

Protecting Significant Moraines in Waterloo Region

A Supplementary Report in Support of Waterloo Region's Growth Management Strategy

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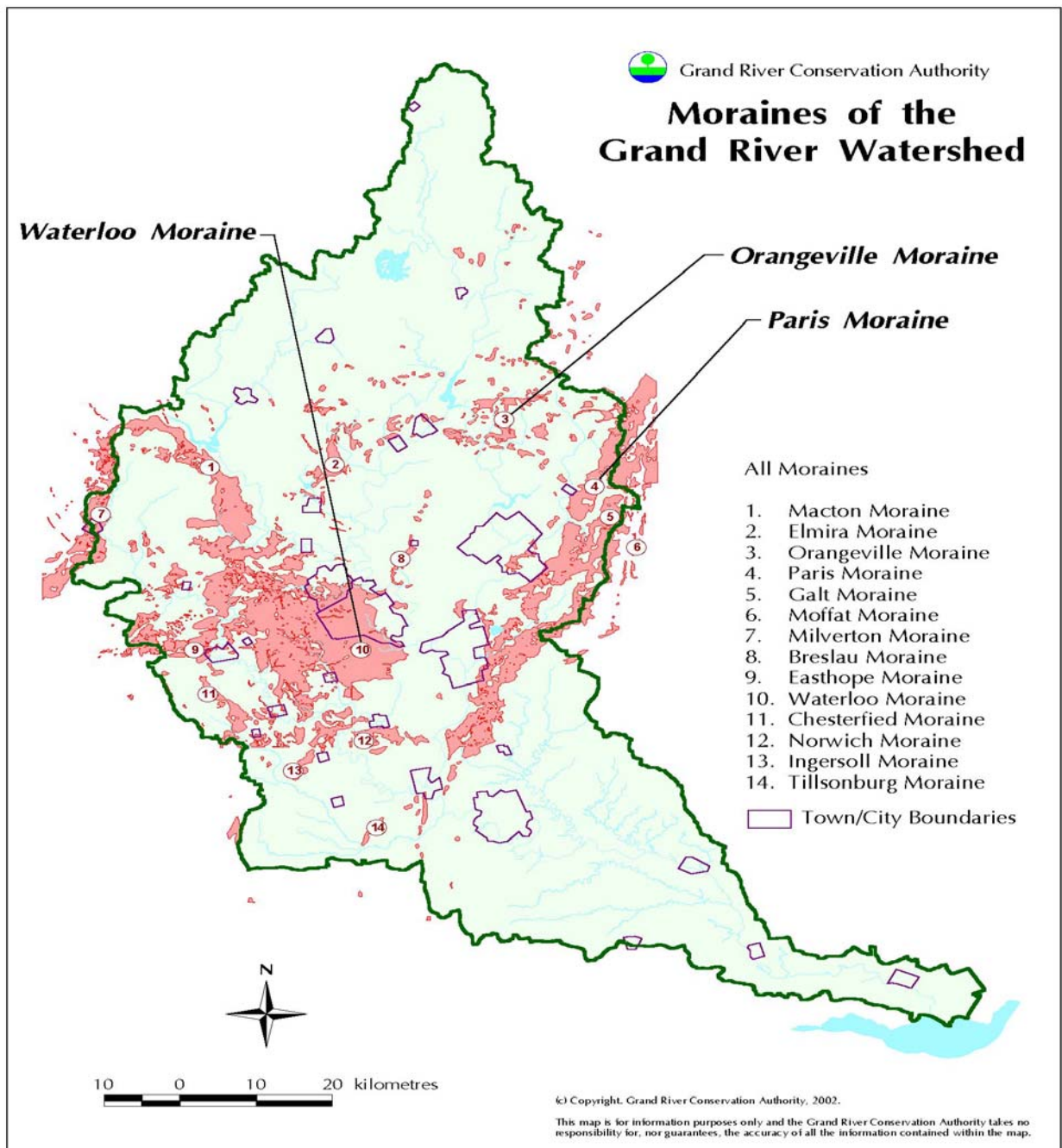
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1.0 Introduction

The need to plan for and protect the moraines in Waterloo Region has gained prominence in recent years. The decision to take a strictly moraine planning approach, or a broader watershed planning approach (similar to Waterloo Region), is irrelevant so long as the significant natural features are protected. Moraines are large glacial features consisting of various levels of bedrock and contain aquifers which provide approximately 50% of the drinking water to surrounding urban areas. Limited development currently exists on the three moraines in the Region, and more is planned for on the Waterloo Moraine, located to the west of the Cities of Kitchener and Waterloo. Given the many functions that moraines perform, the least of which is the provision of drinking water to area residents, concerns are being expressed that further development on the Region's moraines will have implications for this vital groundwater recharge function. The Waterloo Moraine is one of three 'significant' moraines in Waterloo Region, with the other two being the Galt and Paris moraines, located to the south and east of Cambridge (please refer to Figure 1, next page).

