Characterization of Canadian watersheds in the Lake Erie basin

Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health, 2014 (COA)

Nutrient Annex Committee
Science Subcommittee

February 14, 2017

Background

The **COA Nutrient Annex Committee** (NAC) is responsible for implementing COA Annex 1 - Nutrients including developing the **Canada-Ontario Action Plan for Lake Erie** that will outline how we will work collaboratively with our partners to meet phosphorus load reduction targets and reduce algal blooms in Lake Erie.

Science Subcommittee

- Subcommittee under COA NAC was directed to compile and assess existing data and information to characterize geographic areas within the Canadian side of the Lake Erie basin
- Includes staff from 5 federal and provincial agencies

Background

COA NAC Science Subcommittee:

- Pamela Joosse, Natalie Feisthauer
  - Agriculture and Agri-Food Canada (AAFC)
- Jody McKenna, Brad Bass
  - Environment and Climate Change Canada (ECCC)
- Mary Thorburn, Ted Briggs, Pradeep Goel, Matt Uza, Cheriene Vieira
  - Ontario Ministry of the Environment and Climate Changes (MOECC)
- Dorienne Cushman
  - Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)
- Jenn Richards, Tom MacDougall
  - Ontario Ministry of Natural Resources and Forestry (MNRF)

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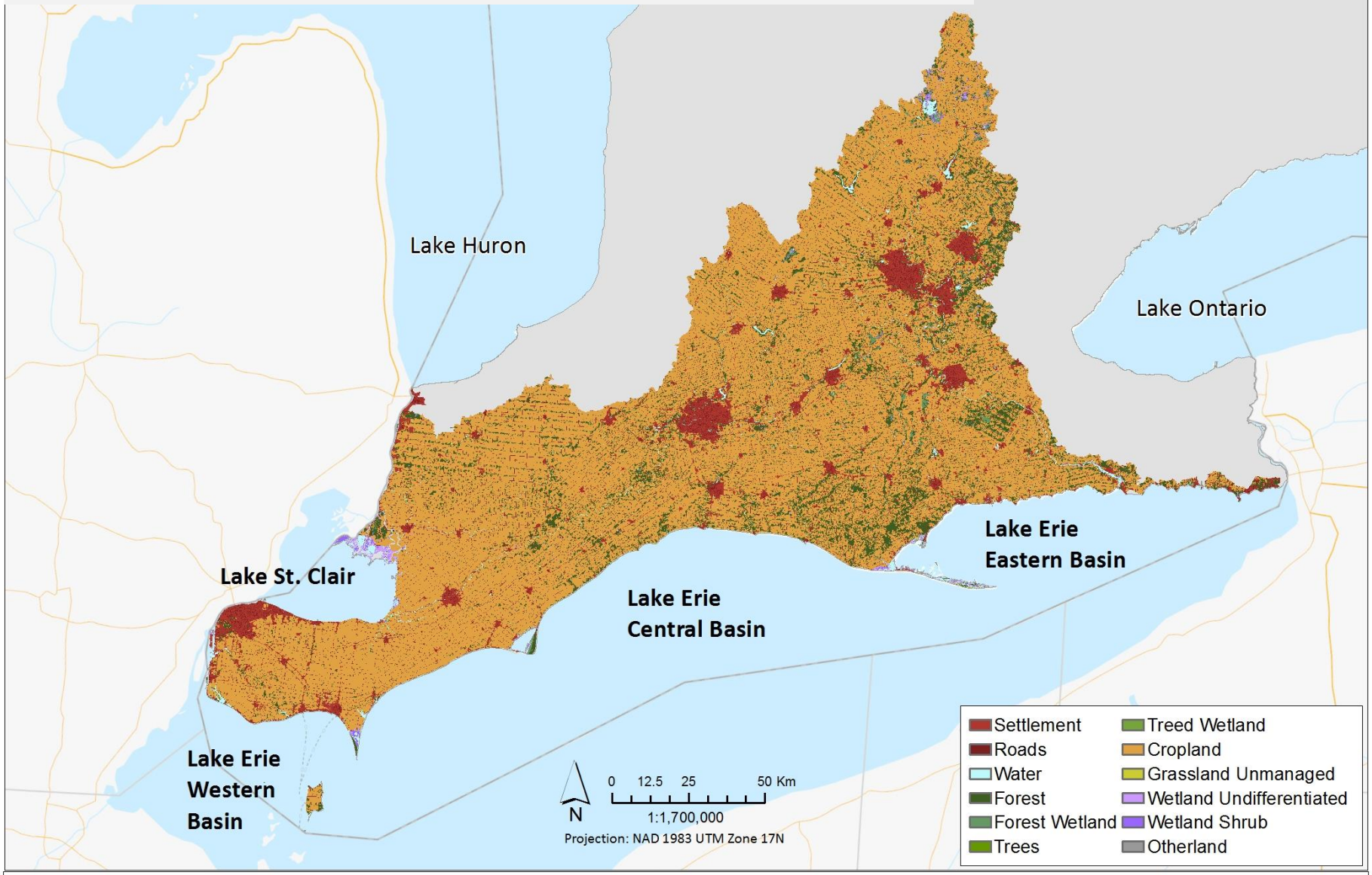
How to characterize the Lake Erie Basin?



