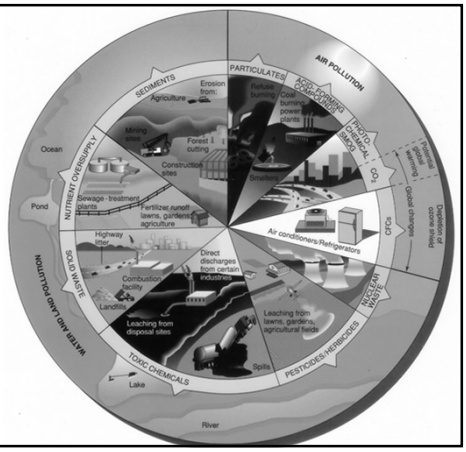
Water

Is the solution to pollution, dilution?

Miller Chapter 21

The World Health Organization (WHO) estimates that 3.3 million die every year from contaminated water

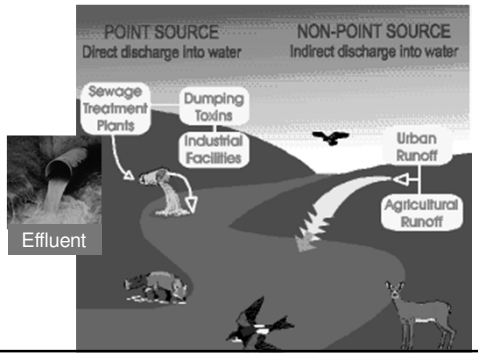
The Different types of pollutants that effect our environment



Runoff from anthropocentric sources creates a multitude of problems

Federal Water Pollution Control Act.

- Established the basic structure for regulating discharges of pollutants into U.S. waters
- Allowed EPA to set wastewater standards for industry
- Made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions.
- Recognized the need for planning to address the critical problems posed by nonpoint source pollution .

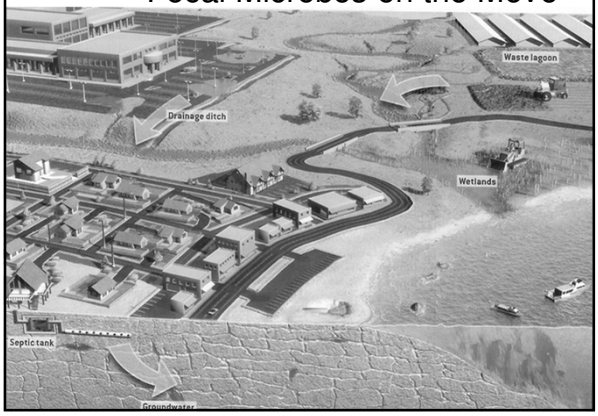


How does urbanization affect water quality?

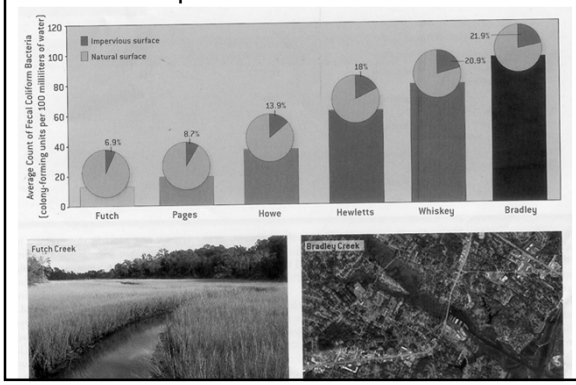
DRUGS IN OUR WATER

- Surfactants are disruptors, field studies show that fish are becoming “intersex”, males bear immature eggs
- In Germany barbiturates are found in the water even though they were replaced 30 years ago
- Up to

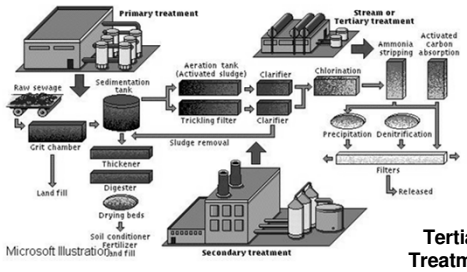
Fecal Microbes on the Move



Coliform Bacteria count
Asphalt to natural surfaces



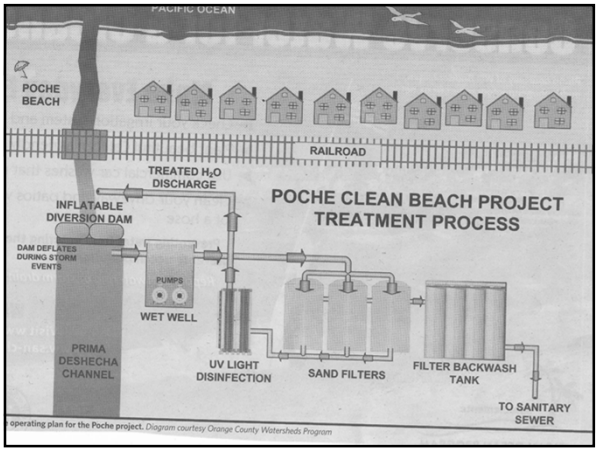
Wastewater Treatment Plant



Primary Treatment-

Secondary Treatment-

Tertiary Treatment-



Orange County is now treating grey water and injecting it into the groundwater basins to recharge the aquifers

