



BLACK/ HARMONY/ FAREWELL CREEK

2020 WATERSHED PLAN UPDATE



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Executive Summary

The 2013 Black/Harmony/Farewell (BHF) Creek Watershed Plan (WSP 2013) provided a framework and recommended actions to protect, restore and enhance a healthy and resilient watershed. Since 2012 there have been changes to provincial planning legislation and land use that affect how we manage some watershed resources. This Watershed Plan (WSP) update identifies those changes, updates resource mapping, and provides new guidance for land use management in the BHF Creek watershed; it does not replace the WSP 2013.

Most notably, this update introduces the Water Resource System for the watershed, as defined by the *2017 Greenbelt Plan* and the *2019 A Place to Grow: Growth Plan for the Greater Golden Horseshoe*. In addition to updated natural heritage, hazard and policy area maps, maps that identify Key Hydrologic Areas and Key Hydrologic Features (if available) have been included. Accordingly, the future land use scenario maps for the watershed have also been revised.

During the development of this update, the vision for the WSP was re-visited, as were the indicators used to measure watershed health over time, the goals necessary to achieve sustained watershed health, and the actions to maintain and improve watershed health. There are now 26 goals and 15 objectives, some existing and some new, for the 2020 BHF Creek Watershed Plan update (WSP 2020) using the Central Lake Ontario Conservation Authority (CLOCA) watershed planning and management framework. This framework provides a new foundation for CLOCA to monitor and evaluate watershed health.

The WSP 2013 tasked CLOCA with completing 23 Action Plans to fill knowledge gaps and inform future recommendations. Many of these have been completed and their content is included in this update. Additional action items, including new Action Plans, have been identified in this update to further assist with achieving the goals and objectives of the WSP 2020, and it is the responsibility of all watershed and community partners to participate in their delivery.

This updated Watershed Plan, which complements the original 2013 BHF Creek Watershed Plan, achieves the following:

- Identifies measurable conservation targets and indicators that CLOCA can use to monitor and evaluate watershed health;
- Establishes clear goals and objectives to achieve a healthy, resilient watershed;
- Adopts provincial planning language to assist municipal partners conforming to provincial policy requirements and provides up-to-date resource mapping; and,
- Outlines specific actions for CLOCA, watershed municipal partners and the broader community to achieve the goals and objectives of the watershed plan with an emphasis on collaboration and coordination.



Table of Contents

- 1. Introduction and Update Rationale 5**
 - 1.1. Rationale and Policy Basis 5
 - 1.1.1. Provincial Watershed Planning Policy 6
 - 1.1.2. Municipalities and Watershed Planning 6
 - 1.1.3. CLOCA and Watershed Planning 6
 - 1.2. Improved Watershed Knowledge 7
 - 1.3. Partners and Stakeholders 7
 - 2. Existing Watershed Conditions 8**
 - 2.1. Regional Landscape and Policy Areas 8
 - 2.2. Natural Heritage Resources 9
 - 2.3. Water Resource System 13
 - 2.4. CLOCA Natural Heritage System (NHS) 14
 - 2.5. Regulated Areas and Flood Damage Centres 14
 - 3. Future Watershed Conditions 17**
 - 3.1. Future Stressors 17
 - 3.2. Future Scenarios 18
 - 4. Changes in Watershed Health (2012-2017) 21**
 - 4.1. Conservation Target 1: Natural Cover 21
 - 4.2. Conservation Target 2: Forest Health 25
 - 4.3. Conservation Target 3: Stream Health 27
 - 4.4. Conservation Target 4: Coastal Wetland Health (Oshawa Second Marsh) 31
 - 4.5. Conservation Target 5: Human Health and Safety 34
 - 5. Planning and Management Framework 36**
 - 5.1. Strategy 1: Conserve, enhance and restore ecosystems of the BHF Creek watershed 36
 - 5.2. Strategy 2: Promote responsible land use practices to protect ecological and human health 38
 - 5.3. Strategy 3: Encourage, acquire, and expand partner/stakeholder support for the watershed plan 42
 - 5.4. Actions: Achieving the Objectives 46
 - 5.4.1. CLOCA Actions 46
 - 5.4.2. Municipal Actions 50
 - 5.4.3. Community Actions 52
 - 6. Next steps 54**
 - 6.1. Working Together in Partnership 54
 - 6.2. How to Get Involved 54
 - 6.3. Monitoring and Evaluation 54
 - 6.4. Implementation 55
 - 7. References 56**
 - 7.1. Reports Cited 56
 - 7.2. Additional Resources Used 57
 - 7.3. Data Layer Sources (Maps) 57
- Appendix A – Legislative summary 58
Appendix B – CLOCA Action Plan Status 61
Appendix C – Planning and Management Framework Overview 65



List of Figures

- Figure 1: Regional Landscape and Policy Areas *11*
 Figure 2: Natural Heritage Resources *12*
 Figure 3: Water Resource System *15*
 Figure 4: Regulated Areas and Flood Damage Centres *16*
 Figure 5: Future Scenarios Mapping *20*
 Figure 6: Impervious Cover *40*

List of Tables

- Table 1: Description of watershed scenarios included in future land use modelling analysis *18*
 Table 2: Summary of scenario analysis by impact category *19*
 Table 3: Summary of Indicators, Goals and Goal Status for Conservation Target 1 (Natural Cover) *23*
 Table 4: Summary of Indicators, Goals and Goal Status for Conservation Target 2 (Forest Health) *26*
 Table 5: Summary of Indicators, Goals and Goal Status for Conservation Target 3 (Stream Health) *28*
 Table 6: Summary of Indicators, Goals and Goal Status for Conservation Target 4 (Coastal Wetland Health – Oshawa Second Marsh) *32*
 Table 7: Summary of Indicators, Goals and Goal Status for Conservation Target 5 (Human Health and Safety) *35*
 Table 8: Impervious cover in the BHF Creek watershed and subwatersheds (2012-2018) *39*
 Table 9: Summary of Strategies, Objectives and Actions for Achieving the BHF Creek WSP Goals *44*

Acronyms

- ANSI – Area of Natural and Scientific Interest
 DRCWMP – Durham Region Coastal Wetland Monitoring Project
 ELC – Ecological Land Classification
 ESGRA – Ecologically Significant Groundwater Recharge Area
 FDC – Flood Damage Centre
 GGH – Greater Golden Horseshoe
 HVA – Highly Vulnerable Aquifer
 HVRA – High Volume Recharge Area
 IBI – Index of Biotic Integrity
 IWMP – Integrated Watershed Monitoring Program
 KHA/F – Key Hydrologic Area/Feature
 KNHF – Key Natural Heritage Feature
 LIB – Lake Iroquois Beach
 LID – Low-Impact Development
 MCR – Municipal Comprehensive Review
 MECP – Ministry of the Environment, Conservation and Parks
 MNRF – Ministry of Natural Resources and Forestry
 NHIC – Natural Heritage Information Centre
 NHS – Natural Heritage System
 OP – Official Plan
 ORM – Oak Ridges Moraine
 ORMCP – Oak Ridges Moraine Conservation Plan
 PPS – Provincial Policy Statement
 PSW – Provincially Significant Wetland
 SAR – Species at Risk
 SGRA – Significant Groundwater Recharge Area
 WPP – Wildlife Permeability Potential
 WRS – Water Resource System

1 Introduction and Update Rationale

In 2013, Central Lake Ontario Conservation (CLOCA) prepared the Black/Harmony/Farewell Creek Watershed Plan (WSP 2013) to characterize watershed health and identify management actions to improve watershed health. Since then, some land use and legislative changes have occurred and knowledge gaps have been filled that affect some aspects of the WSP 2013; consequently, an update is required to address these changes. The update, which complements—not replaces—the WSP 2013, is structured as follows:

Section 1 – Establishes the need for a WSP 2013 update by identifying significant legislative changes and introducing new or updated information since its publication. It also describes the results of the WSP update consultation process.

Section 2 – Characterizes the 2017 Black/Harmony/Farewell (BHF) Creek watershed and highlights changes in land use, planning and policy areas that have occurred since 2013. Updated land use and policy area maps are included.

Section 3 – Identifies future stressors to watershed land use and presents updated future land use scenarios, incorporating the changed elements from Section 2. Updated scenario maps are included.

Section 4 – Establishes the current health of the BHF Creek watershed, as defined by five conservation targets with updated indicators and goals, and discusses changes in watershed health, where feasible, since 2013.

Section 5 – Introduces three strategies developed by CLOCA to achieve the WSP 2020 goals and establishes clear objectives and actions that we, municipal partners and community members need to undertake to maintain and improve watershed health.

Section 6 – Identifies the final steps in the watershed planning and management process and establishes the monitoring standards necessary to assess watershed health over time and track progress made in achieving the WSP 2020 goals and objectives.

This update is intended to be concise and many of the details from the WSP 2013 that are still current, are not restated in this companion document. Please refer to the WSP 2013 for additional information (<https://www.cloca.com/watershed-plans>).

1.1. RATIONALE AND POLICY BASIS

Since 2013, amendments to federal and provincial legislation, land use plans, and municipal policy have occurred. In particular, the provincial planning policy framework has been revised, directly affecting how municipalities manage land use in the BHF Creek watershed. This WSP update incorporates these changes and the roles of the province, municipalities and CLOCA, with respect to watershed planning.

Our vision is for a healthy, resilient BHF Creek watershed that sustains ecological integrity for the plant, animal and human communities within it.



1.1.1. PROVINCIAL WATERSHED PLANNING POLICY

Watershed plans are recognized in Ontario's land use planning policy framework as the meaningful scale for integrated and long-term planning for the protection of water resources, water quality and water quantity.

The 2014 and 2020 updates to the *Provincial Policy Statement (PPS)* and the updated *Greenbelt Plan (2017)* and *A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2019)* more strongly promote land use planning at the watershed scale to protect, enhance or restore water quality and quantity.

Specifically, the policies in these plans require planning authorities to identify Water Resource Systems (WRS) to inform growth and planning decisions related to water and wastewater/stormwater infrastructure. They also encourage them to develop Natural Heritage Systems (NHS) to maintain the long-term hydrologic and ecological functions of the natural features within the watershed.

1.1.2. MUNICIPALITIES AND WATERSHED PLANNING

Municipalities must conform to the *PPS*, the *Oak Ridges Moraine Conservation Plan (ORMCP)*, the *Greenbelt Plan* and *A Place to Grow: Growth Plan for the Greater Golden Horseshoe* through the municipal planning process and when updating their *Official Plans (OP)*. Currently, the Region of Durham is updating its *OP* through a Municipal Comprehensive Review (MCR) process known as

Envision Durham, the goal of which is to develop a “progressive and forward-looking land use planning vision for the region to 2041.” The policies contained within the *OP* will direct growth, land use planning and resource management across the Region of Durham and will inform the land use planning practices of its member municipalities.

1.1.3. CLOCA AND WATERSHED PLANNING

Central Lake Ontario Conservation Authority works in partnership with their watershed municipalities through the management of its Conservation Areas and by monitoring watershed health to advise municipal and private partners on how to responsibly manage watershed resources. This update will provide assistance to municipalities in maintaining and improving watershed health by establishing long-term watershed health goals and objectives and identifying actions to achieve them.

This WSP update will also help municipalities conform to provincial natural heritage and water resource policies by identifying a NHS and WRS for the BHF Creek watershed and providing land use policy recommendations relating to the protection of natural features and functions in accordance with the planning policies set out by the Province of Ontario.

1.2. IMPROVED WATERSHED KNOWLEDGE

In the WSP 2013, there were 23 priority CLOCA Action Plans identified to achieve specific conservation targets. These are detailed in Appendix B. Many of these documents have since been completed and the information in them has contributed to the updated maps and refined WSP 2020 goals, objectives and recommended actions. Specific content from some of these Action Plans has been incorporated into this update to provide context or support actions, but the individual plans contain more detail than can be accommodated in this update; therefore, readers are encouraged to refer directly to relevant Action Plans for in-depth information. Wherever possible, links to specific Action Plans have been included to facilitate this, and access to all completed Action Plans, strategies, and tools can be found at <https://www.cloca.com/action-plans>

1.3. PARTNERS AND STAKEHOLDERS

As part of this update, CLOCA consulted with numerous partners, stakeholders, and community members to receive feedback and input to identify changes for the WSP 2020.

Pre-consultation (June 2018 – May 2019)

- Three formal public information sessions
- Online and in-person public surveys distributed and collected
- Individual consultation with indigenous community partners
- Interactive watershed planning ArcGIS StoryMap developed and made available online
- Individual consultation with municipal staff from planning, engineering, works and parks departments
- Presentations to municipal advisory committees, stakeholder groups, and community groups.

Some of the feedback included making the WSP 2020 more user-friendly, redesignating some of the 2013 recommended *OP* policies to operating guidelines and increasing the focus on protecting and enhancing natural areas in the watershed.

The consultation process also provided the opportunity to gain traditional knowledge and align the vision and guiding principles of the WSP 2020 with some of the priorities of the Métis Nation of Ontario (MNO) and the Williams Treaties First Nations^[1], whose “priority is the protection and preservation of the lands, waters, wildlife, and fisheries within [their] treaty territories and monitoring the existing or potential impact on these interests”^[2].

The feedback from this consultation process—that the relationship between watershed health and human health is important, that it is our responsibility to act as good stewards of our watershed resources, and that we must work collectively to protect and restore watershed health—are principles that are encompassed in the WSP 2020.

Draft review (June 2019 – December 2019)

- Development of draft WSP 2020 and internal CLOCA review
- Feedback booklet and WSP 2020 distributed directly to municipal and Region of Durham staff for review and comment
- Presentation of WSP 2020 at Latornell Conservation Symposium (Nov. 20)
- Draft WSP 2020 made available online for external review
- Virtual open house and questionnaire developed and uploaded to CLOCA website for public review and comment
- Public information session with presentations to introduce WSP update held at CLOCA office (Dec. 11)

[1] The Williams Treaty represents the seven nations of the Chippewas of Beausoleil, Georgina Island and Rama, and the Mississaugas of Alderville, Curve Lake, Hiawatha and Scugog Island.

[2] <https://www.scugogfirstnation.com/Public/Consultation>

2 Existing Watershed Conditions

A watershed is comprised of a mix of natural and non-natural (anthropogenic) features, which are influenced, to varying degrees, by the physical geography of the watershed. How a watershed evolves over time, i.e., how the proportion of natural to non-natural features changes, is influenced by the policies that protect or promote given features or areas within the watershed. Watershed planning is at the intersection of these and it aims to deliver a blueprint for growth to maintain the watershed's ecological integrity.

Changes to the features, or the policies that influence them, have the potential to alter the recommendations within a WSP. It is an important step to update the existing conditions of the watershed periodically to remain current. The landscape features and policy areas that factored into the development of the updated future land use scenarios (Section 3), are described below and any changes that have occurred since 2012 are discussed.

2.1. REGIONAL LANDSCAPE AND POLICY AREAS

The Black, Harmony, and Farewell Creek and their tributaries drain an area of approximately 108 square kilometres, and the BHF Creek watershed is one of four major watersheds in CLOCA's jurisdiction. It is entirely located within the Region of Durham, as Figure 1 illustrates, and straddles the municipal boundary of the City of Oshawa and the Municipality of Clarington.

The headwaters of this watershed originate in the Oak Ridges Moraine (ORM), which is subject to special land use policies outlined in the *Oak Ridges Moraine Conservation Plan (2017)*.

Its watercourses flow south through the Lake Iroquois Beach (LIB), eventually entering Lake Ontario through the Oshawa Second Marsh, a Provincially Significant Wetland. The Provincial Greenbelt encompasses all of the ORM and all the major valleylands. In 2017, the *Greenbelt Plan* expanded its boundary to include the urban valleylands in the watershed and this change is reflected in Figure 1.

The urban boundaries within the watershed have not changed since 2013 as these were already defined up to the Greenbelt boundary with little room for urban expansion unless the Greenbelt boundaries are revised. The only area of the watershed that remains undesignated as either urban or Greenbelt, is a small section of the Grandview subwatershed, southwest of Winchester Road and Townline Road in the City of Oshawa. Figure 1 shows the most current boundary, as provided by the Region of Durham.

The largest land use change in the watershed since 2013 has been residential and industrial development, and the construction of provincial Highways 407 and 412, which were approved in 2013 and included in the WSP 2013 figures, but were not constructed at that time. This new infrastructure, along with increased residential development in the north Courtice area, has resulted in some general losses to natural cover and increased watershed imperviousness, which are discussed in more detail in Section 5.

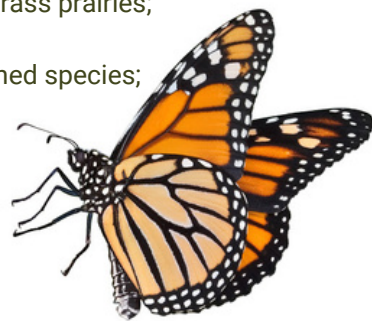
A watershed is an area of land drained by a river or creek and its tributaries into a body of water.

2.2. NATURAL HERITAGE RESOURCES

The 2017 vegetation communities in the watershed are represented by CLOCA's Ecological Land Classification (ELC) dataset (Figure 2). It is updated by CLOCA as new orthophotography is acquired. Overall, there has been a 2.9 per cent net loss in natural cover for the BHF Creek watershed since 2013. While some minor gains and losses have occurred as a result of natural succession and land use changes, other changes are simply the result of improvements made to the digital mapping layer; specifically, more accurate identification and delineation of feature boundaries. Approximately 46 hectares of habitat was lost as a result of urban residential development in Courtice and the construction of a transformer station in the Grandview subwatershed. An additional 30 hectares of natural vegetation loss occurred as a result of the Highways 407 and 412 construction.

A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2019) and the *Greenbelt Plan (2017)* both instruct planning authorities to protect Key Natural Heritage Features (KNHF) from development or site alteration, and identify these as:

- wetlands;
- life science areas of natural and scientific interest;
- significant valleylands;
- sand barrens, savannahs, and tallgrass prairies;
- alvars;
- habitat of endangered and threatened species;
- fish habitat;
- significant woodlands; and,
- significant wildlife habitat.



Central Lake Ontario Conservation Authority currently has mapping for its wetlands, including those that are identified as Provincially Significant Wetlands (PSW), and Areas of Natural and Scientific Interest (ANSI), by the Ministry of Natural Resources and Forestry (MNR). These are shown in Figure 2. No changes to these features have been identified in the past five years. Central Lake Ontario Conservation Authority has also mapped significant valleylands for the BHF Creek watershed, as defined by CLOCA within its regulatory boundary as the stable top of bank.

Central Lake Ontario Conservation Authority does not have any sand barren, savannah, tallgrass prairie or alvar communities identified in the BHF Creeks watershed and therefore, these (KNHFs) are not represented in Figure 2.

Endangered and threatened species are listed on the Species at Risk in Ontario list, and the Ministry of the Environment, Conservation and Parks (MECP) is responsible for protecting their habitat. Central Lake Ontario Conservation Authority has not identified these habitats in Figure 2 due to the sensitivity of this information; however, the general location of many Species at Risk (SAR) can be obtained from the Natural Heritage Information Centre (NHIC) website at <https://www.ontario.ca/page/get-natural-heritage-information>. Detailed information about SAR is also available from the NHIC upon request.

Fish habitat is defined by the *Fisheries Act* as “spawning grounds and any other areas, including nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes.”