The purpose of this paper is to expand the discussion on the role and function of moraines in Waterloo Region while also increasing the understanding of the links between source water protection and moraines. A supplementary objective is to first, describe other approaches to moraine planning in other jurisdictions, such as where the Oak Ridges, Oro and Trafalgar moraines are located. The second part of this objective is to discuss how Waterloo Region has committed itself to the protection of water resources through the Regional Official Policies Plan (ROPP) and in concert with the Grand River Conservation Authority. What is gained from this examination is that there are several possibilities taken by local and Regional governments when choosing how to protect the function of moraines. There is the approach used in the Oak Ridges moraine case that identifies and protects the specific physiographic form, while there is another broader approach that plans on a watershed scale. Both approaches are valid and accomplish the goal of moraine protection.

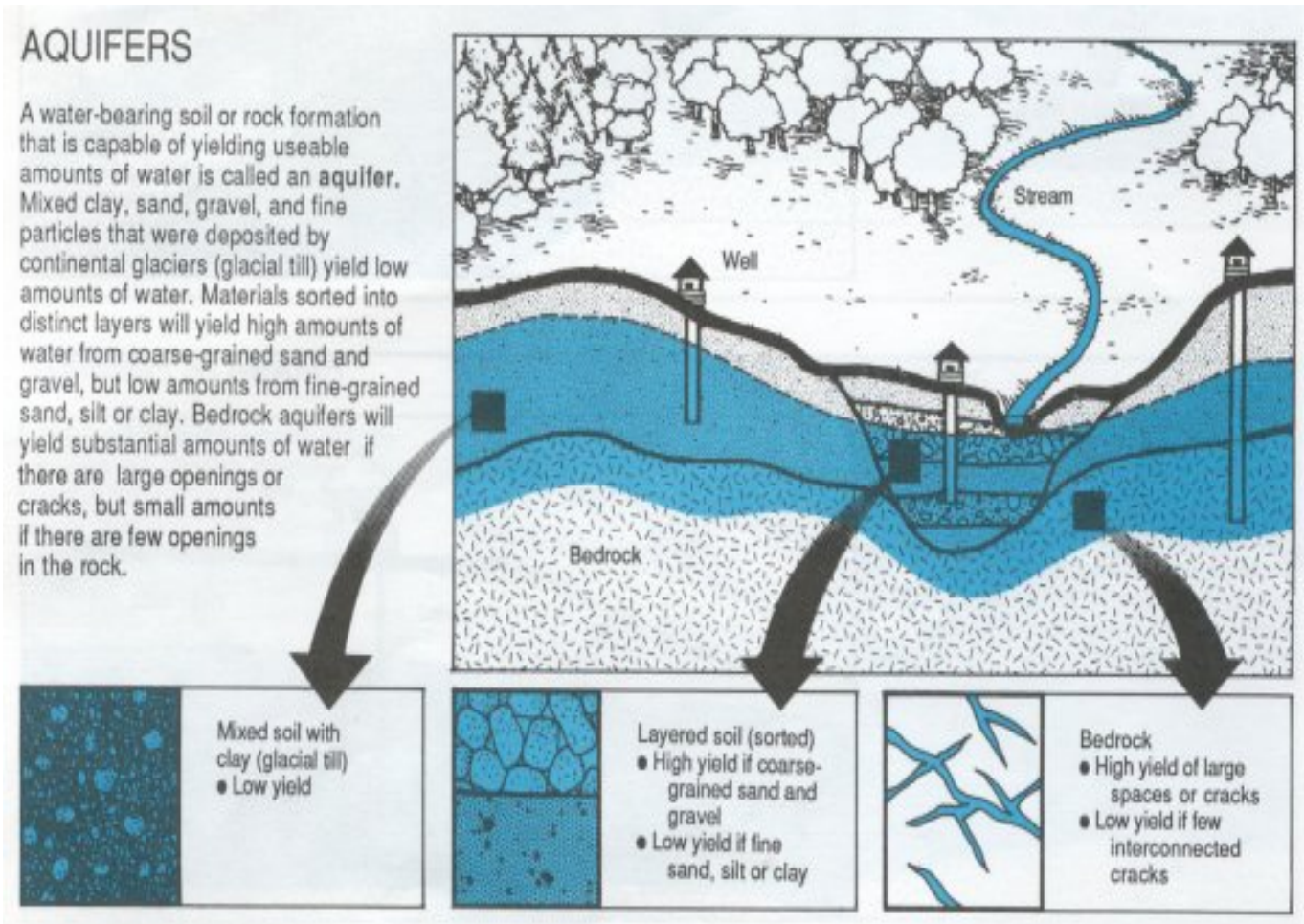
Figure 1 Moraines of the Grand River Watershed



2.0 The Role and Function of Moraines

A moraine is a naturally occurring feature which includes glacial sand and gravel deposits that act like a giant sponge, absorbing rain and snowmelt. This underground water is then stored through these layers of sand and gravel (aquifers), filtered and then slowly released as cool water to lakes, rivers and streams (please refer to Figure 2).

