Durand Notes Chap 21

19.1

Properties of Water

a) high heat capacity
b) good solvent
c) reacts with complex molecules
d) surface tension
e) less dense when solid
f) transparent to visible light

Review water Cycle - pg. 393

97% in oceans
2% ice caps and glaciers
0.001% in atmosphere - average residence time 9 days

Water supply not evenly distributed
Much more water used by humans than other resources, about 100 times as much as the worlds minerals

Groundwater and streams

Recharge zones - areas where surface water enters the ground water systems
Discharge zones - areas whewere groundwater seeps out at surface (ex. Springs)
Vadose zone - an area of rock which water travels through on it's way to the groundwater when seeping from the surface
Water table - the upper surface of the groundwater system
Groundwater - the water underneath the water table where saturation occurs
Aquifer - underground zone from which groundwater can be obtained
Cone of depression - the area where the water table is depressed surrounding awell
SEE FIGURE 19.5
Effluent v. influent stream - effluent maintained during dry season by seepage, influent only flows with input from precipitation

19.2

Water supply US example

Water supply at any point depends on
a) rate of precip
b) evaporation
c) transpiration
d)stream flow
e)subsuyrface flow

water budget - a model that balances input, output and storage

SEE fig 19.6

Interesting numbers

Of the water vapor passing over US every day

10% precipitates
66% of the precip. Evaporates quickly
34% enters surface or groundwater systems
only 50% of this is available about 95% of the time

Shortages are likely in areas with low precipitation and runoff
Droughts happen (period of low precipitation)
Groundwater is porimary source of drinking water for 50% of US
Groundwater in US accounts for 20% of all water used
Cost limits recover of our vast amount of groundwater
OverDraft - when withdrawal of groundwater esceeds inflow
In this case water is similar to a non-renewable, mined resource
-damages river ecosystems
-causes land subsidence (see closer look 19.1)

Desalination
Expensive - about 10 times the cost of traditional water supplies
Place value - this means that the price increases quickly with transport
Because of energyuse tied closely to energy costs

19.3 Water Use
Off-stream use vs. in-stream use
Off stream use - water is removed from it's source for use - much is returned to source after use - example: water used to cool industrial processes
Consumptive use - an off strem use in which water does not return immediately to stream or ground - example: consumption by polnats animals humans or in industrial processes
In-stream use - includes navigating rivers, hydroelectric power, habitat, recreation
Controversy arises because competing uses require different conditions
See figure 19.8

Transport of water (irrigation)
Dates to ancients
California - two thirds of precipitation is north of San Francisco, two thirds of water use occurs south of San Francisco
Also New York example where urban New York imoprts tons of upstate water
Trends in water use - see figure 19.9
1. withdrawal of surface water far exceeds groundwater
2. withdrawal of both surface water and groundwater increased from 1950 until 1980, since 1980 there has been decrease and levelling off
More trends figure 19.10
1. bi uses of water are for irrigation and thermoelectric industry
2. use of water for irrigation levelled off around 1975
3. wateruse in thermoelectric and industry has decreased slightly since 1980
4. use in public and rural has continued to increase

Water conservation 19.4
Water conservation - careful use and protection of water resources involves both quantitiy and quality

Improved irrigation offers area for greates savings since it uses about 80% of all water consumed

See bullet list pg. 400 and figure 19.11

Domestic use is only 10% but is important because concentration of population makes it prone to shortasges

See bullet list pg. 400 - 402

Industry and Manufacturing use - different cooling towers could reduse water use at power plants by 25-30%

Industry could

a) do in-plant treatment

b) recycle water

c) use new methods that require less water

Perception

Tuscon view their area as a desert but Phoenix has "oasis" mentality.

Tuscon use plants like cactu in their yards, Phoenix use mulberry trees and hedges

Sustainability and Water Management 19.5

Sustainable water use - the use of water reources by people that allows our society to edevelop and flourish into an indefenite future without degrading the cvarious componenets of the hydrological cycle or the ecological systems that depend on it.

Criteria for wate use sustainabilit - see bullet list pg 402

Variable source approach - includes reservoirss, wells, reclaimation, conservation

Luna leopold proposes management based on geologic, geographic, and climatic factors as well as economy, social factors and political factors.

Essence of Leopold is - surface and groundwater are both subject to Flux

1. tap difficult water in advance
2. treat and reuse waste water
3. use surface water when available and groundwater when hecessary

Wetlands - salt marshes, swamps, bogs, prairie potholes, vernal pools

Wet at least part of year and have a certain type of vegetation and soil - see fig 19.13

Fundtion of Wetlands - see bullet list on page 405

Over past 200 years 50% of wetlands in US have dissapeared because they have been diked or drained for Agriculture or filled for urban or industrial development

Wetland restoration -

Most important factor- availability of water

Construction of wetland to deal with runoff is new, use wetalnds natural ability to clce nutrients

Dams - pros and cons of multiple use ie when water is needed (summer) the reservoir is low. This tends to also be when people want to fish, boat, etc.

Envioronmetnal effects include

a)loss of land (flooded)

b) sediment behind dam - doesn't go where it would, reduces dam capacity
c) change in downstrream hydrology