices include the following:

- Incorporate a treatment train approach, including lot level/source controls, LID measures and conveyance methods in addition to traditional end-of-pipe methods (Otonabee Conservation 2025, OP 2022, Peterborough 2022).
- ‘Enhanced’ (80% TSS removal) is the water quality control target to be achieved for end of pipe solutions (Peterborough 2022, GRCA 2014).
 - Note: Exceptions for Foster Creek and West Gage Creek are noted to only require Normal levels of control (i.e., 70% TSS removal).

- SWM facilities shall incorporate measures, such as bottom draw outfalls, to reduce the temperature of water discharging to the receiving watercourses (GRCA, 2014; LTRCA 2020).
- Facilities providing quality control only must be located outside the 25-year floodline, and the outlet structure invert elevation must be higher than the 2-year flood elevation (GRCA 2014).
- Control of the 90th percentile event which corresponds to a 27 mm precipitation event (City of Peterborough 2025).
- Conduct a pre-development water balance assessment to establish criteria to maintain the local water balance under development conditions.
 - Note: If the water balance target is less than the 90th percentile event, the difference must be retained and released to the maximum extent possible.

Based on the background review completed, there is good coverage of groundwater quality monitoring stations across the County and poorer coverage of surface water quality monitoring stations (see Figure 36).

Groundwater quality data were provided by ORMGP. Further analysis could be supported by a more detailed surface water quality data analysis against the Provincial Water Quality Objectives (PWQOs) and the Interim PWQOs (MOEE 1994) as well as the Watershed Report Cards available for many of the watersheds. Further analysis will be required as part of future subwatershed studies (as outlined in Section 7.2).

Highly Vulnerable Aquifers and Groundwater Recharge Areas

Highly vulnerable aquifers (HVA) and significant groundwater recharge areas (SGRA) cover most of the County as shown in the Figure 19 series. Impacts of development applications on groundwater must be considered in planning decisions.

Where a major development application is proposed within these areas it could have an effect on the ground water quality or quantity, and studies may be required to demonstrate that the quality and quantity of groundwater in these areas and the function of the recharge areas will be protected, improved, or restored. The requirement for, and scope of, these studies is determined in consultation with the applicable Conservation Authority and/or the Province. Mitigative measures and/or alternative development approaches may be required in order to protect, improve or restore sensitive surface water features, sensitive ground water features, and their hydrological functions.

6.2 Natural Hazards

Natural hazards were identified across Peterborough County and summarized at the tertiary watershed scale in Volume 1 of this Watershed Plan. These hazards include areas affected by natural processes associated with flooding, erosion/unstable slopes, shoreline, unstable soils, unstable bedrock (i.e., karst). Available mapping for these natural hazards is shown in Figure 11 (Bedrock Geology, including karst landscapes), Figure 18 (Regulates Slopes), and Figure 23 (Flood Hazards), however as noted in Volume 1 there are many data gaps across the County for these features and areas, and even where some mapping does exist there will be requirements for further

study at the quaternary watershed/subwatershed scale and potentially at the site-specific scale as well.

Identifying these hazard lands and establishing appropriate management approaches to reduce risks to the public is a critical component of land use planning in the County. Setbacks, allowances, and buffers associated with these hazards in relation to development locations, are typically required to maintain or enhance public safety.

None of the lakes in Peterborough County are defined as large inland lakes. However, as per the PPS, they are still subject to flooding hazards as defined in Section 2.4 (see text box below) of the Technical Guide - River and Stream Systems: Flooding Hazard Limit (see 2026 version last updated June 12, 2026 at <https://ero.ontario.ca/notice/026-0329>).

Provincial Planning Statement Section 2.4: Flood Hazard Limits for Lakes <100 sq. km

“The standard for defining the flood plain along small lakes and large rivers is the same standard used for rivers (Hazel-Centred, Timmins-Centred, maximum observed or 100-year, whichever is applicable) plus an appropriate allowance for wind setup. The wind setup is to be calculated on the basis of mean wind speed and applicable maximum effective fetch. The computed wind setup will then apply along the entire lake shore. Where the maximum effective fetch is less than 3 km, the lake can be treated as an integral component of the river system, therefore the flood standard will be the same as that applied to the river system.” The following sub-sections outline the relevant management strategies for natural hazards and the associated constraints that must be considered during future planning and development.

6.2.1 Flood Hazards

In Ontario, flood hazards are regulated by local Conservation Authorities under the *Conservation Authorities Act*. In areas where no conservation authorities exist (i.e., the northern extents of the County, as shown in Figure 2), floodplain mapping is established by the County and local Municipalities in consultation with MNR.

Flood risk areas are delineated using historical storm events, such as Hurricane Hazel or the Timmins Storm, along with hydrologic and hydraulic modelling tools to simulate the watershed’s runoff response. The resulting analyses establish the Regulatory flood hazard limits, which are then presented on topographic maps to illustrate areas at risk of flooding. These flood hazard maps play a central role in land use planning by guiding development away from high-risk areas. For new development, construction is typically restricted within approximately 15 m of the flood hazard limit to maintain natural flood storage capacity and preserve safe overland flow paths.

Otonabee Conservation has guidance for floodline mapping of lakes in its Watershed Planning and Regulations Policy and Procedures Manual (Otonabee Conservation 2025).

In 2004, the City of Peterborough experienced severe flooding when an intense summer storm exceeded the capacity of both the stormwater system and natural drainage features. Subsequent

flood risk studies concluded that many natural overland flow routes had been altered or infilled over time, reducing or eliminating effective conveyance for stormwater during such extreme events. Although the City of Peterborough is technically outside the current watershed Study Area, it is surrounded by the Study Area and the lessons from this event underscore the importance of preserving natural drainage systems and integrating clearly defined overland flow paths into land use planning to reduce flood risks.

General guidance from the County's Official Plan indicates that no development is permitted in the flood hazard extents. In areas where no floodplain mapping exists, development is subject to the establishment of engineered flood hazard limits deemed appropriate by the Conservation Authority and local municipality. Floodplain delineations are typically based upon hydrologic modelling for determining surface water flows, followed by hydraulic modelling analyses to determine the flood inundation limits associated with the Regulatory event.

In alignment with the MNR technical criteria (last updated with a draft manual released in 2026), as a general rule, watercourses draining a minimum of 125 ha tend to be considered as part of the flood hazard mapping, however this minimum drainage area may be reduced further by the Conservation Authorities on a case-by-case basis where deemed appropriate and/ or necessary.

6.2.2 Erosion Hazards

Erosion hazards are regulated in Ontario through the PPS (2024) and by local Conservation Authorities under the *Conservation Authorities Act*. There are various types of erosion hazards that are delineated following the procedures outlined in the *Technical Guide – River and Stream Systems: Erosion Hazard Limit* (MNR 2002). Each erosion hazard has an analytical approach that results in a defined corridor or area within the hazard, for which setbacks and allowances are applied for regulatory, maintenance, and safety purposes. Erosion hazard setbacks and allowances ensure that natural processes of lateral and downstream channel migration, and valley-slope processes can be maintained while mitigating potential risks to property and infrastructure. These hazards and setbacks are delineated on area mapping, generally at the reach-scale, while modifications can be made at the site level (e.g. geotechnical analyses for slope stability).

An erosion hazard delineation contributes to land use planning by guiding development away from at-risk areas and identifying existing areas at risk that may require specific guidance. Furthermore, specific guidance and mitigation for proposed infrastructure within the hazard can be provided (e.g., road crossings, sewer interactions). For new development, construction is typically restricted within approximately 15 m of the erosion hazard limit by erosion hazard setbacks applied by conservation authorities.

The valley setting guides the practitioner as to the appropriate application for erosion hazard mapping in accordance with the most current guidance.

- For unconfined systems a meander belt allowance is established following procedures outlined in *Belt Width Delineation Procedures* (Parish 2004) and provincial guidelines (MNR 2002).

- For confined systems, the long-term stable top of slope is determined following procedures outlined by MNR guidelines (MNR 2002).

An access allowance of 6 m is then applied based on MNR guidelines but may be encompassed within a Conservation Authorities' regulated setback from the stable slope or meander belt which becomes the erosion hazard limit. Ontario Regulation 41/24 outlines specific elevation contours that Conservation Authorities are required to delineate as hazards and regulated development (i.e., 15 m regulated allowance).

General guidance from the County's Official Plan indicates that no development is permitted within the erosion hazard. In areas where no current erosion hazard mapping exists, development is subject to the establishment erosion hazard limits deemed appropriate by the Conservation Authority and local municipality.

6.2.3 Unstable Soils

Unstable soils are regulated in Ontario through the PPS (2024) as lands containing hazardous sites and by local Conservation Authorities under the *Conservation Authorities Act*. There are two types of unstable soils (MNR 2001):

- **Marine Clays:** Sensitive marine clays are those that were deposited during the last glacial period in the Champlain Sea. When they are disturbed by excessive vibration or shock, or when they become saturated with water, these clays can liquify.
- **Organic Soils:** Organic soils and peat are formed by the decomposition of vegetative and organic materials into humus, a process known as humification. The process of humification releases humic acid into the ground water systems, creating a methane gas which is highly explosive.

Development is not permitted under these policies in areas of unstable stable soils. Within the County the available soil mapping does not indicate the presence of Leda or other sensitive marine clays (OMAFRA 2019), however the soil conditions should be reviewed for all development applications through site specific studies. A review of organic soils mapping suggests that alluvial and organic surficial deposits occur within the County (see Figure 10) and therefore should be evaluated in the future to determine if unstable soils are in the area (OMAFRA 2019).

General guidance from the Official Plan indicates that unstable soils are a Category 1 constraint where no development is permitted in the hazardous site extents. In areas where unstable soils have been identified in an area by provincial mapping, then the results of site-specific studies for the basis for applying MNR (2001) criteria to delineate the unstable soil hazard areas as a basis for defining the Regulation Limit should be carried out. Geotechnical expertise can confirm the presence and hazards associated with unstable soils at the subwatershed or site scale. These studies should be carried out as deemed appropriate by the relevant Conservation Authority.

6.2.4 Unstable Bedrock (Karst)

Unstable bedrock, such as karst, is regulated in the PPS (2024) as lands containing hazardous sites and by local Conservation Authorities under the *Conservation Authorities Act*. There are three classifications of karst features (Brunton and Dodge 2008), as mapped in Figure 11:

- Known Karst: “Observed, measured field data or data from published reports. Key features include karren, cave types and associated precipitates, sinkholes, and disappearing streams.”
- Inferred karst: “Regions of carbonate bedrock units highlighted as most vulnerable or susceptible to karstification, where direct field observation has not been made by OGS staff or other sources. A natural extrapolation of the known karst areas for given rock units.”
- Potential Karst: “Areas of carbonate rock units identified as most susceptible to karst processes.”

Karst landscapes can include features such as caves, sinkholes, and karren which are formed through the erosion of bedrock by water causing the chemical erosion of bedrock. These features make the bedrock unstable and more prone to instability. Development is not permitted under these policies in areas of unstable bedrock and that mitigative measures to stabilize the bedrock for development are not permitted. The karst hazards have been mapped and published by the Ontario Geological Survey (Burton and Dodge 2008) which illustrate areas of known or suspected unstable bedrock.

Karst mapping contributes to land use planning by guiding development away from at-risk areas. For new development, construction is typically restricted to beyond the mapped karst hazard limit, which can be refined with further geotechnical investigations.

General guidance from the Official Plan indicates that no development is permitted in the hazardous site extents. Hazardous sites are not defined within the Official Plan; however, karst features are included in hazardous sites as outlined in the PPS (2024). In areas where potential and inferred karst is mapped, in depth geotechnical investigation should be carried out to confirm bedrock geology and to assess the karst risks as deemed appropriate by the relevant Conservation Authority.

6.2.5 Natural Hazards Key Data Gaps in Peterborough County

The natural hazards outlined in the previous sections have been assessed and summarized on a quaternary watershed scale in Volume 1 of this Watershed Plan. The following provides a high-level summary of the identified gaps in the current natural hazard mapping available which may need to be addressed through future study:

- **Flood Hazards:** Flood hazards have been delineated for several developed areas within Peterborough County; however, the extent of coverage generally only aligns with developed regions within the County and some regions, particularly within the municipality of Havelock, have no existing flood hazard mapping. New studies will be required for future development areas where mapping has not yet been established, as well as in locations where existing mapping requires updates (e.g., outdated land use assumptions, significant hydrologic changes, or other system alterations). Coordination with local conservation authorities and municipalities should be undertaken to determine additional updates or technical needs that must be addressed through future hazard assessments.
- **Erosion Hazards:** Erosion hazards have not been delineated for most Peterborough County; however, there is limited regulated steep slopes mapping for some of the quaternary watersheds to the northwest of the County completed by Kawartha Conservation. New studies will be required for future development areas where mapping has not yet been established, as well as in locations where steep slopes mapping has been completed to complete erosion hazard delineation (e.g., meander belts, toe erosion allowances, updated erosion rate observations, or other system alterations). Coordination with local conservation authorities and municipalities should be undertaken to determine additional updates or technical needs that must be addressed through future hazard assessments.
- **Unstable Soil Hazards:** Unstable soil hazards have been mapped for all of Peterborough County at a provincial scale by the Ontario Ministry of Agriculture, Food and Agribusiness (OMAFRA 2019). The scale of the mapping means there is opportunity to refine the boundaries of organic soils within the County. New studies will be required for future development areas in proximity to organic soil completed to confirm their limits. Coordination with local conservation authorities and municipalities should be undertaken to confirm methodology and hazard boundary delineation for future hazard assessments.
- **Unstable Bedrock/Karst Hazards:** Unstable bedrock hazards have been mapped for all of Peterborough County at a provincial scale by the Ontario Geological Survey (Brunton and Dodge 2008). Locations of inferred and potential karst require new studies for future development to confirm the nature of the bedrock and long-term stability. Coordination with local conservation authorities and municipalities should be undertaken to confirm methodology and hazard boundary delineation for future hazard assessments.

Table 15 outlines available flood and erosion hazard data by tertiary watershed and where applicable by quaternary watershed. As part of future studies, natural hazard identification and mapping is expected to be refined and/or expanded to better characterize and incorporate the existing hazards into future planning initiatives.

Table 15 Natural Hazard Distribution by Tertiary Watershed

Hazard	Otonabee Tertiary Watershed	Trent River - Crowe River Tertiary Watershed	Gull River Tertiary Watershed	Kawartha Lakes Tertiary Watershed	North Lake Ontario Shoreline Watershed
Flood Hazards	Floodplain area had been partially mapped with the largest area being 34km ² mapped in the Otonabee River Outlet watershed.	Floodplain area had been partially mapped with focus on dammed watercourses. Crowe Bay Dam – Trent River is the only watershed with no floodplain mapping.	Floodplain area has not been mapped within this watershed.	Floodplain mapping has been carried out for Nogies Creek and Miskwaa Ziibi River area had been partially mapped with focus on dammed watercourses.	Floodplain area has not been mapped within this watershed.
Erosion Hazards	Erosion hazard mapping was not available and is assumed to have not been completed for the watercourses of the watershed.	Erosion hazard mapping was not available and is assumed to have not been completed for the watercourses of the watershed.	Limited regulated slopes mapping available within the Goose Lake – Burnt River watershed. No other erosion hazard mapping available.	Regulated slopes mapping available across Nogies Creek and Bobcaygeon watersheds. Limited regulated slopes mapping available for Pigeon Lake – Gannon Narrows watershed. No other erosion hazard mapping available.	Erosion hazard mapping was not available and is assumed to have not been completed for the watercourses of the watershed.
Unstable Soil Hazards	Percentage of organic soils across the tertiary watershed: 12%. There are no currently mapped marine clays within the tertiary watershed.	Percentage of organic soils across the tertiary watershed: 16%. There are no currently mapped marine clays within the tertiary watershed.	Percentage of organic soils across the tertiary watershed: 7%. There are no currently mapped marine clays within the tertiary watershed.	Percentage of organic soils across the tertiary watershed: 9%. There are no currently mapped marine clays within the tertiary watershed.	There are no currently mapped organic soils within the tertiary watershed. There are no currently mapped marine clays within the tertiary watershed.

Hazard	Otonabee Tertiary Watershed	Trent River - Crowe River Tertiary Watershed	Gull River Tertiary Watershed	Kawartha Lakes Tertiary Watershed	North Lake Ontario Shoreline Watershed
Unstable Bedrock (Karst) Hazards	Known karst: Inian River (1%), Lock 19 – Otonabee River (<1%), and Ouse River (<1%). Inferred karst: Ouse River (1%). Potential karst: Inian River (12%), Lock 19 – Otonabee River (15%), and Ouse River (53%).	Known karst: Crowe Bay Dam – Trent River (6%), Crow Lake – Crowe River (4%), and Round Lake – North River Outlet (1%). Inferred karst: all but three watersheds have 1% or more. Potential karst: Crowe Bay Dam – Trent River (75%), Crow Lake – Crowe River (48%), and Round Lake – North River Outlet (39%).	Known karst: Goose Lake – Burnt River (1%). Inferred karst: Goose Lake – Burnt River (<1%). Potential karst: Goose Lake – Burnt River (<1%).	Known karst: Nogies Creek (9%), Pigeon Lake–Gannon Narrows (8%), and Burleigh Falls Dam–Lower Buckhorn Lake (1%). Inferred karst: all but Omemee Dam – Pigeon River. Potential karst: all but Omemee Dam – Pigeon River.	Karst: there is no karst hazard identified within the watershed.

6.3 Climate Change Guidance

Climate change is expected to affect the watersheds of Peterborough County over the coming decades. Climate projections for southern Ontario show rising average annual temperatures, more frequent and longer heat waves, warmer winters with fewer very cold days, and changes in precipitation patterns. Total annual precipitation is projected to increase slightly. However, a greater share of rainfall is expected to occur during intense short duration storm events. Winters are expected to be wetter, with more precipitation falling as rain rather than snow. Summers may become drier overall, with longer dry periods between rainfall events.

These changes have direct implications for watershed processes. More intense rainfall increases the risk of flooding, higher peak river flows, streambank erosion, sediment movement, and damage to infrastructure. Warmer winters and more frequent rain on snow events can result in mid winter thaws and higher winter and early spring flows. Longer dry periods in summer can reduce baseflows in rivers and streams, place stress on aquatic ecosystems, reduce water availability, and concentrate pollutants in surface waters. Higher air and water temperatures may also degrade water quality, increase the likelihood of harmful algal blooms, and reduce dissolved oxygen levels in lakes and rivers.

Climate projections from sources such as ClimateData.ca, Environment and Climate Change Canada, and the Canada in a Changing Climate national assessment indicate that under high emissions scenarios, southern Ontario could experience increases in annual average temperature of approximately 3 to 5 degrees Celsius by late century relative to historical conditions. Increases in extreme rainfall intensity are also projected. These findings are consistent with guidance from the Ontario Ministry of the Environment, Conservation and Parks regarding the use of climate adjusted data in planning and infrastructure design.

For watershed planning in Peterborough County, the primary concern is the increasing variability and intensity of hydrologic conditions. Adaptation measures are essential to reduce flood risk, manage erosion, protect water quality, and maintain ecological health under changing climate conditions. The risk of wildfires, particularly in the portion of the County in Ecoregion 5E, is also a concern.

6.3.1 Policy Framework Guiding Climate Change Consideration

Climate change adaptation in Peterborough County is guided by provincial policy and the County's Official Plan.

At the provincial level, the PPS requires planning authorities to consider the impacts of climate change in land use planning and infrastructure decisions. Key policy directions include the protection of public health and safety from natural hazards such as flooding and erosion, directing development away from hazardous lands, promoting green infrastructure to complement traditional infrastructure, planning infrastructure so that it is resilient to climate change, and using watershed planning to assess cumulative and climate related impacts.

In addition to the Provincial Planning Statement, federal and provincial guidance reinforces the need to integrate climate change into infrastructure and environmental decision making. The *Provincial Watershed Planning Guidance* (Draft, 2018) identifies four key steps to guide this work.

1. Assess how climate change may affect existing and future land uses, infrastructure, and development.
2. Evaluate how current and proposed land uses, along with water, wastewater, and stormwater systems, may contribute to or worsen climate-related impacts.
3. Analyze the impacts of alternative land use and management scenarios under a range of climate model projections.
4. Document how climate change influences water use, availability, and management within the watershed or subwatershed plan.

Within the County of Peterborough Official Plan, several policy areas also provide direction relevant to climate change adaptation; these include:

- Natural heritage policies that protect wetlands, woodlands, valleylands, and watercourses.

- Water Resource policies that address surface water and groundwater protection.
- Natural Hazard policies that restrict development in floodplains, unstable slopes, erosion prone areas.
- Wildland fire policies, including mapping of high to extreme risk areas and requirements to provide a Wildland Fire Assessment Report for new development in such areas (and policies to ensure proposed mitigation does not conflict with natural heritage policies).
- Infrastructure and servicing policies that require coordination between growth and environmental constraints.
- Policies that support watershed and subwatershed planning to inform land use decisions.

These policy elements require that watershed plans incorporate climate informed analysis and translate that analysis into clear direction for development, infrastructure design, and environmental protection.

6.3.2 Adaptation Approaches for Watershed Management

Given projected increases in temperature, extreme rainfall, and hydrologic variability, adaptation should be the primary focus of climate change planning in Peterborough County watersheds with priority strategies including:

- Flood risk management: Watershed and subwatershed studies should incorporate climate adjusted rainfall data into hydrologic and hydraulic models. Updated Intensity Duration Frequency curves and scenario-based modelling can help identify potential increases in peak flows and changes to floodplain extents. Where necessary, floodplain mapping should be updated to reflect projected future conditions. Development should continue to be directed away from flood prone and regulated areas.
- Stormwater management: SWM systems should be designed or retrofitted to accommodate the runoff due to more intense rainfall events. This may include increased storage volumes, clearly defined overland flow routes, adequate freeboard, and distributed controls that reduce runoff at the source. Green infrastructure practices such as bioswales, infiltration systems, rain gardens, enhanced soil standards, and expanded tree canopy can also help reduce runoff rates and support groundwater recharge.
- Protection and restoration of natural features: Wetlands provide natural flood storage and reduce downstream peak flows. Forested riparian buffers stabilize streambanks, reduce erosion, filter runoff, and moderate stream temperatures. Maintaining and enhancing these systems increases the resilience of watersheds to both floods and droughts.
- Erosion management: Increased peak flows can accelerate channel erosion and threaten infrastructure such as roads and bridges. Subwatershed plans should identify erosion prone reaches and prioritize stabilization measures that work with natural channel processes.

Drought resilience should also be addressed. Longer dry periods may reduce summer baseflows and affect water supply and aquatic ecosystems. Protecting groundwater recharge areas, limiting

impervious surfaces in sensitive zones, and maintaining natural vegetation cover can help sustain stream flows during dry periods.

Infrastructure planning related to water resources should also incorporate climate resilience principles throughout the asset life cycle. Culverts, bridges, storm sewers, and other drainage infrastructure should be assessed for capacity under projected future flow conditions. Where upgrades are required, designs should reflect anticipated changes in rainfall intensity and seasonal flow patterns.

6.3.3 Data Needs and Ongoing Review

Regional and provincial projections provide useful guidance, but local scale data gaps remain. There is uncertainty regarding the magnitude and timing of changes in extreme rainfall and how these changes will affect specific tributaries within Peterborough County. Continued collaboration with Conservation Authorities where they exist and provincial and federal agencies (e.g., MNR, Parks Canada) will be required to refine modelling inputs, update floodplain mapping, and adjust infrastructure design standards as new climate science becomes available.

6.4 Cumulative Impact Guidance

Cumulative impacts refer to the accumulation of changes in the environmental system caused by the combined/integrated effects of development, climate change, land use/cover conversion (e.g., urbanization), infrastructure design, etc. To fully realize the potential impacts of development, an assessment of cumulative impacts to components of the environment, and local and connected communities is required. However, in practice, meaningful assessment of cumulative impacts is challenging, in part because it requires predicting the combined, long-term effects of multiple, often unrelated projects in a context of dynamic ecosystems and changing land use patterns. In addition, the shift from project-specific to landscape-level predictive analysis introduces data, methodological, and institutional complexities.

Nonetheless, it is identified as a task in provincial policy and watershed guidance (MMAH 2024; GOO 2018) and is best evaluated at the watershed or subwatershed scale, which supports the understanding of impacts beyond primary areas of development. Ideally, such an assessment identifies the extent of change the watershed has experienced from an established point in history to present, then assesses ongoing and anticipated influences, forecasting future stresses to inform decisions related to growth and watershed management.

The County's policies in the Official Plan also speak to cumulative impacts associated with stormwater, flooding, and impacts to existing municipal infrastructure and the natural environment. While cumulative impacts are suggested above to be evaluated at the watershed scale, the Official Plan also requires individual developments to provide a current evaluation. While cumulative impacts may be evaluated at the site-specific scale, if there is potential for broader scale impacts (e.g., to groundwater, surface water, natural cover), then modelling may need to be expanded to support the evaluation. For example, the Official Plan has specific requirements for evaluating the

cumulative impact that development will have on the hydraulics of the Ouse River floodplain. In this case, specific supporting studies might be required for a comprehensive and expanded evaluation of cumulative impacts.

Conservation Authorities also have policies that have regard for cumulative impacts with respect to flooding and erosion hazards and overall hazard management. An example of the current Otonabee Conservation Board approved policy on Cumulative Impacts with respect to development regulations in natural hazard areas is cited below.

Section 3.5: Cumulative Impacts

“The assessment of impacts from development and alterations of hazardous lands, sites and watercourse and wetland features will include the potential for cumulative impacts. Where necessary, Otonabee Conservation will restrict development that may, singularly or cumulatively, affect the natural hazards or impact other properties. Examples of cumulative impacts are: development activities that restrict riverine channel capacities to pass flood flows or reduce storage capacity in floodplains and wetlands resulting in increased flood levels and creation of a potential danger to upstream and downstream landowners; the construction of multiple additions to a residential dwelling in the flood hazard over time, resulting in an unacceptable risk to life and property; and, alterations to shorelines and watercourses to address erosion that may disrupt the channel or shoreline natural processes for erosion and deposition of material.”

Source: Otonabee Conservation Watershed Planning & Regulations Policy & Procedures Manual (April 17, 2025)

This Watershed Plan is focused on providing guidance for completing cumulative impact assessments at the quaternary watershed or subwatershed scale, particularly in the areas identified for future growth. At the quaternary watershed scale, the most potentially impacted areas relate to the four growth areas identified in the Hemson (2022) analysis. Section 7 provides an overview of the prioritization process to advance planning studies for those areas, which considers cumulative impacts at a high level based on the available data and gaps. Confirmation of the location, density, and sensitivity of various natural heritage and water resource features, and their interactions (as outlined in Section 4 and Section 5) should be completed to support an integrated assessment of cumulative impacts. Models (hydrological, hydraulic, and groundwater) should also be developed and/or updated to reflect the current environmental conditions and composition, with additional work to include climate change (historical and future), as the magnitude and frequency of precipitation events increases and vegetation communities adjust (for example).

At the quaternary watershed scale, mapping data relating to change in the environment in relation to development form the basis for assembling data to evaluate cumulative impacts. These include:

Existing Land Use/Cover

- Existing Natural Feature Area — Based on Ecological Land Classification (ELC) mapping and/or more generic mapping of woodlands and wetlands, and other natural features.

- Existing Surface Water Network – watercourses and headwater drainage features, including connected wetlands and other bodies of water (e.g., inland lakes).
- Existing Settlement Area(s) and Urban Land Uses — Derived from the Official Plan land use designations.
 - Future studies should evaluate the different land use types within the urban designations, and the different assumptions regarding impervious surfaces.
- Existing impervious areas beyond settlements, if applicable (e.g. parking lots, roads connecting communities and features).
- Existing Agricultural Area — Derived from the official plan land use designations and mapping for agricultural areas. (Note: Different types of agricultural land uses may be evaluated).
- Other — Land that does not fall into natural, urban, or agricultural categories (e.g., recreation open space, aggregate extraction).

Future Land Use Changes

- Potential Growth (Outside Existing Urban Built-Up Areas) — Summarize all future growth areas identified by Hemson (2022), and as development planning advances.
 - Characterize proposed land use types within each potential growth area, and quantify specific changes (e.g., imperviousness, drainage network adjustments)
 - Evaluate cumulative impacts with and without mitigation, and
 - Include mitigation and improvements that may reduce impacts or enhance existing issues for example: incorporation of low-impact development measures and green infrastructure, stormwater management and upgrades to existing systems, and inclusion of water and wastewater servicing.

The analysis of land use change over time helps quantify the total proposed and potential shifts in land use at a broad scale. This, in turn, highlights the level of stress placed on each quaternary watershed system (or subwatershed) and provides context for understanding potential cumulative impacts.

Further, more specific analyses may also be completed to support the evaluation of particular areas of concern (e.g., stream power mapping to evaluate changes in downstream erosion potential, floodplain mapping updates, and/or changes to terrestrial habitat distribution and connectivity).

7 Guidance for Prioritizing and Scoping Future Subwatershed Studies

The Growth Analysis Report (Hemson 2022) identified the Otonabee River watershed as an area of future urban growth in its entirety and specifically identified the communities of:

- Lakefield (in the Township of Selwyn and straddling Kasshabog Lake-North River Quaternary Watershed and Lock 19 – Otonabee River Quaternary Watershed)
- Millbrook (in the Township of Cavan Monaghan and Otonabee River Quaternary Watershed)
- Norwood (in the Township of Asphodel-Norwood and Ouse River Quaternary Watershed), and
- Havelock (in the Township of Havelock-Belmont-Methuen straddling Crowe Lake – Crowe River Quaternary Watershed and Round Lake – North River Outlet Quaternary Watershed).

These geographies are shown in Figure 4, Figure 6, and Figure 29.

Key considerations guiding identification of these areas, beyond the need to accommodate levels and types of growth specified by the Province, included the need to focus in/adjacent to established settlement areas and the rationale that already serviced settlement areas are better suited to accommodate growth than non-serviced settlement areas. As such, all four of the identified “future growth areas” (as they are referred to in the analysis [Hemson 2022]) already have servicing.

Two of the tasks identified for this Watershed Plan were to (a) guide the prioritization of these four future growth areas based on available information at the quaternary watershed scale, and (b) provide guidance for the environmental studies anticipated to be required to advance and implement growth in ways compatible with the vision, goals and objectives of this Watershed Plan.

- Section 7.1 summarizes the environmental data availability and data gaps in each quaternary watershed and each potential growth area, and then considers these environmental data, along with selected social and economic measures (considered appropriate for a quaternary watershed-scale study and this scale of proposed growth) to inform the prioritization of these future growth areas.
- Section 7.2 provides guidance for scoping the key environmental studies expected to be required to plan for and manage the growth in each of these growth areas (i.e., quaternary watershed / subwatershed studies, natural heritage system studies, master environmental servicing plans, functional servicing studies, stormwater management reports, and environmental impact studies) recognizing that these will each need to be tailored to the specific biophysical and land use context of the study area.

Notably, it is anticipated that growth in all four identified future growth areas will be advanced in time, and so the guidance in Section 7.2 is intended to be applicable to all and could also be generally applicable to any additional growth areas identified based on comparable criteria and considerations.

7.1 Prioritization of Future Growth Areas and Quaternary Subwatershed Studies

Future growth is expected to bring a number of positive changes to affected communities such as improved infrastructure and local amenities, more housing options, and more job options in these communities. However, it also has the potential to result in direct environmental impacts (e.g., reduction in water quality in the community) and indirect environmental impacts (e.g., reduction in water quality downstream) if the land use changes are not planned and implemented with careful consideration for the local natural heritage and water resources, and its sensitivities. Figures 29 through 47 are focused specifically on the growth areas and impacted quaternary watersheds.

7.1.1 Environmental Data for the Potentially Impacted Watersheds

Based on a high-level analysis of the location of the identified future growth areas (as shown in Figure 4), seven quaternary watersheds were identified as potentially being subject to direct or indirect environmental impacts if development were to proceed without the appropriate watershed-based assessments or without implementation of the appropriate management and mitigative measures. These watersheds include (see Figure 6 and Figure 32):

- Lock 19 – Otonabee River, Otonabee River Outlet, and Ouse River Quaternary Watersheds
- Hastings Lock 18 Dam – Trent River Quaternary Watershed (indirectly, as it is downstream of the three previously mentioned watersheds), and
- Indian River and Cavan Creek subwatersheds (as areas of future urban growth identified by the County, as mapped in Figure 6 and Figure 32).

To inform the prioritization of future studies and advancing planning within the four future growth areas, Table 16 summarizes the areas and proportions of potential development.

