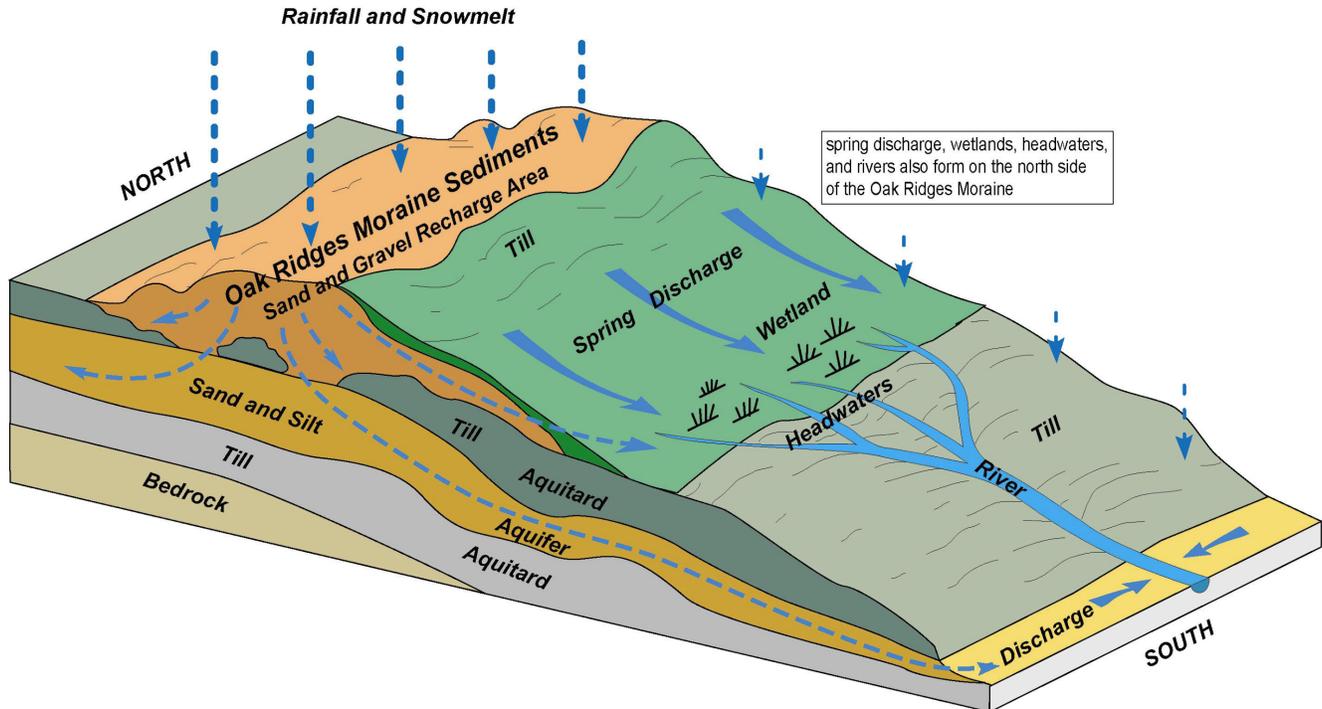


# The Oak Ridges Moraine



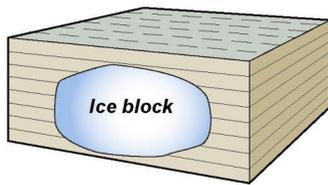
About 13,000 years ago as the Laurentide Ice Sheet melted, **glacial** meltwater accumulated between the ice sheet and the Niagara Escarpment. This formed a **lake basin** into which gravel and sand were deposited. As the **glacier** melted, the accumulated lake water drained, leaving the sand and gravel high above the surrounding landscape as a **moraine**. Today, the Oak Ridges Moraine is the prominent ridge north of Lake Ontario that forms the major **drainage divide** between Lake Ontario and Lake Simcoe–Georgian Bay. The ridge influences the flow of surface and **groundwater**, and local climate in the Greater Toronto Area (GTA). It stretches 160 kilometres from the Niagara Escarpment almost to the Trent River. About 65% of it is within the GTA. It rises up to 300 metres above Lake Ontario and contains **deposits** of sand and gravel up to 200 metres thick.

