# Protecting Ontario's Headwaters

## Extending the Co-ordinate Land Use Planning Review to preserve Ontario's natural heritage, watersheds, and ecological integrity

The Ontario Headwaters Institute

November 2016

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## Introduction and Executive Summary

South-central Ontario, and the Greater Golden Horseshoe in particular, is an area rich in forests, water, agriculture, and human creativity, making it one of the fastest developing areas in North America.

One unfortunate result is that the region's natural heritage, watersheds, and ecological integrity are under increased and increasing pressures from a growing population, greater demand for natural resources and agriculture, and increased infrastructure and pollution - at the same time that the climate is changing.

To address these challenges, the government of Ontario is implementing and/or reviewing several initiatives that include implementing the Great Lakes Protection Act, developing a new wetland strategy, reviewing the Conservation Authorities Act, and an extensive Co-ordinated Land Use Planning Review to address the Niagara Escarpment plan, the Oak Ridges Moraine plan, the Greenbelt plan, and the Growth plan.

Of particular interest to the OHI, the Co-ordinated Land Use Planning Review has committed the Province to what we call the Four Directions:

- An inventory of agricultural lands in the Greater Golden Horseshoe (GGH);
- An inventory of natural heritage in the GGH;
- A watershed planning guidance document, and;
- An initiative to (identify and) protect significant surface water contribution areas.

**The OHI believes that each of these directions, and in particular the last three, offer an extraordinary opportunity protect our region's natural heritage, watersheds, and ecological integrity, but that the scope of the directions needs to be better defined and that the outcomes should be applied not just to the Greenbelt but to the whole of the province.**

In short, we believe that establishing provincial targets to protect natural heritage, that adopting Integrated Watershed Management, and that including headwaters and the OHI construct of their contiguous upland catchments in the last three of the Four Directions represent the best opportunity to preserve the ecological, economic, and social well-being of not just south-central but all of Ontario.

As a result, this paper describes why headwaters and their contiguous upland catchments are important and offers three high-level recommendations. These are that Ontario should:

1. Consult on the establishment of targets for how much natural heritage should be set aside, based in part on the federal publication How Much Habitat is Enough;
2. Focus the development of its proposed watershed planning guidance document on Integrated Watershed Management; and,
3. Integrate the OHI construct of Contiguous Upland Headwater Catchments into the three of the Four Directions related to natural heritage, watershed planning, and significant surface water contribution areas.

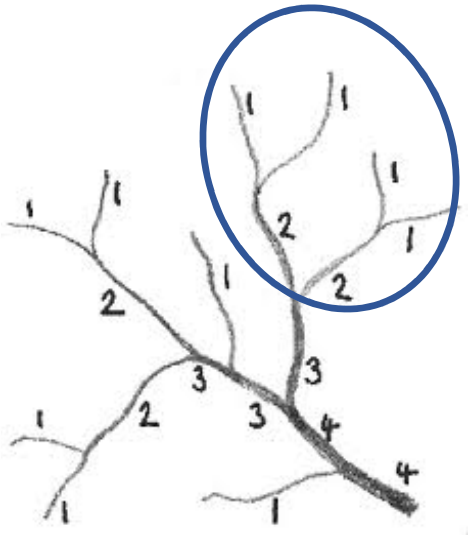
We look forward to discussing this paper and its recommendations with government agencies, community organizations, academia, and others in the coming months and especially over the two year period that the Province has established for work on the Four Directions, as well as any anticipated efforts to develop a process to address boundary changes to the Greenbelt.

## 1. What are Headwaters?

The Ontario Headwaters Institute (The OHI) focuses on research, education, and best practices to protect our headwaters.

We define headwaters as:

- Surface and groundwater collection areas, including sub-surface flows;
- Areas of groundwater discharge and upwelling;
- Vernal pools, spring-fed ponds, and wetlands
- Headwater drainage features, including ephemeral and intermittent streams; and,
- First, second, and third-order streams.



A first order stream is one with no tributaries, as per the drawing to the right. A second-order stream starts where two first-order streams converge, and a third-order stream starts where two second-order streams meet.

First and second-order streams can be permanent, ephemeral (where flow is based on precipitation), or intermittent (where flow occurs when the water table rises). It is rare for a third order stream in Ontario to not be permanent.

While the scientific definition of headwaters usually includes third order streams, the OHI excludes them from both our OHMapping program and in recommendations for certain policy initiatives, such as in this paper. This is because including third order streams would constitute significant majorities of the total area of most watersheds, whereas first and second-order streams and their catchments in rural areas generally have less dense development and more natural heritage, and require a more sensitive policy focus to keep their full watersheds from passing unknown tipping points.

**We also note that most watersheds have significant portions of their headwaters in what we call Contiguous Upland Headwater Catchments, an OHI construct represented by the blue circle in the drawing, and which constitute the drainage areas of first and second-order streams that touch each other in the upstream areas of any watershed**.

In some areas, there might be 2 or 3 such contiguous catchments. In others, there could be 6 or 9. The more that are contiguous and remain high in natural heritage, the better for regional biodiversity, downstream health, and overall ecological integrity.

As a result, the OHI thinks that the best opportunity to protect the future ecological, economic, and social well-being of south-central and indeed all of Ontario resides in protecting our first and second-order catchments, and especially our Contiguous Upland Headwater Catchments.

*Part of a large wetland formed from a first-order stream by beavers. This wetland is a favourite nesting site for Great Blue Herons and provides rich nutrients to the downstream fishery. Photo by Andrew McCammon.*

## 2. Why are Headwaters Important?

Headwaters and their catchments, the areas they drain, are the foundation of Ontario's natural heritage, watersheds, and ecological integrity.

