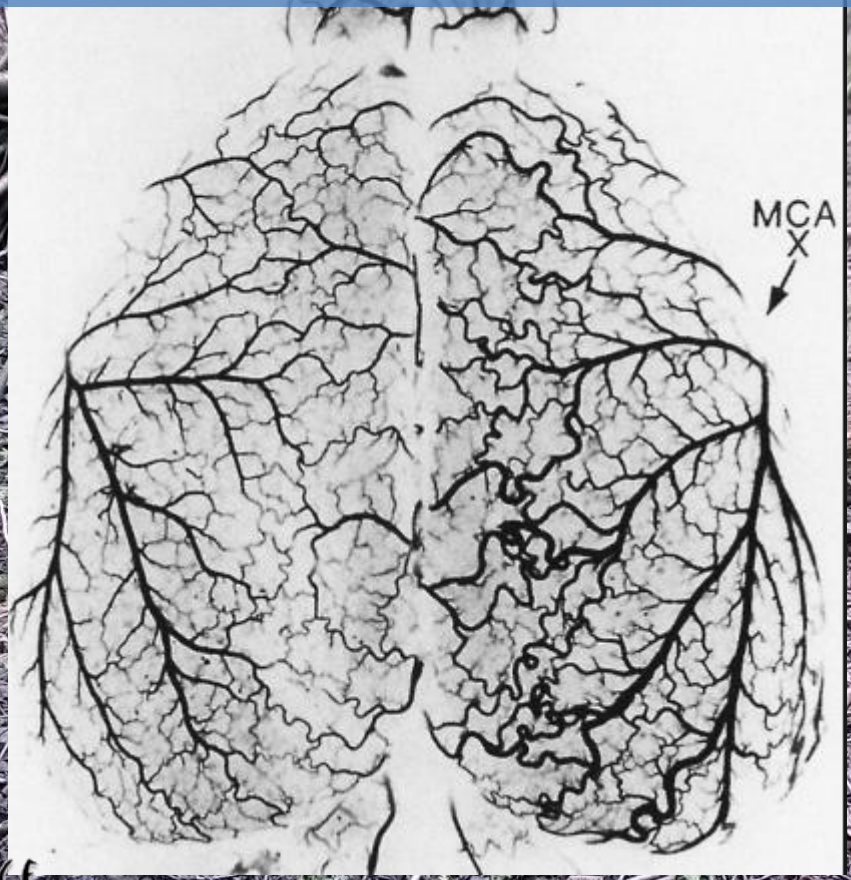
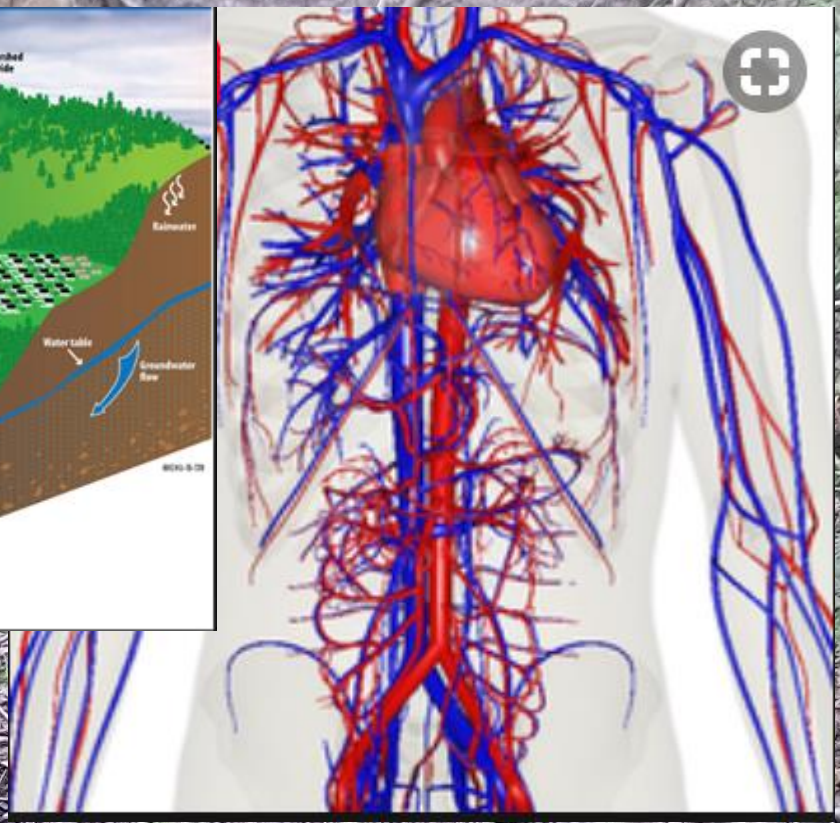
Clogged Arteries: Headwater Drainage Features

Bev Wicks Ph.D.
RIVERSTONE ENVIRONMENTAL SOLUTIONS



MUSKOKA STEWARDSHIP CONFERENCE

Circulation



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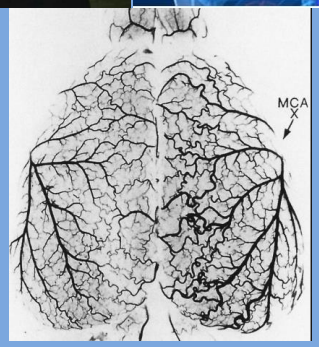
Parts of the System(s)

Circulatory System

- Heart
- Veins in hands
- Arteries and capillaries



The Watershed

- Lakes
- Rivers
- Streams
- Wetlands
- Headwater (features)

The Heart-Lake Muskoka-Georgian Bay

Where does it begin-the Headwaters

- Wetlands
- Seeps and springs
- Swales
- Ephemeral and Intermittent Streams
- Ditches
- Tile Drains

A famous quote “headwaters are more complicated than arteries” ….they “get no respect”…Les Stanfield

What does a headwater drainage feature look like?

Importance in the Watershed

- Headwaters are where it all begins, the water, the nutrients, the microbes etc.
- Wetlands and headwater streams are key components of our watershed
- They are the beginning and act as buffers and filters for the streams and rivers, where pollution can enter or be removed…wetlands, streambeds etc.