Figure 2 Description and Illustration of an Aquifer



Source: Michigan State University Extension, Water Quality Bulletin # 35, August, 1991

All moraines provide ecological, social and public health functions. The vegetated portions of moraines support habitats for rare plants, animals and vegetation communities, and act as a breeding area for amphibians and waterfowl. Headwaters of watersheds also originate in a moraine because of their height and the water discharged from moraines typically sustains wetlands around its perimeters. In addition, a moraine can form part of an extensive natural habitat network that is a vital part of a local or

regional natural heritage system (please refer to Figure 3, below). A natural heritage system is lands that are part of a network of natural areas and/or regenerated areas and the lands that support the ecological functions critical to the survival of these areas.

Figure 3 The Waterloo Moraine at Erb Street West and Wilmot Line

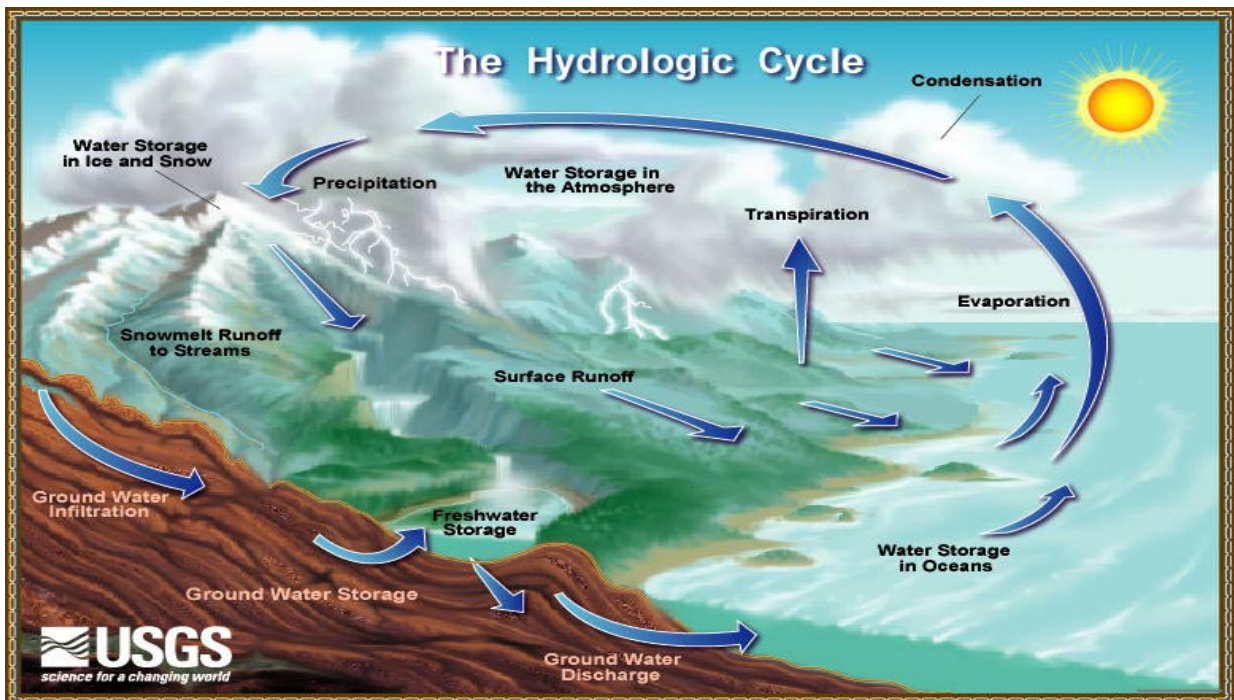


Moraines, in some cases, also assist in defining a community by creating a ‘sense of place’ that may be unique to that area. The views, vistas, elements of the natural heritage system, and land use pattern on a moraine can also contribute to the establishment of a unique ‘spatial’ experience for residents and visitors alike.

However, a moraine’s most important function is as a contributor to public health. Moraines can be described as rain barrels as they have various hydrogeologic components. The permeable sands and gravel deposits act like a sponge, and absorb precipitation. This precipitation is then stored in layers of aquifers, filtered, and slowly released as cool fresh water. Hence, a moraine can provide drinking water and act as a recharge/discharge area - sustaining the health of many watersheds and communities.

The hydrologic cycle, as illustrated in Figure 4, plays an important role in replenishing the available water in moraines. When it rains, precipitation is deposited into a stream, evaporates back into the air, or soaked into the ground. The water that is stored in the ground - groundwater - eventually reappears as springs which feed streams and wetlands. When groundwater is removed faster than can be naturally replenished, it can take decades for these aquifers to be full once again.

Figure 4 The Hydrologic Cycle



Source: <http://ga.water.usgs.gov/edu/watercyclegraphic.html>

In order to protect the groundwater and rivers and streams, it is necessary do the following:

1. Keep water going into the ground, recharging the groundwater;
2. Water must be used sustainably; and,
3. Water must be kept clean.

Protection of groundwater, or source water, ultimately depends on these three actions, all of which Waterloo Region recognizes and promotes through policies and programs.

