

Pratt Institute: Syllabus

Pratt Institute Graduate Center for .

Planning & Environment/School of Architecture

Semester Spring 2006

EMS 621- Environmental Mini-Course: Water Quality Management Systems and Alternatives (February 27-April 3)

Credits - 1 Location –Higgins Hall North, Rm. 108 Day and Time – Mon. 5:30-8:30pm

Type of Course - Lecture/Seminar/Mini-Course

Elective

Enrollment Capacity - 15

Professor: Paul S. Mankiewicz, Ph.D.

e-mail paul.mankiewicz@gaia-inst.org or GaiaInst@aol.com Tel: 718-885-1906

Coordinator: Eva Hanhardt evahanhardt@nyc.rr.com (home) ehanhard@pratt.edu

Tel - 212-529-1274 (evening/day)

MINI-COURSE DESCRIPTION:

This mini-course will present relevant concepts, literature, and practices, both historical and current, relating to Water Quality management. Particular emphasis is placed on the science of water and on new innovations in water quality management systems and approaches including watershed planning and natural waste water systems. The course will examine the environmental planning implications of various practices and technologies relating to water management and will prepare planners and architects to identify and promote more sustainable practices. The class will be taught by a visiting Professor who is leading professional in the field of Water Management. The Professor will be assisted in preparing for and conducting the Mini-Courses by the Environmental Planning Coordinator. The Coordinator will also be available, as needed, to assist and advise students.

COURSE REQUIREMENTS:

The class will include readings, lecture, class discussion, and, where appropriate, site visits and/or field work. Required readings will be provided either in class or electronically.

- Selections from Life in Moving Fluids, Steven Vogel, Willard Geant Press
- Additional individual readings will be handed out weekly.
- Students will also be provided with a listing of Readings and web pages relating to each of the topics

Students are expected to complete all assigned readings and participate in class discussions.

Students must stay current with required readings as the quality of class discussions depends on all students staying abreast of the reading.

For materials from the Internet, students should have a good grasp of the material and read thoroughly those parts that will assist them in class discussions

Final – A take home final exam will be given that asks the students to use the knowledge and skills they have learned in specific applications and to answer specific questions.

GOALS/LEARNING OBJECTIVES:

As an environmental specialty Mini-Course, the goal of the class is to familiarize students with relevant science, concepts, literature, and practices, both historical and current, relating to Water Quality Management Systems and Alternatives at the local, regional, national and global levels. The mini-course gives students concrete technical and analytical skills and an understanding of real world applications that will be important to their work as planners, architects, designers and/or environmentalists. Students will be required to critically evaluate what they have read and heard. In addition, the class will give students an opportunity to learn how to express their ideas verbally and through the final application assignment.

The purpose of the final exam is to give the students personal experience in applying the knowledge and skills presented in the course. Students will learn the fundamentals of gathering and applying environmental information; evaluation of appropriate methods and technologies; presentation of ideas and in quantitative and written form.

METHODS OF ASSESSMENT:

50% of a student's grade will be for the quality of contributions to class discussion.

50% of a student's grade will be for the quality of the final application

COURSE OUTLINE:

Week 1:

- ❖ The physical chemistry of water: The Biosphere
- ❖ How water regulates conditions at different scales:
 - Global scale/the Biosphere
 - Forest/meadow/city scale
 - The leaf
- ❖ Phase Changes and Partition Coefficients
 - Solubilities and diffusion: how water becomes polluted
 - The hydrologic cycle and pollution
 - Water and capillarity
 - Clay and humus: surface area multipliers and filters

Readings :

Life in Moving Fluids, Steven Vogel, Willard Geant Press (Selection provided electronically)

The Biosphere-Sept1970 SciAmer,DavidGatesArt Sept71Sci Amer

Week 2:

- ❖ Water, Plants, Microbes and Soil: interfaces in action
 - The scale of biological interfaces –
 - Interfaces, exchange, and water treatment
- ❖ Principles Governing Flow
 - Geometry of flow
 - Bernoulli's equation and the design of Prairie Dog burrows-
 - Designing into laminar and turbulent flow

- How laminar flow, diffusion & osmosis govern exchange and filtration in fluids
- ❖ Example: Wastewater treatment
 - Primary, Secondary, and Tertiary Treatment
 - Grand Innovations:
 - Activated Sludge
 - Activated Surfaces (DynaSand, et al.)
 - Membranes & reverse osmosis
- ❖ Coupling Natural Systems with Wastewater Treatment
 - Tertiary treatment wetlands
 - Using suspension feeders (mussels, clams & oysters) and seaweeds to improve water quality (tertiary water treatment) around NYC wastewater treatment facilities?
 - Nitrogen and pathogen discharges
 - A mass flow evaluation of the marshes and filter feeders

Readings:

Vernadski, Mankiewicz, Tim Wood thesis (provided by Professor)
Life in Moving Fluids, Steven Vogel, Willard Geant Press (Selection provided electronically)

Week 3:

- ❖ Drinking Water Supplies and Watersheds
 - Scaling clean water supplies with populations
 - How watersheds supply ecosystems services that clean water
 - John Jarvis and the building of the Croton
 - Forests, soils, wetlands and the scale of infrastructure in watersheds
 - Limits to growth: clean water and development
 - Terracing, berms, and wetland retention and groundwater storage: methods for enhancing watershed function
 - Pervious infrastructure in watersheds: a viable method to enhance water capture?