Ontario's headwaters and their catchments:

- Comprise the majority of both surface area and stream length in most watersheds;
- Contribute the majority of flow to most watercourses;
- Help regulate that flow – through natural cover, soil type, and geology – to both surface water and groundwater, influencing flooding, erosion, and water budgets for downstream use;
- Furnish key habitat types for the breeding, feeding, and sheltering of upstream species. In fact, more species require headwaters at some point in their lives than any other type of habitat; and,
- Nurture downstream ecosystems by providing significant portions of a watershed's nutrients, organic material, and sediment, thereby providing the base of a watershed's biodiversity.

Unfortunately, individual headwater streams or catchments are often sheltered from the public eye.

In urban areas, many have been put underground or are corseted in concrete and six foot fences with warning signs about flooding. In rural areas with intense agricultural production, most streams are on private property, where many have lost their streamside cover and/or have been straightened or altered to enhance drainage and agricultural production.

Fortunately, many other headwater streams in rural areas not only continue to function naturally, they combine in what the OHI calls Contiguous Upland Headwater Catchments, the drainage areas of first and second-order streams that touch each other in the upstream areas of any watershed. In some areas, there might be 2 or 3 such contiguous catchments. In others, there could be 6 or 9. The more that are contiguous and remain high in natural heritage, the better for Ontario's biodiversity, down-stream areas, and overall ecological integrity.

The need to protect regional ecological integrity was a catalyst for the creation of the Niagara Escarpment Plan, the Oak Ridges Moraine Conservation Plan, and the Greenbelt. More recently, while reviewing these initiatives in the Co-ordinated Land Use Planning Review, the Province has indicated that it is considering both new protective measures in the Greenbelt in the near term, and what we call the Four Directions for the two years after its initial decisions in the review.

The OHI believes that all of these directions, and in particular the last three, offer an extraordinary opportunity protect our region's natural heritage, watersheds, and ecological integrity, but that the scope of the directions needs to be better defined and that the outcomes should be applied not just to the Greenbelt but to the whole of the province.

*The Oak Ridges Moraine: one of Ontario's most extensive areas of contiguous upland headwater catchments and an area of controlled but increasing development.*

## 3. A Brief Literature Review: Key Documents from Others

Headwaters are important not just to the OHI but to others who see a need to expand the precautionary principle and apply new policies to areas that may have previously been seen as too remote from development or too big to harm, as described in section 6.2.

Although a comprehensive effort to identify, review, and assess a full range of scientific literature was beyond the scope of this paper, we are happy to share observations from key documents on watershed and headwater health.

Before describing three key documents, we note that, while new literature is starting to appear with some frequency, most of the literature on headwater health that we found was:

- More than ten years old;
- Not conducted in areas with surficial geology similar to that in Ontario; and/or,
- Focused on watersheds, with only minor reference to headwater areas.

Regardless, the key documents summarized below offer profound observations.

### 3.1 How Much Habitat is Enough?

*How Much Habitat is Enough* (HMH) is a visionary document published by Environment Canada (1998, revised in 2004 and 2013) that suggests a series of non-regulatory guidelines for healthy lands and waters.

Key issues it addresses which have direct correlation to headwater health, include that:

- A minimum of 30% natural cover is a high-risk threshold for species diversity and healthy aquatic systems, 40% a medium-risk threshold, and 50% a low-risk threshold;
- At a minimum, the greater of (a) 10% of each major watershed and 6% of each sub-watershed, or (b) 40% of the historic watershed wetland coverage, should be protected and restored;
- Both sides of streams should have a minimum 30-metre-wide naturally vegetated riparian (streamside) area to provide and protect aquatic habitat; and,
- Significant impairment in stream water quality and quantity is highly likely above 10% impervious land cover, and can often begin before this threshold is reached.

While some of these targets are being suggested for some development under the Co-ordinated Land use Planning Review, the Province has no high-level targets for Ontario as a whole.

The OHI thinks that watershed targets set a needed vision, and in February suggested the first set of such targets under the new Great Lakes Protection Act, as can be seen at http://ontarioheadwaters.ca/wp-content/uploads/2016/11/OHI-Targets-to-Min-Murray-Feb-12-002.pdf.

Our suggested targets - based on How Much Habitat is Enough but which add regeneration goals where previous development has already impacted natural heritage below the recommended threshold - are the basis for our first recommendation in section 7.

## 3.2 The Natural Functions of Headwater Drainage Features: A Literature Review

The Natural Functions of Headwater Drainage Features: A Literature Review, published in 2007 by the Toronto and Region Conservation Authority (TRCA), is a seminal work summarizing and commenting on the most informative and useful headwater studies over several decades.

The report can be viewed at http://trca.on.ca/the-living-city/water-flood-management/headwater-study.dot, where it is complemented by a series of additional reports from other Ontario agencies. Some, such as those from MNR(F) and the Ausable Bayfield Conservation Authority, provide additional insight, particularly with respect to headwaters in agricultural areas.

Key sections of the TRCA Literature Review relating to this paper include that:

- Current Ontario development "is at or approaching the headwaters of (these) larger systems, which could have broad implications for water quality and quantity, recharge/infiltration, and the overall health of downstream habitats";
- "There is a need for a better understanding of headwater drainage features (HDF) to determine if and how development will impair the functioning of watersheds";
- "Headwater systems are thought to be important sources of sediment, water, nutrients, and organic material" for a watershed's downstream reaches"; and,
- "The spatial context of HDFs account for the majority of total watershed catchment areas within a watershed (70 – 80% according to Gomi et al, 2002), while headwater catchments may derive as much as 90% of a river's flow (Kirby, 1978)".

The third bullet above is of great interest to the OHI and is known as the river continuum concept, which notes the link between the smaller scale of function and smaller species upstream and the larger scale of function and larger species downstream. In other words, the health of the large bodies of water, such as Lake Simcoe or even the Great Lakes, cannot be protected only as a body of water, but must be linked to the cumulative vitality of their watersheds.

