



# ENGG\*4370 Urban Water Systems Design

01

Fall 2023

Section(s): C01

School of Engineering

Credit Weight: 0.75

Version 2.00 - September 06, 2023

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## 1 Course Details

### 1.1 Calendar Description

Estimation of water quantity and quality needed for urban water supply and drainage. Design of water supply, pumping systems, pipe networks and distributed storage reservoirs from analysis of steady and transient, pressurized and free surface flow. Rates of generation of flows and pollutants to sanitary and storm sewers, design of buried pipe and open channel drainage systems with structures for flow and pollution control. Modeling of water systems for sustainable urban development.

**Pre-Requisites:**

ENGG\*2230, ENGG\*3650

**Restrictions:**

Non-BENG students may take a maximum of 4.00 ENGG credits.

### 1.2 Course Description

The main goals of this course are (1) to learn to apply knowledge of hydrology and hydraulics to design of urban water systems; (2) to gain competence using software in the design and evaluation of urban water systems; and (3) to improve ability to clearly and concisely communicate the findings and implications of an engineering analysis.

### 1.3 Timetable

**Lectures (ROZH, Rm. 106)**

Tuesdays

11:30am - 12:50pm

Thursdays

11:30am - 12:50pm

**Labs (THRN, Rm. 2313)**

Wednesdays

2:30pm - 4:20pm

### 1.4 Final Exam

There is no final exam.

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## 2 Instructional Support

### 2.1 Instructional Support Team

<b>Instructor:</b>	Andrew Binns Ph.D., P.Eng.
<b>Email:</b>	binns@uoguelph.ca
<b>Telephone:</b>	+1-519-824-4120 x54011
<b>Office:</b>	THRN 2414
<b>Office Hours:</b>	TBA on CourseLink; or please arrange an appointment by email.

### 2.2 Teaching Assistants

<b>Teaching Assistant (GTA):</b>	Yusra Hasan
<b>Email:</b>	yusra@uoguelph.ca
<b>Office Hours:</b>	TBA on CourseLink.

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## 3 Learning Resources

### 3.1 Required Resources

#### Course Website (Website)

<http://courselink.uoguelph.ca>

Course material, news and announcements will be posted to the ENGG\*4370 CourseLink site. You are responsible for checking the site regularly. Selected lecture notes will be provided on CourseLink but students are expected to provide further annotation and may need to take full notes on some topics.

### 3.2 Recommended Resources

#### Chin, D.A., 2020. **Water-Resources Engineering. 4th Edition. Prentice Hall. (Textbook)**

To access the e-textbook, please refer to the instructions posted under Announcements on CourseLink.

### 3.3 Communication & Email Policy

Please use lectures and lab sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. Answers to frequently asked questions will be posted on CourseLink. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

When emailing the instructor or TAs with questions that are not answered by content posted on Courselink, please include ENGG4370 in the subject line.

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## 4 Learning Outcomes

The main goals of this course are (1) to learn to apply knowledge of hydrology and hydraulics to design of urban water systems; (2) to gain competence using software in the design and evaluation of urban water systems; and (3) to improve ability to clearly and concisely communicate the findings and implications of an engineering analysis.

### 4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Apply the laws of conservation of mass, energy and momentum to the analysis of hydraulic conditions in pipes flowing full or partially full
2. Apply knowledge of design considerations and employ software to design water distribution and wastewater collection systems
3. Translate an understanding of the effects of urbanization on the urban hydrologic cycle to specify stormwater management requirements
4. Apply knowledge of a broad suite of stormwater management alternatives to perform preliminary screening given design constraints and criteria
5. Integrate preventative design techniques into engineering solutions.
6. Design a stormwater management system to meet design criteria.
7. Evaluate a stormwater management system design using simulation software.
8. Concisely and articulately communicate the results of an evaluation of a stormwater management system design, as well as the relevance and implications of the results.

