

## **Water Resources Policy and Watershed Management**

**UEP-0279-01**

**Scott Horsley**

**Fall Semester 2014 Friday Mornings 9:00 AM - 11:30 AM**

Course Summary: This course is designed to present a comprehensive approach to water resources management by integrating environmental science (geology, soils, hydrology) and policy (planning and regulatory analysis). It is intended for both students with and without technical backgrounds. I utilize numerous case studies from my own real-world experience as a consultant to USEPA, state and local governments, industry and NGOs. To the extent possible the course will include a field trip to visit actual project sites in the metro-Boston region.

The course is organized into a series of technical/foundation classes, followed by several resource and issue-specific focused sessions, and completed with discussions about possible management strategies/techniques and adaptive management approaches. The classes examine groundwater, lake, riverine, wetland and coastal management issues at the local, state, tribal, regional, national and international levels and rely heavily on practical case studies to illustrate successful methods. We will focus on an integrated water management approach that links drinking water, wastewater and stormwater management - seeking opportunities to keep water local and for re-use, balancing hydrologic budgets and minimizing costs in the face of climate change.

A broad range of water resource management strategies is examined including structural/nonstructural, regulatory/non-regulatory, and prevention/restoration approaches. Smart growth and low impact development (LID) techniques are presented as effective growth management and climate adaptation techniques. Incentive-based management strategies are presented to modify behaviors and to optimize public participation. Green infrastructure is presented as an innovative and alternative approach to conventional “grey” technologies and includes shellfish aquaculture, bioretention, reforestation of riparian buffers, ecotoilets, and ecosystem restoration.

Grading & Exams: Grades will be based upon three small assignments (10% each), a case study/term paper (50%) and a final presentation

of the case study/term paper (20%). The final presentation can be done in person at the last class/symposium or can be submitted as a video recording. Each student will be required to develop a watershed plan for a case study area that they select. The plan will incorporate an evaluation of the watershed's natural hydrology; the assessment of impacts of historical, current and future land uses; and the development of a targeted restoration/protection plan using a broad range of traditional and non-traditional (green infrastructure) techniques.

Reading Assignments: Reading assignments include numerous government websites, guidance manuals and scientific articles that are referenced throughout this syllabus. Most of these will also be posted on the class website. A guidebook, "EPA Watershed Protection Coursebook" will also be used as a reference document. This guidebook was prepared by my consulting firm for the U.S. Environmental Protection Agency for a nation-wide series of workshops with state and local government officials.

#### Dates - Topic Areas

#### **9/4 Goals of the Course/Overview of Water Resources Policy and Watershed Management**

Content: Course goals, requirements and overview.

#### **9/11 Scientific Framework for Water Resources Policy and Watershed Management: Geology/Soils/Hydrology**

Content: Basic scientific foundation for water resource and wetlands management. These are not highly-technical presentations but rather are directed at providing an adequate background for resource managers. Those who have technical backgrounds will benefit from these discussions as well.

Readings: EPA Watershed Protection Course Book, Chapters 1-2

<http://websoilsurvey.nrcs.usda.gov/app>

## **9/18 Identifying Water Resource Protection/Management Areas:**

Content: Strategies for identifying critical protection areas. Use of field methods, computer models and geographic information systems (GIS) to map (delineate) watersheds, wetlands, wellhead protection areas and aquifer boundaries. Discussion of accepted field survey methods, verification requirements, and controversies surrounding mapping water resource boundaries.

Readings:

[http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs144p2\\_014819.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_014819.pdf) (How to map a watershed) and <http://water.usgs.gov/ogw/pubs/Circ1174> (Estimating Areas of Recharge to Wells)

## **9/26 Methods of Assessing Water Quality Impacts & Identifying Contamination Sources**

Content: Review of techniques for identifying water resource contamination sources: land use mapping, GIS databases, analysis of local zoning ordinances (the “blueprint”) and field survey methods.

Readings: EPA Watershed Protection Course Book, pp 3-38 to 3-58 and 4-27 to 4-89

Assignment #1 Due: Delineate the Watershed

## **10/3 Establishing the Carrying Capacity of Water Resources: Water Quality Standards**

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Content: Discussion and analysis of how governments could/should establish the “carrying capacity”--the limit--of a water resources to assimilate impacts from land development and land use. Discussion of the techniques for establishing carrying capacity thresholds including Total Maximum Daily Loads (TMDLs).

Readings: <http://www.epa.gov/owow/tmdl/intro.html> (Introduction to

TMDLs)

Reference Material:

<http://www.epa.gov/owow/tmdl/nutrient/pdf/nutrient.pdf>

Assignment #2 Due: Hydrologic Budget

### **10/10 Freshwater Management (Lakes and Rivers)**

Content: Discussion of the values and functions of lakes and streams; interrelationships between lake ecosystems and their watersheds, aquatic problems and their identification and lake management techniques.

