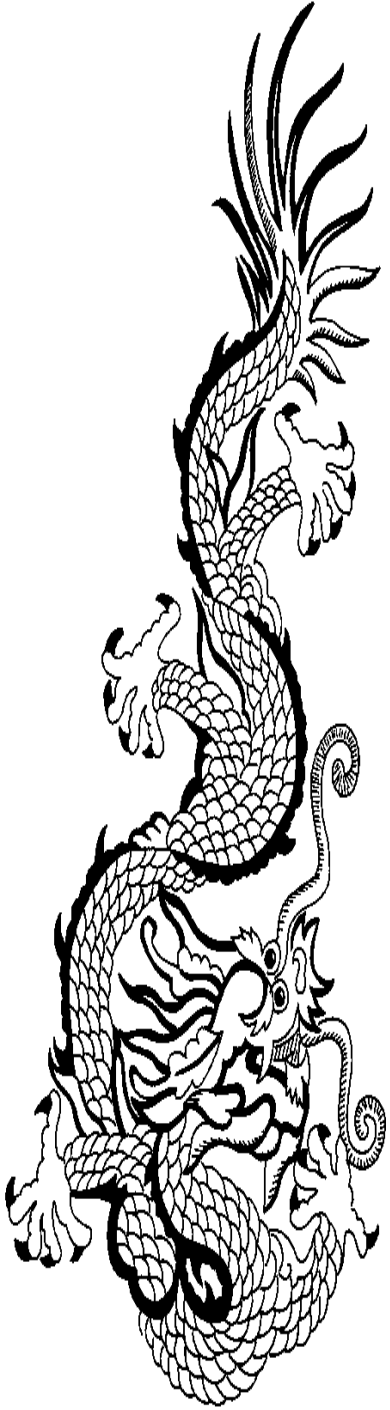
Wag the Dragon – Protecting Creeks and Streams the Water Board Way