Readings:

Liquid Assets: A History of New York City's Water System, Diane Galusha, Purple Mountain Pr Ltd 1999

Water: A Natural History, Alice Outwater, Basic Books (October 1, 1997)
From Know-How to Nowhere: The Development of American Technology, Elting Elmore Morison, Basic Books

NYC Watersheds <http://nyc.gov/html/dep/watershed/home.html>

Celebrating NYC Clean Drinking Water
<http://www.nyc.gov/html/dep/html/celebrate.html>

White Paper on Why New York City Needs a Filtered Croton Supply
<http://www.nyc.gov/html/dep/pdf/croton/whitepaper.pdf>

Week 4:

- ❖ Stormwater, Non-point Pollution, and Combined Sewers: Foibles of Historic Design
 - Soils, infrastructure and runoff: impacts of development on water quality and quantity
 - Impervious surface and runoff: an insoluble urban problem?
 - BlueBelts- NYC DEP innovations
 - Soils & Infiltration- coupling development with water capture
 - Seattle's SEA Streets
 - NYC Dept of Parks & Recreation and the new hydrologically connected GreenStreets
 - Biogeochemistry and a new form of brownfield mitigation/park creation-enhancement.

Readings:

DEP Environmental Newsletters (see Readings/Websites below)

The Staten Island Bluebelt: A Natural Solution to Storm Water Management

<http://www.nyc.gov/html/dep/html/news/bluebelt.html>

Additional handouts from previous week

Week 5:

- ❖ Designing with Water: A Wastes into Resources Paradigm for Urban Redevelopment
- ❖ Greywater: \approx one half the wastewater in New York City (1/2 of 1.2 billion gallons, 600,000,000 gallons of water per day, an energy equivalent of about a trillion kilocalories)
- ❖ Stormwater - 5 billion gallons of water in each inch of runoff from 300 square miles
- ❖ Organic Wastes- 2,500 tons per day
- ❖ Designing and building structures that make their own climate and enhance environmental quality
 - GreenRoofs, water and energy budgets
 - Putting water to work cooling and heating cities
 - Latent heat of vaporization & heat of fusion
 - Community gardens designed to use a major fraction of the NYC organic waste stream and incorporate local stormwater
 - Using composted NYC biosolids to mitigate lead and hydrocarbons and treat stormwater in brownfields

Readings:

2003 New York Harbor Water Quality Report:

<http://www.nyc.gov/html/dep/html/news/depnewshwqs.html>

<http://www.nyc.gov/html/dep/hwqs/pdf/hwqs2003.pdf> PDF Version (3.1 Mb)

Handouts from previous week

Readings, Web pages, Reports

- **Liquid Assets: A History of New York City's Water System**

by *Diane Galusha*

Publisher: Purple Mountain Pr Ltd 1999

New York City's water system is, by every measure, an engineering marvel. Delivering 1.2 billion gallons of water each day to more than nine million people, it is a complex network of reservoirs stretched out over a vast upstate region and connected by a web of subterranean aqueducts to rival the aqueducts of the ancient Romans. The system, so pivotal to the development of the nation's largest city and its northern suburbs, was realized over the past century and a half, and indeed is still being built beneath New York City's subways and skyscrapers. This is the first comprehensive history of that system from colonial times to the present.

- **Water: A Natural History**

by *Alice Outwater*

Paperback: 224 pages, Publisher: Basic Books (October 1, 1997)

This story about American water begins, surprisingly, back in Europe during the Middle Ages, when peasants living in cramped quarters close to their animals were probably warmer than the rich in their drafty great halls.

- **Celebrating NYC Clean Drinking Water**

<http://www.nyc.gov/html/dep/html/celebrate.html>

- **White Paper on Why New York City Needs a Filtered Croton Supply**

DEP has issued a white paper explaining the reasoning for why the City needs to filter the water from its Croton water system. The 18-page report, entitled "Why New York City Needs a Filtered Croton Supply," details issues facing the City's oldest water system and steps the DEP is taking to address them.

The paper documents that filtration in conjunction with a strong watershed protection program is the most effective way to protect the public and increase the reliability of the water supply. The report is summarized in a [press release](#), or is available in its entirety below: <http://www.nyc.gov/html/dep/pdf/croton/whitepaper.pdf>

- **DEP Environmental Newsletters**

Winter/Spring 2005, covering important environmental programs that the agency is involved in within New York City and the upstate watersheds. In this issue: the NYC Noise Code, Watershed Security, the Gowanus Canal and more. [More](#) ▶
<http://www.nyc.gov/html/dep/html/news/depnewsletter05.html>

Winter/Spring 2004: Progress on City Water Tunnel No. 3, The City Explores Options for Protecting the Croton Water Supply, Restoring the Ecology of New York City, and more. <http://www.nyc.gov/html/dep/html/news/depnewsletter04.html>

July 2001: Summer Water Conservation, the First Conservation Easement Closing, Grease Protection Program, the Kensico Dam Plaza Educational Display Unveiling, and more. <http://www.nyc.gov/html/dep/html/news/newsplash2.html>

June 2001: The New York Power Authority Fuel Cell Program, DEP's Beach Protection Program, the Hudson River Bicycle Path, and more.
<http://www.nyc.gov/html/dep/html/news/newsplash1.html>

- **The Staten Island Bluebelt: A Natural Solution to Storm Water Management**

The Staten Island Bluebelt provides ecologically-sound and cost-effective storm water management for the South Richmond area of Staten Island. The project preserves streams, ponds and other wetland areas – called Bluebelts – allowing them to perform their natural functions of conveying, storing, and filtering storm water. In addition, the Bluebelts also provide important community open spaces and diverse wildlife habitats. [More](#) ▶

<http://www.nyc.gov/html/dep/html/news/bluebelt.html>

- **NYC Watersheds**

<http://nyc.gov/html/dep/watershed/home.html>

- **2003 New York Harbor Water Quality Report:**

<http://www.nyc.gov/html/dep/html/news/depnewshwqs.html>

<http://www.nyc.gov/html/dep/hwqs/pdf/hwqs2003.pdf> PDF Version (3.1 Mb)