

Carleton University
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
DRAFT COURSE OUTLINE
Fall 2022

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

Suggested Text

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

Reference Text

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

Lecture Notes

Provided in Brightspace

Marking Scheme

Assignments	20 %
Midterm	30 %
Final	50 %

Use of e-Proctoring system: This course has timed midterm and final examinations. If Carleton moves on-line due to COVID-19, the Carleton University e-Proctoring system may be used and requires the use of webcams, microphones, and smart phones.

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

Teaching Assistants: Jane Gao 1050 MC
(JaneGao4@gmail.com)
Abbas Khursheed 4107 CB
(AbbasKhursheed@gmail.com)

Lectures: Tuesday 2:35-3:55 pm 3020 Nicol Building
Thursday 2:35-3:55 pm 3020 Nicol Building
Problem Analysis: Thursday 6:05-6:55 pm 282 UC

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

Wellness and Mental Health are important issues and Carleton has some excellent resources. Please reach out and seek support from these resources when needed.

- <https://carleton.ca/cee/2021/11/student-support-and-wellness/>
- <https://carleton.ca/wellness/>

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. Visit <https://students.carleton.ca/course-outline/> 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 above 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 above 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 the [Equity and Inclusive Communities website](#).

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 [Senate Policy on Accommodation for Student Activities \(PDF, 25KB\)](#).

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are [a number of actions you can take](#) to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

Feeling sick? Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you must follow Carleton's [symptom reporting protocols](#).

Masks: Carleton has paused the [COVID-19 Mask Policy](#), but continues to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. It may become necessary to quickly reinstate the mask requirement if pandemic circumstances were to change.

Vaccines: Further, while proof of vaccination is no longer required as of May 1 to attend campus or in-person activity, it may become necessary for the University to bring back proof of vaccination requirements

on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible, and submit their booster dose information in [cuScreen](#) as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 response and health and safety requirements please see the [University's COVID-19 website](#) and review the [Frequently Asked Questions \(FAQs\)](#). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca.