EES1126 Term Paper: Analyzing hydrochemical watershed issues in the Grand River Watershed

Project Due Dates

Paper Topic: February 28th 2018 (submitted by email to colin.mccarter@utoronto.ca)

Presentations: Last 2 weeks of class

Final Paper: April 6th 2018 (submitted on Blackboard)

The purpose of the final term paper is for students to gain first-hand experience working with hydrogeochemical data at the watershed scale and make watershed management recommendations to alleviate identified issues based on these data. Streamflow, dissolved nitrate, dissolved phosphate and particulate phosphorous data from ~1964 – 2015 for multiple watersheds in the Grand River Watershed have been provided for students to analysis. You will be responsible to come up with a research question to answer using the data and write a scientific paper that is 10 – 15 pages double spaced; excluding figures, tables and references. The format of the paper will follow that of a journal article. Ensure that the paper is properly referenced following the APA style, a few sources have been provided (see below) to help you get started.

Individually, you will need to select a watershed or 2 watersheds and formulate a research question. The research question does not need to be novel or new but does need to include some analysis of the data. For example, you could compare the streamflow between 2 watersheds, 1 urban and 1 agricultural. Or, you could investigate the nitrate loading over time due to agricultural amendments in 1 watershed. Or, how urbanization effects streamflow (i.e., changes in the hydrographs over time) in 1 watershed. Alternatively, you could compare changes in the hydrochemical conditions pre and post Integrated Watershed Management was implemented (i.e., Veale and Cooke 2017, Week 9). These are just examples and you are encouraged to "think outside the box", so to speak. You are encouraged to gather other data (i.e., landcover, precipitation, etc.) to help answer your question. I have access to some data and those that I do not have access to I will likely know where to access it.

In the last 2 weeks of class, each student will present a short (~7 min) PowerPoint presentation on their research findings. This presentation is not to be an exhaustive presentation of everything you completed for your research paper but the highlights of your results and discussion. Typically, 1 slide per minute is sufficient but do not exceed 10 slides. There will be ~3 min allotted for questions, after the presentation.

Background

The Grand River is a Canadian Heritage River that flows almost 300 km from Grand Valley in the north into Lake Erie in the south. The river basin includes 18 subwatersheds (Fig. 1), and the river and landscape have been significantly altered by human activities. The Grand River is a working river providing drinking water to more than half a million watershed residents and assimilating effluent from over 20 wastewater treatment plants, although there remain many natural ecosystems and habitats within the watershed. The Grand River Conservation Authority (GRCA, http://www.grandriver.ca) was the first watershed management agency in Canada. The GRCA's vision is for a healthy and sustainable natural environment in the Grand River watershed, which includes taking account of possible future threats to water availability.

Section Name	Max Length (pages)	Description
Introduction	1-2	Motivation for the research and context; for example, providing a description of the subwatersheds being studied
Methodology	1-2	Describe details of important methods (e.g., statistical tests or techniques) that are used in the report
Results	4-5	Chapter containing results and analysis.
Discussion	4-5	Draw your findings together and discuss bigger-picture implications of your results.
Conclusions	1	Wrap up the paper explaining the pertinent findings

List of key literature on the Grand River

Balpataky, K (2012): "The shape of things to come?", *news article in "The Grand" magazine*, available online at:
<http://www.grandriver.ca/publication/2012_Fall_Grand.pdf>

Bordages, L., D. Huard, D. Chaumont and A. Frigon (2010): Climate Change Scenario over Ontario Based on the Canadian Regional Climate Model (CRCM4.2), *Ouranos Technical Report*. Available online at:
<http://www.ouranos.ca/Ontario/Results_html/Rapport.pdf>

Farwell, J., D. Boyd and T. Ryan (2008): Making Watersheds More Resilient to Climate Change: A Response in the Grand River Watershed, Ontario Canada, *Grand River Conservation Authority*, PDF available online at:
<http://www.grandriver.ca/AboutGrand/ClimateChange08.pdf>

Garraway, M. and coauthors (2010): *Guide for Assessment of Hydrologic Effects of Climate Change in Ontario*, Ontario Ministry of Natural Resources report, prepared by EBNFLO Environmental AquaResource Inc., PDF available online at:
<http://tinyurl.com/l4ud96p>

Sanderson, M (1998): The Grand climate: weather & water in the Grand River Basin, *Grand River Foundation*.

Southam, C. F., R. J. Moulton, D. W. Brown, and B. N. Mills, (1999): The Potential Impact Of Climate Change In Ontario's Grand River Basin: Water Supply And Demand Issues. *Can. Water Resour. J.*, **24**, 307–330, doi:10.4296/cwrj2404307.

Veale B, Cooke S. 2017. Implementing integrated water management: Illustrations from the grand river watershed. *International Journal of Water Resources Development*; 33: 375-392.