Table 16 Potential Areas of Growth per Quaternary Watershed

Tertiary Watershed	Quaternary Watershed	Potential Growth Area (ha)	Proportion of Quaternary Watershed
Trent River - Crowe River Outlet	Crowe Lake – Crowe River	133	1.0%
	Round Lake – North River Outlet	16.8	0.1%
	Crow Bay Dam – Trent River	12.3	0.2%
Otonabee River	Ouse River	250.2	0.9%
	Lock 19 – Otonabee River	206.5	0.7%
	Otonabee River Outlet	171.1	0.6%
Kawartha Lakes	Stony Lake – Katchewanooka	18.6	0.05%

Table 17 Summary of Available Water Resources and Natural Heritage Data for Quaternary Watersheds Associated with County’s Growth Areas

Growth Area	Havelock			Norwood	Millbrook	Lakefield	
Tertiary Watershed	Trent River-Crowe River			Otonabee River			Kawartha Lakes
Quaternary Watershed	Crowe Lake – Crowe River	Round Lake – North River Outlet	Crow Bay Dam – Trent River	Ouse River	Lock 19 – Otonabee River	Otonabee River Outlet	Stony Lake – Katchewanooka
Water Resources: Surface Water Quantity / Flows	Topography mapping, soils mapping	Topography mapping, soils mapping	Topography mapping, soils mapping	Topography mapping, soils mapping, hydrologic model	Topography mapping, soils mapping, hydrologic model	Topography mapping, soils mapping, hydrologic model	Topography mapping, soils mapping, hydrologic model
Water Resources: Groundwater Water Quantity	Water table mapping, source water protection mapping, bedrock groundwater monitoring	Water table mapping, source water protection mapping, bedrock groundwater monitoring	Water table mapping, source water protection mapping, bedrock groundwater monitoring	Water table mapping, source water protection mapping, bedrock groundwater monitoring	Water table mapping, source water protection mapping, bedrock groundwater monitoring	Water table mapping, source water protection mapping, bedrock groundwater monitoring	Water table mapping, source water protection mapping, bedrock groundwater monitoring
Water Resources: Surface and Groundwater Quality	Bedrock groundwater quality available	Bedrock groundwater quality available	Bedrock groundwater quality available	Bedrock groundwater quality available	Bedrock groundwater quality available	Bedrock groundwater quality available	Bedrock groundwater quality available
Water Resources: Fluvial Geomorphology / Watercourse Dynamics	No available information	No available information	No available information	No available information	No available information	No available information	No available information
Natural Hazards	Unstable bedrock mapping, unstable soils mapping,	Unstable bedrock mapping, unstable soils mapping,	Unstable bedrock mapping, unstable soils mapping,	Flood hazard, unstable bedrock mapping, unstable soils mapping,	Flood hazard, unstable bedrock mapping, unstable soils mapping,	Flood Hazard, unstable bedrock mapping, unstable soils mapping,	Flood Hazard, unstable bedrock mapping, unstable soils mapping,
Natural Heritage: Aquatic	Fish Habitat; Aquatic Endangered / Threatened Species	Fish Habitat; Aquatic Endangered / Threatened Species	Fish Habitat; Aquatic Endangered / Threatened Species	Fish Habitat; Aquatic Endangered / Threatened Species	Fish Habitat; Aquatic Endangered / Threatened Species	Fish Habitat; Aquatic Endangered / Threatened Species	Fish Habitat; Aquatic Endangered / Threatened Species
Natural Heritage: Terrestrial	Provincially Significant Wetlands (PSW), Non-significant Wetlands (NSW) and unevaluated wetlands; Areas of Natural and Scientific Interest (ANSI) – Life Science, Earth Science; Habitat for Endangered and Threatened Species	Provincially Significant Wetlands (PSW), Non-significant Wetlands (NSW) and unevaluated wetlands; Areas of Natural and Scientific Interest (ANSI) – Life Science, Earth Science; Habitat for Endangered and Threatened Species	Provincially Significant Wetlands (PSW), Non-significant Wetlands (NSW) and unevaluated wetlands; Areas of Natural and Scientific Interest (ANSI) – Life Science, Earth Science; Habitat for Endangered and Threatened Species	Provincially Significant Wetlands (PSW), Non-significant Wetlands (NSW) and unevaluated wetlands; Areas of Natural and Scientific Interest (ANSI) – Life Science, Earth Science; Habitat for Endangered and Threatened Species	Provincially Significant Wetlands (PSW), Non-significant Wetlands (NSW) and unevaluated wetlands; Areas of Natural and Scientific Interest (ANSI) – Life Science, Earth Science; Habitat for Endangered and Threatened Species	Provincially Significant Wetlands (PSW), Non-significant Wetlands (NSW) and unevaluated wetlands; Areas of Natural and Scientific Interest (ANSI) – Life Science, Earth Science; Habitat for Endangered and Threatened Species	Provincially Significant Wetlands (PSW), Non-significant Wetlands (NSW) and unevaluated wetlands; Areas of Natural and Scientific Interest (ANSI) – Life Science, Earth Science; Habitat for Endangered and Threatened Species

Table 18 Summary of Key Gaps in Water Resources and Natural Heritage Data for Quaternary Watersheds associated with County’s Growth Areas

Growth Area	Havelock			Norwood	Millbrook	Lakefield	
Tertiary Watershed	Trent River-Crowe River			Otonabee River		Kawartha Lakes	
Quaternary Watershed	Crowe Lake – Crowe River	Round Lake – North River Outlet	Crow Bay Dam – Trent River	Ouse River	Lock 19 – Otonabee River	Otonabee River Outlet	Stony Lake – Katchewanooka
Water Resources: Surface Water Quantity / Flows	Streamflow and rainfall monitoring data, refined land cover mapping	Streamflow and rainfall monitoring data, refined land cover mapping	Streamflow and rainfall monitoring data, refined land cover mapping	Streamflow and rainfall monitoring data, refined land cover mapping	Streamflow and rainfall monitoring data, refined land cover mapping	Streamflow and rainfall monitoring data, refined land cover mapping	Streamflow and rainfall monitoring data, refined land cover mapping
Water Resources: Groundwater Water Quantity	Static and dynamic (monitoring) overburden water levels, ecological significant groundwater recharge areas (ESGRAs)	Static and dynamic (monitoring) overburden water levels, ecological significant groundwater recharge areas (ESGRAs)	Static and dynamic (monitoring) overburden water levels, ecological significant groundwater recharge areas (ESGRAs)	Static and dynamic (monitoring) overburden water levels, ecological significant groundwater recharge areas (ESGRAs)	Ecological significant groundwater recharge areas (ESGRAs)	Static and dynamic (monitoring) overburden water levels, ecological significant groundwater recharge areas (ESGRAs)	Static and dynamic (monitoring) overburden water levels, ecological significant groundwater recharge areas (ESGRAs)
Water Resources: Surface and Groundwater Quality	Overburden groundwater quality data	Overburden groundwater quality data	Overburden groundwater quality data	Overburden groundwater quality data	Overburden groundwater quality data	Overburden groundwater quality data	Overburden groundwater quality data
Water Resources: Fluvial Geomorphology / Watercourse Dynamics	Headwater drainage feature identification and assessment, reach delineation for watercourses and HDFs, watercourse assessments, erosion inventory	Headwater drainage feature identification and assessment, reach delineation for watercourses and HDFs, watercourse assessments, erosion inventory	Headwater drainage feature identification and assessment, reach delineation for watercourses and HDFs, watercourse assessments, erosion inventory	Headwater drainage feature identification and assessment, reach delineation for watercourses and HDFs, watercourse assessments, erosion inventory	Headwater drainage feature identification and assessment, reach delineation for watercourses and HDFs, watercourse assessments, erosion inventory	Headwater drainage feature identification and assessment, reach delineation for watercourses and HDFs, watercourse assessments, erosion inventory	Headwater drainage feature identification and assessment, reach delineation for watercourses and HDFs, watercourse assessments, erosion inventory
Natural Hazards	Hydrologic model, erosion hazard mapping	Hydrologic model, erosion hazard mapping	Hydrologic model, erosion hazard mapping	Erosion hazard mapping	Erosion hazard mapping	Erosion hazard mapping	Erosion hazard mapping
Natural Heritage: Aquatic	Fish community composition, habitat type and quality, thermal regime confirmation	Fish community composition, habitat type and quality, thermal regime confirmation	Fish community composition, habitat type and quality, thermal regime confirmation	Fish community composition, habitat type and quality, thermal regime confirmation	Fish community composition, habitat type and quality, thermal regime confirmation	Fish community composition, habitat type and quality, thermal regime confirmation	Fish community composition, habitat type and quality, thermal regime confirmation
Natural Heritage: Terrestrial	Significant Woodland evaluations, Significant Wildlife Habitat assessments, Significant Valleylands evaluations, confirmation of habitat for Endangered and Threatened Species; determination of linkages	Significant Woodland evaluations, Significant Wildlife Habitat assessments, Significant Valleylands evaluations, confirmation of habitat for Endangered and Threatened Species; determination of linkages	Significant Woodland evaluations, Significant Wildlife Habitat assessments, Significant Valleylands evaluations, confirmation of habitat for Endangered and Threatened Species; determination of linkages	Significant Woodland evaluations, Significant Wildlife Habitat assessments, Significant Valleylands evaluations, confirmation of habitat for Endangered and Threatened Species; determination of linkages	Significant Woodland evaluations, Significant Wildlife Habitat assessments, Significant Valleylands evaluations, confirmation of habitat for Endangered and Threatened Species; determination of linkages	Significant Woodland evaluations, Significant Wildlife Habitat assessments, Significant Valleylands evaluations, confirmation of habitat for Endangered and Threatened Species; determination of linkages	Significant Woodland evaluations, Significant Wildlife Habitat assessments, Significant Valleylands evaluations, confirmation of habitat for Endangered and Threatened Species; determination of linkages

7.1.2 Environmental Data for the Future Growth Areas

To further support and inform the prioritization for growth areas and associated detailed studies, the available data for components of the NHS and WRS specifically within each of the potential future growth areas are summarized in Tables 19 and 20. The number of components, and the constraints and sensitivities associated with them, indicate the relative level of complexity anticipated to meet the various study and policy requirements in each area.

The summaries in Tables 19 and 20 indicate which components have data which is either “available”, “not available” (but expected to be required), or “not applicable” in the given growth area based on the Watershed Plan Volume 1 data review. Notably, this high-level assessment is intended to help scope the growth area prioritization but is not meant to imply that “not available” data are not required. In fact, in most cases these are flags for data gaps that will need to be filled through future studies at the subwatershed study stage, or at the site-specific stage prior to development.

Table 19 Summary of Available Natural Heritage Data within the Future Growth Areas

Growth Area	Havelock	Norwood	Millbrook	Lakefield
Provincially Significant Wetlands (PSW)	available	available	available	available
Locally Significant Wetlands (LSW), Non-significant Wetlands (NSW) and unevaluated wetlands	available	available	available	available
Areas of Natural and Scientific Interest (ANSI) – Life Science, Earth Science	available	available	available	available
Significant Woodlands ⁽¹⁾	not available	not available	not available	not available
Significant Wildlife Habitat (SWH) ⁽²⁾	not available	not available	not available	not available
Fish Habitat ⁽³⁾	available	available	available	available
Significant Valleylands ⁽¹⁾	not available	not available	not available	not available
Habitat for Endangered and Threatened Species ⁽⁴⁾	available	available	available	available
Linkages ⁽⁵⁾	not available	not available	not available	not available

Notes

- (1) As noted in Section 4, criteria and mapping for significant woodlands and significant valleylands in parts of the County within Ecoregion 6E remain to be developed and confirmed.
- (2) As noted in Section 4, provincial criteria SWH exist but they will need to be applied and field verified as part of the subwatershed studies for the growth areas.
- (3) As noted in Section 4, although course-level watercourse mapping (including thermal regimes) and aquatic species at risk data are available, the presence, character, and condition of fish habitat will need to be field-verified as part of subwatershed studies for the growth areas.
- (4) As noted in Section 4, even though there are many records for endangered and threatened species in the County, habitat for these species still needs to be screened for and confirmed as part of future studies.
- (5) As noted in Section 4, an approach and possible criteria for identification of linkages remain to be developed and confirmed.

Table 20 Summary of Available Water Resource System Data within the Future Growth Areas

Growth Area	Havelock	Norwood	Millbrook	Lakefield
Key hydrologic features (KHF)				
Permanent and intermittent streams	available	available	available	available
Inland Lakes	available	available	available	available
Inland lake littoral zones	not available	not available	not available	not available
Seepage areas and springs	not available	not available	not available	not available
Wetlands	available	available	available	available
Key hydrologic areas (KHA)				
Significant groundwater recharge areas (SGRA)	available	available	available	available
Highly vulnerable Aquifers (HVA)	available	available	available	available
Groundwater discharge areas associated with wetlands and coldwater streams (potential areas available; still need to be confirmed)	available in part	available in part	available in part	available in part
Significant surface water contribution areas	not available	not available	not available	not available
Shoreline areas necessary for ecological and hydrological integrity of watershed	not available	not available	not available	not available
Other features, areas and data				
Headwater Drainage Features	not available	not available	not available	not available
Significant Groundwater Recharge Areas (SGRAs)	available	available	available	available
Additional sources of data: Depth to Water Table and groundwater features and areas (water tables, other aquifers, unsaturated zones)	available	available	available	available
Hydrologic features (monitoring)	not Available	not Available	not Available	not Available
Natural hazards				
Karst Features and areas with potential to influence groundwater quality and quantity	available in part	available in part	available in part	available in part
Floodplain, flooding hazard, or floodways	not available	available	available	available
Erosion hazards	not available	not available	not available	not available
Soils	available	available	available	available

The presence or absence of natural hazards in the different future growth areas was also considered in the prioritization process. Table 21 summarizes the presence or absence of a range of natural hazards based on the available data. Where confirmed as present, they will still need further assessment through future studies at the subwatershed study stage, and/or at the site-specific stage prior to development.

Table 21 Summary of Natural Hazards Known to be Present within the Future Growth Areas

Growth Area	Havelock	Norwood	Millbrook	Lakefield
Flood Hazard Mapping	unknown	present	present	present
Unstable Soils – Organic Soils ⁽¹⁾	present	absent	present	absent
Unstable Soils – Marine Clays ⁽¹⁾	absent	absent	absent	absent
Unstable Bedrock – Known Karst ⁽²⁾	absent	present	absent	absent
Unstable Bedrock – Inferred Karst ⁽²⁾	present	absent	absent	absent
Unstable Bedrock – Potential Karst ⁽²⁾	present	present	absent	absent

Notes

- (1) Based on OMAFRA soils mapping (OMAFRA 2019)
- (2) Based on OGS karst mapping (Brunton and Dodge 2008)

7.1.3 Prioritization of Future Growth Areas and Quaternary Subwatershed Studies

One of the tasks for this Watershed Plan is to prioritize among the four future growth areas identified for the County (Hemson 2022) based on the information gathered through the characterization (as summarized in Volume 1) as well as professional judgement, based on experience with such processes and studies in other parts of southern Ontario.

The approach taken is comparable to that used for an environmental assessment whereby different options need to be considered and prioritized with consideration for environmental, social and economic factors. Scores of high (3), moderate (2), and low (1) were applied to one or more measures within each of the three categories below, and each category was weighted equally (i.e., 33.3% each). The specific factors identified for this prioritization exercise are as follows with bolded items representing the evaluation categories and the measures used to evaluate each are noted in the associated text.

- **Social Environment:** For this category, higher scores were assigned for future growth areas providing more development area (e.g., employment lands and/or residential lands), areas with partners/developers with a known and active interest in advancing development, and for areas with the least anticipated planning complexity (e.g., potential growth lands under one or few owners).
- **Natural Environment:** For this category, higher scores were assigned for future growth areas with fewer and less extensive NHS and WRS components, as well as less extent of shoreline (i.e., fewer environmental sensitivities anticipated).
- **Economic:** For this category, higher scores were assigned for future growth areas where the relative cost of the number and complexity of studies expected to be required, and the relative costs of servicing the area is expected to be lower.

Table 22 presents the scoring and outcomes from this exercise for the four future growth areas in the serviced local Municipalities of Havelock, Norwood, Milbrook, and Lakefield.

For the evaluation of Quaternary Watersheds, the results identify that a quaternary watershed study be prioritized for Ouse River and Stony Lake - Katchewanooka share the first priority, followed by Lock 19-Otonabee River and then Crowe Bay Dam – Trent River. When viewed in the context of each Growth Area, the results then identify, Norwood as the first priority potential growth area, followed very closely by Lakefield and Millbrook, then Havelock as the lower priority.

Notably, this is a preliminary prioritization exercise based on the most current information available. This analysis may be rerun in the future with new information which may change the outcomes.

Table 22 Prioritization Matrix for Quaternary Watersheds and Future Growth Areas

Evaluation Category and Weighting (%)	Considerations (Criteria)	Data Sources	Value	Application Guidance	Scoring							
					Growth Area	Havelock			Norwood	Milbrook	Lakefield	
					Tertiary Watershed	Trent River-Crowe River			Otonabee River			Kawartha Lakes
					Quaternary Watersheds Priority Assessment	Crowe Lake – Crowe River	Round Lake – North River Outlet	Crowe Bay Dam – Trent River	Ouse River	Lock 19 – Otonabee River	Otonabee River Outlet	Stony Lake – Katchewanooka
Social 33.33%	Total Amount of Proposed Development (i.e., area)*	Hemson Study (2022)	Crowe Bay Dam - Trent River - 12.3 ha Crowe Lake-Crowe River 116 ha Round Lake - North River Outlet 8.7 ha Stony Lake - Katchewanooka Lake 17.8 ha Lock 19 - Otonabee River 204.6 ha** Otonabee River Outlet 113.2 ha** Ouse River - 237.7 ha**	<i>More development proposed in a QW is considered more positive from an overall efficiency standpoint (H)</i>		3	1	1	3	3	3	1
	Vacant Employment Land (area)*	Hemson Study (2022)	Lock 19 - Otonabee River 10 ha** Otonabee River Outlet 46.4 ha** Ouse River - 170.8 ha			1	1	1	3	1	2	1
	Vacant Residential Land (area)*	Hemson Study (2022)	Crowe Bay Dam - Trent River - 12.3 ha Crowe Lake-Crowe River 35.5 ha Round Lake - North River Outlet 3.6 ha Stony Lake - Katchewanooka Lake 5.4 ha Lock 19 - Otonabee River 47.4 ha Otonabee River Outlet 10.3 ha Ouse River - 36.1 ha			2	1	1	2	2	1	1
	Future Development Lands (area)*	Hemson Study (2022)	Crowe Lake-Crowe River 80.5 ha Round Lake - North River Outlet 5.1 ha Lock 19 - Otonabee River 130 ha Ouse River - 170.5 ha			2	1	1	3	3	1	1
	Willing partners/developers***	County and Municipality - qualitative		<i>If willing partners/developers - High</i>		2	2	2	2	2	2	2
	Anticipated planning complexity (e.g., fragmentation, multiple jurisdictions)?	Hemson study - number of individual parcels vs larger contiguous parcels		<i>Greater complexity = lower score</i>		3	3	3	1	1	1	2
					<i>Social Score</i>	13	9	9	14	12	10	8
					<i>Percentage out of max</i>	72.22	50.00	50.00	77.78	66.67	55.56	44.44
					<i>Normalized score out of 33.33</i>	24.07	16.67	16.67	25.92	22.22	18.52	14.81

Evaluation Category and Weighting (%)	Considerations (Criteria)	Data Sources	Value	Application Guidance	Scoring							
					Growth Area	Havelock			Norwood	Milbrook	Lakefield	
					Tertiary Watershed	Trent River-Crowe River			Otonabee River			Kawartha Lakes
					Quaternary Watersheds Priority Assessment	Crowe Lake – Crowe River	Round Lake – North River Outlet	Crowe Bay Dam – Trent River	Ouse River	Lock 19 – Otonabee River	Otonabee River Outlet	Stony Lake – Katchewanooka
Natural Environment 33.33%	Presence/Absence of Terrestrial and Aquatic natural areas in proposed development	ANSI, wetlands, wooded areas; fish habitat and fish activity areas (map #); potential GW discharge areas for fish (thermal regime - coldwater)	Crowe Lake-Crowe River 32.3 ha Round Lake - North River Outlet 7.4 ha Stony Lake - Katchewanooka Lake 0.1 ha Lock 19 - Otonabee River 30.5 ha Otonabee River Outlet 5.8 ha Ouse River - 37.5 ha	<i>If SIGNIFICANT sensitive features/area - rate as low</i>		1	2	3	1	2	1	3
	Presence/Absence of Water Resource System areas in proposed development	natural hazards (flood extent, regulated slopes); Significant Groundwater Recharge Areas (SGRA), Highly Vulnerable Aquifers (HVA), Wellhead Protection Areas (WHP) intake protection zones, potential discharge areas; drainage/watercourse features	Crowe Bay Dam - Trent River - 12.3 ha Crowe Lake-Crowe River 116 ha Round Lake - North River Outlet 8.7 ha Stony Lake - Katchewanooka Lake 1.4 ha Lock 19 - Otonabee River 130.2 ha Otonabee River Outlet 37.3 Ouse River - 235.4 ha	<i>If SIGNIFICANT sensitive features/area - rate as low</i>		1	1.5	1.5	1	1	2	3
	Potentially affected shoreline length (km) in proposed development areas	Map 15/16/17	Crowe Lake-Crowe River 0.9 km Round Lake - North River Outlet 0.9 km Lock 19 - Otonabee River 0.2 km Otonabee River Outlet 0.1 km Ouse River - 0.7 km	<i>Lower shoreline length = high (favour/promote development inland)</i>		2.5	2	3	2.5	3	2.5	3
					<i>Natural Environment Score</i>	4.5	5.5	7.5	4.5	6	5.5	9
					<i>Percentage out of max</i>	50.00	61.11	83.33	50.00	66.67	61.11	100.00
					<i>Normalized score</i>	16.67	20.37	27.78	16.67	22.22	20.37	33.33
					<i>out of 33.33</i>							
	Relative cost of required quaternary subwatershed studies	size, number of features (will likely be similar to NHS complexity)		<i>if cost of studies is high - rate as low</i>		1	2	3	3	2.5		2
	Relative cost of servicing in one community vs other	Hemson		<i>if cost of servicing is high - rate as low</i>		1	1	1	3	3	3	3
Economic 33.33%					<i>Technical Score</i>	2	3	4	6	5.5	3	5
					<i>Percentage out of max</i>	33.33	50.00	66.67	100.00	91.67	50.00	83.33
					<i>Normalized score</i>	11.11	16.67	22.22	33.33	30.55	16.67	27.78
					<i>out of 33.33</i>							
				<i>Total score/100</i>		51.85	53.70	66.66	75.92	74.99	55.55	75.92
				<i>Ranking</i>		7	6	4	1	3	5	1

Notes:

Scores 1 to 3: 1 = low, 2 = moderate, 3 = high; high is a more positive evaluation, and low is more negative
* Designations and areas derived from Maps in Appendix B of Hemson (2022);
**Total includes Residential Plans of Subdivision designations Hemson (2022)
***A placeholder value of 2 (moderate) has been applied as this requires further/future consultation with/between the County and Partners.

7.2 Future Studies

At the broad scale, watershed planning is completed to facilitate a comprehensive, integrated, sustainable approach to protect, enhance, or restore natural and water-based processes within a watershed. As discussed throughout this Watershed Plan, water resources are inherently integrated with natural heritage features and functions, as well as natural hazards. Consequently, impacts to water resources have the potential to impact natural heritage, and vice versa. Therefore, environmental studies at all scales should take an integrated approach that considers the different water resource, natural heritage systems., notably, resource and natural hazard components.

Higher-level studies generally set the guidance, objectives, and deliverables that are refined through later stages of planning and environmental assessment. Since each stage builds on the last, environmental studies at different scales should be completed sequentially to ensure an effective and efficient process. In addition, implementation should include targeted monitoring and be able to support an adaptive management approach, so that future planning cycles can be adjusted if and where needed based on the outcomes of more advanced growth assessments. As required by the Province, studies must also consider and assess climate-change impacts in a context of urbanization, and identify locally appropriate mitigation and/or adaptation strategies.

Specific study requirements will vary depending on factors such as the specific biophysical and land use context, the stage of the land use planning approvals process, and the scope and scale of what is being proposed. Further, detail may overlap depending on the size and complexity of the planning area.

This Watershed Plan has identified several key gaps in the quaternary watersheds expected to accommodate future growth, as outlined in Section 7.1. It is understood that more area-specific studies (e.g., including field data collection, modelling and monitoring) will be required to fill current data gaps, and better understand the sensitivities and processes associated with the environmental systems, features, and hazards. This section provides some technical guidance for (a) filling the key gaps identified, (b) the types of environmental studies expected to be required, and (c) some of the key elements that need to be considered as part of the more area-specific quaternary scale and subwatershed scale studies to follow this County-wide Watershed Plan.

Image 6 illustrates conceptually how municipal land use planning processes should generally align with related environmental studies in Peterborough County.

Notably, while key gaps in environmental data sources are identified in Volume 1 of this Watershed Plan based on a review of available desktop and secondary source information and summarized for the Quaternary Watersheds in Section 7.1, there are expected to be additional gaps in data and/or coverage that will also need to be addressed as part of the more area-specific quaternary scale and subwatershed scale studies to follow this County-wide Watershed Plan.

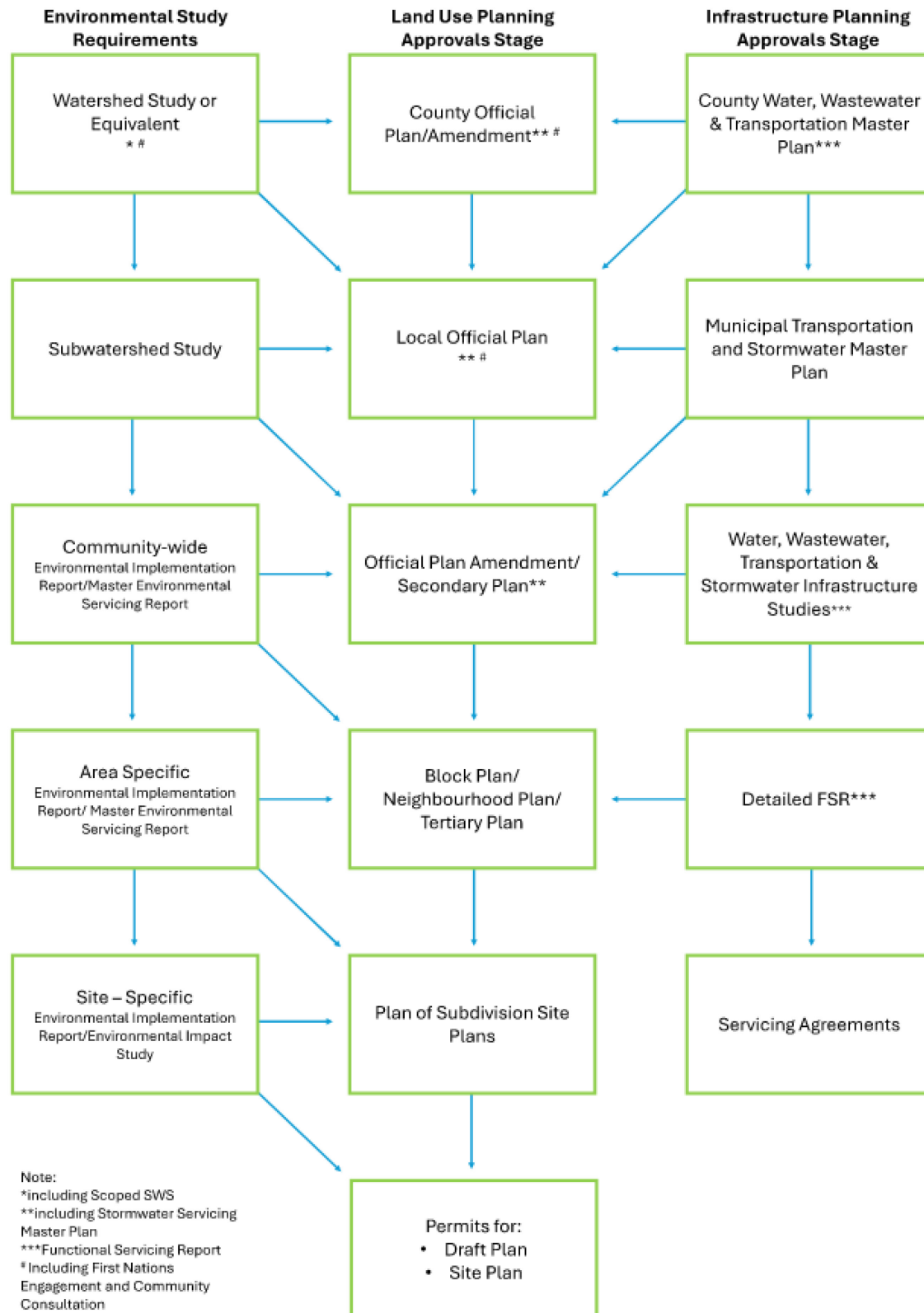


Image 6 Environmental Planning Process and Interrelationship with Municipal Land Use Planning Process

In addition, while it is preferable for some of the key NHS gaps identified (i.e., approach and criteria for identification of significant woodlands, significant valleylands and linkages, as well as application of vegetation protection zones) to be resolved by the County as part of an Official Plan Amendment process at the regional scale, it is recognized this may not be feasible. In the case that one or more area-specific quaternary/subwatershed scale studies are initiated in advance of such Official Plan updates, these studies will be required to fill these gaps at the quaternary/subwatershed scale.

7.2.1 Quaternary Watershed and Subwatershed Scale Studies

Detailed subwatershed studies can provide an opportunity to address many, if not all, the gaps identified in this Watershed Plan for the environmental systems and hazards at the quaternary scale. However, this depends on the size of the catchment, available data, and timelines for completion. In some cases, it may be more feasible to evaluate sub-areas/catchments of the quaternary subwatersheds more localized to the planned development area, as time and materials can be substantial to gather the same detail with a comparative level of management recommendations within a reasonable planning horizon. Defining the ultimate study area should be based on the availability of data, time and resources but should also consider access to lands that are not publicly accessible. Outreach and coordination of access to others' lands for field investigations can be challenging and time consuming, and may need to be scoped to focus on filling the highest priority gaps.

Climate change considerations must be integrated into quaternary watershed/subwatershed planning activities in accordance with the established provincial guidance (as outlined in Section 5.2).

Quaternary watershed and subwatershed studies may be led by local Municipalities, with support and/or direction from the County, or vice versa. Consultation with the relevant Conservation Authorities and provincial and/or federal agencies, as well as engagement with local First Nations, key stakeholders and the community is also a standard part of such studies. Technical advisory committees of local representatives may be formed to support and inform such studies.

Compared to this Watershed Plan, subwatershed studies provide more detailed locally-based data collection and analysis that can apply and may also result in the refinement of Watershed Plan goals and objectives. Subwatershed studies in the County are also expected to provide sufficient data to support the identification of area-specific targets, criteria and management recommendations related to the NHS and WRS, flood and stormwater, erosion control, stream morphology, shorelines, water balance and water quality. This level of study and integration between disciplines and systems should identify and refine the WRS (including natural hazards) and the NHS, with recommended enhancements as appropriate.

The following field-based studies are typically required for a subwatershed-scale study to gather a sufficient amount of information to characterize, assess impacts, and provide feature or site-based management recommendations:

- Natural heritage field studies – terrestrial and aquatic (multi-year and seasonal)

- Watercourse reach and headwater drainage feature (HDF) assessments (multi-season)
- Detailed geomorphic analysis on representative or sensitive reaches to support erosion analyses
- Groundwater and surface water monitoring (multi-year and event-based), and
- Geotechnical investigations (composition and hazards).

The above field studies will support and inform the characterization by adding area-specific and field-verified data to inform the identification and assessment of hydrology and hydraulics (development, calibration/validation of models), hydrogeological processes, and fluvial geomorphology processes. They will also support and inform an integrated evaluation of aquatic habitats, drainage systems (watercourses and HDF), natural heritage features, and key hydrologic features and areas (KHF and KHA). These data and analyses will provide a more detailed characterization and analyses supporting the identification and refinement of constraints and opportunities related to both the WRS and NHS in the study area, with management being evaluated holistically at the subwatershed scale.

Subwatershed studies typically follow a phased approach that allows for multi-season or multi-year data collection (depending on available resources and timelines). The following outlines a comprehensive four-phased example:

Phase 1: Subwatershed Characterization and Preliminary Discipline Integration

- Focuses on developing a clear understanding of the state, health, and overall characteristics of the subwatershed and its environmental features (surface and subsurface).
- Draws on existing studies and reports, supplemented by desktop analyses (e.g., air photo interpretation, digital elevation model processing) and supporting, confirmatory field investigations.
- Establishes baseline conditions for key components including hydrology and hydraulics and hydrogeology, typically involving modelling.
- Involves integrated consideration of surface water resources, groundwater, stream morphology, and aquatic and terrestrial resources. Specific additional disciplines or sub-disciplines may be engaged based on the needs of the subwatershed (e.g., karst specialist). Together, these components form the basis for characterizing the subwatershed areas of interest, and their interactions and interdependencies characterized prior to evaluating potential future condition impacts.

Phase 2: Impact Assessment

- Focuses on assessing the potential impacts of the future development/urbanization proposed in the identified growth area.
- This part of the study process may be iterative. For example, an initial impact evaluation may be completed in the context of proposed land use changes, which may be refined to avoid or minimize some of the identified impacts.

- Watercourses and natural heritage features are evaluated and may be assigned constraint rankings, followed by an overall net rating, and proposed refinements are considered.
- Working targets and preliminary management strategies are developed to address anticipated natural environment and stormwater impacts.

Phase 3: Management, Implementation, Monitoring and Adaptive Management

- Identification and consolidation of:
 - recommendations for water management (including traditional approaches and low-impact development measures)
 - environmental management measures to protect and enhance stream stability and terrestrial and aquatic systems, and
 - framework for implementation of environmental measures and monitoring outlining procedures, priorities, policy direction, and any follow-on studies required.