3.0 Approaches to Planning for Moraines in Other Jurisdictions

The Province has historically, through the Provincial Policy Statement (PPS), required that municipalities protect Provincially Significant Wetlands (PSWs) and Areas of Natural and Scientific Interest (ANSIs) from development. Development in significant woodland areas, significant wildlife habitat areas, significant valley lands and other significant features is permitted provided it can be proven that the development will not have a negative impact on the identified feature. While many of these significant features may be located on moraines, the Province does not specifically identify moraines as a landform or natural heritage feature to be considered for protection.

The only exception to date is with the Oak Ridges Moraine, located north of Toronto. While the Province has identified significant natural heritage features on other moraines, no other moraine has been reviewed in its entirety. The study and review of

the ORM began in the early 1980's when it was recognized that urban development pressures were beginning to be felt on this important landform. A number of other municipalities are now beginning to consider dealing with moraines within their jurisdictions. Examples are the Oro Moraine in the Township of Oro-Medonte in the County of Simcoe and the Trafalgar Moraine in the Town of Oakville.

3.1 The Oak Ridges Moraine

In May 2001, the Minister of Municipal Affairs and Housing introduced the Oak Rides Moraine Protection Act, 2001. The intent of the Act was to establish a six month moratorium on development on the ORM. Following the passage of this Act, the Minister appointed an advisory panel of 13 members to develop a land use plan for the ORM. Following a period of consultation, Bill 122 received Royal assent and the Oak Ridges Moraine Conservation Act, 2001 came into effect on December 14, 2001. On April 22, 2002, Ontario Regulation 140/02 came into effect through which the Oak Ridges Moraine Conservation Plan (ORMCP) was established. A policy framework for the long term protection of the ORM has been established.

Figure 5 The Oak Ridges Moraine



Source: <http://www.city.toronto.on.ca/moraine/pages/pic9.htm>

According to the ORMCP, the following are the objectives of the Oak Ridges Moraine Conservation Act, 2001:

- a. To protect the ecological and hydrological integrity of the Oak Ridges Moraine area;
- b. To ensure that only land and resource uses that maintain, improve or restore the ecological and hydrological functions of the Oak Ridges Moraine Area are permitted;
- c. To maintain, improve and restore all the elements that contribute to the ecological and hydrological functions of the Oak Ridges Moraine Area, including the quality and quantity of its water and its other resources;
- d. To ensure that the Oak Ridges Moraine Area is maintained as a continuous natural landform and environment for the benefit of present and future generations;
- e. To provide for land and resource uses and development that are compatible with these objectives;
- f. To provide for continued development within exiting urban settlement areas and recognize existing rural settlements; and,
- g. To provide for a continuous recreational trail through the Oak Ridges Moraine Area that is accessible to all including persons with disabilities.

Based on these objectives, the Region, through the various programs and policies described in further detail in this paper, has fulfilled the first six of seven points. The final point regarding recreational trails is under the jurisdiction of local area municipalities, and therefore, not the responsibility of the Region. This comparison, therefore, suggests that Waterloo Region has different, yet sufficient, policy framework.

3.2 The Oro Moraine

The Oro Moraine has an area of about 17,000 hectares, is about 25 kilometres long and about 10 kilometres wide at its widest point. The intent of the process in Oro-Medonte is to identify significant natural heritage features on the Oro Moraine, using a locally developed methodology, and then to protect these features from development to ensure their continued function as a major groundwater recharge and discharge area. The approach selected to develop a natural heritage system for the Oro Moraine uses both principles of landscape ecology and published data bases that contain more detailed information on vegetation and wildlife species. Although the Natural Heritage Study (NHS) uses primarily a landscape ecology approach, the database was designed to be flexible and to have the potential to be updated to include data from site-specific natural heritage studies as they become available.

The goal of the Oro Moraine process is to ensure that the ecosystems on the moraine remain diverse and functional with or without development. Core areas and naturally vegetated linkages (corridors) have been established to protect identified ecological

and hydrological features and functions and to focus settlement into more concentrated areas, thereby minimizing the environmental effects of human disturbance such as the fragmentation and isolation of sensitive habitat.

The result of the Oro Moraine land use process was the preparation of a comprehensive Official Plan Amendment. The intent of the Amendment is to protect as much of the Oro Moraine from development as possible to ensure that its function as a major recharge and discharge area is maintained. On this basis, approximately 50% of the moraine is proposed to be placed in a Natural Core/Corridor Area designation. Much of this area is currently wooded and is considered, using the locally developed methodology, to be a significant woodland feature. Land uses within the Natural Core/Corridor Area designation are limited and the policies indicate that applications for new golf courses, residential subdivisions and aggregate extraction operations will not be considered within this area, since any such development would have a negative impact on the significant natural heritage feature. The remainder of the Oro Moraine is divided into a number of land use designations, with the primary two designations being the Agricultural designation and the Rural designation. A number of settlements are also located on the Oro Moraine as well.

3.3 The Trafalgar Moraine

Another moraine that has been in the news lately is the Trafalgar Moraine. Located just west to Toronto, the Trafalgar Moraine stretches from the Niagara Escarpment through Oakville to the City of Mississauga and is a scenic ridge of rolling green hills, fields, forest and sensitive kettle wetlands. Although smaller than the ORM, the Trafalgar Moraine is considered to be a significant landform by many local residents, measuring 20 kilometres in length and 4 kilometres in width and having an approximate area of 8,000 hectares.