Evolution of a River

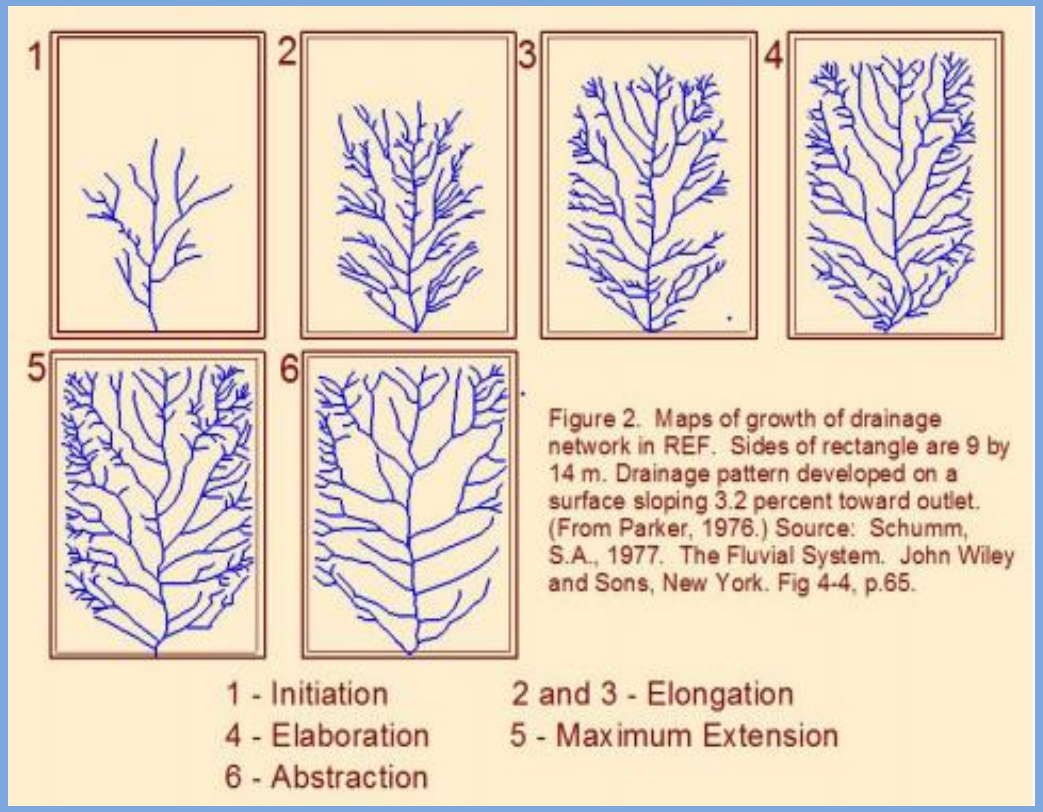
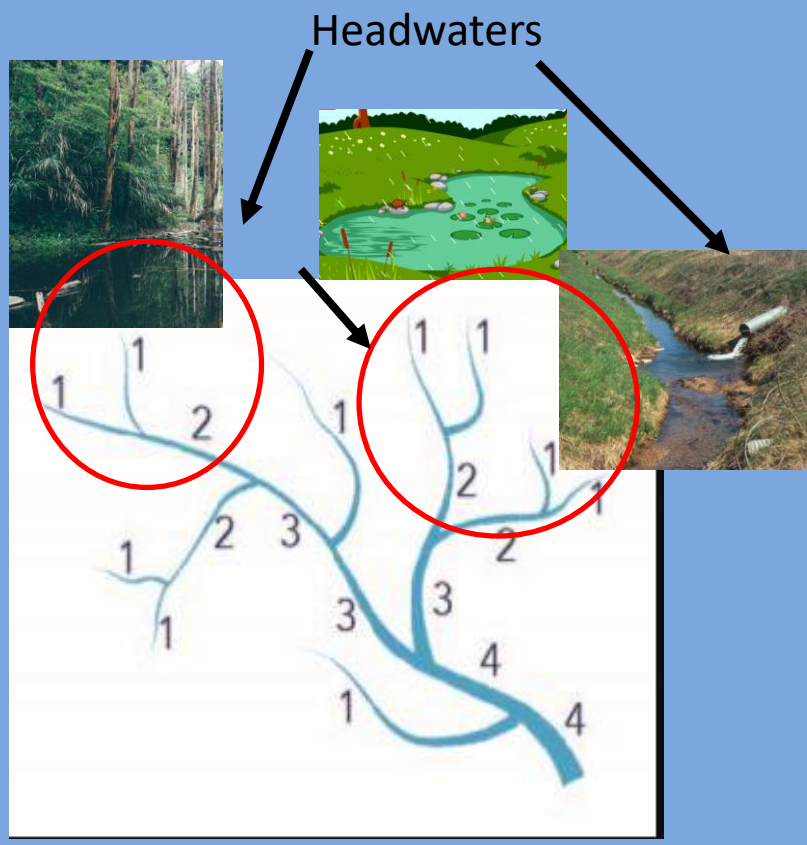
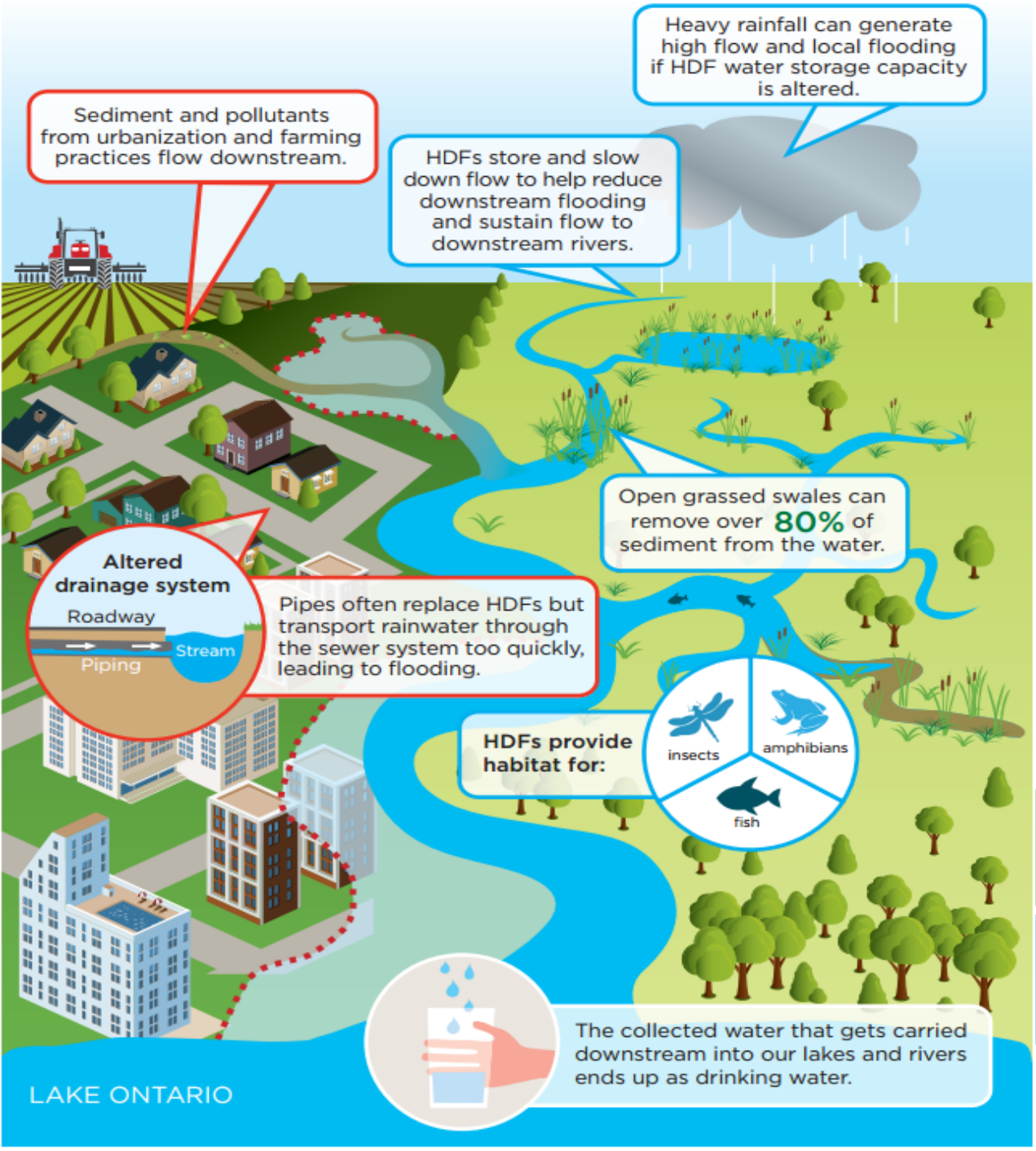