Phase 4: Long-term Monitoring

- A comprehensive subwatershed study includes long-term monitoring, assuming it is detailed in the environmental monitoring recommendations.
- This supports implementation of adaptive management, ideally with specified and reasonable response times to evaluate and address issues as they are identified.
- Targeted monitoring of key measures and indicators is a crucial but often underfunded and therefore neglected part of subwatershed and land use planning.
- The types and scope of long-term monitoring plan should be determined in consultation with land stewards, regulators, and upstream/downstream residents and municipalities. Ideally this monitoring should consider and fit into any established and ongoing monitoring at the broader watershed scale.

Comprehensive subwatershed studies be completed for quaternary watersheds that interact meaningfully with the four future growth areas (see Table 16) prior to implementing Secondary Plans and / or comparable area-specific land use plans.

In addition to the high-level guidance above, General Terms of Reference (TOR) for Subwatershed Studies in Peterborough County have been appended to this Watershed Plan (Appendix B). These General TOR are intended to provide a solid base or template for developing area-specific TOR for subwatershed studies that are tailored to the local biophysical and planning context, including consideration for differences between Ecoregion 5E and Ecoregion 6E. While these General TOR have been provided to guide identification of requirements for subwatershed studies associated with growth areas in Ecoregion 6E, these TOR could be tailored for subwatershed studies anywhere in the County.

Natural Heritage System Identification

Even once the County moves forward with NHS mapping (as outlined in Section 5.1), at least for the municipalities in Ecoregion 6E if not for the County as a whole, given the scale and biophysical diversity of the County, as well as some of the existing data gaps (as noted in Table 3), NHS mapping will still be required at the subwatershed scale.

More area-specific NHS should be mapped through future subwatershed studies at the quaternary level or finer (subcatchments) as part of future planning studies or more proactively as part of natural heritage mapping projects. This should be undertaken with consideration for the guidance in Section 4.2 and Section 5.1 of this Watershed Plan, and align with any County-wide NHS policy updates and / or NHS mapping developed following the completion of this Watershed Plan.

In addition to implementing the guidance in Section 5.1 and/or the County's updated NHS policies and mapping, assessing the NHS at the subwatershed scale should include the following components:

- Updated land use and vegetation classification (using the ELC system) mapping based on current aerial imagery and field verified supplemented with scoped botanical screening for dominant and rare species
- Targeted wildlife assessments to inform screening for SWH, as well as habitat of endangered and threatened species (e.g., breeding birds, anuran call surveys - when suitable breeding habitat is present, reptile surveys, and other site-specific surveys required to confirm feature and habitat significance)
- Assessment of watercourses and HDF, and their intersections with any natural features and areas, including targeted fisheries assessments if current background data is lacking
- Assessment of existing or potential linkages, including riparian corridors if present
- Analyses for natural feature and area sensitivities, constraints, and management requirements.
- Compilation of available mapping, desktop analyses and field data to develop or refine a draft NHS
- Verification of feature status based on site investigations, and refinement of NHS where appropriate, and
- Confirmation of appropriate vegetation protection zones, linkages and any enhancement, restoration or compensation recommendations.

These assessments should also include a subwatershed-scale impact assessment for all NHS components and identification of mitigation and management measures to ensure long term sustainability of the NHS, including a monitoring framework.

7.2.2 Master Environmental Servicing Plans

Master Environmental Servicing Plans (MESP) are focused at the secondary plan level, for example, where land use refinements and modifications to natural systems (e.g. channel realignments; alternate linkages) are drafted at the preliminary scale. MESP are generally required by

municipalities to support new development or block re-development, at the secondary plan level, but may also be completed to support the development of a secondary plan. These studies are primarily led by municipalities but often require support from the higher-tier municipality (the County) and the relevant Conservation Authority. Technical review and authorization would be required by both the County and the Conservation Authority before subsequent planning can proceed (e.g., neighbourhood plans or tertiary plans).

MESPs use the broad guidance developed through the parent subwatershed study (SWS), translating them into more detailed, implementable requirements that address collective site-specific issues and requirements for the MESP study area. This usually involves an update to the technical characterization completed through the subwatershed study, to fill gaps, and confirm/update the results of the characterization, impact assessment, and management recommendations provided on an area or feature basis, including: desktop analysis, targeted field investigations, refinements to the preliminary NHS as delineated in the parent study, identification of development limits, and refinement of modelling. Where data were unavailable or have undergone a substantial modification since the SWS, the characterization must be updated. An impact assessment must then be completed as the land use plans, SWM plans, and servicing plans are more detailed, and include specific modifications to natural features that were determined to be of a lower constraint through the SWS (e.g., mitigation or no management HDF). Impacts are to be measured against similar criteria of the SWS, with more quantitative analysis of impacts (local and cumulative) under existing and proposed conditions.

Following the impact assessment, and study integration, resulting recommendations define the conceptual or detailed functional servicing needs and environmental management requirements for development and infrastructure. These studies establish detailed refinements to the previously delineated natural heritage system and water resource system extents and boundaries for protection, relocation, and/or enhancement, and provide direction on the function, sizing, and location of stormwater management facilities. They also address phasing, financing, and cost-sharing considerations for environmental, natural heritage, and stormwater management.

7.2.3 Functional Servicing Studies

Functional Servicing Studies (FSR) are typically undertaken during detailed site design to determine how water, sanitary, and stormwater services will be provided to a development site. These studies outline the servicing strategy and identify the existing infrastructure and capacity, and infrastructure required to support the proposed development. They generally include, but are not limited to, the following components:

- Location and preliminary sizing of sanitary sewers to service the site
- Location and preliminary sizing of storm sewers required to convey runoff
- Location and preliminary sizing of watermains to ensure adequate supply and pressure
- A preliminary site grading plan to establish drainage patterns and development limits
- Location and preliminary sizing of SWM facilities, including quantity and quality controls

- Location and preliminary sizing of hydraulic structures, such as bridges and culverts
- Preliminary channel corridor designs (realignment) and associated technical analyses, and
- Assessment of riparian storage for existing channels and preliminary channel design concepts.

Current practice also requires these studies to evaluate the potential impacts of proposed servicing on groundwater systems, including identification of risks and recommended mitigation strategies to ensure protection of groundwater quality and function. Functional servicing studies can be summarized in a functional servicing report (FSR) and are required in support of development applications.

7.2.4 Stormwater Management Reports

Stormwater management (SWM) plans and reports need to be prepared to support applications for large scale development and detailed site design. The content and scope of the SWM report is to be determined when development is proposed.

A Stormwater Management (SWM) Report must present the full design and supporting technical calculations for all components of the proposed stormwater management system. It provides the detailed design of stormwater controls, confirms or refines constraint boundaries, and includes the required hydraulic and hydrologic analyses to demonstrate that the proposed system meets applicable performance criteria.

The scope and detail required for a SWM Plan and Report will be informed by principles, recommendations, targets, and implementation guidance provided by broader scale studies such as a SWS or MESP, or a Stormwater Master Plan if available for the development area. They should aim to incorporate a treatment train approach to reduce runoff and dependence on stormwater management facilities (SWMF), including the incorporation of LID measures and green infrastructure.

To support this work, the SWM Report should include or reference the following technical materials:

- Geotechnical and hydrogeological studies that inform infiltration potential, groundwater interaction, and soil conditions.
- Environmental reports and associated preservation, restoration, or remediation plans.
- Sediment and erosion control plans for both construction and post-construction phases.
- Monitoring plans outlining requirements for performance verification and adaptive management.
- Long-term operations and maintenance requirements for stormwater infrastructure.

Some additional guidance tailored to the County is provided in Section 6.1.

7.2.5 Environmental Impact Studies

The Official Plan includes comprehensive guidance for when an Environmental Impact Study (EIS) is required to support a development application (Section 6.3.8 of the Official Plan). An EIS should be prepared in support of planning applications whenever a proposed development wholly or partially contains natural heritage features (or components of the NHS) or other regulated natural features, or is located on lands adjacent to such features or areas that could be impacted.

An EIS provides a detailed characterization of existing biophysical conditions at the development or site level, an assessment of constraints and feature/area sensitivities, then an evaluation of potential impacts associated with the proposed development conceptual designs. It also recommends measures to avoid, minimize, mitigate, or otherwise address those impacts. Where appropriate, an EIS should include monitoring recommendations to evaluate the effectiveness of the mitigation measures. Some refinements may be addressed later through detailed design and should be specified in the EIS, with support from the Local Municipality and Conservation Authority.

The purpose and requirements of an EIS may be informed or scoped through a subwatershed study or MESP. In general, an EIS should be required where:

- The subwatershed study or MESP (or equivalent servicing study) is older than approximately five years, such that updated field characterization is necessary
- Natural heritage policies have changed in a substantive way since the subwatershed study was completed
- The property was not comprehensively surveyed during the subwatershed study (for example, where site access was not granted), and / or
- The subwatershed study identifies gaps or the need for further site-specific investigation to be addressed through subsequent planning applications.

The above guidance is to ensure that the EIS provides current, site-specific information to support sound environmental planning and decision-making, and the ability to apply adaptive management in response to monitored impacts.

8 Guidance for Monitoring and Adaptive Management

Monitoring and adaptive management plans are generally developed as part of, or following, local Subwatershed Studies and associated EIS, and as conditions of approval for stormwater management plans and watercourse reconstruction/realignment. The information collected as part of these monitoring plans is intended to:

- Verify the performance of the environmental and stormwater management system against the established targets and objectives, and

- Use this information as guidance for adapting environmental management systems (and/or approaches and/or policies) if and where needed, thereby improving local environmental conditions.

These typically require corroboration of various levels of government, Conservation Authorities, and other stakeholders to ensure successful and efficient data collection and analysis.

The specific components, measures, protocols and targets are to be developed for each quaternary watershed and/or subwatershed study based on the local biophysical and planning context, as well as the scope and scale of what is being proposed. However, the following sections outline general recommendations regarding the framework for various components of the monitoring and adaptive management plans for the future quaternary scale/subwatershed plans.

8.1 Overview of Existing Monitoring in the County

The Watershed Plan Volume 1 document reviewed the availability, distribution, and activity of monitoring datasets available for Peterborough County per Tertiary Watershed. Monitoring and/or reporting included: climate stations, stream gauging, groundwater monitoring wells, and water quality (surface and groundwater). The coverage ranged from “good coverage” to “no coverage” varying between the type of monitoring and between watersheds. Where gaps exist, such as those with no or limited coverage, this will need to be addressed as part of future studies through potential monitoring programs by jurisdiction or municipality, or in the advancement of subwatershed studies at the quaternary level or subwatershed scale. Further discussion of the current status of monitoring is available throughout the Volume 1 characterization report.

Table 23 summarizes all available monitoring stations at a high-level (i.e., total number of stations). This tabular summary identifies key gaps (in general) with respect to coverage across the quaternary watersheds and extends beyond the County boundary as these are naturally connected networks irrespective of a municipal boundary. Further details regarding the monitoring stations can be found in the respective tertiary watershed characterization in Volume 1 of this Watershed Plan, while this current summary focuses on Quaternary Watersheds that interact with potential growth areas.

As growth is anticipated, the type of environmental study to support growth—whether at the quaternary scale or the subwatershed scale—must shape how indicators and targets to evaluate sensitivity and response, are determined and monitored. Indicators and targets, or thresholds need to address the sensitivities of water resource and natural heritage features and areas, to minimize or avoid impacts. A tiered approach to setting and assessing indicators, targets and/or thresholds at the quaternary scale to consider system-wide indicators, while local, more detailed studies (e.g., subwatersheds or subcatchment of the quaternary system) should focus on feature-specific conditions and sensitivities – e.g., specific watercourse reach, wetland, or infrastructure connection.

The development of a monitoring program, including locations/features, distribution of sites, duration of baseline monitoring, and the identification of targets or thresholds for a variety of environmental indicators must be developed in consultation and collaboratively with area

stakeholders, municipalities, and regulators to ensure that provincial, and regional policy are appropriately considered, and that community concerns/expectations are sufficiently incorporated and reported.

Table 23 Inventory of Existing Monitoring per Quaternary Watershed Associated with Future Growth

Tertiary Watershed	Quaternary Watershed	Total Drainage Area (ha)	Monitoring Stations					
			Climate		Streamflow		Surface Water Quality	Groundwater Quality
			Active	Inactive or Decommissioned	Active	Inactive or Decommissioned		
Trent River - Crowe River Outlet	Crowe Lake – Crowe River	27,185	0	0	0	0	0	11
	Round Lake – North River Outlet	15,841	0	0	0	0	0	0
	Crowe Bay Dam – Trent River	17,021	0	0	0	0	0	6
Otonabee River	Ouse River	28,984	0	2	2	0	0	9
	Lock 19 – Otonabee River	31,464	1	4	2	1	4	6
	Otonabee River Outlet	31,659	0	4	2	1	4	15
Kawartha Lakes	Stony Lake – Katchewanooka Lake	39,114	0	3	0	0	0	10

8.2 Subwatershed Study Monitoring Phases

Monitoring and adaptive management plans are typically prepared as a component of, or after Subwatershed Studies and related Environmental Impact Studies, and they often form part of the approval conditions for stormwater management designs, habitat compensation plans, and watercourse reconstruction or realignment projects.

The purpose of these plans is to collect information that confirms whether the environmental and stormwater systems are performing as designed, based on the targets, thresholds, and objectives established through environmental studies. The results are then used to guide modifications to environmental management practices, helping to refine system design performance over time and support mitigation or improvements for environmental systems or features.

Various monitoring programs will require collaboration and integration with, and between, different levels of government, agencies, and area stakeholders to support sufficient and efficient data collection, analysis, and interpretation. The purpose and objectives will vary at different scales, and

at different stages of development. Holistic watershed or subwatershed monitoring may evaluate general broad-scale trends and adjustments across a network, while more targeted monitoring may be required at select developments (e.g., evaluate SWM performance) or select features (e.g., monitor significant wildlife habitat).

The purpose and objectives of monitoring programs vary, as do the components assessed and the targets, which should be tailored to the local biophysical context as well as the area-specific planning and environmental objectives, and the available capacity and resources to undertake the monitoring. However, monitoring program phases for subwatershed studies typically includes the following stages:

1. Pre-development: Characterization of the subwatershed and key indicators prior to development.
2. During development: Short-term to medium-term monitoring to ensure mitigation measures recommended are implemented as approved.
3. Post-development – short-term: After most or all the planned development has been built, key indicators are re-assessed over a period of 1 to 5 years to confirm that established environmental objectives and targets have been achieved, or if not to identify how the approach may be corrected in the given subwatershed study, or improved for the next study.
4. Long-term: This typically relates to broader, regional-scale monitoring for key components such as regional-scale surface water quality, regional-scale natural areas cover, etc. to ensure jurisdiction-wide environmental objectives are being addressed.

Following construction, or at an agreed level of development (e.g., 80% build-out), monitoring should be completed at two scales:

- Compliance Monitoring: Local monitoring of infrastructure and design components that have specific functions and targets or thresholds associated with them. These would be monitored against specific conditions of permits, approved Environmental Monitoring Plans (EMPs) for a development, and requirements of agencies (e.g. DFO, MNR, local CA). These are typically developer led studies, with annual reporting. Compliance monitoring should extend for 3 years post construction, and depends on the proportion of build out agreed-upon for monitoring (i.e., 80% or 100%).
- Performance Monitoring: A more holistic or sub-catchment scale (or other broader network scale) monitoring that continues the evaluation of changes in the rates of baseline adjustments, and identifies potential cumulative impacts across multiple impact areas or development areas. This program may be initiated by developer groups, but should be managed by an appropriate agency or other regional-scale regulator. These programs should extend over a longer period of time – 5+ years depending on the phasing and progress of development.

The following sections outline general recommendations regarding the framework for various components of the monitoring and adaptive management plan proposed for Peterborough County.

8.3 Subwatershed Study Monitoring Framework Components

8.3.1 Surface Water Quantity

Meteorology: Additional precipitation and climate data should be collected as part of future studies so it can be integrated with existing rainfall and streamflow records to better describe the meteorological conditions occurring during the monitoring period, improve characterization of surface water hydrology and runoff response, and further validate the hydrologic models that will support future watershed planning.

- New data collection should build on the precipitation network currently operated by Environment Canada, which has been summarized at a high-level in the current Watershed Plan Volume 1 document, and presented in Figure 7. Expansion of the meteorological monitoring program should focus on the quaternary watersheds and subwatersheds identified for future growth or those that may be indirectly impacted, where existing coverage is limited.

Streamflow: Similar to rainfall data and climate data, streamflow monitoring networks operated by Water Survey of Canada (WSC; Environment Canada) and Kawartha Conservation have been reviewed at a high level through Volume 1, and are mapped in Figure 7. As part of future studies, streamflow monitoring should continue and be expanded and used in combination with precipitation and climate data (above) to characterize the runoff response to receiving surface water features, which will support the verification and refinement of the hydrologic models used in upcoming watershed planning initiatives.

To achieve this, streamflow monitoring should include the installation of level-loggers to record continuous water level data, along with field surveys to develop rating curves under several flow events/conditions at each station. This will allow water levels to be converted to continuous flow datasets. The resulting dataset should extend the streamflow information currently maintained by the WSC and Kawartha Conservation. Expansion of the streamflow monitoring network should prioritize quaternary watersheds and subwatersheds identified for future growth where existing coverage is insufficient. For example, Kawartha Conservation's station coverage does not extend toward the serviced area of Lakefield, but may need to evaluate impacts from planned development.

Moreover, as part of holistic monitoring programs, surface water monitoring should include the collection of local stream flow and rainfall data in the vicinity of future development areas. The selection of the appropriate gauge site should be completed in consultation with the local CA (where applicable) and municipal staff.

SWM Facilities: As part of performance monitoring at the local scale (post construction), stormwater management facilities should be monitored for inflow, outflow, and temperature. Since inlet and outlet control structures are typically well documented and have established hydraulic rating curves, continuous water level recorders are an appropriate method for tracking system performance. Regular inspections of inlet and outlet structures are also necessary to confirm they remain free of debris and sediment and are operating as designed. At minimum, inspections should

occur monthly and after major storm events (e.g., 25 mm in 24 hours) during the first two years of operation. Any issues identified should be corrected promptly or reported to the municipality if specialized equipment is required.

Monitoring gauges should be installed during active rainfall periods (e.g. April 1 to November 30 in Southern Ontario) and must be capable of collecting data at intervals of no more than five minutes. If appropriate and feasible, the period of time may be extended.

Hydrologic Modelling: As part of the future quaternary and subwatershed studies, it is recommended that hydrologic modelling be developed for the watershed/subwatershed systems. Due to the need to assess flood control, erosion and water balance, it is highly recommended that models capable of long-term continuous simulation be adopted. As noted previously, through review of the current watershed plans, there is a lack of hydrologic modelling and analysis of land use changes as part of the legacy watershed plans. Therefore, consultation with the local Municipalities and Conservation Authorities is required to confirm the existence and/or status of available hydrologic models developed as separate studies/initiatives, subsequent to the respective legacy watershed plan.

Rainfall and stream flow data collected as part of the local watershed monitoring programs should be used to further validate the performance of hydrologic models and re-establish the baseline conditions within the respective study areas as appropriate.

Hydraulic Modelling: As part of the future quaternary and subwatershed studies, it is recommended that hydraulic modelling and respective floodplain mapping, be reviewed and updated/refined as needed; updates may include incorporating updated information within, and proximate to, the corresponding study area (i.e. new roadway crossings, stormwater management facilities, grading/creek works, hydrology). These initiatives should be completed in coordination with the local Conservations Authorities' floodplain mapping program to ensure the most up-to-date data, model and floodplain delineations are used as part of future land use

8.3.2 Groundwater

An appropriate spatial discretization will be required in future studies to capture potential changes in groundwater levels, groundwater-dependent ecological linkages, and variations in hydro-stratigraphy, including both surficial soils and deeper overburden or bedrock units.

The scope and design of long-term groundwater monitoring will depend on the baseline programs completed through future Subwatershed Studies, particularly those assessing groundwater conditions and groundwater–surface water interactions under pre-development conditions. These programs will operate at different spatial and temporal scales, reflecting the type and location of proposed development, the sensitivity of local groundwater functions, and the potential magnitude of groundwater impacts. In addition, site-specific monitoring will be required where long-term groundwater management is anticipated, such as areas where dewatering may be needed to support subsurface infrastructure. A comprehensive program typically includes:

- A spatially representative network of water-table monitors and multi-level wells to track changes in water-table elevation, vertical hydraulic gradients, and broader groundwater flow patterns.
- Multi-level drive-point piezometers installed within wetlands and watercourses to assess vertical gradient trends and identify changes in groundwater discharge or recharge conditions.
- Seasonal groundwater-level measurements at locations intended to represent general conditions, supplemented by continuous data loggers at selected sites to capture short-term fluctuations and responses to recharge events.
- Groundwater-level and vertical-gradient monitoring at sensitive natural features, such as wetlands where post-construction mitigation may be required. Continuous monitoring is particularly important at these locations.
- Spot baseflow measurements to track changes in groundwater contributions to streams.
- Monitoring of flow quantity and quality associated with long-term dewatering, where applicable.
- Annual water-quality sampling at selected monitoring wells and baseflow sites to identify potential changes in groundwater chemistry.

During construction and any associated dewatering activities, monitoring should address groundwater levels, groundwater discharge, hydraulic gradients, baseflow, and the quantity and quality of discharge water. Particular attention is needed where groundwater–surface water interactions are sensitive or where natural features rely on consistent groundwater inputs.

The long-term groundwater monitoring program is expected to incorporate representative monitoring sites established during the pre-construction phase, and those already existing as summarized through the current Watershed Plan Volume 1 document. Long-term groundwater monitoring programs should engage regulatory agencies, the County, and local municipalities to ensure the distribution of sites and overall monitoring program meets regulation, policy, and municipal objectives.

8.3.3 Surface Water Quality

Water quality monitoring is recommended to be incorporated into monitoring programs for future watershed planning studies, to characterize the surface water chemistry within the receiving watercourses, and to provide a baseline assessment for comparison against results from future holistic monitoring programs.

Water Chemistry: Chemical sampling through grab sampling should be carried out to assess and confirm the effectiveness of the stormwater quality management system. Establishing pre-development (baseline) instream water-quality conditions should occur over a two-year period prior to development, with monitoring locations selected in consultation with the Conservation Authority and appropriate Municipal staff.

Post-development water-quality monitoring should continue for a minimum of three years and include sampling at the inlet and outlet of each stormwater management facility (ref. above), as well as instream at the same locations used for baseline monitoring. Grab sampling is the recommended method for collecting water-quality samples from each facility. Each monitoring location should be sampled during three events per year, typically representing spring, summer, and fall conditions, with rainfall events greater than 15 mm preferred to ensure meaningful water-quality characterization. The samples should be analyzed for a suite of water quality indices subject to review and consultation with the agencies, such as:

- | | | |
|--|--------------------------------|--|
| • Oil and Grease | • Total Solids (TS) | • Total Coliforms |
| • Total Phosphorus | • Total Suspended Solids (TSS) | • Faecal Coliforms |
| • Anions (Nitrate, Nitrite, Phosphate, Chloride) | • Turbidity | • PAH |
| • Ammonia | • BOD5 | • 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, Ti, Sn, Tl, W, U, V, Zn, Zr). |
| • Total Kjeldahl Nitrogen (TKN) | • Dissolved Oxygen | |
| • Conductivity | • pH/alkalinity | |
| | • Salinity | |

Water chemistry should continue to be monitored through the post-development stage, and should be completed at SWM facilities (inlet and outlet), in addition to receiving watercourse reaches with samples being taken upstream and downstream of outflow connections.

As specific data are collected through baseline and subwatershed characterizations, it is anticipated that additional chemical parameters may need to be monitored as there may be site-specific variability detected.

Temperature: Continuous temperature gauges should be installed from June 1 to September 30 at the outlets of all stormwater management facilities, as well as at upstream and downstream locations, to evaluate how effectively the facilities cool effluent and reduce thermal impacts on receiving streams. The selection of instream temperature-monitoring sites should be made in consultation with the Conservation Authority and Municipal staff to ensure that monitoring locations capture both baseline conditions and potential thermal effects associated with facility operation.

As temperature is a key indicator of aquatic ecosystem health—particularly for cold-water or temperature-sensitive species—this type of monitoring helps determine whether additional mitigation measures are needed or whether existing designs are performing as intended. It may be helpful to pair temperature monitoring with flow or shading assessments to better understand the drivers of any observed thermal changes.

8.3.4 Streams and Shorelines

This section focuses largely on monitoring of stream morphology, but given the number, extent and importance of lakes in the County, targeted monitoring of lake shorelines should also be prioritized

(e.g., water levels, water quality and carrying capacity), particularly where development pressures or other stressors are anticipated and already documented.

An overall, systems-based geomorphic monitoring program should be established for receiving, sensitive and/or representative sites downstream and within the anticipated development area. The collection of field data should establish a baseline condition from which continued monitoring during and post-development can determine channel response in terms of process and function, as upstream land use changes. Adaptive management strategies may be implemented when observations exceed targets, as determined during the baseline monitoring phase.

Despite typical water measures to maintain the hydrological regime and reduce impacts of impervious surfaces, there is the potential that a local land use change will result in some alteration in the hydrologic regime (i.e., increased flow volumes and/or altered seasonal timing) and sediment regime (i.e., initially more fine sediment being supplied to the channel followed by an overall decrease in loadings). These alterations can result in changes in the channel planform, bank erosion, cross sectional area and substrate composition, which, in turn, may affect aquatic habitat, riparian habitat and water quality.

Baseline monitoring should be established through future quaternary or subwatershed studies, and as land use plans and designs evolve, additional monitoring locations should be established, and baseline surveys completed, for reaches downstream of headwater drainage features slated for removal and stormwater outfalls. Monitoring should subsequently take place annually to fulfill performance evaluation requirements through to the post-construction/development period. Specifically, the following steps should be taken to monitor development impacts:

- **Control Cross-sections:** Are to be monitored annually during periods of low flow. An additional site visit should be conducted at each site following a peak storm in excess of the 5-year storm event for the system. Cross section morphology from each visit should be overlaid and compared. Changes in cross-sectional area the context of acceptable ranges of adjustment will trigger a review of the need for mitigation in the form of restoration (based on professional review).
- **Substrate Composition:** A modified Wolman pebble count should be conducted at each control cross-section on an annual basis, the results of which will be tabulated in a particle size distribution chart. An additional site visit will be conducted at each site following a peak storm in excess of the 2 to 5-year storm event for the system. Grain size adjustments in excess of an order of magnitude will act as a trigger for investigation. Due to the dynamic nature of substrate composition, no action should be taken until Year 5 unless the adjustment is identified as a potential risk to the function of the channel by a qualified geomorphologist.

- Lateral Migration:** A series of erosion pins (minimum of 5) installed in areas of active bank migration, as well as areas of anticipated migration should be measured on an annual basis during low flow conditions to determine rates of bank adjustment. An additional site visit will be conducted at each site following a peak storm in excess of the 2 to 5-year storm event for the system. Annual migration rates in excess of 20 cm/year will trigger an assessment by a geomorphologist to determine whether the adjustment is localized or representative of broader site conditions. Mitigation measures would be recommended based on the extent and source of the issue.
- Photographic Record:** Photographs from a known vantage point should be used to document general geomorphic site conditions on an annual basis. An additional site visit will be conducted at each site following a peak storm in excess of the 2 to 5-year storm event for the system. These photographs will be used as supplemental information to inform decisions regarding the need for mitigation.

Analysis of ongoing monitoring may be used for adaptive management of the study area; however, mitigation should only be applied following an investigation into the causes. The exception being major adjustments requiring immediate works where risk to property, human safety, or infrastructure is imminent. Mitigation measures would be recommended based on the extent and source of the issue. Table 24 summarizes monitoring parameters and example indicator thresholds for investigation.

Indicator targets should be developed appropriately based on existing/baseline conditions for each site. These targets and methods should be supported by a professional who is qualified to practice fluvial geomorphology.

Table 24 Summary of Typical Fluvial Geomorphology Monitoring Targets

Monitoring Parameter	Indicator Monitoring Threshold*
Bankfull cross-sectional area (m ²)	Maintain bankfull cross-sectional area within acceptable tolerances based on continued measurements of the baseline condition.
Mean bankfull channel depth	Maintain bankfull depth within acceptable tolerances based on continued measurements of the baseline condition.
Bank migration rates (cm/yr.)	Normal migration rates within acceptable tolerances of bankfull width per year where migration is expected (i.e., cutbanks). As rates may vary due to extreme flood events; evaluate migration over the longer term (e.g., 3-5 years).
Substrate distribution, D ₅₀ and D ₉₀	Maintain D ₅₀ and D ₉₀ particle sizes within acceptable tolerances based on continued measurements of the baseline condition. As sizes may vary due to extreme flood events; evaluate substrate trends over the longer term (e.g., 3-5 years).

Note: * Threshold exceedances, if documented, will require an interpretation of site conditions and trends by a qualified Professional Geomorphologist to explore if any adaptive management or remediation recommendations are appropriate.

This system monitoring could be undertaken by a variety of parties, including the Local Municipality and / or Conservation Authority. However, a fluvial geomorphologist should interpret the findings

and assess whether substantial change has occurred. The geomorphologist should also be able to link any change with the causative factors and processes. For natural channel designs, it is recommended that the proponent responsible for the design develop and undertake an appropriate monitoring plan, similar to that proposed for overall system monitoring.

Additional consideration for new technologies and techniques can be made when developing and implementing a stream morphology monitoring program. New technologies, such as the use of UAV to capture aerial imagery of the watercourse for annual comparison, would enable the capture of high-resolution colour imagery or high-definition video for analysis purposes.

8.3.5 Aquatic Ecology

Monitoring of aquatic habitat is necessary to confirm that designed or altered aquatic systems are functioning as intended. Monitoring may be initiated by requirements for habitat reconstruction or compensation needs (e.g., permit requirements), and/or by known or potential impacts on aquatic features resulting from site development. The detailed effectiveness- of monitoring programs must be developed in consultation with the relevant regulatory agencies during detailed design, consistent with federal and provincial expectations, and should be informed by parent studies, updated existing conditions, and baseline monitoring studies. Site-specific monitoring of all constructed habitat will be required to demonstrate that the habitat is stable, sustainable, and performing as designed. Additional monitoring may also be needed to evaluate the effectiveness of SWM facilities and LID measures in mitigating water-quality and thermal impacts.

Pre-construction (baseline) Monitoring

Baseline monitoring establishes existing conditions and provides the reference point for evaluating post-construction performance.

- **Fish community** — Baseline assessments are required to document existing fish community and species and to guide natural channel design(s) and localized habitat enhancements. Designs and enhancements need to incorporate features that have a composition and morphology to target the fish community. A standardized assessment protocol such as the Ontario Stream Assessment Protocol (OSAP) is recommended, including the three-pass electrofishing method with block nets described by Stanfield (2010). Final method selection should be confirmed with the Conservation Authority and should be consistent between pre- and post-construction phases.
- **Aquatic habitat** — Detailed habitat mapping of existing watercourses should be completed as part of the Fish Habitat Offsetting Plan and Fisheries Act approvals. Using a standardized protocol such as OSAP ensures comparability between pre- and post-construction assessments.
- **Benthic invertebrates** — Baseline benthic invertebrate sampling is recommended to evaluate aquatic health and water quality, and for comparison following channel realignment and development construction. Approved methods and guidance documents should be followed in consultation with the Conservation Authority (if applicable) and other agencies, as applicable.

Post-construction Monitoring (Natural channel Designs)

Monitoring of impacts related to broader development construction and stormwater infrastructure should be completed for the same components methods as that for pre-construction (above), and be compared for potential impacts requiring interpretation, continued monitoring and/or adaptive management.

In instances where development requires natural channel design for realignment or other watercourse enhancements, the design report should outline specific monitoring requirements based on the intent of the design, anticipated stability (stable or dynamic), and intended habitat or species targets. Post-construction monitoring evaluates whether constructed habitat features are stable, functioning, and supporting the intended aquatic community.

- **Aquatic habitat** — post construction monitoring includes detailed assessments and mapping of pools, riffles, and installed habitat features. Comparisons to the detailed design plan will confirm whether constructed features are aligned with the design drawings and details. Functional assessments of habitat designs should also be completed following construction. Ideally, monitoring should occur over a 10-year period in order to evaluate the effectiveness of the constructed channel to sustain its function as designed. The frequency and timing of monitoring should be established through the SWS in consultation with the Conservation Authority and other agencies, as applicable.
- **Fish community** — Monitoring stations should be established in a range of locations that capture the designed habitat features, and intended ecological function along the reach or system. The objective is to confirm that the target fish community is establishing in the realigned/designed system. The same methodology used during baseline surveys must be applied post-construction. Monitoring should ideally occur over a 10-year period, to evaluate the re-establishment, health, abundance and diversity of the fish community in the design channel. The frequency and timing of monitoring should be established through the SWS in consultation with the Conservation Authority and other agencies, as applicable.
- **Benthic invertebrates** — Post-construction benthic invertebrate assessments help determine whether the realigned channel is functioning as intended. Benthic invertebrate assessments provide an effective means to assess aquatic health and water quality relative to baseline conditions and over time. Approved methods and guidance documents should be followed in consultation with the Conservation Authority and other agencies, as applicable.

Development related monitoring should be site-specific, with guidance determined through a SWS, and ongoing planning studies (e.g. MESP, block plans, tertiary plans), and through the development application process. Review and input should be provided at each stage by the Local municipality(ies), Conservation Authority and other agencies, and First Nations communities, as applicable.