One of the Oak Ridges Moraine's primary features is that it is a major **recharge** area, which means that most of the rain and snow that falls on the moraine is absorbed and **seeps** deep down into the ground to recharge the **aquifers** or **reservoirs** which store huge amounts of groundwater. This happens because most of the sediments that were deposited by the glaciers are sand and gravel, which allow water to infiltrate more quickly and in larger amounts than the surrounding, less permeable **till** plains. As a result, there are few flowing streams on the moraine. Instead, water seeps into the depths of the moraine until it reaches a less permeable **aquitard** layer. It then moves sideways to emerge as **springs** or **wetlands** along the lower slopes of both the north and south sides of the moraine. These springs are the **headwaters** of over 60% of the watersheds in the GTA.

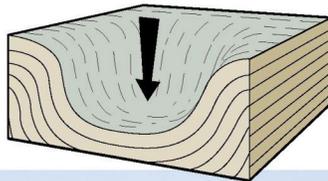


One of the Oak Ridges Moraine's most recognizable characteristics is its "**kettle**" **topography**. Kettles are depressions in the ground formed when sediments from the rapidly melting ice sheet covered blocks of ice. When the trapped ice blocks melted, the land above them collapsed, leaving a depression. Most of these kettles remain dry because water, which falls into them, seeps quickly into the ground. However, some kettles are lined with **organic matter** that acts like a seal, causing rain, snow, and groundwater to pond in them and form kettle lakes or kettle wetlands. These lakes don't usually have an **inlet** or **outlet** for water because of the permeability of the surrounding sediments. This makes them very susceptible to **pollution** since the water doesn't get recycled very often. It takes anywhere from 10 to 15 years for a kettle lake to exchange its water. To be healthy, kettle lakes rely on a balance between the inflow of precipitation, and surface run-off, and the outflow of year-round seepage from the lake bottom, **evaporation** from the surface of the lake, and **transpiration** from the plant cover surrounding the lake.

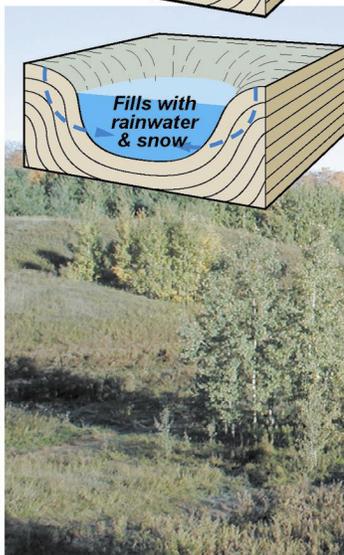
### Kettle Formation



*Ice block covered by sediment*

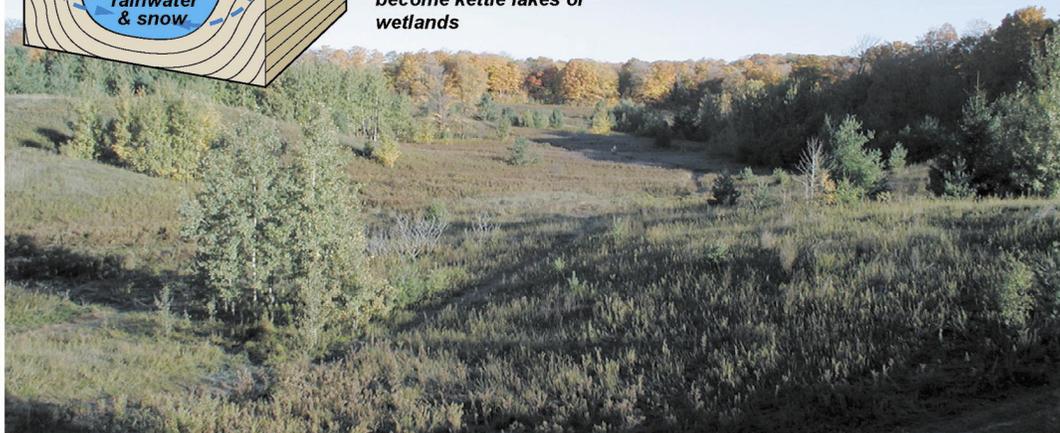


*Depression forms after ice block melts*



*Most kettles drain, but some fill with rain, snow, and groundwater to become kettle lakes or wetlands*