Figure 2. Maps of growth of drainage network in REF. Sides of rectangle are 9 by 14 m. Drainage pattern developed on a surface sloping 3.2 percent toward outlet. (From Parker, 1976.) Source: Schumm, S.A., 1977. The Fluvial System. John Wiley and Sons, New York. Fig 4-4, p.65.





What is a Headwater Drainage Feature (HDF)

HDFs are more important than you think!

HDFs are located across the landscape and are small stream, swale and wetland features that capture water and transport it to larger streams and rivers. They do not necessarily flow all the t but may flow after rainfall or snowmelt.

When left in their natural state, these features have many functions like helping to reduce strea flooding, purifying water, and providing food an habitat for fish and wildlife.

However, they can be altered by people through activities like piping, ditching, and channelizing, which reduce or eliminate these functions. This especially becomes a problem when many HDF are altered in one watershed.

What can you do?

Leave HDFs in their natural, undisturbed state. Leave vegetation within and around them, main existing drainage flow, and keep livestock away.

Maintain the vegetation surrounding the str to improve the quality of water and food ca downstream and to remove nutrients and sedi

50% - 80%
of the river's length is constituted by Headwaters streams

Flood vulnerable area

Toronto and
Conser
for Th

Assessment of HDFs in Other Jurisdictions




Evaluation, Classification and Management of Headwater Drainage Features Guidelines
January 2014

CVC
CREDIT VALLEY CONSERVATION

Toronto and Region Conservation
for The Living City®

TRCA, CVC Assessment Method classifies HDFs based on four features:

1. **Hydrology**
2. **Riparian**
3. **Fish and Fish Habitat**
4. **Terrestrial**

Each Feature Evaluated as having:

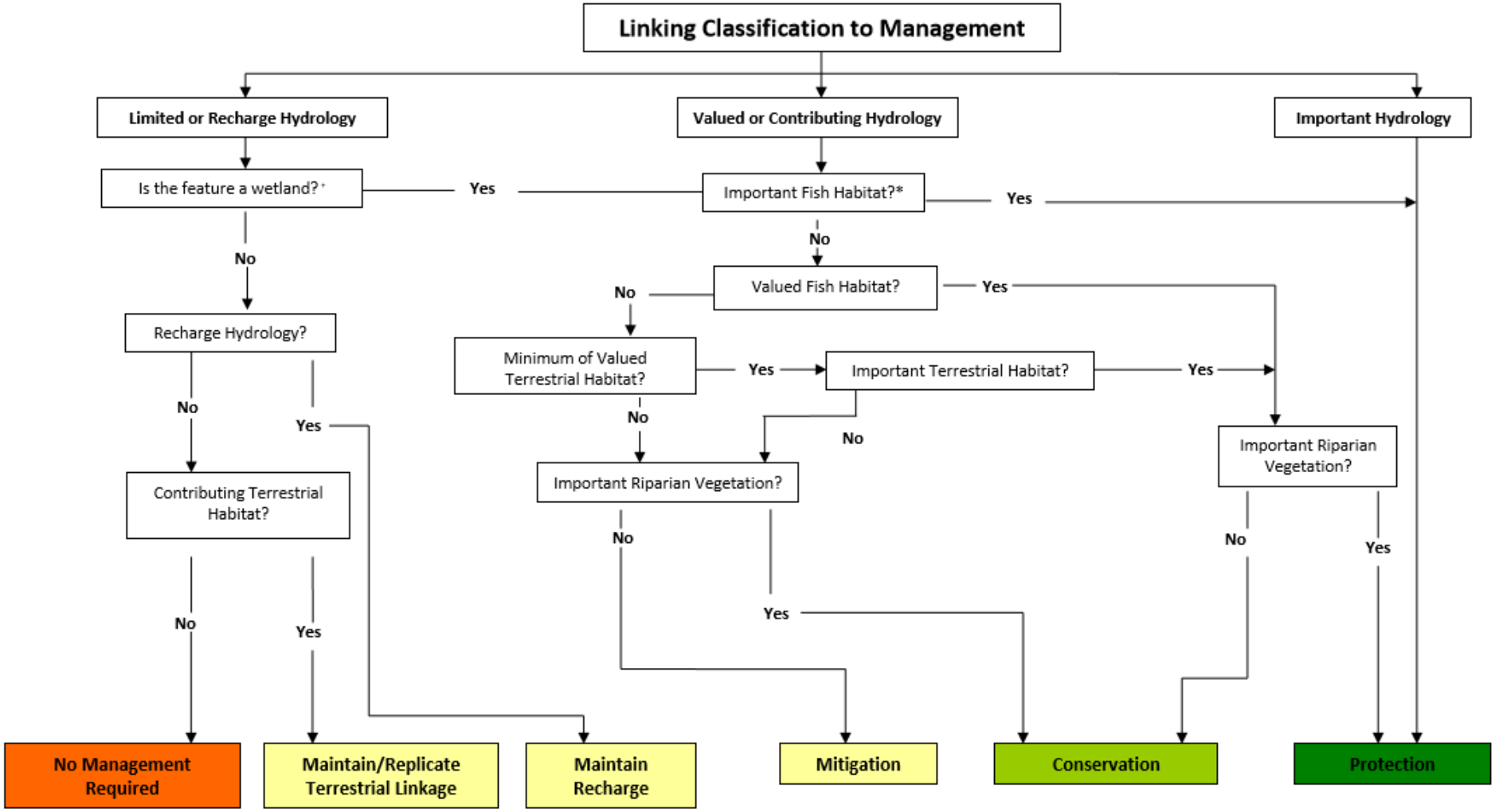
- **Important Function**
- **Valued Function**
- **Contributing Function**
- **Limited Function**

Based on the assessment,

Management Options Provided

Headwater Drainage Features (HDFs)

Feature code	Feature Type	Feature Definition
1	Defined natural channel	Channel banks and sorted substrates are visible; there is no evidence that the drainage feature has been historically dredged or straightened.
2	Channelized or Constrained	Channel banks and sorted substrates are visible and there is evidence that the stream has been historically dredged or straightened. In some instances the channel is constrained by filling, such that access to the flood-plain is no longer available.
3	Multi-thread	Multiple channels for one flow source; multi-thread channels are subdivided at low-water stages by multiple midstream bars of sand or gravel. At high water, many or all bars are submerged.
4	No defined feature	A topography with no identifiable depression to convey water and no facultative wetland species are present. Water is transported through overland or sheet flow.
5	Tiled	An outlet from a buried stream or tile drain is visible. There may be a defined channel downstream of the outlet caused by scouring.
6	Wetland	Feature with sustained water storage function. Lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case, the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants. Obligate wetland species will be dominant (e.g. cattails).
7	Swale	A shallow trough-like depression that carries water flow during rainstorms or snowmelt and has ill-defined banks. Water conveyance is the primary function for the purposes of this definition. Flow not sufficiently sustained to cause substrate sorting or prevent instream vegetation from establishing, and water storage not sustained to promote obligate wetland vegetation (e.g. cattails). Bed may contain facultative wetland plants (e.g. reed canary grass).
8	Roadside ditch	A watercourse that only conveys road runoff. It does not extend upslope of the road that could generate a catchment
9	Pond outlet	Flow is from the outlet of an on or offline, irrigation, storm- water or other pond. Indicate the type of pond present in the comments field.

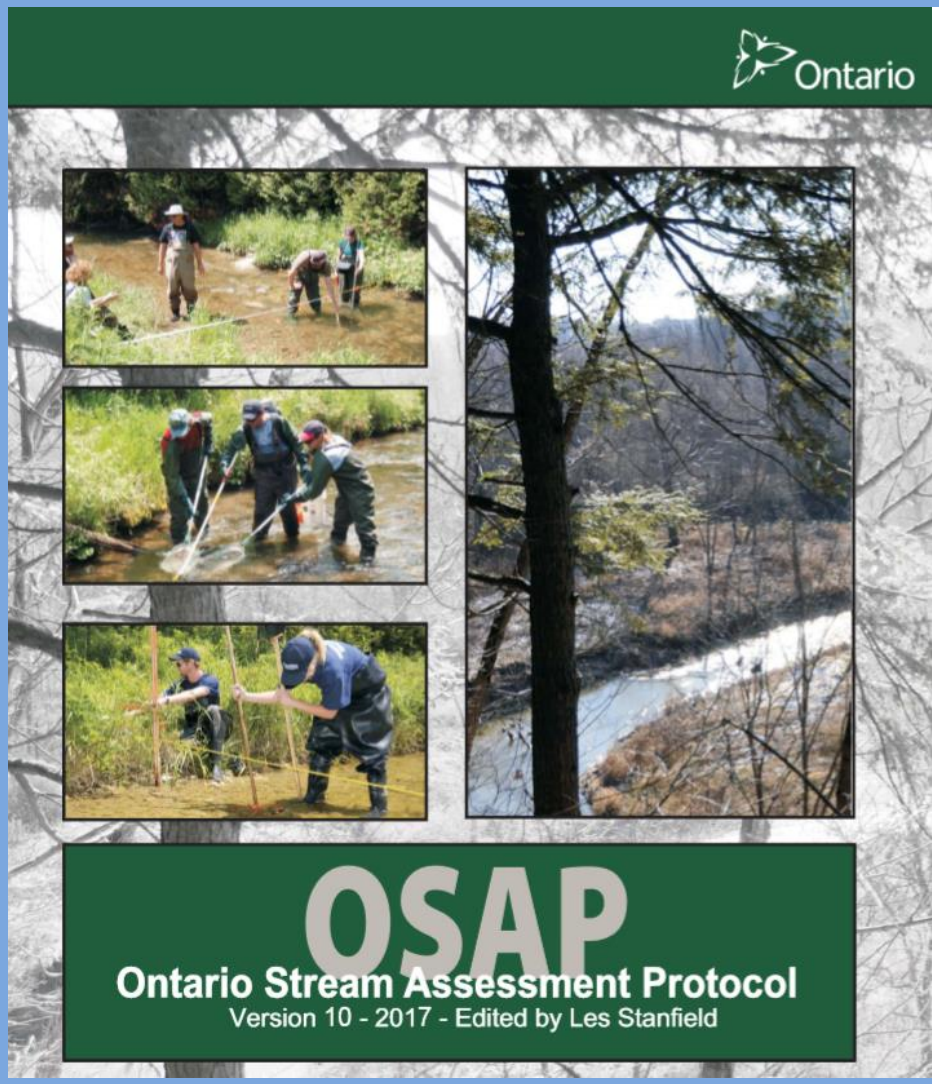


*Other Conservation Authority policies or other legislation with respect to wetlands, watercourses and/or species at risk need to be assessed in the context of this key.
+Note that headwater wetlands are considered to be HDFs in the context of this guideline.

Figure 2: Flow chart providing direction on management options

Ontario Stream Assessment Protocol –

Not a requirement in any jurisdiction, but can be applied across Ontario



ONTARIO STREAM ASSESSMENT PROTOCOL

SECTION 4: MODULE 10

Constrained Headwater Sampling[1]

Contents

[1] Authors: L. Stanfield, L. Del Giudice, E. Bearss and D. Morodvanschi

Watershed Dynamics

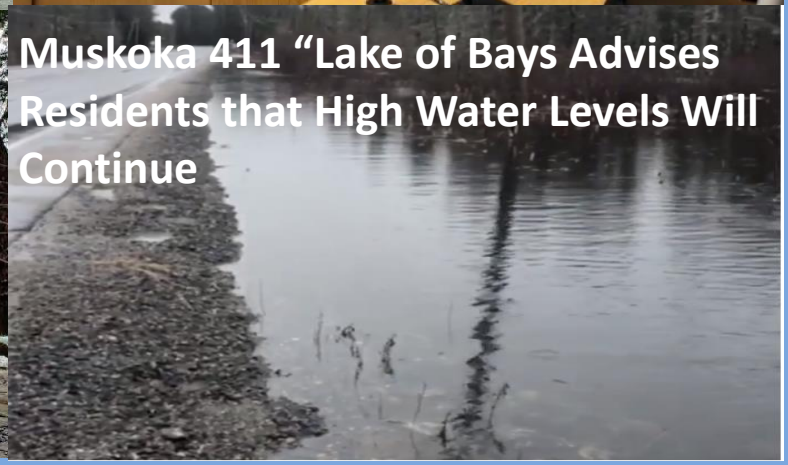
- A multitude of variables affect the formation and maintenance of a watershed, including: climate, hydrology, geology, soil types, topography, land use, forest cover, wetlands etc.
- Climate (change): droughts (more snow, less rain), temperature extremes, flooding-increased intensity and frequency of precipitation events, changes in water supply due to seasonal changes, water quality changes (warmer air temperatures, reduced stream flows, reduced dilution potential, increased water temperatures-*E.coli*, unionized ammonia)

- IN THE NEWS

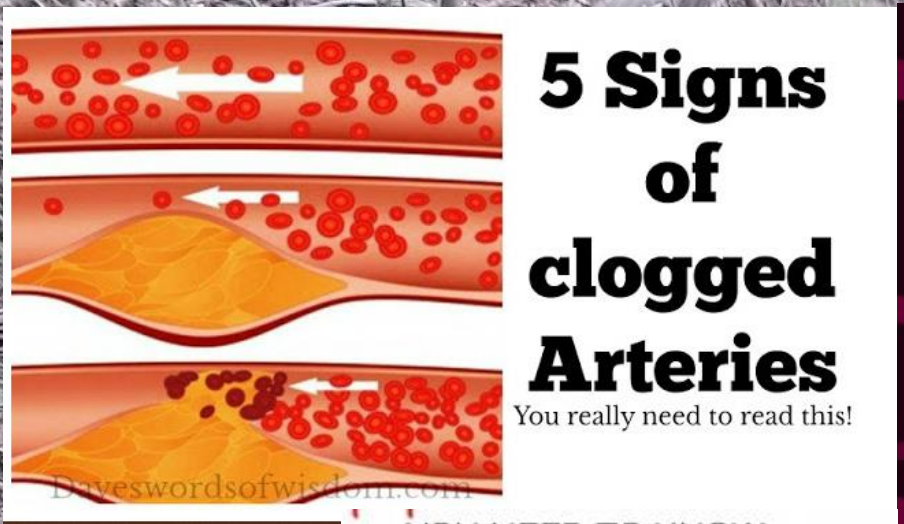

Muskoka 411 "State of Emergency Declared in Bracebridge"