The Trafalgar Moraine is composed of a silty clay ridge and is therefore different from the ORM and Waterloo Moraines, which are mostly comprised of sand and gravel. On this basis, recharge rates on the Trafalgar Moraine are much lower than on the ORM and Waterloo Moraines. Notwithstanding the above, the Trafalgar Moraine serves as the headwaters of six of Oakville's major creeks, the Fourteen Mile, McCraney, Shannon's, Munn's, Morrison, and Joshua's Creeks. The Trafalgar Moraine is also the site of most of Oakville's remaining farmland.

On May 29, 2002, the Town of Oakville adopted Official Plan Amendment 198 (OPA 198). The intent of the Amendment was to extend the Oakville urban area north of Dundas Street onto lands that are the site of the Trafalgar Moraine. The intent of the Amendment is to provide the basis for developing subwatershed plans and Secondary Plans for the area that would provide for the addition of 50,000 people on 3,000 hectares.

It is the intent of OPA 198 that a review of the population and employment targets for North Oakville be carried out to "*reflect the natural heritage system and the Trafalgar Moraine identified through the Sub-watershed characterization studies*". Following the preparation of the Sub-Watershed Study, a further Amendment to the Official Plan will be required prior to the approval of any detailed Secondary Plan for any portion of

North Oakville. At least two Secondary Plan studies will be required. It should be noted that all of these lands will be serviced by full municipal services.

The approach taken to protect the Oak Ridges, the Oro, and the Trafalgar moraines is one that clearly identifies moraines as unique physiographic features and protects this form. However, as suggested earlier, the approach taken by Waterloo Region focuses on protecting water sources, which by extension, encompasses moraines. Neither approach is considered better or worse, merely different. Both are consistent with the Provincial approach to moraine protection.

4.0 Moraines in Waterloo Region

There are three significant moraines in the Waterloo Region. The Galt and Paris Moraines are located to the south and east of the City of Cambridge and the Waterloo Moraine is located to the west of the Cities of Kitchener and Waterloo. Since the mid 1990s, the Waterloo Moraine has been recognized by the Region for its importance in groundwater protection for the long-term supply of municipal water. The Waterloo Moraine is a large geologic feature that covers much of Kitchener, Waterloo, Wilmot and parts of Wellesley and North Dumfries (outlined in black in Figure 6, below).

Figure 6 The Waterloo Moraine



The Waterloo Moraine has an area of about 40,000 hectares and is considered to be the largest moraine in the Region. This feature contains areas of sand and gravel deposited through glacial activity that contain a series of large aquifers which discharge to and maintain the base flow of the Grand River and many of its tributaries. These aquifers are also the source for approximately 50 percent of all the groundwater used within the Regional water supply system. Some of these aquifers, and in particular the easterly flanks of the moraine which underlie the urban development areas within the westerly portions of the Cities of Kitchener and Waterloo, are covered by less permeable silt and till materials which limit the infiltration of rain water and associated chemicals. As a result, the westerly portion of the moraine serves as the main area of recharge for the aquifers associated with this feature. While groundwater protection is important for the entire moraine, protection of the regionally significant recharge areas (regional recharge area) is of the highest priority as this area contributes the majority of the water to the aquifers.

The Galt (Figure 7) and the Paris Moraines were created by the bulldozing action of the Ontario ice lobe, which was estimated to be about 5,000 metres thick. Much of the material left by the ice lobe was deposited in the shape of oval hills called drumlins. The ridge along the east side of the Grand River between Paris and Glen Morris is considered to be an 'end moraine', and the flats on the west side of the Grand River are part of an out-wash plain, which is an area where melt water from the glacier flowed wherever it could. The Grand River, as it is known today, was the main channel for meltwater at that time and is a remnant from the receding glaciers.