Many of these elements are contained within CLOCA's NHS and are captured in the Water Resource System map (Figure 3). It should be noted a specific layer for this KNHF has not been developed, as more detailed drainage mapping is needed to identify many of the headwater features critical for fish habitat.

Technical guidance for the identification and delineation of significant woodlands was developed for the *2005 Greenbelt Plan*, but at the time of this update, a comprehensive woodlands inventory had not been completed for the BHF Creek watershed. In the City of Oshawa, any woodlands ≥ 0.5 hectares (ha) are to be considered significant and designated in its *OP*. Figure 2, therefore, identifies significant woodlands^[3] (≥ 0.5 ha) within the City of Oshawa municipal boundary only. Regarding significant woodlands within the Municipality of Clarington, CLOCA, in partnership with the other Conservation Authorities in Durham Region, has encouraged the Region to commission a regional geographical study to determine local criteria and thresholds for protection, management, and mapping of significant woodlands as part of the *Envision Durham* process. In the absence of more specific criteria, CLOCA recommends that all woodlands ≥ 0.5 ha be considered significant.

The identification of significant wildlife habitat has not been completed for any of the watersheds within CLOCA's jurisdiction and does not appear in Figure 2. A technical guide developed by the MNR to accompany the Natural Heritage Reference Manual, is available to assist planning authorities to identify and map these features. It can be found online at <https://docs.ontario.ca/documents/3620/significant-wildlife-habitat-technical-guide.pdf>



Barn Swallow –
threatened in Ontario

[3] Significant woodlands include the following ELC communities:
FOD, FOM, FOC, CUW, CUP, SWD, SWM and SWC.

Figure 1: Regional Landscape and Policy Areas

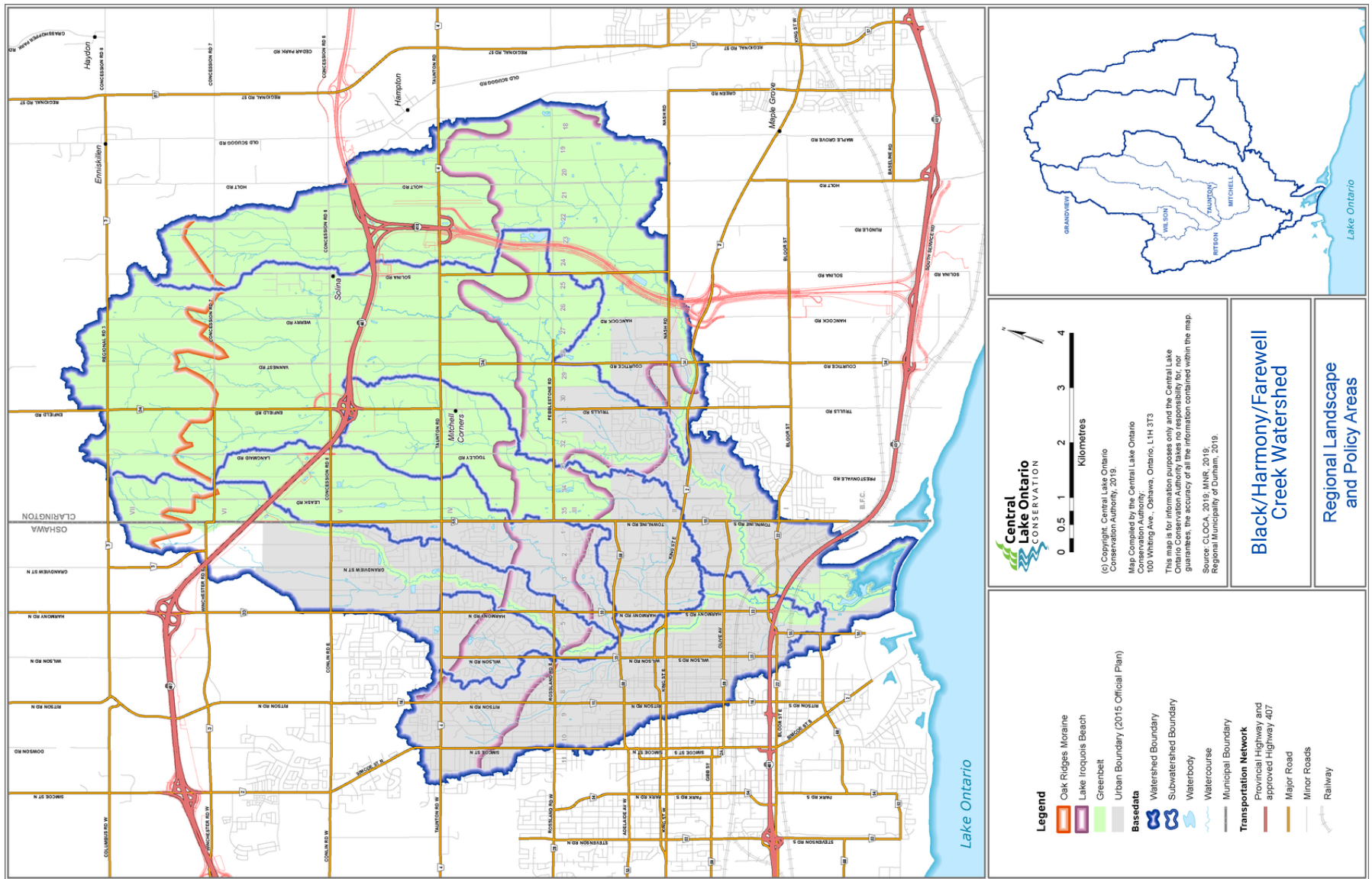
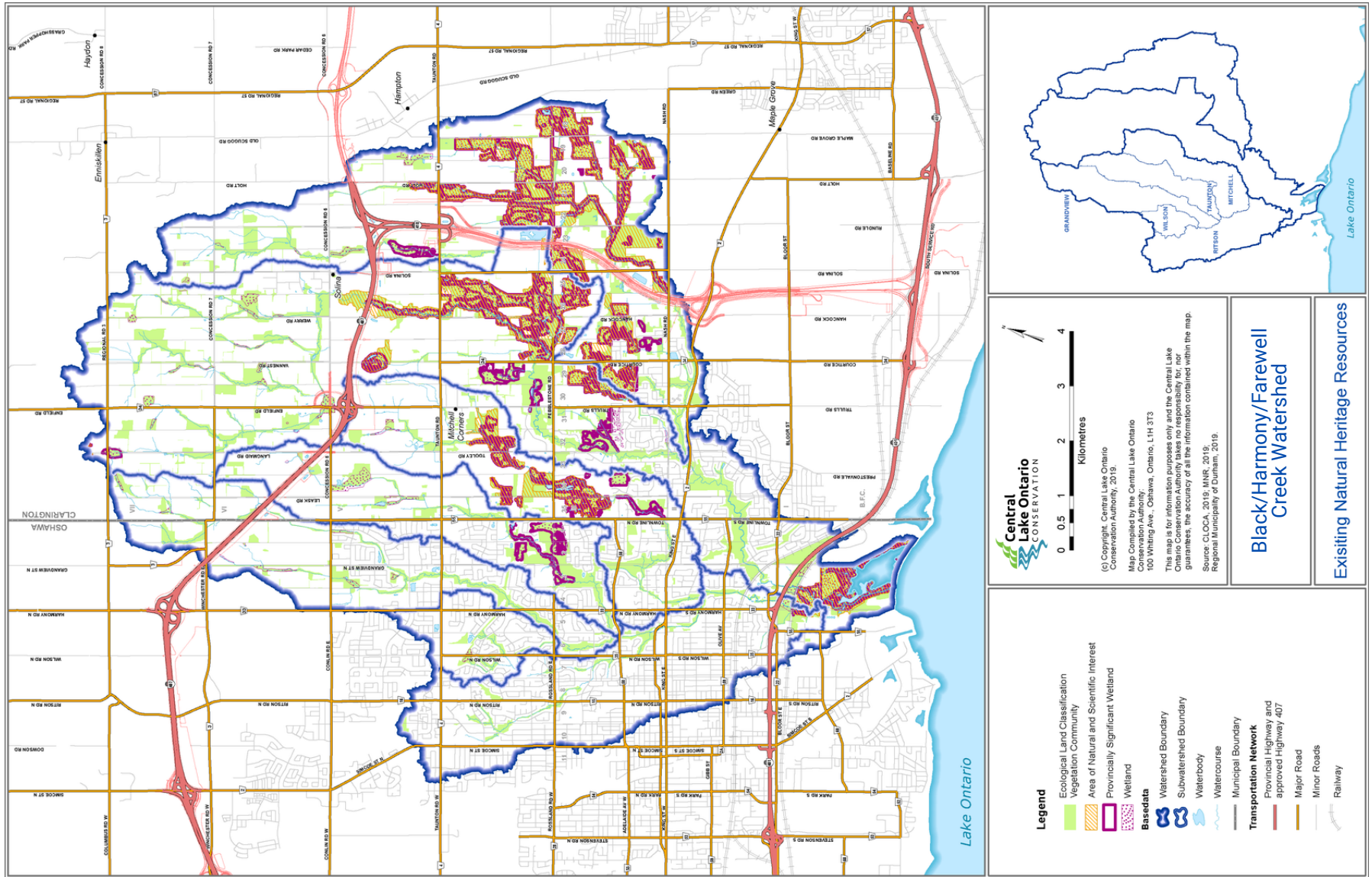


Figure 2: Natural Heritage Resources



2.3. WATER RESOURCE SYSTEM

In 2014, the PPS directed planning authorities to identify a WRS to protect the ecological and hydrological integrity of the watershed, and this directive has been maintained in this WSP 2020. *A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2019)* and the *Greenbelt Plan (2017)* further defined the WRS as being comprised of two main components: Key Hydrologic Areas (KHA) and Key Hydrologic Features (KHF).

KHAs include: Significant Groundwater Recharge Areas (SGRA); Highly Vulnerable Aquifers (HVA); and, Significant Surface Water Contribution Areas.

The SGRAs and HVAs in the Central Lake Ontario Source Protection Area (CLOSPA), as shown in Figure 3 for the BHF Creek watershed, were delineated following the Director's Technical Rules outlined under the *Clean Water Act, 2006*. The SGRA layer shown consists of two components: SGRAs, as defined for the purposes of source protection; and, Ecologically Significant Groundwater Recharge Areas (ESGRA), which CLOCA developed to identify important groundwater recharge areas for hydrologically sensitive natural heritage features, such as wetlands.

Figure 3 does not identify significant surface water contribution areas because, at the time of this update, the methodology for delineating these areas is in development.

KHFs include:

- permanent and intermittent streams;
- seepage areas and springs;
- inland lakes (and their littoral zones);
- wetlands.

Streams, inland lakes, and wetlands in the watershed have been mapped and are shown in Figure 3. At the time of this update, data for seepage areas and springs was only available for areas within the Oak Ridges Moraine; consequently, not all the seepage areas and springs in the BHF Creek watershed are shown.



2.4. CLOCA NATURAL HERITAGE SYSTEM

Ontario's planning policy framework encourages planning authorities to develop a Natural Heritage System (NHS) to maintain, restore and improve the diversity and connectivity of natural features and their long-term ecological function and biodiversity. An NHS should also recognize linkages between natural heritage, surface water and groundwater features.

In 2013, CLOCA developed an NHS for the BHF Creek watershed comprised of two parts: a *functional NHS*, which contains a connected system of existing natural heritage and hydrologic features, riparian buffers and wildlife movement corridors; and a *targeted NHS*, which identifies potential restoration areas in the watershed based on a GIS modeling exercise that places target restoration areas where they will grow higher quality habitat. As part of the WSP 2020, CLOCA's NHS was revised to incorporate land use changes and updated natural heritage resources information (Figure 5). Central Lake Ontario Conservation Authority's NHS includes many of the KNHFs and KHF's that planning authorities are required to protect, and it maintains connectivity between them. By designating CLOCA's NHS in OPs is one way that municipal partners can conform to provincial planning policies. Recognition and protection of CLOCA's NHS through policy will also help maintain watershed health at its current state because the functional NHS was designed to include all of the existing features and functions that support plant, animal, and human communities in the watershed in a single, connected system.

To move beyond maintaining watershed health and toward improving watershed health, planning authorities are encouraged to recognize CLOCA's targeted NHS in policy, as it has been developed with the intent to achieve many of the goals and objectives outlined in the WSP 2020. This targeted system is also important to protect,

restore, and mitigate the effects of climate change on watershed health.

2.5. REGULATED AREAS AND FLOOD DAMAGE CENTRES

Central Lake Ontario Conservation Authority regulates construction, alteration and development activities in and around valleys, streams and wetlands and along the Lake Ontario shoreline through Ontario Regulation 166/06 under the *Conservation Authorities Act*. These regulated areas were updated in 2017 to incorporate CLOCA's most current ELC, PSW and hazard land mapping layers (Figure 4).

Figure 4 also displays the Flood Damage Centres (FDC) in the watershed, which have been updated as a result of the completion of the 2017 *CLOCA FDC Upgrading report* (available online at <https://www.cloca.com/action-plans>). The FDC Upgrading report identifies areas in all CLOCA watersheds that are vulnerable to flooding, and evaluates the level of risk to life and property. In the BHF Creek watershed, there are 22 FDCs of which only one is considered moderate risk, with the remaining 21 considered low risk.

As Figure 4 illustrates, the moderate risk FDC (HF_1) situated between Bloor Street East and Harmony Road South in the City of Oshawa. Elevated flood depths of more than five metres (m) greater than downstream are created by the Canadian National Railway embankment and Highway 401. It is acknowledged that while hydraulic improvements through the embankment will reduce flood depths in of the upstream area, it will not eliminate flood risk to the structures as they have been built within the natural floodplain.

Figure 3: Water Resource System

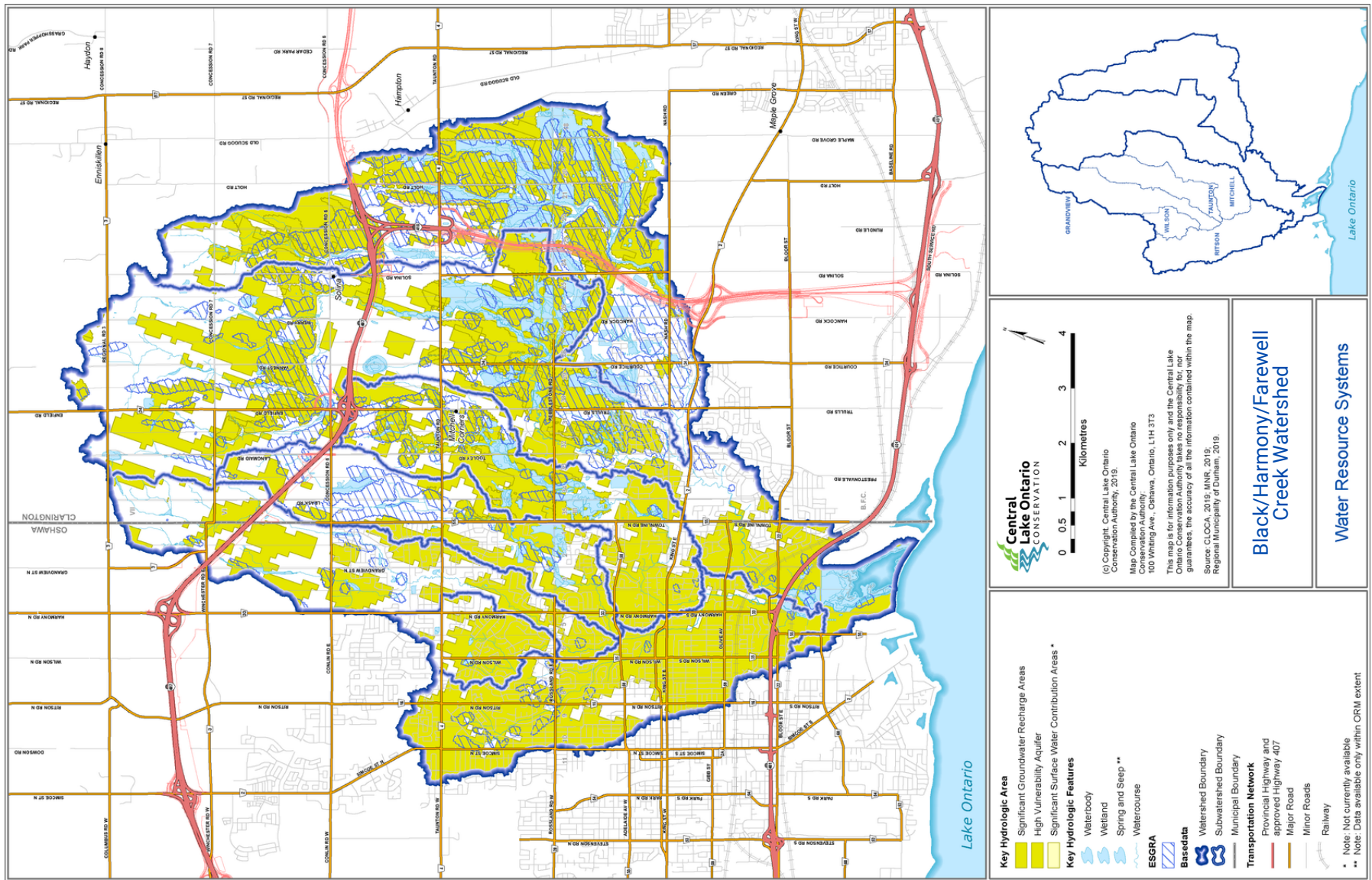
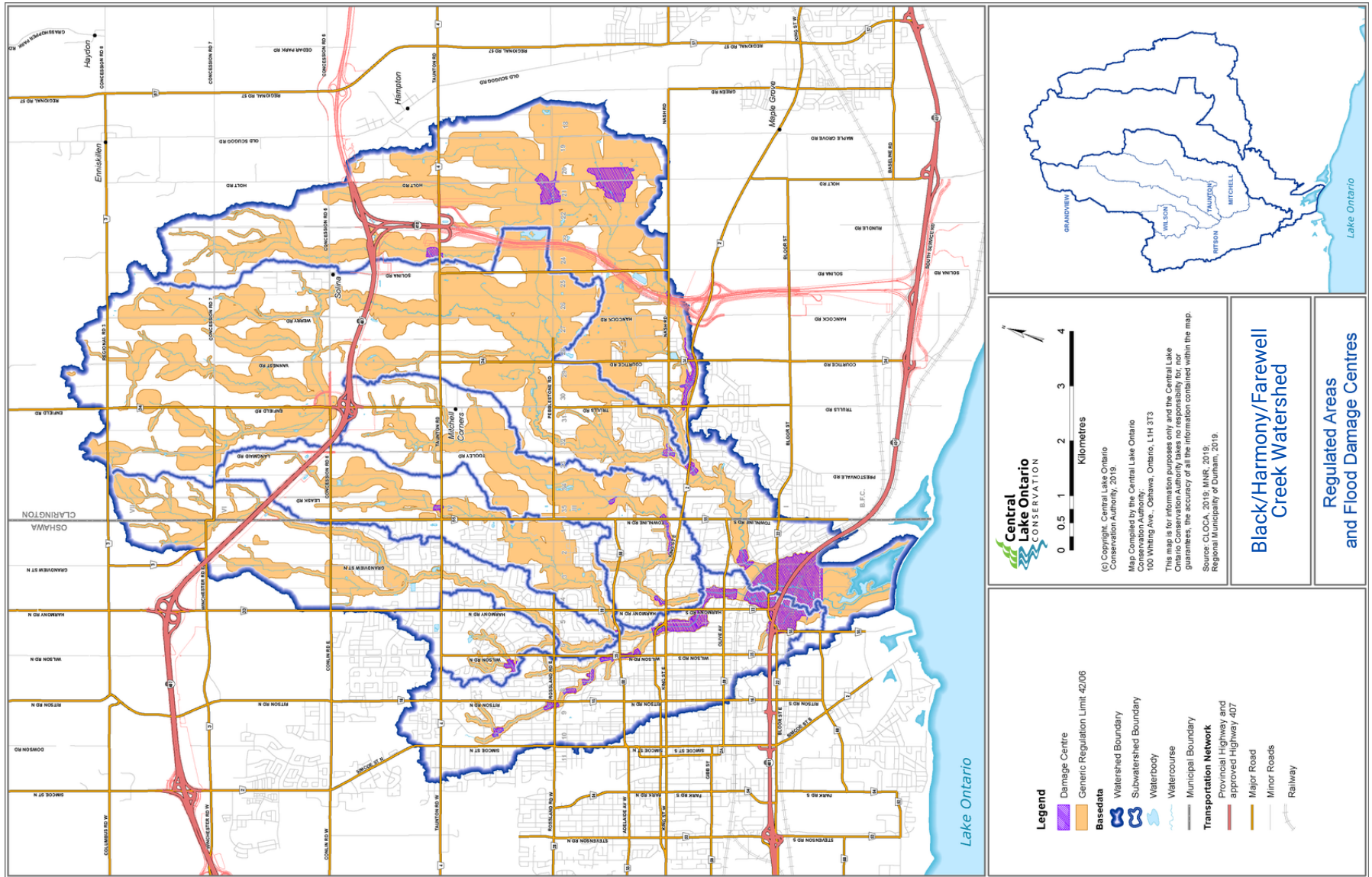


