

Urban Stormwater Impacts at Royal Botanical Gardens

Water Quality & Quantity Challenges

Environmental context support for staff report
Watershed Action and Stormwater
(PW19008u)

About **50%** of City of Hamilton's **surface runoff** flows through RBG managed coastal marsh environmental protection areas
(Cootes Paradise and Grindstone Marshes)

Watersheds

1. Spencer Creek (Dundas/Ancaster/West Flamborough)
2. Bokers Creek (Waterdown/Dundas/ E&W Flamborough)
3. Ancaster Creek (Dundas/Ancaster/West Hamilton)
4. Chedoke Creek (West Hamilton/Ancaster)
5. Westdale Creek (Dundas/Ancaster/West Flamborough)
6. MacLanding Creek (West Hamilton)
7. Delsey Creek (Dundas/W. Flamborough)
8. Grindstone Creek (Waterdown/E&W Flamborough)
9.and more



Tys Theijsmeijer
Royal Botanical Gardens
June 2023

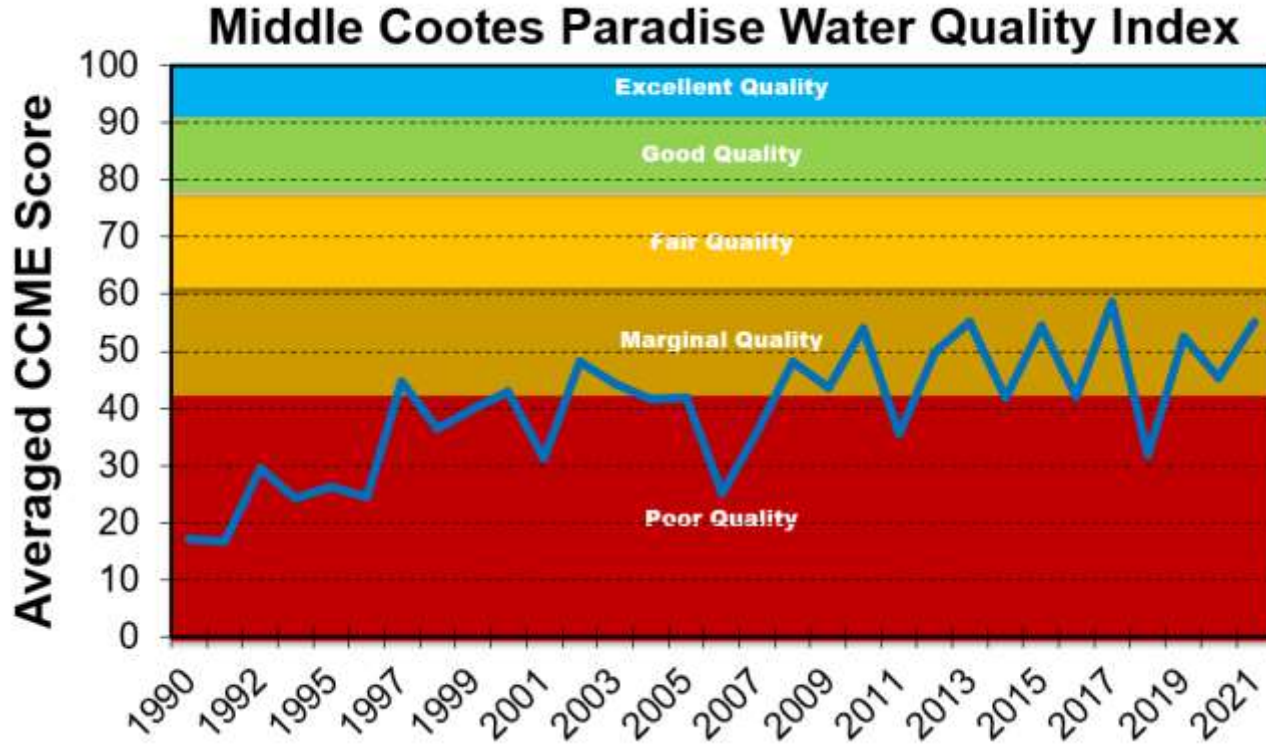