Figure 7 Face of the Galt Moraine



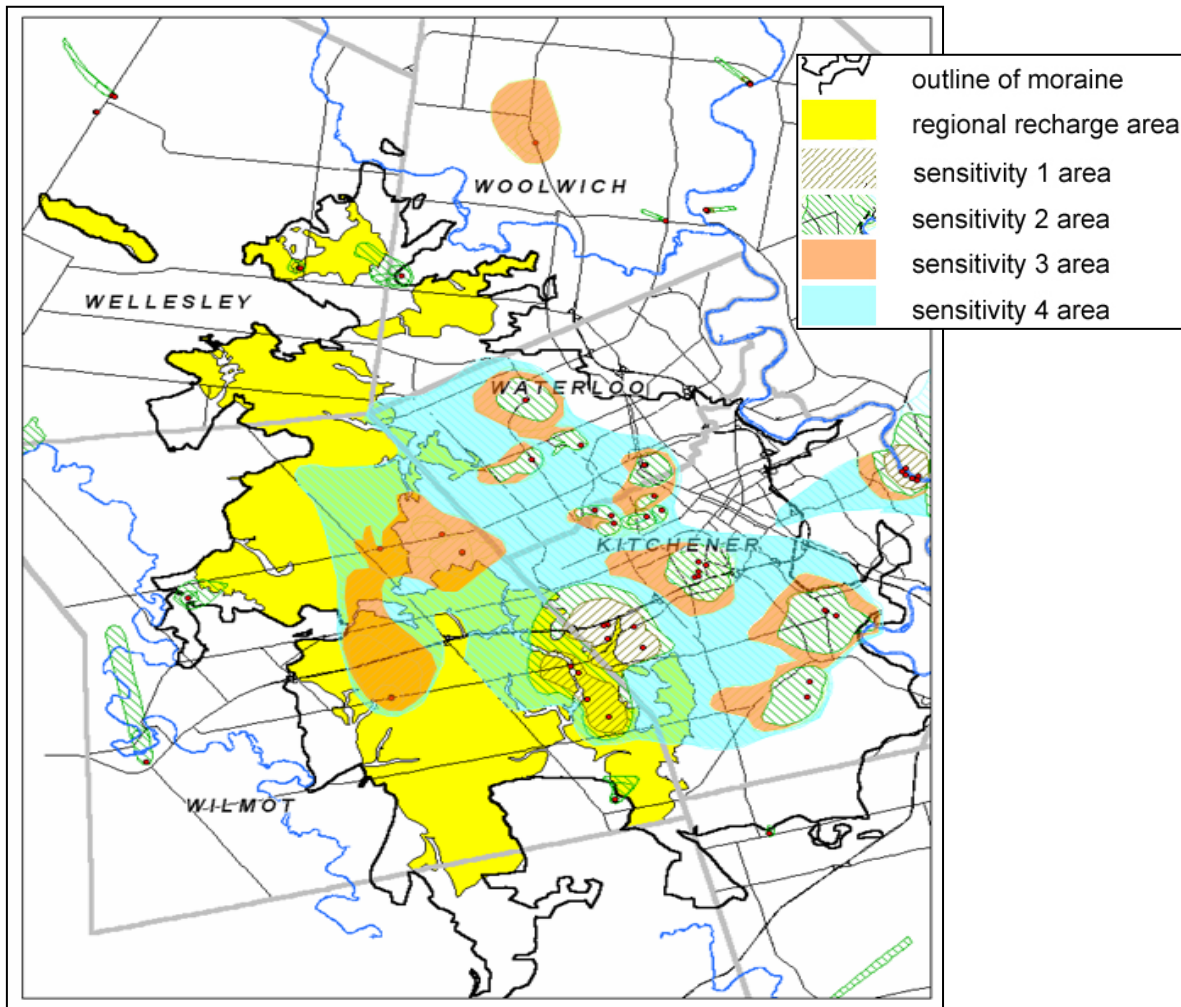
5.0 Protection of Moraines in Waterloo Region

Over the past decade, both the Region and the Grand River Conservation Authority (GRCA) have completed studies to delineate municipal wellhead protection areas, inventory known and potential contaminant sources and characterize the regional groundwater flow system. These activities were initiated as part of the Region's

comprehensive Water Resources Protection Strategy (WRPS-1993) and the GRCA's Grand Strategy in 1997.

In 1999, Regional staff presented a report to Regional Council (PC99-027/E99-052) which concluded that adequate protection of municipal water supplies, including the moraines, requires a combination of wellhead and aquifer protection programs. By definition, a wellhead is the physical structure at the land surface from which the groundwater is drawn. A Wellhead Protection Area (WHPA) can be defined as the surface and subsurface area surrounding a well or wellfield, through which contaminants are reasonably likely to move toward and reach such well or wellfield (please refer to Figure 8). The implementation of a wellhead protection program helps to protect groundwater from potential contamination. A complementary Regional aquifer protection program helps ensure that the aquifers beneath the moraines will be able to adequately recharge as well as maintain their level of water quality for future municipal and private water supply.