Lake Erie Basin Characterization

Quaternary watersheds in the Canadian Lake Erie basin were characterized according to the Canadian basin-wide distribution of distinguishing land cover/activities from which different sources and characteristics of P loss can be inferred

- Quaternary watersheds within the Lake Erie basin were characterized by the following land cover/land activity categories:
  - Natural Heritage
  - Urban
  - Agriculture – Crop
  - Agriculture – Livestock
- Landscape characteristics that could render a watershed more susceptible to P loss were also identified
  - Risk of soil erosion, high potential for runoff
- Environmental state parameters were also identified
  - Water quality

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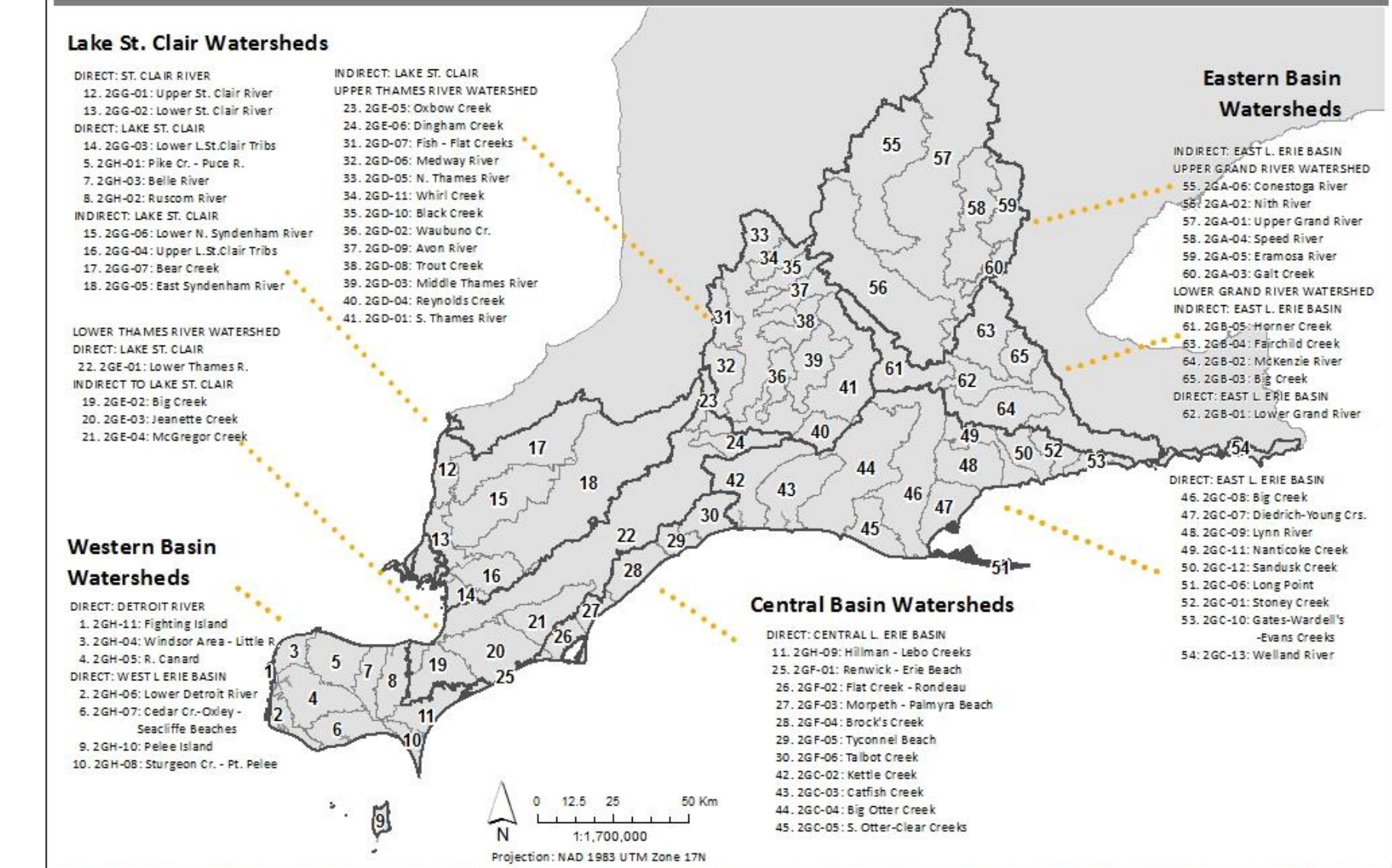
Lake Erie Quaternary Watersheds



Lake St. Clair Watersheds

DIRECT: ST. CLAIR RIVER
12. 2GG-01: Upper St. Clair River
13. 2GG-02: Lower St. Clair River
DIRECT: LAKE ST. CLAIR
14. 2GG-03: Lower L.St.Clair Tribs
5. 2GH-01: Pike Cr. - Puce R.
7. 2GH-03: Belle River
8. 2GH-02: Ruscom River
INDIRECT: LAKE ST. CLAIR
15. 2GG-06: Lower N. Syndenham River
16. 2GG-04: Upper L.St.Clair Tribs
17. 2GG-07: Bear Creek
18. 2GG-05: East Syndenham River

INDIRECT: LAKE ST. CLAIR
UPPER THAMES RIVER WATERSHED
23. 2GE-05: Oxbow Creek
24. 2GE-06: Dingham Creek
31. 2GD-07: Fish - Flat Creeks
32. 2GD-06: Medway River
33. 2GD-05: N. Thames River
34. 2GD-11: Whirl Creek
35. 2GD-10: Black Creek
36. 2GD-02: Waubuno Cr.
37. 2GD-09: Avon River
38. 2GD-08: Trout Creek
39. 2GD-03: Middle Thames River
40. 2GD-04: Reynolds Creek
41. 2GD-01: S. Thames River

LOWER THAMES RIVER WATERSHED
DIRECT: LAKE ST. CLAIR
22. 2GE-01: Lower Thames R.
INDIRECT TO LAKE ST. CLAIR
19. 2GE-02: Big Creek
20. 2GE-03: Jeanette Creek
21. 2GE-04: McGregor Creek

Eastern Basin Watersheds

INDIRECT: EAST L. ERIE BASIN
UPPER GRAND RIVER WATERSHED
55. 2GA-06: Conestoga River
56. 2GA-02: Nith River
57. 2GA-01: Upper Grand River
58. 2GA-04: Speed River
59. 2GA-05: Eramosa River
60. 2GA-03: Galt Creek
LOWER GRAND RIVER WATERSHED
INDIRECT: EAST L. ERIE BASIN
61. 2GB-05: Horner Creek
63. 2GB-04: Fairchild Creek
64. 2GB-02: McKenzie River
65. 2GB-03: Big Creek
DIRECT: EAST L. ERIE BASIN
62. 2GB-01: Lower Grand River

DIRECT: EAST L. ERIE BASIN
46. 2GC-08: Big Creek
47. 2GC-07: Diedrich-Young Crs.
48. 2GC-09: Lynn River
49. 2GC-11: Nanticoke Creek
50. 2GC-12: Sandusk Creek
51. 2GC-06: Long Point
52. 2GC-01: Stoney Creek
53. 2GC-10: Gates-Wardell's -Evans Creeks
54. 2GC-13: Welland River

Western Basin Watersheds

DIRECT: DETROIT RIVER
1. 2GH-11: Fighting Island
3. 2GH-04: Windsor Area - Little R.
4. 2GH-05: R. Canard
DIRECT: WEST L ERIE BASIN
2. 2GH-06: Lower Detroit River
6. 2GH-07: Cedar Cr.-Oxley - Seacliffe Beaches
9. 2GH-10: Pelee Island
10. 2GH-08: Sturgeon Cr. - Pt. Pelee

Central Basin Watersheds

DIRECT: CENTRAL L. ERIE BASIN
11. 2GH-09: Hillman - Lebo Creeks
25. 2GF-01: Renwick - Erie Beach
26. 2GF-02: Flat Creek - Rondeau
27. 2GF-03: Morpeth - Palmyra Beach
28. 2GF-04: Brock's Creek
29. 2GF-05: Tyconnel Beach
30. 2GF-06: Talbot Creek
42. 2GC-02: Kettle Creek
43. 2GC-03: Catfish Creek
44. 2GC-04: Big Otter Creek
45. 2GC-05: S. Otter-Clear Creeks

N

0 12.5 25 50 Km

1:1,700,000

Projection: NAD 1983 UTM Zone 17N

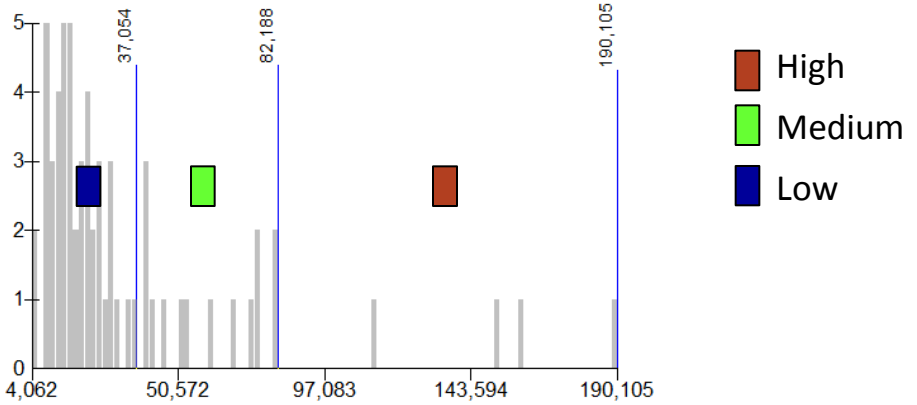
Watershed Characterization Process

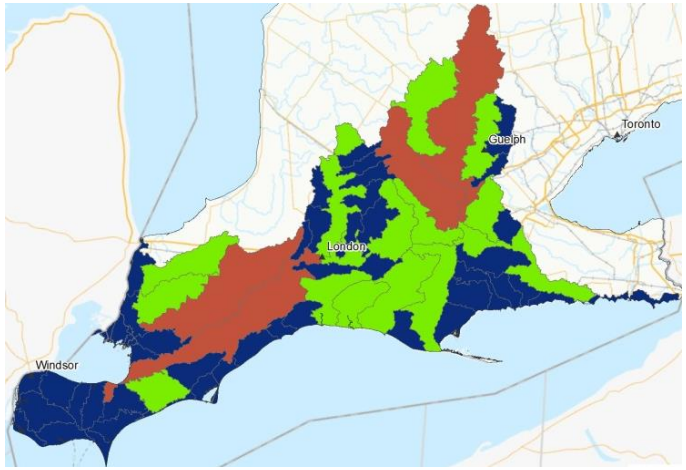
- Why characterize by quaternary watersheds?
  - Uniform biophysical scale that can be rolled up into management units
- Evaluated available datasets and selected only those that are:
  - Available basin-wide
  - Comparable among all quaternary watersheds
  - Directly related to land use/activity or landscape vulnerability categories
  - Unique (not redundant with other datasets)
  - High quality (data consistently collected and subjected to QA/QC procedures)
  - Recent (2008 or later)
- Based on these criteria, 35 out of over 100 possible parameters from datasets from 5 federal and provincial government agencies were selected for further consideration in the characterization process

Watershed Characterization Process

For each of the 35 parameters:

- Created 3 classes (high, medium, low) for each parameter based on the distribution ("clustering") of the data among all 65 Lake Erie watersheds using statistical methods





- High, medium and low classes represent how the *data were distributed for any given parameter across the basin*
- Pre-determined thresholds were used for 3 parameters:
  - water quality, % natural heritage cover and risk of soil erosion