**Typical dry kettle depression of the Oak Ridges Moraine**



Today the Oak Ridges Moraine is widely recognized as providing and supporting **ecological** functions in the GTA. Large amounts of groundwater in the Oak Ridges Moraine aquifers provide clean water that over 200,000 people rely on for drinking water, either from a private **well** or from large-capacity municipal wells. Almost 28% of the Oak Ridges Moraine is forested, compared to less than 5% in many parts of the GTA south of the moraine. These forests provide wildlife **habitat** and allow plants and animals to establish between the major **watersheds** in the GTA. The result is that the moraine contains the highest **biodiversity** in the GTA including: 1,033 plant species, 118 breeding bird species, 26 reptile and amphibian species, 38 mammal species, and 55 fish species. The Oak Ridges Moraine also provides approximately 50% of the unconsolidated aggregate material (sand and gravel) used in construction projects within the GTA, making this moraine a resource area of provincial importance. The area is also widely used for agriculture and recreation. Increased understanding of the Oak Ridges Moraine is critical to maintaining its many functions as the pressures of urbanization reach northwards into this area.

# ***The Oak Ridges Moraine***



## ***Case Study***

A developer has proposed the construction of a new housing development of 500 units on a portion of the Oak Ridges Moraine. This development proposes mixed residential and commercial usage. The residential component consists of both low-income housing and market-value housing. The housing densities range from single-family dwellings to three-story townhouses. No apartment towers are planned. The plan calls for commercial properties along the main thoroughfare, with the intention that this would form a town centre focus for the community. The plan includes a public school, playing fields, and parkland. The present use of the land is a farm that grows market garden crops, a gas station, and a swamp that would be filled in to form part of the parkland. There is an identified aggregate resource under part of the property. A creek that flows through the property would be incorporated into the park. A map of the proposed development is provided on the following page.

Some people in the local area are in favour of the new development, others are opposed to the proposal. At an upcoming "Town Hall Meeting" you will debate the issue of whether or not the proposed development should be built. You will be assigned a role within an interest group that brings a particular point of view to the discussion. You need to help research the group's viewpoint and form an argument that supports, with examples, this point of view. Make sure that you can respond to opposing group's arguments as well. Once the debate has been concluded, all debate participants will vote, according to their personal opinion, as to whether or not the developer should be allowed to go forward with the project.