Water Quantity Impacts

- Urban runoff is a very high proportion of Water flowing in the summer dry conditions for Cootes Paradise Marsh
- Urban stormwater is the cause of CSO events
- RBG Management response to stormwater challenges
 - Grindstone Creek Delta Project
 - Spencer Creek Delta Project
 - Chedoke Delta Project - Chedoke Water Quality Framework.
 - Operating multiple carp barriers
 - HHRAP Cootes Paradise Fishway/carp barrier



Water Quality Status Cootes Paradise

Water Quality Index – CCME (Canadian Council of Ministers of the Environment)



Water Quality Index Trend

- Variable clarity
- Extreme algae blooms

Overall the area remains on the Great Lakes Area of Concern most damaged places of the Great Lakes

A focus for the 3 levels of government to restore

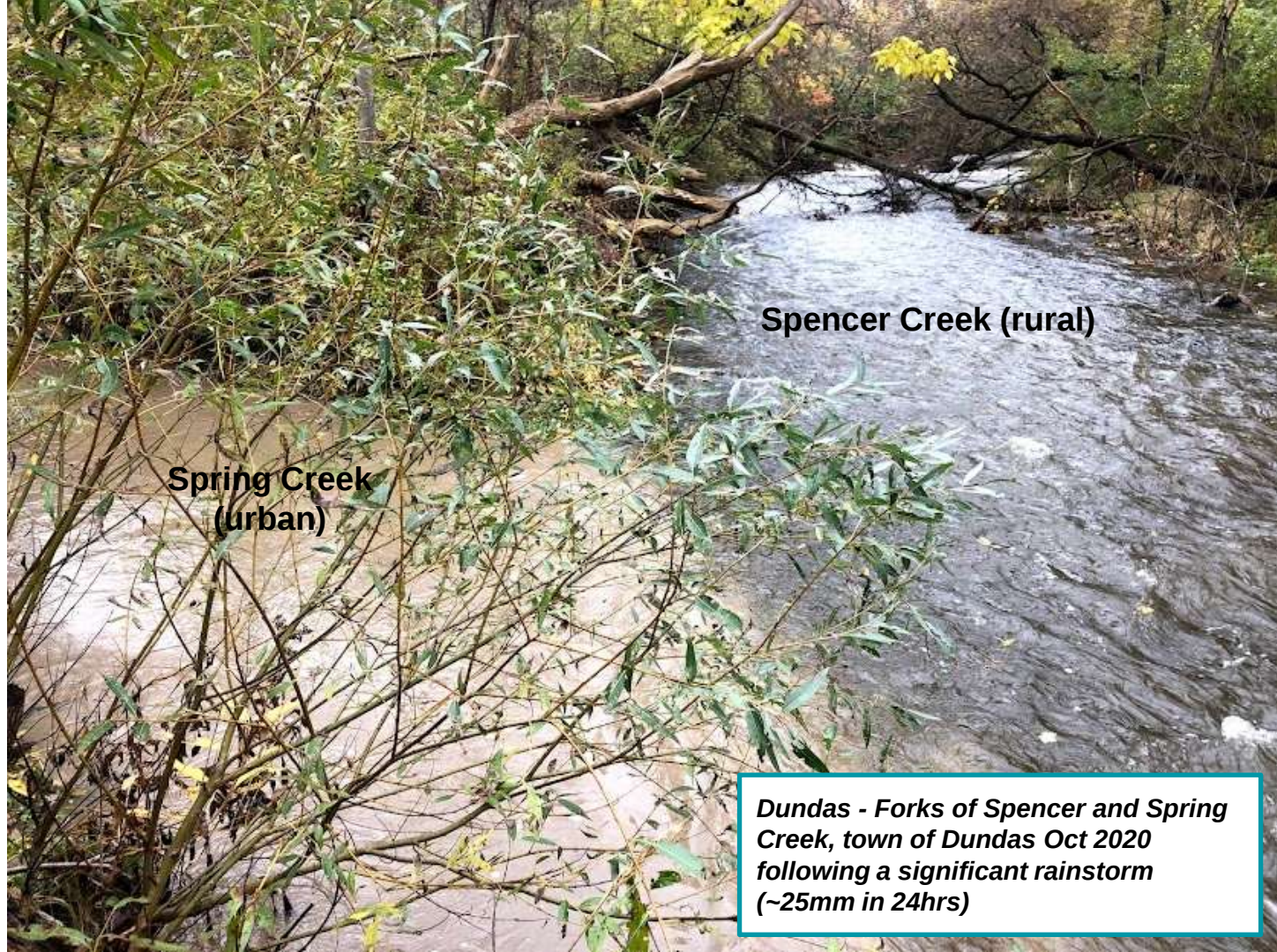
Why Does it Matter?