Watershed Characterization Process

Assigning Watersheds to Categories

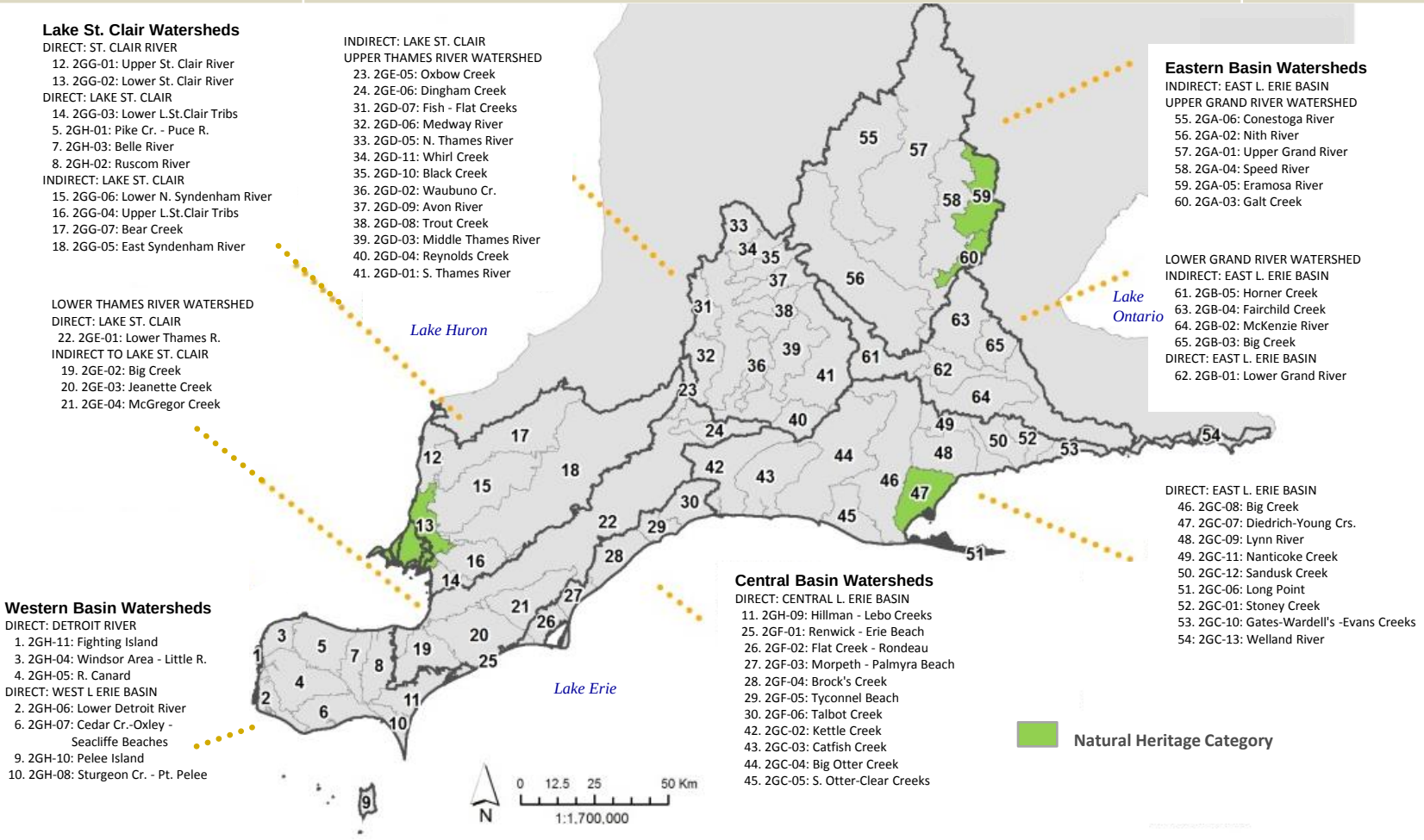
- Reviewed parameters to determine:
  - Those most directly related to land use/activity categories
  - Those most descriptive or distinguishing so they can be used as criteria to assign watersheds to categories
- Reduced the original "short-list" of 35 parameters to 13
- All watersheds that fell into the "H" (high) class for the selected parameters were included in a given land use/activity category

NOTE: Categorization of a watershed does not mean it only has or is dominated by that land use/activity (or landscape feature/environmental state); if a watershed is in a category it means it falls into the high end of the parameter distribution across the Lake Erie basin

- There can still be varying levels of urban, agriculture types or natural heritage in each categorized watershed as well as landscape vulnerabilities and environmental states