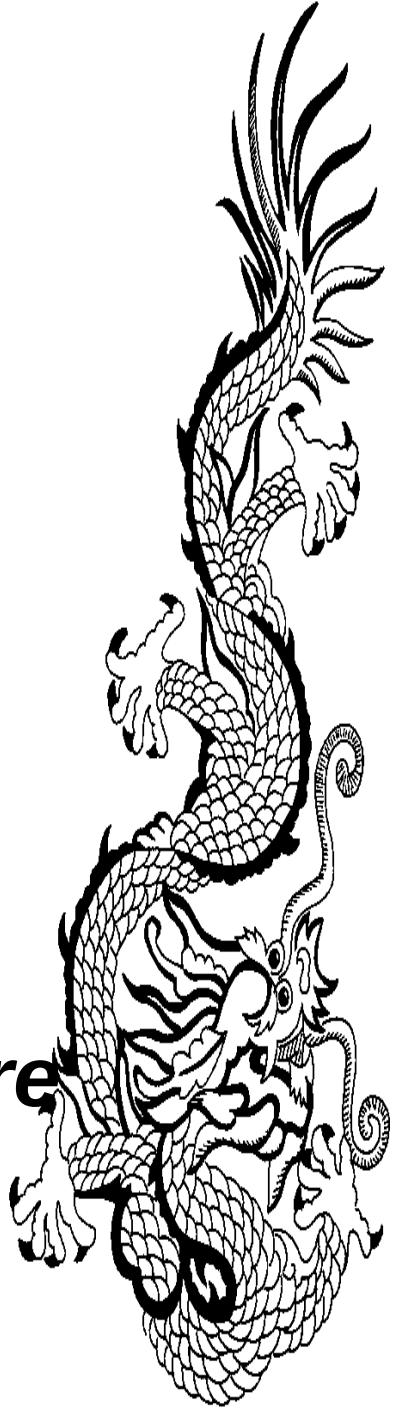
Greg Gearheart, PE

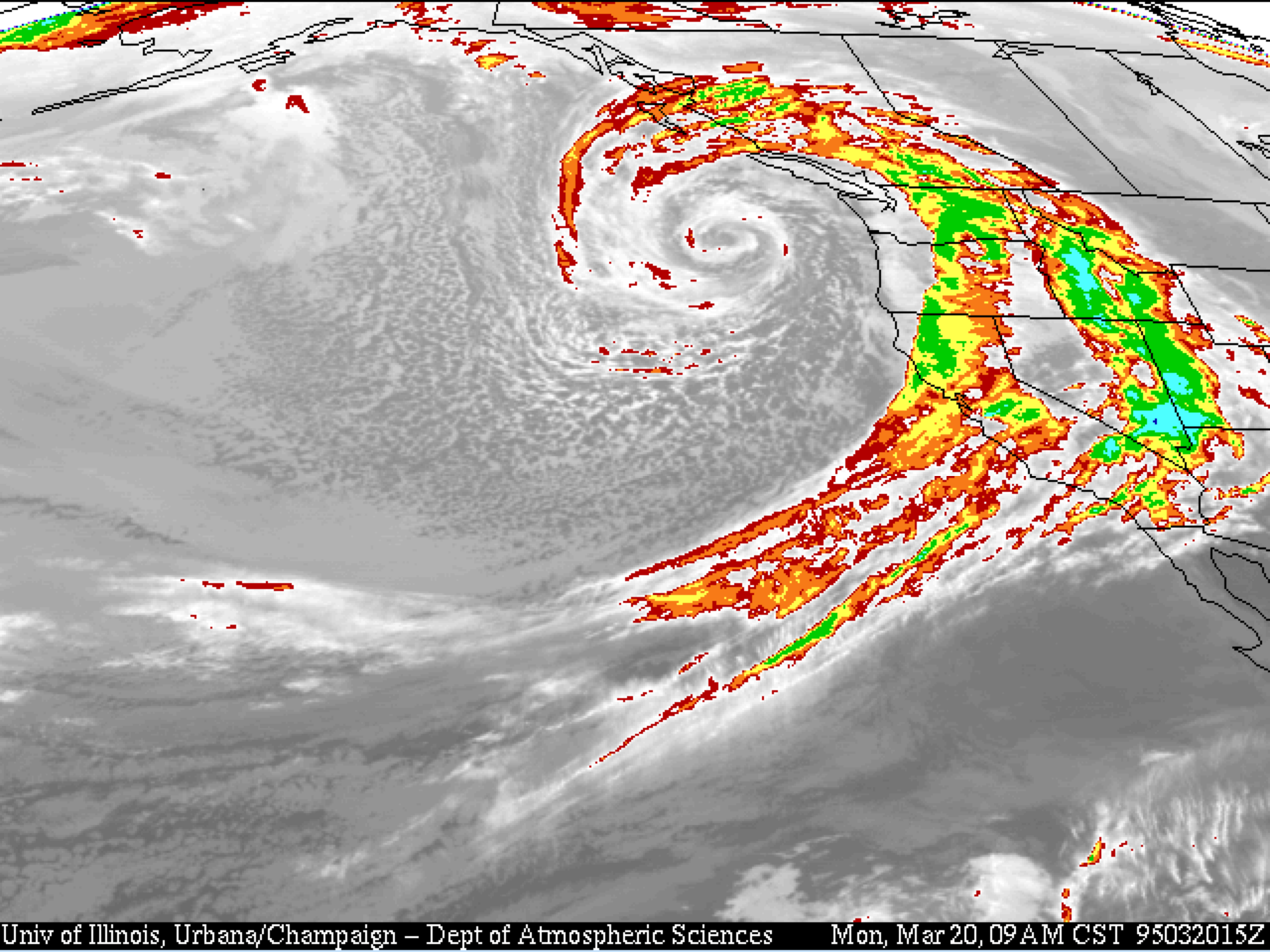
Stormwater Program / SWRCB



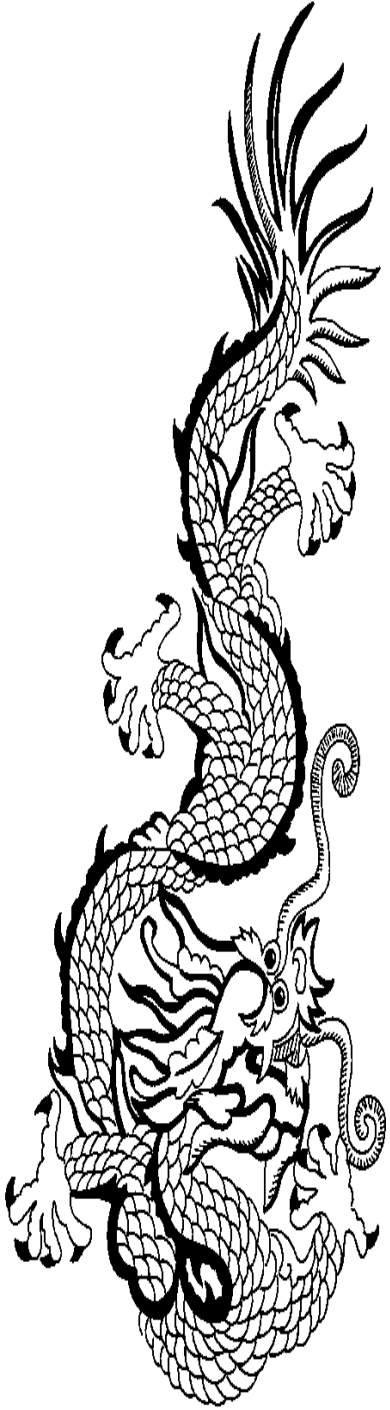
The Tail End

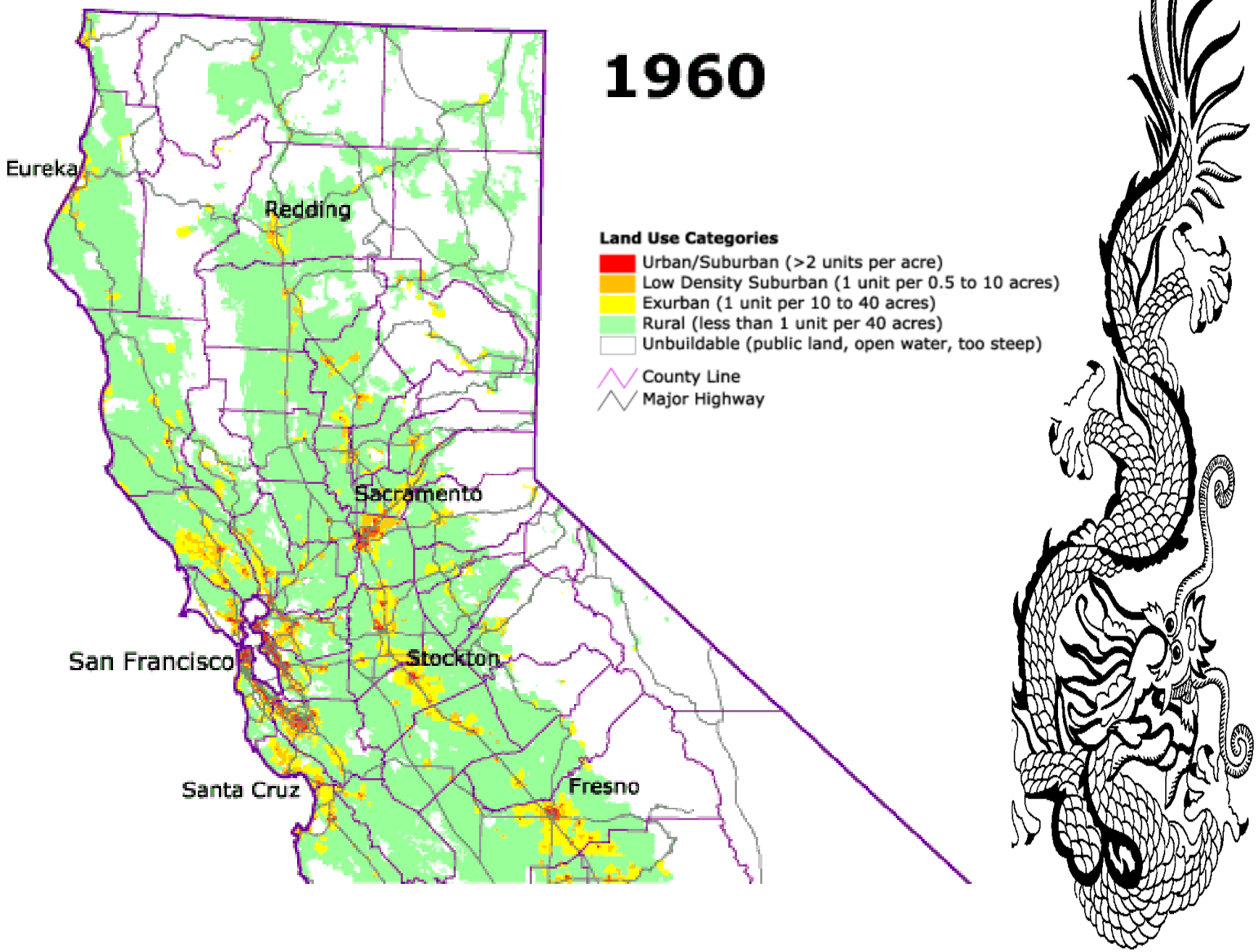
- Our mission is to preserve and enhance the quality of CA's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations.
- ***Who are the present and future generations?***