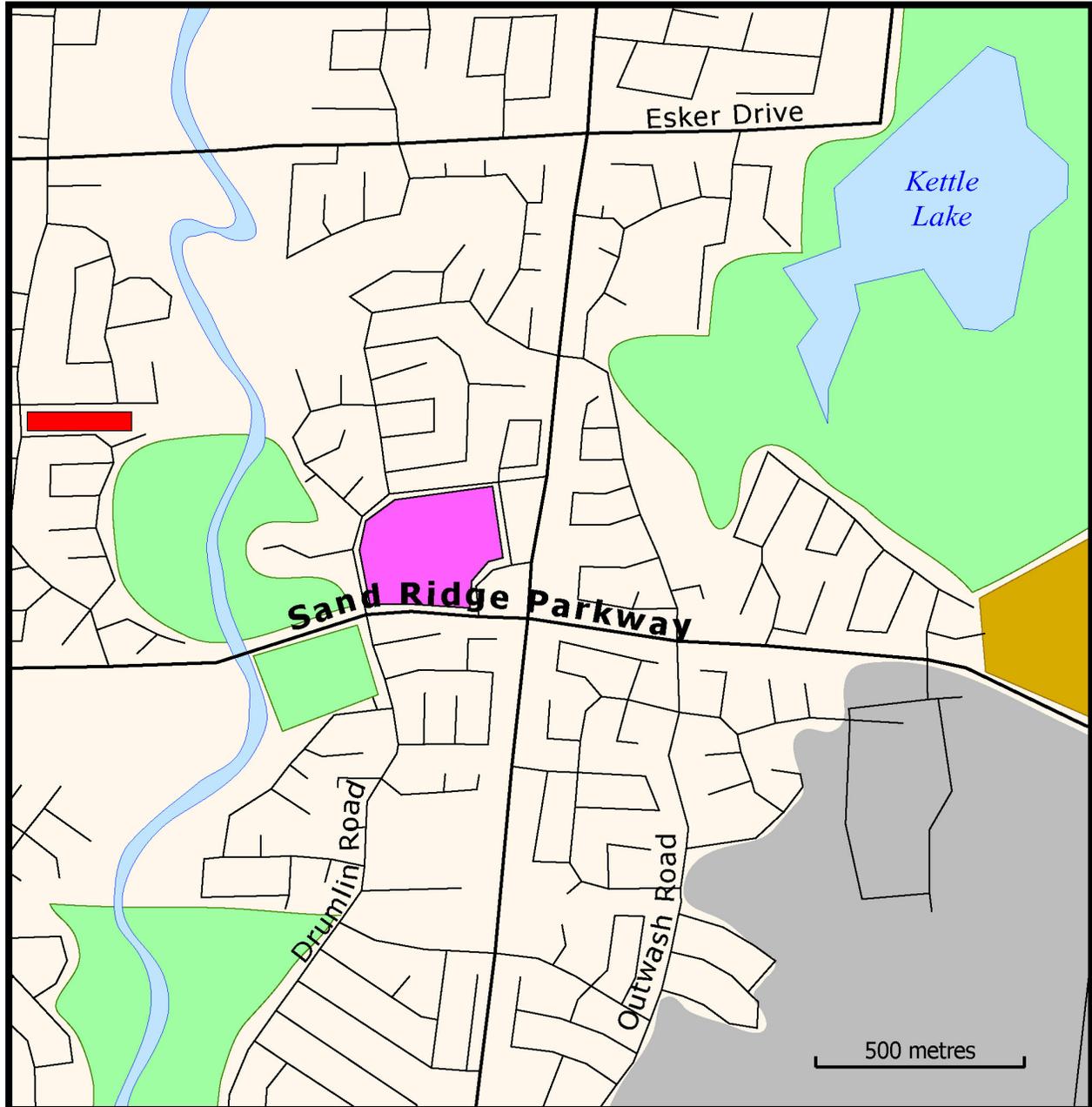
## ***Roles***

1. Ontario Ministry of Municipal Affairs and Housing
2. Housing Developer
3. Conservation Group
4. Ontario Ministry of Natural Resources
5. Farmers and Local Land Owners
6. Business Owners

# The Oak Ridges Moraine



## Map of Proposed Development on the Oak Ridges Moraine



Legend					
	School		Water		Swamp Land
	Shopping Mall		Parkland		Sand & Gravel Resource

# ***The Oak Ridges Moraine***



## ***Role Description 1***

### **Ontario Ministry of Municipal Affairs and Housing**

#### **Role**

- Your interest is to provide affordable housing for people in Ontario.
- You are in support of well planned, affordable and environmentally responsible housing.
- You are in support of protecting provincially significant natural resources including wetlands and mineral resources from developments that would have negative impacts on them, or restrict their use.

#### **Assignment**

- Find out what public or policy statements the Ontario Ministry of Municipal Affairs and Housing has made regarding the Oak Ridges Moraine.
- After conducting your research, decide whether you are FOR or AGAINST the proposed development on the Oak Ridges Moraine.
- Develop an argument, based on research, to support your position.
- Research the other interest groups to anticipate their arguments. Be prepared to put forward solutions to problems the other groups might propose.
- Present your argument in a 5 to 7-minute presentation in the 'Town Hall Meeting'.
- Make sure that your position is clear and powerful in order to convince the audience.
- Provide images and data, in the form of overheads, to support the points in your presentation.
- Provide a one page summary of your presentation ideas.
- At the end of the 'Town Hall Meeting' the entire audience, including presenters, will be asked to vote for or against the proposal.

# ***The Oak Ridges Moraine***



## ***Role Description 2***

### **Housing Developer**

#### **Role**

- You represent the housing developer who wants to build a community on the Oak Ridges Moraine.
- Your interest is to make a profit by providing attractive housing in a pleasant community setting.
- You believe your plan provides for adequate greenspace to protect the area's biodiversity.

#### **Assignment**

- Find out what developers in the Oak Ridges Moraine area have presented as their arguments for development.
- You are FOR the proposed development on the Oak Ridges Moraine.
- Develop an argument, based on research, to support your position.
- Research the other interest groups to anticipate their arguments. Be prepared to put forward solutions to problems the other groups might propose.
- Present your argument in a 5 to 7-minute presentation in the 'Town Hall Meeting'.
- Make sure that your position is clear and powerful in order to convince the audience.
- Provide images and data, in the form of overheads, to support the points in your presentation.
- Provide a one page summary of your presentation ideas.
- At the end of the 'Town Hall Meeting' the entire audience, including presenters, will be asked to vote for or against the proposal.