1. **Dominant** source to surface water during summer dry periods
2. Can be very poor water
3. Is the cause of CSO events
4. Recovery of the Hamilton Great Lakes Area of Concern hinges on it



Impacts

1. Escarpment Erosion & infilling of Lake Ontario rivermouth marshes
2. Aquatic life/Lake Ontario ecosystem function
3. Water Aesthetics
4. Water Quality
5. Combined Sewage Overflows
6. Climate Change exacerbated



Spencer Creek (rural)

**Spring Creek
(urban)**

***Dundas - Forks of Spencer and Spring
Creek, town of Dundas Oct 2020
following a significant rainstorm
(~25mm in 24hrs)***

Provincial Surface Water Objectives vs Stormwater

<https://www.ontario.ca/document/stormwater-management-planning-and-design-manual-0#section-3>



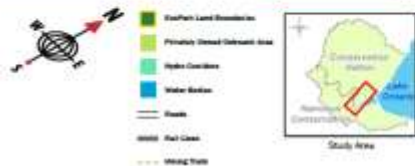
Escarpment Erosion - Hickory Brook

Table 1.2: Comparison of Urban Stormwater Runoff Concentrations with Provincial Water Quality Objectives

Parameter	Units	PWQO	Observed Concentrations
Fecal coliforms	CNT/dL	—	10,000 - 16E6
SS	mg/L	—	87 - 188
TP	mg/L	0.03	0.3 - 0.7
TKN	mg/L	—	1.9 - 3
Phenolics	mg/L	0.001	0.014 - 0.019
Al	mg/L	—	1.2 - 2.5
Fe	mg/L	—	2.7 - 7.2
Pb	mg/L	0.025	0.038 - 0.055
Ag	mg/L	0.0001	0.002 - 0.005
Cu	mg/L	0.005	0.045 - 0.46
Ni	mg/L	0.025	0.009 - 0.016
Zn	mg/L	0.030	0.14 - 0.26
Cd	mg/L	0.0002	0.001 - 0.024

Escarpment Erosion

Cootes to Escarpment EcoPark System Vision Map



Our **Vision** for the Cootes to Escarpment EcoPark System is that it becomes a permanently protected natural lands sanctuary linking Cootes Paradise Marshlands with Hamilton Harbour and the Niagara Escarpment. Our **Mission** as partners is to collaborate to preserve and enhance the natural lands we own and steward by using sustainable approaches to protect biodiversity, highlight ecosystem services, and enable responsible human connection to nature.