Readings: EPA Watershed Protection Course Book, pp 3-1 to 3-38, and <http://www.mass.gov/eea/agencies/dcr/water-res-protection/lakes-and-ponds/massachusetts-lakes-and-ponds-guide.html> (Massachusetts Lake & Pond Guide)

Assignment #3 Due: Carrying Capacity

### **10/17 Coastal Waters Management**

Content: Discussion of coastal water quality issues; impacts from watershed development, and coastal management techniques

Readings: EPA Watershed Protection Course Book, pp 4-1 to 4-27.

Reference Material:

[http://www.oceanscience.net/estuaries/report/3Bays/3Bays\\_MEP\\_Final.pdf](http://www.oceanscience.net/estuaries/report/3Bays/3Bays_MEP_Final.pdf)  
(Massachusetts Estuary Program Report - Three Bays)

### **10/24 Groundwater Management**

Content: Discussion of ground water management issues including water supply/demand, capacity and contamination. Techniques for ground water (wellhead) protection.

Readings:

<http://water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/upl>

oad/guide\_swppocket\_2002\_updated.pdf (Source Water Protection Guide - USEPA)

### **10/31 Stormwater Management**

Content: Discussion of stormwater as an emerging central focus of non-point source pollution management. Chronic loadings of load-based pollutants are being identified as significant sources of pollution to receiving waters. This class will look at EPA's Stormwater Management Program and Massachusetts' response to this issue as one of the nation's most recognized management programs.

Readings: <http://cfpub.epa.gov/npdes/stormwater/munic.cfm> (USEPA MS4 Stormwater Program, Massachusetts DEP Standards & Policy for Stormwater Management, Volume 1  
<http://www.mass.gov/dep/water/laws/policies.htm#storm> and EPA Watershed Protection Course Book, Chapter 6.

Reference Material: Massachusetts DEP Stormwater Management Handbook - Volume 2

### **11/7 Wetlands Protection**

Content: What is a wetland? Why are they important? Discussion of wetland resource areas, methods of delineation, values & functions and protection techniques.

Readings: EPA Watershed Protection Course Book, Chapter 5

### **11/14 Climate Change and Water Resources**

Content: Sea level rise, thermal shifts and storm intensity/frequency: How will these changes affect water resources. Some likely impacts include increased stormwater runoff/ pollution, increased floodplain areas, loss of drinking water supplies and migration of wetlands. Mitigation and adaptation strategies will be discussed and evaluated.

Reference Materials: USEPA, Office of Water Climate Change Policy and Massachusetts Climate Change Adaptation Plan Report

## **11/21 Water Resources Policy at the Federal Level - Clean Water Act/Safe Drinking Water Act**

Content: The United States has developed two principal water management laws: the Clean Water Act and the Safe Drinking Water Act. These laws will be examined as the cornerstones of US water law and how they impact water use and protection at the state and local government/community levels.

Readings: The Clean Water Act (<http://www.epa.gov/watertrain/cwa/index.htm>) and the Safe Drinking Water Act <http://www.epa.gov/OGWDW/sdwa/>

## **12/4 The Role of Local Governments in Water Resources Management**

Content: Despite decades of federal involvement in water resource management, the fact remains that public is highly-dependent upon local governmental actions and implementation to protect public water resources. An in-depth look at local governments' roles, responsibilities and opportunities to protect resources.

This analysis will include a survey of regulatory (zoning, subdivision and health regulations) and non-regulatory strategies (land acquisition, public education and monitoring). The concepts of smart growth and low-impact development (LID) will be examined as a new approach to regulating land use patterns.

Readings: EPA Watershed Protection Course Book, Chapters 7 & 8. [http://www.mass.gov/envir/smart\\_growth\\_toolkit/](http://www.mass.gov/envir/smart_growth_toolkit/) (Smart Growth Toolkit)

## **12/11 Case Study in Water Resources Management and Policy**

Content: The 2014 Cape Cod 208 Plan was prepared in response to litigation filed by the Conservation Law Foundation to bring the fifteen Cape Cod towns into compliance with the Clean Water Act. Fifty-seven

estuaries are impacted by excessive nutrient loading derived from wastewater, stormwater, fertilizers and natural sources. Traditional sewerage options have been defeated numerous times at town meetings and are deemed to be not affordable by the voters. The plan presents an innovative alternative approach that includes a broad range of green infrastructure including shellfish restoration, permeable reactive barriers, fertilizer management, ecotoilets and other decentralized solutions. An adaptive management plan provides a practical framework to implement and optimize an integrated array of strategies to attain compliance with the Clean Water Act.

Readings: Cape Cod 208 Plan, [www.capecodcommission.org](http://www.capecodcommission.org)

**12/13 (Tentative Date) Saturday afternoon 1-5 PM)**

**Course Symposium & Reception (Live Distance Connection Provided)**

Content: Presentations by class participants on individual watershed projects, group discussions on innovative management strategies/approaches, and presentations on selected strategies. Reception with refreshments to follow. This event is designed to give an opportunity for distance learners to attend a class function in person or through a live web connection.