Alternatives to Wastewater Treatment

Arcata, CA. A diverse community whose resourcefulness has demonstrated that a constructed wetland system can be a cost-efficient and enviromentally sound wastewater treatement solution. Stimulate and encourage this kind of sound environmental design in your community.

For practical low-scale purposes of water treatment on a school campus, onsite wastewater can be provieded by means of a product similar to a "Living Machine". Pictured above, these products have been designed and constructed to utilize the natural processes to purify wastewater. This technology is an excellent teaching tool.

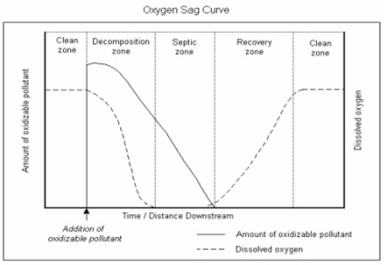
The most contaminated beaches in America

How do we improve water quality?

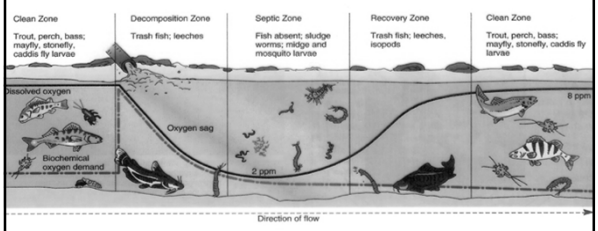
BEACH LOCATION	TYPE OF BACTERIA MEASURED	HIGHEST COUNT (CFU PER 100 MILLILITERS)	NUMBER OF CLOSURE OR ADVISORY DAYS IN 2004
Doheny State Beach Orange County, California	*Enterococcus*	38,800	312
Phil Foster Park Palm Beach County, Florida	*Enterococcus*	600	108
South Shore Beach Milwaukee County, Wisconsin	*Escherichia coli*	2,419	72
Myrtle Beach Horry County, South Carolina	*Enterococcus*	1,130	54
Cole Park Nueces County, Texas	*Enterococcus*	14,400	53

How does the discharge of organic matter effect aquatic organisms?

Oxygen Sag Curve

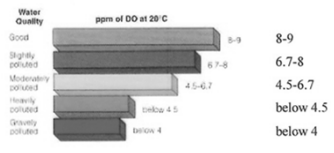


Oxygen Sag Curve with Critters



The time & distance for a water system to recover depends upon the volume, flow rate, temperature, pH, and amount of incoming oxidizable pollutants

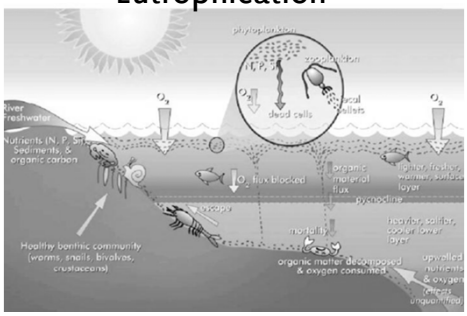
The amount of dissolved oxygen in water is a measure of water quality



8-9
6.7-8
4.5-6.7
below 4.5
below 4

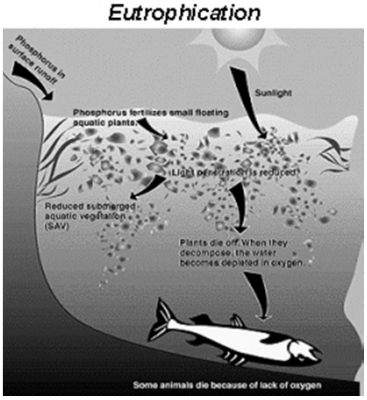
The slope of the curve depends upon the amount of pollution added

Eutrophication



As nutrients enter water, phytoplankton bloom consuming nutrients, block off light and oxygen flow from surface, benthic plants and animals die, raises BOD lowers DO