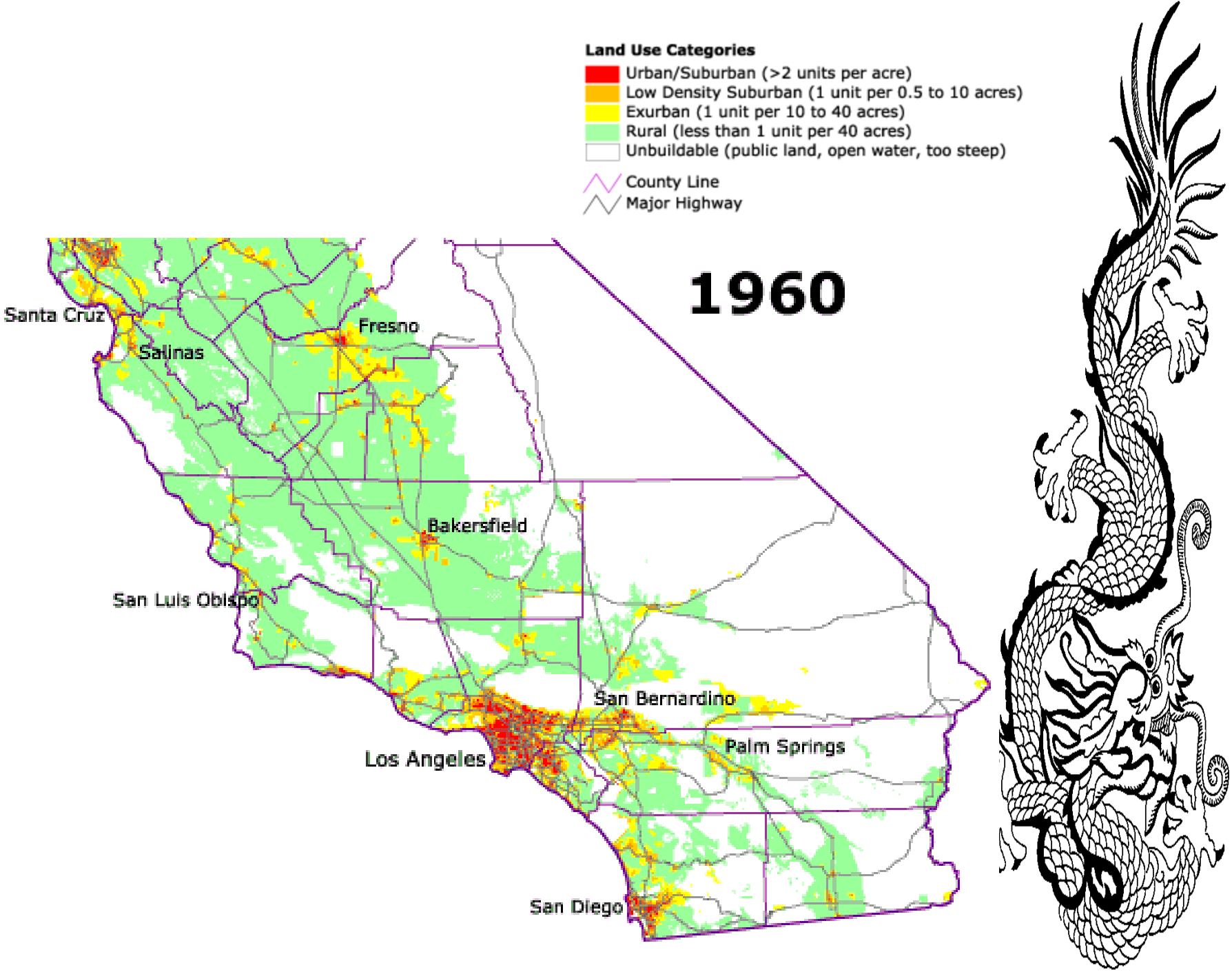



Univ of Illinois, Urbana/Champaign – Dept of Atmospheric Sciences
Mon, Mar 20, 09 AM CST 950320152