An adaptive management approach to monitoring should be initially developed through the SWS, and refined through detailed design approvals process, and subsequent site plans. Monitoring plans should clearly identify specifics of an adaptive management approach, and when feedback and

design adjustments should occur. Key milestones—such as the end of years 1, 3, 5, and 10—should be established to allow agencies to evaluate system performance and stability. This process will help identify deficiencies in channel function and guide corrective actions or design refinements.

8.3.6 Terrestrial Ecology

Development-related ecological monitoring will be site-specific, as established through a SWS and refined in support of development applications. It is recommended that the municipality lead these efforts but with guidance and support from the local Conservation Authorities and other partners wherever possible.

Terrestrial and wetland monitoring will address and confirm/validate anticipated impacts (per an SWS or EIS) and identify early results of any proposed Natural Heritage restoration (e.g. wetland restoration). This monitoring may include:

- **Pre-construction monitoring:** establishing monitoring locations and completing baseline inventories/mapping, and other related work.
- **During-construction monitoring:** assessing the effectiveness of required environmental protection and mitigation measures, including the integrity of buffers and setbacks.
- **Post-construction monitoring:** evaluating early restoration success within the Natural Heritage features, including plant establishment and warranty-related performance.

Monitoring efforts should remain practical and targeted to areas where validating impact predictions or assessing natural heritage restoration success will provide meaningful information. Specific monitoring components (e.g., vegetation, breeding birds, anuran call surveys) will be determined based on the objectives and content of development applications, the detailed design of the secondary plan area, and block or community-level planning through the parent SWS.

Two parallel monitoring programs are recommended:

- **Holistic monitoring:** long-term assessment of ecological conditions and changes at the landscape scale.
- **Effectiveness monitoring:** evaluation of how well mitigation strategies perform at a local scale and identification of Best Management Practices (BMPs) to support adaptive management.

Since the holistic program should be established in advance of effectiveness monitoring, its key elements are summarized below. The effectiveness program requires site specific information regarding proposed land use change/development, and required mitigation strategies for each site. Therefore, effectiveness monitoring should be established through later planning stages as part of an MESP (or other equivalent study) and refined through future functional servicing studies. Opportunities to integrate data from Conservation Authority watershed monitoring programs (e.g., watershed report cards) should also be explored.

Generally, monitoring of the NHS should:

- Employ measures and methods that will effectively monitor terrestrial and aquatic features and systems, with a focus on those most likely to reflect changes in condition during the period of monitoring.
- Include pre-, during- and post-construction / development monitoring to ensure baseline and monitoring for short and longer-term impacts are captured (e.g., 5 years post-construction).
- Be structured and executed in a manner that captures appropriate timing and frequency to monitor change efficiently and effectively.

The monitoring program is to be designed for and include recommendations for adaptive management responses and how the proposed monitoring plan will inform or trigger adaptive management and inform the response to address issues or concerns as may be identified through the course of monitoring. This should include direction to amend and update the plan to reflect the change in mitigation and the need to re-assess frequency, and duration of the monitoring plan. As appropriate, reference to legislation or regulation(s) should be made to support compliance.

Guidance on typical components is provided in the text below.

Vegetation

Vegetation monitoring should focus on change in conditions which may be attributed to impacts from or conditions resulting from development. Generally, this should include:

- Ecological Land Classification (Lee et al, 1998, or updated standards as may be developed) to monitor for changes in community type and boundaries, which may reflect changes in hydrology or other environmental conditions. Community monitoring should use a ‘red-line’ approach, demarking changes in community type, boundary or condition.
- Vegetation plot transects to monitor species composition in selected representative habitats over time. Transects should be placed to capture the range of communities present and placed, to the extent possible, perpendicular to feature boundaries to look at edge impacts, ingress of invasive species, etc. The same transects and interval distances are to be used for every monitoring event.

Ecological Land Classification should include at least one year of pre-construction monitoring and occur every other year throughout construction (e.g., years 1, 3, 5, etc.) and include monitoring at 1, 3, and 5 years post-construction. Monitoring should occur once, during the early to mid-summer in monitoring years. Timing of surveys should be consistent across monitoring years to facilitate comparison year-over-year.

Transect surveys should include at least one year of pre-construction monitoring and occur every other year throughout construction (e.g., years 1, 3, 5, etc.) and include monitoring at 1, 3, and 5 years post-construction. Monitoring should occur three times per year – spring, summer, fall – in monitoring years. Timing of surveys should be consistent across monitoring years to facilitate comparison year-over-year.

Breeding Birds

Breeding birds are to be monitored using 10-minute point count methods in accordance with the Ontario Breeding Bird Atlas (OBBA) protocols. Alternative, standardized methods, consistent or comparable to OBBA (e.g., Forest Bird Monitoring) may be appropriate in some site conditions. Any proposed method must include consideration for replication so that data can be compared year-over-year. Point count locations should be clearly identified and selected to permit their use across pre-, during-, and post-construction monitoring without the need to move (barring unforeseen circumstances).

Breeding bird surveys should include at least one year of pre-construction monitoring and occur every year throughout construction and include monitoring at least 3 years post-construction monitoring. Monitoring should occur include two surveys during the breeding bird period and in accordance with OBBA protocols (time between surveys, time of day, weather, etc.).

Calling Amphibians

Where amphibian breeding habitat is identified, monitoring is to include surveys for calling amphibian species. Calling amphibian surveys are to be conducted using passive auditory point count method consistent with the Marsh Monitoring Program (Bird Studies Canada 2008). Modifications to the MMP protocol regarding habitat size, distance between survey stations, etc., are permitted to ensure coverage of features present is achieved. Monitoring stations should be identified and placed in a manner which provides coverage of the subject property for assessing presence / absence and relative abundance of amphibian species present.

Calling amphibian surveys should include at least one year of pre-construction monitoring and occur every year throughout construction (e.g., years 1, 3, 5, etc.) and include monitoring at least 3 years of annual post-construction monitoring. Three monitoring events are to occur per year in accordance with the MMP protocol (approximately April, May and June) of each monitoring year. Exact timing should be established based on conditions (temperature, weather) and focal species (e.g., chorus frog).

Other Terrestrial Monitoring

The monitoring components listed above include those most common to development and post-development monitoring. The terrestrial monitoring program may require additional surveys be included to address the one or more of the following:

- Vegetation protection zones and/or enhancements and/or compensation features
- Habitat structures proposed as part of a mitigation or compensation plan
- Specialized species surveys (e.g., endangered bats, marsh birds, salamanders, rare snakes, turtles –hibernation, nesting and/or basking), rare insects)
- Rare or uncommon species of plants, and

- Species at Risk and/or Compliance Monitoring (e.g., required to comply with permits or other authorizations).

Protocols and methods for additional monitoring types should be identified based on common or best practice, available standardized survey methods, and purpose of the monitoring (e.g., presence / absence).

8.4 Reporting Monitoring Outcomes

The purpose of the monitoring program is to ensure water quality, water quantity, aquatic and terrestrial features and their functions are maintained in the County even in a context of growth. However, for the monitoring completed to be of value, it is critical that work done and key outcomes be summarized and shared with local Council, local Municipalities, First Nations, local Conservation Authorities and interested members of the community.

An integrated monitoring program focuses on a diverse range of monitoring parameters that act as indicators of ecosystem health. Integrating expertise from such disciplines as meteorology, hydrogeology, hydrology, terrestrial, fluvial geomorphology, water quality, and biology allows for many facets of the environment to be simultaneously analyzed. Five-year summaries of the program are a good period of time over which to assess and discuss spatial trends.

Documenting and sharing these results in a clear and understandable way (e.g., through report cards and/or status summaries once every two to five years is as important as collecting and analyzing the data.



Aerial imagery of drumlins across Peterborough County, Ecoregion 6E (Credit: Flickr)

9 Watershed Planning Recommendations

This Watershed Plan provides a synthesis of the available and relevant data at the tertiary at quaternary watershed scales (i.e., Volume 1) and guidance to inform planning and management direction, and future studies, to advance and implement the vision, goals and objectives of this Plan (Volume 2). This section focuses on guidance for informing the County's Official Plan which, at the time of writing this document, had been updated and approved by Council but remains before the Province for approval, and does not yet include any maps as schedules or appendices, including natural heritage and water resource mapping.

It is also anticipated that quaternary-scale / more area-specific subwatershed plans will start to be advanced to support planning in identified future growth areas, starting with the highest priority areas (as discussed in Section 7). As future studies proceed, NHS and WRS identification and mapping are expected to be refined, along with an understanding of these systems, which may also inform future Official Plan policy updates.

Irrespective of the scale of study, a collaborative and consultative approach of engagement with local communities, Municipalities, First Nations, Conservation Authorities, and other stakeholders and experts is recommended and, with respect to the Official Plan and other planning studies, required.

Key considerations when updating Official Plan policies in the County, while also trying to advance the vision, goals and objectives of this Watershed Plan (see Section 3), are as follows.

- Natural heritage system planning, water resource and natural hazard management and climate change considerations must be incorporated into Official Plans to meet established provincial and other regulatory requirements.
- Accommodating the Province's requirements for population and employment increases while also addressing the applicable regulations and policies increases the need and creates opportunities for active natural heritage, natural hazard and water resource management.
- Identified future growth areas have been identified prior to the comprehensive identification of NHS and WRS components, and thus it is possible that the specific extent and location of available lands for residential and employment uses may need to be refined once informed by future environmental studies.
- The potential impacts of climate change are not fully understood. Taking a precautionary approach may be most appropriate when setting policy directions and identifying minimum standards.

This Watershed Plan is to provide guidance for identification and mapping of components of an NHS and WRS, including the integrated consideration of these components (as outlined in Section 4). The bulk of the Official Plan guidance provided in this section relates to this direction.

It is understood that updates and refinements to the Official Plan must also consider matters not considered through this Watershed Plan and will also need to consider input received through

engagement, and therefore it is anticipated that some of the guidance in this section will be refined in the future through the update process.

It is recommended that the comment-response matrix in Appendix A of Volume 2 of this Watershed Plan, (i) serve as a transparent record of the feedback received on this first high-level Watershed Plan, and (ii) be re-considered through future engagement as part of more detailed area-specific growth or development plans in the County, as appropriate. This is to help ensure that the feedback and insights gathered as part of this County-wide study are re-considered as part of more area-specific studies, as appropriate.

9.1 Official Plan Policy Guidance: Water Resources

Building a Water Resource System (WRS): The County's policies related to identifying a WRS must align with applicable source water protection guidance (TCC 2025a, b) and the most current sources of provincial guidance (e.g., related to natural hazards, headwater drainage features, etc.) at a minimum.

The County's Official Plan must, at a minimum, refer to, and define, the Water Resource System as including the following components (which should also be defined):

- **Key Hydrologic Features (KHF) including permanent and intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands; and**
- **Key Hydrologic Areas (KHA) including significant groundwater recharge areas (SGRA), highly vulnerable aquifers (HVA) and significant surface water contribution areas.**

It is also recommended that:

- **Natural hazards be considered to the extent possible with the other WRS components, in consultation with the Conservation Authorities, as part of Official Plan updates to ensure a comprehensive approach. (Note, currently, both floodplain and erosion hazard mapping are lacking for most of the County, representing a key gap for current and future land use planning that will need to be filled as part of future subwatershed or other environmental studies (as outlined in Section 8.2 and Appendix B)).**
- **Even though HDF mapping is not currently available, HDFs should be explicitly identified and considered as components of the WRS (e.g., through quaternary-scale / subwatershed studies) to the greatest extent possible in partnership with the Conservation Authorities who should have these data available as part of their hydrologic analyses.**

Based on an understanding of the County's biophysical context and good practices from other jurisdictions, it is recommended that the following WRS components be considered and, where possible mapped:

- **Vegetation Protection Zones associated with KHF**

- Recharge / discharge areas other than those captured as KHF and KHA, and
- Ecologically Significant Groundwater Recharge Areas (ESGRA).

The guidance provided in Section 4.3 (see Table 4), Section 5.2, Section 5.3 and Section 5.4 of Volume 2 of this Watershed Plan has been provided to support implementation of this recommendation.

Developing Locally Appropriate Guidance for Feature-Based Water Budgets: The current Official Plan does not include requirements for a features-based water balance for new development lands adjacent and/or contributing to protected wetlands. It is understood that the Conservation Authorities have had mixed results in applying the available feature-based wetland water balance guidance developed by the TRCA to local development proposals. As such, there is a need for a more locally applicable guideline and / or formal terms of reference for implementation in the County, one that considers the relevant aspects of the biophysical context in Ecoregions 5E as well as Ecoregion 6E.

The County's Official Plan should include policies that require maintenance of groundwater recharge rates between the existing and future land use condition, including through application of low impact development measures. The County and Local Municipalities should also support the development of locally-appropriate feature-based water balance guidelines, likely by the local Conservation Authorities.

The guidance provided in Section 5.2.3 and Section 6.1.1 of Volume 2 of this Watershed Plan has been provided to support implementation of this recommendation.

Including Protection for Lakes and Shorelines Outside Growth Areas: Over the course of developing this Watershed Plan concerns from Council, the community, First Nations and the local Conservation Authorities were raised about increasing pressures on some of the County's many lakes relates to localized new lot creation and/or intensification on existing lots (see Section 5.3 of Volume 2 of this Watershed Plan and Appendix A). The gaps in both data and policies to inform and support the identification, protection and management for sensitive lakes was also identified by the consulting team based on the review completed for this Watershed Plan.

To address this gap, it is recommended that the County, Local Municipalities, First Nations and local agencies review and strengthen lake protection and shoreline policies across the County with a particular focus on identifying, prioritizing and managing lakes considered sensitive to changes in surrounding land uses and associated impacts.

The guidance provided in Section 5.3 and Section 6.1.1 of Volume 2 of this Watershed Plan has been provided to support implementation of this recommendation.

Clarifying and Strengthening Water Resource System Policies - Flood Hazards: The County's current Official Plan speaks to "flooding and erosion". However, spill flood hazards are becoming more prevalent as a unique hazard distinct from contained riverine flooding, especially in areas of intensification.

The County should update its Official Plan to include specific policy language around spill flood hazards.

On June 12, 2026, the Province released a proposed update to the [Technical Guide - River and Stream Systems: Flooding Hazard Limit and Technical Bulletin - Special Flooding Hazard Conditions in River and Stream Systems](#). This technical bulletin outlines how spills can be modelled using two-dimensional modelling techniques. Local Conservation Authorities (such as Otonabee Conservation) have already successfully applied this approach to two projects in the City of Peterborough.

Ensuring and Integrated Approach to Water Resource System (WRS) and Natural Heritage System (NHS) Planning: Current provincial policies require municipalities to identify and protect water resource systems including ground water features, hydrologic functions, natural heritage features and areas and surface water features including shoreline areas, to maintain the ecological and hydrological integrity of watersheds. Although Provincial and County policies identify these systems separately, it is imperative to consider and update mapping of features and areas associated with the WRS and NHS in an integrated way, to inform the identification of sensitive features and areas.

The County and its partners should advocate for and ensure an integrated approach to Water Resource System (WRS) and Natural Heritage System (NHS) planning is promoted in the Official Plan and implemented through environmental studies at all scales, from watershed and subwatershed to Environmental Impact Studies.

The guidance provided in Section 4.4 and Table 5 of Volume 2 of this Watershed Plan has been provided to support implementation of this recommendation.

9.2 Official Plan Policy Guidance: Natural Heritage

Building a Natural Heritage System (NHS): The County currently has comprehensive natural heritage policies but lacks natural heritage mapping, which is required for parts of the County in Ecoregion 6E and may also be helpful in Ecoregion 5E. The County includes many biologically diverse areas that are distinct. However, from a planning perspective, Ecoregion 5E covering the north/northeastern part of the County and Ecoregion 6E covering the south/southwestern part of the County reflect an important biophysical difference which is also recognized in provincial policy.

It is recommended that the County develop and implement an approach to NHS identification, including mapping, that builds the system “from the ground up” based on the natural heritage features and areas considered significant in the County based on the most current and comprehensive data and mapping. As part of this approach, these features (as appropriate) should be identified (in policy and, where appropriate, in mapping) with minimum vegetation protection zones and functional linkages, which should be identified to maintain system connectivity.

As part of this process:

- **Natural features and areas (as appropriate) should be identified (in policy and, where appropriate, in mapping) with minimum vegetation protection zones and functional ecological linkages between them to maintain and, where possible, enhance system connectivity**
- **Potentially different approaches to identifying the County's NHS in Ecoregion 5E versus Ecoregion 6E should be carefully considered as part of the process for advancing the NHS identification, and**
- **There should be broad engagement with local First Nations, agencies, institutions and community organizations and members (including outreach to the former KNC NHS partners).**

The guidance provided in Section 4.2.1, Section 4.2.2 (including Table 3) and Section 5.1 of Volume 2 of this Watershed Plan has been provided to support implementation of this recommendation.

Clarifying and Strengthening Natural Heritage Policies: As outlined in this Watershed Plan (see Section 4 and Section 5) in the County's Official Plan:

- The current policies for significant and non-significant wetlands are not entirely clear and could be improved
- The current policies for significant woodlands could be improved with some locally appropriate criteria and measures for identification derived from analysis of local data, including analysis and recognition of old growth stands
- The current policies for significant valleylands could be improved with some locally appropriate criteria and measures for identification derived from analysis of local data and input from the Conservation Authorities and other agencies, particularly in Ecoregion 6E
- The current policies for significant wildlife habitat (SWH) could be broadened and strengthened with references to available provincial guidance
- Natural Core Areas (which currently include provincially significant wetlands (PSW), locally significant wetlands (LSW), unevaluated wetlands and streams plus a 30 m vegetation protection zones around all those features) could be expanded to include some other significant features and areas, and
- Policies around ecological linkages could be enhanced.

It is recommended that the County review and consider updating its Official Plan policies related to natural heritage features and areas, and the Natural Heritage System as a whole. This should include considering:

- **Clarifying the distinction between Locally Significant Wetlands (LSW) and Non-significant Wetlands (NSW)**

- **Clarifying that unevaluated wetlands are to be treated as significant until formally assessed**
- **Enhancing County-specific criteria for identifying woodlands as significant, including specific consideration of old growth forests and potentially different thresholds and/or criteria for Ecoregion 5E versus Ecoregion 6E**
- **Developing locally appropriate criteria and measures for identification derived from analysis of local data, particularly in Ecoregion 6E**
- **Building on flooding and erosion hazards identified in the Water Resource System (i.e., taking an integrated approach)**
- **Broadening the SWH policies to, in addition to noting sand barrens, savannahs, tallgrass prairies and alvars, pointing to other SWH types identified in other established provincial guidance for Ecoregions 5E and 6E**
- **The County could consider referencing these sand barrens, savannahs, tallgrass prairies and alvars in the context of broader SWH policies to ensure consideration for strengthening protections for them.**
- **Enhancing Natural Core Areas to include terrestrial natural heritage features and areas considered significant, particularly those already afforded protection under the PPS (2024) in Ecoregion 5E and 6E**
- **Ensuring connectivity within the NHS is maintained and, where possible, improved by recognizing woodland corridors, wetland complexes, and riparian zones and potentially other features as ecological linkages providing connectivity at both the regional (i.e., County or tertiary watershed scale) and local scale (e.g., subwatershed scale).**

The guidance provided in Section 4.2.1, Section 4.2.2 (including Table 3) and Section 5.1 of Volume 2 of this Watershed Plan has been provided to support implementation of this recommendation.

Enhanced Support for Stewardship: The County is fortunate to have many local organizations that are interested in supporting and advancing local stewardship (as outlined in Section 1.3 and Section 10 of this Volume 2 of the Watershed Plan).

The County should consider adding one or more policies supportive of stewardship, including potentially speaking to support for securement of lands as well as invasive plant species management.

9.3 Other Watershed-Related Policy Guidance

Climate Change Adaptation: Given the projected increases in temperature, extreme rainfall, and hydrologic variability (including periods of drought), the County's Official Plan should recognize the following as cornerstones of adaptation and climate change management:

- Flood risk management
- Stormwater management, including leveraging the services provided by green/natural infrastructure
- Protection and restoration of natural features and areas
- Erosion management, and
- Building drought resilience while also addressing fire risks.

Supporting and Investing in Long-term Monitoring: Monitoring a jurisdiction the size of County's with such vast and diverse natural heritage features and areas is complex. However, strategic and consistent long-term monitoring of targeted features and areas using transparent protocols that are easy to replicate can ensure that the NHS and WRS policies and plans are functioning as intended.

Existing surface and groundwater monitoring (as identified in Volume 1) should be proactively expanded (including installation of new climate stations, surface water gauges and groundwater monitoring wells), prioritizing gap filling in quaternary watersheds containing identified growth areas.

The County's Official Plan should commit to supporting and investing in a strategic monitoring and adaptive management plan, in partnership with the Conservation Authority and others as applicable.

Further, the County and its municipal partners should work to integrate the emerging monitoring requirements from the Province (MECP) as related to municipal responsibilities under the Consolidated Linear Infrastructure (CLI) Environmental Compliance Approval (ECA).

The data consolidated in Volume 1 (including records and mapping of existing surface and groundwater monitoring stations) and the guidance provided in Section 8 of Volume 2 of this Watershed Plan has been provided to support implementation of this recommendation.

Advancing Consistent Tools for Protection for Lakes and Shorelines: Over the course of developing this Watershed Plan a key gap in policies and guidance to inform and support the identification, protection and management of both cold/coolwater and warmwater lakes was identified (as discussed in Section 5.3 of Volume 2 of this Watershed Plan).

To address this gap, it is recommended that the County and its municipal partners (including local agencies) support and / or advocate for the development of more comprehensive lake ecosystem sensitivity thresholds related to shoreline / watershed development capacity for both warm and coolwater waterbodies.

This work should be undertaken in collaboration with local agencies, including Conservation Authorities and build on existing provincial and federal guidance and leadership in this area.

Advancing Natural Hazard Mapping: As confirmed through this Watershed Plan (see Volume 1), there are some key gaps in the available natural hazard mapping, as well as shoreline and flood hazard lines that have been mapped for some of the lakes within the County by the Conservation Authorities but not incorporated into the mapping for this Watershed Plan. As shown in Figure 11, the County also has extensive karst landscapes (known, inferred and potential), as well as areas of unstable soils (see Figure 12 for the current County-wide soils mapping).

Updated County-wide high-level natural hazards mapping developed in consultation with the local agencies, including Conservation Authorities, should be incorporated into the County's Official Plan along with updated policies aligned with the most current guidance as a top priority. Updated policies should specifically and explicitly acknowledge karst features and areas of unstable soils as extant natural hazards, that need to be considered in all planning applications. This high-level mapping can provide a basis for more detailed studies, which may result in iterative refinements to the high-level mapping based on area-specific field work and modelling.

The Official Plan should be updated with (a) County-wide high-level natural hazards mapping developed in consultation with the local agencies, and (b) natural heritage policies aligned with the most current guidance including policies to explicitly acknowledge karst features and areas of unstable soils as extant natural hazards that need to be considered in all planning applications.

This work should be undertaken in close collaboration with local agencies, including Conservation Authorities.

The data consolidated in Volume 1 (including records and mapping of existing surface and groundwater monitoring stations) should support implementation of this recommendation.

Recognizing the Value and Services Provided by Natural Assets: There are already several regulatory and policy tools in place to help protect natural flood storage areas. For example, preservation of riparian storage associated with regulated floodplains is a core requirement of Conservation Authorities. In addition, the County's Tree Canopy and Vegetation Policy commits the County to proactive protection and management of its forests, as well as other treed assets. Wetlands also contribute significantly to water storage on the landscape, which is increasingly important in a context of climate change, and are generally protected through provincial and County policies.

However, there are also asset management regulations in Ontario (i.e., Ontario Regulation 588/17) that requires municipalities to consider their green infrastructure, including natural heritage features and areas, as part of building local resilience to climate change. Having this information can also be another tool for engaging stakeholders and helping to inform and prioritize environmental management efforts.

The County should work with local agencies to formally recognize the ecosystem services (such as flood storage) being provided by the natural areas and features across the County, and consider formally assessing these services and value of the natural assets on lands it owns and manages as part of a municipal natural asset management plan.

Recognizing Water and Natural Heritage Resource Integration: As underscored throughout this Watershed Plan, recognizing functional linkages between terrestrial and aquatic features and areas, as well as surface and groundwater features (e.g., lake shorelines, creeks and baseflows provided to them, seepage areas etc.) is a critical part of understanding and managing these systems so that they can be sustained in a context of both growth and climate change.

Official Plan policies should recognize and support work to identify and understand how water and natural heritage resources function in integrated ways at different scales. This includes considering:

- **Natural hazards to the extent possible that overlap with NHS and WRS components, and**
- **Enhancing some natural heritage policies to account for the impacts due to anticipated climate change, recognizing that interconnected systems are more resilient to environmental shifts.**

The guidance provided in Section 6 of Volume 2 of this Watershed Plan has been provided to support implementation of this recommendation.

Recognizing the Importance of Study at Different Scales: In its policies on watershed planning, the County and local Municipalities commit to implementing a watershed-based approach to land use planning and water management through a “watershed management plan”. Although it may be implied, it is important to recognize that study at different scales is needed to provide different types of information.

Official Plan policies should:

- Recognize the strategic need for both watershed and subwatershed plans, as well as other supporting technical studies, to advance sustainable land use planning in a context of climate change
- Recognize the ability of subwatershed plans to guide intensification efforts of lands already developed in part
- Require comprehensive subwatershed studies be completed for quaternary watersheds that interact meaningfully with identified growth areas prior to implementing Secondary Plans and comparable area-specific land use plans, and
- Clearly state that site-specific EIS should only be done after a subwatershed study has conducted a watershed-based assessment including consideration of cumulative impacts.

The guidance provided in Section 7.1, Section 7.2 and Appendix B of Volume 2 of this Watershed Plan has been provided to support implementation of this recommendation.

9.4 Other Notable Data Gaps

A key deliverable from this Watershed Plan is the identification of data gaps related to both the WRS and NHS. Key gaps related to data and mapping are identified in Volume 1 of this Watershed Plan. Key gaps which have been identified as priorities which are not directly related to the Official Plan but which would greatly facilitate advancing the watershed planning in the County, as outlined above, are as follows.

County-wide Rainfall Data: There is uncertainty regarding the magnitude and timing of changes in extreme rainfall and how these changes will affect specific tributaries in Peterborough County.

Continued collaboration with Conservation Authorities where they exist and provincial and federal agencies (e.g., MNR, Parks Canada) will be required to refine modelling inputs, update floodplain mapping, and adjust infrastructure design standards as new climate science becomes available.

County-wide ELC Mapping: Reasonably current Ecological Land Classification (ELC) for southern Ontario (Lee et al. 1998) mapping is available for a few subwatersheds including Kawartha Conservation and Ganaraska Conservation's jurisdictions. However, most of the County does not have ELC coverage, even at a coarse (i.e., desktop) level.

ELC mapping remains the current standard for southern Ontario and has been in place for nearly 30 years. It would be very helpful to have this mapping completed, at least for the lands in Ecoregion 6E as a start, to provide a technical basis to inform NHS policies and mapping on this part of the County. As noted by the Conservation Authorities, ELC mapping is also used as a base layer to help inform accurate flood mapping and predictions.

The County and its Local Municipalities should strongly support the development and maintenance of County-wide ELC mapping among and by the local agencies with the skills and capacity to do so (e.g., the Conservation Authorities) to inform Official Plan mapping, improved flood forecasting, and ongoing development planning, among other matters.

Setting Priorities for and Advancing Lake Capacity Studies and Related Lake Management Plans: Section 2.7 of Peterborough County's Official Plan currently includes guidance to protect "at capacity" lakes from further development. The community, First Nations and Conservation Authorities have indicated strong support for this direction and requested it be supported with guidance regarding the steps necessary to confirm lake capacity in this Watershed Plan.

Based on the review and engagement completed for this Watershed Plan, it is understood that the current status of the many lakes within the County remains unknown and that provincial policy guidance is lacking to inform this status (as outlined in Section 5.3 of Volume 2 of this Watershed Plan). Therefore, it would be premature to suggest priorities and identify potentially responsible parties or update frequencies for lake assessments and plans.

However, it is suggested that the Watershed Planning Committee (recommended in Section 10.3) could provide a forum for developing and advancing more comprehensive lake ecosystem sensitivity thresholds related to shoreline / watershed development capacity for both warm and coolwater waterbodies. The Watershed Planning Committee could also provide a forum, with or without this more comprehensive guidance, for discussing and identifying a framework for setting priorities for Lake Capacity Studies and related Lake Management Plans.

It is understood that resources and capacity to undertake this work among the County, Local Municipalities and agencies is currently limited. Therefore, this work will need to be advanced opportunistically and as resources and capacity permits.

The County and its Local Municipalities, in collaboration with local agencies (including Conservation Authorities) and First Nations, should undertake a review of the County's lakes to set priorities for lake assessment and related lake management plans within each quaternary watershed.

The focus could be on lakes in both Ecoregion 5E and 6E in the County where development pressures / land use changes in and around the lakeshore have been, or are expected to be, increasing. Examples identified by the local Conservation Authorities include Lovesick Lake, Crystal Lake and Bass Lake.

Fish Habitat in Ecoregion 5E: Key data gaps in fisheries data (e.g., Nogies Creek subwatershed, including Bass Lake and Crystal Lake) and an outdated Fisheries Management Plan for Zone 17 have been noted by Kawartha Conservation (see Section 4.2 of Volume 2 of this Plan). Additional characterization of fish and fish habitat (specifically within Nogies Creek Subwatershed) and development of an updated Fisheries Management Plan for Zone 17 linked to this Watershed Plan have been identified as priorities to help inform watershed health monitoring and development impact tracking (as outlined by Kawartha Conservation in more detail in Appendix A).

The County and its Local Municipalities should advocate for and / or support updated characterization of fish and fish habitat and development of Fisheries Management Plans where needed on a priority basis to help inform watershed health monitoring and development impact tracking.

Assessing Dam Removals Where Feasible: The extent of the impacts of dams on flooding, fish passage, and water temperature is not well understood within the County's quaternary watersheds. This is further complicated by the presence of the Trent-Severn Waterway, which extends for about 70 km through parts of the County, and continues to be maintained by Parks Canada to preserve the historic lock systems and to maintain water levels of lakes created as by-products of this lock system.

Further study is recommended to assess the broader impacts (i.e., environmental, social, financial, etc.) of dams in the County. Smaller dams, generally those owned by Conservation Authorities, municipal government, or privately, may be targeted for dam Environmental Assessments to better understand function and utility relative to ecological, social value and flow impacts.

As noted elsewhere in this Plan, water and lake management in parts of the County is complicated by the Trent-Severn Waterway which is managed by Parks Canada. The purpose of Trent-Severn Waterway management by Parks Canada is to regulate the levels and flows of the watershed to balance six primary objectives: (1) reducing flood risks, (2) ensuring safe navigation, (3) supporting hydroelectric generation, (4) protecting aquatic habitats, (5) maintaining municipal water supplies, and (6) facilitating recreational enjoyment.

The County should consider potential modifications to existing dams, as resources permit and opportunistically (e.g., through Environmental Assessments), outside of the Trent-Severn waterways drainage / catchment areas.

10 Recommendations to Support Watershed Governance and Stewardship

Peterborough County is a large upper tier municipality of over 4,000 km² with a relatively small population (about 64,000 residents). This vast and diverse jurisdiction has many different owners including:

- **Williams Treaties First Nations:** Peterborough County is the traditional territory of the Mississauga Anishinaabeg and home to the Curve Lake and Hiawatha First Nations. The Hiawatha First Nation, for example, consists of approximately 868 ha of land.
- **Provincial/Government Land:** Significant portions of the County are under conservation, including over 39,000 ha in provincial parks (e.g., Kawartha Highlands Provincial Park alone has over 37,500 ha).
- **Conservation Authorities and Public Bodies:** For example, Otonabee Conservation owns the 243-hectare Birdsall Wildlife Area and the Kawartha Land Trust has protected over 3,200 ha.
- **Private Landowners and Developers:** Large, private, and commercial landholdings exist.
- **Local Municipalities:** The County Forest occupies over 2,000 ha and is located in Douro-Dummer, Havelock-Belmont-Methuen, and Cavan Monaghan.

As a result of the diverse ownership across this large County, governance and stewardship of the natural heritage and water resources in the County is necessarily a shared responsibility.

Although the County already engages with its local Municipalities and First Nations on a regular basis, and also engages with its local Conservation Authorities, there is often limited capacity to coordinate multi-jurisdictional activities that are needed to inform short and long-term planning. This section provides a few recommendations to help coordinate multi-jurisdictional initiatives and stewardship to support implementation of this Watershed Plan.

There are many local agencies, institutions, lake and cottage associations, and other organizations with an active interest in learning about, sharing information about, and helping to steward the natural features and areas in the County, as confirmed through the engagement undertaken for this Watershed Plan (see Section 1.3 of this Volume 2 of the Watershed Plan). Therefore, the County should try to build on and enhance its governance, outreach and engagement as capacity and resources permit, and work to leverage information sharing and identification of potential partnerships with interested parties in the community. Some examples of opportunities to enhance outreach, engagement and stewardship identified incidentally through this project are noted below.

10.1 First Nations Engagement

In 2018, the Williams Treaties First Nations' rights to harvest were re-affirmed by both the provincial and federal governments, including the right to fish, hunt, trap, and gather foods and medicinal plants upon recognized treaty territories including Peterborough County.

Peterborough County is located on the Treaty 20 Michi Saagiig territory and in the traditional territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations which include:

- Alderville First Nation
- Beausoleil First Nation
- Chippewas of Georgina Island First Nation
- Chippewas of Rama First Nation
- Curve Lake First Nation
- Hiawathas First Nation, and
- Mississaugas of Scugog Island First Nation.