Figure 4: Regulated Areas and Flood Damage Centres



3 Future Watershed Conditions

3.1. FUTURE STRESSORS

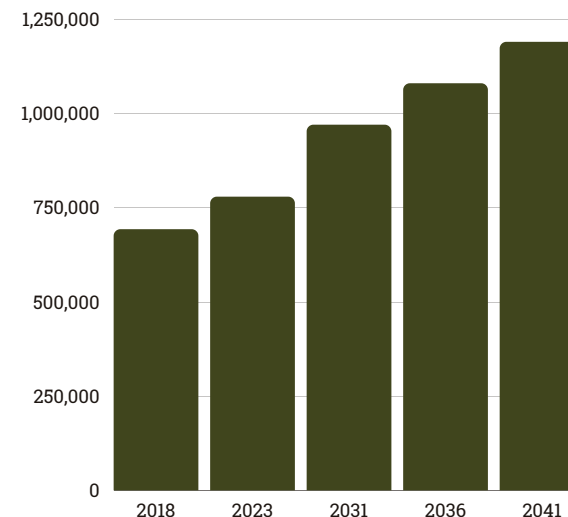
Between 2007 and 2017, the population of the Region of Durham increased by 15 per cent, which is significantly higher than the rest of Ontario (11 per cent). In the next 13 years, the population is forecast to grow by another 28 per cent and by 2041 there is expected to be 1.19 million people living in the Region of Durham. According to the 2016 census^[4], almost 160,000 of these people reside in the City of Oshawa and 92,000 live in the Municipality of Clarington.

With growth comes the need for more residential, commercial and institutional land, transportation infrastructure, and space for recreation. At the same time, climate change is expected to bring more severe weather events to Southern Ontario. These pressures will have a negative impact on watershed health if mitigation and adaptation strategies are not implemented to protect the watershed's natural heritage and water resources. Central Lake Ontario Conservation Authority has developed an NHS that, if protected and restored, will contribute to a resilient watershed capable of continued delivery of environmental services and sustainable communities in response to the significant stressors associated with climate change.

In response to climate change, the Region of Durham is working with watershed stakeholders to develop a regional climate change ensemble model that uses key indicators, such as temperature and precipitation, to predict local changes under different climate scenarios. The model results will inform the Region's climate change adaptation and mitigation strategies and be incorporated into CLOCA's *Natural Heritage System Climate Change Vulnerability*

Assessment. This assessment will identify and prioritize vulnerable areas across the CLOCA jurisdiction and address the protection and restoration of the WRS and NHS. If these areas are properly protected and restored, this will further increase ecosystem resilience and support efforts toward climate adaptation.

Everyone in the BHF Creek watershed plays an important role in contributing to more resilient communities, maintaining watershed health, and managing the risks associated with climate change. Preserving and enhancing our existing natural resources at the same time as our communities are growing, is a critical and cost-effective way of adapting to climate change impacts while providing additional social, economic, and health benefits for the community.



Population Growth in Durham Region

[4] <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E>

3.2. FUTURE SCENARIOS

Future urbanization of the BHF Creek watershed, has the potential to adversely impact natural heritage and water resource systems, and overall watershed health. To continue comparing and assessing future watershed impacts from planned and anticipated future land uses, the scenario modelling developed for the WSP 2013 was applied to the WSP 2020 using the 2017 existing conditions data described in the previous section. The same WSP 2013 scenarios modeled and analyzed as part of this update are summarized in Table 1. The analysis was undertaken using the previously developed methodology and impact categories.

Land use scenario analysis helps to ensure the setting of watershed plan goals and objectives are driven by sound data and science. The results of this analysis guide the development of

watershed management recommendations and supports municipalities in land use and infrastructure planning and decision-making. It should be acknowledged that the Envision Durham (MCR) process could result in changes to future land use boundaries. These land use scenarios may need to be updated to reflect changes to regional and local municipal land use boundaries as a result of these ongoing planning processes.

It should be noted that scenario 3d, which considers climate change impacts, was not updated as the information from the Region's climate change ensemble model was still in development. When this model is finalized, the results will be applied to identify and prioritize vulnerable areas within the natural heritage system of the BHF Creek watershed and to develop appropriate mitigation and adaptation strategies.

Table 1: Description of watershed scenarios included in future land use modelling analysis.

SCENARIO		DESCRIPTION
1	Existing Conditions	2008 Baseline conditions, updated with 2017 data
2a	Full Official Plan (OP) Build-out	Conditions of the watershed if all the development approved in the OP occurred
2b	Full OP Build-out + Natural Heritage System (NHS)	Conditions of the watershed with full OP build-out, plus protection of the NHS
2c	Full OP Build-out + NHS + Key Hydrologic Areas (KHAs)	Scenario 2b, plus the protection of KHA function
3a	Full OP and Whitebelt Build-out	Scenario 2a, plus full Whitebelt development
3b	Full OP and Whitebelt Build-out + NHS	Scenario 3a, plus protection of the NHS
3c	Full OP and Whitebelt Build-out + NHS + KHAs	Scenario 3b, plus protection of KHA function

In accordance with the requirements of the ORMCP, and as a predictive tool, the seven scenarios described in Table 1 were analyzed and mapped to illustrate future potential impacts to the watershed based on updated existing conditions.

The analysis offers insight into the effects that each growth scenario could have on land cover, and these results are shown in Table 2.

Table 2: Summary of scenario analysis by impact category

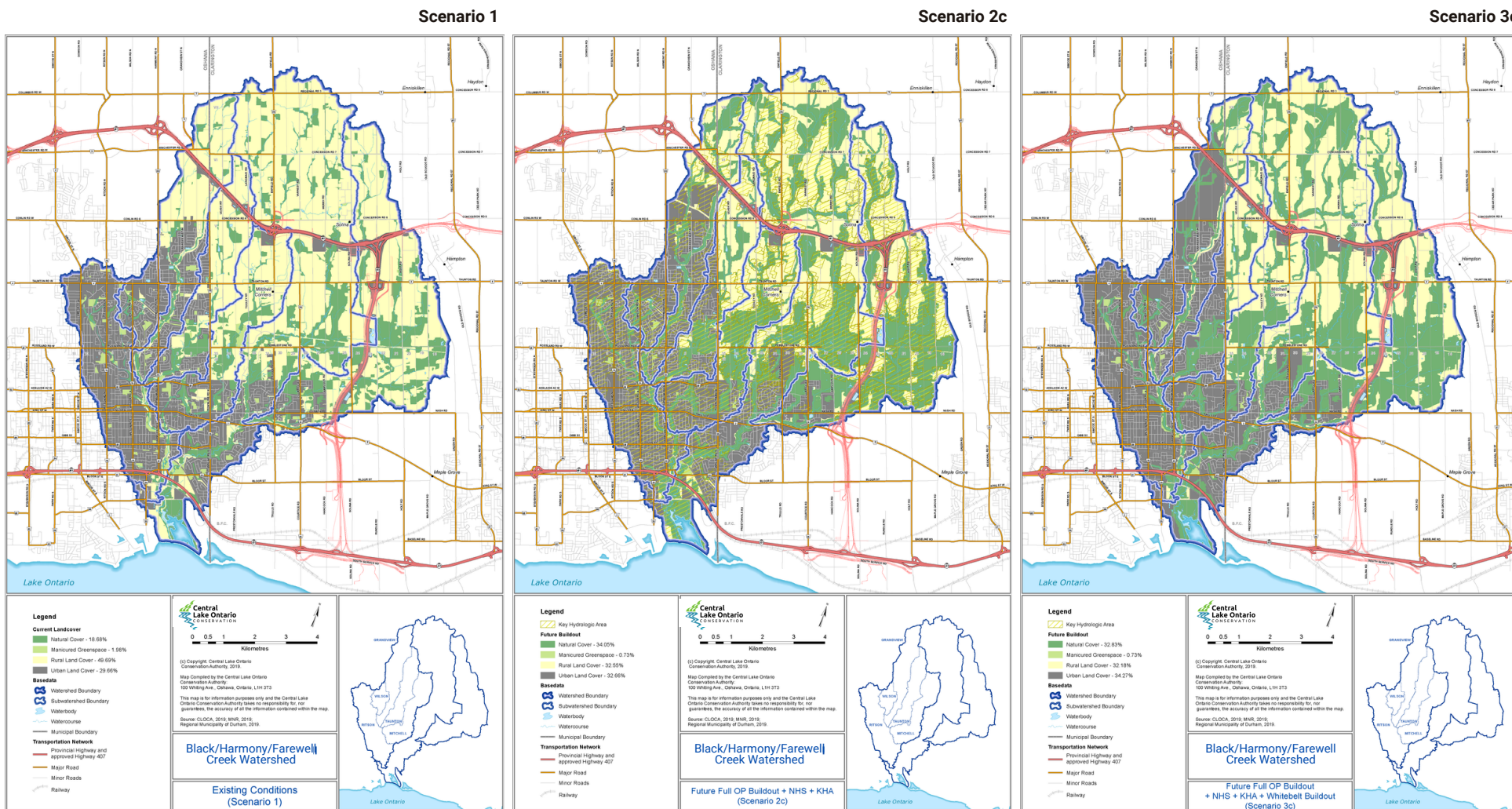
Impact Category (% Land Cover)*	Scenario 1	Scenario 2a	Scenario 2b	Scenario 2c	Scenario 3a	Scenario 3b	Scenario 3c
Natural Cover	19%	18%	34%	34%	18%	33%	33%
<i>Natural Cover and NHS</i>	19%	18%	34%	34%	18%	33%	33%
Manicured Greenspace	2%	1%	<1%	<1%	1%	<1%	<1%
<i>Manicured Greenspace</i>	2%	1%	<1%	<1%	1%	<1%	<1%
Rural Land Cover	50%	47%	33%	33%	44%	32%	32%
<i>Agriculture</i>	87%	85%	82%	82%	84%	78%	78%
<i>Aggregate/ Landfill</i>	<1%	<1%	<1%	<1%	<1%	<1%	<1%
<i>Rural Development</i>	9%	11%	12%	12%	12%	16%	16%
<i>Transportation</i>	3%	4%	5%	5%	4%	5%	5%
Urban Land Cover	30%	34%	33%	33%	37%	34%	34%
<i>Urban Development</i>	82%	83%	82%	82%	84%	83%	83%
<i>Aggregate / Landfill</i>	<1%	n/a	n/a	n/a	n/a	n/a	n/a
<i>Transportation</i>	18%	17%	18%	18%	16%	17%	17%

*For percentage changes to aquifer drawdowns, surface water run-off and baseflows, please refer to the original 2013 WSP.

The results of scenarios 1, 2c, and 3c modeling are shown in Figure 5 and may be used by planning partners to help inform land use decisions made through the municipal planning process. As in the WSP 2013, scenario 3c (Full OP and Whitebelt Build-out + NHS + KHAs) is the preferred land use management scenario, reflecting the realities of a quickly urbanizing watershed, while

providing an opportunity to protect, restore and enhance its health and resiliency. This scenario represents a balanced management approach suitable for promoting environmentally, economically, socially and culturally vibrant communities. For a more detailed review of the scenario analysis process and discussion refer to Section 3 of the WSP 2013.

Figure 5: Future Scenarios Mapping



4 Changes in Watershed Health

Central Lake Ontario Conservation Authority has implemented a refined, science-based framework for evaluating watershed health based on the internationally accepted *Open Standards for the Practice of Conservation*. The framework components are incorporated into the WSP 2020, providing a systematic, comprehensive and consistent process for:

- identifying conservation targets for watershed health and defining the attributes and indicators to monitor;
- setting appropriate goals and objectives to improve watershed health; and,
- tracking changes in watershed health over time.

Conservation targets are the elements of ecological health, human health, and human safety chosen to represent overall watershed health for the WSP 2020. They inform goal setting, conservation actions, and measure outcomes to determine effectiveness.

Five conservation targets have been identified for this WSP 2020 focus:

1. **Natural Cover**
2. **Forest Health**
3. **Stream Health**
4. **Coastal Wetland Health**
5. **Human Health and Safety**



The attributes, indicators and goals, as well as their current status and any changes in status over the past five years, are discussed in this section and are summarized in Tables 3–7. For a more detailed overview of the framework refer to Appendix C.

4.1. CONSERVATION TARGET 1: NATURAL COVER

Natural cover is the watershed areas covered by natural vegetation, like meadows, thickets, and forests, and is calculated using CLOCA's 2017 ELC mapping layer. The percentage of watershed covered by forest, wetland and riparian habitats, and the percent natural cover within CLOCA's NHS and wildlife corridors, collectively have been used to assess watershed health for the natural cover conservation target (Table 3). Natural cover contributes to watershed health by providing essential habitat for wildlife, as well as providing valuable ecological, hydrological and social services such as flood control, water quality improvements, erosion control and habitat connectivity.

The goals for forest, wetland and riparian cover were adopted from the guidelines set out in *How Much Habitat is Enough?* (Environment Canada, 2013).

Status of Natural Cover in the Watershed

As of 2017, only one of the eight goals for the natural cover conservation target was met, which indicates significant restoration of natural vegetation will be required in the BHF Creek watershed in the future.

Since 2012, natural cover in the BHF Creek watershed declined by 2.9 per cent. Due to several factors, there have been measured gains and losses in watershed natural cover over the past five years, but overall a net loss of 74 hectares has occurred.

The BHF Creek NHS natural cover also declined by three per cent, from 64 per cent to 61 per cent. The goal is 100 per cent natural cover in the NHS. Within the NHS, losses are due primarily to the construction of Highways 407 and 412, as well as the construction of a transformer station.

The amount of forest cover^[5], forest interior and deep forest interior^[6] in the watershed has changed very little since 2012. Forest cover is estimated to be at 16 per cent, which is up one per cent from 2012, but is only just over half-way to the minimum goal of 30 per cent. The gain in forest cover is not significant, but is reflective of numerous thicket communities that have grown up over the past five years and have been re-classified as woodland and swamp (forest) communities. Forest interior and deep forest interior cover has not changed since 2012; both are calculated to be at less than one per cent. The goal for forest interior is a minimum of 10 per cent and the goal for deep forest interior is a minimum of five per cent.

Wetland cover^[7] in the BHF Creek watershed is estimated to be 13 per cent and shows a slight increase (one per cent) from 2012. The minimum wetland cover goal is 12 per cent. Efforts to protect wetlands from further loss have clearly been effective in the watershed and should continue.

In 2017, riparian cover^[8] was at 41 per cent in the watershed, which is well below the minimum goal of 75 per cent. Due to a change in the methodology used to calculate riparian cover between 2012 and 2017, the data from 2012 is not suitable for direct comparison and not included in this update.

The Lake Ontario regional wildlife corridor, which is identified in the *2015 Wildlife Corridor Protection and Enhancement Plan* (<https://www.cloca.com/action-plans>) as including all lands within

one kilometre (km) of the Lake Ontario shoreline, currently has 73 per cent natural cover. This has increased by three per cent since 2012, from 70 per cent to 73 per cent, and the goal for the watershed is to have more than 78 per cent cover. The percent natural cover within the landscape and local corridors of the BHF Creek Wildlife Habitat Network (as defined in the *2015 Action Plan*) is not currently available for reporting, as a methodology is still in development. Strategy 1, objective 6 (see Section 5) addresses this gap and the status of this goal will be reported in the next WSP update.



[5] Forest cover was calculated using the following ELC communities: CUW, CUP, FOD, FOM, FOC, SWC, SWM and SWD.

[6] Forest interior and deep forest interior refer to the areas within a forest that are 100 m and 200 m, respectively, or further from the forest edge.

[7] Wetland cover was calculated using the following ELC communities: FEO, FET, MAM, MAS, SAM, SWC, SWD, SWM, and SWT. The inclusion of swamp communities in both forest and wetland cover calculations is acknowledged.

[8] Riparian cover is defined as the amount of natural vegetation within 30 m of a creek edge.

Table 3: Summary of Indicators, Goals and Goal Status for Conservation Target 1 (Natural Cover)

Attribute	Indicator	Description	Goal	Status
NHS integrity	% NHS cover	This indicator measures the difference between the existing cover within the CLOCA NHS and the total area of the NHS to determine how much restoration is required to achieve 100% cover. Tracking change in NHS cover over time will help CLOCA assess our collective success at protecting and improving the system.	By 2060, achieve and maintain 100% natural cover of the CLOCA NHS in the BHF Creek watershed.	<p>2017 (61%) 2012 (64%) Goal (100%)</p>
Forest cover	% forest cover	The amount of forest cover in a watershed is an indicator of healthy wildlife communities. It also provides important ecological services such as water retention and transpiration, heat regulation, and air purification.	By 2060, achieve and maintain a minimum of 30% forest cover in the BHF Creek watershed.	<p>2012 (15%) 2017 (16%) Goal (>30%)</p>
	% forest interior cover	The amount of forest interior and deep forest interior in a watershed are indicators of healthy wildlife communities and provide insight into the size and shape of the forest patches on the landscape.	By 2060, achieve and maintain a minimum of 10% forest interior cover in the BHF Creek watershed.	<p>2017 (<1%) Goal (>10%)</p>
	% deep forest interior cover		By 2060, achieve and maintain a minimum of 5% deep forest interior cover in the BHF Creek watershed.	<p>2017 (<1%) Goal (>5%)</p>

Table 3: Summary of Indicators, Goals and Goal Status for Conservation Target 1 (Natural Cover) cont.

