1. Introduction

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> 🔔 **Course Website**
>
> http://54.243.252.9/ce-3372-webroot/

Readings

> 🔔 **Textbook**
>
> Gupta, R.S., 2017. Hydrology and Hydraulic Systems, pp 1-39

> 🔔 **Additional Readings**
>
> 1. [Introduction to Water Resources Engineering Pages 1-33 from Wurbs,R.A., and James, W.P. (2002) Water Resources Engineering, Prentice Hall.](#)
> 2. [Introduction to Water Resources Engineeirng Pages 1-11 from Mays, L.W. (2011) Water Resources Engineering, J. Wiley and Sons.](#)
> 3. [Introduction to Water Resources Engineering Pages 1-8 from Chin, D. A. (2006) Water-Resources Engineering, Pearson-Prentice Hall.](#)
> 4. [Cleveland, T. G. (2020) *Water Systems Design Notes (Introduction Part 1) to accompany CE-3372*, Department of Civil, Environmental, and Construction Engineering, Whitacre College of Engineering.](#)
> 5. [Cleveland, T. G. (2020) *Water Systems Design Notes (Introduction Part 2) to accompany CE-3372*, Department of Civil, Environmental, and Construction Engineering, Whitacre College of Engineering.](#)
> 6. [Cleveland, T. G. (2020) *Water Systems Design Notes (Introduction Part 3) to accompany CE-3372*, Department of Civil, Environmental, and Construction Engineering, Whitacre College of Engineering.](#)

Videos

1. [none](#)

Lesson Outline

1. Course Overview
2. Types of Water Systems
3. Photo Essay
4. Software

Overview

The title of the course is water systems design. The catalog description is:

> CE 3372. Water Systems Design (3:3:0).Prerequesite: CE 33051, 33542.Hydraulic analysis and design of municipal water distribution, stormwater collection, and wastewater collection systems. Oral and written presentations. (Writing Intensive)

The general scope of the course is:

- Examination of design guidance documents for drinking water distribution systems, a review of pipeline hydraulics, demand estimation, then a design project related to a drinking water distribution system.
- The computer program EPANET is presented to provide a tool for the hydraulic modeling component of drinking water system design.
- Examination of design guidance for stormwater collection systems, presents a review of open channel hydraulics (as related to storm sewers), capacity (hydrology) estimation, then a design project related to a stormwater collection system.
- The computer program SWMM 5 is presented to provide a tool for the hydrologic/ hydraulic modeling component of the stormwater collection system design.
- Examination of design guidance for wastewater collection systems, then a design project related to a stormwater collection system.

The graded components of the course are:

- Quizzes (administered on a learning management system); individual activity
- Exercises (collected on a learning management system); individual activity
- Exams (administered on a learning management system); individual activity
- A design report (Three parts; collected on a learning management system); group activity
- A design presentation (administered on a learning management system); group activity

Water Systems Definition(s)

The course title is Water Systems Design, so a natural question is what is meant by a water system? In this course it refers to a water distribution system that conveys raw or treated water to customers, a storm water collection system that conveys storm water

away from infrastructure to reduce flooding damages and activities of daily life inconvenience,and wastewater collection systems that convey wastewater to treatment facilities for eventual release of the water back into the environment (or intentional reuse).

Water systems can be classified into three main categories (Chin, 2006; Mays, 2011):

1. Water-control systems – to control the spatial and temporal distribution ofsurface runoff from rainfall events (drainage engineering). They can also servea use role if the captured rainwater is used later on for water supply (rainwaterharvesting).
2. Water-use system – to support human habitation and include water-treatmentsystems, water-distribution systems, wastewater-collection systems, and wastewater-treatment systems.
3. Environmental restoration system – to manage spatial and temporal distributionof water (quality and quantity) in support of non-human habitation.

> **ⓘ Note**
>
> Cleveland, T. G. (2020) *Water Systems Design Notes (Introduction Part 2) to accompany CE-3372*, Department of Civil, Environmental, and Construction Engineering, Whitacre College of Engineering. is an extended version of this section

Water Control Systems

Spatial and temporal distribution of surface runoff from rainfall events (drainage engineering)

- Flood control
- Storm water harvesting
- Capacity is based on AREA served
- Hydrologicaly dominated designs

Water Use Systems

Spatial and temporal distribution in support of human habitation

- Water supply/treatment/distribution
- Waste water collection/treatment/discharge
- Capacity is based on POPULATION served
- Hydraulically dominated designs

Environmental Restoration Systems

Systems to manage spatial and temporal distribution in support of non-human habitation

- Create "desirable" conditions
- "Desirable" <= Policy <= Value Judgment

Water System Photo Essay

This brief photo essay is adapted from

> "Historical Urban Water Systems" by Dr. Robert Pitt, Department of Civil and Environmental Engineering, University of Alabama, Tuscaloosa, AL 35487 http://54.243.252.9/ce-3372-webroot/3-Readings/water-system-photo-tour/water-system-photo-tour.pdf

As we proceed through the tour, using the general definitions above, decide whether the picture represents a water control, water use, or environmental restoration system.

> **ⓘ Note**
>
> Cleveland, T. G. (2020) *Water Systems Design Notes (Introduction Part 3) to accompany CE-3372,* Department of Civil, Environmental, and Construction Engineering, Whitacre College of Engineering. is an extended version of the photo essay, with URLs to notable water systems worldwide.

Course Specific Software

In this course we will use **EPANET** pipe network simulator software with the EPA supplied GUI, and **SWMM 5+** drainage network simulator software with the EPA supplied GUI.

The remainder of the lesson demonstrates the installation of these tools:

Installing EPANET

EPANET as supplied by https://www.epa.gov/water-research/epanet also includes a graphical user interface (GUI) that will allow one to quickly build network simulation models, run them, and present results. The GUI runs on Windows machines using Intel/AMD hardware. It can be made to run on other operating systems and architectures, but not easily.

Follow the guidelines on the https://www.epa.gov/water-research/epanet or watch https://www.youtube.com/watch?v=HoZC4FPBQzI

You can also examine https://epanet22.readthedocs.io/en/latest/2_quickstart.html

EPANET with the GUI runs in the Windows environment and expects the underlying machine to be an x86-64 chipset. Generally this means an Intel or AMD-based machine.

> ⚠️ **Warning**
>
> *(circa 2020)* If you have a Chromebook or Raspberry Pi, or Macintosh EPANET as deployed from the EPA won't install directly. You can try WINE or other emulators but **YOU ARE ON YOUR OWN!**.
>
> A viable alternative is an Amazon Web Services (AWS) Lightsail instance. The $12/month service will run both softwares, and works like ordinary Windows.

Installing SWMM

Check your system

SWMM with the GUI runs in the Windows environment and expects the underlying machine to be an x86-64 chipset. Generally this means an Intel- or AMD-based machine.

> ⚠️ **Warning**
>
> *(circa 2020)* If you have a Chromebook or Raspberry Pi, or Macintosh SWMM as deployed from the EPA won't install directly. You can try WINE or other emulators but **YOU ARE ON YOUR OWN!**.
>
> An alternative for these cases is an Amazon Web Services (AWS) Lightsail instance. The $12/month service will run both softwares, and works like ordinary Windows.

Download the installer

URL to installer

Screen capture download

Run the installer

Screen capture running the installer

Check the install

To check the install, simply launch the program. If the GUI opens and renders the program is working. You can try a simple example if you wish.

Screen capture check

URL to SWMM by Example, load example 1

End of Section