On the fourth bullet above, the OHI notes that, in spite of ubiquitous references in Ontario to the percentages sited by Gomi et al and Kirby, real data on these aspects of Ontario's headwaters are not tracked by agencies and are not part of the normal discussion about our watersheds. In contrast, one set of data in our OHMapping project provides information on the percentage of headwater stream length in each watershed, but only for 1$^{st}$ and 2$^{nd}$ order streams.

Additional perspectives shared in the review note that headwaters play important roles in the health of our watersheds with respect to:

- Ecosystem services - such as overland flow, hyporheic (saturated streambed areas) exchanges, groundwater infiltration, and erosion and flood mitigation; and,
- Biological vitality - as may relate to water temperature, riparian cover, sediment deposition, organic material & nutrient cycling, overall water quality, and biodiversity.

Although an excellent summary of most of the literature available, the TRCA Review was not designed to address one of the key issues that the OHI believes is fundamentally important to headwater protection: the monitoring of headwater health. Instead, the review served as a basis for the development of a document to direct near-urban development in headwater drainage features: the *Evaluation, Classification and Management of Headwater Drainage Features Guidelines*.

While the OHI acknowledges the need for this guideline, we believe that Ontario must address a more meaningful inclusion of headwaters in our watershed management framework across the province, as per our Recommendations in section 7.

### 3.3 Comments from the Environmental Commissioner of Ontario

The Environmental Commissioner of Ontario (ECO) has published annual reports with numerous sections on both broad policy issues affecting Ontario's headwaters and on issues more directly focused on headwaters.

On the former, the ECO has called for better protection in headwater policies related to planning, biodiversity, endangered species, forestry, aggregates, monitoring, the need to shift Ontario toward Integrated Watershed Management, and both staff capacity and departmental commitment to effectively deliver the Province's mandates to maintain ecosystem integrity.

On the latter point above, the ECO has tabled numerous reports on issues such as groundwater, permits to take water, Ontario's Low Water Response Plan, wetland protection, unregulated fill in rural areas, the Drainage Act, the Walkerton Inquiry & the Clean Water Act, the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan, and how urban stormwater management is negatively impacting headwaters.

These and other terms can be searched on the ECO website to access an impressive array of work.

This paper does not oppose on-going development in Ontario. It agrees with the ECO, however, that development must include requirements for sound planning, monitoring, and adaptive management, and that we need to be vigilant with respect to both the local and cumulative impacts of development – especially as it expands into our contiguous upland headwater areas.

*As implied by the river continuum concept, even the largest of our lakes and rivers depend on their headwaters for much of their physical and ecological attributes. In short, there will be no champion salmon, bass, nor trout without healthy headwaters.*

## 4. Headwater Health: Characteristics and Pressures

People living in highly urbanized or suburban areas may not have the opportunity to explore and understand headwaters. Many of these areas may contain higher-order streams flowing through ravines, with broad floodplains, and that may have become part of a municipal recreation system with hardened pedestrian or cycling trails, manicured lawn, barbeque pits, park benches, and more.

In contrast, where they are not underground or on private property, headwater streams are usually natural are full of bugs, have few amenities, and are where your feet get wet.

Fortunately, understanding headwaters is relatively straight-forward. Headwaters – and indeed whole watersheds – are best understood through their characteristics and the pressures they face, where characteristics consist of a series of fundamental conditions while pressures arise from emerging impacts, such as development, pollution, invasive species, or climate change.

### 4.1 Characteristics

Characteristics tend to describe base-line conditions. Will water fall as rain or snow, due to climate and elevation? Is the area relatively flat or significantly sloped? Does the area have extensive forests or wetlands, with high retention rates or rapid run-off? Is the surficial geology impervious, expediting surface runoff, or is it porous, allowing infiltration to groundwater? Do streams have high or low levels of sediment, nutrients, and organic material? Do regional temperatures and other conditions result in the presence of cold, cool, or a warm-water fishery?

As described in the next section, headwater areas in south-central Ontario can be highly varied but are consistent with the characteristics of their watersheds.

For example, headwaters in clay plains or with little soil covering impervious rock generally have little groundwater infiltration and discharge, quickly direct surface flows into the stream network, and usually send low levels of sediment and stream nutrients downstream.

In contrast, headwater catchments containing extensive deposits of soil, sand and gravel over more pervious surficial geology have sustained groundwater infiltration and discharge, have slower discharge into the stream network, and provide moderate to high levels of sediment downstream.

*A rainbow chases a storm over the Niagara Escarpment, the 800 km backbone of the province and a major upland area where headwater streams and groundwater begin to accumulate.*

*This and cover photo by David McCammon.*

4.2 Pressures

Unlike long-term characteristics, pressures arise from emerging impacts, and can be applied across huge areas, such as by acid rain or climate change, or be highly localized, as might be caused by sediment, chemical, or thermal pollution resulting from development.

Pressures in headwater areas can come from activities such as agriculture, forestry, mining & aggregate extraction, and other industries that may be located in headwater areas, as well as housing, infrastructure development such as for energy or transportation needs, and even recreational use.

Possible negative impacts include habitat depletion and fragmentation as well as reduced natural cover, including wetlands; alterations to surface flow or groundwater; changes in riparian cover, water temperature, sediment flow, channel form & location, and water availability; and changes in water quality, clarity, chemistry, or temperature.

Unfortunately, watershed report cards generally say little, if anything, about either the chief characteristics or the health of our headwaters, and instead use averages for a whole watershed. Not only does this unacceptably balance bad scores from heavily urbanized areas with good scores from rural upland areas, it presents a false sense of security by ignoring the impact that future development in headwater areas might have on a watershed that may be poised near an unrecognized tipping point.