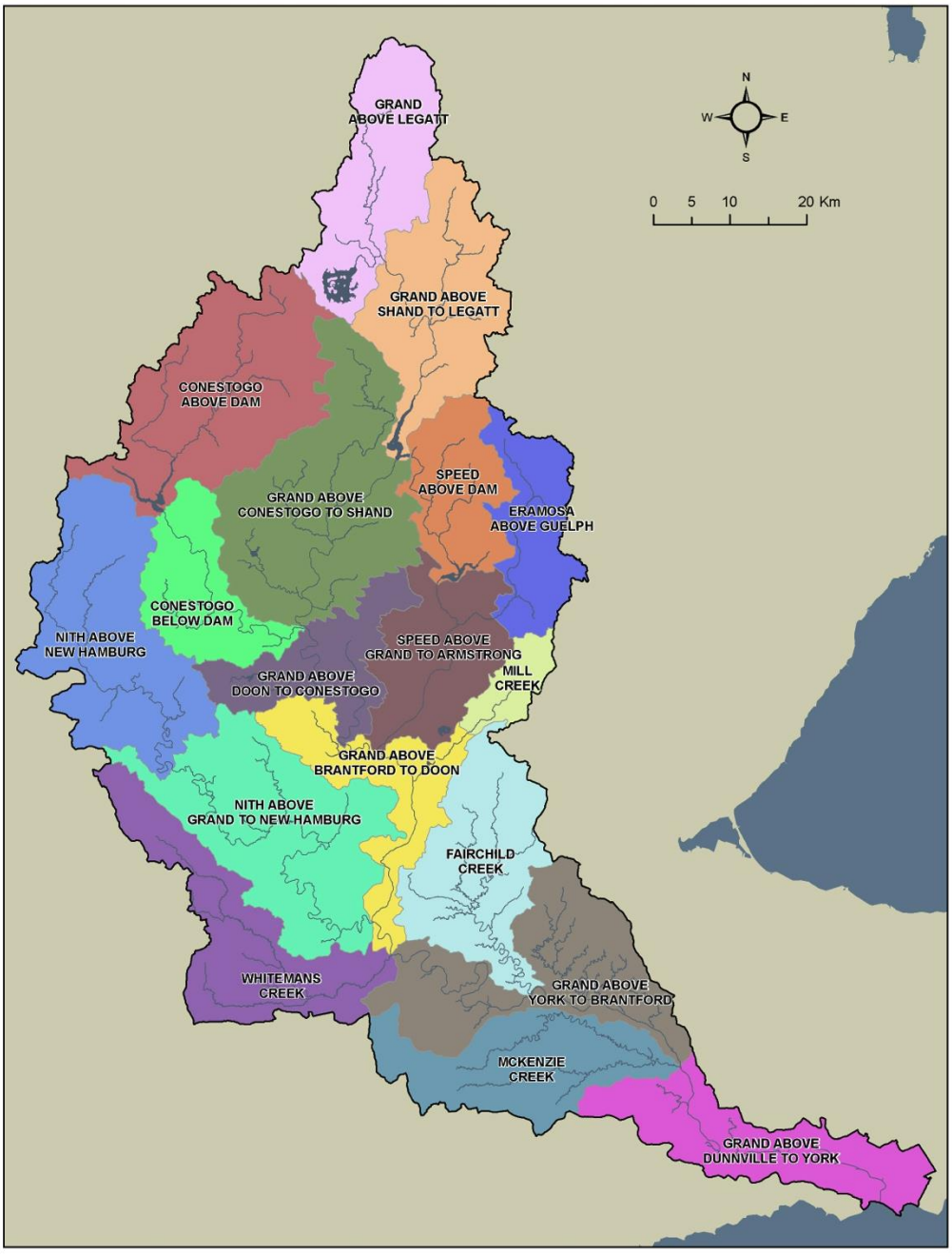

Figure 1: The Grand River watershed in Southern Ontario, with a selection of sub-watersheds. Courtesy of the GRCA.

Rubric for Term Paper

Criterion	60-69%	70-79%	80-89%	90-100%
Technical competence in data analysis tasks	Demonstrates limited competency; tasks are incomplete or inaccurate.	Demonstrates adequate competency; tasks are generally complete but still contain inaccuracies	Demonstrates considerable competency; tasks are fully completed and accurate	Demonstrates thorough competency; tasks are fully completed and accurate, and student demonstrates additional insight or skills
Appropriate use of sources, methods and terminology	Demonstrates limited use of sources; methods and terminology are not consistently applied	Demonstrates adequate use of sources; methods and terminology are applied consistently but with some inaccuracies	Demonstrates considerable use of sources; methods and terminology are applied consistently and with high levels of accuracy	Demonstrates extensive use of sources; methods and terminology are applied consistently, with high levels of accuracy and in novel and insightful ways
Critical and creative thinking skills	Uses critical and creative thinking skills with limited effectiveness	Uses critical and creative thinking skills with moderate effectiveness	Uses critical and creative thinking skills with considerable effectiveness	Uses critical and creative thinking skills with a high degree of effectiveness
Communication of information and ideas	Communicates information and ideas with limited clarity	Communicates information and ideas with some clarity	Communicates information and ideas with considerable clarity	Communicates information and ideas with a high degree of clarity and with confidence

Rubric for Presentations

Content:

1. Is the content of the presentation factually correct? (/20)
2. Does the presentation adequately cover the breadth of the topic? (/40)
    a. Brief summary
    b. What are the objectives?
    c. Major Findings
    d. What is the broader context in terms of Watershed Management?
3. Was the presenter able to successfully answer questions? (/5)

Appearance:

1. Is the presentation well illustrated? Is there too much writing in relation to graphics or is it appropriate? (/5)
2. Are the graphics and writing easy to read? (/5)
3. Does the flow of the presentation make sense with respect to the paper? (/5)

Delivery:

1. Are the presenters clear in their delivery (do they have good oral presentation skills)? (/10)
2. Were the presenters successful in making the paper interesting to this audience? (/5)
3. Was the presentation an appropriate length (~7 min)? (/5)