### 4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2, 3, 4, 5
1.4	Recall, describe and apply program-specific engineering principles and concepts	1, 2, 3, 4, 5
2	Problem Analysis	1
2.2	Identify, organize and justify appropriate information, including assumptions	1
2.3	Construct a conceptual framework and select an appropriate solution	1

#	Outcome	Learning Outcome
	approach	
2.4	Execute an engineering solution	1
4	Design	2, 3, 4, 5, 6, 7
4.2	Construct design-specific problem statements including the definition of criteria and constraints	3
4.3	Create a variety of engineering design solutions	5, 6
4.4	Evaluate alternative design solutions based on problem definition	2, 4, 6, 7
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	6, 7
5	Use of Engineering Tools	2, 7
5.2	Demonstrate proficiency in the application of selected engineering tools	2, 7
5.3	Recognize limitations of selected engineering tools	2, 7
7	Communication Skills	8
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	8
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	8
9	Impact of Engineering on Society and the Environment	3, 7
9.1	Analyze the safety, social, environmental, and legal aspects of engineering activity	3, 7
9.2	Evaluate the uncertainties and risks associated with engineering activities	3, 7
9.3	Anticipate the positive and negative impacts of introducing innovative technologies to solve engineering problems	7

## 5 Teaching and Learning Activities

Timing of course content subject to adjustment at the discretion of the instructor. Italicized topics are independent study.

## 5.1 Lecture

### Week 0

**Topics:** Course Outline; Hydraulics for Water Distribution Systems (WDS) I

### Week 1

**Topics:** Hydraulics for WDS II; Design Considerations for WDS I

### Week 2

**Topics:** Design Considerations for WDS II; Water Network Analysis, Quality

### Week 3

**Topics:** Aging Infrastructure and Emerging Crises; Hydrology Review and Urban Hydrology

### Week 4

**Topics:** Effects of Urbanization; Stormwater Management (SWM) Objectives / LID Approach

### Week 5

**Topics:** Tuesday Study Day: Independent Topics: *Overview of SWM/LID Practices, Better Site Design, Pollution Prevention*

Screening Level Design, Open Channel Hydraulics Review, Gutter, Inlet, Stormsewer Design

