

Aquatic Environmental Science

13. Management of Aquatic Environments



Management of Aquatic Environments

Direction (Policy)

- Environmental Management
- Ecosystem Management

Component

- Hydrology, Hydraulics
- Morphology, Sediment
- Water Quality, Biogeochemistry
- Biological Community

Methodology

- Water Resources Management
- Sediment Control
- Pollution Control
- Regulation on Species Distribution

Ecosystem Service



Millennium Ecosystem Assessment, 2005

Targets in Ecosystem Management

- Preservation（保存）：To preserve a system as it is
- Protection（保護）：To protect a system from external impacts
- Conservation（保全）：To maintain a system not to be deteriorated while people use it.
- Restoration（回復）：To restore a system to the condition which serves ecological functions same as the one before deterioration
- Rehabilitation（再生）：Similar to restoration, but not completed
- Creation（創出）：To create a new system which differs from its original system in terms of function and structure

Today's Program

- 15 min. Introduction and Consideration
- 20 min. Initial Opinion
- 25 min. Second Read and Group Discussion
- 10 min. Presentation "Grazing"
- 10 min. Presentation "No Grazing"

Questions and comments will be counted.

Grazing in Vernal Pools Restoration Management Decisions

The Situation

The U.S. Fish and Wildlife Service has recently acquired 200 acres of open land in the Central Valley of California. This land once supported vernal pools that were home to many endemic and endangered flora and fauna. Unfortunately, over the last decade human activities such as off-road driving have significantly degraded the landscape. Because of this degradation invasive species have taken over both the uplands and the pool basins.

The acquired site has been approved for an active restoration plan that seeks to create ...

Lecture schedule

- 1) June 13, Mon., Guidance to aquatic environmental science
- 2) June 16, Thu., Present state and properties of water
- 3) June 20, Mon., Watershed hydrology and aquatic ecosystem
- 4) June 23, Thu., Sediment and habitat dynamics
- 5) June 27, Mon., pH and redox potential
- 6) June 30, Thu., Dissolution and Kinetics
- 7) July 4, Mon., Particle and adsorption (with a guest speaker)
- 8) July 7, Thu., Mid-term exercise
- 9) July 11, Mon., Primary production (with a guest speaker)
- 10) July 14, Thu., Nutrient cycle
- 11) July 18, Mon., Organic carbon dynamics and microbial community
- 12) July 21, Thu., Biodiversity and species distribution
(with a guest speaker)
- 13) July 25, Mon., Fate and transport of pollutants
- 14) July 28, Thu., Management of aquatic environments**
- 15) August 1, Mon., Exam (Presentation and Report)**

Class on August 1

- 30 min. Exam
- 50 min. Preview
- 10 min. Lecture Evaluation

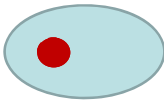
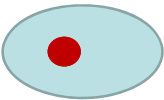
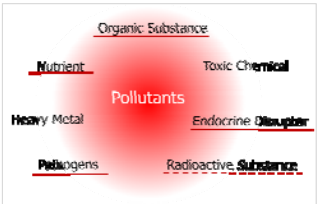
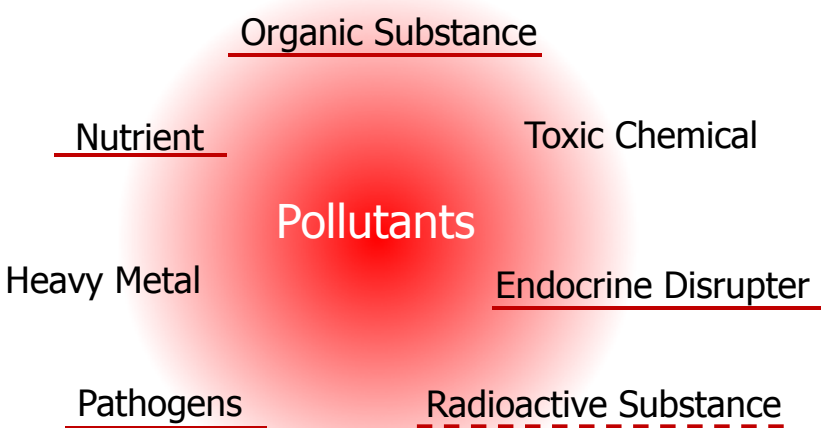
Student Evaluation (weight)

- Exercise and Report 25%
 - Mid-term Exercise 25%
 - Final Exam 50%
- # More than 9 times of attendance (exams not included) are required for the credit.

Appendix

Principle of Water Treatment

Pollutants in Aquatic Environment



Separation

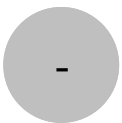
Decomposition

Organic Substance
Chemical Substance
Pathogens



Nutrient
Heavy Metal
Radioactive Substance

Transformation



Pollutants & Water Treatment Techniques

	Screen/ Sedimentation	Coagulation	Filtration	Floatation	Stripping	Microbes	Adsorption	S. P. Extraction	Cl Oxidation	UV Oxidation	Membrane	Adv. Oxidation
SS	✓	✓	✓	✓								
BOC						✓						
VOC					✓		✓					
Pathogens									✓	✓		✓
Nitrogen					✓	✓		✓				
Phosphorus		✓				✓						
POPs							✓					✓
Heavy Me.		✓						✓				
NOM								✓			✓	

Separation/Decomposition

Wastewater Engineering, McGraw-Hill, 2003

Major Sewage Treatment Methods

Component	Category	Treatment
Solid (Suspended Matter)	Primary	Physical (Sedimentation)
Organics	Secondary	Biological (Activate Sludge)
Nutrient (N, P)	Tertiary	Biological
Pathogens	Disinfection	Oxidation

In principle domestic WWTP doesn't have a process to remove harmful substances.

	Separation	Decomposition
Organic Substance Chemical Substance Pathogens	✓	✓✓
Nutrient Heavy Metal Radioactive Substance	Transformation ✓✓	-

General Removal Efficiency

Category	Process	BOD %	COD %	SS %
Primary	Sedimentation	30-50	30-50	40-60
+ Secondary	Activated Sludge, others	90-95	90-95	75-85

Common Sequence of Domestic WWTP

- Physical Treatment (Primary Treatment)
 - Screening
 - Sedimentation
- Biological Treatment (Secondary Treatment)
 - Activated Sludge
- Advanced Treatment (Tertiary Treatment)
 - Oxidation by Ozone or UV
 - Activated Carbon or Biological Activated Carbon
- Disinfection
 - Chlorination, Ozone, or UV

Sludge Treatment

- Concentration
- Digestion (anaerobic, aerobic)
- Adjustment
- Dehydration
- Compost
- Drying
- Incineration
- Melting



Incineration ash of sewage sludge containing radioactive material (Kanagawa prefecture)