The reserve lands of Curve Lake First Nation and Hiawatha First Nation, and the Indigenous-owned Islands in the Trent Waters 36A are under First Nations jurisdiction located within Peterborough County. While the County's Official Plan policies are not directly applicable to the reserve lands of Hiawatha First Nations and Curve Lake First Nations, they are applicable to the wider treaty territory within the County, and they may address planning matters which require cross-jurisdictional coordination.

Over the past two centuries there have been, and continue to be, changes to the lands and waters in and around Peterborough County that have disrupted natural ecological processes and functions. For example, the area was once known for its abundance of wild rice (e.g., the origin of the name Rice Lake) but building of the Trent Severn Waterway caused significant changes to the water levels, contributing to the decline of wild rice beds.

The County has engaged with some of the Williams Treaties First Nations over the course of the development of this Watershed Plan and is committed to continuing to collaborate through follow-on engagement opportunities.

Established mechanisms for collaboration include:

- The Technical Advisory Committee (TAC) for this Watershed Plan which included Curve Lake First Nation and Hiawathas First Nation
- The Treaty 20–Greater Peterborough Area Community Economic Development Initiative (CEDI) which included:
 - A Planning and Consultation Working Group to support consultation processes that respond to the Duty to Consult.
 - A Regional Economic Development Working Group to identify joint community economic development initiatives.
 - An Indigenous Tourism Working Group to explore regional tourism collaboration opportunities, resulting in the formation of a joint Indigenous Tourism and Community Economic Development association.
 - Ongoing efforts to focus on Treaty education and youth engagement about the importance of reconciliation.

Collaborating on implementation of this Watershed Plan presents another opportunity to honour the Ezhi-Wijikiwendiyang (Friendship Accord) signed between the County and local First Nations in November 2019. One of the objectives of this Watershed Plan is to provide high-level guidance to ensure that future changes are accommodated in ways that avoid, minimize, mitigate and – where there are no other feasible alternatives – compensate for negative impacts to the County’s valued land and water resources. This objective, and others in this Watershed Plan, may be aligned with First Nations perspectives and values, which may create space for partnering on aspects of the implementation of this Plan.

It is recommended that the County engage in meaningful ways with interested local First Nations to confirm interest and try to identify mutually agreeable and beneficial opportunities to collaborate on implementation of this Watershed Plan.

10.2 Community Outreach and Stewardship

The County is fortunate to have many engaged community members and groups, including numerous lake and cottage associations, a number of which were engaged in the development of this Watershed Plan. These community members and organizations are often knowledgeable and passionate about stewardship of the environment including lakes particularly in the areas they live and recreate.

A few of the lake and cottage associations and other community groups actively engaging in their communities identified through the engagement for this Watershed Plan include:

- Baxter Creek Watershed Alliance (BCWA) (<https://baxtercreekwatershed.org/>) based in Millbrook and focused on People living and working in Cavan-Monaghan. This organization has a Strategic Plan (2024-2027) and a strong commitment to:
 - supporting reconciliation through ongoing Indigenous learning
 - working with the local farming community (note over 50% of the Baxter Creek watershed consists of agricultural and rural land use), and
 - promoting and implementing natural and cultural heritage conservation through ecosystem restoration and source water protection.
- Environment Council for Clear, Stony and White Lakes (ECCSWL) (<https://www.environmentcouncil.ca/who-we-are>) who published a lake report in 2008 and are committed to implementing this plan focused on sustaining water quality through:
 - preservation and restoration of natural shorelines
 - prevention of pollution from septic systems, and
 - monitoring of municipal planning and development.
- Kawartha Lake Stewards Association (KLSA) (<https://klsa.ca/>) has been involved in lake water quality monitoring since 2001 and, among other activities, published “Climate Change and the Kawarthas, Context, Issues and Response” (2020) as well as annual Lake Water Quality Reports.

- Lovesick Lake Association developed a comprehensive Lovesick Lake Plan (2022) (<https://www.trentlakes.ca/media/ev3nbu0q/lovesick-lake-plan-first-release.pdf>) developed to inform the Lovesick Lake community about the environmental condition and sensitivities of the lake and engage them in stewardship to support its protection.
- Municipality of Trent Lakes Environmental Advisory Committee (EAC) - Shoreline Sub-Committee whose mandate is to advise, provide guidance, and make recommendations to Council on environmental issues (<https://www.trentlakes.ca/media/4pcnnsof/b2024-003-schedule-a-environmental-advisory-committee-terms-of-reference.pdf>).
- Shoreline Conservation: Peterborough County (SCPC) - SCPC focuses on education and advocacy across much of Ecoregion 5E with a particular focus on sustaining healthy lakes. Work over the past five years has included deputations to the five Townships in Ecoregion 5E, submissions to Peterborough County and the Province of Ontario, and presentations to various ratepayers and lake associations.

Other local stewardship organizations, initiatives and resources identified to support watershed stewardship in the County identified through the engagement for this Watershed Plan include the:

- Coalition for Equitable Water Flow (CEWF)
- Federation of Ontario Cottagers' Associations (FOCA) which, among other items, published the "Lake Planning Handbook for Community Groups" which was updated in March 2026 (available for members at <https://foca.on.ca/lake-planning/>)
- GreenUP (<https://greenup.on.ca/>) a long standing environmental non-profit organization that supports communities across the County through programs, education, and outreach
 - GreenUP works with residents, schools, businesses, and municipalities to promote water conservation, stormwater management at the property level, tree planting, and sustainable land stewardship. Through education and community engagement, GreenUP builds local capacity to respond to climate related risks such as flooding and heat
- Lake Partner Program run by the Ministry of the Environment, Conservation and Parks (MECP) in partnership with the Federation of Ontario Cottagers' Associations (FOCA)
- Kawartha Conservation and Climate Partnerships
- Kawartha Land Trust (KLT)
- Ontario Woodlot Association
- Watersheds Canada's (<https://watersheds.ca/>) Natural Edge Program which is already being delivered by some of the lake and cottage associations (such as KLSA).

Notably, although technically outside of the Study Area for this Watershed Plan, the City of Peterborough has adopted the Pathway to Net Zero 2050 Climate Change Action Plan which can provide an example for the County. While the plan focuses primarily on reducing greenhouse gas emissions, it also recognizes the need to build resilience to climate impacts that are already occurring. The plan supports strengthening infrastructure, protecting natural systems, and

integrating climate considerations into asset management and long-term financial planning. It emphasizes collaboration with surrounding municipalities, community organizations, and residents.

It is recommended that the County engage with these organizations and others, proactively and opportunistically, as capacity and resources permit, to identify mutually agreeable and beneficial opportunities to collaborate on implementation of this Watershed Plan.

10.3 Watershed Planning Committee

As part of the Phase 2/3 engagement (see Section 1.3), several parties suggested the County establish a technical resource and / or governance committee dedicated to advising the County and the local Municipalities on matters related to implementing the recommendations and actions outlined in this Watershed Plan. The specific role(s) and members of such a committee remain to be determined, but potential tasks for their scope of work to be considered include:

- Providing a coordinated governance body to inform or guide watershed planning matters
- Coordinating watershed-based monitoring efforts and reporting, and
- Coordinating watershed-based cumulative effects tracking.

It was agreed that this would be a positive way of (a) engaging local First Nations, organizations and agencies with specialized knowledge of the various environmental sensitivities in the County, and (b) ensuring the information and guidance in this Watershed Plan is built upon and carried forward.

It is recommended that a Watershed Planning Committee, or comparable (e.g., Curve Lake First Nation suggested a Watershed Governance Table) be established to support the County and its partners in the implementation of this Watershed Plan's recommendations.

This Committee should consider including representatives with local environmental knowledge from:

- Local Municipalities and the County
- Curve Lake First Nation
- Hiawatha First Nation
- The local Regional Conservation Authority (i.e., Eastern Lake Ontario Regional Conservation Authority, expected to be formalized by February 2027)
- Provincial ministries
- Local environmental organizations

This Committee should have a clear mandate identified in the Committee's Terms of Reference, regularly scheduled meetings, and include some flexibility to refine or amend the representation to include persons with specialized technical knowledge as appropriate. This Committee could also provide a forum for coordinating and advancing watershed monitoring and stewardship initiatives.

11 Summary and Next Steps

Peterborough County is a large upper tier municipality west of the Greater Toronto Area (i.e., over 8,000 km²) that has urban and urbanizing centres, extensive agricultural lands and even more extensive water and natural heritage resources. Biophysically, Peterborough County is broadly characterized by thousands of rivers and lakes with extensive shorelines, as well as extensive forests and wetlands. Physically, the County's natural resources are broadly shaped the fact that the southern third to half of the County is south of the Canadian Shield (Ecoregion 6E) and the top two-thirds are in the transition onto the Canadian Shield (Ecoregion 5E).

This Watershed Plan is documented in two volumes as follows:

1. Peterborough County Watershed Plan Equivalent, Volume 1: Characterization (referred to herein as Volume 1 of the Watershed Plan), and
2. Peterborough County Watershed Plan Equivalent, Volume 2: Planning and Management Guidance (referred to herein as Volume 2 of the Watershed Plan).

Based on the background review, assessments and engagement undertaken, a vision, guiding principles, goals and objectives have been identified for the County's first Watershed Plan, as presented in Section 3 of Volume 2.

The Growth Analysis Report (Hemson, 2022) identified the Otonabee River watershed (in Ecoregion 6E) as an area of future urban growth in its entirety and specifically identified the communities of:

- Lakefield (in the Township of Selwyn and straddling Kashiabog Lake-North River Quaternary Watershed and Lock 19 - Otonabee River Quaternary Watershed)
- Millbrook (in the Township of Cavan Monaghan and Otonabee River Quaternary Watershed)
- Norwood (in the Township of Asphodel-Norwood and Ouse River Quaternary Watershed), and
- Havelock (in the Township of Havelock-Belmont-Methuen straddling Crowe Lake – Crowe River Quaternary Watershed and Round Lake – North River Outlet Quaternary Watershed).

The recommendations in Volume 2 of this Plan build on the comprehensive characterization provided in Volume 1, input from the engagement undertaken and the consulting team's experience with environmental studies at various scales in Ontario. A suite of high-level recommendations to guide watershed planning in the County have been provided in Section 9 and Section 10, with many of these recommendations being supplemented with guidance provided in Sections 4 through 8 of Volume 2 of this Watershed Plan.

Key next steps for the County include:

- 1. Completing updates to its Official Plan following Ministerial approval, including advancing NHS and WRS mapping building on the guidance in this Watershed Plan, and**
- 2. Working with the appropriate local Municipalities and Conservation Authorities to start to advance quaternary-scale/subwatershed studies in the identified priority growth areas, also building on the guidance in this Watershed Plan.**
- 3. Collecting environmental data and filling information gaps through coordinated monitoring efforts by the County with its partners and stakeholders.**

This Watershed Plan should be treated as a living document that is periodically reviewed and updated as new information (e.g., from quaternary/subwatershed studies, climate projections, hydrologic analyses, and monitoring data) become available.

It provides a basis for both sources of data / mapping and planning / management guidance that can be updated and adapted based on evolving circumstances and the outcomes of collaborative efforts and engagement. This adaptive approach will help ensure that planning decisions remain aligned with evolving climate risks and that communities across Peterborough County are better prepared for future hydrologic variability.

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Appendix A Comment Response Matrix

Appendix A. Comments on Draft Watershed Plan (Volumes 1 and 2) and responses

Project Name:				Peterborough County Watershed Plan	
Materials Submitted:				DRAFT Peterborough County Watershed Plan (Equivalent) Volume 1: Characterization AND Volume 2: Planning and Management Guidance	
Comment No.	Date Received	Comment Source	Volume and / or Section	Comments on Draft Volumes 1 and 2	Responses from the Consulting Team
1	01-05-2026	Shoreline Conservation: Peterborough County	2	Shoreline Conservation: Peterborough County (SCPC) applauds the concept of a County Watershed Study focusing on the region's natural heritage and water resources systems and the cumulative impact of human development on these systems. Increasingly, the burden of planning and implementing best management practices to minimize risks to watersheds is falling on upper- and lower-tier municipalities. SCPC's willingness to assist efforts to safeguard the County watershed reflects its mandate to sustain healthy lakes and rivers through natural shoreline preservation.	Noted. Thank you for sharing this information.
2	01-05-2026	Shoreline Conservation: Peterborough County	2	The Study's prioritization of natural shorelines is entirely appropriate, acknowledging their essential role in the natural hydrologic cycle and waterbodies' ecosystems. The shoreline planning guidance largely reinforces published best practice. In addition to a development and septic system setback from the highwater mark, the Study's recommendations include shoreline alteration controls to restrict shoreline damage such as natural vegetation removal, dredging, dumping fill and building hard engineering structures. The Study urges natural stabilization of shorelines, not the use of hard structures. It outlines related risks, such as densification and backlotting behind waterfront properties. The Central Lake Ontario region is referenced for incorporating future climate change impacts into its shoreline management plans. For a shoreland buffer, however, we recommend a more ambitious goal: retaining 75% of the buffer area in its natural state.	Next steps. While we agree policies and/or guidance related to enhancement of naturalized buffers is a good way to help support site-specific lake protections, it is outside the scope of this high-level, County-wide study to recommend or prescribe specific buffers to natural heritage features and / or water resource areas. Furthermore, a single prescribed buffer may not be applicable or appropriate in all cases and therefore, some site-specific and/or contextual flexibility likely needs to be built in to any such policies or guidance. This should however be further considered and addressed as part of next steps / future studies. Notably, specific shoreline buffer dimensions and approaches should follow all applicable regulatory and policy planning guidance and be supported by technical information gathered through local studies that speak to both the sensitivity of the feature needing protection and the nature and scope of the exiting and anticipated land use / cover changes.
3	01-05-2026	Shoreline Conservation: Peterborough County	2	On the essential role of woodlands, greater attention is required to recognizing and preserving "old-growth" forests – a unique feature of Peterborough County deserving higher public visibility and protection.	Addressed and more to do as part of next steps. An analysis of the available data to develop mapping of old growth forest areas was outside the scope of this project, as was any field verification to confirm the status of such features. However, guidance in Volume 2 has been enhanced to emphasize that it is recommended that the presence of old growth forest be included as a criterion for significant woodlands, in accordance with current provincial guidance in the Natural Heritage Reference Manual. This work will need to be done as part of an Official Plan Amendment as part of the process to identify the County's Natural Heritage System (NHS) in both updated policies and new NHS mapping. Addressed in Volume 2, Section 5.1.1 and Section 9.2
4	01-05-2026	Shoreline Conservation: Peterborough County	2	Of real concern is the watershed Study's focus for future work, such as research at the quaternary watershed level, in Ecoregion 6E, with less highlighted for 5E. Admittedly, Ecoregion 6E, with its natural heritage already fragmented, faces a greater absolute rise in population and economic activity. But unchecked, development activity in 5E threatens substantive damage to its largely pristine waterbodies and natural ecosystems that anchor 5E's local economy and its economic prosperity. Compounding future ecological risk in Ecoregion 5E are less extensive environmental data and the relatively small fraction of Ecoregion 5E under the jurisdiction of Conservation Authorities. Of note are the highly sensitive lake trout lakes in Ecoregion 5E judged to be at capacity alongside a number of moderately sensitive lake trout lakes with limited capacity for new development.	Addressed. In our opinion, the Watershed Plan Volume 1 recognizes the biophysical distinctions between Ecoregions 5E and 6E at various scales quite comprehensively, but because most of the information is presented using tertiary and quaternary watershed scale boundaries, the ecoregional distinctions may not be as immediately apparent. We have tried to insert a bit more Ecoregional context in Volume 1 to highlight this linkage. See Volume 1, Section 1.1 and Section 2.

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					In Volume 2, it is acknowledged that there is more emphasis on planning guidance for Ecoregion 6E. his largely due to the planned growth pressures in this part of the County and the need for this Plan to provide guidance for the subsequent subwatershed, and other studies, needed to support this growth. However, the Plan also speaks to the need to protect natural heritage and water resources in Ecoregion 5E in accordance with the applicable provincial policies and guidance. In addition, the high-level guidance and recommendations around the need for Lake Capacity Studies and interest in/support for Lake Management Plans as resources and partnerships permit, has been enhanced based on supplemental comments provided by the CAs (Conservation Authorities). See Volume 2, Section 2.1, Objective 1.1, Section 4.2.1, Section 4.2.2, Section 5.1, Section 9.2 and Section 9.4.
5	01-05-2026	Shoreline Conservation: Peterborough County	2	The lack of financial resources to pursue all the worthwhile watershed research is understood, but a slightly more balanced approach between Ecoregions 6E and 5E could result in stronger overall environmental and economic results. We strongly urge the County to explore the potential of existing resources to expand the work undertaken. These resources include existing, albeit slightly dated data, institutions such as Trent University and Fleming College and the active environmental non-profits with considerable knowledge and experience in the County.	Addressed. See responses to comment 4. Please note Trent University, Fleming College and several active environmental non-profits have been flagged as key resources for the County in implementing this Plan. Also see Section 10.3 which adds a recommendation for a Watershed Planning Committee.
6	01-05-2026	Shoreline Conservation: Peterborough County	2	We noted that Volume 2's examples of environmental non-profit entities did not include Shoreline Conservation: Peterborough County. SCPC stands out for its active education and advocacy efforts stretching across much of Ecoregion 5E where there are fewer champions working to sustain healthy lakes. Since 2021, SCPC and the EC have made a dozen deputations to the five Townships referenced above, ten submissions to Peterborough County and the Province of Ontario and at least 20 presentations to ratepayers and lake associations. We participate in a broad network of environmental groups across southern Ontario, and we strongly support further work on the County's watershed study.	Addressed. Thanks for catching this oversight. It has been addressed in Volume 2 Section 10.2.
7	16-04-2026	Township of Cavan Monaghan	2	When I review the document, specifically looking at the 'Goals', 'the Guidance for Developing a natural Heritage System', and 'Guidance For Managing Land Use Impacts' as presented I notice the document presupposes that the suggestions are wanted. There is a lack of a "Why" these protections and planning tools are beneficial to decision makers, outside of ecological protections for its own sake (for which I do believe).	Addressed. Agreed. To address this comment some rationale has been added in text box to Section 1 of Volume 2.
8	16-04-2026	Township of Cavan Monaghan	2	I hoped that the document would provide more of a land use planning focus, Township management that I could use to support my request for an NHS in the next OP. Without the Growth Plan mandating the NHS, I am expecting to have opposition to getting it in place again.	Already addressed. Understood. However, providing planning guidance was only one of multiple components within the scope of this Watershed Plan. Please note that even though the Growth Plan no longer imposes a Provincial NHS, all municipalities in Ecoregion 6E remain <u>required</u> to identify an NHS (ref. 2024 PPS policy 4.1.3).

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					Guidance to support this is provided in Volume 2 Section 2.1, Section 4.1, Section 4.2, and Section 9.2.
9	16-04-2026	Township of Cavan Monaghan	2	As we all know, ecological protection is a low point. The powers that be often perceive the “green areas” as blockages and a detriment to development. I don’t see much in this document to help me achieve any additional buy-in to establish these goals in policy. My comment is that the document only speaks to people who already believe in the goals and objectives of Watershed Planning. By preaching primarily to the choir, I fear these goals will not see the light of day.	Noted. Please see responses to comments 7 and 8 above. The policy guidance in Volume 2 of this Plan is intended to support and reinforce natural systems’ protection and enhancement, which is equally supported in the PPS. Furthermore, the Township could also highlight the ecosystem services provided by natural heritage that provide clean water, clean air, support the pollinators that give us food crops, etc.
10	16-04-2026	Crowe Valley Conservation Authority	1&2	There is an “e” on the end of Crowe that isn’t consistently there throughout the document	Addressed. Thank-you for catching this error, it has been corrected throughout both documents.
11	16-04-2026	Crowe Valley Conservation Authority	1&2	The Conservation Authorities are responsible for administering Ontario Regulation 41/24, the document references O.Reg 41/42 2024	Addressed. Thank-you for catching this error, it has been corrected throughout both documents.
12	16-04-2026	Crowe Valley Conservation Authority	2	The CVCA is Crowe Valley Conservation Authority, pg 38 calls us Crowe River Conservation Authority	Addressed. Thanks for catching this error. It has been corrected.
13	16-04-2026	Crowe Valley Conservation Authority	2	With regards to Section 5.3.1 (pg 57), “Development Setbacks and Hazard Management”, you may wish to include that development should take place outside of the natural hazard and hazard setback or the 30-metres from the HMW whichever is the more restrictive. I highlight this because there are some lots where the flood hazard would be greater than 30 metres from the HWM.	Addressed. Thank-you for this suggestion. It has been added in Volume 2 bullet 1 under Section 5.3.1.
14	09-09-2026	Crowe Valley Conservation Authority	1	CVCA provided our floodplain mapping in March 2024, page 24 states that the floodplain geodata was not provided.	Addressed. Thanks for catching this oversight. It has been corrected in Volume 1, Section 2.5.
15	09-09-2026	Crowe Valley Conservation Authority	1	The Conservation Authority Act states that CA’s regulate unstable soils or bedrock and dynamic beaches. Dynamic beaches is missing, there aren’t any dynamic beaches in the CVCA’s watershed I can’t speak to the other watersheds	Noted. We have confirmed there are no dynamic beaches within the study area. The text has been updated accordingly in Volume 1, Section 3.5.
16	09-09-2026	Crowe Valley Conservation Authority	1	I am assuming that only the mapped wetlands are shown and referenced, there are lots of unmapped wetlands in Peterborough County, this may be worth clarifying	Addressed. Correct. Clarified in Volume 1 Section 2.5 with a note added that only mapped wetlands have been included in current study.
17	22-04-2026	Curve Lake First Nation	General	Appendix A - Michi Saagiig Historical/Background Context – as prepared by Elder Gitiga Migizi (Doug Williams)	Addressed. Thank-you for providing this important context. It has been included in full and verbatim as a foreword to Volume 1 of this Plan in recognition of the importance of this history and the importance of First Nations in the County and beyond, with the written consent of the CLFN representative.
18	22-04-2026	Curve Lake First Nation	General	Recommendation: The County is encouraged to adopt a Watershed Constraints Overlay that identifies areas where growth should be limited or redirected due to hydrologic, ecological, or cultural sensitivity. Why: Growth Areas intersect PSWs, HVAs, WHPAs, ANSIs, cold-water streams, and woodland corridors. These	Next steps. Agreed, however this can only be addressed as part of next steps / future studies. The details associated with development constraints need to be informed by field work and water-based modelling, which are to be central components of the future subwatershed planning outlined and anticipated in the County as part of future, more area-specific studies.

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				features are foundational to watershed function. An overlay ensures that growth boundaries and servicing strategies reflect real-world constraints rather than administrative lines.	
19	22-04-2026	Curve Lake First Nation	General	Recommendation: Growth Areas should proceed only after subwatershed-scale planning is completed. Why: Parcel-level EIS cannot capture cumulative hydrologic changes. Subwatershed plans allow the County to set infiltration targets, phosphorus budgets, stormwater criteria, and natural heritage system refinements at the correct scale.	Already addressed. Agreed and in our opinion this perspective is supported and is inherent across the Watershed Plan guidance recommendations in Volume 2.
20	22-04-2026	Curve Lake First Nation	General	Recommendation: The County is encouraged to establish minimum infiltration targets for all Growth Areas. Why: Infiltration protects groundwater recharge, maintains baseflow in streams, and reduces flooding. Growth Areas overlap HVAs, WHPAs, and drumlin fields where recharge is critical. Without infiltration targets, development can permanently alter watershed hydrology.	Next steps. Agreed. This is to be addressed as part of next steps / future studies. Please note that the MECP requires the hierarchal application of source controls to manage the 90th percentile runoff (approximately 28 mm); this is also a requirement of municipal Consolidated Linear Infrastructure Environmental Compliance Approvals (CLI ECA) - this will be reinforced in the document. This comment has been addressed with additional text added to Volume 2 Section 5.2.3 Water Budgets.
21	22-04-2026	Curve Lake First Nation	General	Recommendation: A phosphorus budget approach should be adopted for all lakes and rivers. Why: Many Kawartha lakes are already phosphorus-sensitive. Even small increases from new development can trigger algal blooms, reduce water quality, and impact fish habitat and recreational use.	Addressed and more to do as part of next steps. We agree this is an important component of Lake Management Studies, which are needed in the County, particularly where ecologically sensitive lakes are known to be under pressure from changes in surrounding land uses. However, we also understand that both provincial requirements and resources to do so County-wide are currently lacking. We also understand the Province recommends that municipalities on the Precambrian Shield (Canadian Shield) use Lakeshore Capacity Assessment Handbook (LCA) tools and several jurisdictions (e.g., District of Muskoka, Municipality of Magnetewan) require Lake Capacity Studies - which include consideration of phosphorus. Furthermore, we agree Lake Capacity Studies should be done and Management Plans should be developed for lakes in both Ecoregion 5E and 6E in the County where development pressures / land use changes in and around the lakeshore have been, or are expected to be, increasing. To address this in the Watershed Plan, some high-level guidance and recommendations related to the need for Lake Capacity Studies and Lake Management Plans as resources and partnerships permit have been added to Volume 2. Specifically: - Text has been added to Section 5.3 (Sensitive Waterbodies Planning Guidance) to flag this as a need and gap, and - A new recommendation to prioritize lakes for study and management planning on a quaternary watershed basis has been added to Section 9.4 of Volume 2, with the details to be determined by the Watershed Planning Committee.

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					This recommendation is supported by some additional local information and potential priority areas/lakes identified by the Conservation Authorities and the community (see comments 96 and 97 below).
22	22-04-2026	Curve Lake First Nation	General	Recommendation: Stormwater systems should incorporate thermal mitigation measures. Why: Cold-water systems (e.g., Baxter Creek, Sawers Creek) are highly sensitive to warming. Urban runoff can raise stream temperatures, affecting brook trout and other species vital to ecological and cultural values.	Addressed and more to do as part of next steps. Agreed. Please note that standard stormwater management (SWM) planning and design requires consideration of the thermal regime of the receiving system. The Watershed Plan has been revised to make this more explicit in Volume 2 - Sections 5.2.4, 5.2.5 and Table 7 “Summary of Select SWM Practices” which includes Thermal Mitigation.
23	22-04-2026	Curve Lake First Nation	General	Recommendation: Unevaluated wetlands should be treated as significant until formally assessed. Why: Many unevaluated wetlands in Growth Areas are hydrologically connected to PSWs or headwater systems. Treating them as significant prevents premature loss of wetland function.	Addressed. Agreed and thank-you for flagging this oversight. This text has been added to Section 5.1.1 and 9.2 of Volume 2 to provide this clarification.
24	22-04-2026	Curve Lake First Nation	General	Recommendation: Woodland corridors, wetland complexes, and riparian zones should be protected as connected systems. Why: Connectivity supports wildlife movement, climate resilience, and hydrologic stability. Fragmentation increases edge effects, reduces biodiversity, and disrupts natural drainage.	Addressed and more to do as part of next steps. Agreed and already largely addressed in this Plan through the guidance related to Natural Heritage System linkages and connectivity. Some additional text has been added to Section 4.2.1, Table 3 and Section 9.2 of Volume 2.
25	22-04-2026	Curve Lake First Nation	General	Recommendation: Development should avoid Earth and Life Science ANSIs. Why: Drumlins, eskers, and delta formations are irreplaceable landforms that regulate groundwater movement and support unique ecological communities.	Noted and already addressed. Generally agreed. Please note that the Provincial Planning Statement (PPS) provides protection for all ANSIs considered provincially significant. The County also protects regionally significant ANSIs in their Official Plan, as mapped in Figure 25 of this Plan.
26	22-04-2026	Curve Lake First Nation	General	Recommendation: Land-use permissions in WHPA-A/B/C/D should align with Source Protection Plan policies. Why: Growth Areas overlap municipal wellhead protection zones. Protecting these areas safeguards drinking water sources and reduces long-term servicing risks.	Next steps. Agreed. This is to be addressed as part of next steps. The Terms of Reference (scope) for Subwatershed Studies (which are a pre-requisite for growth planning) typically include requirements for hydrogeological studies and require alignment with Source Protection Plan policies.
27	22-04-2026	Curve Lake First Nation	General	Recommendation: All Growth Areas should include hydrogeological assessments that evaluate recharge, contaminant pathways, and wellhead drawdown. Why: Groundwater systems in the County are shallow and vulnerable. Growth without hydrogeologic analysis risks contamination, reduced recharge, and long-term servicing challenges.	Next steps. Agreed. This should also be addressed as part of next steps. The Terms of Reference (scope) for Subwatershed Studies (which are a pre-requisite for growth planning) include requirements for hydrogeological studies.
28	22-04-2026	Curve Lake First Nation	General	Recommendation: Stormwater design should use 2050 climate rainfall intensities. Why: Climate change is increasing rainfall intensity and frequency. Designing to historical rainfall data will under-size infrastructure and increase flood risk.	Next steps. Agreed and this should also be addressed as part of next steps. The Terms of Reference (scope) for subwatershed studies (which are a pre-requisite for growth planning) include requirements for climate change impact assessments.

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					Section 5.2.1 (flood control) and Section 7.2.1 (quaternary watershed / subwatershed scale studies) note that climate change must be considered for stormwater management through subwatershed planning.
29	22-04-2026	Curve Lake First Nation	General	Recommendation: Wetlands, floodplains, and riparian zones should be preserved as natural flood storage. Why: These areas reduce downstream flooding, protect infrastructure, and maintain water quality. Engineered systems cannot replicate their function.	Addressed. Agreed. Preservation of riparian storage associated with regulated floodplains is a core requirement of Conservation Authorities; further, any protected wetland would similarly be required to preserve storage. With that said, there is a strong industry push for determining the municipal services offered by natural assets and making these part of municipal asset management plans. See new recommendation added to Volume 2, Section 9.3.
30	22-04-2026	Curve Lake First Nation	General	Recommendation: New climate, surface water, and groundwater monitoring stations should be installed in data-poor areas. Why: Monitoring gaps limit the County's ability to track hydrologic change, phosphorus loading, and climate impacts. Data is essential for adaptive management.	Already addressed. Agreed. This is a gap that has already been identified in the Watershed Plan which includes recommendations for future monitoring and partnering with those agencies (such as the CAs) who currently have programs in place.
31	22-04-2026	Curve Lake First Nation	General	Recommendation: Developers should provide post-construction verification of infiltration, water-quality performance, and baseflow protection. Why: Design intentions do not always match real-world performance. Verification ensures stormwater systems function as intended.	Already addressed. Agreed. This would be part of multi-year post- development monitoring requirements which are a component of subwatershed planning which is outlined in Section 8 of Volume 2.
32	22-04-2026	Curve Lake First Nation	General	Recommendation: Engagement with CLFN should occur early and be distinctions-based. Why: CLFN is a rights-holder, not a stakeholder. Early engagement ensures watershed decisions respect Treaty Rights and cultural responsibilities.	Cannot address in the scope of this Plan. The County appreciates the willingness of several First Nations to engage in this project process. However, this comment, and related comments are understood by the consulting team to require more extensive engagement which could not be accommodated in the scope of this study. We suggest the County engage with CLFN and other Williams Treaties First Nations to identify a separate process to discuss these issues in a mutually agreed to manner.
33	22-04-2026	Curve Lake First Nation	General	Recommendation: Growth Areas should undergo RIAs assessing impacts to harvesting, medicines, fish habitat, water quality, and cultural landscapes. Why: Watershed changes directly affect rights-bearing landscapes and cultural continuity.	Cannot address in the scope of this Plan. See response to comment 32 above.
34	22-04-2026	Curve Lake First Nation	2	Hydrologic Sensitivity Growth Areas intersect: • High drainage density zones • Cold-water streams • Headwater wetlands • Steep drumlin slopes • Flood-susceptible lowlands	Already addressed. Agreed. Please note this requirement is embedded in the scope for subwatershed studies, as outlined in Section 8 of Volume 2.

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				Implication: Growth must maintain infiltration, baseflow, and hydrologic connectivity.	
35	22-04-2026	Curve Lake First Nation	2	Groundwater Vulnerability Growth Areas overlap: - Highly Vulnerable Aquifers (HVAs) - Wellhead Protection Areas (WHPAs A–D) - Significant Groundwater Recharge Areas (SGRAs) Implication: Land-use restrictions and minimum infiltration targets are needed.	Already addressed. Agreed. Please note this requirement is embedded in the scope for subwatershed studies, as outlined in Section 8 of Volume 2.
36	22-04-2026	Curve Lake First Nation	2	Natural Heritage Constraints Growth Areas intersect: - Provincially Significant Wetlands (PSWs) - Unevaluated wetlands - Life and Earth Science ANSIs - Large woodland corridors Implication: Avoidance-first planning is required; unevaluated wetlands must be assessed.	Already addressed. Agreed. Please note this requirement is embedded in the scope for subwatershed studies, as outlined in Section 8 of Volume 2.
37	22-04-2026	Curve Lake First Nation	2	Landform & Soil Constraints - Drumlinized terrain - Thin soils over bedrock - Erosion-prone slopes - Limited infiltration capacity Implication: Stormwater design must be watershed-based, not subdivision-based.	Already addressed. Agreed. Please note this requirement is embedded in the scope for subwatershed studies, as outlined in Section 8 of Volume 2.
38	22-04-2026	Curve Lake First Nation	2	Governance & Monitoring Gaps - Four Conservation Authorities regulate different parts of the County - Monitoring stations are unevenly distributed - Limited long-term hydrologic and groundwater data Implication: A coordinated governance and monitoring framework is required.	Addressed and more to do as part of next steps. Notably, the four CAs will be merged into one Regional CA by early 2027 which may over time equalize the differences in monitoring approaches and density of stations. Nonetheless, we agree it should be a priority to fill the surface and groundwater monitoring gaps identified in this Plan (see Volume 1) at the tertiary and quaternary watershed scale and recommendations are included in the Plan to guide the filling of these gaps. A recommendation was added in response to this comment to establish a multi-jurisdictional Watershed Planning Committee (see Section 10.3, Volume 2).
39	22-04-2026	Curve Lake First Nation	2	Recommendation 1 — Adopt a Watershed Constraints Overlay Apply a constraints overlay to all Growth Areas that includes: - PSWs - Unevaluated wetlands - ANSIs - HVAs - WHPAs - Cold-water streams - Woodland corridors - Cultural landscapes Purpose: Ensure growth boundaries and servicing strategies avoid high-constraint areas.	Next steps. Agreed. This is to be addressed as part of next steps / future studies. The details associated with development constraints need to be informed by field work and water-based modelling, which are to be central components of the future subwatershed planning outlined and anticipated in the County as part of future, more area-specific studies.