### Week 6

**Topics:** Design Criteria; Infiltration System Design

### Week 7

**Topics:** Bioretention and Bioswale Design; Conveyance Systems I; Guest Lecture

### Week 8

**Topics:** Conveyance Systems II; Hydrologic Routing; Stormwater Management Pond Design I

**Week 9**

**Topics:** Stormwater Management Pond Design II; Wastewater Design Flows and Hydraulics of Sewers

**Week 10**

**Topics:** Partial Pipe Hydraulics; Sanitary Sewer Design Considerations; Sanitary Sewer Design Procedure

**Week 11**

**Topics:** Sanitary Sewer Design Example Continued; Infrastructure Maintenance; Test 2

**Week 12**

**Topics:** Integrated Urban Water Management; Sustainability of Water Resources

**5.2 Lab**

**Week 1**

**Topics:** EPANET Tutorial 1 - Introduction to EPANET

**Week 2**

**Topics:** EPANet Tutorial 2 - Water Distribution Network System Modeling

**Week 3**

**Topics:** EPANet Tutorial 3 - Practice Test

**Week 4**

**Topics:** Test 1

**Week 5**

**Topics:** SWMM Tutorial 1 - Simulation of Pre-development site - Design storms

#### **Week 6**

**Topics:** SWMM Tutorial 2 - Simulation of Post-development site - Design storms and continuous data

#### **Week 7**

**Topics:** SWMM Catch-Up/Review Tutorial & Green Street Design project introduction

#### **Week 8**

**Topics:** SWMM Tutorial 3 - Simulation of Post-development - Controlled with Bioretention only

#### **Week 9**

**Topics:** SWMM Tutorial 4 - Simulation of Post-development - Control with Bioretention and other LID

#### **Week 10**

**Topics:** SWMM Tutorial 5 - Simulation of post-development - Control with Storm Sewers and Pond

#### **Week 11**

**Topics:** Work on Green Street Design project

#### **Week 12**

**Topics:** Work on Green Street Design project

### **5.3 Other Important Dates**

**Thursday, September 7, 2023:** Classes commence

**Monday, October 9, 2023:** Holiday (No classes scheduled)

**Tuesday, October 10, 2023:** Fall Study Break Day (No classes scheduled)

**Thursday, November 30, 2023:** Classes rescheduled from Tuesday, October 10 (Tuesday

schedule in effect)

**Friday, December 1, 2023:** Classes rescheduled from Monday, October 9 (Monday schedule in effect)

**Friday, December 1, 2023:** Last day to drop F23 one-semester courses and S23/F23 two-semester courses

## 6 Assessments

**Passing grade:** In order to pass the course, students must obtain a grade of 50% or higher.

### 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Quizzes	20
Test 1	20
Test 2	20
Project - Individual Written Submission	15
Project - Group Presentation	25
Total	100

### 6.2 Assessment Details

#### Quizzes (20%)

Five quizzes will be administered throughout the term (each quiz worth 4%). Quizzes will be distributed on September 15 (Quiz 1), September 29 (Quiz 2), October 20 (Quiz 3), November 3 (Quiz 4), and November 17 (Quiz 5). Quizzes will be due on the Monday following the date they are distributed (i.e., Quiz 1 is due on September 18; Quiz 2 is due on October 2; Quiz 3 is due on October 23; Quiz 4 is due on November 6; Quiz 5 is due on November 20). Quizzes will generally focus on the content of the lecture and labs covered in the previous two weeks. However, they may include material covered earlier that has relevance to new topics.

#### Test 1 - Water Distribution System Design and Simulation (20%)

**Learning Outcome:** 1, 2

Wednesday, October 4, 2023 (During Lab Period)

#### Test 2 - Sanitary Sewer Design (20%)

**Learning Outcome:** 1, 2

Thursday, November 23, 2023 (During Lecture Period)

#### SWMM Labs (0%)

**Date:** Weeks 5 to 10



Completion of Lab Activities Required. Students will not be placed in a group for the Green Street Design project in Week 9 if the preparatory labs have not been completed. Students are strongly encouraged to keep up with the weekly labs.

### **Green Street Design Project (40%)**

**Learning Outcome:** 5, 6, 6, 7, 7, 8

Friday, December 8, 2023 (group presentation/model results); Monday, December 11, 2023 (individual written submission). The final assessment will include a group presentation (25%) and an individual written submission (15%). The group presentation will be an in-person presentation and all group members are required to attend in-person to present. There is some flexibility if students have other final assessments around this date. This should be arranged with the instructor before the last day of classes. Presentation dates/times will be arranged with various options available to students over the period December 8-13, 2023.

## **7 Course Statements**

### **7.1 Course Grading Policies**

**Missed assessments:** If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please contact the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:

[http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec\\_d0e1400.shtml](http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e1400.shtml)

**Accommodation of religious obligations:** If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

**Missed quizzes:** If you miss a quiz due to grounds for granting academic consideration or religious accommodation, the weight of the missed quiz will be added to the weight for the remaining quizzes. There will be no makeup quizzes.

**Missed tests:** If you miss a test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the weight for the second test. There will be no makeup tests.

**Late assignments:** Late submissions of assignments will receive a 10% penalty per day. Assignments submitted after five days past the due date will no longer be accepted.

## **8 School of Engineering Statements**

## 8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

## 8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

## 8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

# 9 University Statements

## 9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

## 9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

### 9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

### 9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### 9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website

<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website

<https://www.ridgetownc.com/services/accessibilityservices.cfm>

## 9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

## 9.9 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

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