Escarpment Erosion

Example: Scour and
forested slope
collapse from
increased quantity



Escarpment Erosion Ancaster Creek

Example:
Scour and
forested
slope
collapse from
increased
quantity



Escarpment Erosion

Example:
Infrastructure
Failures



Overwhelmed Storm Drain - Grindstone Creek

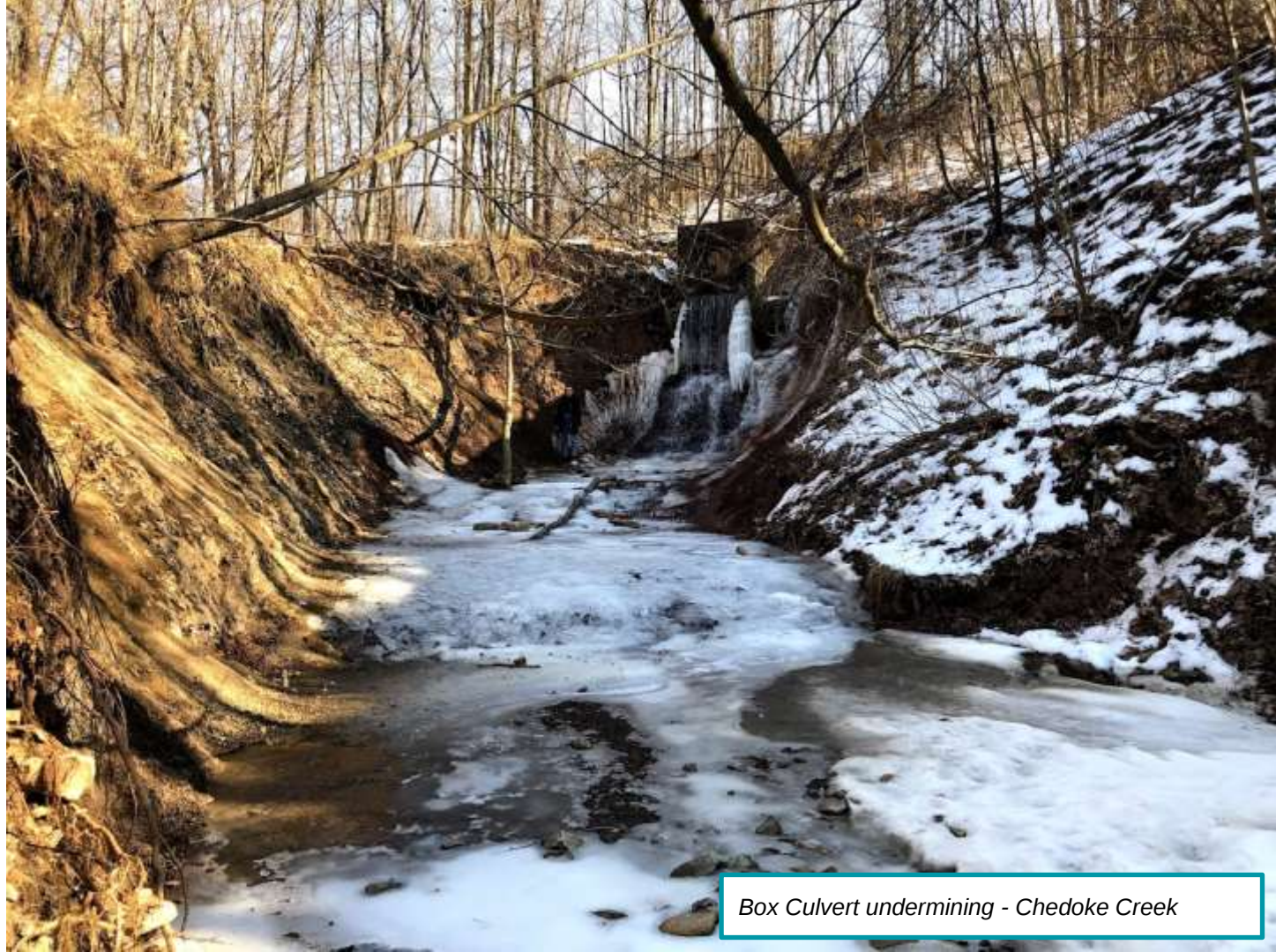
Escarpment Erosion Buried Creek Sections