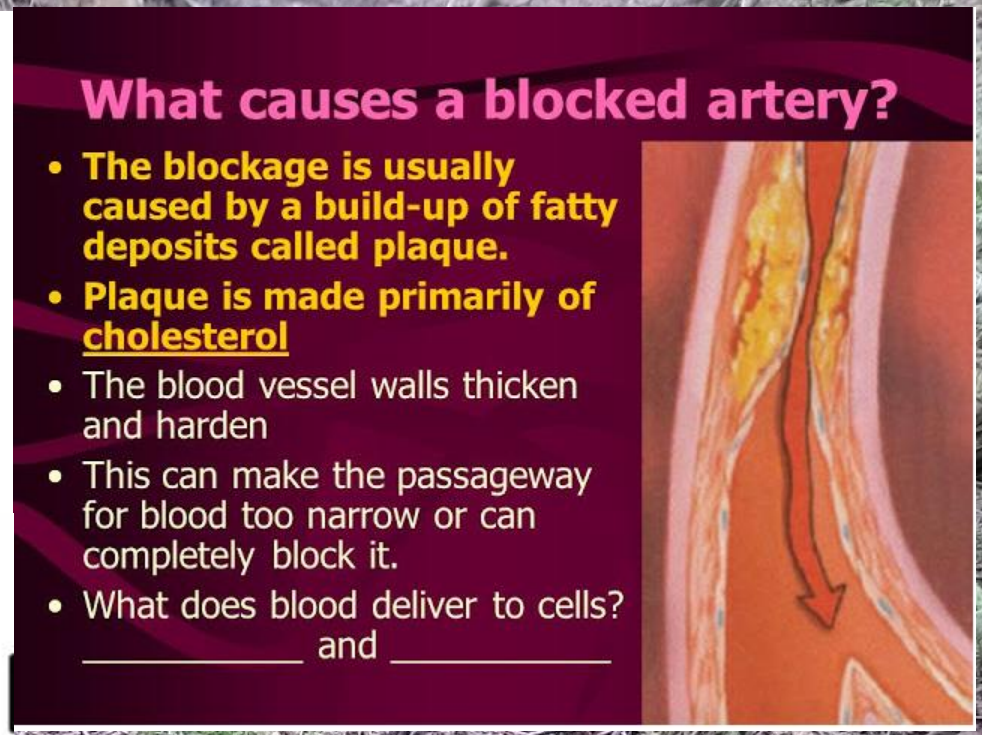

Muskoka 411 "Bracebridge Mayor Smith Details Town Efforts As Flooding Continues"
BRACEBRIDGE

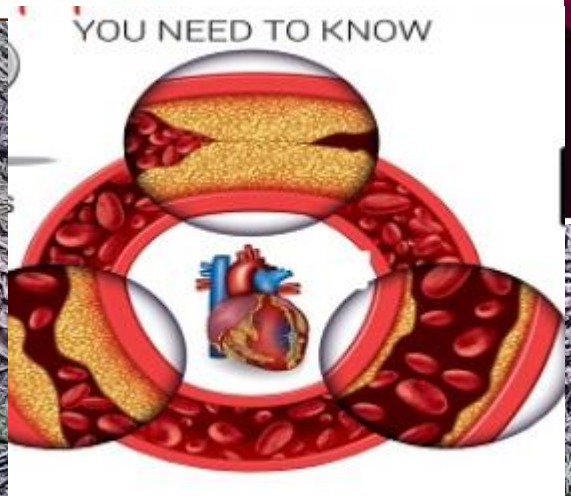

Muskoka 411 "Road Closures and Repairs Due to Flooding in Huntsville"