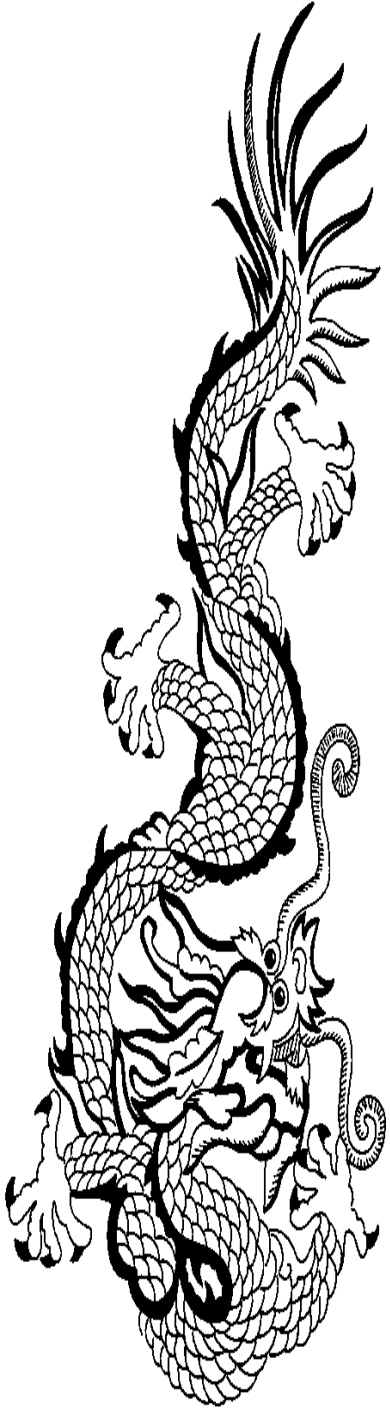
AP / Damian Dovarganes



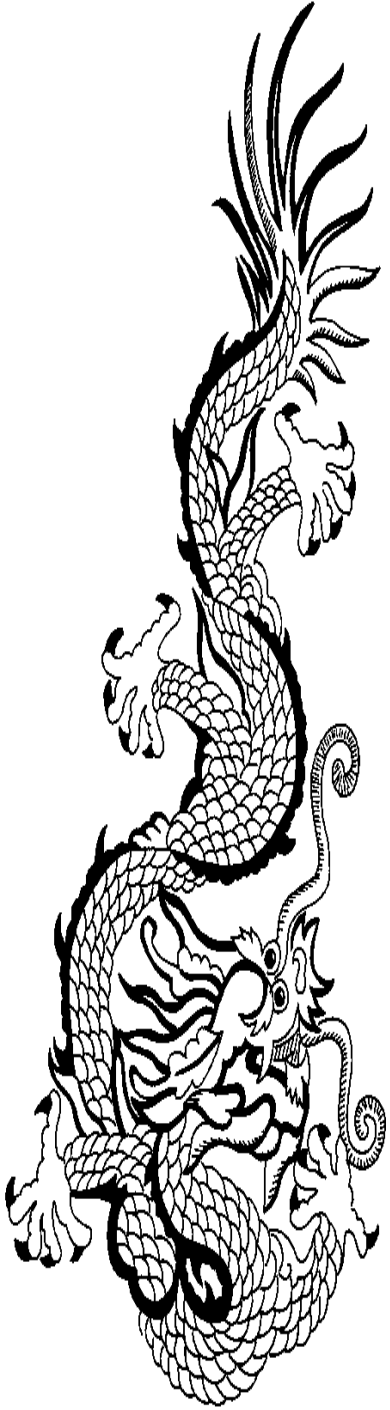

1960
Land Use Categories
Urban/Suburban (>2 units per acre)
Low Density Suburban (1 unit per 0.5 to 10 acres)
Exurban (1 unit per 10 to 40 acres)
Rural (less than 1 unit per 40 acres)
Unbuildable (public land, open water, too steep)
County Line
Major Highway
Eureka
Redding
Sacramento
San Francisco
Stockton
Santa Cruz
Fresno

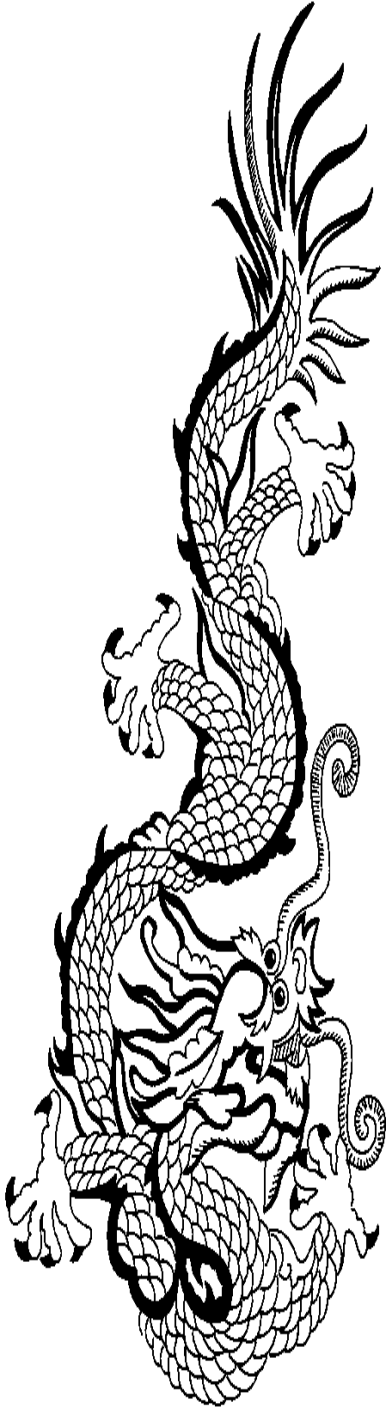

Land Use Categories
Urban/Suburban (>2 units per acre)
Low Density Suburban (1 unit per 0.5 to 10 acres)
Exurban (1 unit per 10 to 40 acres)
Rural (less than 1 unit per 40 acres)
Unbuildable (public land, open water, too steep)
County Line
Major Highway
1960
Santa Cruz
Salinas
Fresno
Bakersfield
San Luis Obispo
San Bernardino
Palm Springs
Los Angeles
San Diego

“New development” is not to blame.



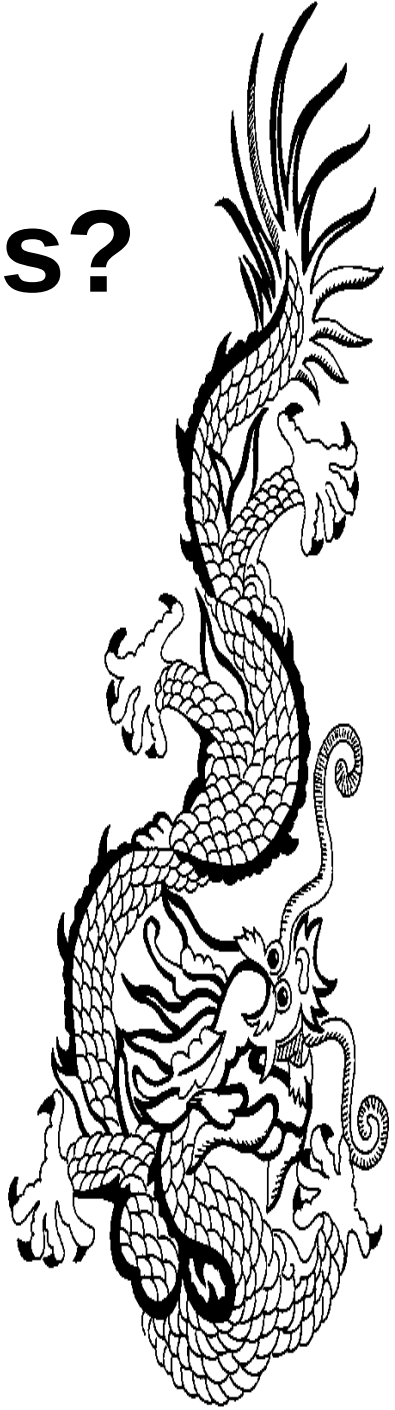
I blame it on the rain.





How does rain harm us?

- It hurts our ability to “use” California’s resources, namely the wetlands and streams, including:
  - Riparian areas
  - Intermittent, ephemeral and headwater streams
  - Isolated “wetlands” (e.g., vernal pools)
- Watershed functions and values



Paradise Lost – why are they special?