Attribute	Indicator	Description	Goal	Status
Wetland cover	% wetland cover	Wetland cover is an indicator of a watershed’s ability to manage water. Increased wetland cover is related to reduced flooding, higher base flows in creeks, and reduced occurrence of high flows, which are important factors for stream health and protecting municipal infrastructure and human safety.	By 2060, maintain a minimum of 12% wetland cover in the BHF Creek watershed.	<p>A gauge chart showing the percentage of wetland cover. The scale goes from 0 to 100. A green segment represents the current value, which is 13% in 2017. A red line indicates the 2012 value at 12%. A dashed line marks the goal at >12%. A hatched area represents historical cover, which is unknown.</p>
Riparian cover	% riparian cover	Riparian cover plays an important role in stream health by reducing sedimentation, moderating stream temperatures, stabilizing banks, and generating substrate habitat that can support sensitive benthic communities.	By 2060, achieve and maintain a minimum of 75% riparian cover in the BHF Creek watershed.	<p>A gauge chart showing the percentage of riparian cover. The scale goes from 0 to 100. A green segment represents the current value, which is 41% in 2017. A dashed line marks the goal at >75%.</p>
Wildlife corridor cover	% wildlife corridor cover	<p>Habitat connectivity is important to preserve because it allows plants and animals to move between habitat areas on the landscape and may be even more important if species need to migrate in response to climate change. Many species move slowly and require continuous natural cover to protect them from harm. The amount of natural cover within the landscape and local corridors in the watershed is an indicator of how well-connected the habitats are in the watershed.</p> <p>Along the shoreline natural cover is key for migrating birds crossing the lake and need suitable habitats to stop, rest, and re-fuel. Natural cover within this corridor is an indicator of how high functioning the shoreline habitats are for migratory species.</p>	By 2060, achieve and maintain 75% natural cover in the landscape and local corridor systems in the BHF Creek watershed.	At the time of this WSP update, the methodology to calculate % natural cover in the landscape and local corridor systems was being developed. Strategy 1, objective 6 addresses this data gap.
			By 2040, achieve and maintain a minimum of 78% naturally-vegetated wildlife corridor within 1 km of the Lake Ontario shoreline in the BHF Creek watershed.	<p>A gauge chart showing the percentage of wildlife corridor cover. The scale goes from 0 to 100. A green segment represents the current value, which is 73% in 2017. A dashed line marks the goal at >78%. A hatched area represents the 2012 value at 70%.</p>

4.2. CONSERVATION TARGET 2: FOREST HEALTH

Forest communities are integral watershed ecosystems, contributing to overall health by providing essential habitat and connectivity for local flora and fauna communities. In addition to this, they play a role in maintaining and improving surface water quality and quantity by providing flood control, nutrient filtration, and soil erosion reduction. Forests provide many irreplaceable societal services such as sequestration of carbon, production of oxygen, and climate moderation. In the BHF Creek watershed, they are impacted by stressors including surrounding land uses, climate change, invasive pests and pathogens, and fragmentation, making forest health a good indicator of overall terrestrial watershed health.

Central Lake Ontario Conservation Authority's Integrated Watershed Monitoring Program (IWMP) is a long-term program introduced in 2017 to assess, among other things, the health of forests within CLOCA's jurisdiction over time. The program uses three attributes of forest ecosystems to best reflect forest health and changing conditions. **These attributes are tree health and dead wood, plant community, and breeding birds.** Each is measured using an Index of Biotic Integrity (IBI) and collectively, the indicators are used to assess overall conditions. Annual, long-term monitoring enables CLOCA to evaluate changes in forest health over time.

The IWMP monitors forest health within three zones, comprised of multiple watersheds. Forest health data collected from the Eastern Zone^[9], which includes the Farewell and Black Creeks' watersheds, was used to set forest health conservation target goals (Table 4). For more information on CLOCA's IWMP, visit <https://www.cloca.com/watershed-monitoring>. A link to the program's interactive ArcGIS StoryMap tool, which presents all the mapping and monitoring data collected since 2017, is available on this web page.

Status of Forest Health in the Watershed

According to the IBI for each indicator, scores in the range of 61-80 are considered "Good" for forest health. As of 2017, all the forest health indicators were rated good, achieving the scores in this range and reaching the established goals. Tree health and dead wood and plant community both scored 69 out of 100, and breeding birds scored 65 out of 100.

INDEX OF BIOTIC INTEGRITY (IBI)

A scoring system used to measure the health or condition of a biological community (e.g., fish community). Several metrics are combined into each IBI. Metrics are characteristics of a community that are sensitive to changes caused by human disturbance (e.g., native species' richness). Each metric is scored and the scores are combined into a total overall IBI score (out of 100) for a particular community. The higher the overall score, the healthier the biological community.

[9] The Eastern Zone includes the Black, Farewell, Robinson, Tooley, Bowmanville, Soper, Darlington, Westside, and several other small shoreline watersheds.

Table 4: Summary of Indicators, Goals and Goal Status for Conservation Target 2 (Forest Health)

Attribute	Indicator	Description	Goal	Status
Tree health and dead wood	Tree health and dead wood IBI	Trees provide the structural and biophysical components of a forest and yield important functions like regulating light and moisture, and supply habitat for forest flora and fauna. Downed woody debris, or the accumulation of dead wood on the forest floor, promotes nutrient cycling within the community. This indicator uses crown health, the presence of diseases, pests and pathogens, and the volume of downed woody debris as a measure of forest ecosystem function.	By 2040, maintain a minimum tree health and dead wood IBI score of 60 in the Eastern Zone.	<p>2017 (69) Goal (>60)</p>
Plant community	Plant community IBI	Increased diversity of native plants can lead to improved resistance to stressors and increased diversity in higher trophic levels, as plants provide the basis for the food web. 'Plant community' looks at the diversity and sensitivity of floral species, the presence and abundance of invasive species, and the regeneration of trees and shrubs which, in turn, provides insight into the structure of the future forest.	By 2040, maintain a minimum plant community IBI score of 60 in the Eastern Zone.	<p>2017 (69) Goal (>60)</p>
Breeding birds	Breeding birds IBI	Some birds have specific habitat needs while others can successfully nest in a variety of habitats and conditions. In this indicator, the presence or absence of sensitive forest birds is used as a measure of how high functioning the forest habitats are.	By 2040, maintain a minimum breeding birds IBI score of 60 in the Eastern Zone.	<p>2017 (65) Goal (>60)</p>

4.3. CONSERVATION TARGET 3: STREAM HEALTH

Streams are integral components of watersheds, providing water to wildlife and people, habitat to aquatic species, drainage from the land, and offering the community social and cultural benefits. They are excellent features for measuring watershed health because they reflect existing conditions and respond to land use changes in the surrounding landscape.

Central Lake Ontario Conservation Authority's IWMP also assesses the long-term health of streams within our jurisdiction using five attributes of stream ecosystems that best reflect stream health and changing conditions: **water quality, biological connectivity, stream stability, and fish and macroinvertebrate communities.** Except for water quality, every attribute is measured using one indicator that reflects stream health. Water quality uses three indicators due to the complexity of the stressors. Collectively, the attributes are used to assess overall stream health and ongoing monitoring of the indicators enables CLOCA to evaluate changes in stream health over time.

The IWMP monitors stream health within three zones, which are comprised of multiple watersheds. Stream health data collected from the Eastern Zone, which includes the Black and Farewell Creeks' watersheds, was used in this WSP update to set four of the stream health conservation target goals (Table 5). For more information visit <https://www.cloca.com/watershed-monitoring>.

Status of Stream Health in the Watershed

As of 2017, none of the stream health goals of achieving and maintaining IBI scores above 60 have been met. In the Eastern Zone, both water quality and fish community scored 48 out of 100, and macroinvertebrate community scored 49 out of 100. In terms of stream health, scores in the range of 41-60 are considered 'Fair'.

Within the watershed, Chloride samples exceeded the *Canadian Water Quality Guidelines* (120 mg/L) 33 per cent of the time, which is well above the target of zero per cent, and stream stability scored 0.27, which is above the target of 0.2.

There were 16 instream barriers identified in the *2017 Watershed Instream Barrier Action Plan* (<https://www.cloca.com/action-plans>) that were classified as barriers to biological connectivity. Since the development of the *Action Plan*, two of the 16 barriers have been removed and creek connectivity successfully restored. This has allowed resident and migratory fish access to an additional 32.4 km of stream habitat.

The status of water temperature in the Eastern Zone was not available at the time of this update, as the water temperature indicator was recently reviewed and requires updates. Once the indicator is revised, the data collected in 2017 will be evaluated and the indicator status will be included in future updates.

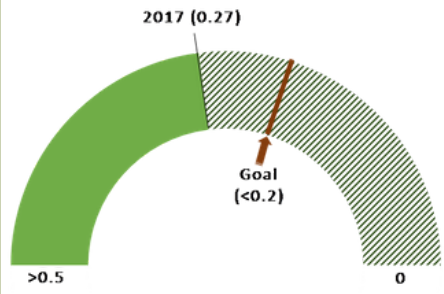
Table 5: Summary of Indicators, Goals and Goal Status for Conservation Target 3 (Stream Health)

Attribute	Indicator	Description	Goal	Status
Water quality	Water temperature	Long-term stability in water temperature is important for maintaining a healthy aquatic habitat. Just as air temperature is important for people, water temperature impacts the type of habitat available for fish species. Local changes in land use and larger-scale impacts like climate change can have negative impacts on water temperature, putting stress on aquatic life. By understanding the temperature and rate of change in different seasons, we can understand how much stress there is in aquatic ecosystems.	By 2040, achieve and maintain a water temperature score of 60 in the Eastern Zone.	Indicator updates required, therefore no status available at the time of WSP update.
	Water Quality Index (WQI)	As water becomes contaminated, it is more difficult for aquatic species to survive, less desirable for recreation, and more expensive to purify for drinking water. For aquatic species, high levels of nutrients from fertilizers cause decreases in dissolved oxygen, erosion and sediment run-off cause gravel beds to be filled in destroying spawning habitat, and road salt increases chloride concentrations putting stress on aquatic species chemical exchanges. Understanding whether certain water quality parameters are under safe thresholds is critical for understanding the health of aquatic ecosystems.	By 2040, achieve and maintain a minimum WQI of 60 in the Eastern Zone.	<p>A gauge chart showing the Water Quality Index (WQI) for the Eastern Zone. The scale ranges from 0 to 100. The current value for 2017 is 48, represented by a solid green segment. The goal is to maintain a minimum WQI of 60, indicated by a red needle pointing to a dashed line at 60. The area between 48 and 60 is shaded with diagonal lines.</p>
	Chloride	One of the most common chemicals present in streams systems in northern climates is Chloride. Due to its affordability and properties that make it ideal for de-icing roads in the winter, huge quantities of Chloride (as road salt) are applied across the watershed. After being applied to roads, Chloride dissolves and flows into streams, resulting in increasing concentrations. Chloride has been identified by the Canadian Water Quality Guidelines as dangerous to aquatic health when its concentrations exceed 120 mg/L.	By 2040, achieve and maintain 0% of samples exceeding Canadian Water Quality Guidelines or Chloride (120 mg/L) in the BHF Creek watershed.	<p>A gauge chart showing the percentage of samples exceeding Canadian Water Quality Guidelines or Chloride (120 mg/L) in the BHF Creek watershed. The scale ranges from 0% to 100%. The current value for 2017 is 33%, represented by a solid green segment. The goal is to maintain 0% of samples exceeding the guidelines, indicated by a red needle pointing to a dashed line at 0%. The area between 33% and 100% is shaded with diagonal lines.</p>

Table 5: Summary of Indicators, Goals and Goal Status for Conservation Target 3 (Stream Health), continued

Attribute	Indicator	Description	Goal	Status
Biological connectivity	Number of instream barriers	Aquatic species may use many types of habitats during their life cycle. For some species, spawning may happen in small headwater tributaries while overwintering occurs in Lake Ontario. For fish to be able to access different habitat types streams must be free of barriers, which can include old mill ponds or poorly installed culverts. In the CLOCA Instream Barrier Action Plan, barriers have been documented and prioritized for removal to restore access to stream habitat. This indicator measures habitat availability by tracking the number of instream barriers in the watershed over time.	By 2040, improve biological connectivity through the removal of 16 barriers from the BHF Creek watershed, as identified in the Instream Barrier Action Plan.	<p>A gauge chart representing the number of instream barriers. The scale ranges from 0 to 16. The current value in 2017 is 2, shown as a small green segment. The goal is 16, indicated by a red needle pointing to the end of the scale.</p>
Fish community	Golden Horseshoe Fish Index	Fish species have individual preferences and ranges of conditions in which they can survive; therefore, the relative abundance of different fish species at a site can be used to indicate stream health. If a fish community is dominated by sensitive coldwater species, such as Brook Trout, it is representative of good stream health, and if a community is dominated by non-native tolerant species, such as Common Carp, it is representative of poor health. By taking all species into consideration, a comprehensive stream health score can be determined.	By 2040, achieve and maintain a minimum Golden Horseshoe Fish Index of 60 in the Eastern Zone.	<p>A gauge chart representing the Golden Horseshoe Fish Index. The scale ranges from 0 to 100. The current value in 2017 is 48, shown as a green segment. The goal is greater than 60, indicated by a red needle pointing to a mark on the scale.</p>
Macro-invertebrate community	Hilsenhoff Biotic Index	Aquatic bugs, otherwise known as macro-invertebrates, all have their own habitat preferences and range of conditions they can survive in. Like the Golden Horseshoe Fish Index, using this knowledge of their relative abundance and sensitivity to watershed stressors makes this a valuable measure for understanding stream health. With increasing impacts on stream ecosystems, sensitive species will become less abundant and result in a lower score. If that system is restored, both the sensitive species and stream score will increase.	By 2040, achieve and maintain a minimum Hilsenhoff Biotic Index of 60 in the Eastern Zone.	<p>A gauge chart representing the Hilsenhoff Biotic Index. The scale ranges from 0 to 100. The current value in 2017 is 49, shown as a green segment. The goal is greater than 60, indicated by a red needle pointing to a mark on the scale.</p>

Table 5: Summary of Indicators, Goals and Goal Status for Conservation Target 3 (Stream Health), continued

Attribute	Indicator	Description	Goal	Status
Stream stability	Stream Stability Index	Streams naturally move and change shape over time because flowing water moves stream habitat material. When changes occur naturally, they tend to be relatively slow and that allows aquatic life to adjust to the habitat that is present. If changes to flow rates and timing occur due to changes in land use practices or stormwater management, this can cause accelerated and extreme changes to stream channel shape and stability. These changes tend to decrease stream habitat quality by reducing the diversity and type of habitat available to aquatic species. As a result, stream shape and stability can be a very useful indicator for stream health as deviation from a natural state will result in poorer stream habitat, functions and services.	By 2040, achieve and maintain an average stability index score of <0.2 in the BHF Creek watershed.	



Brook Trout

4.4. CONSERVATION TARGET 4: COASTAL WETLAND HEALTH

Great Lakes' coastal wetlands are formed at the mouths of watercourses and in shoreline bays. They are biologically rich and productive ecosystems that, when healthy, contribute to watershed health by providing essential ecological and societal services such as flood control, sediment and nutrient filtration, shoreline protection and wildlife habitat. Conditions in coastal wetlands reflect the cumulative effects of land-use activities in the watershed. The loss of natural cover and the release of pollutants into waterways affects the health and functionality of coastal wetlands that are located downstream.

The Durham Region Coastal Wetland Monitoring Project (DRCWMP) is a long-term program assessing wetland health along the north shore of Lake Ontario. Coastal wetland health is evaluated using five indicators: **breeding birds, fish, aquatic macroinvertebrates, submerged aquatic vegetation** and **water quality**. Together, these indicators are used to assess the overall condition of a wetland, and ongoing annual monitoring enables CLOCA to evaluate changes in health over time (Table 6).

Status of Coastal Wetland Health in the Watershed (Oshawa Second Marsh)

As of 2017, none of the five wetland health attributes for Oshawa Second Marsh have met their goals of achieving and maintaining IBI scores above 60: the aquatic macroinvertebrate community scored in 'Very Poor' condition (0-20); water quality, fish community and submerged aquatic vegetation scored in 'Poor' condition (21-40); and breeding birds scored in 'Fair' condition (40-60). Although the status of each of these attributes has declined, the only statistically significant change was in aquatic macroinvertebrates, which dropped from 44 in 2012 to 19 in 2017.

In 2009, a barrier gate designed to keep invasive Common Carp from entering Oshawa Second Marsh was vandalized, and this allowed large numbers of common carp and goldfish into the Marsh, displacing native fish and reducing species diversity. Common Carp uproot aquatic plants and re-suspend sediments, which leads to increased turbidity and degraded water quality, reducing aquatic plant growth, as light cannot penetrate the water column. The loss of submerged aquatic vegetation and high turbidity in the marsh impacted the macroinvertebrate, fish and bird populations, resulting in decreased IBI scores. In 2016, a water level drawdown was initiated, which is designed to improve water quality, re-establish vegetation, and improve overall marsh health. The impact of the drawdown on the health of Oshawa Second Marsh will be evaluated in the next WSP update.



Oshawa Second Marsh (left) and McLaughlin Bay (right)

Table 6: Summary of Indicators, Goals and Goal Status for Conservation Target 4 (Coastal Wetland Health – Oshawa Second Marsh)

Attribute	Indicator	Description	Goal	Status
Breeding bird community	Wetland breeding bird IBI	Coastal wetlands provide important habitat for wetland-dependent birds, and some are more sensitive than others. This indicator uses the suite of bird species breeding within a marsh to evaluate how high functioning the wetland is.	By 2040, achieve and maintain a minimum wetland breeding bird IBI score of 60 at Oshawa Second Marsh coastal wetland.	<p>A gauge chart showing the Wetland breeding bird IBI score. The scale ranges from 0 to 100. A goal line is marked at >60. The 2017 score is 53 (yellow segment), and the 2012 score is 67 (hatched segment).</p>
Fish community	Fish IBI	Coastal wetlands provide spawning and nursery habitat for many native fish species, which is influenced by changes in water quality, physical habitat conditions, and invasive fish species. Fish community monitoring documents the species present and their biomass to assess habitat quality.	By 2040, achieve and maintain a minimum fish IBI score of 60 at Oshawa Second Marsh coastal wetland.	<p>A gauge chart showing the Fish IBI score. The scale ranges from 0 to 100. A goal line is marked at >60. The 2017 score is 24 (yellow segment), and the 2012 score is 34 (hatched segment).</p>
Submerged Aquatic Vegetation (SAV) community	SAV IBI	Submerged aquatic vegetation provides essential food and habitat for a variety of coastal wetland wildlife species throughout their life stages. This indicator documents species present and their coverage within a wetland to evaluate wetland habitat quality.	By 2040, achieve and maintain a minimum SAV IBI score of 60 at Oshawa Second Marsh coastal wetland.	<p>A gauge chart showing the SAV IBI score. The scale ranges from 0 to 100. A goal line is marked at >60. The 2017 score is 38 (yellow segment), and the 2012 score is 52 (hatched segment).</p>

Table 6: Summary of Indicators, Goals and Goal Status for Conservation Target 4 (Coastal Wetland Health – Oshawa Second Marsh), cont.

