

Carleton University
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
DRAFT COURSE OUTLINE V2
Fall 2020

ENVE 3003 (GEOG 4103) Water Resources Engineering

Hours per week
Lect./Lab/P.A.
3 0 1

Learning Outcomes

Water resources engineering involves the analysis and design of systems to control the quality, quantity and distribution in time and space of water resources to meet societal needs while protecting human life and the environment.

By the end of the course, successful students will have achieved the following learning outcomes:

- Awareness of Federal and Provincial legislation related to the protection of our water resources
- Understand concepts of probability and risk in the context of return periods, extreme event distributions and meaning of a 100-year storm.
- Evaluate a water budget and estimate precipitation, interception and depression storage, infiltration, evapotranspiration and runoff
- Evaluate runoff flows and hydrographs
- Develop design storms and hydrographs
- Design flow control structures to reduce peak flows
- Design stormwater management systems to address stormwater quality and quantity
- Assess groundwater resources
- Understand the optimization of reservoirs to meet critical water needs (i.e. drinking water) and for flood control

Water resources engineers can work in a variety of firms and organizations. They work for engineering consulting firms or the City to evaluate and design systems to limit the impacts of development on flows in a river to ensure that the development does not cause flooding or significantly impact the quantity and quality of water resources. Stormwater retention ponds in new developments are a visible example. Water resources engineers work for conservations authorities to protect surface and subsurface water resources used for drinking water and control storage levels and flows from reservoirs. Ottawa gets its drinking water from the Ottawa River while rural residents and small smaller communities rely on groundwater resources. The Rideau Valley Conservation Authority controls the flows through the Rideau River canal system. Water resources engineers can work for all levels of government and research institutions to develop policy to protect water resources and to understand the impacts of climate change on our water resources.

Graduate Attributes (GAs): Engineering programs are accredited by the Canadian Engineering Accreditation Board (CEAB). As part of this process, we collect GA data to assess how effectively we are teaching or conveying the GAs with a goal to continually improve our programs. The GA data are aggregate data for a course and are NOT linked to student names or student numbers. The GAs assessed in this course include the following:

- GA 1.11.C Discipline-specific concept; Water Resources/Contaminant Hydrology
- GA 5.1 Engineering Tools; Diagrams and engineering sketches
- GA 5.2 Engineering Tools; Document-processing and graphics packages

For information on GAs and continual curriculum improvement, visit the Accreditation section of Engineers Canada website: <https://engineerscanada.ca/>

Topics covered:

- 1 **Introduction**, aspects of water resources engineering, global and regional water quantities, hydrologic cycle, water budget analysis, Canadian legislation
- 2 **Probability Concepts in Water Resources**, return periods, risk, reliability, probability distributions, analysis of hydrologic data, frequency analysis
- 3 **Precipitation/Rainfall**, generation and distribution, intensity and duration, IDF curves, design rainfall, snow, extreme rainfall events
- 4 **Rainfall Abstractions**, interception, depression storage, infiltration, Horton and Green-Ampt models, evapotranspiration
- 6 **Hydrologic Time Series Analysis**, stochastic time series, simple Markov models for river flows
- 7 **Runoff Models**, time of concentration, peak-runoff models, Rational Method, continuous-runoff models, hydrographs, unit hydrograph, time-area model
- 8 **Routing Models**, Modified Puls method, Muskingum method, hydraulic routing for reservoirs
- 9 **Stormwater Management**, stormwater quality, design flows, flood control, water-quality control, best management practices
- 10 **Groundwater Resources**, distribution and measurement, aquifer properties, well hydraulics, superposition, image wells
- 11 **Water Resources Planning and Management**, water supply, floodplain management, drought management, irrigation, dams and reservoirs

Required Texts

Water Resources Engineering, 2nd Edition, David A. Chin, Prentice Hall, 2006 or *3rd Edition*, 2012 (on reserve in library)

Reference Texts

Water Resources Engineering, 2005 Edition, Larry W. Mays (on reserve in library)

Lecture Notes

Provided on cuLearn

Marking Scheme

Quizzes	10%
Assignments	20 %
Midterm(s)	20 %
Final	50 %

Instructor: Dr. Paul Van Geel 6210 CB ext. 1884
(paul.vangeel@carleton.ca)

Teaching Assistants: TBA

Lectures: Tuesday 10:05-11:25 On-line
Thursday 10:05-11:25 On-line
Problem Analysis: Tuesday 4:35-5:25 On-line

Please note: Final exam papers will not be returned to students.

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. Visit <https://students.carleton.ca/course-outline/#accommodation-for-student-activities> for information. For an accommodation request the processes are as follows:

Pregnancy obligation: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website.

Religious obligation: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website.

Academic Accommodations for Students with Disabilities: If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the Paul Menton Centre website.

Survivors of Sexual Violence: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For

more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities: Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the policy (<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>)