- California has lost 95% of our inland wetlands and streams since 1850's due to “development”
- They are a critical part of the watershed:
  - support BUs onsite
  - maintain the "quality of the water" of watershed
  - provide critical watershed functions like generating/moving/storing sediment, removing pollutants, retaining flood flows, and supporting habitat connectivity

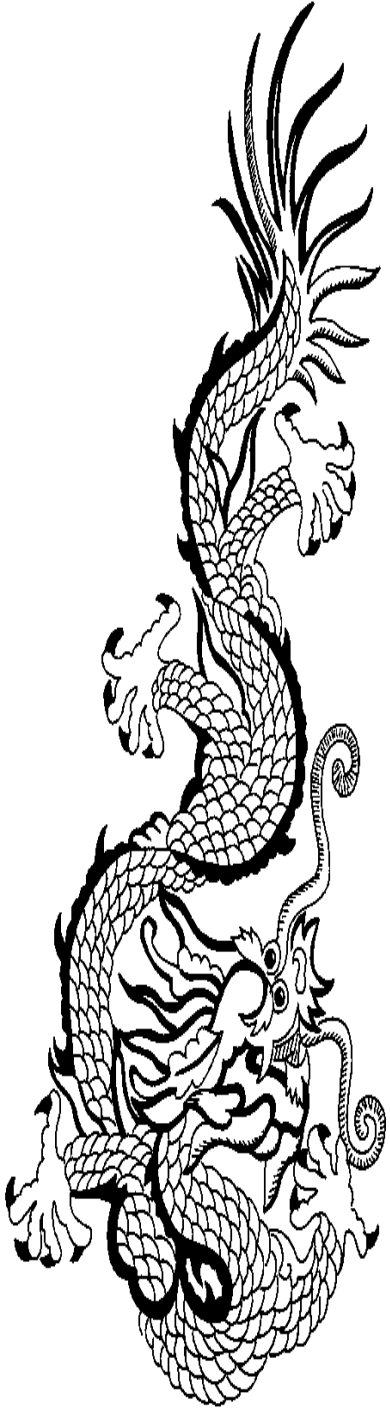
Why do they need special protection?

- Highly sensitive ecosystems
- Most threatened by landscape activities (urbanitis, development, industry, etc.)
- It is much more difficult to regulate landscape activities than it is to control point discharges
- It is very difficult to restore them once they are gone

How do human activities affect stormwater and its evil doings?

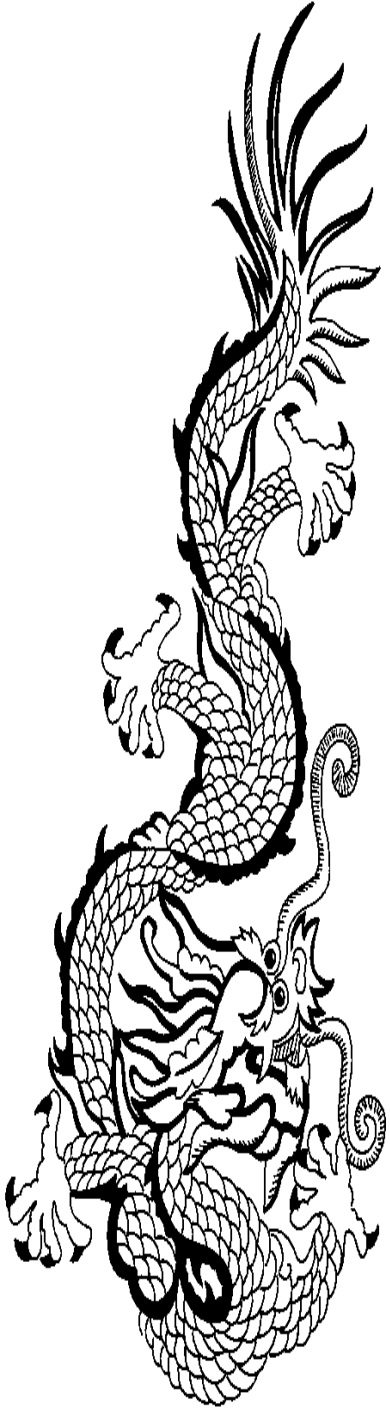
- Bank hardening (rip rap, concrete, refrigerators, cars, etc.)
- Dams and diversions
- Development (stream/swale burial, realignment, concrete-lining, etc.)
- “Agricultural” activities (vineyard development, dairy waste, cattle, stream crossings, clear-cut erosion, etc.)

Focus on hydromodification



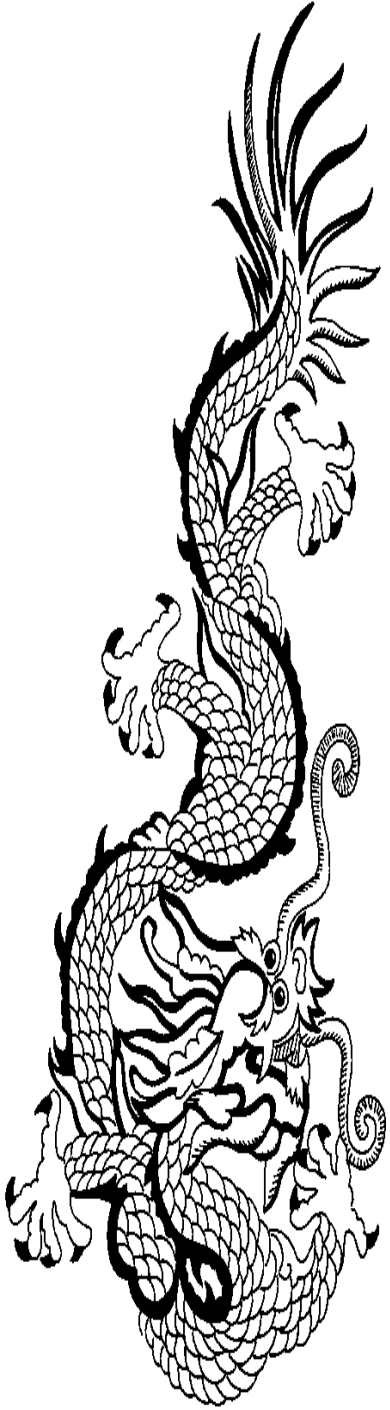
Hydromodification

- Alteration of the hydrologic characteristics of waters, which in turn could cause degradation of water resources.