Attribute	Indicator	Description	Goal	Status
Aquatic macro-invertebrate community	Aquatic macro-invertebrate IBI	Aquatic macroinvertebrates provide food resources for amphibians, fish and waterfowl. As aquatic organisms, they are sensitive to both changes in water quality and physical habitat conditions, and their abundance in a wetland is an indicator of habitat quality.	By 2040, achieve and maintain a minimum aquatic macroinvertebrate IBI score of 60 at Oshawa Second Marsh coastal wetland.	<p>A gauge chart showing the Aquatic macro-invertebrate IBI score. The scale ranges from 0 to 100. A goal is indicated by a red arrow pointing to a score of >60. The 2017 score is 19 (green segment), and the 2012 score is 44 (yellow segment).</p>
Water quality	Water Quality Index (WQI)	Wetland plants and animals are heavily influenced by the water quality in a wetland. Water quality is assessed using water temperature, pH, conductivity and turbidity. These parameters reflect the cumulative effects of land use activities in the watershed, including nutrient and chemical inputs, road salt runoff, erosion, as well as conditions in the wetland itself, like the presence of invasive species.	By 2040, achieve and maintain a minimum WQI of 60 at Oshawa Second Marsh coastal wetland.	<p>A gauge chart showing the Water Quality Index (WQI) score. The scale ranges from 0 to 100. A goal is indicated by a red arrow pointing to a score of >60. The 2017 score is 23 (green segment), and the 2012 score is 28 (yellow segment).</p>



4.5. CONSERVATION TARGET 5: HUMAN HEALTH AND SAFETY

Healthy watersheds provide valuable goods and services that protect the local human population. These goods and services include such things as safe drinking water, flood control, clean air and the moderation of climate. How safe a watershed is for its population has been evaluated for this update using two indicators: **Flood Damage Centres (FDC) and Ontario Drinking Water Standards for groundwater (Table 7).**

Flooding is a significant natural hazard that causes risk to public safety. The *2017 FDCs Upgrading Report* (<https://www.cloca.com/action-plans>) identified 22 FDCs in the watershed, assessing each for vulnerability to flooding (property, structures, and public safety), likelihood of flooding, and potential social, economic, and environmental impacts from a flood event. These were then risk-assessed and ranked. One FDC was assessed as moderate risk in the BHF Creek watershed and is the focus of this WSP goal.

Rural communities rely on groundwater wells as their primary source of drinking water and depend on groundwater supplies to maintain domestic, commercial, industrial, agricultural and institutional operations. Chloride is a chemical that does not naturally exist in deep aquifers, but is abundant in surface water due to its use as a de-icer in winter. This makes it a useful chemical to gauge potential anthropogenic impacts on deep aquifers and the risk to well water quality and human health. The *Ontario Drinking Water Quality Standards* sets guidelines for safe limits of chemicals in drinking water sources. The guideline for chloride is 250 mg/L.

Status of Human Health and Safety in the Watershed

The Harmony and Farewell Creeks Flood Relief Study (Greck Assoc., 2017) assessed flood relief alternatives for the FDC, which is caused by hydraulically deficient openings in the CNR railway embankment. The feasibility of implementing the various alternatives versus costs have yet to be analyzed and more work is required to assess the current status of this goal.

The goal for shallow groundwater quality has not been met, with 53 per cent of samples from wells exceeding the chloride concentration limit. Data for deep groundwater water quality in the BHF Creek watershed was not available at the time of the WSP 2020 and will be reported in future updates.




Table 7: Summary of Indicators, Goals and Goal Status for Conservation Target 5 (Human Health and Safety)

Attribute	Indicator	Description	Goal	Status
Deep groundwater quality	Ontario Drinking Water Quality Standards (Chloride)	Monitoring Chloride levels in groundwater, which can be negatively impacted by activities occurring at the watershed surface over time, is a good indicator of how significant the impact. High Chloride levels are generally reflective of poor watershed health and, as a source of drinking water for many rural communities, impaired groundwater may also pose a direct risk to human health.	By 2040, maintain 0% of samples from deep wells exceeding the Ontario Drinking Water Quality Standards prescribed limits for Chloride in the BHF Creek watershed.	Data not available at the time of the WSP update.
Shallow groundwater quality	Ontario Drinking Water Quality Standards (Chloride)	For this indicator, the Ontario Drinking Water Quality Standards guideline for Chloride was followed, which is 250 mg/L.	By 2040, maintain fewer than 10% of samples from shallow wells exceeding Ontario Drinking Water Quality Standards prescribed limits for Chloride in the BHF Creek watershed.	<p>2017 (53%)</p> <p>100%</p> <p>Goal (<10%)</p> <p>0%</p>
Flooding	Flood Damage Centres	Flooding is a threat to public safety and may result in the loss of property or damage to structures. It also has social, economic, and environmental impacts. Removing and/or mitigating high and moderate risk flood damage centres in the watershed will result in a healthier watershed community.	By 2040, pursue reduction and mitigation measures in all moderate risk FDCs in the BHF Creek watershed and identify measurable goals for this indicator as assessment reports for FDCs in this watershed are completed.	Data not available at the time of the WSP update.

5 Planning and Management Framework

The watershed planning and management framework establishes strategies that CLOCA will use to achieve the WSP 2020 goals and identifies specific, measurable objectives and actions to be taken to achieve the goals.

Three strategies have been developed for the WSP 2020 to achieve the updated watershed plan goals:

- 
1. *Conserve, enhance and restore ecosystems of the BHF Creek watershed;*
 2. *Promote responsible land-use practices to protect ecological and human health (includes protection of infrastructure and property); and,*
 3. *Encourage, acquire, and expand partner/stakeholder support for the watershed plan.*

For each strategy, the intended outcomes of their implementation have been stated as short-term objectives. These are described in this section and are presented in Table 9. It is important to note that one objective may directly or indirectly help to achieve more than one goal and that the objectives are not goal specific. These overlaps, where they exist, are identified in the discussion of that objective.

Wherever possible the 2017 status of the objective is discussed and any progress made toward its achievement is identified; however, for the objectives that were newly developed for this update, there is no progress to report (Table 9). The actions recommended in the WSP 2020 for CLOCA, municipal partners, and the watershed community to take to achieve the WSP goals, have been identified in Table 9 and are summarized (by group) later in this section.

5.1. STRATEGY 1: CONSERVE, ENHANCE AND RESTORE ECOSYSTEMS

This strategy and objectives relate to protecting and restoring natural cover and improving watershed ecosystem health. The achievement of the natural cover and ecosystem health goals can only occur with dedicated action toward protecting these natural heritage features from loss to development and the implementation of a compensation program, habitat enhancement and restoration.

OBJECTIVE 1: By 2025, restore at least 189 hectares (1.75 per cent) of forest cover in the BHF Creek watershed through reforestation and natural succession.

This objective is directed at achieving the goal of 30 per cent forest cover in the watershed, as well as increasing the amount of forest interior and deep forest interior on the landscape, but this objective has farther-reaching benefits. Expanding forest cover in the NHS will help achieve the goal of 100 per cent natural cover within that system. It will also positively contribute to overall forest health by increasing the amount of breeding habitat for forest birds and will improve wildlife connectivity and riparian cover. Increased forest cover also benefits adjacent and downstream communities, like the coastal wetlands and streams, as their associated communities are impacted by the cumulative effects of land use activities in the watershed. Increased forest cover in the watershed also benefits human health through improved drinking water quality and reduced flooding.

To achieve the goal of 30 per cent forest cover in the BHF Creek watershed by 2060, 1,512 hectares of forest will need to be restored through reforestation and natural succession, which equates to 189 hectares every five years. As this is a new objective, there is no change in status to report.

OBJECTIVE 2: By 2025, maintain existing wetlands in the BHF Creek watershed.

As was stated in the previous section, the current wetland cover in the BHF Creek watershed is 13 per cent, which exceed the minimum goal for watershed health in the WSP 2020. In five years, this objective will have been achieved if no net loss of wetland cover is observed in the watershed during that period.

OBJECTIVE 3: By 2025, restore at least 55 hectares of natural riparian cover in the BHF Creek watershed.

This objective focuses on achieving the riparian cover goal of 75 per cent natural cover. Achieving this objective will positively impact the stream health conservation target indicators, as riparian cover moderates stream temperature, intercepts sediment and contaminants in run-off, and reduces erosion, improving habitat quality for fish and other aquatic wildlife. Increased riparian cover in the watershed also benefits human health and safety through improved water quality and reduced flooding.

Currently, riparian cover for the watershed is 41 per cent. To achieve 75 per cent cover by 2060, 439 hectares of riparian habitat will need to be restored. If 55 hectares of riparian cover is restored in the watershed every five years, then the goal of 75 per cent cover can be achieved.

As this is a new objective, there is no change in status to report.

OBJECTIVE 4: By 2025, remove at least four barriers as identified in the Instream Barrier Action Plan.

This objective is directly related to the accessible fish habitat indicator in the stream health conservation target. The *Instream Barriers Action Plan* identified 16 barriers that should be removed from the BHF Creek system in order to expand available fish habitat in the watershed. If four barriers are removed every five years this goal will be achieved.

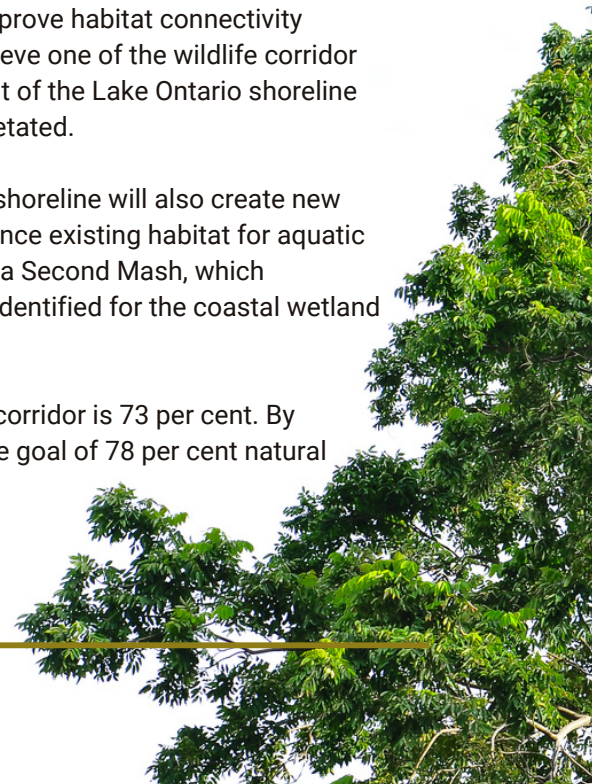
As with the previous objectives, this objective is new and there is no change in status to report.

OBJECTIVE 5: By 2025, restore at least 1.9 ha of natural cover within one km of Lake Ontario.

Restoring 1.9 ha of shoreline habitat back into natural cover will directly support migratory birds, improve habitat connectivity between watersheds, and help achieve one of the wildlife corridor cover goals, which is for 30 per cent of the Lake Ontario shoreline wildlife corridor to be naturally vegetated.

Increasing habitat cover along the shoreline will also create new habitat for breeding birds and enhance existing habitat for aquatic plant and wildlife species in Oshawa Second Mash, which contributes to achieving the goals identified for the coastal wetland health conservation target.

Currently, natural cover within this corridor is 73 per cent. By restoring 1.9 ha every five years, the goal of 78 per cent natural cover can be achieved by 2040.



OBJECTIVE 6: By 2025, develop an objective to restore natural cover in the landscape and local wildlife corridor systems.

Percent natural cover in the wildlife corridor system is introduced in this WSP 2020 as a measure of habitat connectivity; however, at the time of the update, a methodology had not yet been developed for conducting this analysis. As the data was unavailable, a specific objective for achieving the 75 per cent cover goal could not be set. Instead, the objective for WSP 2020 is to develop an appropriate objective by 2025.

5.2. STRATEGY 2: PROMOTE RESPONSIBLE LAND USE PRACTICES TO PROTECT ECOLOGICAL AND HUMAN HEALTH

This strategy and objectives relate to promoting responsible and use practices in the watershed to protect natural ecosystems and watershed health as well as protect human health and safety from hazards.

OBJECTIVE 1: By 2040, achieve and maintain <10 per cent imperviousness in the watershed.

Stream health is directly related to impervious cover, and guidance documents (Environment Canada, 2013) have shown the benefits of maintaining imperviousness in the watershed at less than 10 per cent. Both water quality and stream temperature are negatively impacted when this threshold is exceeded and cumulatively, the impacts affect aquatic habitat in the creeks. By maintaining impervious cover at less than 10 per cent, many of the stream health goals will be positively impacted.

Public safety is also affected by the amount of impervious cover in the watershed. Water runs off impervious surfaces more quickly than off natural substrates and can contribute to an increase in flash floods. This flooding phenomenon is more common and more intense in the lower parts of the watershed. Climate change may also increase the frequencies of this type of flooding. Achieving this objective will contribute to reaching the goal for reducing flood risks in the watershed.

In 2018, CLOCA recalculated impervious cover for the watershed and determined an increase of one per cent since 2012 – from 15 per cent to 16 per cent (Table 8). Overall, imperviousness in the BHF Creek watershed exceeds the maximum 10 per cent objective set in the WSP 2013; however, individually, the Harmony Creek watershed is the only watershed with more than 10 per cent impervious cover. The Farewell Creek watershed is currently under the threshold at 9.5 per cent and concerted efforts will need to be made to ensure that impervious cover does not increase. The Black Creek watershed is at six per cent imperviousness.

The overall increase in impervious cover in the BHF Creek watershed is related to new development; specifically, the construction of Highways 407 and 412, new residential development in the north Courtice area, intensification within some rural residential areas, and the construction of a transformer station in the north end of the Grandview subwatershed.

As Table 8 shows, none of the subwatersheds have had significant increases in impervious cover since 2012, and this is likely because the urban boundary in this watershed coincides with the current Greenbelt boundary, limiting urban expansion. Intensification of existing urban development does have the potential to increase impervious surface values though, so it is important for development proposals to incorporate new technologies into designs to reduce the impacts of imperviousness on watershed health.

Table 8: Impervious cover in the BHF Creek watershed and subwatersheds (2012-2018)

Watershed/ Subwatershed	% Imperviousness (2012 ¹⁰)	% Imperviousness (2018 ¹¹)	% Change
Black Creek	5.2%	6.0%	0.8%
Harmony Creek	24.8%	25.5%	0.7%
Grandview	15.8%	17.7%	1.9%
Mitchell	16.2%	16.5%	0.4%
Ritson	43.8%	44.2%	0.3%
Taunton	13.2%	13.5%	0.4%
Wilson	42.8%	42.8%	0.0%
Farewell Creek	9.1%	9.5%	0.4%
BHF Creek	15%	16%	1%

% Change in Subwatershed Imperviousness (2012–2018)

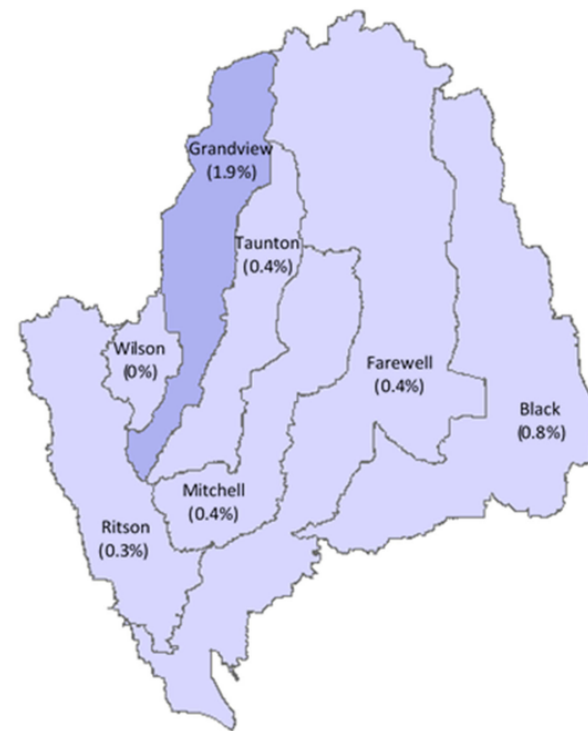
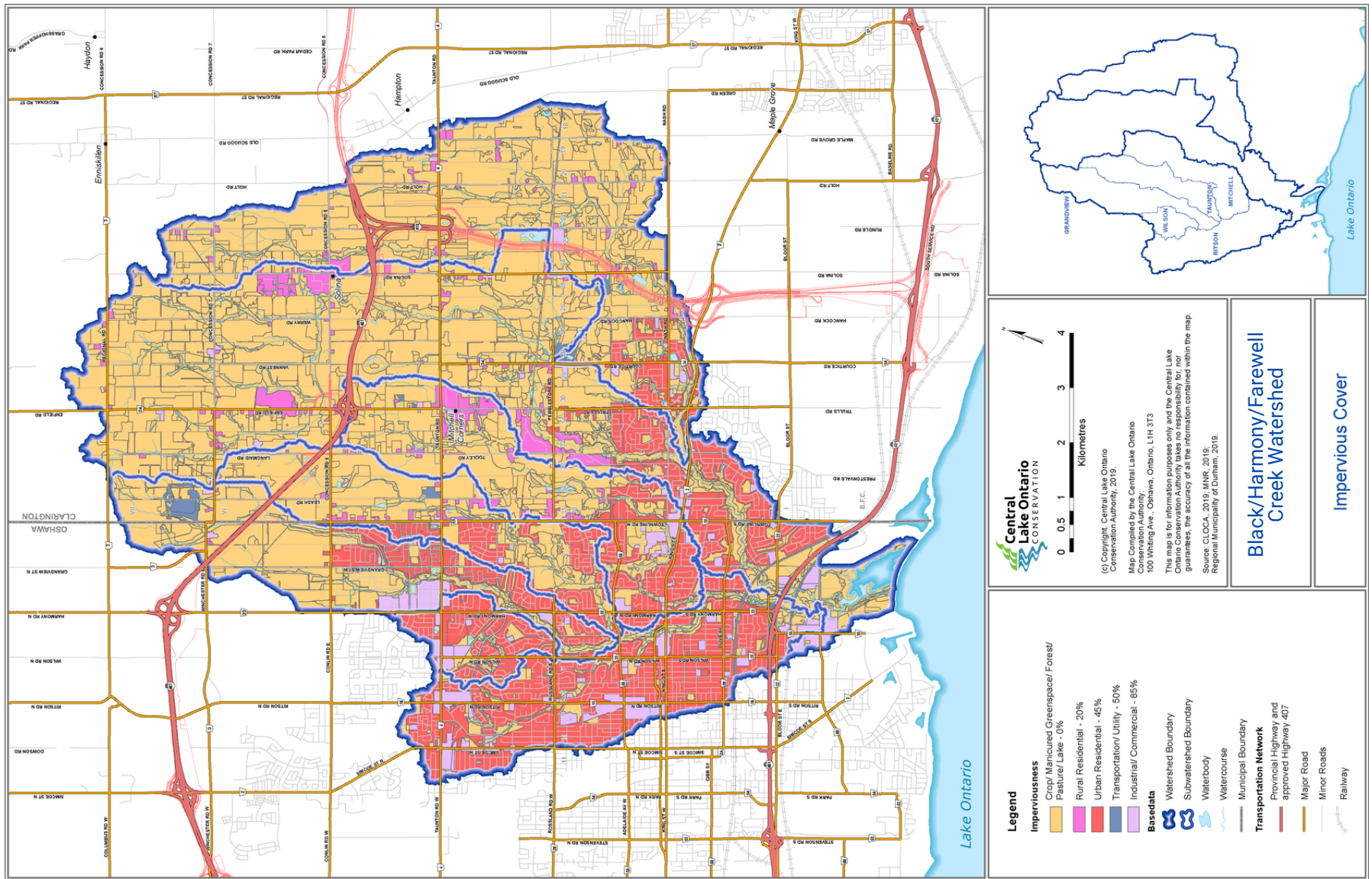


Figure 6 shows updated land uses for the BHF Creek watershed and identifies the percentage of each land cover type that is impervious.