Adopting improved watershed report cards and incorporating both headwaters in general and the concept of Contiguous Upland Headwater Catchments into the current framework of watershed management would significantly advance the public's understanding of headwater characteristics and pressures.

While the current land use planning review has a targeted geographical focus, the OHI hopes that the work promised over the coming few years to develop a natural heritage inventory of the GGH, a new watershed planning guidance document, and to (identify and) protect significant surface water contribution areas in the Great Golden Horseshoe can be better defined and extended to the whole province.

*Frozen eddies in February and a blanket of Marsh marigolds in May at Ralph Edmondson Conservation Area, Halton. Photos by David McCammon*

## 5. Headwater Areas Inform Their Watersheds

In south-central Ontario, our watersheds are influenced by major landscape features such as the sand and gravel of the Oak Ridges Moraine and the dolomite of the Niagara escarpment. They are thus somewhat homogenous within larger areas, as described in section 4.1.

Headwaters can also be highly varied, however, even within a watershed, as local conditions may dictate natural cover or flow regimes. For example, local climate, elevation, slope, soil type, surficial geology, and hydrology may influence if an area is dominated by deciduous trees, coniferous trees, mixed forests, or shrub land, as well as how much surface water is retained by natural features, how quickly it flows off the landscape, how much sediment it carries, and how much might infiltrate into groundwater.

Regardless, headwaters both inform and represent their watersheds and regional natural heritage, including socio-economic activity, and so must be managed to protect ecological integrity, economic vitality, and social stability. The three headwater areas described below, each a part of our Headwater Hikes program, offer some practical insight.

**Short Hills Provincial Park** is located in the Niagara Escarpment, just south of St Catharines, Ontario. At a latitude less than 150 kilometres north of the northern border of California, and close to the influences of Lakes Erie and Ontario, it has with a moderate climate with an annual average temperature of 8.8° Celsius. Much of this area consists of the Ontario Plain, characterized by flat or gently rolling lands and fertile soils, with excellent drainage provided by the fractured dolomite of the Escarpment.

As a result, Short Hills has 18 first order streams and scores of vernal pools and pocket wetlands. In addition, while has a rich cover of mixed forests and Black Walnut savannahs, the soft soils here are easily carved by run-off into innumerable ephemeral and intermittent streams throughout its sloped forests.

Outside of Short Hills and areas protected by the Niagara Escarpment Plan, agriculture has dominated the landscape, both locally and along the North shore of Lake Erie.

Forests are fragmented. Many wetlands have been drained and many streams have been altered. In spite of progressive actions from government and the local agricultural sectors, nutrient flow into Lake Erie is up, as is algae in the lake.

Having dealt with a significant problem in the 1960s caused mostly by phosphates in detergent, we are now experiencing a similar challenge, but this time caused by multiple sources and requiring enhanced stewardship from thousands of stakeholders.

While the causes seem different, they have a common thread: human actions, whether from a single pollutant or from thousands of sources, can overwhelm nature.

*Swayze Falls, Short Hills Provincial Park. Photos on this and the next page by Andrew McCammon.*

In contrast, the **Pigeon River Headwaters Conservation Area** is near the north-eastern limit of the Oak Ridges Moraine, where rainwater sinking in to its sand and gravel emerges into the headwaters of about 65 of Ontario's watersheds. While relatively close to Lake Ontario and only about 100 kilometres north of the latitude of Short Hills, it has a higher elevation, receives a lot of lake effect snow, and has an annual average temperature of 6.0° Celsius, almost 3 degrees lower than that of Short Hills.

Local characteristics include mixed forests on top of sand and loam soils, which support a wide variety of wetlands and forests that are full of life and cold-water streams, like the one in the photo, thriving with trout.

Areas around Pigeon are characterized by glacial deposits, resulting in aggregate operations where there is sand and gravel, forests where soils are thin or poor, and extensive farming. So abundant are soils and farming across the top of the Moraine, however, that this region has more stream-side cover on higher-order streams than on lower order streams. Impacts include elevated nutrient levels similar to those flowing to Lake Erie and thermal loading to what are traditionally cold-water streams.

**Terra Cotta Conservation Area**, for its part, lies half-way between the two areas described above and straddles both the Oak Ridges Moraine and the Niagara Escarpment.

Located at about the same distance from Lake Ontario as Pigeon River, at a similar latitude, and with a similar elevation, Terra Cotta has the same annual average temperature but a very different topography, soil types, and a more varied vegetation community.

In addition, one special feature of this area is the interplay between surface and ground water in the Niagara Escarpment, such as how the later provides cold, clear baseflow to local streams.

While the upper reaches of the Credit River have more natural heritage than either Short Hills or Pidgeon River, they also host a lot of aggregate extraction. Extensive extraction can impact infiltration rates to groundwater, sub-surface flows, water temperature, and add sediment to local streams, requiring assertive best practices and monitoring.

In summary, headwaters inform their watersheds. The less natural heritage they have, however, and the less healthy and robust headwaters are, the greater the risk that human action might significantly impact regional ecology.

Given expanding development and a changing climate, our headwater areas and their Contiguous Upland Headwater Catchments may represent the best opportunity to preserve the natural heritage, watersheds, and ecological integrity of south-central and indeed all of Ontario.

## 6. Ontario's Approach to Watershed Management

Ontario and indeed Canada have been global leaders in many aspects of developing and implementing a framework approach to watershed management. Unfortunately - yet naturally, as explained below - a coherent approach to headwater management has lagged behind.

### 6.1 Natural Heritage and Watershed Management

Efforts on natural heritage, public health, and watershed management, although it was clearly not called that until recently, started with efforts to reduce local contagions such as cholera in the 19th century, the 1909 Boundary Waters Treaty between Canada and the US, and initial efforts at various water resource, fishing, and navigation regulations.