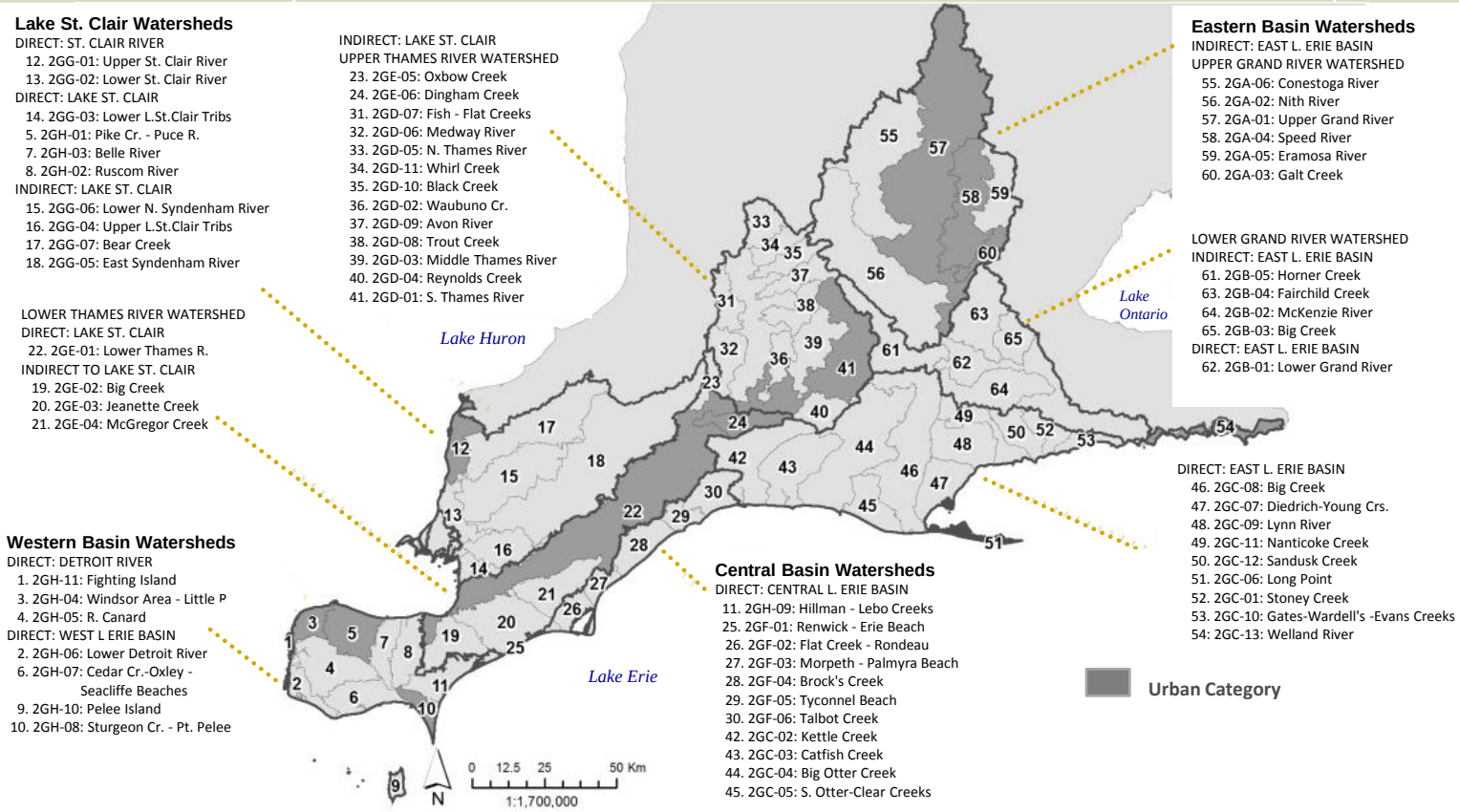
Watershed Characterization Results

Land Use/Activity Category	Parameter Used	Threshold
Natural Heritage	% of watershed area in natural heritage land cover	> 30%



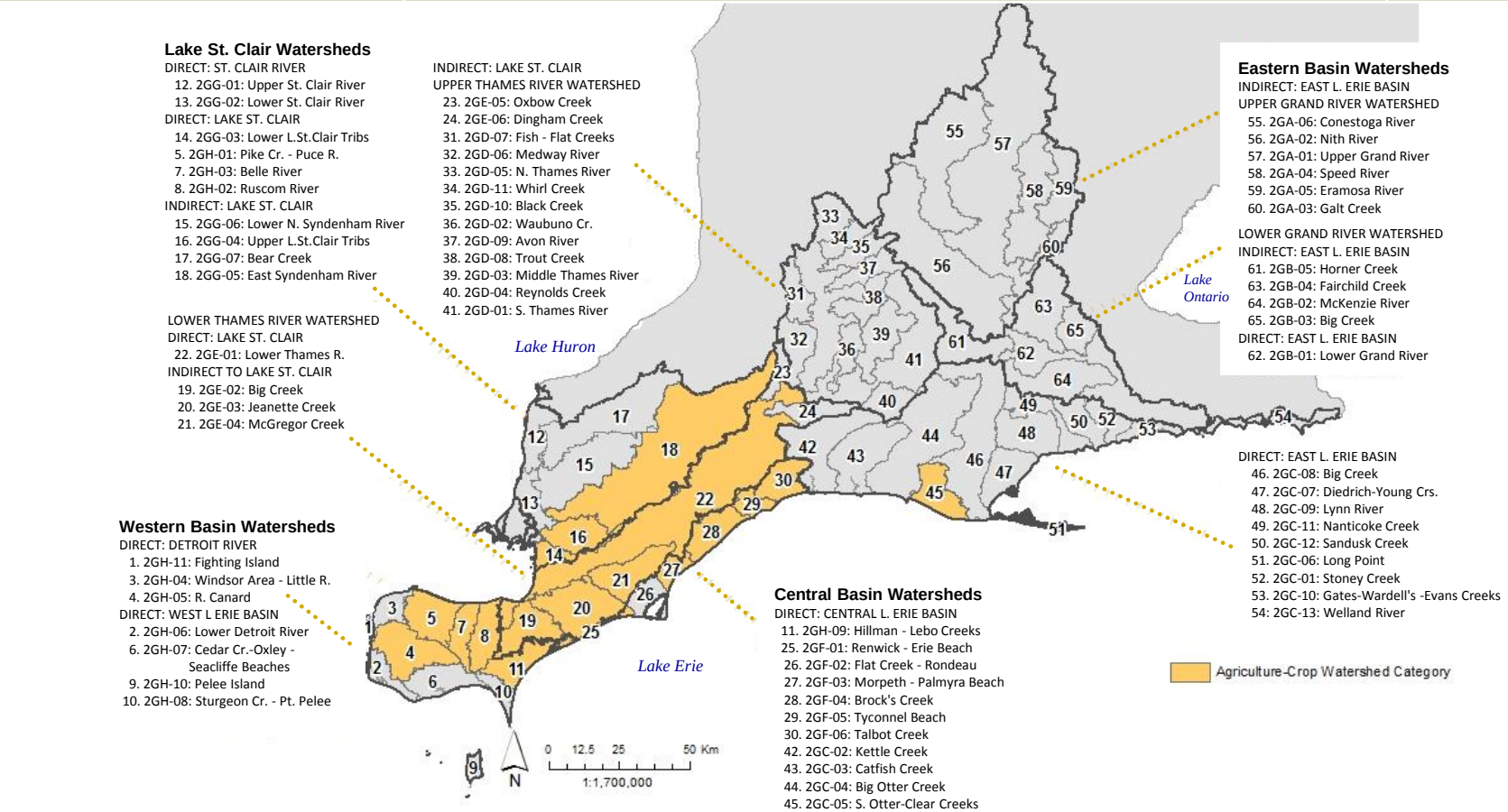
Watershed Characterization Results

Land Use/Activity Category	Parameters Used	Thresholds
Urban	% of watershed area in urban land use	> 13%
	Total urban PS load	> 10.9 t P
	Total urban NPS load	> 4.84 t P
	% of total watershed load from urban PS	> 27%
	% of total watershed load from urban NPS	> 10%