[10] 2009 land use dataset used to calculate impervious cover reported in 2012.
 [11] 2015 land use dataset used to calculate impervious cover reported in 2018.

Figure 6: Impervious Cover



OBJECTIVE 2: By 2040, achieve and maintain wildlife potential permeability (WPP) scores of 'Very Good' or better in the landscape corridor system.

OBJECTIVE 3: By 2040, achieve and maintain wildlife potential permeability (WPP) scores of 'Moderate' or better in the local corridor system.

Transportation infrastructure is a barrier to wildlife movement, and roads/railways that intersect with the wildlife habitat network, as defined in the *2015 Wildlife Corridor Protection and Enhancement Plan (WCPEP)*, reduce habitat connectivity overall. These barriers are potentially mitigated, for the majority of wildlife, by the presence of culverts; however, some culverts are more suitable for wildlife use than others.

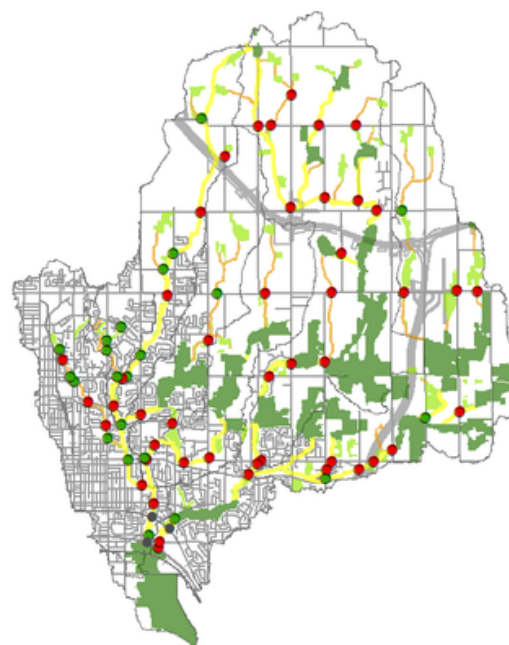
The WCPEP categorizes wildlife movement corridors by scale – regional, landscape, and local – and conducts an evaluation of the passage potential for each of the transit crossings (known as wildlife potential permeability) within these corridors, scoring them from 'Excellent' to 'Very Poor'. The objectives for the WSP 2020 were adopted from the WCPEP, which recommends working toward removing wildlife movement barriers so the landscape corridor system is accessible to all mammals and reptiles (WPP scores of 'Very Good' or better); and the local corridor system is accessible to most mammals and/or reptiles (WPP scores of 'Moderate' or better). The proportion of scores in the system will be used to assess the overall connectivity of the wildlife habitat network in the watershed.

Currently, the BHF Creek watershed has 47 movement barriers in its landscape corridor system (shown in the sidebar figure in yellow)

and of these, 11 have WPP scores of 'Very Good' or better (23 per cent). In the local corridor system (shown in orange), the report identifies 24 movement barriers, 11 of which have WPP scores of 'Moderate' or better (46 per cent). In the below graphic, which is shown for context only, the crossings with WPP scores that currently meet their objective are shown in green, and those with WPP scores that do not, are shown in red. Crossings shown in black indicate where WPP scores could not be determined.

A more detailed map is available in the WCPEP¹² (<https://www.cloca.com/action-plans>).

WPP Scores for the
Black/Harmony/Farewell Creek Watershed



[12] The *Wildlife Corridor Protection and Enhancement Plan* is scheduled to be updated in 2020 and will incorporate new barriers to the system as a result of the 400-series highways recently constructed in the watershed and recalculate the WPP scores to capture changes associated with recent road improvement projects. The results of the updated *Action Plan* will be reflected in the 2025 WSP update. As these objectives are new, there is no progress to report.

5.3. STRATEGY 3: ENCOURAGE, ACQUIRE, AND EXPAND PARTNER/STAKEHOLDER SUPPORT FOR THE WATERSHED PLAN

This strategy and its objectives focus on measuring and gaining support for goals identified in the WSP 2020. The achievement of the watershed plan goals, as discussed in Section 4, can only occur with appropriate support for protecting existing natural heritage and water resources, promoting stewardship and restoration on the landscape, and committing to responsible land use and management practices.

OBJECTIVE 1: By 2025, municipal OPs continue to designate a connected NHS in OPs that protects the features identified in the functional CLOCA NHS.

The PPS, 2020 defines a 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.” The PPS, 2020 further recognizes that “natural heritage systems will vary in size and form...” CLOCA has developed a NHS that is comprised of a functional system that includes these features and areas and connects them via corridors. CLOCA encourages their municipal partners to have regard for the CLOCA watershed-scale NHS when designating a NHS into OPs. It is recognized that municipalities are required to identify a NHS pursuant to the PPS, 2020. This objective supports municipalities in meeting their obligations under the PPS, 2020 for both the establishment of a NHS and utilizing watershed

planning as the ecologically meaningful scale for integrated and long-term planning, including considering cumulative impacts of development.

Currently, all CLOCA’s municipal partners have met this objective, either by designating a NHS that has had regard for CLOCA’s watershed-scale system or a system that has met the requirements of the PPS, 2020 into their OPs. Accordingly, this objective encourages the Region of Durham and local municipal partners to continue this practice in future OP updates. For municipal partners that have developed a NHS of their own, this objective will also assess how successful their NHS is at protecting and connecting existing features in the watershed and evaluate the potential for the NHS to meet the WSP 2020 goals.

OBJECTIVE 2: By 2025, municipalities designate a connected NHS in OPs that includes CLOCA’s targeted NHS or includes policy direction supporting the restoration of a targeted NHS.

The 2020 PPS NHS definition further provides that “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 state, areas that support hydrologic functions, and working landscapes that enable ecological functions to continue.”

Central Lake Ontario Conservation Authority’s watershed-scale NHS also contains a targeted system that identifies land in the watershed that, if protected and restored, would enable many of the goals of the natural cover target to be achieved, and positively contribute toward achieving the goals of other targets identified in Section 4.

The WSP 2020 encourages the Region of Durham and local municipal partners to have regard for and integrate CLOCA's targeted NHS as part of their NHS, as the target areas have been selected with the goals in mind and in consideration of watershed characteristics; however, the objective recognizes that municipal partners may choose to identify future restoration areas for their NHS, independently. Central Lake Ontario Conservation Authority supports the adoption of its targeted system, as well as an alternative target system, provided the targeted land base adequately meets the goals of the WSP 2020. For partner municipalities that have developed a NHS of their own, this objective will determine if the system includes target restoration areas and whether these areas, if restored, will be enough to realize the goals for the WSP 2020.

OBJECTIVE 3: By 2025, municipalities develop asset management plans that recognize a connected NHS as a natural asset.

Asset management planning is a legislated municipal requirement. The *2012 Municipal Infrastructure Strategy* requires municipalities to demonstrate how projects fit within a comprehensive asset management plan and encourages municipalities to improve integration of planning for land use and infrastructure. Green infrastructure is one way that municipalities can achieve cost-savings to infrastructure and CLOCA's NHS contains numerous features that could be considered natural assets and valued to quantify the services provided. For more information about asset management planning, see the Municipal Actions description below.

OBJECTIVE 4: By 2025, increase the number of volunteers engaged in CLOCA volunteer initiatives related to watershed health and develop, where feasible, watershed-based objectives.

Volunteers are an important component to CLOCA's outreach and education strategy, as they help staff facilitate programs to larger

audiences and become ambassadors for watershed health. In 2016 and 2017, CLOCA's volunteer program attracted 1,855 volunteers in total.

OBJECTIVE 5: By 2025, increase the number of students engaged in CLOCA curriculum-based education programs related to watershed health and develop, where feasible, watershed-based objectives.

Students are the watershed stewards of the future and instilling in them the importance of maintaining and enhancing watershed health, for themselves and for the next generation, is essential to achieving this outcome. Central Lake Ontario Conservation Authority's education programs introduce students to natural heritage features and water resource systems, helping them understand how they work and why they are important to protect, further inspiring them to take actions in their own backyards or communities.

In 2016 and 2017, CLOCA education programs reached 25,719 students in total.

Objective 6: By 2025, increase the number of community members engaged in projects and activities related to watershed health and develop, where feasible, watershed-based objectives.

The watershed community includes everyone who resides, works, owns property or a business, or visits its natural spaces. They must be motivated to take responsibility for maintaining and enhancing the watershed resources that plants and animals depend on for survival and that sustain human populations as well. Central Lake Ontario Conservation Authority public programs aim to raise awareness about watershed health and empower the community to take positive action to protect and improve our natural assets. In 2016 and 2017, CLOCA engaged 30,119 community members across its watersheds.

Table 9: Summary of Strategies, Objectives and Actions for Achieving the BHF Creek WSP Goals

Strategy	Objective	Progress	CLOCA Actions Completed	Actions Identified
Conserve, enhance and restore ecosystems of the BHF Creeks watershed	By 2025, restore at least 189 ha (1.75%) of forest cover in the BHF Creek watershed through reforestation and natural succession.	New objective	1. Integrated Watershed Monitoring Program (AP #8). 2. Riparian Corridors Restoration Plan (AP #2). 3. Wildlife Corridor Protection and Enhancement Plan (AP #5). 4. CLOCA Land Acquisition Strategy (AP #11). 5. Restoration and planting projects have occurred within the watershed however formal tracking of gains by all stakeholders has not occurred. 6. Instream Barrier Action Plan (AP #17). 7. CLOCA and member municipalities have worked together to ensure policies have been adopted into Official Plans. 8. Ecological Services: Valuing natural areas within CLOCA (AP #14). 9. Invasive Species Management Strategy (AP #16).	CLOCA Actions: 1. Complete Ecological Compensation Action Plan (AP #18). 2. Complete Restoration Guidelines and Prioritization Tool (AP #1). 3. Complete Conservation Lands Master Plan (AP #28 – new). 4. Complete Urban LID Action Plan (AP #9). 5. Complete Identification of Salt Vulnerable Areas in the BHF Creek watershed (AP #15). 6. Complete Natural Heritage System Climate Change Vulnerability Assessment (AP #25 – new). 7. Complete Connected Imperviousness Action Plan (AP #13). 8. Complete headwater protection mapping using LIDAR for future indicator development. 9. Work with partners to complete an updated Oshawa Second Marsh Management Plan. 10. Develop and implement a stewardship and restoration program and integrate these into relevant outreach programs. 11. Implement the Invasive Species Management Strategy in partnership with municipal and community partners. 12. Update Wildlife Corridor Protection and Enhancement Plan in 2020 to include corridor analysis methodology (AP #5). 13. Complete Rapid Geomorphic and Stream Assessments (AP #26 – new). 14. Complete Stream and Water Level Forecasting Model (AP # 27 – new). 15. Complete Municipal Environmental Policy Review and Assessment (#29). 16. Expand volunteer community by pursuing program funding/sponsorship, facilitating co-op placements and corporate partnerships, and accommodating volunteer requests. 17. Work with municipal partners to develop and deliver collaborative environmental learning experiences.
	By 2025, maintain existing wetlands in the BHF Creek watershed.	New objective		
	By 2025, restore at least 55 ha of natural riparian cover in the BHF Creek watershed.	New objective		
	By 2025, remove at least four barriers as identified in the Instream Barrier Action Plan.	New objective		
	By 2025, restore at least 1.9 ha of natural cover within 1 km of Lake Ontario.	New objective		
	By 2025, develop an objective to restore natural cover in the landscape and local wildlife corridor systems.	New objective		
Promote responsible land use practices to protect ecological and human health.	By 2040, achieve and maintain <10% imperviousness in the watershed.			
	By 2040, achieve and maintain 100% wildlife potential permeability (WPP) scores of 'Very good' or better in the landscape corridor system.			

Table 9: Summary of Strategies, Objectives and Actions for Achieving the BHF Creek WSP Goals, cont.

Strategy	Objective	Progress	CLOCA Actions Completed	Actions Identified
	By 2040, achieve and maintain 100% wildlife potential permeability (WPP) scores of 'Moderate' or better in the local corridor system.	A gauge chart with a blue arc representing 11% progress towards an objective of 24%.	10. BHF Creek Imperviousness Update (AP #12). 11. Education Program Delivery Assessment with brochure and website. 12. Community Needs and Opportunities for Environmental Education (AP # 3). 13. Online volunteer program promotion, registration and training. 14. Conservation Area trail stewardship program. 15. Well best management practices education program. 16. Flood Damage Centres Upgrading Report (AP # 23). 17. The Harmony and Farewell Creeks Flood Relief Study (Greck Assoc, 2017)	18. Develop a corporate strategy to ensure that all departments participate in showcasing the depth of our business and expertise. Municipal Actions: <ol style="list-style-type: none"> 1. Implement adopted Official Plan policies. 2. Adopt outstanding fundamental, key and voluntary policies to protect natural heritage features and functions (Table 5 – 2013 BHF Creek WSP). 3. Implement best management practices identified in the Wildlife Corridor Protection and Enhancement Plan, Riparian Corridors Restoration Plan, Instream Barriers Action Plan, and Invasive Species Management Strategy and Update in the BHF Creek watershed. 4. Work with CLOCA to develop a BMP for the enhancement and protection of urban forests. Community Actions: <ol style="list-style-type: none"> 1. Implement best management practices identified in the Riparian Corridors Restoration Plan, Wildlife Corridor Protection and Enhancement Plan and Instream Barriers Action Plan. 2. Work with CLOCA and member municipality to protect and restore natural heritage features on your property. 3. Partner with provincial agencies in tax-incentive programs to protect and restore natural heritage features on your property. 4. Work with regional and local municipalities to ensure you are following tree by-laws. 5. Follow best management practices on your property to prevent the introduction and spread of invasive species. 6. Practice responsible recreation to reduce your impacts on natural heritage features in the Oshawa Creek watershed. 7. Utilize existing programs to reduce your property's stormwater impacts on streams.
	By 2025, municipal OPs continue to designate a connected NHS in OPs that protects the features identified in the functional CLOCA NHS.	A gauge chart with an orange arc representing 100% progress towards an objective of 100%.		
	By 2025, municipalities designate a connected NHS in OPs that includes CLOCA's targeted NHS or includes policy direction supporting the restoration of a targeted NHS.	Analysis not available at the time of update completion.		
Encourage, acquire, and expand partner/ stakeholder support for the watershed plan.	By 2025, municipalities develop asset management plans that recognize a connected NHS as a natural asset.	New objective		
	By 2025, increase the number of volunteers engaged in CLOCA volunteer initiatives related to watershed health and develop, where feasible, watershed-based objectives.	New objective		
	By 2025, increase the number of students engaged in CLOCA curriculum-based education programs related to watershed health and develop, where feasible, watershed-based objectives.	New objective		
	By 2025, increase the number of community members engaged in projects and activities related to watershed health and develop, where feasible, watershed-based objectives.	New objective		

5.4. ACTIONS: ACHIEVING THE OBJECTIVES

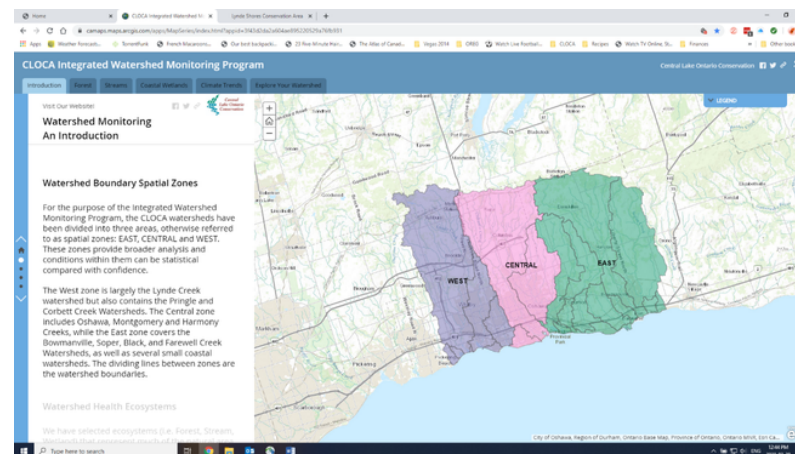
A complete list of recommended actions for CLOCA, municipalities and the community can be found in Table 9. The following sections describe these actions in greater detail and provide context for implementation.

5.4.1. CLOCA ACTIONS

Central Lake Ontario Conservation Authority is committed to providing its partners with up-to-date resources to assist them in making informed land use decisions and taking strategic action toward maintaining and improving watershed health for the benefit of its residents and visitors. The WSP 2013 identified numerous Action Plans for CLOCA to complete in order to better understand and/or manage watershed health, and many of these have been completed and are available online at <https://www.cloca.com/action-plans>. Some of the Action Plans identified in the WSP 2013 are still outstanding and CLOCA is committed to completing these. This WSP 2020 also identifies new action plans for CLOCA to develop. For a list of the Action Plans and their 2020 status, as well as any new Action Plans, see Appendix B.

Action Plan (AP) #8, CLOCA *Integrated Aquatic Monitoring Program*, was completed in 2017 but the project was expanded to include forest communities and coastal wetlands and is now called the CLOCA Integrated Watershed Monitoring Program. This annual program monitors the forest, stream and coastal wetland health

indicators identified in Section 4 of this update as a long-term tool to evaluate watershed health across CLOCA's jurisdiction. Due to resource constraints, the Integrated Watershed Monitoring Program's forest and stream components assess health across three zones as opposed to by watershed; however, CLOCA will pursue opportunities to expand the program to collect data at the watershed scale if there is support for this level of detail. The results of the monitoring program are communicated annually via CLOCA's online Integrated Watershed Monitoring Program ArcGIS StoryMap (<https://www.cloca.com/watershed-monitoring>) and will be summarized in future watershed plan updates.



Action Plan #1, *NHS Restoration Guidelines*, is currently being developed. This plan has evolved over time to include areas outside of the NHS and now consists of two parts: a restoration prioritization mapping tool to determine restoration locations and a restoration document to support implementation of the restoration priorities.

The *NHS Restoration Guidelines* will further inform:

- Stewardship and restoration – help CLOCA develop a stewardship program and identify/implement restoration projects across the jurisdiction on both private and public lands.
- AP #11, *CLOCA Land Acquisition Strategy* – assist in the continued strategic acquisition of lands for protection, restoration and/or recreation.
- AP #28 (new), *CLOCA Conservation Lands Master Plan* – develop management guidelines and recommendations to help ensure CLOCA-owned and managed land is maintained in a manner that is consistent with the original mandate of conserving natural features and functions while providing for compatible, high-quality visitor experiences that meet the needs of the community. Lands within the BHF Creek watershed have been identified for acquisition within the Lake Iroquois Beach Acquisition Strategy and will be discussed in the Master Plan.
- Oshawa Second Marsh *Restoration and Management Plan* – help to make specific recommendations as to how to improve the health of this coastal wetland.

The outcome of implementing these projects, guidelines, and recommendations will be increased natural cover, which directly relates to the natural cover goals and objectives identified in the WSP 2020. Consequently, completing these actions will positively impact wildlife habitat connectivity, forest and stream health in the watershed, as well as the Oshawa Second Marsh.

In order to address potential losses in ecological features or functions within CLOCA's NHS as a result of changes in land use, we are developing an *Ecological Compensation Action Plan* (AP #18)

for use in planning applications to provide a transparent and consistent means of replacing losses to the NHS that are determined to be unavoidable, after the protection hierarchy has been applied (avoid, minimize, mitigate). If natural cover within the NHS cannot be maintained within a new land use, then it is important for the features and functions to be replaced in an appropriate location to meet watershed cover targets. Central Lake Ontario Conservation Authority will need to develop an effective system to track the results of restoration projects, as well as natural and anthropogenic changes in natural cover. This *natural heritage tracking tool* (AP #29 – new) will be an important reporting tool to accurately document gains or losses over time.