Muskoka 411 "Lake of Bays Advises Residents that High Water Levels Will Continue

When the system clogs








Northeast of Haliburton


East End of Lake of Bays


Lake of Bays near Baysville


East End of Lake of Bays


Lake of Bays near Baysville


East End of Lake of Bays


Town of Bracebridge


Town of Bracebridge


Rebecca Lake, TLOB


Rebecca Lake, TLOB


Town of Huntsville


North Markham


Near Town of Caledon


North Markham

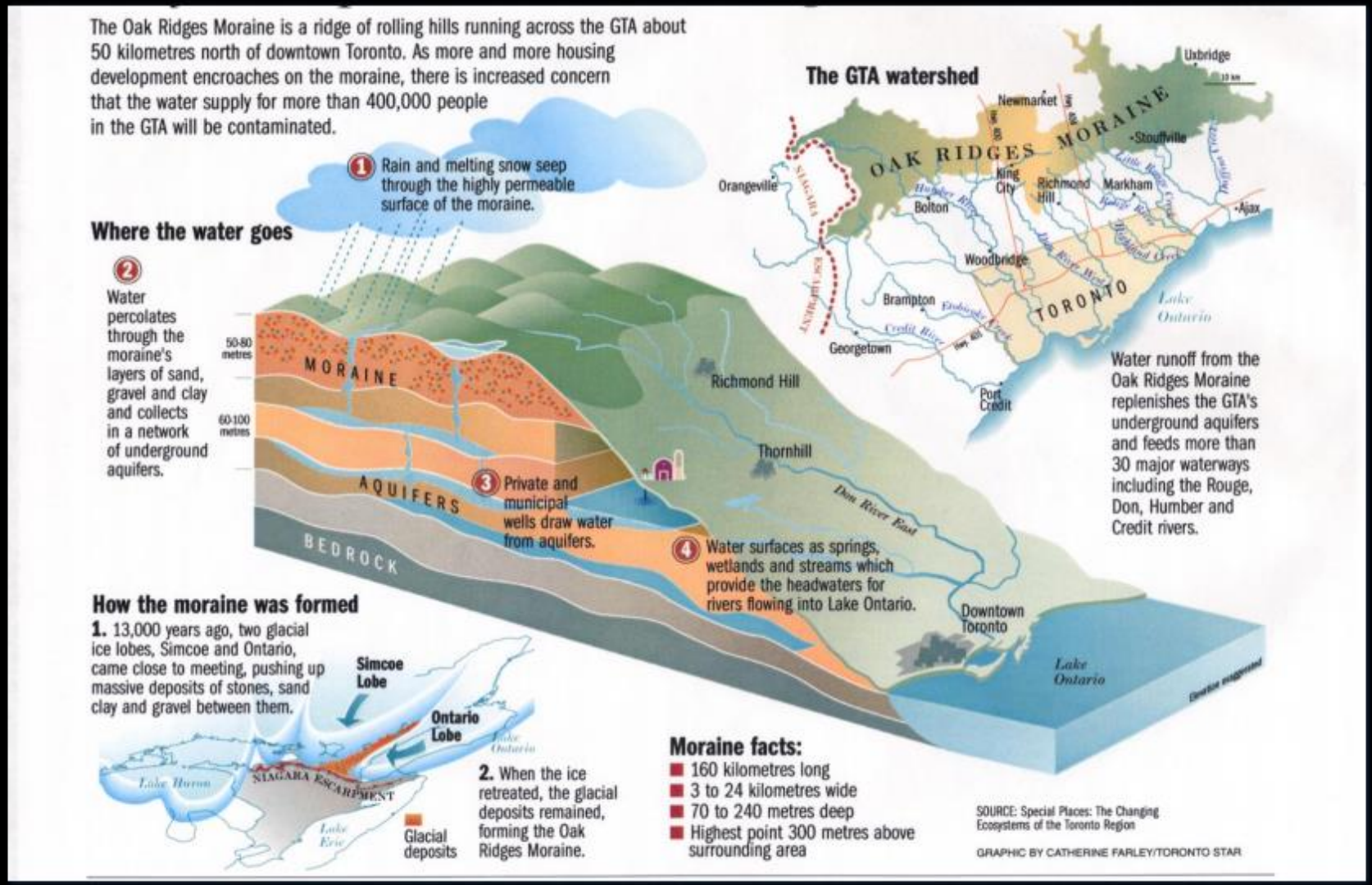

North Guelph


North Markham – contributing habitat for fish


Lake of Bays

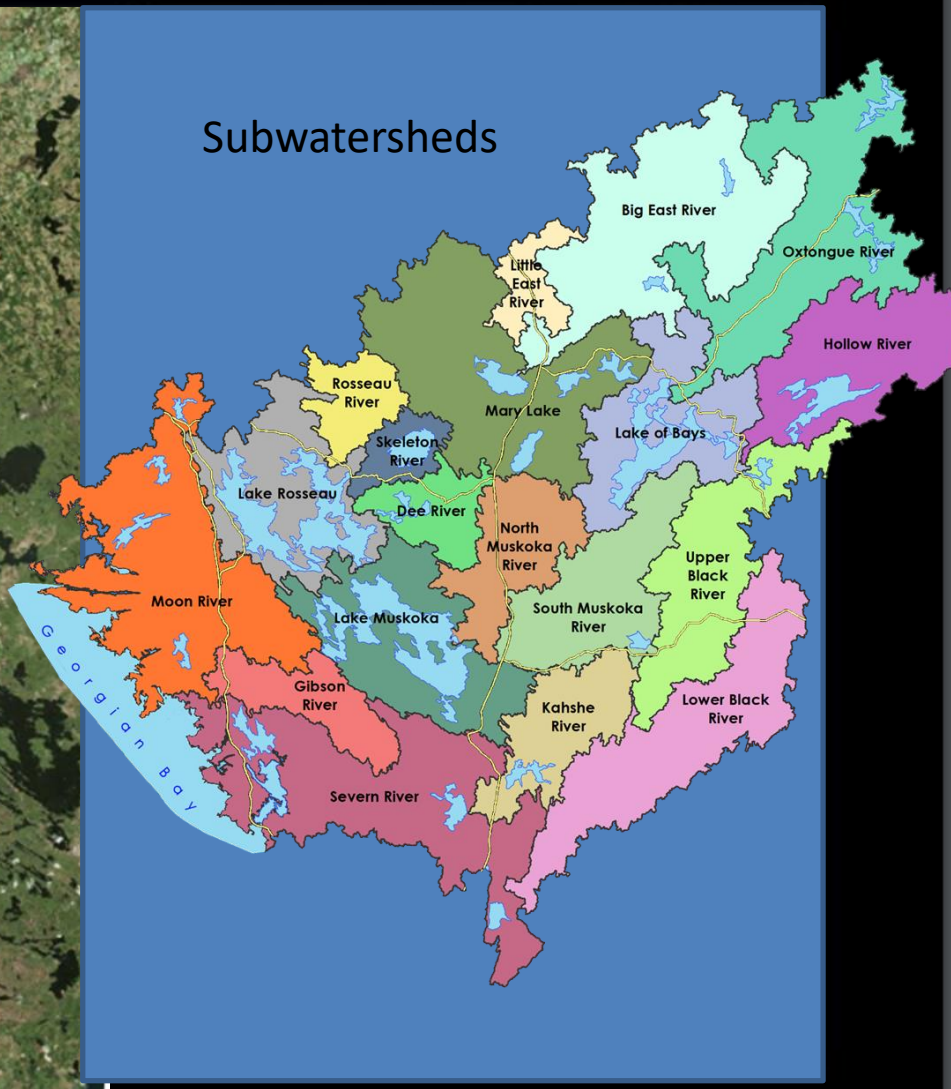

Bloomington

Protecting the land to protect the water



Source OGA 2017

Protecting the land to protect the water



Source OGA 2017

Protecting Headwaters

- **Education** – what are they and why are they important?

  Actions: headwater indicators in watershed report card, stewardship initiatives
- **Protection** – currently DFO protects seasonal fish habitat. Policy protects wetlands, buffers, EP zones, etc.

  Action: improve policy and implementation, identify and preserve significant headwater areas, **natural heritage system**
- **Implementation** - Low Impact Development, Maintain Open Channels, SWM wetlands, bioswales, daylighting, restoration

A Closer Look - What is Natural Heritage System

- What is the Natural Heritage System… not yet developed in Muskoka.
- Why is it important? Protect the land to protect the water!
- What are our goals? …the District and Watershed Council?
- How do we get there?...some thoughts

What is a natural heritage system?