Biological Effects of Eutrophication

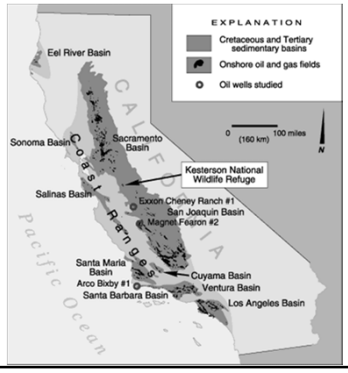


Matt of algae at surface characteristic of a Eutrophic Lake

Mississippi Delta Dead Zone

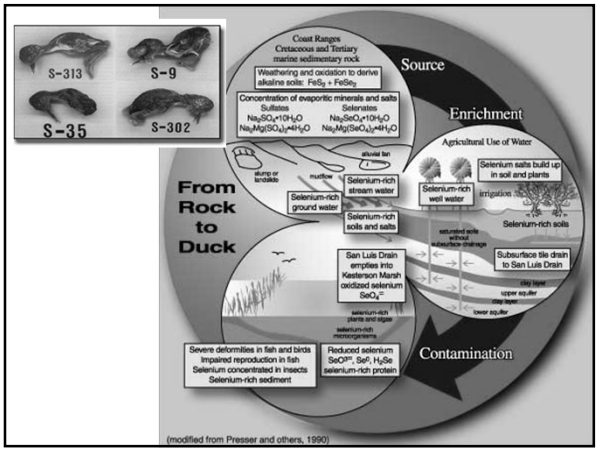
Dead Zones throughout the world

Kesterson Wildlife Refuge San Joaquin Valley

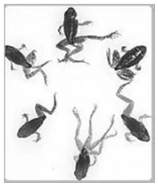


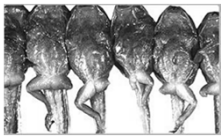
The Kesterson Story

- In the early 1980s, waterfowl in marshy areas of San Joaquin Valley started appearing with birth deformities. Scientists traced the cause of this disaster to the element
- The selenium was carried into the refuge in the irrigation water flowing from the drainage canal. Selenium concentration was low in the original irrigation water, but in the dry California valley, water used in irrigation evaporated quickly from the soil, concentrating the selenium.



Catfish living in a polluted water system

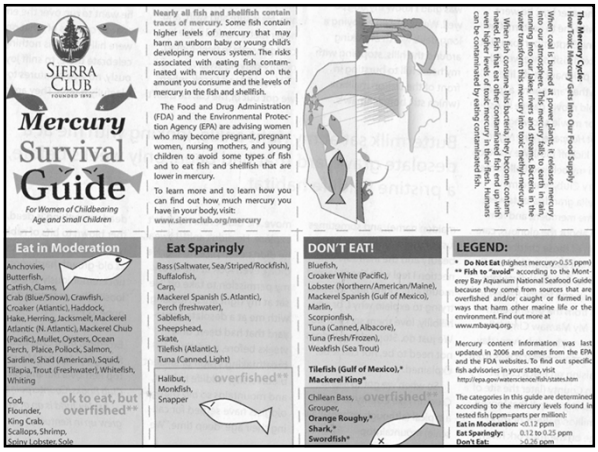




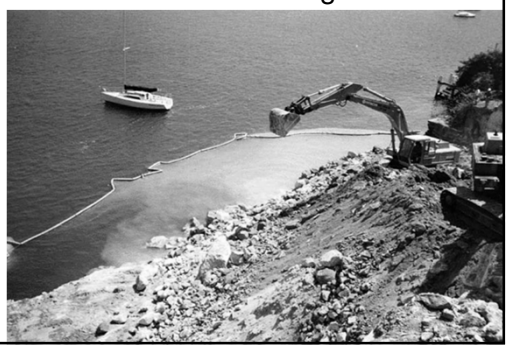
Frogs mutated from pesticides

Common water pollutants

- **Heavy metals-**
  mercury -due to acid rain, burning coal: damages nervous system
  lead-paint
  arsenic-herbicides and wood preservatives
  aluminum- leaching from acid deposition-role in dementia and Alzheimer's
- **Heat-**thermal
- **Nutrients**- nitrates and phosphates
- **Sediment**
- **Organic material-** sewage and agricultural runoff