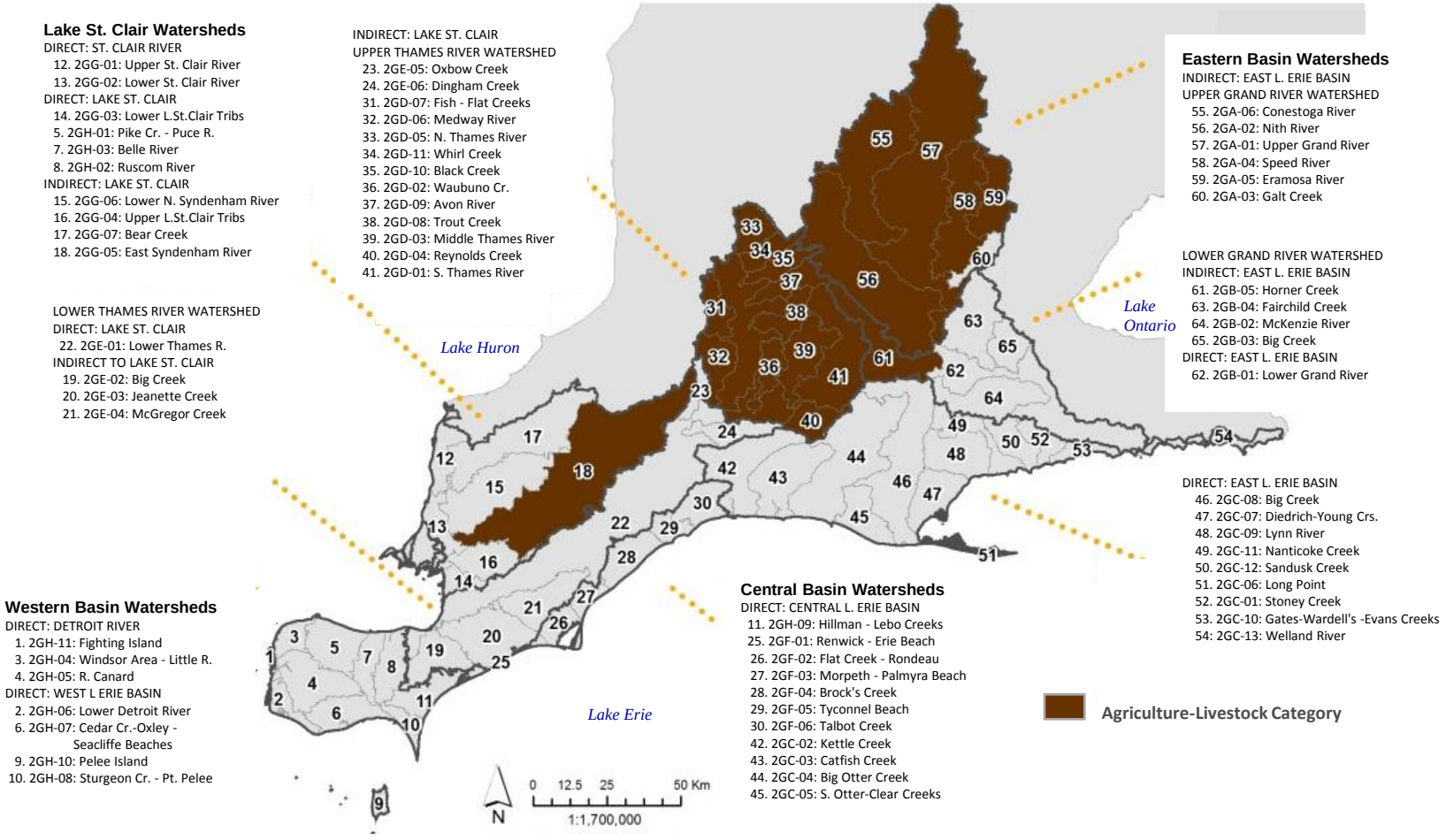
Watershed Characterization Results

Land Use/Activity Category	Parameters Used	Thresholds
Agricultural-Crop	% of watershed area in vegetable or potato production in at least 1 of 4 years	> 13%
	% of watershed area in continuous corn, continuous soybean or in a corn-soybean rotation over 4 years	> 27%



Watershed Characterization Results

Land Use/Activity Category	Parameters Used	Thresholds
Agricultural-Livestock	Rate of manure applied (to cropland + pasture) in watershed	> 13 kg P/ha
	Total amount of manure applied in watershed	> 638 t P