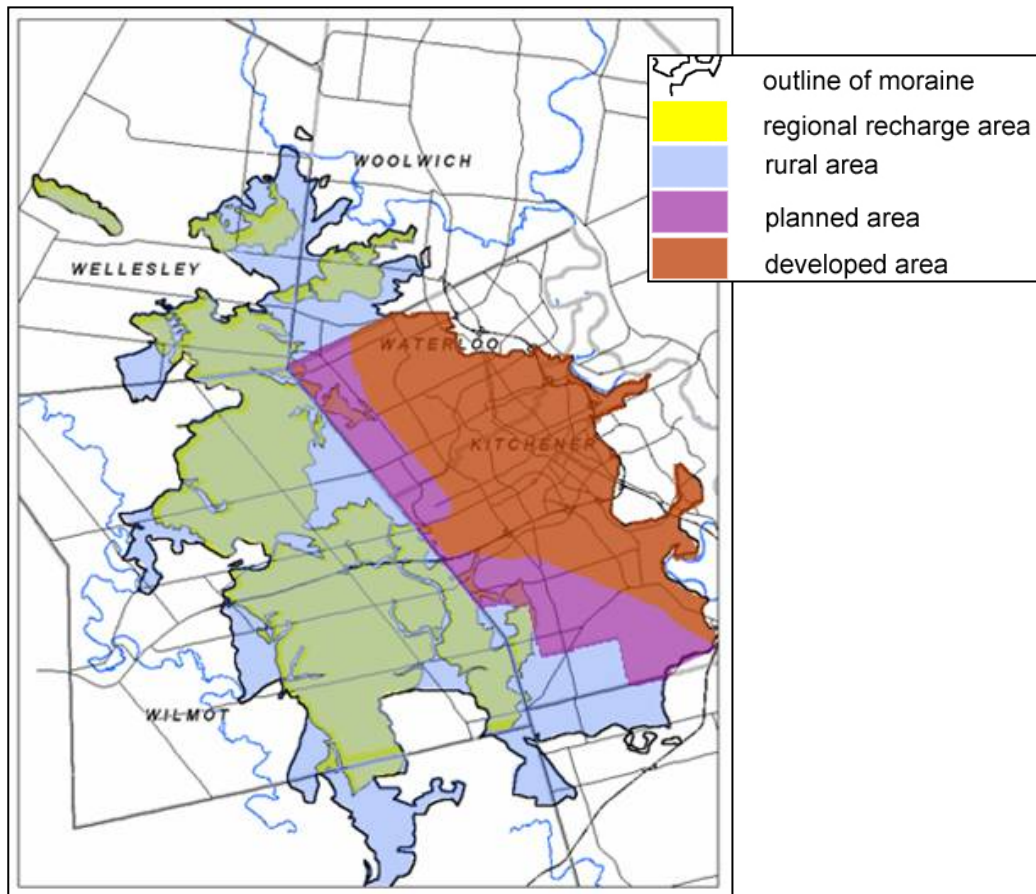
Figure 8 Regional Wellhead Protection Areas



In setting priorities for the protection of water resources, the Region chose to initially focus on protecting areas around wells from new non-residential development.

Protecting these areas achieved the most dramatic effect in maintaining the high quality and quantity of municipal water supply. A significant milestone in these efforts was completed in November 2000 when Regional Council adopted Regional Official Policies Plan (ROPP) Amendment No. 12. This Amendment established policies and mapping to restrict the designation of new areas of non-residential development within sensitive wellhead areas around Regional wells (please refer to Figure 9). Other programs promoted by the Region such as the Business Water Quality Program (BWQP) and education/awareness activities within urban areas help further reduce the risk of chemical spills which may affect groundwater and surface water resources, and thus seep deep into the Regional moraines.

Figure 9 Water Resource Protection Strategy and the Waterloo Moraine



While aquifer protection, and by extension moraine protection, has been identified as a key element of the Region's long-term source-water protection program, no specific land-use controls have been proposed. Much of the regional recharge area on the moraines are located within the Agricultural Resource Area and as such is protected from the encroachment of urban development through existing policies in the ROPP. In addition, all of the regional recharge areas located within the City Urban Area (CUA) overlap with wellhead protection areas which either have a high level of protection within the ROPP or are target areas for the BWQP and educational awareness activities.

Existing policies for wellhead protection, the BWQP and the educational awareness activities are structured to reduce the impact of urban land uses. The key focus for the aquifer protection program is managing impacts from non-point sources of contamination, such as fertilizer and road salt application.

5.1 Development Review Policies

While neither the ROPP nor the Area Municipal Official Plans provide policies directly relating to the moraines, the current practices guiding the review of development provide significant protection to groundwater quantity and quality within moraine areas. Development can mean anything from the approval of a new subdivision to the severance of a lot.

Since the early 1990s, the Province, the GRCA, the Region and the Area Municipalities have partnered to ensure the completion of sub-watershed plans to support the designation of any significant new areas of development or redevelopment. The purpose of these sub-watershed plans is to identify important hydrologic and hydrogeologic functions that support environmental features such as fisheries, wetlands, discharge areas, locally significant natural areas and Environmentally Sensitive Protection Areas. Through these plans, constraint areas, associated buffers, water quality criteria and water balance requirements are defined to protect such features from development. Over the past decade more than a dozen such sub-watershed plans have been completed and several more are currently in process.