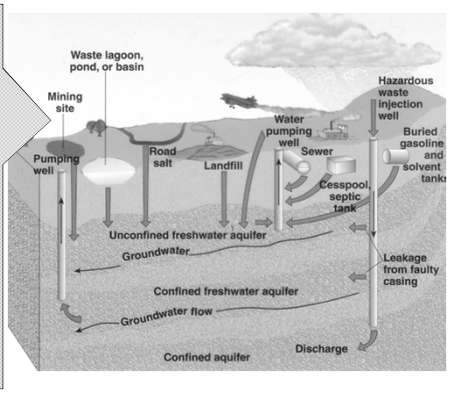


Sediment pollution from construction, contained due to Environmental Regulations

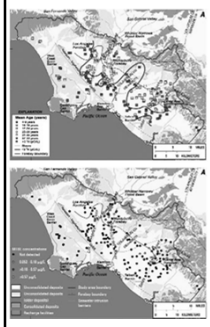


Sources of Groundwater Pollution

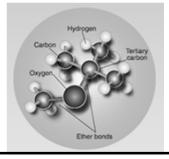
12 million tons of radioactive uranium mill tailings are sitting a couple hundred feet from the Colorado River in Moab, Utah.
LA Times 3/5/05



MTBE
Methyl tertiary butyl ether



In 1996 Santa Monica closed down 7 of its 11 municipal wells due to MTBE contamination

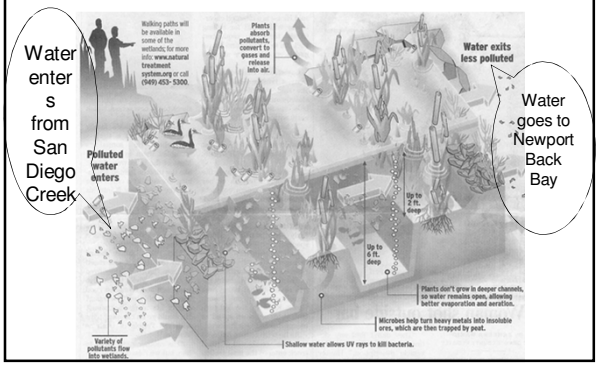


Point Source Pollution

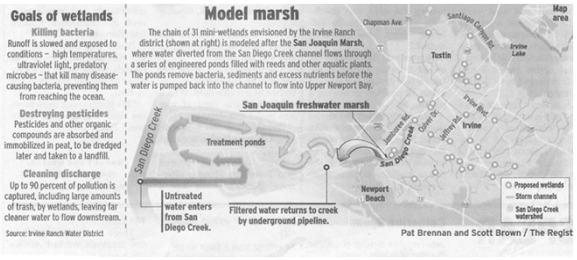
- The textile industry discharges 53 billion gallons of waste effluent a year, this is loaded with reactive dyes and hazardous waste
- The paper and wood pulp industry produces more than 100 million metric tons of effluent
- The bleaching of wood pulp with chlorine is a major source of dioxin

Cleaning Contaminants Nature's Way

San Joaquin Marsh Created by Irvine Ranch Water District

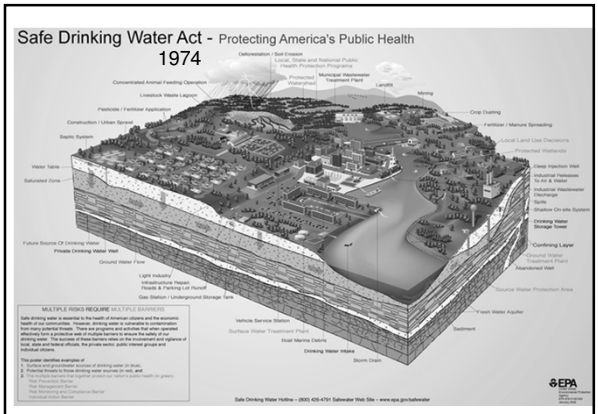


The San Joaquin Marsh is a model for water treatment worldwide and is monitored by UCI



Safe Drinking Water Act - 1974

Protecting America's Public Health



Set levels for pathogens and dangerous contaminants

Some Pathological Contaminants of Drinking Water

- **Bacteria**
  - **Typhoid Fever**
  - **Cholera**
  - **Dysentery**
- **Virus**
  - **Hepatitis**
- **Parasitic**
  - **Amoebic Dysentery**
  - ***Crytosporitium***

Coliform Bacteria are an indicator of water quality

*

Green Chemistry

A class of catalysts created by chemists to destroy pollutants

- A group of catalysts called TAML's mimic biological catalysts and work with hydrogen peroxide and other oxidents to break down a wide variety of stubborn pollutants.
- Most of the catalysts incorporate carbon, hydrogen, oxygen, nitrogen, and iron, all of these are chosen due to their low toxicity

"The Industrial Revolution has unfolded, for the most part, without design or forethought. Perhaps now we can take some creative steps to reverse that trend and help make a world, and a future, that we can live with."

Terrance Collins; Chemist Carnegie Mellon University
Institute for Green Oxidation Chemistry