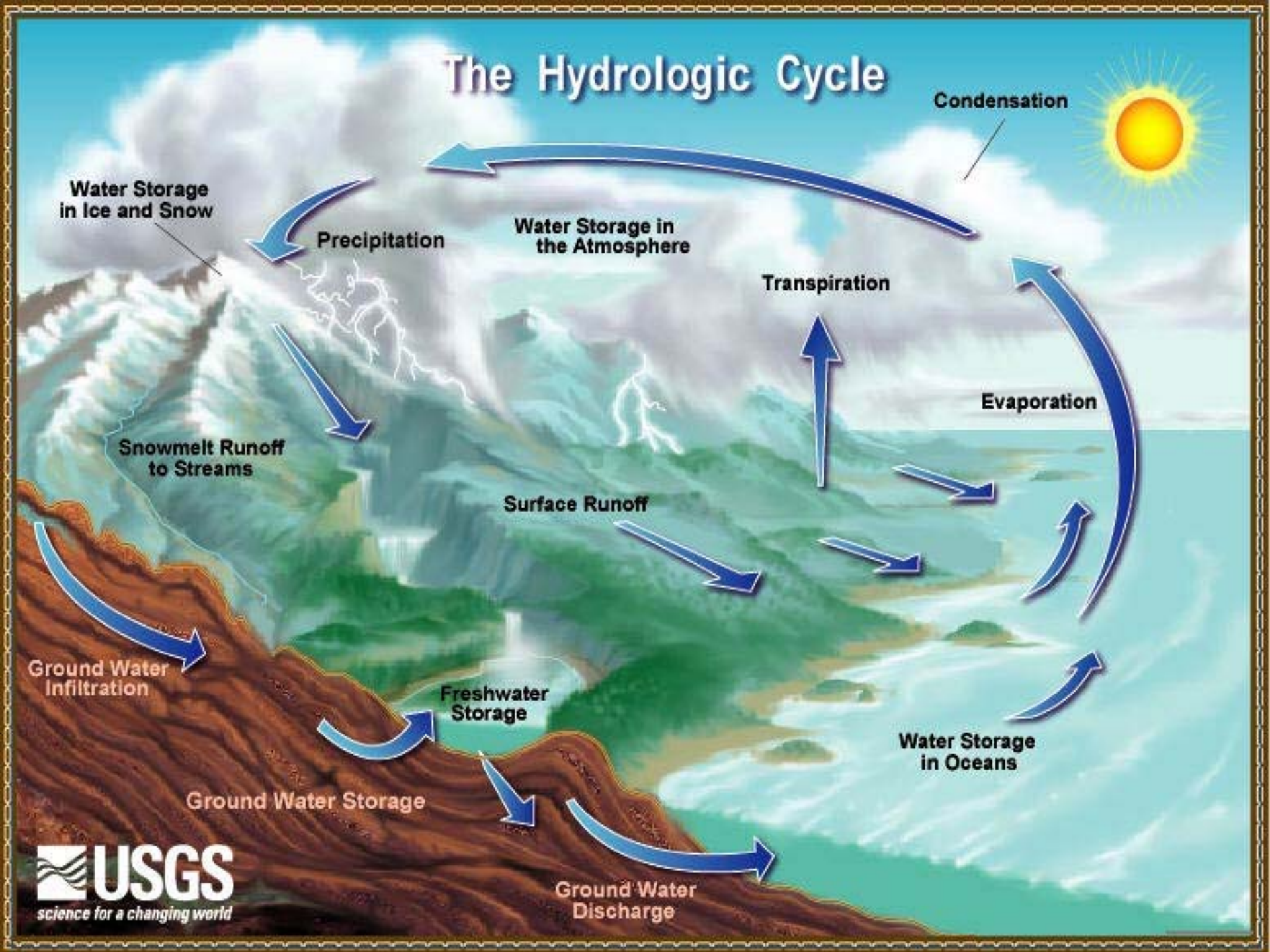
Hydromodifocation

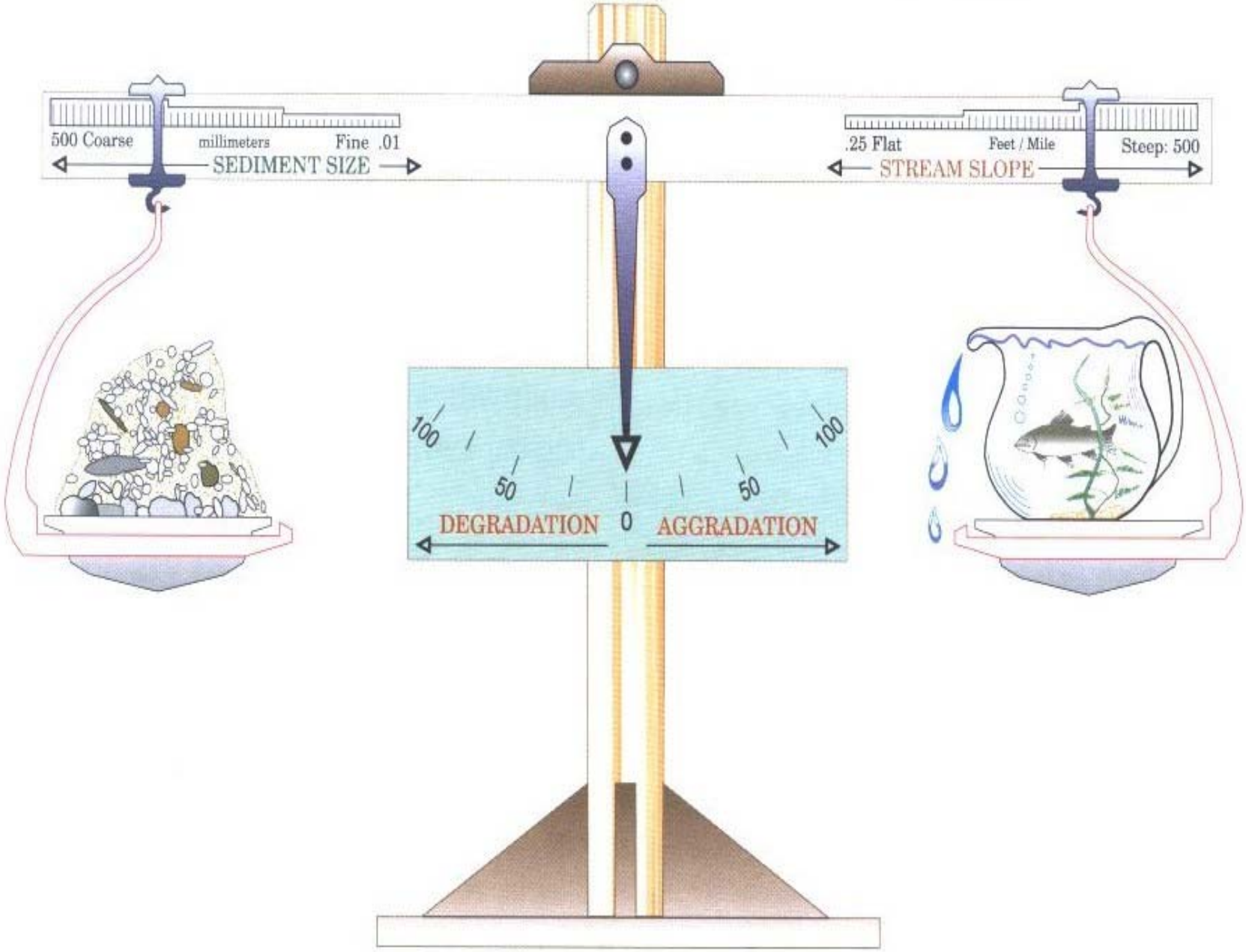
- Hydromodification (aka **hydromod**) causes excessive erosion and/or sedimentation rates, causing excessive turbidity, streambank downcutting, and/or excessive deposition within the stream channel.