Although Ontario had conservation authorities before Hurricane Hazel, that 1954 storm might be called the mother of modern watershed management in Ontario, as the existence and roles of conservation authorities began to be significantly expanded after Hazel.

These were still early days, however, and it is worth noting that no government in the world had a ministry of the environment until after the 1972 UN Conference on the Human Environment in Stockholm.

As it turns out, 1972 was a watershed year. Not only did Ontario create its Ministry of the Environment that year, it revamped previous government departments meant to develop lands, forests, and mines into a new Ministry of Natural Resources. In addition, 1972 saw Canada and the US expand on the Boundary Waters Treaty with the Great Lakes Water Quality Agreement, one of the first documents in the world to call for an ecosystem approach to protecting the environment and human health.

While this is not the place for a detailed account of the development of the province's approach to natural heritage and watershed management and how they are informed in part by land use planning, the basic architecture is framed by the *Ontario Water Resources Act*, the *Environmental Protection Act*, the *Lakes and Rivers Improvement Act*, the *Conservation Authorities Act*, and the Provincial Policy Statement.

Key aspects of legislative and other milestones include:

- The *Niagara Escarpment Planning and Development Act*, *1973*, one of the world's first large-scale approaches to protecting natural heritage and agriculture;
- The 1993 publication of *Water Management on a Watershed Basis: Implementing an Ecosystem Approach*, one of the first documents to describe what an ecosystem approach might look like for watershed management (and a document that looks to be updated under a promise in the Review for a new guideline for watershed management);
- The colossal achievement of the Provincial Policy Statement, 1996, with sections dedicated to natural heritage, water, and wetlands;
- The *Oak Ridges Moraine Conservation Act, 2001*, which ingrained the concept of protecting natural heritage and water in both natural countryside and "core and corridor" areas of natural heritage, and the subsequent *Greenbelt Act, 2005,* which extended the approaches taken on the Niagara Escarpment and Oak Ridges Moraine to create the world's largest greenbelt;

- The 2006 amendment of the *Conservation Authorities Act*, which amongst other key updates provided an important new definition of an Ontario watercourse;
- The *Clean Water Act*, 2006. While developed in response to a public health crisis and focused primarily on protecting surface and ground-source drinking water quality, this Act also mandated the mapping of groundwater and the development of water budgets for our watersheds; and,
- The *Great Lakes Protection Act, 2015*, which seeks to establish a broader vision for the Great Lakes Basin, including greater collaboration amongst several ministries as well as ways in which ecological targets and local restoration initiatives might be developed.

Before moving on, two issues must be pointed out. First, Ontario has no targets similar to those in How Much Habitat is Enough, as described in section 3.1.

Secondly, while the *Oak Ridges Moraine Conservation Act, 2001,* includes a commitment to protecting the "ecological and hydrological integrity" of this important landform, the OHI believes that this provision is beyond the reach of a land use planning regime and must be augmented with more robust directives in the Province's watershed management framework.

Regardless, the initiatives listed above and the agencies involved in them have spawned an incredible set of tools for natural heritage and watershed management, including policies, guidelines, and formal and informal networks. Examples include the Provincial Water Quality Objectives, the Ontario Natural Heritage Reference Manual, the Ontario Stream Assessment Protocol, the Provincial Water Quality Monitoring Network, the Ontario Benthos Biomonitoring Network, the Low Water Response Plan, and the requirement for conservation authorities to have guidelines required under O. Reg 97/04 for Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses.

In addition, the Ontario Government, and in particular the Ministry of Natural Resources and Forestry, the Ministry of the Environment and Climate Change, the Ministry of Municipal Affairs, and the Ministry of Agriculture, Food & Rural Affairs, maintain or support numerous programs and databases meant to assist society in understanding the health of our watersheds. This includes the collection of data on water quality and quantity, forests, wetlands, municipal and agricultural drains, and biodiversity, as well as the Land Information Office, which hosts much of the Province's GIS data. The government also provides numerous guidelines for agriculture, forestry, municipalities, and numerous other sectors, and gathers data required under provincial authorizations, although the monitoring data collected by private entities is not currently considered public domain.

There is also an array of initiatives at other levels, particularly in or across conservation authorities. Tools include formal efforts such as the publication of watershed report cards, sub-watershed report cards, biodiversity and natural heritage reports, and core data relating to natural heritage, source water protection, wetland protection, groundwater, and water budgets. Conservation authorities (CAs) have also led the charge on Adaptive Management, Low Impact Development, and have tried to get the Province to see the light on Integrated Watershed Management.

In addition, Conservation Ontario, an organization of Ontario's 36 CAs, manages the annual Latornell Symposium, which brings CA staff and others together for three days of high-level presentations and information sharing. Further informal initiatives led by CAs include working groups on a range of issues, including the establishment of various regional SMART groups (Stream Monitoring and Reporting Teams) and an effort called the Headwaters Steering Committee.

While terms of reference and accountability are often ambiguous in the working groups referred to above, which are essentially both visionary and voluntary, the second working group was formed to help develop the *Evaluation, Classification and Management of Headwater Drainage Features Guidelines (TRCA and CVCA 2013)* mentioned previously.

While focused on near urban headwater drainage features in a development context, the guidelines set precedent, are being widely adopted, and have been incorporated as a module in the Ontario Stream Assessment Protocol.

### 6.2 Headwater Management

While this is not the place to express concerns about gaps in mandates, resources, transparency, and accountability in the provincial framework for watershed management, it is clearly vast and relatively effective.

Unfortunately, while that framework was being developed, its headwaters were somewhat neglected.

