Objective: Storm water discharges continue to cause impairment of our Nation's waterbodies. The ultimate goal of this course is to design retention and/or treatment facilities to reduce storm water runoff volumes and pollutant loads. We will first review hydro-climatic processes, including frequency analysis and estimations of design storms and flows (overland runoff and river discharges) and groundwater. The U.S. Environmental Protection Agency (EPA)'s Storm Water Management Model (SWMM) will then be utilized to compute watershed design runoff volumes and pollutant loads. The associated design problems will be solved through a series of complementary projects such as the estimations of design storms, post-development runoff, surface drainage, detention ponds, low impact development (LID), runoff water quality, and runoff treatment.

Prerequisite: CE 347. Corequisite: N/A.

Instructor: Omar I. Abdul-Aziz, Ph.D., Associate Professor, Dept. of Civil & Environmental Engineering; Office: ESB-611D; Tel: 304 293 9929; Email: oiabdulaziz@mail.wvu.edu.
GA: TBD.
Office hours: 12:00 PM-1:00 PM, MWF, ESB 611A

Required texts:
Storm Water Management Model Applications Manual; Authors: Jorge Gironás, Larry A. Roesner, and Jennifer Davis. National Risk Management Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, OH 45268. Available online (*free of charge*) at https://www.epa.gov/water-research/storm-water-management-model-swmm

Reference books/texts:
Storm Water Management Model User's Manual; Author: Lewis A. Rossman. National Risk Management Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, OH. Available online (*free of charge*) at https://www.epa.gov/water-research/storm-water-management-model-swmm

Water Resources Engineering; Author: Larry W. Mays; Publisher: Wiley; 2nd edition (2011), 920 pages, ISBN-10: 0470460644; ISBN-13: 978-0470460641.

Procedure: Material will be covered by lectures, not necessarily restricted to the texts and handouts. Students are expected to read the texts and/or other assignments thoroughly.

Evaluation: All work must be your own. Any evidence of copying or cheating will result in a grade of zero and may invoke further actions based on WVU policies on plagiarism/cheating.

> Homework, Attendance, and Class Performance: 10%
> Mid-term Exam: 20%; *No Final Exam*
> Design Projects (7-10): 70%

Instructor reserves the right to modify evaluation criteria. Here is a tentative grading policy: $93.3 \leq$ A ≤ 100.0; $90.0 \leq$ A- < 93.3; $86.7 \leq$ B+ < 90.0; $83.3 \leq$ B < 86.7; $80.0 \leq$ B- < 83.3; $76.7 \leq$ C+ < 80.0; $73.3 \leq$ C < 76.7; $70.0 \leq$ C- < 73.3; $66.7 \leq$ D+ < 70.0; $63.3 \leq$ D < 66.7; $60.0 \leq$ D- < 63.3; F < 60.0.

Important Notes:
(i)   All homeworks and project reports should be done neatly and professionally on **papers**. Pages must be numbered and stapled. The problem should be defined, diagrammed (if appropriate), and the solution should be developed in a step-by-step procedure. The final solution should be reported to two or three significant figures and underlined.
(ii) *Homework and project report* must be placed on the instructor's desk at the beginning of the class. *Software for each project (Excel and/or SWMM) should be uploaded on the shared Google Drive by the deadline*. No late submissions will be accepted without proof of extraneous circumstances.

(iii)   You are encouraged to work together in study groups; however, copied homework/project/exams will receive a grade of zero (0).

(iv)   ***Attendance is critical for a successful completion of the class***. It may be recorded regularly/randomly. Delayed entry interrupts the lecture. ***Students must come on time***.

(v)   *Academic misconducts, including cheating in homeworks/projects/exams, refusal to obey class rules and disrupting the instructions, and insulting/threatening the GA/instructor will NOT be tolerated.* ***Based on WVU bylaws, misconducts could result in removal from the class and/or permanent expulsion from WVU and/or legal prosecutions.***

Absence at tests: If absent, it is the student's responsibility to contact the instructor at least 24 hours before the exam to schedule a make-up, which <u>may</u> be scheduled at the instructor's discretion based on proper documents supporting any extraneous circumstances.

Course Outline

Date	Topic	Reference Chapter(s)
8/16	Introduction	
8/21	Review of hydro-climatic processes	7
8/23	Review of hydro-climatic processes	7
8/28 *(HW-1 due)*	Project-1: Estimations of design storms	10
8/30	Project-1: Estimations of design storms	10
9/4	Project-1: Estimations of design storms	10
9/6	Review of groundwater processes	6
9/11 *(Project-1 due)*	Review of groundwater processes	6
9/13 *(HW-2 due)*	Computation of design runoff	8
9/18	Computation of design runoff	8
9/20	Introduction to SWMM software and applications manual	
9/25 *(HW-3 due)*	*Mid-term Exam (hydroclimatology, design storms, runoff, groundwater)*	
9/27	Project-2: Post-Development Runoff	App. Manual
10/2	Project-2: Post-Development Runoff	App. Manual
10/4 *(Mid-term grades due)*	Project-2: Post-Development Runoff	App. Manual
10/9 *(Project-2 due)*	Project-3: Surface Drainage	App. Manual
10/11	Project-3: Surface Drainage	App. Manual
10/16	Project-3: Surface Drainage	App. Manual
10/18	Project-4: Detention Pond Design	App. Manual
10/23 *(Project-3 due)*	Project-4: Detention Pond Design	App. Manual
10/25	Project-4: Detention Pond Design	App. Manual
10/30 *(Project-4 due)*	Project-5: Low Impact Development (LID)	App. Manual
11/1	Project-5: Low Impact Development (LID)	App. Manual
11/6	*General Election; No Class*	
11/8	Project-5: Low Impact Development (LID)	App. Manual
11/13 *(Project-5 due)*	Project-6: Runoff Water Quality	App. Manual
11/15	Project-6: Runoff Water Quality	App. Manual
11/20	*Fall Recess; No Class*	
11/22	*Fall Recess; No Class*	
11/27	Project-6: Runoff Water Quality	App. Manual
11/29	Project-7: Runoff Treatment	App. Manual
12/4 *(Project-6 due)*	Project-7: Runoff Treatment	App. Manual
12/6	Project-7: Runoff Treatment	App. Manual
12/10 *(Project-7 due)*		

NOTE: **This is a course "outline", which can be revised by the instructor to implement the concepts of "dynamic curriculum" based on the continuing progress and response of the class.** You will be informed if changes are made. The reference chapters are taken from the reference book, *Water Resources Engineering* (Author: Larry W. Mays). App. Manual refers to the SWMM Applications Manual. HW refers to homework.