Stream health is closely related to land use and CLOCA is developing additional resources to help protect water quality and quantity. The *Urban LID Action Plan* (AP #9), *Salt Vulnerability Mapping Tool* (AP #15), and *Connected Imperviousness Action Plans* (AP #13) will provide specific recommendations for reducing imperviousness in the watershed, improving water quality as it relates to salt levels and other common contaminants. It is expected that by implementing the recommendations from these plans (and from others already completed) that improved water quality, stream health and coastal wetland health goals will be achieved. Central Lake Ontario Conservation Authority will also undertake a Light Detection and Ranging (LIDAR)-based mapping project to identify the headwater protection areas in the watershed for future consideration in land use management.

Despite best efforts to manage stormwater with lot-level conveyance and end-of-pipe treatments, urban development can still trigger stream instability. *Rapid Geomorphic and Stream Assessments* (AP #26 – new) will be undertaken to determine stream stability urban stressors.

To stay current in the management of its regulated areas, protect people and property from harm, and be prepared for the potential impacts of climate change, CLOCA regularly updates a number of documents to ensure changes in the watershed are captured in a timely manner. The *Policy and Procedural Document for Regulations and Plan Review* (AP #4) formalizes existing regulation plan review policies and procedures, as well as commonly accepted standards applied during the plan review process, within CLOCA's jurisdiction, in order to improve transparency and increase public understanding of the plan review approval process. Updates reflect changes to policy and legislation, new standards, and updated technical documents to continue safeguarding public safety and protecting the local environment. Revisions are circulated to municipalities when updates are proposed.

As part of CLOCA's core mandate, the effective monitoring and reporting of flood conditions and FDCs is achieved through regular updates to floodplain mapping and risk assessments. When these updates are carried out, they consider:

- improvements to topographic mapping and modelling techniques and reflect climate change;
- improvements to web-based information access for agencies and partners;
- assessment and evaluation of risk / threats, and the development of mitigation plans for high and moderate risk FDCs;
- the addition of new vulnerable population centres to improve understanding of risk; and,
- improvement of business and economic risk assessment through the collection of additional business information and data.

The CLOCA *2017 Flood Damage Centres Upgrading Report* (AP #23) updates the BHF Creek FDCs as a result of recent changes in land use. These are mapped and discussed in Section 2.5. Flood forecasting is required to reduce the risk of loss of life and property damage due to flooding through predicting flood events, issuing flood warnings, alerts and advisories. This information assists with the management of flood risk and emergencies in these FDCs in order to improve public safety.

THE FUTURE OF STORMWATER MANAGEMENT

Integrating green infrastructure and low-impact development into traditional stormwater management will be one of the most significant ways to improve water quality and mitigate impacts of climate change. Future flows will likely increase due to climate change. The aim of green infrastructure and low- impact development projects is to decrease imperviousness, increase infiltration and retain rainfall event volumes onsite.

GREEN INFRASTRUCTURE

Natural and human-made elements that provide ecological and hydrological functions and processes, e.g., street trees, urban forests, natural channels, permeable surfaces and green roofs.



LOW IMPACT DEVELOPMENT

Small-scale structures that minimize runoff volumes by mimicking natural hydrology, infiltration, evapo-transpiration, harvesting, filtration and detention of stormwater.

In 2017, Greck and Associates Limited completed the Harmony and Farewell Creeks Flood Relief Study, which assessed alternatives for the moderate risk FDC identified in this watershed. Flooding in this area is caused by hydraulically deficient openings in the CNR railway embankment and the study considered the cost/benefit of various alternatives for creating larger culverts/bridges. Implementation of this work is dependent on funding and until improvements can be completed, flood forecasting and warning will be critical to protect against loss of life and property damage. In addition, the development of the *Stream Flow and Water Level Forecasting Model* (AP #27 – new) will provide the ability to effectively analyze and predict the potential impacts of runoff on stream flow rates at the local level.

Climate change has become an increasingly important factor to consider in watershed management. It is a consideration that will be included in any restoration planning that CLOCA undertakes; furthermore, CLOCA will develop a *Natural Heritage System Climate Change Vulnerability Assessment Report* (AP #25 – new) to identify vulnerable areas and restoration opportunities within CLOCA's NHS, based on identified risks and priorities with respect to climate change impacts. This report will leverage the new regional climate change ensemble model work currently in development for Durham Region.

Finally, CLOCA works effectively to communicate, educate, and inspire the broader community in our various watershed management activities. To motivate watershed 'champions' and to take action for real change, CLOCA has developed several programs to engage students, volunteers and the general public, as well as tools to guide, recognize, and track participation. Although CLOCA has set objectives to increase its engagement of these future watershed champions, it is recognized that the quality of program deliverables is as important, if not more so, than the number of participants. Developing high-quality engagement opportunities will always be CLOCA's priority.

In 2018, CLOCA completed an Education Program Delivery Assessment and updated its brochure, finalized Action Plan #3 – *Community Needs and Opportunities for Environmental Education*, and initiated the Conservation Area Trail Stewardship program, engaging volunteers with maintenance and engagement activities at a specific Conservation Area. The online Volunteer Program promotion, registration and training platform provides a convenient format to manage and track volunteer activities and will be used to help monitor CLOCA's success in reaching the 2020 WSP engagement objectives.

Central Lake Ontario Conservation Authority is committed to expanding its volunteer community by pursuing funding and partnership opportunities, working with municipal partners to deliver collaborative learning experiences for the watershed community, and communicating CLOCA's successes to municipal partners and other stakeholders.

INVASIVE SPECIES

Invasive Species are an ongoing threat to the health and biodiversity of CLOCA's natural heritage features. The 2017 Invasive Species Management Strategy outlines actions municipalities and non-profit organizations can take, in partnership with CLOCA, to prevent, detect, manage and respond to invasive species, including:

- Work with partners to communicate the threats of invasive species.
- Implement best practices to prevent, detect and manage invasive species.
- Work with all levels of government to address new and existing invasive species.
- Strengthen existing partnerships, build new alliances and create connections.
- Use and enhance existing monitoring programs to detect new invaders and track the spread of existing invasive species.



5.4.2. MUNICIPAL ACTIONS

The current status of many of the watershed health indicators, as shown in Tables 3-7, are below the targeted goals. While the Region of Durham and lower-tier municipalities have made significant efforts to incorporate the WSP 2013 recommendations into policy documents, there is still more work to be done. To achieve the goals and objectives of this update, all municipal levels must continue to ensure land use policies are in place to protect existing natural heritage features and functions. It should be noted that simply protecting what currently exists, will not achieve the intention of the WSP 2020. There is a need to strengthen support for significant restoration efforts within the watershed if all municipal levels intend to achieve a healthy, resilient watershed by 2060. In particular, support for stewardship programs on private lands and restoration activities on public lands will result in significant gains in the natural cover goals.

Adopting CLOCA's NHS, or a connected system with similar attributes to the CLOCA functional NHS, into regional and local municipal *OPs*, is one way of protecting the land base needed to achieve many of the WSP goals. Adopting and implementing the recommended policies (see Table 5, page 89 of the WSP 2013 [<https://www.cloca.com/watershed-plans>]), which were developed with the WSP 2013 goals in mind, ensures protecting and improving watershed natural heritage and water resource systems is a priority at every level of land management.

Since the WSP 2013 was published, CLOCA has developed numerous Action Plans and tools designed to support the goals and objectives of the WSP 2020. These plans are available online at <https://www.cloca.com/action-plans>.

For example, the *2015 Wildlife Corridor Protection and Enhancement Plan* (AP # 5), the *2017 Riparian Corridors Restoration Plan* (AP #2), the *2017 Instream Barriers Action Plan* (AP #17), and the *2017 Invasive Species Management Strategy* (AP #16) all include best management practices that various departments within the Region of Durham or local municipalities can incorporate into new and existing programs or work plans. Consideration of these practices, particularly in the management of natural municipal spaces, will ensure existing habitats are protected and/or improved, thereby contributing to the achievement of many of the WSP 2020 goals. Specifically, the management of urban forests should be addressed by the Region of Durham, local municipalities, and landowners to prevent the decline of these important natural heritage features. Central Lake Ontario Conservation Authority is committed to working with interested municipal partners to develop best management practices for urban forests to ensure their long-term health contributes to achieving forest cover and health goals.

URBAN FORESTS

Urban Forests play an integral role in the community and the health of CLOCA's watersheds. They are increasingly under pressure from invasive pests and pathogens, soil compaction, disturbance to the understory, and the effects of climate change. Municipalities are encouraged to develop best practices to preserve and enhance urban forests to protect their many benefits for future generations. Tree Canada has produced a *Compendium of Best Urban Forest Management Practices* (Bardekjian, A., 2018) that identifies many of these important topics and how to address them.



The *Wildlife Corridor Protection and Enhancement Plan* (2015) and the *Instream Barriers Action Plan* (2017) contain maps prioritizing instream and terrestrial wildlife barriers that can be incorporated into municipal work plans for culvert replacements and transportation network improvements. By considering the recommendations in these plans, and including culvert upgrades in initial designs, these goals can be achieved over time, resulting in a healthier and more resilient watershed. Improving culverts for wildlife may also reduce the risk to municipal infrastructure and human safety from flooding, which is also a target discussed in the WSP 2020.

The application, handling and storage of road salt, as well as snow storage and snow-melter sites, are listed as prescribed drinking water threats under the *Clean Water Act (2006)* and within the *Credit Valley – Toronto and Region – Central Lake Ontario (CTC) Source Protection Plan* (2019). It is well-documented that salt used to maintain winter road safety has adverse impacts on the health of our aquatic ecosystems. Often, salt is over-applied and makes its way into creeks, groundwater and drinking water, negatively affecting human health, fish, wildlife, soils, vegetation and even infrastructure. A reduction in road salt usage is needed to maintain watershed health, which can be achieved by continuously improving winter maintenance operations through application of best management practices. Central Lake Ontario Conservation Authority will work with its municipal partners to develop a plan that identifies the salt vulnerable areas in the watershed and recommends salting practices for those areas to protect water quality.

Policy Support

The goals in the WSP 2020 cannot be achieved without the Region of Durham and local municipal support. Incorporating the recommended policies, as identified in Table 5 of the WSP 2013,

into either *OPs* or other operational documents; developing asset management plans that include NHS features as natural assets; and recognizing a NHS in *OPs* that achieves the goals of the WSP 2020, are key actions that demonstrate commitment to achieving the overall vision for this watershed and meeting specific objectives.

Since the implementation of the WSP 2013, CLOCA municipalities have included a significant number of the original fundamental, key and voluntary policies into their *OPs*. Currently, the Region of Durham, the City of Oshawa, and the Municipality of Clarington, which are the municipalities whose *OPs* govern land use in the BHF Creek watershed, have collectively adopted 93 per cent of the WSP 2013 fundamental policies, 67 per cent of the key policies, and 48 per cent of the voluntary policies in some form. Central Lake Ontario Conservation Authority acknowledges this effort

and will continue to work with our watershed municipalities to strengthen environmental protection by reviewing each *OP* and undertaking a gap analysis to ensure conformity with provincial environmental planning policies and to recommend specific policies to achieve the WSP 2020 goals and objectives. The results of this analysis will be presented to municipal partners as part of AP #29, *Municipal Environmental Policy Review and Analysis*.



Asset Management Plans

The Infrastructure for Jobs and Prosperity Act (2015) sets the framework for which the province and municipalities work together to ensure long-term asset management planning to prioritize investment in public infrastructure. Ontario Regulation 588/17 further outlines asset management planning for municipal infrastructure, providing prescriptive timelines and the context to consider core municipal infrastructure and green infrastructure assets.

As municipalities develop asset management plans, there is a greater need to consider the value and benefits provided by natural assets. Increasingly, it is being demonstrated that natural assets provide equivalent or better services than many engineered assets. Inclusion of natural assets in asset management planning contributes to further protection and management with potential for significant cost savings on engineered structures, while supporting a community that is resilient and adaptable to climate change.

In CLOCA's jurisdiction, the identified NHS offers a suite of ecological services such as flood attenuation, water purification, mitigation of extreme weather events, and support for healthy lifestyles among many other services; therefore, components of the NHS would be ideal to consider as natural assets and included in municipal asset management plans.

As municipalities move forward in the development of asset management plans, there is an opportunity to work in partnership with CLOCA in the valuation of natural assets and their services to inform decision-making processes. Central Lake Ontario Conservation Authority's 2017 report *Ecological Services: Valuing Natural Areas in the CLOCA Jurisdiction* is one tool that municipal partners can use to inform their own natural asset valuations for asset management plans. Identifying, measuring and

managing natural assets as part of an overall asset management strategy can save costs, ensure better management of natural resources and support community resiliency. The complete report (as well as other completed Action Plans and tools) is available online at <https://www.cloca.com/action-plans>.

5.4.3. COMMUNITY ACTIONS

Private landholdings comprise much of the watershed; therefore, the conservation targets identified in the WSP 2020 require action from those landowners to achieve the goals and objectives.

The Action Plans completed to-date contain best management practices for landowners, business owners, and institutions to apply to their properties to protect and improve natural cover, forest communities, streams and coastal wetlands. *The Riparian Corridors Restoration Plan*, the *Instream Barriers Action Plan*, and the *Wildlife Corridor Protection and Enhancement Plan* contain maps for landowners to identify these features and implement strategies for further protection. These plans are available online at <https://www.cloca.com/action-plans>.

For landowners interested in taking a more active restoration role on their properties, CLOCA staff and local municipalities can assist with identifying natural feature enhancement opportunities and interpreting regulatory constraints and bylaw restrictions. Central Lake Ontario Conservation Authority may also be able to provide advice on where to focus restoration efforts and connect landowners with financial incentive programs. For landowners with existing natural heritage features, provincial tax-incentive programs may be available to offset property taxes and encourage the preservation of important habitats.

Residents and businesses in urban and suburban watershed areas can help improve stream health by practicing water conservation and reducing imperviousness. Invasive species can also be addressed in these locations by choosing native plants for gardens and ponds and removing known invasive species. Some excellent resources include the *Grow Me Instead* guide and species-specific best management guides, available online, and websites such as <http://www.invadingspecies.com/plants/>.

Finally, responsible, low-impact recreation is a key component to achieving watershed health. Simple actions, such as refraining from dumping yard waste in ravines and brushing off shoes between visits to natural areas can have a big impact on reducing the spread of non-native and invasive species to natural areas, further promoting forest, stream, and wetland health. See the sidebar for more actions.



10 THINGS YOU CAN DO!

- 1 Be a responsible pet-owner: keep dogs on a leash in natural areas and pick up pet waste.
- 2 Buy native plants whenever possible and remove invasive species from your property.
- 3 Install rain barrels and make your yard less impervious by putting in gardens and permeable driveway/patios.
- 4 Dispose of waste—including yard waste and compost—properly.
- 5 Only storm water should go down the storm sewer grate!
- 6 Practice the “take only pictures, leave only footprints” philosophy when visiting natural areas.
- 7 Stay on established trails to avoid trampling plants and compacting soil.
- 8 Keep wildlife wild by securing food waste and by not hand-feeding.
- 9 Use sand instead of salt for winter traction.
- 10 Understand what you can and cannot do by learning about regulated areas, tree by-laws, and fill regulations.

For additional tips visit: <https://www.cloca.com/stewardship>

6 Next Steps

6.1. WORKING TOGETHER IN PARTNERSHIP

Achieving a healthy, resilient BHF Creek watershed that sustains ecological integrity for the plant, animal and human communities within it requires the cooperation and dedicated action of all stakeholders. Every person has a role to play in the environmental, social and economic health of the BHF Creek watershed through their everyday lives. Our environmental choices today matter for the future and how we ‘make space for nature’ through our decisions and actions will ultimately determine the success in achieving the WSP 2020 vision, goals, and objectives.

6.2. HOW TO GET INVOLVED

Stakeholder comments, ideas and suggestions on how to achieve the WSP 2020 vision, goals, and objectives, will be considered and supported where possible. All stakeholders interested in becoming involved to help implement the various aspects presented in the WSP 2020 should visit CLOCA’s website, www.cloca.com. We look forward to working with existing partners and new stakeholders who would like to contribute to improving watershed health.

6.3. MONITORING AND EVALUATION

A critical component of achieving the WSP 2020 vision, goals and

objectives is understanding current conditions and how those are changing over time. Sir William Thomson summarized this same sentiment more concisely, “If you cannot measure it, you cannot improve it.” The backbone of this WSP 2020 is the baseline and annual data collected through the Integrated Watershed Monitoring Program, the Durham Region Coastal Wetland Monitoring Program, through ELC inventory programs, and delivery of CLOCA’s mandated planning and regulation services. This long-term data allows us to understand how healthy and resilient the watersheds are and how they are changing so that tracking success of the goals and objectives is possible. These monitoring and inventory programs have gone through extensive scientific review and planning to ensure results and recommendations are reliable, accurate, and can guide us towards a healthier watershed in the future. Updates and success tracking of the WSP 2020 will be dependent on appropriate resourcing to sustain these programs. Recommendations have been suggested where gaps in monitoring or data quality exist in order to improve CLOCA’s ability to understand conditions and trends and maintain our goal of advancing watershed science and knowledge.

Further to this, additional support and advancement in technology will be important for creating tracking tools, such as restoration and communication tracking systems, managing large datasets, and updating Geographic Information System (GIS) modelling for climate change and land use change impacts for scenario modelling. These tools help convert large amounts of scientific data into resources that can be interpreted efficiently to support the WSP 2020 recommendations for maintaining a safe and healthy watershed.

6.4. IMPLEMENTATION

Watershed Plans will be updated every five years from the date they are finalized to reflect changing conditions, pressures and trends in the watershed. The next five-year review following the WSP 2020 will include a complete update of all existing condition reports, re-evaluated targets and updated mapping and modelling. This review will be initiated in 2025. Decisions and actions to develop collaborative implementation begins the next steps of the WSP 2020's progress.

The actions identified in this WSP represent a continued effort dedicated to achieving a healthy and resilient watershed. As stated in the WSP 2013, the fundamental barrier to executing these actions is commitment. Provincial, regional and local municipal endorsement of the WSP 2020, as well as resource support for implementation, will need to be sustained.

Central Lake Ontario Conservation Authority is well-positioned to undertake the majority of the work with our current level of in-house expertise. It is anticipated that additional resources will be necessary to develop and execute all the actions within the next five-year period. The WSP 2020 continues to support the achievement of strategic corporate goals, satisfies upper- and lower-tier municipal natural heritage responsibilities and integrates well with their existing environmental programs. Outside funding sources will continue to be sought to supplement the required resources where available and appropriate.



7 References

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7.2. ADDITIONAL RESOURCES USED

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7.3. DATA LAYER SOURCES (MAPS)

Central Lake Ontario Conservation Authority. *Current Landcover* (2019); *Ecological Land Classification* (2019); *Ecologically Significant Groundwater Recharge Areas* (2014); *Flood Damage Centre* (2017); *Future Landcover* (2019); *Generic Regulation Limit* (2016); *Highly Vulnerable Aquifer* (2011); *Impervious* (2019); *Key Hydrologic Area* (2019); *Lake Ontario Shoreline* (2019); *Natural Heritage System* (2017); *Significant Groundwater Recharge Areas* (2011); *Significant Valleylands* (2017); *Wildlife Movement Corridor* (2015); *Watershed Boundary* (2014).