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40	22-04-2026	Curve Lake First Nation	2	Recommendation 2 — Require Subwatershed Plans Before Growth Proceeds Growth Areas must not advance without: - Subwatershed-scale hydrologic modelling - Cumulative-effects assessment - Natural heritage system refinement - Groundwater recharge analysis Purpose: Parcel-level EIS is insufficient for watershed-scale impacts.	Already addressed. Agreed. This a core requirement of this Plan, as outlined in Section 8 of Volume 2.
41	22-04-2026	Curve Lake First Nation	2	Recommendation 3 — Establish Minimum Infiltration Targets To maintain recharge and baseflow: - Maintain pre-development infiltration volumes - Infiltrate the first 5–10 mm of rainfall - Prohibit infiltration-reducing land uses in HVAs and WHPAs	Addressed and more to do as part of next steps. Agreed. Please see the response to comment 20.
42	22-04-2026	Curve Lake First Nation	2	Recommendation 4 — No-Net-Increase in Phosphorus Apply phosphorus budgets to all lakes and rivers.	Addressed and more to do as part of next steps. Agreed. Please see the response to comment 21.
43	22-04-2026	Curve Lake First Nation	2	Recommendation 5 — Thermal Protection for Cold-Water Streams Require: - Thermal mitigation - Shading - Infiltration-based stormwater design	Already addressed and more to do as part of next steps. Agreed. This is currently a standard requirement of stormwater planning and design, as noted in Section 8 of Volume 2.
44	22-04-2026	Curve Lake First Nation	2	Recommendation 6 — Treat Unevaluated Wetlands as Significant Until evaluated, unevaluated wetlands must be treated as PSWs.	Addressed and more to do as part of next steps. Agreed this should be clarified as part of the anticipated Official Plan updates. This text has been added to Section 5.1.1 and 9.2 to echo this recommendation.
45	22-04-2026	Curve Lake First Nation	2	Recommendation 7 — Maintain Ecological Connectivity Protect woodland corridors and wetland complexes through: 30–120 m buffers - Wildlife passage design - Avoidance of fragmentation	Already addressed in part and next steps. Agreed that ecological connectivity should be maintained in policy and mapping as part of the anticipated Official Plan updates. However, it is outside the scope of this Plan to prescribe specific ecological buffers. Some text emphasizing the importance of maintaining ecological connectivity has been added to Section 4.2.1, Table 3 and 9.2 of Volume 2.
46	22-04-2026	Curve Lake First Nation	2	Recommendation 8 — Prohibit Development in ANSIs Maintain landform integrity (drumlins, eskers, delta formations).	Already addressed. The Provincial Planning Statement provides protection for all ANSIs considered provincially significant. In addition, the County protects regionally significant ANSI in their Official Plan.
47	22-04-2026	Curve Lake First Nation	2	Recommendation 9 — Enforce WHPA Land-Use Restrictions - WHPA-A: prohibit new development - WHPA-B: prohibit high-risk uses - WHPA-C/D: require Risk Management Plans	Already addressed and more to do as part of next steps. Agreed. This is currently a standard requirement of subwatershed planning, as noted in Section 8 of Volume 2, and is expected to be addressed in future more detailed studies.
48	22-04-2026	Curve Lake First Nation	2	Recommendation 10 — Require Hydrogeological Impact Assessments All Growth Areas must demonstrate: - No reduction in recharge - No increase in contaminant loading	Already addressed and more to do as part of next steps. Agreed. This is currently a standard requirement of subwatershed planning, as noted in Section 8 of Volume 2, and is expected to be addressed in future more detailed studies.

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				No interference with wellhead drawdown	
49	22-04-2026	Curve Lake First Nation	2	Recommendation 11 — Update Stormwater Standards to 2050 Climate Use future IDF curves for: - Peak flow control - Floodplain mapping - Stormwater design	Already addressed and more to do as part of next steps. Agreed. This is currently a standard requirement of subwatershed planning, as noted in Section 8 of Volume 2, and is expected to be addressed in future more detailed studies.
50	22-04-2026	Curve Lake First Nation	2	Recommendation 12 — Protect Natural Flood Storage Areas Wetlands, floodplains, and riparian zones must be preserved.	Already addressed: There are already several regulatory and policy tools in place to help protect natural flood storage areas (e.g., Conservation authority regulations, Official Plan policies), as noted in Section 2 of Volume 2. However, this comment reminded us to add a recommendation for the County to consider a green infrastructure and/or natural asset management plan (see Section 9.3 of Volume 2). Also please see the response to comment 29.
51	22-04-2026	Curve Lake First Nation	2	Recommendation 13 — Establish a Watershed Governance Table Include: - CLFN - County - Municipalities - Conservation Authorities - Provincial ministries Purpose: Coordinate watershed decisions and cumulative-effects tracking.	Addressed and more to do as part of next steps. Agreed there would be value in having a multi-jurisdictional governance body to help coordinate and inform watershed decision-making and cumulative effects tracking. A recommendation was added in response to this comment to establish a multi-jurisdictional Watershed Planning Committee (see Section 10.3, Volume 2).
52	22-04-2026	Curve Lake First Nation	2	Recommendation 14 — Expand Monitoring Networks Install new: - Climate stations - Surface water gauges - Groundwater monitoring wells Purpose: Fill data gaps in Growth Areas.	Already addressed and more to do as part of next steps. Agreed. A core recommendation of the Watershed Plan is to fill monitoring gaps proactively and strategically (see Section 9.3, Volume 2).
53	22-04-2026	Curve Lake First Nation	2	Recommendation 15 — Require Post-Construction Verification Developers must demonstrate: - Infiltration performance - Water-quality performance - Baseflow protection	Already addressed and more to do as part of next steps. Agreed. This is currently a standard requirement of subwatershed planning, as noted in Section 8 of Volume 2, and is expected to be addressed in future more detailed studies.
54	22-04-2026	Curve Lake First Nation	General	Distinctions-Based Engagement Engagement must occur before : - Growth boundary decisions - Secondary plans - Servicing strategies - Subwatershed plans	Cannot address in the scope of this Plan. See response to comment 32 above.

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55	22-04-2026	Curve Lake First Nation	General	Rights Impact Assessments (RIA) Every Growth Area must undergo an RIA evaluating impacts to: • Harvesting • Medicines • Fish habitat • Water quality • Cultural landscapes • Cumulative effects on Treaty Rights	Cannot address in the scope of this Plan. See response to comment 32 above.
56	22-04-2026	Curve Lake First Nation	General	Indigenous-Led Monitoring CLFN must co-lead: • Water quality monitoring • Groundwater monitoring • Cultural landscape verification	Cannot address in the scope of this Plan. See response to comment 32 above.
57	22-04-2026	Curve Lake First Nation	General	Implementation Pathway for the County Step 1 — Integrate constraints overlay into the Watershed Plan Step 2 — Update Official Plan policies accordingly Step 3 — Request subwatershed plans for all Growth Areas Step 4 — Embed minimum infiltration targets and phosphorus budgets Step 5 — Establish the Watershed Governance Table Step 6 — Expand monitoring networks Step 7 — Adopt Rights Impact Assessment recommendations	Noted and thank-you for this summary. Please see the step-specific responses above.
58	22-04-2026	Curve Lake First Nation	2	Millbrook Growth Area Key Constraints • Overlaps with Wellhead Protection Areas (WHPAs A–D). • Highly Vulnerable Aquifers (HVAs) underlie much of the settlement area. • Baxter Creek, a cold-water system, flows through the Growth Area. • Drumlinized terrain creates steep slopes and erosion-prone soils. • Significant Groundwater Recharge Areas (SGRAs) support municipal wells and baseflow. Implications Millbrook is the most groundwater-sensitive Growth Area. Protecting recharge and preventing thermal impacts to Baxter Creek are essential. Recommendations • Apply minimum infiltration targets to maintain recharge. • Incorporate thermal mitigation into stormwater design. • Avoid development on steep drumlin slopes. • Align land-use permissions with Source Protection Plan policies. • Consider phasing growth to ensure hydrologic function is maintained.	Next steps. Thank-you for this concise summary of key area-specific constraints relevant to the Millbrook Growth Area and suggested recommendations. As noted above, these constraints will need to be considered and addressed at the subwatershed planning stage, as noted in Section 8 of Volume 2, and these recommendations should be considered and incorporated as appropriate based on the findings of more detailed studies completed to help guide and implement planned growth in this area.
59	22-04-2026	Curve Lake First Nation	2	Lakefield Growth Area Key Constraints • Adjacent to Katchewanooka Lake, a phosphorus-sensitive waterbody. • WHPAs and HVAs present in northern and central areas.	Next steps. Thank-you for this concise summary of key area-specific constraints relevant to the Lakefield Growth Area and suggested recommendations. As noted above, these constraints will need to be considered and addressed at the subwatershed planning stage, as noted in Section 8 of Volume 2, and these

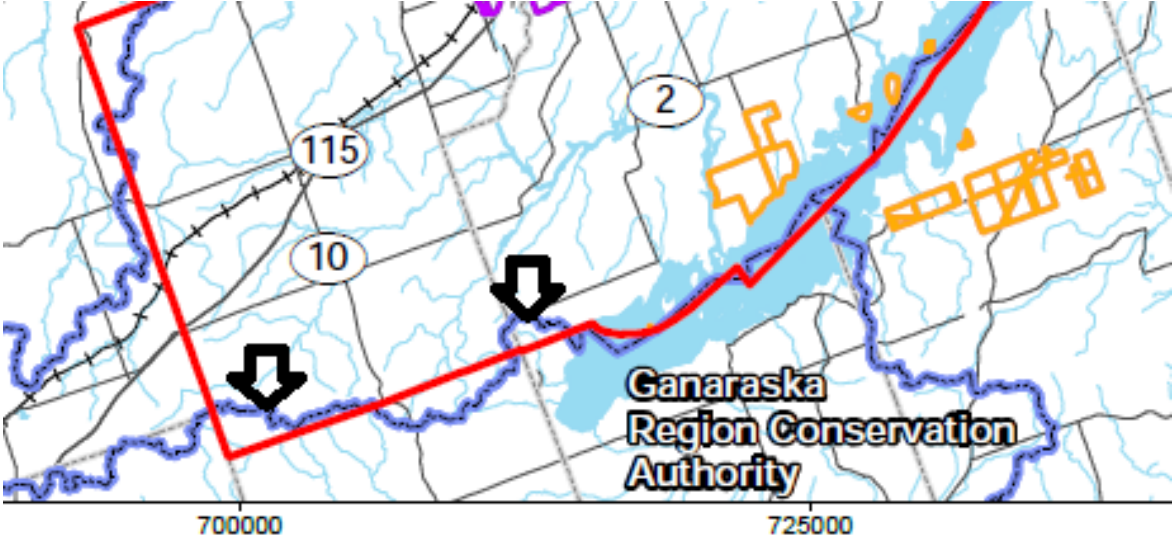
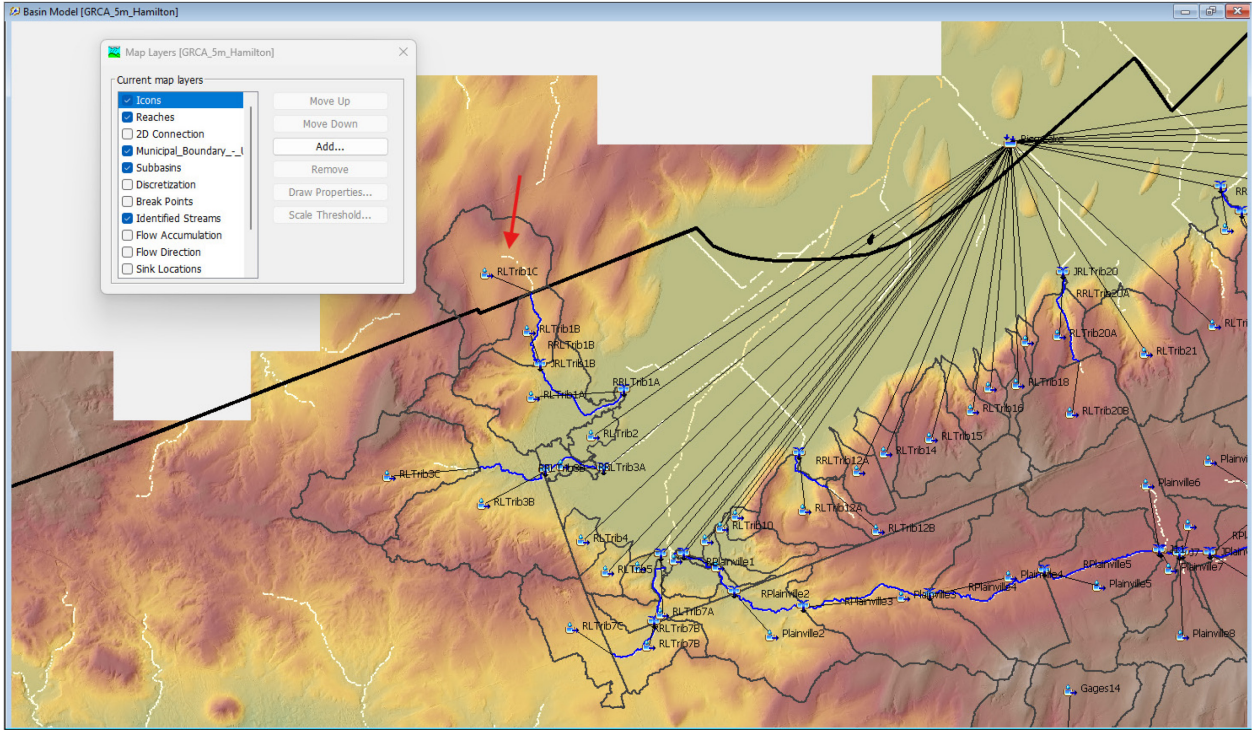
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				- Wetland complexes and riparian corridors drain directly to the Otonabee River. - High recreational use increases water-quality sensitivity. Implications Even small increases in phosphorus or stormwater runoff can affect lake health, fish habitat, and recreational use. Recommendations - Apply a no-net-increase phosphorus policy. - Maintain and enhance shoreline and riparian buffers. - Treat unevaluated wetlands as significant until assessed. - Use low-impact development (LID) stormwater approaches. - Protect woodland corridors that maintain connectivity to the Otonabee River.	recommendations should be considered and incorporated as appropriate based on the findings of more detailed studies completed to help guide and implement planned growth in this area.
60	22-04-2026	Curve Lake First Nation	2	Norwood Growth Area Key Constraints - Intersects large Provincially Significant Wetlands (PSWs) and unevaluated wetlands. - Contains headwater systems draining to the Ouse and Crowe Rivers. - Shallow soils and high-water tables limit infiltration and septic suitability. - Agricultural tile drainage increases nutrient transport risk. Implications Norwood is a wetland-dominated hydrologic landscape. Altering drainage patterns could increase downstream flooding and nutrient loading. Recommendations - Treat unevaluated wetlands as significant until evaluated. - Maintain hydrologic connectivity between wetland complexes. - Avoid development in low-lying, flood-susceptible areas. - Apply subwatershed-scale stormwater planning. - Consider alternative servicing strategies where soils limit infiltration.	Next steps. Thank-you for this concise summary of key area-specific constraints relevant to the Norwood Growth Area and suggested recommendations. As noted above, these constraints will need to be considered and addressed at the subwatershed planning stage, as noted in Section 8 of Volume 2, and these recommendations should be considered and incorporated as appropriate based on the findings of more detailed studies completed to help guide and implement planned growth in this area.
61	22-04-2026	Curve Lake First Nation	2	Havelock Growth Area Key Constraints - Located within Shield terrain with thin soils and exposed bedrock. - High drainage density results in rapid runoff and erosion potential. - Wetland complexes and headwater streams are highly sensitive. - Limited infiltration capacity increases reliance on engineered stormwater systems. Implications Havelock is highly sensitive to grading, blasting, and stormwater changes. Runoff can quickly enter downstream systems. Recommendations - Use avoidance-first planning in thin-soil and bedrock areas. - Apply enhanced erosion and sediment controls during construction. - Maintain and enhance wetland buffers. - Consider clustered development to preserve natural infiltration areas.	Next steps. Thank-you for this concise summary of key area-specific constraints relevant to the Havelock Growth Area and suggested recommendations. As noted above, these constraints will need to be considered and addressed at the subwatershed planning stage, as noted in Section 8 of Volume 2, and these recommendations should be considered and incorporated as appropriate based on the findings of more detailed studies completed to help guide and implement planned growth in this area.

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				Expand monitoring to track hydrologic changes in Shield terrain.	
62	14 -06-2026	GRCA	Section 2.1	Table 3 – There are several small watercourses that drain to Rice Lake within the GRCA watershed within the County, southeast of Bailieboro. These lands are within the Township of Otonabee-South Monaghan and should be added to Table 3.	Addressed. Please note that in Section 2.1 the Ontario Watershed Boundary, last updated on May 8, 2020, is the foundational mapping used by this study to define the tertiary and quaternary watershed boundaries. Through consultation with the TAC and based on the scale of this study, the OWB boundaries are being used as opposed to the boundaries defined by the Conservation Authorities. Maps 1 and 2 show the differences between the CA regulatory limits and the OWB layers used for this study. As suggested, a recommendation to confirm and or refine the watershed boundaries and watercourse mapping through local subwatershed study has been included in Volume 2 Section 5.2.
63	14 -06-2026	GRCA	Section 2.4.1.1	This section indicates that ‘the Ganaraska Conservation watercourse layer included watercourses and flow paths that differed from the OHN watercourse layer’. This is correct. Staff have found that the OHN data contains errors and inaccuracies in some areas and the data produced by GRCA was a refined data layer based on watercourse locations observed in recent orthophotography and detailed LiDAR mapping. The use of OHN data is appropriate for high level studies but should be reviewed and refined for more detailed analyses that would occur through subwatershed studies, etc.	Addressed. Thank you for this feedback. The last sentence of this comment has been added to Volume 1, Section 2.4.1.1 with some refinements for clarity. In addition, a recommendation has been added to Volume 2 in section 4.3.2
64	14 -06-2026	GRCA	Section 2.5	Background Review: Natural Hazards’ – the list of reports presented appears to be missing several studies pertaining to mapping of floodplain hazards for the communities of Lakefield and Norwood, completed by Otonabee Conservation, even though the linework is depicted on Figure 23. Also, reference to Figure 22 on page 24 should be updated to Figure 23.	Addressed. Thanks for catching this oversight. Addressed in Volume 1, Section 2.5 as suggested to include the reports received as part of the data request. Note that while there are four reports that were not included with the data request, a comparison of the mapping received and the publicly available floodplain mapping on the Otonabee Conservation open data portal, shows that the mapping data Onterris received is current and inclusive. The colours on Figure 23 have been updated for clarity.
65	14 -06-2026	GRCA	Section 2.7	‘Summary of Background Findings and Data Gaps by Tertiary Watershed’ – Regarding data gaps, the comment ‘no floodplain mapping for Crowe Valley Conservation or Ganaraska Region Conservation Authority’ is somewhat misleading. As mentioned in the meeting of April 9 th , CVCA has previously provided mapping to the study team. Regarding the GRCA floodplain mapping, the portion of the GRCA watershed within the limits of Peterborough County is not substantial and the drainage area is small. See excerpt from Figure 2 in the image below. This drainage area is split between the Ganraska River and Rice Lake. This should be reflected	Addressed and noted. Thanks for catching this oversight and sharing these updates. References to the Crowe Valley Conservation and Ganaraska Region Conservation Authority floodplain mapping have been updated to reflect these comments in Section 2.7. Please see comment 62 for how the data has been organized (i.e., by Tertiary Watershed rather than by Conservation Authority). As such, since the portion of the GRCA-regulated lands that drains into Rice Lake is within the Otonabee River Tertiary watershed, it has been included and characterized in those sections of the Plan, Volume 1.

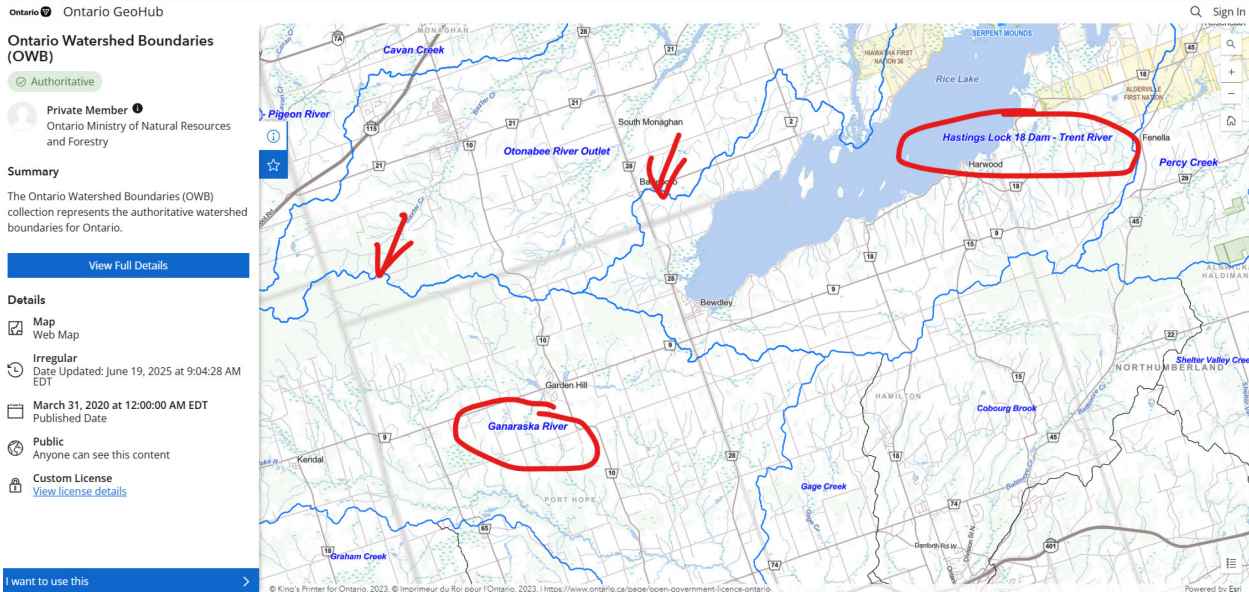
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				in the various tables in the report as the document only indicates 'Ganaraska River'.  The GRCA is in the process of producing updated floodplain mapping for a significant portion of the watershed and there is a small area at the western end of Rice Lake that will be mapped, with a portion of a tributary extending into the County. See excerpt below from the HEC-HMS model that is currently being developed for Hamilton Township. 	

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				Please add this information to Tables 6, 7, 9, 11 and 22 (in addition to any other relevant tables in subsequent sections of the report).	
66	14 -06-2026	GRCA		The document does not discuss the hazard lines for the lakes prepared for the County by the GRCA. This should be discussed in the report.	Noted but cannot be fully addressed. Thanks for noting this gap. Unfortunately, hazard lines for the lakes prepared for the County by GRCA were not shared with the consulting team over the course of Phase 1 when background data was being requested, gathered and integrated into the Plan text, tables and mapping. As such it is too late to fully integrate this information into the Watershed Plan at this time. However, the availability of this data has now been noted in Volume 1 (see Section 3.5.2), and we have also added a note in Volume 2 to consider this data as part of future area-specific studies, as appropriate.
67	14 -06-2026	GRCA	Section 3.4.2	‘Trent Severn Waterway’ - it is important to highlight that a lot of the dams within the drainage areas of the Trent Severn Waterway were constructed as dams to float timber down to the sawmills. A lot of these dams have transitioned to maintaining water levels for cottage lakes and do not have a formal flood control function. Parks Canada does a great job of managing the system to mitigate flood risks to the extent possible but it is important for the reader to understand the purpose and context under which many of the dams were originally created.	Addressed. Thanks for this local insight. This context has been added to Section 3.4.2 of Vol. 1.
68	14 -06-2026	GRCA	Section 3.4.3	‘Surface Drainage’ – watercourse and HDF identification should be done in partnership with the conservation authorities as they will be processing and DEM data as part of their respective hydrologic analyses and metrics such as drainage density are automatically calculated within the models. The report should recommend a collaborative approach in assessing surface drainage so efforts are cost effective.	Addressed. Agreed. We have added text to this effect in Volume 1 Section 3.4.3 and in Volume 2 Section 4.3.1, Section 5.4 and Section 9.1
69	14 -06-2026	GRCA	Section 3.5.2	‘Shoreline Hazards and Dynamic Beach’ – the (historic observed) flood hazard lines for the lakes within Peterborough County should be included in the discussion in this section. Are these lake hazards adequately mapped to apply provincial policies? What recommendations does the team have in this regard?	Noted but can only be addressed in next steps. Thanks for noting this gap. Unfortunately, hazard lines for the lakes prepared for the County by GRCA were not shared with the consulting team over the course of Phase 1 when background data was being requested, gathered and integrated into the Plan text, tables and mapping. As such it is too late to consider or assess this data in the Watershed Plan at this time. However, the availability of this data has now been noted in Volume 1 (see Section 3.5.2), and we have also added a note in Volume 2 to assess the adequacy of these data to support flood hazard mapping for the lakes in Peterborough County as part of future studies.
70	14 -06-2026	GRCA	Section 3.5.3.1	‘Meander Belt Width and Long-Term Stable Top of Slope’ – The mapping of slopes within this region of the province can be challenging given the topography, particularly in areas where valley systems traverse the drumlin fields. Consistent mapping of these hazards within the County will be helpful and should be recommended.	Already addressed. Agreed. We have this recommendation in Volume 2, Section 6.2.2.
71	14 -06-2026	GRCA		Table 19 – the units are missing from the line ‘Unevaluated Wetland’.	Addressed. Thanks for catching this oversight. This has been added in Table 19 of Volume 1.
72	14 -06-2026	GRCA	Section 8.1.2	‘Physiography and Slopes’ – page 154 – the second paragraph of this section incorrectly references the ‘Trent River – Crowe River Tertiary Watershed’ instead of the North Lake Ontario Shoreline Tertiary Watershed.	Addressed. Thanks for catching this oversight, This has been corrected in Section 8.1.2 of Volume 1.

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73	14 -06-2026	GRCA		Table 92 has an incorrect reference to Chandos Lake.	Addressed. Thanks for catching this oversight. This has been corrected in Table 92 of Volume 1.
74	14 -06-2026	GRCA		Table 93 incorrectly references the ‘Trent River – Crowe River Tertiary Watershed’ instead of the North Lake Ontario Shoreline Tertiary Watershed.	Addressed. Thanks for catching this oversight. This has been corrected in Table 93 of Volume 1.
75	14 -06-2026	GRCA	Section 8.3.1	‘Surface Drainage’ – The text of this section requires a minor correction. The second sentence of the first paragraph indicates that there is a single quaternary watershed, the Ganaraska River. There are in fact, two quaternary watersheds within GRCA’s jurisdiction according to the Ontario Watershed Boundaries (OWB) layer. See below. 	Noted but cannot be fully addressed. Please see replies to comments 62 and 65.
76	14 -06-2026	GRCA	Section 8.4	‘Natural Hazards’ – as mentioned previously in our comments for Section 2.7, the GRCA is in the process of producing updated floodplain mapping for a significant portion of the watershed and there is a small area at the western end of Rice Lake that will be mapped, with a portion of a tributary extending into the County. Please add this discussion to the text in this section. The watercourses are mapped as hazards under the current regulation mapping as depicted on the GRCA website: https://grca.on.ca/permits-planning/search-your-property/	Addressed. Thanks for this additional information. This feedback has been addressed in Section 8.4.
77	14 -06-2026	Kawartha Conservation	General	- It would be beneficial to characterize the extent of land use change related to the shorelines (e.g., adjacent lands to lakes and littoral areas), for large water bodies within Peterborough County (e.g., Pigeon Lake, Bass Lake, etc.). For example, research that we undertook on lakes within neighbouring City of Kawartha Lakes indicated significant changes have occurred and are expected to occur along the shorelines - this is key watershed management issue. Here are some of our key findings from an analysis of land cover over time within 120m: - Existing: As of 2018, development occupies approximately 45% on average (range 28 to 55%) of the shoreline land area along 120m of each lake. - Past: From 1988 to 2018, development has increased by approximately 68% on average (range 0 to 342% increase) along the shorelines of each lake.	Addressed in part as part of recommended next steps. Thanks for this comment and sharing additional information about related analyses done previously. Further analyses in this regard are outside the scope of the current Watershed Plan; however, this feedback has been incorporated into Section 5.3 (Sensitive Waterbodies Planning Guidance) of Volume 2, and a new recommendation to prioritize lakes for study and management planning on a quaternary watershed basis has been added to Section 9.4 of Volume 2, with the details to be determined by the Watershed Planning Committee.