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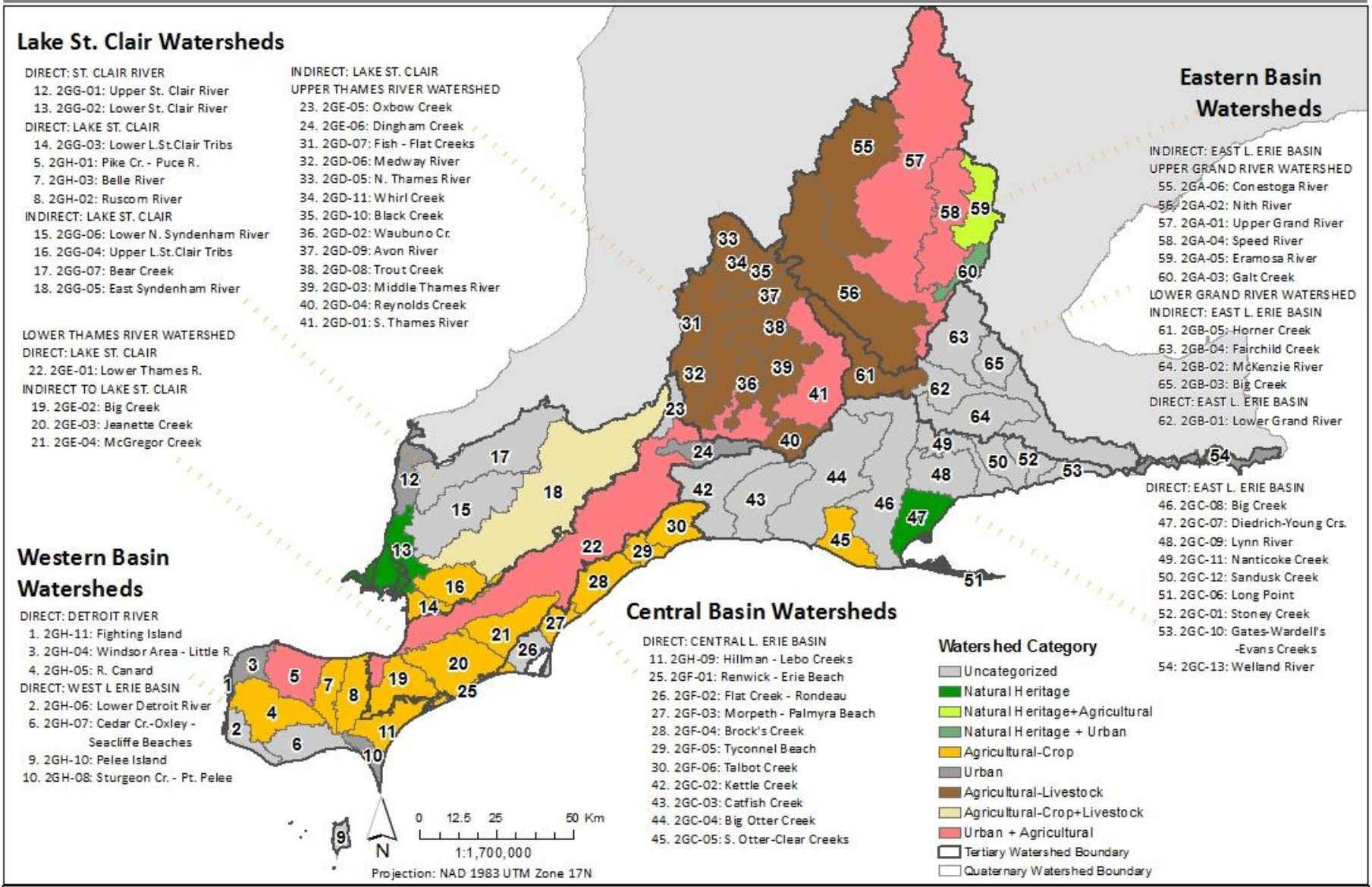
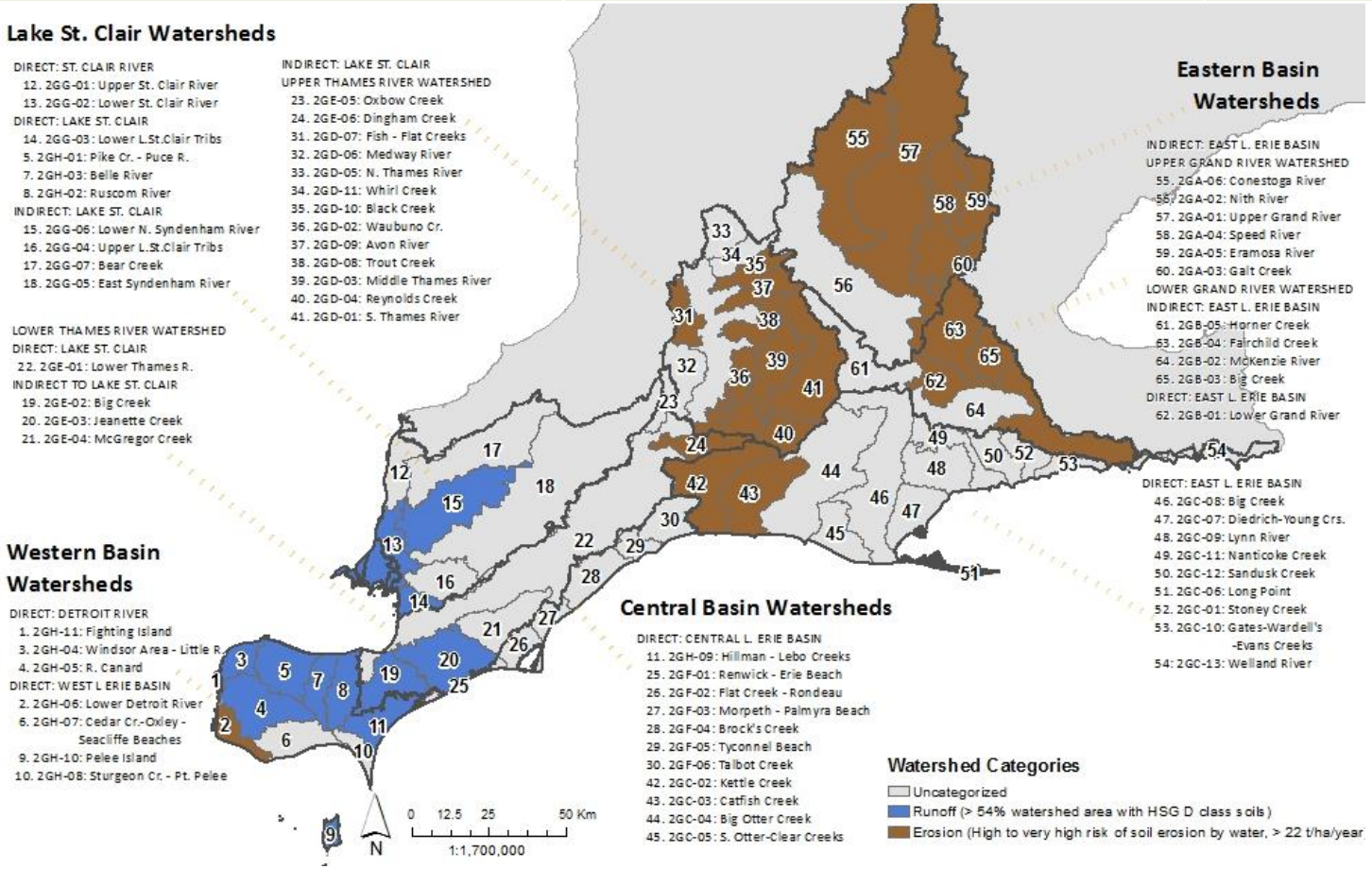
Watersheds in the Lake Erie Basin Categorized by Land Use/Activities