*Dundas
Box Culvert plugged -
Sydenham Creek 2021
Dundas Star*

Escarpment Creeks

Example: Channel
Erosion



Box Culvert undermining - Chedoke Creek

Escarpment Erosion

RBG Outcome: Marsh sedimentation
and infilling of Lake Ontario river mouth
marsh habitat

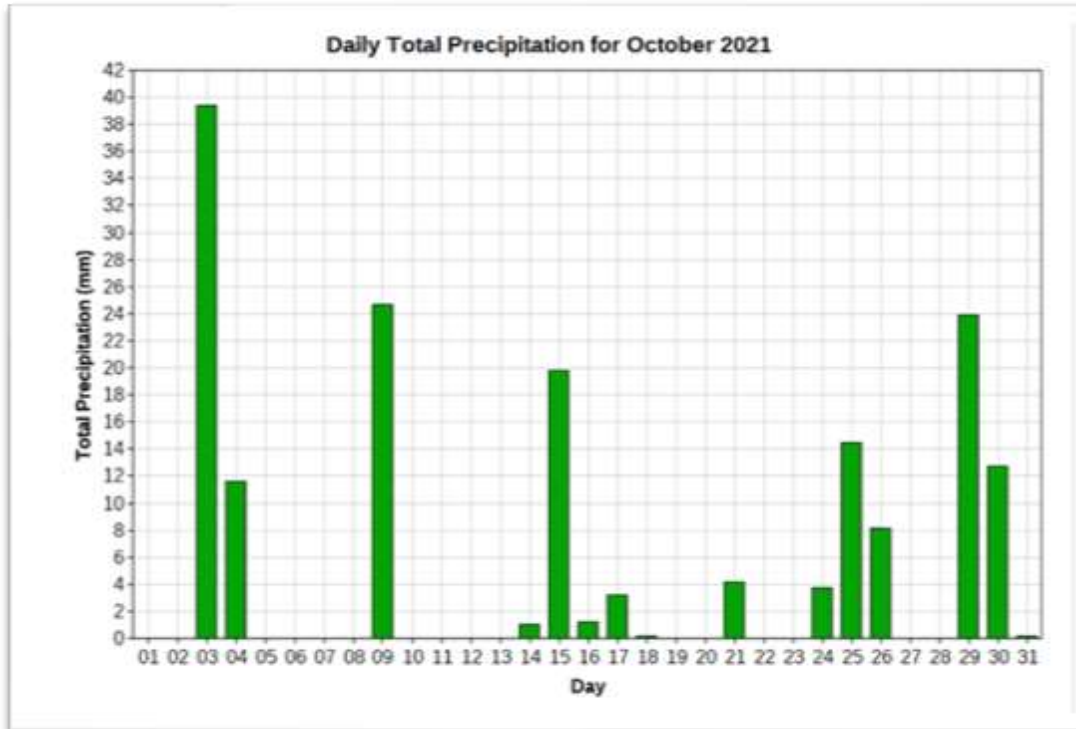
*Cootes Paradise Marsh April 2020
Spencer Creek Delta Area*



Rainfall Events & Climate Change

RBG Arboretum Weather Station - Environment and Climate Change Canada

- 2021 - 10 rain events > 20mm rain in 24hrs
- For the Wastewater Masterplan EA (2006) 1 rain event over 20mm over two years was modelled for impacts (based on existing weather data to end of 1980s)