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Comment No.	Date Received	Comment Source	Volume and / or Section	Comments on Draft Volumes 1 and 2	Responses from the Consulting Team																																												
				Future: Expansion and intensification of existing shoreline development are expected to continue for all lakes into the foreseeable future; however, the rate of increase is not clear.																																													
78	14 -06-2026	Kawartha Conservation	General	There is a lack of knowledge regarding the sensitivity/capacity of many of the lakes within the municipality due to watershed land use change/development. Currently 'at capacity' designations, and the process through which at capacity is determined, only applied to Shield lakes containing Lake Trout (e.g., Crystal Lake). This 'model' does not apply on the shallower warmwater managed lakes, for example: Pigeon Lake, Bass Lake, Sandy Lake, Buckhorn Lake, etc. The report would benefit from a discussion related to the need to fill this management and data gap.	Addressed in part as part of recommended next steps. See response to comment 77.																																												
79	14 -06-2026	Otonabee	General	Any references to ORCA should be replaced with Otonabee Conservation	Addressed. Thanks for catching this oversight. This has been corrected in Volume 1 and Volume 2.																																												
80	14 -06-2026	Otonabee	Natural Hazards Mapping	The shorelines of the Kawartha Lakes/Trent Severn Waterway were mapped to provide the flood hazard contour levels as provided by Parks Canada. These are the highest recorded water levels. These contours are also required by Ontario Regulation 41/24 to be regulated by Otonabee Conservation as flood hazard. The elevations are found in Appendix B of the Watershed Planning & Regulations Manual and copied below. The .shp files for mapping purposes can be downloaded here. KawarthaLakesHighWaterLevel.zip. It is recommended that these lines be added to the natural hazards mapping. Ontario Regulation 41/24 stipulates that these elevations be used to determine the regulated areas associated with flooding along the Kawartha Lakes and determines the extent of the flood hazard. The below table provides this information and the corresponding datum corrections. <table><tr><th>Kawartha Lakes (CGVD2013)</th><th>Regulation Limit (m): Floodplain Elevation + Wave Uprush (0.3 m) + 15 m Allowance</th><th>Floodplain Elevation (m): Highest Recorded Water Level</th><th>Floodproofing Elevation (m): Highest Recorded Water Level + 0.3m</th></tr><tr><td>Buckhorn Lake</td><td>246.77 plus 15 m</td><td>246.47</td><td>246.77</td></tr><tr><td>Chemong Lake</td><td>Setback</td><td></td><td></td></tr><tr><td>Pigeon Lake</td><td></td><td></td><td></td></tr><tr><td>Lower Buckhorn Lake</td><td>243.89 m plus 15m</td><td>243.59</td><td>243.89</td></tr><tr><td>Deer Bay</td><td>Setback</td><td></td><td></td></tr><tr><td>Lovesick Lake</td><td>241.83 m plus 15m</td><td>241.53</td><td>241.83</td></tr><tr><td>Stoney Lake</td><td>235.46 m plus 15m</td><td>235.16</td><td>235.46</td></tr><tr><td>Clear Lake</td><td>Setback</td><td></td><td></td></tr><tr><td>Katchewanooka Lake</td><td>233.26 m plus 15m</td><td>232.96</td><td>233.26</td></tr><tr><td>Rice Lake (Modeled Floodplain)</td><td>187.85 m plus 15m</td><td>187.55</td><td>187.85</td></tr></table> Table 1: Regulation Limits in CGVD2013 Vertical Datum	Kawartha Lakes (CGVD2013)	Regulation Limit (m): Floodplain Elevation + Wave Uprush (0.3 m) + 15 m Allowance	Floodplain Elevation (m): Highest Recorded Water Level	Floodproofing Elevation (m): Highest Recorded Water Level + 0.3m	Buckhorn Lake	246.77 plus 15 m	246.47	246.77	Chemong Lake	Setback			Pigeon Lake				Lower Buckhorn Lake	243.89 m plus 15m	243.59	243.89	Deer Bay	Setback			Lovesick Lake	241.83 m plus 15m	241.53	241.83	Stoney Lake	235.46 m plus 15m	235.16	235.46	Clear Lake	Setback			Katchewanooka Lake	233.26 m plus 15m	232.96	233.26	Rice Lake (Modeled Floodplain)	187.85 m plus 15m	187.55	187.85	Noted but can only be addressed in next steps. Thanks for noting this gap. Unfortunately, these data were not shared with the consulting team over the course of Phase 1 when background data was being requested, gathered and integrated into the Plan text, tables and mapping. As such it is too late to consider or assess this data in the Watershed Plan. However, the availability of this data has now been noted in Volume 1 (see Section 3.5.2). Notably, Peterborough County has confirmed that it now has these mapping layers in its online mapping resources and that as such they can easily and will be expected to be considered as part of future studies.
Kawartha Lakes (CGVD2013)	Regulation Limit (m): Floodplain Elevation + Wave Uprush (0.3 m) + 15 m Allowance	Floodplain Elevation (m): Highest Recorded Water Level	Floodproofing Elevation (m): Highest Recorded Water Level + 0.3m																																														
Buckhorn Lake	246.77 plus 15 m	246.47	246.77																																														
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Project Name:			Peterborough County Watershed Plan		
Materials Submitted:			DRAFT Peterborough County Watershed Plan (Equivalent) Volume 1: Characterization AND Volume 2: Planning and Management Guidance		
Comment No.	Date Received	Comment Source	Volume and / or Section	Comments on Draft Volumes 1 and 2	Responses from the Consulting Team
81	14-06-2026	GRCA	Section 2.1.2	‘Water Resource System Policies’ – We would recommend that the identification of any water resource systems, as highlighted in item c), be carried out in collaboration with local conservation authorities. Many of these features will be mapped and identified in development of hydrologic models used for floodplain mapping updates and/or flood forecasting activities. The necessary elements for mapping the water resource system(s) could be extracted from these efforts. This approach would ensure effective use of resources and avoid the potential for duplication of efforts. Collaborative efforts to identify water resources systems should also include local First Nations.	Addressed. Agreed. This guidance has been added to Section 2.1.2 and Section 9 in Volume 2.
82	14-06-2026	GRCA	Section 2.1.3	‘Natural Hazard Policies’ a. first sentence - ‘mange’ should be revised to ‘manage’. b. Third bullet - <i>Hazardous forest types for wildland fire, meaning forest types assessed as being associated with the risk of high to extreme wildland fire using risk assessment tools established by the Ontario Ministry of Natural Resources, as amended from time to time, and</i> - this is not part of Section 5.2 and not a role of the Conservation Authority. The way this section is worded implies CAs have a role in this matter. Please revise. c. This section identifies erosion hazards but is not as specific as it should be. Section 2.1.3 should be expanded by stating meander belt of watercourses, erosion hazards associated with large inland lakes, and valley slopes.	Addressed. Volume 2, Section 2.1.3: a. Thanks for catching this error. This has been corrected. b. Thanks for catching this error. This has been corrected. c. Agreed. The suggested text has been added.
83	14-06-2026	GRCA	Section 2.3	‘Conservation Authorities Act’ - <i>This means, with respect to natural heritage, they may no longer provide advice to municipalities related to any prescribed Acts, including the Planning Act</i> - although accurate, this should be reworded – see Otonabee remark below.	Addressed. Thank-you for this insight. The text in Section 2.3 in Volume 2 has been revised as suggested. See related comment 103.
84	14-06-2026	GRCA	Section 2.7	Peterborough County Official Plan’ – the second bullet on page 16 indicates ‘protect ‘at capacity’ lakes from further development’. GRCA is very supportive of this recommendation and would request recommendations be added to the watershed plan to provide guidance regarding the steps necessary to confirm lake capacity. Who would be responsible for completing a Lake Assessment or Lake Plan? How frequently are they completed? What is the current status of the lakes within the County? Which lakes require updates? Further information and discussion in this regard would be helpful.	Addressed. Agreed. A recommendation to this effect has been added to Section 9 in Volume 2. Please note that identifying responsible parties, priorities and implementation details is outside the scope of this Watershed Plan. However, these items have been flagged as future action in the added text.
85	14-06-2026	GRCA	Section 3.2.1	‘Goal 1: Support Identification of a Natural Heritage System and Water Resource System’ a. ‘Objective 1.2 Complete the Technical Work to Identify a Water Resources System (WRS) – as highlighted previously, GRCA would recommend that the identification and delineation of any water resource systems be carried out in collaboration with local conservation authorities, prior to translating the information into the Official Plan. Many of these features will be mapped and identified in development of hydrologic models used for floodplain mapping updates and/or flood forecasting activities. The necessary elements for mapping the water resource system(s) could be extracted from these efforts. This approach would ensure effective use of resources and avoid the potential for duplication of efforts. b. ‘Objective 1.5 Map a WRS for the County’s Official Plan’ – similar to the above comments, the mapping of any water resource systems be carried out in collaboration with local conservation authorities.	Addressed. Agreed. Not specifically mentioning conservation authorities and/or other agencies was an oversight. References to collaborating with the local conservation authorities / agencies have been added to Objectives 1.2 and 1.5 in Volume 2.

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Comment No.	Date Received	Comment Source	Volume and / or Section	Comments on Draft Volumes 1 and 2	Responses from the Consulting Team
86	14 -06-2026	GRCA	Section 3.2.5	'Goal 5: Protect Human Health and Safety and the Natural Environment; Objective 5.1 Work with local conservation authorities and agencies to identify and manage natural hazards' – GRCA would suggest that a bullet be added to this section to recommend that flood hazard mapping and associated models (where available) be used to assess flood risk levels for various road segments and inform emergency management planning and municipal asset management plans.	Addressed. Agreed. Not specifically mentioning conservation authorities and/or other agencies was an oversight. Text to this effect has been added under Goal 5 in Volume 2. A bullet has been added that flood hazard mapping (riverine) can be used to support emergency management planning among other information such as pluvial flooding data.
87	14 -06-2026	GRCA	Section 3.2.6	'Goal 6: Engage Communities to Advance the Watershed Plan Vision' a. GRCA is very supportive of this goal and commends the County on charting a progressive path forward for advancing the watershed plan vision. Objective 6.2 'Continue and enhance collaboration with local Municipalities, agencies and non-governmental organizations on watershed matters' – it is recommended that the language be expanded to include Conservation Authorities in watershed and subwatershed planning, etc. as they can offer their experience and expertise to municipal partners in these processes. This will be valuable, particularly for the smaller municipalities that may not have the in-house expertise.	Addressed. Agreed. Not specifically mentioning conservation authorities and/or other agencies was an oversight. Text to this effect has been added under Goal 6 in Volume 2.
88	14 -06-2026	GRCA	Section 4.3	As highlighted previously, GRCA would recommend that the identification and delineation of any water resource systems be carried out in collaboration with local conservation authorities, prior to translating the information into the Official Plan. Many of these features will be mapped and identified in development of hydrologic models used for floodplain mapping updates and/or flood forecasting activities. The necessary elements for mapping the water resource system(s) could be extracted from these efforts. This approach would ensure effective use of resources and avoid the potential for duplication of efforts.	Addressed. Agreed. Not specifically mentioning conservation authorities and/or other agencies was an oversight. Text to this effect has been added under Goal 6 in Volume 2.
89	14 -06-2026	GRCA	Section 5.1.4	'Other Notable Data and Gaps', second paragraph – It is important to recognize that the utility of ELC mapping extends into the development of accurate hydrologic models used in floodplain mapping updates. If ELC mapping could be updated on a County-wide basis, it would support the Conservation Authorities in the creation and updates of models and mapping for the County. This should be noted in the text.	Addressed. Good point. Text to this effect has been added to Section 5.1.4.
90	14 -06-2026	GRCA	Section 5.2.1	'Flood Control' – GRCA agrees with the need to develop well-calibrated existing conditions hydrologic models to establish a robust set of flood control criteria for future development. We would encourage the County to collaborate with the conservation authorities to expand and maintain the rainfall and streamflow gauges within and downstream of future development areas to enable calibration of models to the actual system response and to develop unitary discharge rates for use in future growth studies.	Addressed. Agreed. This has been added to the monitoring guidance in Sections 8 and 9 of Volume 2.
91	14 -06-2026	GRCA	Section 5.2.2	'Erosion Control' – similar to the previous comment, through collaboration, the County and conservation authorities can expand and maintain gauge networks to collect long-term continuous streamflow data to characterize streamflow conditions in preparation for future subwatershed studies to facilitate growth planning.	Addressed. Agreed. This has been added to the monitoring guidance in Sections 8 and 9 of Volume 2.
92	14 -06-2026	GRCA	Section 6.2	'Natural Hazards' – the second paragraph of this section should be expanded to explain that while the lakes in the County are not considered large inland lakes as per the PPS, they are subject to flooding hazards defined in Section 2.4 of the Technical Guide - River and Stream Systems: Flooding Hazard Limit (MNR, 2002). See excerpt below: 2.4 Flood Hazard Limits for Lakes < 100 sq. km. <i>The standard for defining the flood plain along small lakes and large rivers is the same standard used for rivers (Hazel-Centred, Timmins-Centred, maximum observed or 100-year, whichever is applicable) plus an</i>	Addressed. Thank-you for this insight and clarification. This context has been added to Section 6.2 of Volume 2.

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				<i>appropriate allowance for wind setup. The wind setup is to be calculated on the basis of mean wind speed and applicable maximum effective fetch. The computed wind setup will then apply along the entire lake shore. Where the maximum effective fetch is less than 3 km, the lake can be treated as an integral component of the river system, therefore the flood standard will be the same as that applied to the river system.</i>	
93	14 -06-2026	Kawartha Conservation	Page 28	Regarding Kawarthas Naturally Connected NHS. The document states on Page 28: “[The KNCNHS] it was not accepted by the Province due to insufficient coverage in areas of provincial interest.” Regardless, this initiative was widely accepted and praised by local organizations and therefore remains an excellent and ‘agreed-to’ tool and approach for land management, stewardship, acquisition, and protection. We recommend re-engaging the same partners to augment this Strategy (for example, to meet provincial policy) to achieve buy-in from these same groups, rather than starting a new NHS from ‘the ground up’ as recommended in this Plan.	Noted and addressed in part. It is understood that the KNC initiative was widely accepted and praised by local organizations as an excellent tool to inform stewardship. However, to develop an NHS the County will require support and guidance from a multi-disciplinary team of professionals with expertise in land use planning, natural heritage system identification and mapping, and policy development that is, at a minimum, fully aligned with current provincial policies, regulations and applicable guidance. Nonetheless, we acknowledge the former KNC partners as an excellent local resource to be engaged as part of the forthcoming NHS updates in Sections 4 and 9 of Volume 2.
94	14 -06-2026	Kawartha Conservation	Page 50	Regarding Fish Habitat. The document states on Page 50: “County-wide coverage for aquatic/fisheries data is moderate to good as the Province’s LIO mapping covers systems throughout the County with no major gaps observed. However, this mapping is known to contain gaps and, in some cases, is based on older data, and so subwatershed-specific fisheries reports and more current Conservation Authorities data should also be used to supplement the broader data coverage, with field studies needed to fill any remaining gaps as part of area or site-specific planning.” Note that for our area of jurisdiction (e.g., Nogies Creek subwatershed, including Bass Lake and Crystal Lake), fisheries related data, such as taxa lists and areas of habitat sensitivity, is extremely limited and out-of-date. We recommend that additional characterization of fish and fish habitat be undertaken within Nogies Creek Subwatershed, within the scope of assisting with watershed health monitoring and development impact tracking, particularly related to shoreline development. This might include for example, provincial or federal guidance on approaches for how to locally develop and calibrate Index of Biotic Integrity’s (or similar biomonitoring approaches) and water quality indices, and guidance on how to delineate zones of habitat/water quality sensitivity. Kawartha Conservation has expertise to fill data gaps, and test and apply biomonitoring and water quality testing for watershed health approaches. Further, the Fisheries Management Plan for Zone 17 is out of date – a Plan that should be linked with the Watershed Plan. We recommend efforts be made to emphasize the need for FMP Zone 17 updating and to link those Fish Management related objectives to the Watershed Plan.	Addressed. Thank-you for this insight and additional local context. This context has been added to Section 4.4 and Section 9.4 of Volume 2.
95	14 -06-2026	Kawartha Conservation	Page 58	Regarding Sensitive Waterbodies Planning Guidance. Please refer to our comments for Volume 1 regarding the need to establish sensitivity guidelines/thresholds for warmwater lakes and waterbodies, for example Bass Lake, and Pigeon Lake. Currently there is no mechanism (e.g., provincial approach) for determining the degree of sensitivity of warmwater lakes. We recommend the Watershed Plan support the development, through collaboration based on provincial/federal leadership, of lake ecosystem sensitivity thresholds related to shoreline/watershed development capacity for warm and coolwater waterbodies. This is a significant gap for our most pressured (populated) waterbodies.	Addressed. Agreed. Text to this effect has been added to Section 5.3 and a new recommendation has been added to Section 9.4 of Volume 2.

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96	14 -06-2026	Kawartha Conservation	General	Regarding the need for more detailed studies, as indicated on Page 1 of the document: <i>“Provide a basis and framework for more detailed studies (including detailed modelling of the water-based systems and fieldwork) in priority quaternary watersheds in the future...”</i> We recommend more detailed studies/management for Nogies Creek watershed, especially Crystal Lake and Bass Lake. These systems are under significant development pressure. Crystal Lake is already designated ‘at capacity’. Therefore we feel that the Nogies Creek Subwatershed would benefit from Subwatershed and/or Lake Management Plan.	Addressed. Text to this effect has been added to Section 5.3 and a new recommendation has been added to Section 9.4 of Volume 2.
97	14 -06-2026	Kawartha Conservation	General	There is no reference to the Pigeon Lake Management Plan (Kawartha Conservation, 2019), which was supported by neighbouring City of Kawartha Lakes and local stakeholders. We recommend this Watershed Plan establish linkages to the Pigeon Lake where applicable. For example, water management by Parks Canada in the Trent-Severn Waterway, and the potential impact to aquatic ecosystems, was indicated as a high priority management concern needed to be addressed. This is also exemplified by the local Save the Walleye campaign (emphasis on Bobcaygeon Dam, a key spawning area for Pigeon Lake). The Watershed Plan should emphasize the need for responsible management of critical areas for lake health and to monitor effectiveness.	Addressed. Thank-you for this additional insight. Text to this effect has been added to Section 5.3 and a new recommendation has been added to Section 9.4 of Volume 2. Text on this stewardship initiative has also been added to Section 10.2.
98	14 -06-2026	Otonabee	Section 2.1.3	Recommend mention of Special Policy Areas and Two-Zone floodplain management areas with which there are one each within Peterborough County. - Millbrook Special Policy Area - Ouse River Norwood Two-Zone Special Policy Area See Appendix E of the Watershed Planning & Regulations Policy and Procedures Manual	Addressed. Thank-you for this additional information. The text in Section 2.1.3 of Volume 2 has been expanded as suggested.
99	14 -06-2026	Otonabee	Section 2.3	‘Conservation Authorities Act’ - revise to <i>“This means, with respect to natural heritage, they may no longer provide a program to provide peer review services to municipalities related to any prescribed Acts, including the Planning Act.”</i> O.Reg 686/21 outlines CA’s required programs and services. An authority cannot provide any Category 2 (municipal) programs or services related to <i>the Planning Act</i>. 5th Paragraph – Update last sentence as the proposal has been approved and the consolidation process progressing swiftly. The Conservation Authorities listed will be part of the new Eastern Lake Ontario Regional Conservation Authority (ELORCA).	Addressed. Thank-you for this suggested clarification. The text in Section 2.3 has been revised as suggested. Please note a text box outlining the consolidation of the Conservation Authorities has been added to the Preamble of both Volume 1 and Volume 2.
100	14 -06-2026	Otonabee	General	Find/Replace – Otonabee Region Conservation Authority to simply, Otonabee Conservation	Addressed. This change has been made throughout.
101	14 -06-2026	Otonabee	Section 2.4	As part of the consolidation of the CAs into the ELORCA, changes will be required under the Clean Water Act and associated regulations to function in alignment with the changes to conservation authority names and boundaries and to clarify how source protection authorities would operate under the regional CA structure. Drinking water source protection remains a core mandated responsibility of CAs, and source protection plans will continue to be carried out.	Noted. Thank-you for this additional information. However, speaking to these pending changes is outside the scope of this Watershed Plan. As noted above, a text box outlining the consolidation of the Conservation Authorities has been added to the Preamble of both Volume 1 and Volume 2.
102	14 -06-2026	Otonabee	Section 4.3	Natural Hazards – flood and erosion – the third paragraph of this section is not accurate. Mapping has been done within the county within Otonabee Region Conservation Authority’s watershed. See the following web page for more information: https://www.otonabeeconservation.com/permits-planning/floodplain-mapping/ .	Addressed. Thank-you for this additional information. The text in Section 4.3 of Volume 2 has been revised to correct this oversight.

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				Under the NDMP and FHIMP grant regime, ten engineered floodplain mapping studies have been carried out and adopted by the Otonabee Conservation Board of Directors. Where most erosion hazards are not officially mapped in the Otonabee watershed, preliminary work has been undertaken to identify valley features associated with River & Stream Systems along the south shore of the Kawartha Lakes (small inland lakes less than 100 ha). Further work is required to better understand and delineate the stable top of slope and identify regulated allowances. Otonabee Conservation has a board approved Floodplain Mapping Implementation Strategy that has ranked priority mapping projects in the watershed that still remain unmapped or require updating.	
103	14 -06-2026	Otonabee	Section 5.2.3	Water Budgets - It could be noted here that development permit requirements at the CA level may include requirements of water budget and infiltration targets such as Low Impact Development in those areas where wetland removal or potential wetland hydrologic impacts are being proposed (e.g stormwater). This would be required to justify that no impacts to downstream regulated features (wetland, watercourse) and associated flooding and erosion hazards will not be adversely impacted. This applies to those scenarios where development permits are required under the <i>Conservation Authorities Act</i>. Setting a minimum infiltration target – is this permissible under changes advanced by the passing of Bill 98?	Next steps. Agreed. This is to be addressed as part of next steps / future studies. Please note that the MECP requires the hierarchal application of source controls to manage the 90th percentile runoff (approximately 28 mm); this is also a requirement of municipal Consolidated Linear Infrastructure Environmental Compliance Approvals (CLI ECA) - this will be reinforced in the document. This comment has been addressed with additional text added to Volume 2 Section 5.2.3 Water Budgets. The influence of Bill 98 remains uncertain as it relates to the application of Green Standards and will need to be considered by all parties moving forward; however, the high-level Watershed Plan guidance and recommendations are not expected to be impacted by this bill which appears to have more sire-specific implications.
104	14 -06-2026	Otonabee	Section 5.3	Through recent development proposals, there have been requests from local public interest groups for a Lake Capacity Study of Lovesick Lake, in the Kawartha Lakes. This small lake is under development pressure, similar to others referenced in the document.	Addressed. Thanks for this comment and sharing additional local information. A new recommendation to prioritize lakes for study and management planning on a quaternary watershed basis has been added to Section 9.4 of Volume 2, with the details to be determined by the Watershed Planning Committee.
105	14 -06-2026	Otonabee	Section 6.1.1 7.2.4	Water Quantity – further to those outlined, Otonabee Conservation shares these terms of reference when pre-consulting for new or redevelopment. Standard Stormwater Management Criteria - ORCA Ver. January 2021.pdf Conservation Authorities such as Otonabee have been working on comprehensive stormwater management and other engineering report submission guidelines. These draft guidelines could serve as a basis or starting point in the development of more comprehensive set of requirements further to the Watershed Plan. Flood Control Stuctures – the updated technical guide also (see below comment) addresses how flood control structures will be incorporated to determine flood hazard mapping.	Addressed. Thank-you for this additional information. The text in Sections 6.1.1 and 7.2.4 of Volume 2 has been expanded as suggested.
106	14 -06-2026	Otonabee	Section 6.2	Further to above GRCA comment: Technical Guide - River and Stream Systems: Flooding Hazard Limit and Technical Bulletin - Special Flooding Hazard Conditions in River and Stream Systems. Available at ERO posting https://ero.ontario.ca/notice/026-0329 The reference to determining the flood hazard associated with small lakes has not changed from the prior 2002 version, quoted above in GRCA's comment. Ontario Regulation 41/24 outlines specific elevation contours that Conservation Authorities are required to delineate as hazards and regulated development (15 m regulated allowance). The elevations associated with Otonabee Conservation regulation are in Table 2 – Schedule 3 of the Regulation.	Addressed in part. Thank-you for this additional information. The text in Sections 6.2 of Volume 2 has been updated to include reference to the updated Manual. The table below was considered too detailed for this high-level Plan and has not been included, but will remain on record for reference if needed as part of this comment-response matrix.

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				Appendix B of the Watershed Planning & Regulations Manual outlines these elevations converted to updated datum CGVD2013 Ontario Regulation 41/24 stipulates that these elevations be used to determine the regulated areas associated with flooding along the Kawartha Lakes and determines the extent of the flood hazard. The below table provides this information and the corresponding datum corrections. <table><tr><th>Kawartha Lakes (CGVD2013)</th><th>Regulation Limit (m): Floodplain Elevation + Wave Uprush (0.3 m) + 15 m Allowance</th><th>Floodplain Elevation (m): Highest Recorded Water Level</th><th>Floodproofing Elevation (m): Highest Recorded Water Level + 0.3m</th></tr><tr><td>Buckhorn Lake Chemong Lake Pigeon Lake</td><td>246.77 plus 15 m Setback</td><td>246.47</td><td>246.77</td></tr><tr><td>Lower Buckhorn Lake Deer Bay</td><td>243.89 m plus 15m Setback</td><td>243.59</td><td>243.89</td></tr><tr><td>Lovesick Lake</td><td>241.83 m plus 15m Setback</td><td>241.53</td><td>241.83</td></tr><tr><td>Stoney Lake Clear Lake</td><td>235.46 m plus 15m Setback</td><td>235.16</td><td>235.46</td></tr><tr><td>Katchewanooka Lake</td><td>233.26 m plus 15m Setback</td><td>232.96</td><td>233.26</td></tr><tr><td>Rice Lake (Modeled Floodplain)</td><td>187.85 m plus 15m Setback</td><td>187.55</td><td>187.85</td></tr></table> Table 1: Regulation Limits in CGVD2013 Vertical Datum	Kawartha Lakes (CGVD2013)	Regulation Limit (m): Floodplain Elevation + Wave Uprush (0.3 m) + 15 m Allowance	Floodplain Elevation (m): Highest Recorded Water Level	Floodproofing Elevation (m): Highest Recorded Water Level + 0.3m	Buckhorn Lake Chemong Lake Pigeon Lake	246.77 plus 15 m Setback	246.47	246.77	Lower Buckhorn Lake Deer Bay	243.89 m plus 15m Setback	243.59	243.89	Lovesick Lake	241.83 m plus 15m Setback	241.53	241.83	Stoney Lake Clear Lake	235.46 m plus 15m Setback	235.16	235.46	Katchewanooka Lake	233.26 m plus 15m Setback	232.96	233.26	Rice Lake (Modeled Floodplain)	187.85 m plus 15m Setback	187.55	187.85	
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107	14 -06-2026	Otonabee	Section 6.2.1	125 hectare rule – double check this – I don’t believe this is a requirement for floodplain mapping outlined in the Technical Guide, but has been used as a general rule since the 1980s (FDRP)?	Addressed. This is correct – the drainage area threshold is used as a guide not an absolute. Clarifying text has been added in Section 6.2.1.																												
108	14 -06-2026	Otonabee	Section 6.4	Recommend mentioning that CAs currently have policies that have regard for cumulative impacts with respect to flooding and erosion hazards and hazard management. Current Otonabee Conservation Board approved policy on Cumulative Impacts is found here on page 74 – this is with respect to development regulations in natural hazard areas. “The assessment of impacts from development and alterations of hazardous lands, sites and watercourse and wetland features will include the potential for cumulative impacts. Where necessary, Otonabee Conservation will restrict development that may, singularly or cumulatively, affect the natural hazards or impact other properties. Examples of cumulative impacts are: development activities that restrict riverine channel capacities to pass flood flows or reduce storage capacity in floodplains and wetlands resulting in increased flood levels and creation of a potential danger to upstream and downstream landowners; the construction of multiple additions to a residential dwelling in the flood hazard over time, resulting in an unacceptable risk to life and property; and, alterations to shorelines and watercourses to address erosion that may disrupt the channel or shoreline natural processes for erosion and deposition of material. “	Addressed. Thank you; this is an excellent policy – text has been added to Section 6.4 accordingly																												

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109	14-06-2026	Otonabee	Section 8.0	Conservation Authorities including Otonabee Conservation already complete a number of monitoring programs, both provincially mandated (OBBN, PWQMN, PGWM) but also as part of Category 2 Programs and Services. Otonabee currently carries out development driven monitoring programs (pre, during, post) within its watershed. It is anticipated that Conservation Authorities will continue to improve and enhance these programs to provide essential monitoring services to member municipalities to assist in the implementation of this Watershed Plan.	Noted. The Watershed Plan wholly supports these data collection initiatives and is promoting future collaboration amongst all parties to fill gaps accordingly.
110	14-06-2026	Otonabee	Section 9.1	Water Budgets – agree with requirements for feature-based water balance however, the CA has had mixed results in applying current developed guidelines/study terms of reference to local development proposals. The current feature-based wetland water balance guidance was developed by the TRCA with a Toronto/urban context in mind. A local made guideline would be recommended for terms of reference if this type of policy were to be explored further for implementation. What will be the impact of Bill 98, which received Royal Assent on June 2, 2026, be for the recommendation to require application of low impact development measures via County Official Plan? Spill Policy Guidance – On June 12, 2026 the Province released a proposed update to the Technical Guide - River and Stream Systems: Flooding Hazard Limit and Technical Bulletin - Special Flooding Hazard Conditions in River and Stream Systems. Available at ERO posting https://ero.ontario.ca/notice/026-0329 This technical bulletin proposes how Spills can be modelled using 2D modelling techniques. Conservation Authorities such as Otonabee Conservation have already demonstrated this ability in mapping spills via 2D mapping techniques in two projects in the City of Peterborough.	Addressed. Thank you for the insight; we were unaware that the TRCA TOR for FBWB were not working well in your jurisdiction; a recommendation has been added to section 9.1 that the CAs work on updating the TOR for FBWB. Noted but cannot be addressed. As noted above, the influence of Bill 98 remains uncertain but is not expected to impact the high level guidance and recommendations in this Watershed Plan. Noted but cannot be addressed. Thank you for these insights but as this document remained “proposed” at the time of finalizing the Watershed Plan the Plan was not amended to account for its guidance. That said, we acknowledge that policies and guidelines will continue to be updated moving forward, and that the Watershed Plan should adopt and use the most current information. A note to this effect has been added to the Preamble of both Volumes 1 and 2.
111	14-06-2026	Otonabee	Section 9.3	Official Plan and Recommendations – as part of the one window planning approach with the Province, Otonabee Conservation provided direct feedback regarding the redlined County OP to the MMAH. These comments culminated in revisions to the wording of the natural hazards sections to include hazardous lands, hazardous sites and areas of unstable soils and unstable bedrock for consistency to the PPS.	Noted. Thank you for sharing these insights.
112	14-06-2026	Otonabee	Section 2.1.2 5.1.4 5.2.1 6.2.1 8.3.1	Otonabee agrees with GRCAs comment above as it relates to these sections. ELC mapping and Hydrology modelling should be emphasized as a priority with respect to next steps for Peterborough County. Conservation Authorities have been shifting their focus to enable them to have the resources and capacity to spearhead this type of work alongside municipal partners. Otonabee Conservation, and as part of the future ELORCA will be advocating to complete a continuous hydrological model for the entirety of Peterborough County. Our current Floodplain mapping Implementation Plan, as approved by the Board of Directors requires new mapping for the Otonabee River as a priority, which makes the development of the hydrology model an absolute must. The development of this model will benefit municipalities with respect to (see Otonabee Conservation - Hydrology Briefing Note.pdf): • Improved flood forecasting and warning • Natural Asset Management (required by regulation) • Watershed Planning – assist in subwatershed planning • Assess wetland water balance	Addressed. Thank-you for this additional information. The recommendations in Section 9 of Volume 2 have been revised to reflect the CA priorities as shared. The Watershed Plan also strongly supports the development of a continuous hydrological model for the entirety of Peterborough County.

Appendix B Terms of Reference

Terms of Reference

Subwatershed Studies
(Quaternary Scale)

July 2026

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1 Introduction

This document constitutes a generic approach to conducting subwatershed studies at a quaternary scale which are required to support growth planning across the County of Peterborough. Stakeholders involved in these undertakings should consult with the County, CA and local municipalities to prepare and tailor the scope of these Subwatershed Studies to the needs and resources in the respective study areas.

The lands being proposed for development through a Secondary Plan are generally referred to as the Primary Study Area (PSA) while those lands beyond the PSA within the subwatershed limits are referred to as the Secondary Study Area (SSA). Subwatershed Study (SWS) work in the PSA is typically more detailed and supported by field investigations, whereas the work in the SSA is generally less detailed and primarily supported by desktop information and limited field work, largely of a confirmatory nature. The broader watershed/subwatersheds may have existing downstream constraints beyond the identified Secondary Plan study area and, to the appropriate extent, these constraints either environmental or public safety will have to be considered in establishing the management strategies in the subject Secondary Plan area based on the overall study objectives and ultimate targets. Where there are watershed wide management strategies established through approved watershed studies, the established strategy is to be considered a minimum requirement.

The Subwatershed Studies will need to:

- Identify the location, extent, present status, significance, and sensitivity of the existing natural environment;
- Identify environmentally sensitive areas and natural hazards, including constraints and opportunities;
- Confirm or refine the natural environment system(s) (i.e., natural heritage system and water resource system) to protect, rehabilitate, and enhance the water quality/quantity, ecological form, function and the interactions and interdependences between 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 to be compatible with the natural environment system(s);
- Undertake an iterative Impact Assessment based on an initial Preliminary Preferred Land Use Plan for the Secondary Plan area (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 urbanization proposed through the Secondary Plan (from an environmental and water management perspective);

- Provide direction on future study requirements (i.e., Environmental Implementation Study or equivalent), infrastructure needs (i.e., Master Environmental Servicing Plan (MESP) - planning and implementing servicing and transportation infrastructure from an environmental and water management perspective);
- Establish an implementation and management strategy and requirements for environmental systems monitoring;
- Support the Class Environmental Assessment processes being undertaken as part of the infrastructure planning for the Secondary Plan area, specific to constraints and opportunities associated with the natural and water-based systems.

As noted above, the extent and form of study varies based on the discipline and the areas of interest, with more intensive field investigations in the Secondary Plan area and less intensive desk-top forms of study in the lands beyond the Secondary Plan area to provide an overall subwatershed context. This systems-based assessment is required to examine 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 is built on a period of field data collection and monitoring (minimum 2-years preferred 3-years), which 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 consideration of the findings and requirements of other infrastructure studies such as Master Servicing (Water/wastewater) and Transportation Plans, which need to be concurrently advanced for consideration through a consultative process involving local municipalities and the County the Conservation Authorities, other provincial agencies, landowners, Indigenous Nations and Peoples, and the public. This public consultation is vital to ensure that the varied interests of all stakeholders are appropriately considered in the study. Once appropriately vetted, management and monitoring recommendations to implement the recommendations of the Subwatershed Study and related municipal Master Plans are required to be translated into policy and strategies for community development as part of the Secondary Plan which will be enacted through an Official Plan Amendment (OPA).

1.1 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.