# ***The Oak Ridges Moraine***



## ***Role Description 3***

### **Conservation Group**

#### **Role**

- You represent an conservation group (create a name for your group) that wishes to protect the environment and opposes development on the Oak Ridges Moraine.
- You feel that the interests of the environment and future generations must be taken into account when planning land usage.
- You are committed to preserving natural habitats for indigenous wildlife species.

#### **Assignment**

- Find what other conservation groups have said about the Oak Ridges Moraine.
- You are AGAINST the proposed development on the Oak Ridges Moraine.
- Develop an argument, based on research, to support your position.
- Research the other interest groups to anticipate their arguments. Be prepared to put forward solutions to problems the other groups might propose.
- Present your argument in a 5 to 7-minute presentation in the 'Town Hall Meeting'.
- Make sure that your position is clear and powerful in order to convince the audience.
- Provide images and data, in the form of overheads, to support the points in your presentation.
- Provide a one page summary of your presentation ideas.
- At the end of the 'Town Hall Meeting' the entire audience, including presenters, will be asked to vote for or against the proposal.

# ***The Oak Ridges Moraine***



## ***Role Description 4***

### **Ontario Ministry of Natural Resources**

#### **Role**

- You are committed to protecting and managing the province's natural resources, including forests, fish and wildlife, aggregates, and water for the individuals, communities and economies that depend on them.
- You contribute to the environmental, social and economic well-being of the people of Ontario, to meet the resource needs for today and the future.
- You play a significant role in ensuring that water resources and their hydrologic functions are sustained in order to support the needs of the public and a healthy natural environment.

#### **Assignment**

- Find what public or policy statements the Ontario Ministry of Natural Resources has made regarding the Oak Ridges Moraine.
- After conducting your research, decide whether you are FOR or AGAINST the proposed development on the Oak Ridges Moraine.
- Develop an argument, based on research, to support your position.
- Research the other interest groups to anticipate their arguments. Be prepared to put forward solutions to problems the other groups might propose.
- Present your argument in a 5 to 7-minute presentation in the 'Town Hall Meeting'.
- Make sure that your position is clear and powerful in order to convince the audience.
- Provide images and data, in the form of overheads, to support the points in your presentation.
- Provide a one page summary of your presentation ideas.
- At the end of the 'Town Hall Meeting' the entire audience, including presenters, will be asked to vote for or against the proposal.

# ***The Oak Ridges Moraine***



## ***Role Description 5***

### **Farmers and Local Land Owners**

#### **Role**

- You represent the interests of the farmers and local land owners in the area.
- Farmers and land owners want the right to determine the best use of the land that they own.
- You are concerned about traffic, and the associated air and noise pollution that could accompany development.

#### **Assignment**

- Find any statements that have been made by farmers or local land owners regarding development on the Oak Ridges Moraine.
- After conducting your research, decide whether you are FOR or AGAINST the proposed development on the Oak Ridges Moraine.
- Develop an argument, based on research, to support your position.
- Research the other interest groups to anticipate their arguments. Be prepared to put forward solutions to problems the other groups might propose.
- Present your argument in a 5 to 7-minute presentation in the 'Town Hall Meeting'.
- Make sure that your position is clear and powerful in order to convince the audience.
- Provide images and data, in the form of overheads, to support the points in your presentation.
- Provide a one page summary of your presentation ideas.
- At the end of the 'Town Hall Meeting' the entire audience, including presenters, will be asked to vote for or against the proposal.

# ***The Oak Ridges Moraine***



## ***Role Description 6***

### **Business Owners**

#### **Role**

- You represent the local business community.
- The development of agricultural land for housing means improved opportunity for business, more jobs, and better shopping for residence.
- You favour more housing.

#### **Assignment**

- Find any presentations the local business community or Chamber of Commerce have made that would support your business case.
- You are FOR the proposed development on the Oak Ridges Moraine.
- Develop an argument, based on research, to support your position.
- Research the other interest groups to anticipate their arguments. Be prepared to put forward solutions to problems the other groups might propose.
- Present your argument in a 5 to 7-minute presentation in the 'Town Hall Meeting'.
- Make sure that your position is clear and powerful in order to convince the audience.
- Provide images and data, in the form of overheads, to support the points in your presentation.
- Provide a one page summary of your presentation ideas.
- At the end of the 'Town Hall Meeting' the entire audience, including presenters, will be asked to vote for or against the proposal.