

CIEG 443-010/643-010

Watershed Engineering, Planning, and Design

Syllabus for Spring Semester 2009

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Institute for Public Administration - Water Resources Agency

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Class Hours:

Wed 9:30 am – 12:30 noon

Room 101 Recitation Hall

Texts & Resources

To be provided by instructor:

Delaware Sediment and Stormwater Regulations. Delaware Department of Natural Resources and Environmental Control, Division of Water Resources and Division of Soil and Water Conservation. January 1991, amended March 1993.

Stream Restoration: A Natural Channel Design Handbook. North Carolina Sea Grant. North Carolina State University and North Carolina A & T University. 2003.

Stream Corridor Restoration: Principles, Processes, and Practices. Federal Interagency Stream Restoration Working Group. USDA – Natural Resources Conservation Service. October 1998, revised August 2001.

Stormwater Best Management Practices. North Carolina Department of Environment and Natural Resources, Division of Water Quality. April 1999.

Maryland Stormwater Design Manual, Volumes I and II. Center for Watershed Protection and Maryland Department of the Environment. 2002.

Important related web sites:

www.ce.udel.edu	University of Delaware Department of Civil and Environmental Engineering
www.wr.udel.edu	University of Delaware, , Water Resources Agency
www.udel.edu/dgs/	Delaware Geological Survey
www.ipa.udel.edu	Institute for Public Administration
www.dnrec.state.de.us	DE Dept. of Natural Resources and Environmental Control
www.drbc.net	Delaware River Basin Commission
www.epa.gov	U.S. Environmental Protection Agency

Catalog Description

This course reviews the planning, design and engineering of watershed best management practices necessary to protect and restore the quality and quantity of surface and ground waters. Students will design various stormwater and watershed best management practices such as wet detention basins, bioretention wetlands, stream restoration and bioengineering, and soil erosion and sediment control plans. This independent study course is designed to prepare interested students for future careers in water resources engineering and watershed management.

Course Objectives

This course will enable students to:

1. Understand the delineation of watersheds and rainfall-runoff characteristics.
2. Review various Federal, state, and local laws and regulations (such as the TMDL provisions of the Clean Water Act) that require design of stormwater best management practices.
3. Design stormwater BMPs such as detention ponds and bioswales using open channel flow and hydrologic computer models.
4. Design groundwater recharge facilities based on water balance, soil moisture, and soil permeability methods.
5. Design stream restoration and bioengineering projects using stream geomorphology and open channel flow techniques.

Grading

Final grades will be based on the following calculations:

Project No. 1, Watershed Planning/Ordinances	25%
Project No. 2, Upper Christina River Floodplain Delineation, City of Newark	25%
Project No. 3, White Clay Creek Dam Removal/Shad Restoration Project	25%
Project No. 4, Design of Design of Green Roof/Stormwater BMP for UD campus	25%

Class Schedule

Module 1 – Watershed Planning

Wed Feb 11, 2009

- Introductions, syllabus review, review of text books
- Watershed delineation, land use, and soil characteristics
- Preparation of watershed plan – Christina Basin Watershed Restoration Action Strategy
- Federal regulations - Clean Water Act (TMDL provisions)
- State - Delaware stormwater and sediment regulations
- Local - New Castle County Unified Development Code - WRPA ordinance
- Stormwater BMP removal efficiencies
- Homework – Review www.cwp.org. Prepare one page summary of stormwater ordinance.

Module 3 – Upper Christina River Floodplain Delineation

Wed Feb 18 – Review floodplain delineation principles. Review USDA NRCS TR55 hydrology and US Army Corps of Engineers HECRAS hydraulics models.

Wed Feb 25 – Field survey stream cross sections and hydraulic structures along Upper Christina River.

Wed Mar 4 – Compute flood flows using TR55 model.

Wed Mar 11 – Compute flood elevations using HECRAS model.

Wed Mar 18 – Delineate floodplains using LIDAR topographic mapping.

Wed Mar 25 – Prepare floodplain delineation report

Module32 – White Clay Creek Dam Removal/Shad Restoration

Wed Mar 25 – Impacts of dams on stream environment.

Wed Apr 1 – Spring Break

Wed Apr 8 - Stream field survey at dam removal sites.

Wed Apr 15 – Stream field survey/sediment sampling. Kayak field reconnaissance.

Wed Apr 22 – Prepare design drawings, plan, profile, cross sections, specifications for dam removal/hydroelectric conversion.

Module 4 - Design of Green Roof Stormwater BMP for UD campus

Wed Apr 29 – Review green roof design criteria. Compute 2 – yr design flow. Select building for retrofit.

Wed May 6 – Field survey of candidate green roof retrofit on campus.

Wed May 14 – Produce plans, specification for green roof retrofit project. Plant pilot scale demonstration green roof at UDWRA building

Wed May 21 - Last Day of Class - Field reconnaissance (via kayak) along the White Clay Creek to monitor watershed BMPs.

Project Assignments

Grades are based on four projects, each pertaining to a different design module. Students may be asked to present their findings before the class. Each student will submit a 4 to 5 page report summarizing the design of each water resources engineering project according to the following schedule.

Project	Due Date
Module 1 - Watershed Planning/Ordinances	Feb 25
Module 2 – Upper Christina Floodplain Delineation	Mar 25
Module 3 – White Clay Creek Dam Removal	Apr 22
Module 4 - Design of Design of Green Roof/Stormwater BMP for UD campus	May 21