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Appendix A – Legislative summary

Legislation/ Policy Title	Year	Description
Federal		
Federal Fisheries Act	2018	Direction on the conservation and protection of habitat essential to sustaining freshwater and marine fish species. The Act includes a self-assessment process to review future activities in and around water. It also includes increased recognition of Indigenous rights and knowledge.
'How Much Habitat is Enough?', 3rd Edition	2013	Provides information in the Great Lakes Areas of Concern, to be used in setting and listing criteria concerning fish and wildlife habitat. This guide is used to set restoration targets and identify restoration project locations.
Provincial		
Environment Plan	2018	Ontario's commitment to conservation and climate action, the protection of natural resources and waste diversion, in an effort to maintain a healthy and economically prosperous province.
Conservation Authorities Act	2019	Increase clarity and consistency in the roles and responsibilities of Conservation Authorities with regards to the delivery of core programs and services that help advance conservation, development, management and restoration of natural resources in Ontario's watersheds.
Endangered Species Act	2019	Legal protection to species classified as endangered or threatened and their habitat. It sets timelines for strategies and plans to recover at-risk species and provides tools to encourage protection and recovery activities and reduce impact of human activity.
Fishing in Your Backyard	2015	Encourages responsible and sustainable use of Ontario's natural resources and promotes angling, healthy aquatic habitats and accessible fishing sites throughout the Greater Toronto Area.
Great Lakes Protection Act	2015	Provides support to combat climate change through the protection and restoration of the Great Lakes- St. Lawrence River Basin, more specifically <ul style="list-style-type: none"> • The Great Lakes Protection Initiative that ensures all land use decisions conform • In circumstances associated with provincial legislation the Great Lakes Initiative prevails • Great Lakes Guardian Council established to include Conservation Authorities whose purpose is to provide a forum to identify priority actions, foster collaboration, share information and provide input on issues pertaining to the Great Lakes

Appendix A – Legislative summary, cont.

Legislation/ Policy Title	Year	Description
Great Lakes Strategy	2012	<p>Outlines goals to protect and restore the ecological health of the Great Lakes-St. Lawrence River Basin through:</p> <ul style="list-style-type: none"> • Water quality management • Protection and restoration of coastal shorelines, beaches and wetlands • Improving habitat and supporting biodiversity • Dealing with invasive species • Utilizing advance climate change science • Managing salt contamination
Greenbelt Plan	2017	Facilitates long-term strategic growth in the Greater Golden Horseshoe that incorporates environmental protection to mitigate development impacts and climate change and identify special areas of concern within the Greenbelt.
A Place to Grow: A Plan for the Greater Golden Horseshoe	2019	To plan for growth and development in a way that supports economic prosperity, protects the environment and helps communities achieve a high quality of life in the Greater Golden Horseshoe Area.
Infrastructure for Jobs and Prosperity Act (O. Reg 588/17)	2015	Regulation includes Green Infrastructure Assets which consist of natural or human-made elements that provide ecological and hydrological functions and processes. Requires every municipality to prepare a strategic asset management policy and plan.
New Horizons: Ontario's Agricultural Soil Health and Conservation Strategy	2018	This document is a long-term framework to guide collaborative soil health research, investments and activities until 2030.
Oak Ridges Moraine Conservation Plan	2017	Ecologically based plan and provides land use and resource management direction for the Oak Ridges Moraine.
Ontario's Biodiversity Strategy	2011	Safeguards Ontario's species variety and ecosystems through coordinated conservation strategies.
Ontario's Five-Year Climate Change Action Plan	2016-2020	Framework to create competitive conditions for the adoption of low-carbon technology using a variety of actionable target areas.
Planning Act	2019	A land use planning framework in which municipalities shall have regard to the protection of ecological systems including natural areas, features and functions.

Appendix A – Legislative summary, cont.

Legislation/ Policy Title	Year	Description
Provincial Policy Statement	2020	Policy regarding land use planning and development to protect/enhance quality of life for all Ontario residents. Includes considerations to prepare for the impacts of climate change, enhance stormwater management policies, address excess soil, maintain policies related to natural and human made hazards, identify natural heritage systems and protection for the Greenbelt.
Runoff Volume Control Targets for Ontario	2016	Provides a minimum runoff volume control target (RCVT) for Ontario for the implementation of low impact development to maintain pre-development water balance to ensure ecosystem function and natural water quality. Applies to new development, redevelopment, re-urbanization, residential intensification and stormwater retrofits.
CTC Source Protection Plan	2019	A set of policies developed to address the sources of water for municipal drinking water systems from current and potential future drinking water threats.
Watershed Planning in Ontario (DRAFT)	2018	A framework for watershed and sub-watershed planning to be used by municipalities and other planning authorities in fulfilling legislative requirements.
Wetland Conservation Strategy for Ontario	2017-2030	Framework to guide Ontario through the conservation of wetlands with a focus on protection. The Province has committed to two targets: <ol style="list-style-type: none"> 1. By 2025, the net loss of wetland area and function is halted where wetland loss has been the greatest. 2. By 2030, a net gain in wetland area and function is achieved where wetland loss has been the greatest.
Regional/Municipal		
Towards Resilience: Durham Community Climate Adaption Plan	2016	Endorsed for climate adaptation for Durham Region. Includes 18 programs for social infrastructure for emergency, standards for new buildings and retrofits, protection against flooding, improve electrical reliability, redefine flood hazards, improve flood forecasting and warnings, advanced warning of extreme weather, property standards, manage urban heat, resilient asphalt and roads, enhance natural capital and climate adaptation.
Durham Region Official Plan (conformity amendment in 2019 - Envision Durham)	2017	Considerable efforts have been made by the Region and all municipal governments in CLOCA's jurisdiction to incorporate fundamental and many of the key/ voluntary policies from 2013 Watershed Plans into current Official Plans. The 2020 CLOCA watershed plans will directly inform and support the Envision Durham process, as well as subsequent official plan updates by area municipalities.
City of Oshawa Official Plan	2018	
Municipality of Clarington Official Plan	2017	

Appendix B – CLOCA action plan status

No.	Current Title ¹³	Status	Product	Available Online	Description
1	NHS Restoration Guidelines	In Progress	Mapping tool, methodology, planning framework, and program development guidelines	No	Mapping tool prioritizes restoration sites based on several ecological and socio-political factors. Project planning framework and restoration program guidelines still to be developed.
2	Riparian Corridors Restoration Plan	Complete	Report with maps and recommendations	Yes	Evaluation of riparian cover for each watershed with recommendations for improving cover.
3	Community Needs and Opportunities for Environmental Education	Complete	Report	No	Assessment of current and future demographics in CLOCA's jurisdiction with recommendations on how to reach target audiences.
4	Policy and procedural document for regulation and plan review	Complete	Report	Yes	Evaluation of corridor connectivity and road barriers within the wildlife habitat network. Priority restoration areas identified.
5	Wildlife Corridor Protection and Enhancement Plan	Complete	Report with maps and recommendations	Yes	Evaluation of corridor connectivity and road barriers within the wildlife habitat network. Priority restoration areas identified.
6	High Volume Recharge Area Study	Complete	Report with maps	Yes	Identifies broad, jurisdiction-wide tools and resources that support protection of HVRAs, specifically, the "Ecologically Significant Groundwater Recharge Area Delineation in the Central Lake Ontario Conservation Authority Area" and "Hydrogeological Assessment Submissions, Conservation Authority Guidelines to Support Development Applications".
7	CLOCA Data/Analytical Needs and Coordination Assessment	Removed			

[13] Some action plans titles have changed since 2013. Original numbers have been maintained for cross-reference purposes.

Appendix B – CLOCA action plan status, cont.

No.	Current Title ¹³	Status	Product	Available Online	Description
8	CLOCA Integrated Watershed Monitoring Program	Complete	ArcGIS StoryMap	Yes	Integration of the terrestrial, aquatic and coastal wetland monitoring projects across the jurisdiction to monitor health of the western, central and eastern watershed zones over the long term.
9	CLOCA Urban LID Plan	Not Started			Plan will identify potential opportunities across the jurisdiction to incorporate Low Impact Development (LID) retrofits into existing stormwater management systems, and where LID could be integrated into new development. Guidelines and BMPs will be proposed through this document.
10	Stewardship and Education Priorities Plan	Removed			
11	CLOCA Land Acquisition Strategy	Complete	Report with maps	Yes	Identifies areas for future land acquisition with rationale for locations identified.
12	Imperviousness Report Card	Complete	Discussion and mapping in WSP update Methodology document	No	2012 imperviousness assessments re-done for each watershed with updated watershed boundaries, land uses, policy areas and physiographic regions. These are included in this WSP update.
13	Connected Imperviousness BMP	In Progress			Establish a connected impervious (impervious area connected to a common outlet to a stream) to methodology for documenting existing conditions and identifying priority restoration and mitigation areas.
14	Ecological Services: Valuing Natural Areas within CLOCA	Complete	Report with maps	Yes	Valuation of services that forests, wetlands, successional habitats, and streams provide to watershed community.
15	Identification of Salt Vulnerable Areas in the CLOCA Watershed	In Progress			Provide a list of recommended practices and provide maps that identify the vulnerable areas in the watershed where a) municipalities are required to have regard for policy SAL-10 in the CTC Source Protection Plan, or b) CLOCA encourages modified salting practices to protect water quality.

Appendix B – CLOCA action plan status, cont.

No.	Current Title ¹³	Status	Product	Available Online	Description
16	Invasive Species Management Strategy and Update (2017)	Complete	Report	Yes	Recommendations on how to educate and engage partners in management of invasive species.
17	In-stream Barriers Action Plan	Complete	Report with maps and recommendations	Yes	Identifies barriers in each watershed and prioritizes removal of each.
18	CLOCA Ecological Compensation protocol	In Progress			To help replace losses to the natural system that are determined to be unavoidable, after the protection hierarchy has been applied (avoid, minimize, mitigate), CLOCA, municipalities and landowners have used ecosystem compensation. Formal guidance on how, when and where compensation may be considered will be developed.
19	Lichen Pilot Project	Complete	Report	Yes	Report recommends not developing a lichen monitoring program
20	CLOCA Climate Change Monitoring/Adaptive Management Strategy	Replaced with AP #25			
21	CLOCA SWM Performance Monitoring and Maintenance Plan	Removed			
22	HWY 407 Post-construction monitoring plan	Removed			
23	Flood Damage Centres Upgrading	Complete	Report with maps and recommendations	Yes	Report identifies flood risk areas in each watershed and evaluates risk of flooding for each.
24	NHS Climate Change Vulnerability Assessment	NEW			A vulnerability assessment will identify vulnerable areas and restoration opportunities within the natural heritage system based on identified risks and priorities with respect to climate change impacts. This assessment is based on the recently completed climate change ensemble approach modelling completed by the Region of Durham. It is also recommended that a focus be placed on potential impacts to CLOCA's land holdings to determine vulnerable areas and restoration options to reduce the likelihood of risks and hazards from occurring.

Appendix B – CLOCA action plan status, cont.

No.	Current Title ¹³	Status	Product	Available Online	Description
25	Rapid Geomorphic and Stream Assessments	NEW			<p>Despite best efforts to manage stormwater with lot-level conveyance and end-of-pipe treatments, urban development can still trigger stream instability. Both rapid geomorphic and rapid stream assessments can be undertaken to determine stream stability and stress due to urban pressures. Development of a regular monitoring schedule to undertake these assessments will provide critical information on stream health. Areas identified as stressed will be considered for future land restoration and/or private land stewardship engagement.</p>
26	Stream Flow and Water Level Forecasting Model	NEW			<p>Flood forecasting is required to reduce the risk of loss of life and property damage due to flooding through forecasting of flood events, issuing flood warnings, alerts and advisories. The development of a model will provide the ability to effectively analyze and predict the potential impacts of runoff on stream flow rates. Project considerations will include:</p> <ul style="list-style-type: none"> • Desired forecasting lead time (i.e., 5-10 days) and appropriate level of flood response and preparedness time • Scale of weather data to utilize (i.e., local, regional, etc.) • Integration of existing real-time rainfall monitoring • Continue to improve web-based presence for agencies and partners
27	Conservation Lands Master Plan	NEW			<p>CLOCA owns and manages over 2,700 hectares of environmentally sensitive land across our watershed. These lands are referred to as conservation areas, and with population growth in the community, the demand for our greenspace, trails and nature appreciation has increased significantly. CLOCA's Conservation Lands Master Plan will ensure these public lands continue to meet our original intention to conserve natural features and functions, while providing for compatible high-quality visitor experiences that meet the needs of our community. This Master Plan involves a conservation area lands assessment and consultation with the public and stakeholders to ensure we meet the needs of our visitors and our municipal partners now and into the future.</p>

Appendix B – CLOCA action plan status, cont.

No.	Current Title ¹³	Status	Product	Available Online	Description
28	Natural Heritage Tracking Tool	NEW			CLOCA will need to develop an effective system to track the results of restoration projects as well as natural and anthropogenic changes in cover. This natural heritage tracking tool will be an important component in CLOCA’s ability to accurately report gains or losses to the natural cover in the watershed over time.
29	Municipal Environmental Policy Review and Assessment	NEW			CLOCA will review Regional and local municipal Official Plans to evaluate PPS conformity (environmental policies) and develop specific policy recommendations for municipalities to incorporate that will help achieve the WSP updated goals and objectives.

Appendix C – Planning and Management Framework Overview

Central Lake Ontario Conservation Authority has implemented a refined, science-based framework for watershed planning and the components of this framework have been incorporated into this WSP update (see example on next page). The framework provides a systematic, comprehensive, and consistent process that links actions to results and ultimate outcomes.

Watershed Vision

The first component of the framework is to develop a clear vision statement that describes the desired state of the watershed. Central Lake Ontario Conservation Authority's new WSP 2020 vision is: *A healthy, resilient BHF Creek watershed that sustains ecological integrity for the plant, animal and human communities within it.*

Conservation targets, attributes and indicators

To achieve the vision, it is necessary to identify the elements of the watershed (referred to as conservation targets) that represent the ecological and human focus of the WSP 2020. Central Lake Ontario Conservation Authority has identified five conservation targets:

1. Natural Cover
2. Forest Health
3. Stream Health
4. Coastal Wetland Health
5. Human Health and Safety

For each conservation target, attributes have been identified that best represent whether a conservation target is in good condition. Attributes are then measured using indicators – specific measurable characteristics or collections of characteristics combined into indices. Conservation targets, attributes and indicators are the basis for setting goals, carrying out actions and measuring WSP success.

Threats

As part of the first step in the framework, threats to watershed health were considered, e.g., natural cover losses due to land use changes or development, impairments to water quality as a result of various land use activities, or increased risk to property as a result of climate change impacts. Understanding the threats enabled CLOCA to identify strategies to overcome or mitigate those threats.

Goals

Central Lake Ontario Conservation Authority has identified specific goals for each conservation target, 26 in total, which are stated in terms of the desired future status of each indicator (Tables 3–7). These goals represent what the WSP 2020 aims to accomplish over the next 40 years to achieve a healthy, resilient watershed.

FRAMEWORK IN FOCUS

The watershed planning framework that CLOCA has adopted for evaluating watershed health is based on the Open Standards for the Practice of Conservation framework, developed by the Conservation Measures Partnership. It is an internationally-recognized framework, used federally by the Government of Canada, for planning, implementing, and monitoring conservation initiatives.

For more information on the Conservation Measures Partnership Open Standards, visit <https://cmp-openstandards.org/>



Appendix C – Planning and Management Framework Overview, cont.

Strategies and Objectives

To ensure success, three strategies have been selected to focus the actions of CLOCA, municipal partners and the watershed community towards achieving the watershed goals:

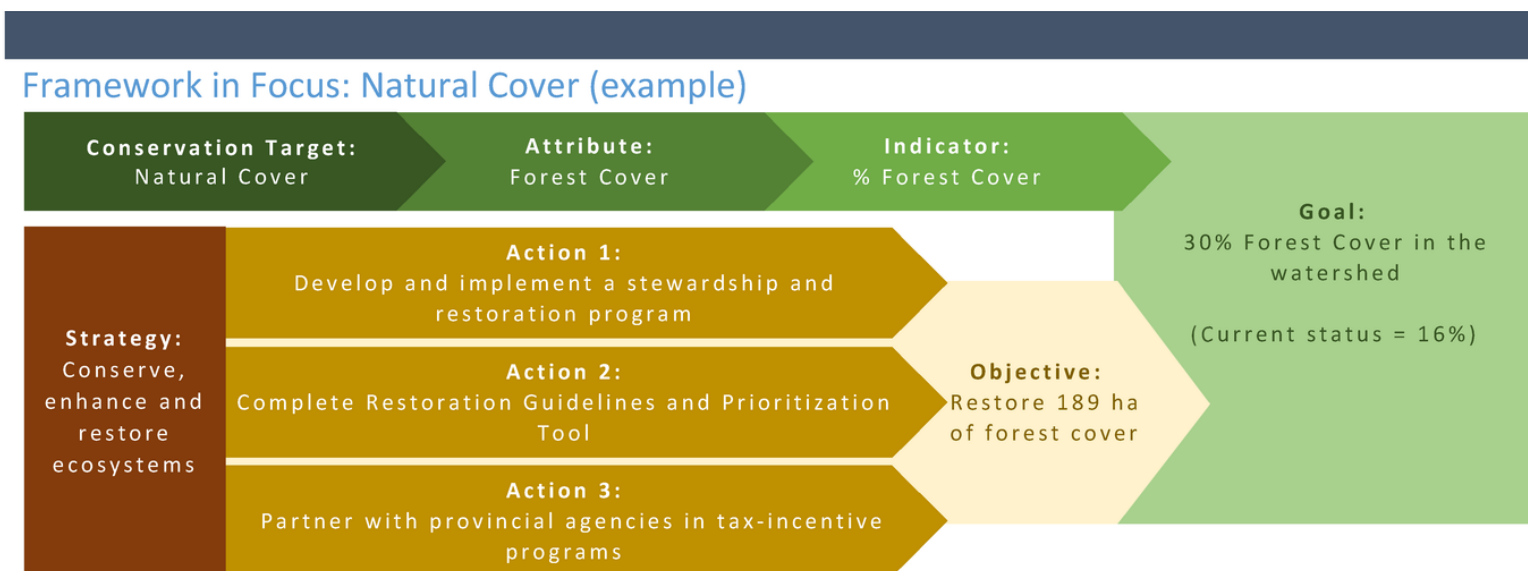
1. *Conserve, enhance and restore ecosystems of the BHF Creeks watershed.*
2. *Promote responsible land use practices to protect ecological and human health (includes protection of infrastructure and property).*
3. *Encourage, acquire and expand partner/stakeholder support for the watershed plan.*

The intended outcomes from the implementation of each of the three strategies have been stated as 15 short-term objectives. It is important to

note that the strategies are broad and address threats that apply to multiple conservation targets, for example, one objective may help achieve several goals. Recognizing that there is substantial overlap and to avoid unnecessary duplication, this WSP update is organized such that the targets, indicators and goals are grouped and discussed together (Section 5).

Actions

The final step of the framework is to identify specific actions to be taken to achieve the objectives. In this WSP update these have been divided into actions to be taken by CLOCA, its municipal partners, and the watershed community, as everyone has a role to play in maintaining and improving watershed health.







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