Data provided through partnership with Agriculture and Agri-Food Canada, Environment and Climate Change Canada and Ontario Ministries of the Environment and Climate Change, Natural Resources and Forestry and Agriculture, Food and Rural Affairs. The map shown is for reference purposes only and while every effort has been made for accuracy it is not guaranteed to be accurate, correct or complete. The Canadian and Ontario governments will accept no liability for consequential and indirect damages arising from the use of these maps.

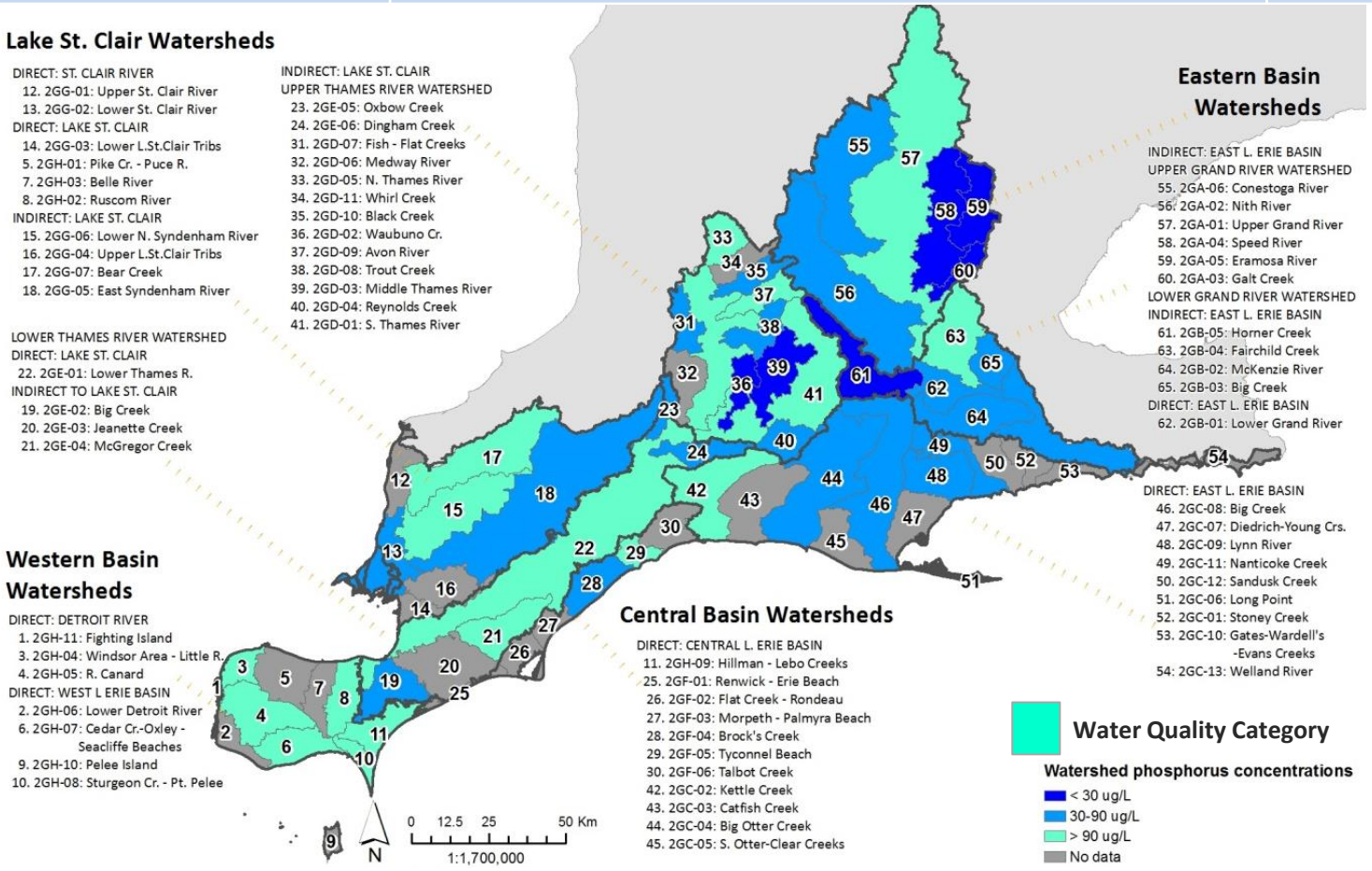
Watershed Characterization Results

Landscape Vulnerability Categories	Parameters Used	Thresholds
Soils with high runoff potential	% of watershed area with HSG D soil	> 54%
Risk of soil erosion	High to very high risk of soil erosion	> 22 t soil/ha/yr



Watershed Characterization Results

Environmental State Category	Parameter Used	Threshold
Water Quality	Average watershed maximum median of PWQMN	> 90 µg TP/L



Conclusion

- A comprehensive assessment was conducted to identify the relevant data held collectively by participating COA government agencies

- With this characterization, may be able to emphasize particular types of actions in different watersheds
  - Note that in this process:
    - No management data was considered
    - No capacity for change (human/financial capacity/current plans) was assessed

- This is a basin-wide view of the nature of the Lake Erie watersheds. Determination of appropriate P reduction actions is done on a site by site basis.

Questions?