Some of this was natural, as the watershed management regime was immature. For example:

- Unlike many urban streams that were put under conservation authority ownership and into service as recreational areas, most rural headwater streams run through private property;
- Rural headwaters may have been thought of as being too far away and too numerous to be impacted by extensive development; and,
- The regulation of small streams without fish were excluded from the mandate of conservation authorities until 2006, enabling municipalities and farmers to alter them, drain them, and/or put them underground, without CA permits.

For more than the last ten years, however, things have begun to change - for headwaters, natural heritage, biodiversity, and in land use planning.

Key aspects have included:

- A realization that growing populations, increased demands for natural resources and agricultural products, and a changing climate are presenting daunting challenges across Ontario;
- Conservation authorities have begun to develop Natural Heritage System Strategies to protect whole ecosystems within watersheds, as well as the synergy between natural heritage and watercourses, and not just narrow bands beside the water;
- Ontario's designation of both "protected countryside" or "core and corridor" areas to protect agriculture and natural heritage in the near-urban, south-central part of the province;
- Provincial support for the establishment of a Biodiversity Council, a provincial biodiversity strategy, and biodiversity report cards;
- The changed definition of a watercourse in the 2006 amendment of the *Conservation Authorities Act*, as mentioned above, from water flowing between discernable banks with fish to "an identifiable depression in the ground in which a flow of water regularly or continuously occurs". As a result, the jurisdiction of CAs was extended upstream, although not without controversy such that competing interests are being revisited in the 2016 review of the Act; and,
- The development of both an informal Headwaters Steering Committee and the document *Evaluation, Classification and Management of Headwater Drainage Features Guidelines,* as mentioned above.

In addition, there are other aspects of Ontario's watershed management framework that could provide significant benefits to headwaters if embraced across the landscape.

These include:

- Addressing the suitability of the definition of a watercourse in the current review of the *Conservation Authorities Act*, as described above, but also with respect to similar words used in other acts or authorizations, such as a "waterway";
- Similar efforts to address the definition of a wetland, as being pursued in the current consultation on a new provincial wetland strategy, as well as addressing gaps in wetland mapping, evaluation, monitoring, and protection;
- Improving the integration of Ontario's biodiversity strategy with both provincial agencies involved in natural heritage and regional work in municipalities and conservation authorities;
- Elevating the voluntary guidelines in the Ontario Natural Heritage Reference Manual to become mandatory minimums for permitting agencies;
- Standardizing CA guidelines to address O. Reg 97/04 for Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses, some of which have recently been updated and are comprehensive while others are out-of-date, selective, and contain erroneous definitions;
- Establishing a common framework for what organizations might call a headwater in Ontario, how stream order is established, and if and where small order stream mapping is performed;
- Addressing the almost universal absence of headwater monitoring in watershed report cards; and,
- Pursuing the announced direction in the Co-ordinated Land Use Planning Review to (identify and) protect significant surface water contribution areas.

In summary, while Ontario's historic efforts on natural heritage protection and watershed management have been relatively extensive and effective, there are no Provincial targets to protect natural heritage, and neither the Province nor the CAs have a comprehensive approach to include headwaters in the existing watershed management framework nor in watershed reporting.

As increasing development and a changing climate loom in south-central Ontario, protecting our headwater catchments – and particularly those that are contiguous, upland, and host significant surface water contribution areas – may be the best opportunity to preserve our natural heritage, watershed health, and overall ecological integrity.

As at least three of the Four Directions mentioned previously provide a timely confluence of need and opportunity, we offer a series of observations and recommendations in the next section.

## 7. Observations and Recommendations for Integrative Change

### 7.1 The Confluence of Need and Opportunity

This is an extremely important time for land use planning, watershed management, biodiversity, and climate change in Ontario. To face numerous challenges, the Ontario government is pursuing several initiatives, including:

- The implementation of the Great Lakes Protection Act;
- The development of a new wetland strategy;
- A review of the Conservation Authorities Act;
- Increased effort on the biodiversity, climate change, and energy files; and,
- The Co-ordinated Land Use Planning Review, combining reviews of the Oak Ridges Moraine Conservation Plan, the Niagara Escarpment Plan, the Greenbelt Plan, and the Growth Plan.

Under the last item, the Province has announced its commitment to what we call the Four Directions:

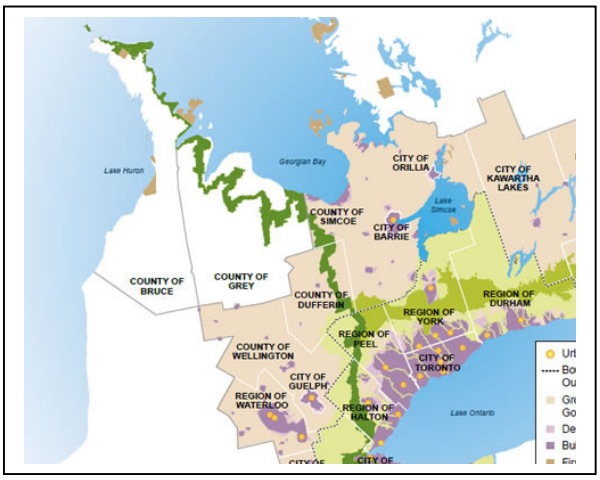
- An inventory of agriculture in the Greater Golden Horseshoe (GGH – see drawing below);
- An inventory of natural heritage in the GGH;
- The development of a watershed planning guideline to support the new requirement for watershed and sub-watershed plans prior to development in the area under review; and,
- An initiative to (identify and) protect significant surface water contribution areas.

The OHI welcomes the expansion of Ontario's lens for land use planning in the GGH, and in particular the last three of the Four Directions, which we believe have significant synergy with headwaters and their contiguous upland catchments.

Currently, key land use planning initiatives address the Niagara Escarpment (shown in the drawing in in dark green), the Oak Ridges Moraine (medium green), and the Greenbelt (light green).