Photo: Joe Crowley

Source OGA 2017

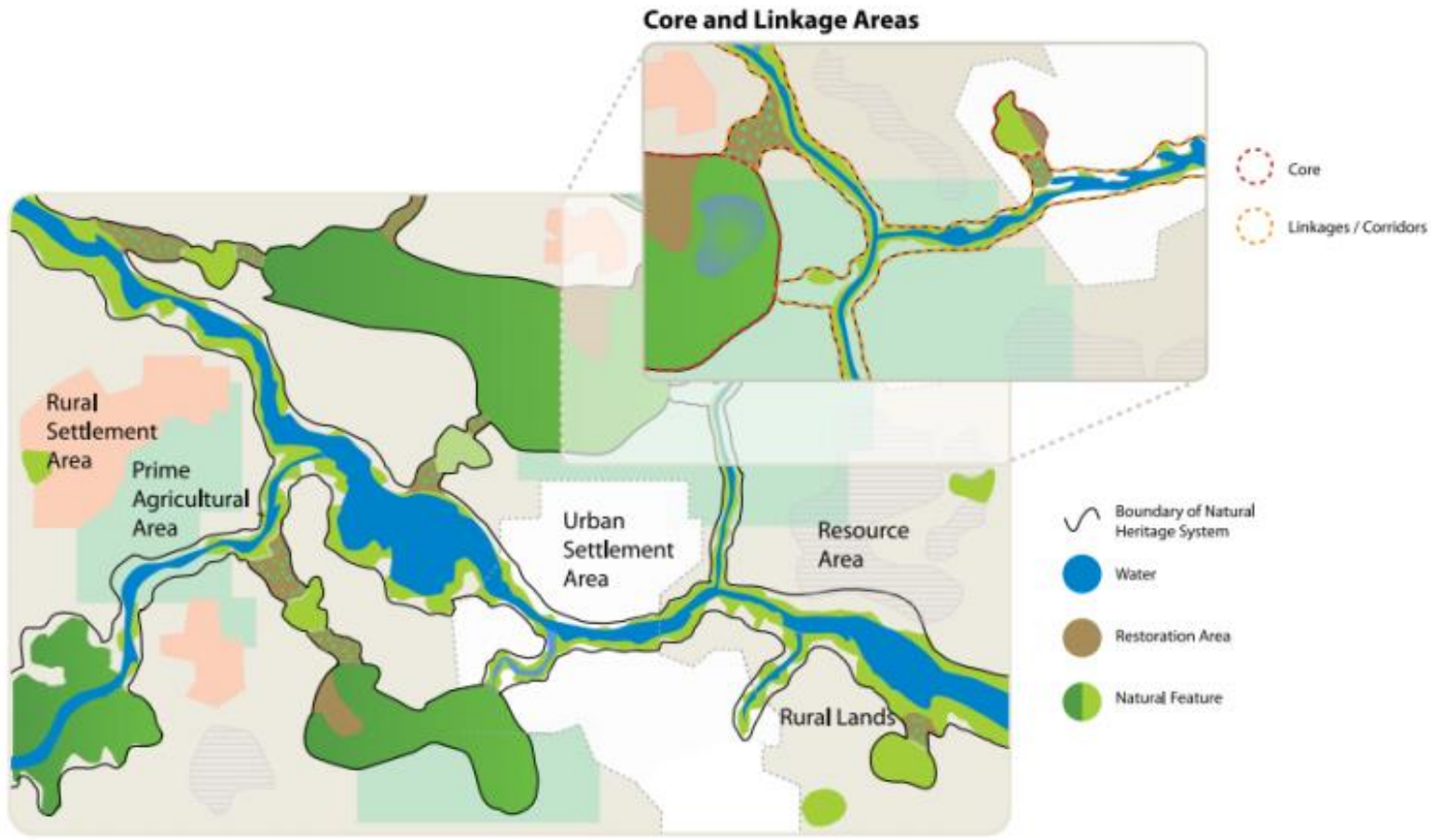
Natural Heritage System

QUESTION - How much needs protecting?

Approach

- Core Areas- select using consistent criteria – (i.e. high ecological integrity, effective size to protect headwaters, may be already protected etc.)
- Linkages – select areas that connect the core areas for example wetlands, riparian areas, river valleys, forests (consider barriers like roads, length, width, connectivity)

Protecting natural heritage … well

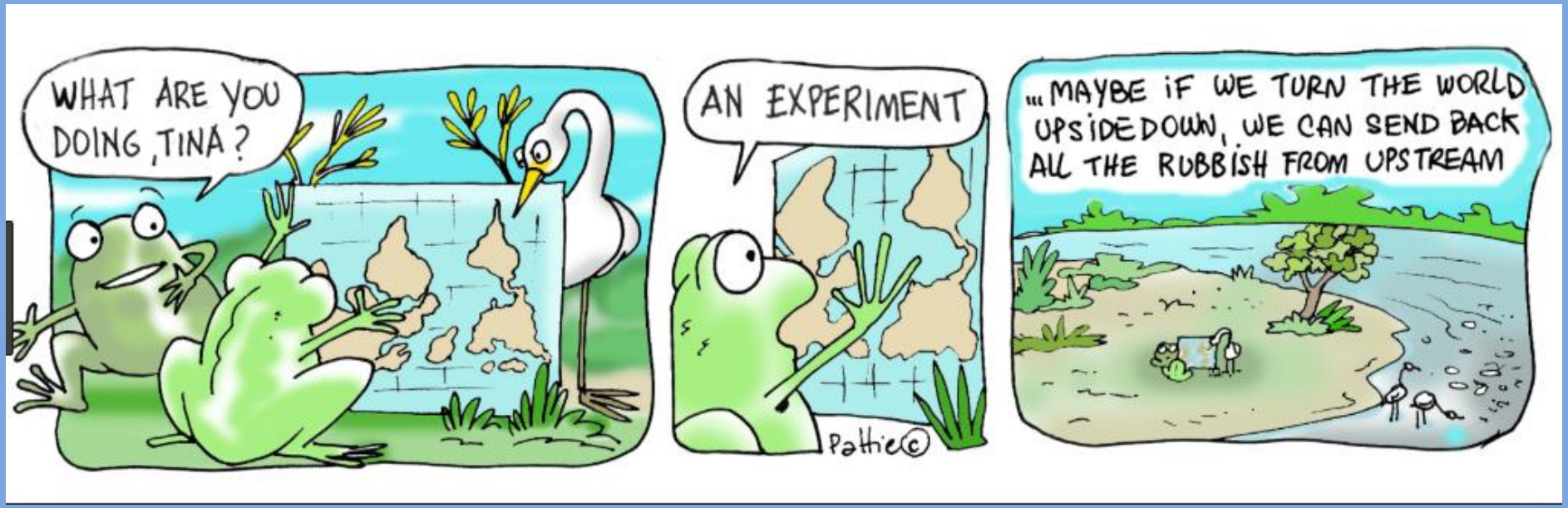


Building Blocks of a Natural Heritage Systems

This diagram shows the components of a natural heritage system running through areas with different land uses.

Source OGA 2017

Brandy Lake


WHAT ARE YOU DOING, TINA?
AN EXPERIMENT
Pattie©
"MAYBE IF WE TURN THE WORLD UPSIDEDOWN, WE CAN SEND BACK ALL THE RUBBISH FROM UPSTREAM

ACKNOWLEDGEMENTS

District of Muskoka and Muskoka Watershed Council:
Christy Doyle, Rebecca Willison

Many of our Clients
– data, photos

RiverStone Staff
– photos, discussions

The work of others who have strived to explain these complex systems