Hydromodification (cont.)

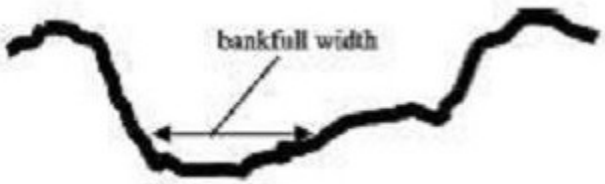
- Hydromodification in turn leads to secondary water quality problems, like the uninterrupted delivery of chemical pollutants to sensitive, downstream waters that would otherwise be “mitigated” by an unmodified waterbody.


The Hydrologic Cycle
Condensation
Water Storage in Ice and Snow
Precipitation
Water Storage in the Atmosphere
Transpiration
Evaporation
Snowmelt Runoff to Streams
Surface Runoff
Ground Water Infiltration
Freshwater Storage
Water Storage in Oceans
Ground Water Storage
Ground Water Discharge
USGS
science for a changing world



(Sediment LOAD) x (Sediment SIZE) $\propto$ (Stream SLOPE) x (Stream DISCHARGE)

Pre-development

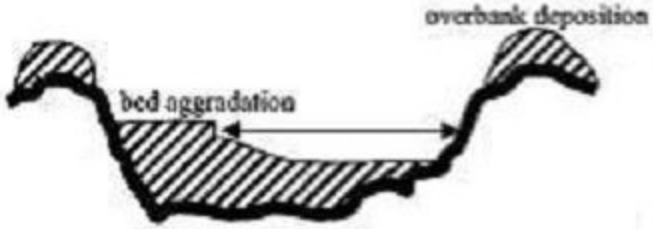


Aggradation Phase

- hillslope erosion is largest sediment source

- width:depth may increase or stay constant

- cross-sectional area increases

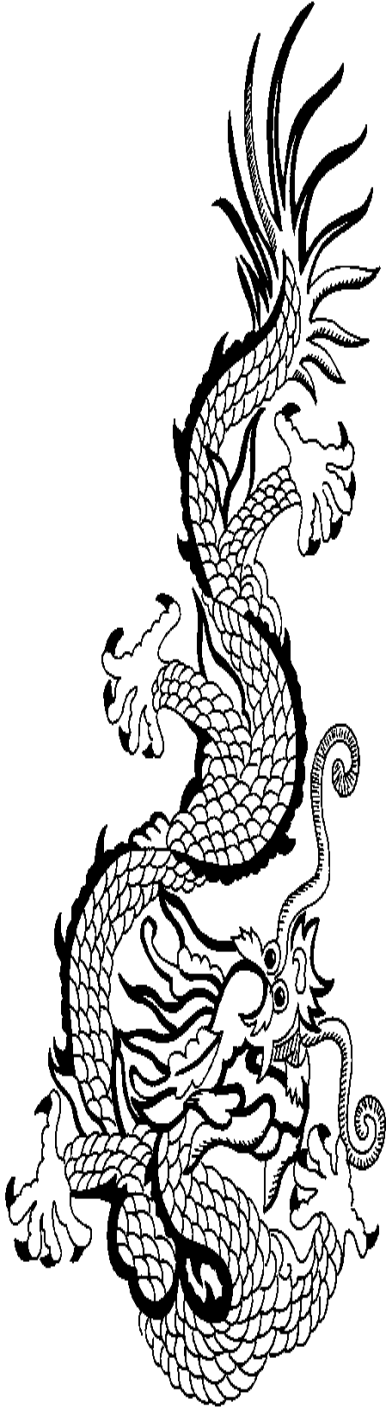