Expanded initiatives agriculture, natural heritage, watershed management, and significant surface water contribution areas in the Greater Golden Horseshoe, the beige area around the Greenbelt, is needed.

**The Greater Golden Horseshoe**




It is needed because south-central Ontario as a whole represents one of the fastest-growing areas in North America, with development occurring in rural areas with headwaters for Lake Ontario, Lake Huron, and Lake Simcoe.

Given increasing development, a changing climate, and the Four Directions, the OHI believes that the Province has unparalleled opportunity to implement three key strategic actions not only for the Greenbelt and GGH but for the whole of the province: to set targets for natural heritage protection; to shift to Integrated Watershed Management; and to integrate headwaters and their contiguous upland headwater catchments into efforts to protect significant surface water contribution areas.

We offer the observations and recommendations below.

## 7.2 The Promised Direction on Natural Heritage

In 1992, Canada agreed to the recommendation from the World Commission on Environment and Development that 12% of each type of habitat be protected nationally. Later, How Much Habitat is Enough, as summarized in section 3.1, suggested that 50% of each watershed be set aside as a low-risk threshold for the future, with 40% as a medium threshold and 30% as a high-risk threshold.

More recently, E. O. Wilson, the father of conservation biology, bolstered the higher figure of 50% based on emerging perspectives of the extent of the damage that humans have done to both regional habitat and whole eco-systems.

The OHI is encouraged that the recent publication of the Province's preferred direction in the Co-ordinated Land Use Planning Review has suggested that 30% of some areas under development be retained in natural heritage.

We are discouraged, however, that the Province has chosen a high-risk threshold in an area of significant development, and has no targets to protect natural heritage outside of the Greenbelt.

To remedy this oversight, we suggest that the Province conduct public consultations to develop targets similar to those in How Much Habitat is Enough, as per our request for natural heritage targets under the Great Lakes Protection Act described earlier, and various provincial documents such as the Ontario Natural Heritage Reference Manual.

Discussions should address how much habitat might be protected; what does protected mean; how do we account for agriculture; and how or where natural habitat might be protected on a development basis, a watershed basis, and/or a broader scale.

This last question is extremely important. We are not against setting aside areas in new development for natural heritage, but we would oppose any short-term perspective that might mandate a patchwork approach to natural heritage based on individual developments which might preclude the creation of a larger network of linked areas across a watershed or ecological region.

**Recommendation 1: Establish Provincial Targets to Protect Natural Heritage**

**Within or parallel to the promised inventory of natural heritage, we urge Ontario to consult on the establishment of thresholds for how much natural heritage should be set aside to protect our ecological integrity and the well-being of future generations. The consultation should:**

**a.) Be based in part on the federal publication How Much Habitat is Enough and the Ontario Natural Heritage Reference Manual;**

**b.) Be held in conjunction with the Province's proposed directions in the Greater Golden Horseshoe on a watershed planning guidance document and on protecting significant surface water contribution areas;**

**c.) Address a balance amongst local development targets, watershed targets, and broader regional targets, and including discussion on the OHI construct relating to Contiguous Upland Headwater Catchments; and,**

**d.) Consider applying the targets not just to the GGH but to the whole province, especially to the Far North, the watersheds draining in to Lake Superior, and other areas facing significant development.**

7.3 The Promised Direction on Watershed Planning

The OHI is encouraged by the new direction in the Co-ordinated Land Use Planning Review to require watershed planning prior to the issue of land use permits and that commits the Province to craft a watershed planning guidance document within two years of the initial completion of the review.

The OHI is concerned, however, that this direction will establish different policies in different parts of the province; that it is somewhat vague, especially on the process for crafting the guideline; and that will take some time to implement once the guidance document is finalized.

The OHI therefore suggests that the Province expand the scope of the guideline to the whole of the province and that it focus on how Ontario could implement Integrated Watershed Management (IWM).

Currently, IWM is being embraced by leading jurisdictions around the world, and has been recommended for Ontario by the province's Environmental Commissioner and Conservation Ontario, which represents Ontario's 36 conservation authorities.

As described by Conservation Ontario, IWM is "the process of managing human activities and natural resources in an area defined by watershed boundaries. It is an evolving and continuous process through which decisions are made for the sustainable use, development, restoration and protection of ecosystem features, functions and linkages. Integrated watershed management allows us to address multiple issues and objectives; and enables us to plan within a very complex and uncertain environment."

A commitment to IWM by the Province could both mandate better inter-agency collaboration across the province and include the implementation of the shift to cumulative monitoring broached frequently in the past, such as in the Provincial Policy Statement (2014).

**Recommendation 2: IWM and the Proposed Watershed Planning Guideline**

**In proceeding to implement the current direction in the Co-ordinated Land Use Planning Review to develop a watershed planning guidance document, the OHI recommends that Ontario focus the development of the document on Integrated Watershed Management, ensure the inclusion of headwaters in the guidance document, apply the document to the whole of the Province, and include the establishment of clear ministry mandates and defined roles for other agencies, such as municipalities and conservation authorities.**

Please also see associated recommendations 4, 5, and 6 in section 7.5.

7.4 The Promised Direction on Significant Surface Water Contribution Areas

The OHI firmly believes that the Province must embrace a more fulsome role for headwaters in all aspects of our framework approach to watershed management, including outreach & education, natural heritage & stream mapping, and monitoring.

In particular, given the Province's commitment in the Co-ordinated Land Use Planning Review to inventory natural heritage, craft a watershed planning guidance document, and to (identify and) protect significant surface water contribution areas, we believe that the OHI's construct of Contiguous Upland Headwater Catchments can play a very meaningful role in the long-term protection of Ontario's natural heritage, watershed health, and ecological integrity.