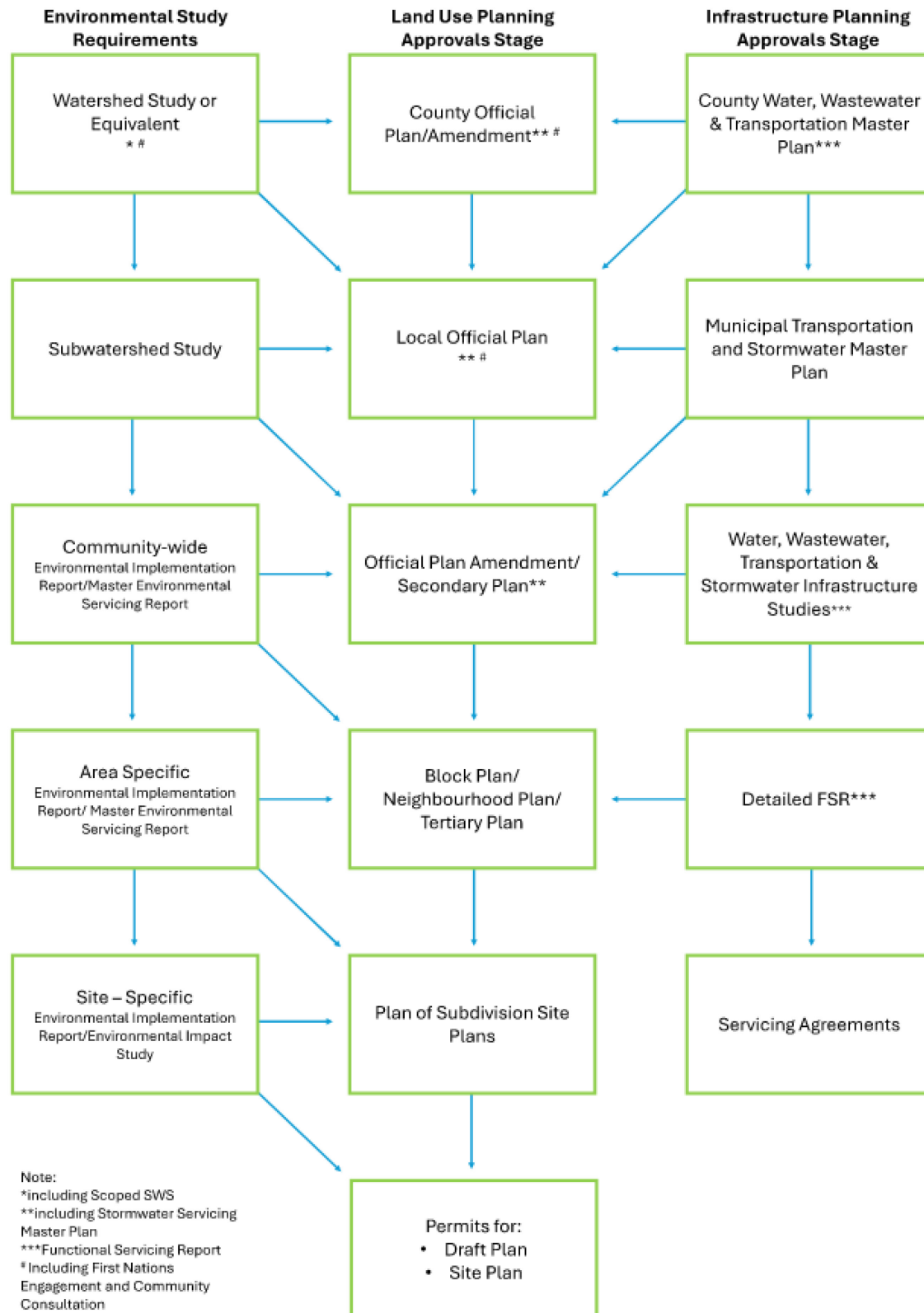


Figure 1 Integrated Land Use, Subwatershed, and Infrastructure Study Process

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

The SWS will provide the environmental base and context for the natural and water-based systems to support the infrastructure planning for the Secondary Plan Area. Combining the Planning Act and Municipal Class EA process permits the Municipality and County to plan the Secondary Plan area and its required infrastructure collaboratively in a holistic manner, whereby the SWS will provide important resource and management guidance to the Environmental Assessments for roads, water and wastewater servicing.

To facilitate consultation, a Technical Advisory Committee (TAC) will be formed comprising of staff from the local Municipality, the County, Conservation Authority, various applicable Provincial representatives, First Nations, landowner technical representatives, and the consulting team(s). For specific and specialized matters, “sub TACs”, involving discipline-specific professionals, will be established. The TAC will advise and help direct 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 Subwatershed Study to a Community Development Plan in a collaborative manner through the integration of the outputs and recommendations from the concurrent studies.

As noted above, the environmental base for the Secondary Plan (i.e., the natural heritage system and the water resource system) will be defined by the Subwatershed Study. The natural heritage system and water resource system established through the Province and Regional Official Plan, refined through the Municipal Official Plan, will be further refined or confirmed through the Subwatershed Study in support of the Secondary Plan.

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 sustainable, healthy, connected and complete community.

An overview of each phase of the SWS process is provided below, with further details provided in the subsequent section.

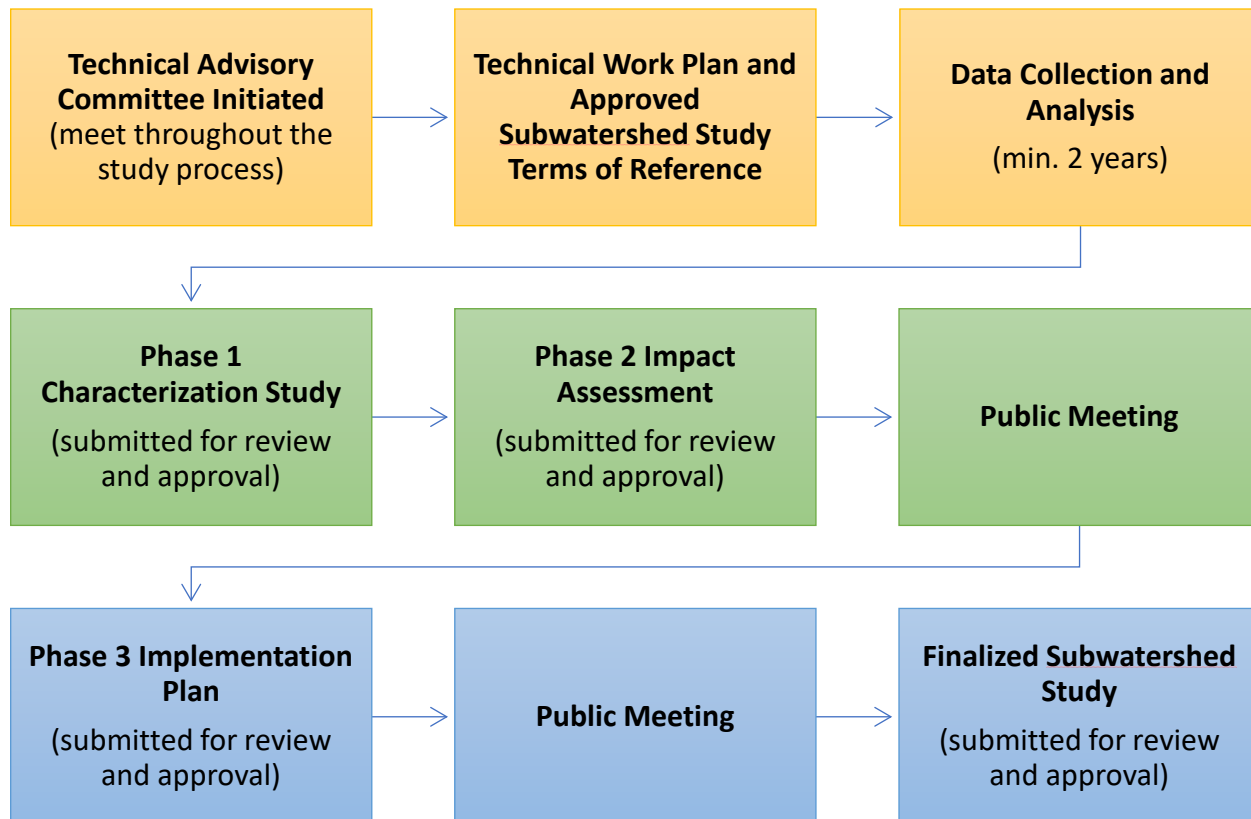


Figure 2 Subwatershed Study Process

2 Subwatershed Study Work Plan

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 (3) levels of investigation, including (i) review of desk-top secondary sources (compiling information from existing documents); (ii) reconnaissance-level fieldwork; and (iii) detailed field work (Minimum 2 years, 3 years preferred).

Existing desk-top information relevant to the Subwatershed Study Area will need to be reviewed.

Gap Analysis:

Background data used to prepare the 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 possible preferred methods by which to appropriately address the information gaps in Phase 1, as required.

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

Technical Work Plan Confirmation:

Once all of the background data have been collected, the need and requirements for obtaining additional information 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 Technical Work Plan. It will be important to receive final sign-off from the TAC prior to advancing the updated/refined work plan.

2.2 Phase 1 – Subwatershed Characterization and Integration

2.2.1 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, County, 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:

Depending on availability, the Hydrologic Modelling should:

- apply the approved hydrologic modelling from the Conservation Authorities for Regulatory Flood Hazard assessments, and
- develop new local detailed continuous hydrologic modelling for assessment of frequency flows, water balance and erosion.

The detailed continuous hydrologic model shall be selected for use in the SWS; the model(s) will need to be developed and calibrated for the subwatershed's existing condition. The local hydrologic 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 modelling should ensure that the hydrologic and hydraulic features are appropriately represented for each subwatershed/catchment within the study area. The development of the model(s) will need

to be in accordance with applicable standards to support future Municipal, County or Conservation Authority use of the model, and model results.

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

The results from the surface water modelling 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 system. As noted, it is required that the model(s) will be calibrated and validated based upon both historical rainfall and flow monitoring data, as well as new hydro-meteorological data collected as part of this study. The exercise should meet Provincial standards to provide a comprehensive understanding of the existing hydrologic conditions of the study area. The model shall be calibrated and validated to provide comparable flows at the subwatershed outlets to those determined in any previous watershed or drainage studies for the given watercourses, and any differences need to be rationalized. 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 extent of area modelled should be sufficient to generate results at key/important downstream locations/confluence points and locations of interest (i.e., Special Policy Areas, Flood Vulnerable Areas, Flood Vulnerable Roads etc.) to confirm that the development of the Secondary Plan Area will not have any adverse impacts on the peak flow rates and runoff volumes specific to the objectives of managing the impacts due to adverse flooding and erosion.

The Erosion potential assessment of receiving and downstream watercourses shall be carried out using continuous simulation of watercourse flows over a suitable period of time, to evaluate the duration of critical discharge exceedance, cumulative erosion index (Ontario Ministry of Environment, 2003), cumulative effective work (per CA SWM Criteria), and other methodologies proposed by the study team stream morphologist (e.g. cumulative effective discharge, number of exceedances), to determine erosion thresholds (discharge, velocity and shear stress) established by the study stream morphologist and the associated guidance on the appropriate methodology.

Hydraulics:

The SWS will require a field inventory of creeks, road crossings (culverts and bridges), stormwater facilities, etc. The current drainage systems and outlets shall be characterized as to potential drainage constraints and opportunities. The intent of the hydraulic modelling is to define area flood 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., based on the flows associated with the greater of the Regional Storm event or 100 Year Storm) for existing conditions. For the creeks that have floodplain delineation, as identified in previous studies, the flood lines shall be updated to reflect the current limits of the flood hazard, for land use planning purposes, but not as a formal flood plain map. The floodplain delineation should be based on hydraulic modelling, using the latest Hydrologic Engineering Center's 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 SWS. As noted, this component of the SWS, while preparing preliminary floodlines for land use planning purposes, is not intended to be a formal floodline mapping study.

2.2.2 Hydrogeology

The goal of the SWS 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 of the hydrogeologic study 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 establish an understanding of the effects of future development on the local groundwater resource to assist in the need and implementation of measures to address overall water balance. The Subwatershed Study will build upon the understanding derived through the Watershed Plan and other senior level plans such as Source Water Protection plans. The incorporation of additional field monitoring using new data and refined modelling tools will provide additional spatial and temporal insights on the groundwater system. The refined analysis will be needed to achieve the primary objectives and extend the understanding of the following key matters:

- Presence of potentially significant local recharge areas, linked with local discharge,
- Shallow depth to groundwater,
- Locations of strong upward gradient,
- Groundwater/surface water interaction,
- Dewatering needs,
- Seepage areas and
- Existing tile drainage.

In order to accomplish the above, additional data made available over the course of the SWS will need to be reviewed prior to finalizing the groundwater field program, as part of the Technical Work Plan. The groundwater field program, which is to be prepared by a qualified hydrogeologist, is expected to be tailored to the characteristics and resources in the subject Subwatershed area and 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.

Depending upon the needs of the SWS study area, the conceptual groundwater model scope 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 including contributions to and from areas outside the subwatershed(s).

The baseline groundwater conceptual model and more detailed numerical groundwater model and 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 other component disciplines associated with the SWS.

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

2.2.3 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 and required) 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.

The fluvial geomorphological assessments in support of Subwatershed Studies should meet or exceed the criteria outlined in the CA Stormwater Management Criteria.

Available data for the subwatershed and other existing sources, are to be reviewed to confirm the need for updating the existing information. Surface water feature types (watercourses and headwater drainage features) should be defined and identified appropriately as a reach delineation is performed. Reach delineations and feature types are to be confirmed and/or updated based on refined mapping and field investigations. 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 processes 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 through 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 to support the development of stormwater management guidance. Assessments will identify those 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 current 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 watercourse constraints (high, medium, or low constraints) to confirm or refine the results from available higher level studies, while also completing an assessment of the headwater drainage features (HDFs) in accordance with the application methodology presented in *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (TRCA/CVC 2014). The assessment will need to involve multi-seasonal field work (preferably a minimum of two years) 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. The classification and management of HDFs provides for detailed, field verified assessments to maintain overall system function and contributions, that previously may have been estimated through the application of legacy drainage density targets.

2.2.4 Aquatic Environment

The available background information on fish habitat in the study area, including information on permanence of flow and thermal regime, fish communities, fish species present, aquatic species at risk present, and benthic invertebrate communities should be acquired and used to characterize the aquatic environment. Some aspects of aquatic habitat, such as channel form and stability, headwater drainage feature classification, and riparian vegetation will be addressed by, or in conjunction with, other disciplines (e.g., fluvial geomorphology, terrestrial ecology). Data gaps should be identified, if present. If data gaps exist that will limit the effectiveness of the subsequent phases of the SWS, field programs should be conducted to address these gaps. In some cases, data gaps may be addressed through baseline monitoring.

Baseline monitoring sites should be established and monitoring initiated. Baseline monitoring sites should be representative of larger reaches based on key parameters such as the fish community and thermal regime and on expected susceptibility to development impacts. Baseline monitoring methods should follow established protocols (e.g., Ontario Stream Assessment Protocol, Ontario Benthic Biomonitoring Protocol) and conform with the monitoring methodologies employed by the CAs, if possible, to maximize the utility of the data.

2.2.5 Terrestrial Environment

Landscape Scale Screening

To better understand the ecological context of the proposed development area, as part of the overall subwatershed, the Subwatershed Studies will need to review and build upon the direction and guidance in the County's Watershed Plan (2026). The purpose of this review will be to generate information on the ecological context of the Study Area, consider its position and role in the overall County Natural Heritage System and potential connectivity of the Study Area within the broader landscape. This Landscape Scale Screening supports identification of 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, confirm and, where appropriate recommend additional linkages between the ecological systems and enhancement opportunities within the Secondary Plan area and with lands beyond their boundaries on the landscape. This screening will rely on existing desktop information sources.

Building on the approaches advocated in the Watershed Plan, a variety of metrics should be used to quantify existing landscape-scale conditions and functions. Given the broader scale of interest for the Landscape Scale Screening, the objective should be to characterize patches of natural cover that occur within the subwatershed and the area surrounding the Secondary Plan Area being studied. Metrics should include, but are not limited to, those that quantify:

- The occurrence and diversity of vegetation community types within and across natural heritage features and areas
- The size and shape characteristics of vegetation and habitat patches

- Landscape composition (i.e., matrix influences) influence on features and/or natural area patches
- Connectivity of patches (i.e., physical and functional connectivity)
- The occurrence and coverage of features and/or habitats that have policy implications (e.g., habitat for Species at Risk, species that are provincially rare, Significant Wildlife Habitat, etc.)

Detailed Assessment of Terrestrial Resources

A detailed assessment of terrestrial resources in the subwatershed shall be undertaken. The Natural Area Inventory information from the Conservation Authority and the local municipality and County, and other relevant background studies, should be consulted to guide the necessary fieldwork requirements for each Secondary Plan area Subwatershed Study. The proposed inventory and associated fieldwork should be included in the Technical Work Plan and confirmed by the local municipality and TAC. The methods for data collection shall follow industry standards and be used to ensure that future land-use planning and proposed development is consistent with the Provincial Planning Statement, County's Official Plan, and Future Municipal Official Plans.

Detailed field assessment of the subwatershed's terrestrial resources shall be conducted to characterize the terrestrial environment and establish a baseline understanding of the composition, function, and policy context of the terrestrial environment for the Secondary Plan Area, including the proximity to, and the degree of linkage with other habitats. **Table 1** provides a summary of typical inventory requirements for terrestrial environment features and functions. 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. Features are to be assessed against criteria and direction outlined in the Watershed Plan and County/Local Municipal Official Plans to inform implementation of management guidelines for features and other components of the NHS, as detailed in the Watershed Plan (2026). Specific consideration shall be given to the location and relationship of features and areas within the NHS (e.g., occurring within the Province's NHS, linkage, proximity to Key Features, etc.). Opportunities for enhancement of the terrestrial environment shall build on the guidance identified in the Watershed Plan, including confirmation of enhancement areas, objectives and targets.

Table 1 Terrestrial Environment Inventory Requirements

Biophysical Inventory	Standard 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.
Woodland Evaluations	Inventory within woodland areas should be sufficient to evaluate the significance of woodland features based on relevant criteria and policy definitions. Woodland boundaries should be field verified with responsible authorities where feasible.

Biophysical Inventory	Standard Inventory Requirements
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 24 and June 16 and the second between June 17 and July 10 using 10-minute point counts and area searches. Breeding evidence by species should be recorded according to the Ontario Breeding Bird Atlas protocol.
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 database.
Significant Wildlife Habitat Screening and Assessment	This assessment will include identifying candidate and confirmed Significant Wildlife Habitat and will utilize the MNR's <i>Significant Wildlife Habitat Technical Guide 2000</i>) and associated Criteria Schedules (MNRF 2015).

2.2.6 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 to provide the baseline reference and identify any water quality concerns and constraints in the study area. Other potential 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 complete an inventory of existing SWM facilities within the subwatershed and the respective catchment areas, as the baseline reference for stormwater management in terms of water quantity/ quality control.

Local water quality monitoring data will need to be collected to support characterizing the area's surface water quality based upon the contributing land use, soils, and existing stormwater quality management practices during both wet (storm) and dry (baseflow) periods. Surface water quality monitoring at the same locations as the streamflow gauging is preferred in order to correlate the surface water quality with the study area hydrology. For all permanently flowing streams,

continuous monitoring of temperature is required between April and December for a minimum of two (2) years. Surface water quality monitoring needs to be conducted between the months of April and December. Water quality grab sampling should be completed at each station for three (3) dry weather events and three (3) wet weather events, capturing at least one (1) wet and one (1) dry event for each season. Two (2) grab samples need to 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.

The grab samples for each wet weather and dry weather event should be analyzed for the following contaminants, subject to review by the TAC:

- Oil and Grease
- Total Phosphorus
- Anions (Nitrate, Nitrite, Phosphate, Chloride)
- Ammonia
- Total Kjeldahl Nitrogen (TKN)
- Conductivity
- Total Solids (TS)
- Total Suspended Solids (TSS)
- BOD₅
- 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 CaCO₃
- Turbidity

2.2.7 Phase 1 Report – Subwatershed Characterization and Integration

At the completion of Phase 1, the general characteristics of the study area subwatershed 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 and Water Resource System should be identified, building upon that identified in the County's Official Plan. The Phase 1 Report will establish the general characteristics of the subwatershed and the Secondary Plan Area, which will be the starting point from which the proposed land uses are to be developed. Of importance, the Phase 1 Characterization report

should identify/delineate all key natural heritage and key hydrologic features and assess their status and significance tied to policy requirements, as a key deliverable and component of the constraint mapping.

The Phase 1 Report shall include:

1. Summary of background literature and data reviewed;
2. 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
 - f. Natural Environment Systems
3. Integrated assessment of above identified features and functions to evaluate their significance
4. Summary of the subwatershed study area major issues, concerns and constraints.

The constraint-based framework that is developed should be consistent and inclusive of all relevant federal, provincial, County, municipal, and CA policies and clearly identify areas that are protected from development and those that provide opportunities for development.

Note: It is expected that a Draft Table of Contents will be submitted for review and comment by the TAC well in advance of the Draft Report submission.

2.3 Phase 2 – Subwatershed Impact Assessment

Based on the outcomes of Phase 1, including the review of background information sources and supplementary field work, Phase 2 will require an iterative assessment of the potential impacts of proposed future land use changes on the natural environment and water-based system within the study area. The findings from the Phase 1 Characterization, 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 to determine a preliminary preferred concept(s) for the impact assessment in Phase 2.

The Phase 2 Impact Assessment will be completed concurrently to the other component studies such as the Transportation Master Plan, and Water/Wastewater Master Servicing Plan, which will also assess 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 where present;
- assist in the establishment of open space linkages;
- address opportunities and constraints to development;
- provide a strategy to manage legacy impacts from existing land uses;
- Establish details on preliminary locations and areas for stormwater management (source controls and end-of-pipe facilities);
- identify restoration and enhancement opportunities to meet system targets; and
- ensure that the land use plan meets the goals, objectives and targets of the Subwatershed Study.

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 an iterative approach whereby the feedback from the initial land use assessment shall be provided to the TAC and the Land Use Planning Team. The impact assessment shall also consider the impacts of climate change to the Natural Heritage System and Water Resources System, and the manner in which the proposed development and management plan may exacerbate or mitigate these impacts. At a minimum, the Subwatershed Studies should identify known climate change impacts and vulnerabilities that were cited in the Watershed Plan based on the climate change vulnerability assessments prepared for the County and CAs. In this regard, the impacts resulting from the proposed development and climate change are intended to be assessed in an integrated manner, rather than evaluating the impacts separately.

For the Subwatershed Studies being undertaken within the County various approaches to climate change assessments should be considered and discussed with the TAC including downscaling to the applicable study area. Should the applicant prefer to establish a different approach this should be provided in the Technical Work Plan and approved by the TAC.

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

The next iteration of impact assessment will be expected to be more scoped and focused on the specific changes to the land use and proposed environmental impact management strategies. Hence the scope outlined in the following sections will need to be conducted iteratively, whereby the initial assessment will inherently be more complex and detailed than the subsequent assessments. It is expected that the majority of the impacts and associated management and land use changes will have been captured as part of the initial 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(s) shall be modified to reflect post-development conditions and executed both continuously (using flow frequency analysis) and in event mode (using design storms) to generate peak flows for all events ranging from 2, 5, 10, 25, 50, 100 and 350-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 of planned development on surface water, groundwater and water budgets. The Phase 2 Impact assessment hydrologic analysis will need to:

- Delineate discrete drainage areas based on potential future development;
- Calculate post-development flows for all event storms and the Regional Storm at predetermined locations, as per the discretized drainage area plan and model schematic diagram for the study area. The post-development flows shall be compared to existing flows for all storm events at the hydrologic nodes of interest. If the Conservation Authority has an approved hydrologic model which establishes unit release rates for development, then the results of the local modelling as part of this study are to be validated against the existing guidance from local Conservation Authorities;
- 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 Watershed Plan and other guidance documentation;
- Assess the future discharge impacts (both flows (peak and volume) and erosion potential) on the local systems and the broader creek systems based upon the methods completed as part of the Phase 1 hydrologic assessment (critical discharge, cumulative erosion index, and cumulative effective work), in coordination with the Study Team Stream Morphologist;
- Complete a climate change assessment consisting of evaluating the hydrologic impacts for projected design storms and four (4) local historic storms, and the formative timeseries for four (4) formative storm events which occurred in other jurisdictions,
- Any preliminary stormwater management strategies, required to match the post-development flows to existing conditions, shall be identified.

The future development impact assessment should evaluate the impacts on both runoff volumes and peak flow rates, without and with mitigation. SWM practices will be required to be sized to a

preliminary level of detail as related to managing the flows for 2 to 100 year event. Furthermore, impacts to Regulatory flows (Hurricane Hazel) will need to be assessed including consideration for Regional Storm flood control/management facilities. Guidance from the Watershed Plan and other related documentation, and a review of downstream FVAs and FVRs will need to be considered as part of this task. The hydrologic impact assessment should be integrated with the ecological component impact assessments and should include an environmental flows analysis at critical locations (e.g., Indicators of Hydrologic Alteration).

Hydraulics:

The existing hydraulic conditions 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 based upon critical erosion parameters (i.e., critical flow, critical shear, critical velocity) and/or flood risk concerns due to the proposed development shall be identified and compared to those identified under Phase 1, in consultation with stream morphologists. Again, for any watercourses where the flow regime 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 level of service for hydraulic structures within the study area and the resulting overtopping depths, caused by the Regulatory Event, shall be assessed and documented on existing roads at all crossing structures. The floodplain 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.

For those watercourses which are anticipated to be altered (realigned and reconfigured) as part of the watercourse management plan, full hydraulic modelling is not required however the hydraulic capacity of the proposed geometry (cross-section and longitudinal slope) needs to be checked using approved methods, and documented accordingly.

2.3.2 Hydrogeology

The hydrogeologic impact analysis shall examine the potential impact of future development land use changes on the groundwater systems, as well as the impacts of climate change. 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 subwatershed investigation shall:

- Ensure the groundwater sensitive areas are recognized and protected from future urbanization 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
- Consider any relevant needs within the Source Water Protection Plan.

The baseline water balance assessment described in Phase 1, should be updated to reflect changes in the various parameters related to development scenarios and climate change to consider potential impacts particularly to changes in groundwater recharge. As presented in Phase 1, the hydrological model is also to be used to carry out a water balance, and a comparison and differences rationalized. 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 their physical representation. These 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.

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 land use plan to ensure that area watercourses which are proposed to be protected in-place 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 for each of the critical parameters (critical discharge, cumulative erosion index, and cumulative effective work). 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, by applying the methodology per the approved Technical Work Plan. 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 (HDFs) in the proposed development area are stable and have sufficient conveyance capacity, and which watercourses and headwater drainage features need restoration or alteration through the application of natural channel design principles. Stream morphology shall be assessed downstream of future development areas, with a focus on existing and potential erosion concerns. The extent to which downstream areas need to be assessed will be based on a sensitivity review by the Stream Morphologist and the Hydrologist. Existing and future development impacts shall be evaluated with the development strategy indicated to limit the potential for negative impacts, while accommodating opportunities to restore and improve the existing watercourses or HDF condition. This approach will need to consider watercourse constraints (high or medium constraint) and HDF management classifications (protection, conservation, mitigation, no management) which determine the recommendations for those features which remain on the landscape (protected in-place or realigned) versus those (HDFs) 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 erosion hazard, 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 and/or tertiary plan). The natural channel design strategy must clearly define that all channel blocks can 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 HDFs are to be maintained and considered for relocation or removal, needs approval of the TAC. The Conservation Authority and MNR 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 and climate change on the aquatic habitats through direct modifications (e.g., watercourse realignments, watercourses crossings) and impacts arising from changes to the hydrologic and hydrogeologic regimes and disruption to riparian vegetation. Opportunities for aquatic habitat enhancement by direct modification (e.g., eliminating barriers to fish migration) or enhancement of riparian buffers should also be considered. The effects of the anticipated changes to aquatic habitat on aquatic biota will need to be assessed.

Consideration is to be given to the presence and role of aquatic features and functions as part of the Natural Heritage System. This is to include, at a minimum, thermal regime, species diversity, water quality and quantity, and their long-term protection within the NHS to inform the assessment of impacts at the system scale.

2.3.5 Terrestrial Environment

The Study Team is to investigate potential land use impacts and climate change on terrestrial features, their associated functions and their role within the NHS based on the integrated system

analysis completed in Phase 1. Appropriate mitigation strategies, including establishing appropriate buffers/setbacks, will be identified to protect the natural heritage features and functions from disturbance. In addition, linkages and enhancement areas identified through the County and local municipal OPs will need to be confirmed or refined according to the guidance in the Watershed Plan and other related documentation, and consideration for additional linkages (e.g., site scale linkages) is to be assessed. The function and conceptual location of linkages and enhancements shall be confirmed and defined through this phase. Linkages are important in reducing the potential for adverse impacts of habitat fragmentation on natural areas. The management strategies shall be documented to:

- Demonstrate protection of features retained as components of the NHS;
- Demonstrate efficacy of mitigation measures to protect features from impacts associated with proposed development.
- Clearly identify linkages and enhancements necessary to maintain system connectivity (and thus functions).
- Demonstrate how system targets are met.

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.

In addition to management strategies that address land use impacts, consideration should also be given to impacts or opportunities associated with the active transportation network (particularly NHS/WRS crossings) and trail networks.

2.3.6 Surface Water Quality

The Study Team shall investigate potential land use impacts (i.e., increased imperviousness, land use type changes, etc.) and develop strategies to maintain or enhance in-stream water quality. Actions to address existing point and non-point sources of pollution potentially resulting in degraded water quality shall be developed. To ensure sufficient thermal mitigation for these sensitive species, the recommended management practices will need to consider the resulting thermal impact of the changing land uses.

Best Management Practices (BMPs) for urban stormwater management shall be recommended for all new developments 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 Impact Assessment, the results of the iterative land use assessments will need to be documented in a report (i.e., one for each iteration) outlining the

findings 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 to the TAC for review and comment well in advance of the Draft Report submission.

2.4 Phase 3 – Management, Implementation and Monitoring Plan

Phase 3 shall identify and set the framework for implementation and monitoring of the preferred subwatershed management strategy building from the results of the iterative land use impact assessments, as part of Phase 2. Management recommendations are required to address the objectives identified in the County's and local Municipal OP, as well as the goals, objectives and targets from the Watershed Plan (2026). A Management, Implementation, and Monitoring Plan shall be developed, which sets out the requirements for phasing, operation of facilities, and monitoring to ensure that the future development(s) follow the recommendations associated with the approved Subwatershed Study and Secondary Plan Policies. The direction provided in the Watershed Plan shall be used as the foundation for developing the monitoring plan to further refine, develop and identify management recommendations and requirements established through the detailed subwatershed studies. The Phase 3 work will be completed when a preferred land use plan has been determined based upon the findings and recommendations from Phase 1 and 2 of the detailed Subwatershed Study, considering the natural heritage system and water resource system direction and guidance, as well as the companion studies for transportation and servicing. The findings of this study will provide implementation recommendations and a technical framework for future infrastructure works and support the future development proposals in accordance with the approved Secondary Plan.

The stormwater management strategy will need to outline the siting for various components of the overall stormwater management plan, including key locations for facilities and general guidance for selecting green infrastructure and LID practices to manage the impacts to the Natural Heritage System and Water Resources System. The scope for additional studies will also need to be identified that are to be completed in support of future Tertiary Plans, Draft Plans of Subdivisions or Condominium, and Site Plans as required, to meet the objectives and targets of the Subwatershed Study. The Subwatershed Study is to identify preliminary locations for logical development blocks based on contiguous drainage sheds for consideration as part of future neighbourhood plans and/or tertiary plans. The scope for additional studies should include requirements to complete hydrologic and/or hydraulic modelling to verify the stormwater management criteria established in the higher-level studies based upon more detailed information, and revise/refine the criteria as required.

Management strategies are required that will consider and preserve the local and functional linkages of sensitive groundwater 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 determination or refinement of hydrogeologically sensitive areas relating to both recharge and discharge, issues related to shallow water table or strong upward gradients, potential location and function of Stormwater Management facilities and other BMPs, as well as planning and policy recommendations for groundwater quantity and quality protection.

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 Subwatershed Study, through the application 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.

Managing features of the NHS will build on the proposed strategy outlined in the County's and local municipal OP and the Watershed Plan (2026). Specific management strategies and implementation recommendations should be prescribed for features/areas based on - avoidance (i.e., protect in-situ), minimize and mitigate, linkage, enhance, replicate, and compensate. Avoidance is required and/or recommended for key features (e.g., protected by policy) and/or supporting features included in the NHS. Minimization of impacts and mitigation strategies should identify the required set of integrated approaches that reduce the degree of disturbance and impacts on natural features resulting from the proposed land use changes. Linkage recommendations should include specific design and implementation requirements to support connectivity at multiple scales (landscape, local, and site-scale). Enhancement recommendations should identify improvements to biological composition and function of areas in the context of the local landscape (e.g., habitat diversity / availability) or within the system (e.g., under-represented habitats). Replication and/or compensation management strategies should be identified, as a last resort, for features that cannot be protected in-situ, but require inclusion in the NHS; sufficient guidance should be presented such that the success of the proposed replication and/or compensation can be assured based on appropriate site selection, restoration protocols, financing, and long-term ownership/management responsibility

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;
 - 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; the monitoring program will need to ensure compliance with the Subwatershed Study, and a strategy for corrective actions which may be necessary based on results of the monitoring program; it is notable that MECP is advancing industry guidance for broad-based community monitoring plans to support the Consolidated Linear Infrastructure ECA process; the SWS monitoring program should take this into consideration and align with its requirements accordingly;
- Assist Secondary Plan Team with developing policies for consideration in the Secondary Plan;
- Criteria and time frame for the review/update of the Subwatershed Plan;

The Management, Implementation, and Monitoring Plan shall also recommend the phasing of development, and provide guidance to address climate change considerations, particularly demonstrating compliance with emerging Climate Change Action Plans. This will permit changes to recommend mitigation measures and management strategies for future phases of the development, in the case where 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 to the TAC for review and comment well in advance of the Draft Report submission.

Consultation and Engagement:

Fulsome consultation and engagement are the cornerstone to a successful land use study process. It is important to integrate and coordinate the consultation and engagement associated with the Secondary Plan and companion studies with the Subwatershed Study. The reason for this is to ensure that the public understands the relationship of environmental and water-based studies to the community planning associated with the Secondary Plan.

As noted, a TAC should be formed and at minimum three (3) meetings of the TAC will be required roughly aligned with each phase of the Subwatershed Study. A minimum of two (2) Public Information Centers (PICs) should be held and can again be aligned with those points of contact for the Secondary Plan.

Indigenous Peoples and Nations engagement is similarly important to consider throughout the land use planning process; hence it is again recommended that the SWS Team work to align communications with Indigenous People and Nations in accordance with the protocols of the Province and the County, fully coordinated with the land use planning provisions.