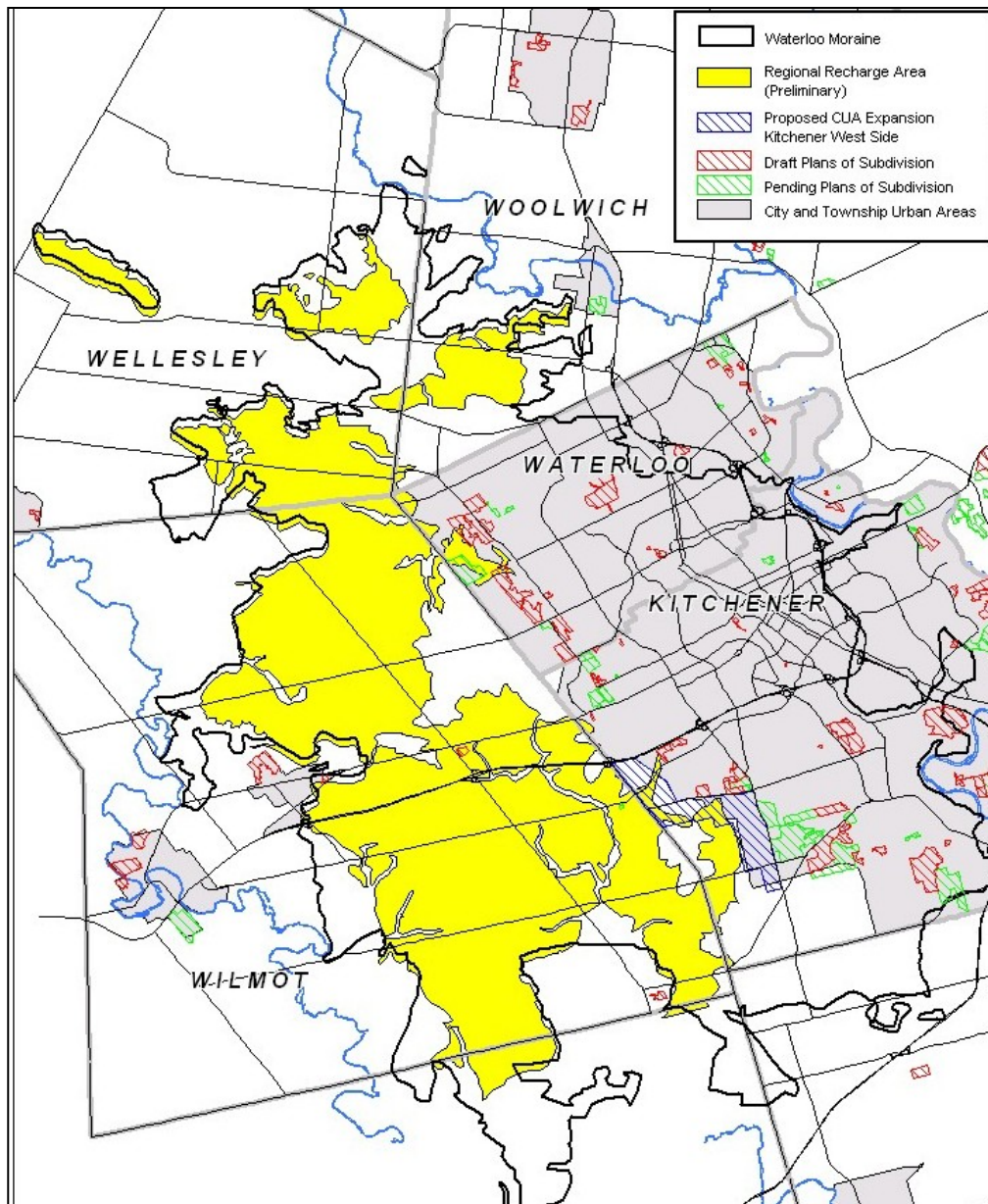
One of the major outcomes of a sub-watershed plan is the development of water quality and recharge targets that need to be met before a development can be supported. Compliance with these targets is assured through the review and approval of storm water management and lot grading and drainage plans for new development. Implementation of the approved stormwater management and lot grading and drainage plans is then secured through the development approval process.

At a recent meeting of Regional Planning and Works Committee, concern was expressed as to the extent of development that had occurred and was anticipated to occur on the Waterloo Moraine. At this meeting, staff was asked to identify plans of subdivision currently in process within the Moraine area. This information is included on Figure 10. Limited development will also continue to occur on the eastern flanks of the Waterloo Moraine within the current and proposed CUA boundaries, including smaller pockets of regional recharge area located within the permanent "countryside line" on the west side of the Cities of Kitchener and Waterloo, proposed in the Regional Growth Management Strategy (RGMS). However, such future development will be subject to appropriate conditions to protect the moraine's water resources from unacceptable impacts.

As part of the original processing of ROPP Amendment No. 12, Regional staff proposed the establishment of policies applicable to new and expanding non-residential uses on lands already designated for such purposes within wellhead areas. Council deferred consideration of these policies pending investigation into the use of a Development Permit System (DPS) as a mechanism to require the installation and long term maintenance of structural best management practices by industries. In the summer of 2001, the Region was selected by the Province as a pilot project for the use of a DPS.

Since that time, Regional staff has been working with the Ministry of Municipal Affairs and Housing to correct a deficiency in the supporting regulation. Recent discussions with the Province may lead to this concern being rectified in the near future. In the mean time, Regional staff will continue to work with the Area Municipalities to determine where, when and under what conditions such a system could be implemented.

Figure 10 Draft Approved and Planned Areas



6.0 Conclusions

A combination of the implementation of the WRPS endorsed by Regional Council in 1994, and the leading edge surface and groundwater protection policies jointly developed by the GRCA, the Region and the Area Municipalities through sub-watershed plans, has put the Region far ahead of other municipalities in Ontario in the area of source water protection, and thus the protection of moraines. The level of protection afforded to moraines in Waterloo Region is similar to the level provided in *the Oak Ridges Moraine Conservation Act*, and with the impending implementation of the Regional Growth Management Strategy, these natural features will be preserved and enhanced for future generations.