**Recommendation 3**: **Pursue the OHI Construct of Contiguous Upland Headwater Catchments**

**We urge the Province to pursue the synergies in three of the Four Directions under the Co-ordinated Land Use Planning Review - the preparation of a natural heritage proposed inventory, a watershed planning guidance document, and the effort to (identify and) protect significant surface water contribution areas – by incorporating the OHI's construct of Contiguous Upland Headwater Catchments into all three efforts and across the province.**

Please also see associated recommendations 7 through 10 in section 7.5.

7.5 Associated Recommendations

While the three recommendations above indicate our priorities for discussion under the Four Directions, the OHI offers a series of seven associated recommendations for their implementation.

Associated Recommendation 4: Watershed Planning / IWM Stakeholder Committee

To facilitate the broadest possible discussion on the watershed planning guidance document, we urge Ontario to create a multi-sectoral committee to advise on both the inclusion of IWM as a main focus of the document and on the earliest possible implementation of IWM in Ontario.

Associated Recommendation 5: IWM Implementation

The OHI supports the establishment of an on-going multi-stakeholder table to regularly address the implementation of IWM in Ontario, as recommended by Conservation Ontario in the review of the Conservation Authorities Act, provided it includes representatives from civil society.

Associated Recommendation 6: Require Watershed Planning before Issuing Land Use Permits

To ensure a consistent approach to watershed planning and land use permitting, we recommend that the Province extend the current direction in the Co-ordinated Land Use Planning Review to require watershed planning prior to the issue of land use permits in the Greenbelt to the whole province. One way to accomplish this would be amend section to 2.2.1 a) of the Provincial Policy Statement, as follows:

> "~~using the~~ requiring watershed and/or sub-watershed plans as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for considering cumulative impacts of development".

Associated Recommendation 7: Headwater Mapping

To address the current reality that our headwaters are not well mapped, we urge the Province to pursue the creation of a common GIS template so that agencies can map stream order and Contiguous Upland Headwater Catchments; that the template have a capacity to display multiple layers of data such as on water quantity, quality, and temperature; and that Ontario support the development of automated queries for meaningful indicators of headwater health for inclusion in watershed report cards.

Associated Recommendation 8: Headwater Monitoring

To address the absence of headwater indicators in watershed report cards, we urge the Government to facilitate multi-sectoral discussion on the inclusion of headwater indicators in those reports, and we offer the following indicators* for discussion:

- Percentage of combined 1st and 2nd order catchments in natural heritage;
- Percentage of remaining historic wetlands in 1st and 2nd order catchments;
- Percentage of 1st and 2nd order streams, by stream order, that have been altered;
- Percentage of 1st and 2nd order streams with 30 M of natural cover (one and both sides);
- Conformity of historic flow at confluence of 3rd and 4th order streams;
- Water Quality Indices at confluence of 3rd and 4th order streams; and
- Water temperature at confluences of 3rd and 4th order streams.

* Note: The first four bullets above focus on 1st and 2nd order streams. This data can be generated from aerial and satellite imagery and would require only limited staff time in ground-truthing images to current conditions. The last three bullets are based on the practical reality that significantly larger amounts of staff time and site visits on private property would be required at the confluences of lower order streams, and so we suggest that this data be obtained at fewer locations, being the confluence of the higher-order streams cited.

Associated Recommendation 9: Providing and Enforcing Standards

The OHI urges the Province to consider:

- Requiring that agencies adhere to the Natural Heritage Reference Manual;
- Standardizing CA guidelines required under O. Reg 97/04 for Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses; and
- Developing thresholds for required actions for exceedances under the Provincial Water Quality Objectives.

Associated Recommendation 10: Using Ecological Indicators in Provincial Reviews

We urge Ontario to consider:

- Ensuring public participation in and transparency for discussions on the evolution of Ontario's watershed report card template; and,
- Ensuring adequate public input on the selection of meaningful ecological indicators for future reviews of land use planning effectiveness and that the data is made available to the public in a timely manner prior to such reviews.

## 8. Conclusion

South-central Ontario's natural heritage, its watersheds, and its ecological integrity are facing increased and increasing pressures from a growing population, a greater demand for natural resources and agriculture, and increased infrastructure and pollution - at the same time that the climate is changing.

Fortunately, we have an opportunity to preserve some of the remaining key components of the region – its natural heritage, watershed characteristics, and ecological integrity – by creating reservoirs of biodiversity in both our headwater areas in general and our Contiguous Upland Headwater Catchments in particular.

The OHI believes that each of the Four Directions offered in the Co-ordinated Land Use Planning Review, and in particular the last three, offer an extraordinary opportunity protect our region's natural heritage, watersheds, and ecological integrity, but that the scope of the directions needs to be better defined and that the outcomes should be applied not just to the Greenbelt but to the whole of the province.

In particular, we believe that establishing provincial targets to protect natural heritage, that adopting Integrated Watershed Management, and that including headwaters and the OHI construct of their contiguous upland catchments in the last three of the Four Directions represent the best opportunity to preserve the ecological, economic, and social well-being of not just south-central but all of Ontario.

We therefore recommend that Ontario:

1. Consult on the establishment of provincial targets for how much natural heritage should be set aside, based in part on the federal publication How Much Habitat is Enough;
2. Focus the development of the proposed watershed planning guidance document on Integrated Watershed Management; and,
3. Integrate headwaters and the OHI construct of Contiguous Upland Headwater Catchments into the three of the Four Directions related to natural heritage, watershed planning, and significant surface water contribution areas.

We also offer a series of seven associated recommendations for the implementation of our three main Recommendations, touching on public participation, transparency, headwater mapping and monitoring, the provision and enforcement of provincial standards, and the utility of ecological indicators in provincial reviews.

The OHI will continue to work diligently on all our recommendations and will be pleased to share our thoughts with others, especially as the Province proceeds on the Four Directions.

Please feel free to contact us at your convenience to discuss any of our observations or recommendations.

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