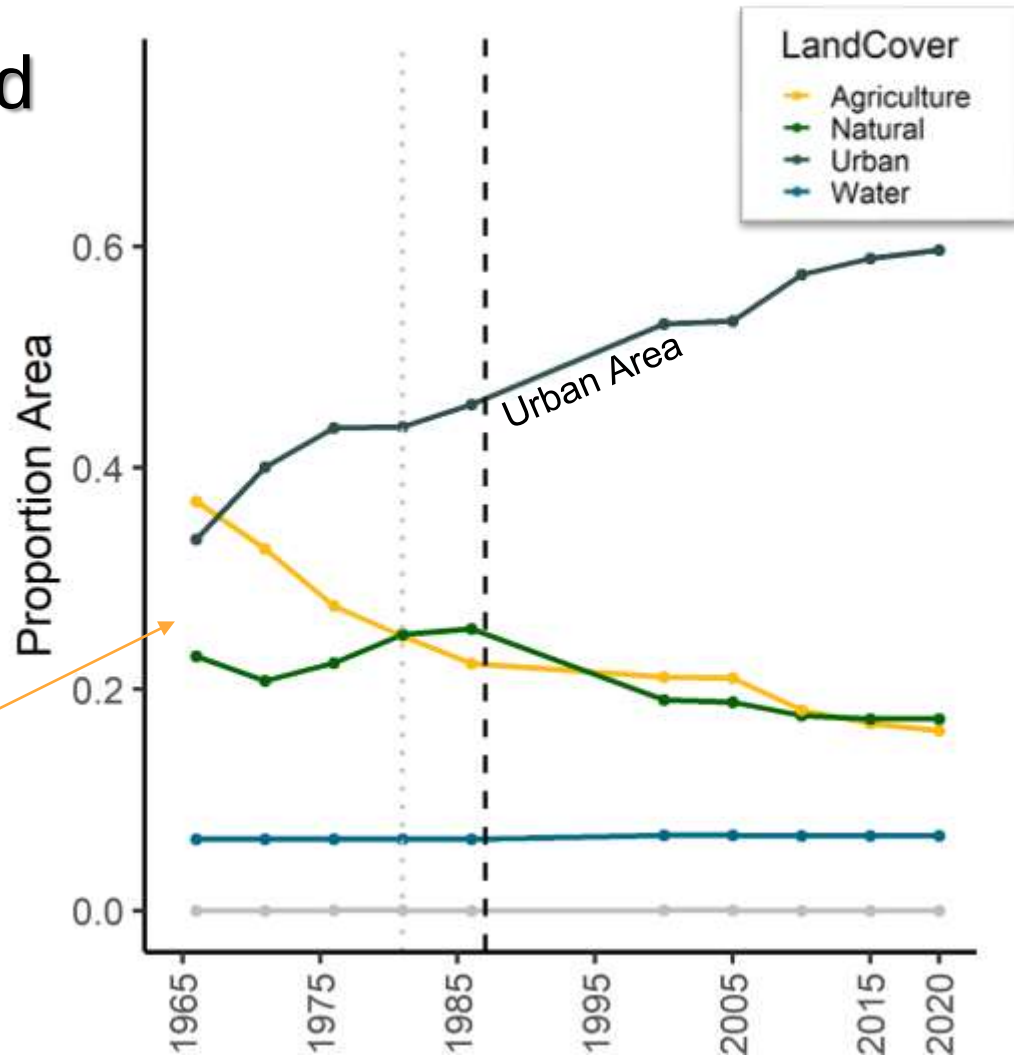
Map: Arboretum Weather Station location



Land Use Hamilton Trend

Trends in general land cover types in the Hamilton Harbour watershed. Prior to 1990, land cover information were collected by the Canada Land Use Monitoring Program. These data were available solely within the boundaries of the City of Hamilton (delineated by the orange line in the inset map) and so all future land cover maps were clipped to this orange boundary instead of the entire Hamilton Harbour watershed (red line in inset map). After 1996, data were from the Ontario Land Cover Database. All land cover data were accessed via the Ontario GEOHub (<https://geohub.lio.gov.on.ca/>).

Information from Hamilton Harbour RAP Fish Population Status Assessment Document (Draft 2023)



Complexity of urban stormwater

A result of increasing proportion of watershed

Evolution of stormwater management in Ontario

Adapted from MOE, Subwatershed Planning, June 1993



Current Guidelines provided by Province of Ontario, Ministry of Environment Conservation and Park dated 2003 (Draft vs 2022)

Timeline:

Prior to 1980 → 1980 → 1990 → 2000 → Current