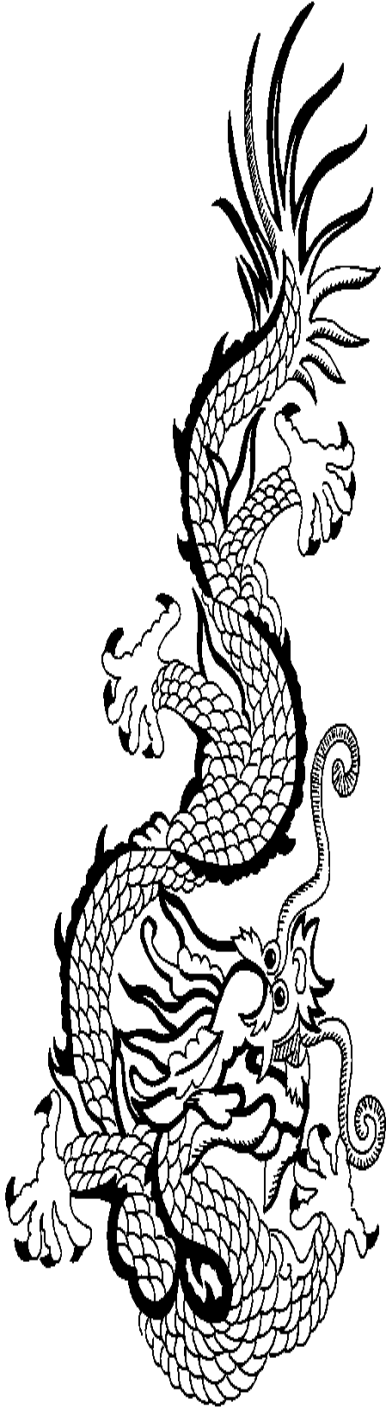
Erosional Phase

- channel erosion is largest sediment source

- width:depth increase eventually

- cross-sectional area increased to accommodate larger bankfull discharge





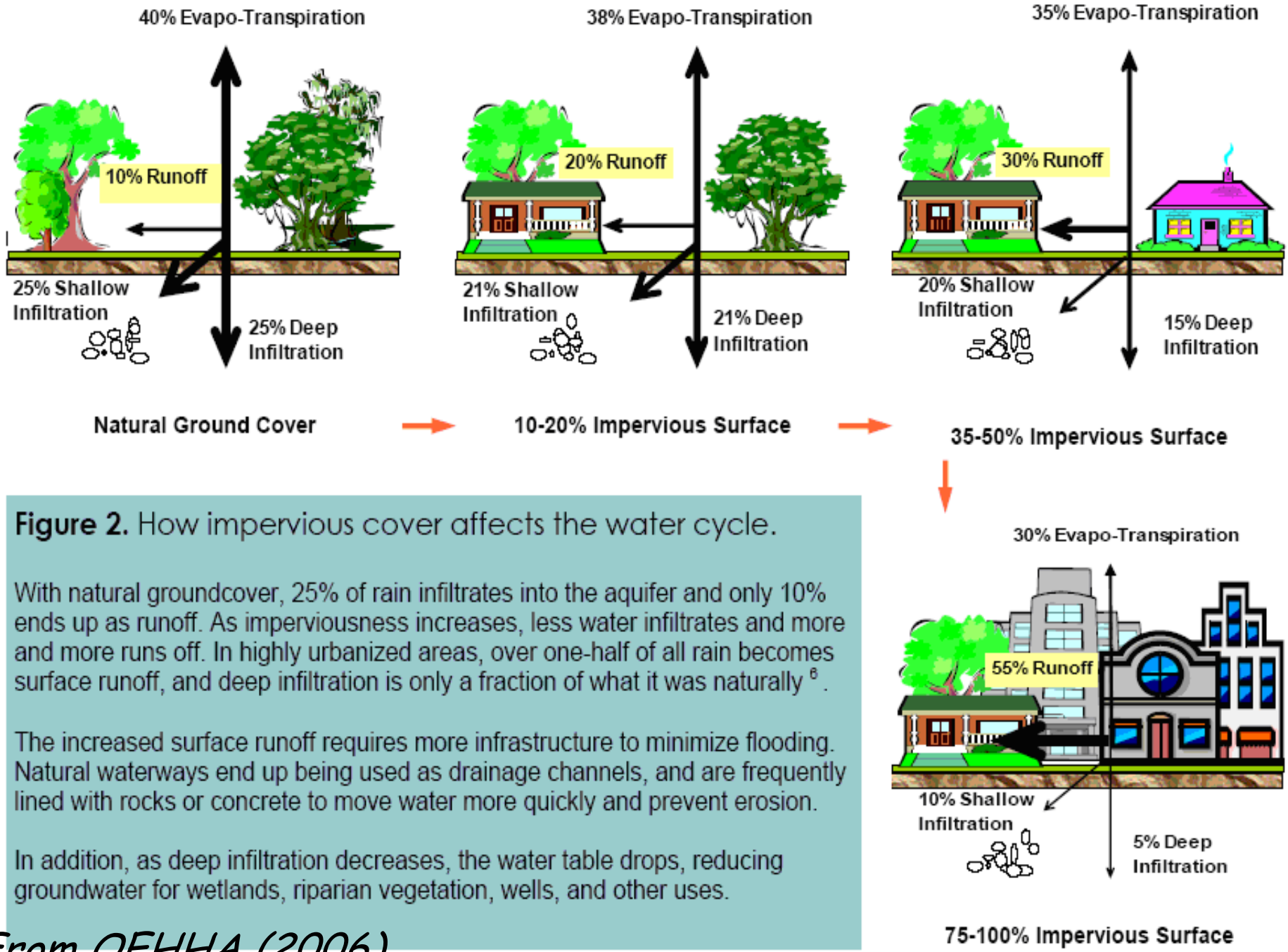


Figure 2. How impervious cover affects the water cycle.

With natural groundcover, 25% of rain infiltrates into the aquifer and only 10% ends up as runoff. As imperviousness increases, less water infiltrates and more and more runs off. In highly urbanized areas, over one-half of all rain becomes surface runoff, and deep infiltration is only a fraction of what it was naturally [6].

The increased surface runoff requires more infrastructure to minimize flooding. Natural waterways end up being used as drainage channels, and are frequently lined with rocks or concrete to move water more quickly and prevent erosion.

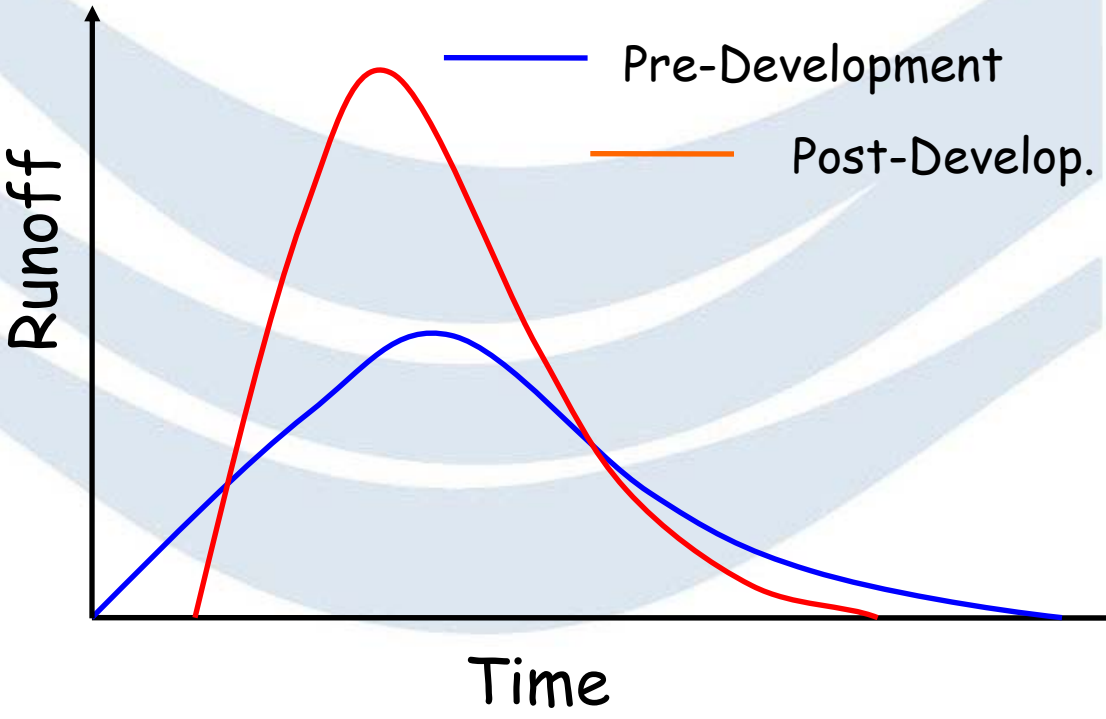
In addition, as deep infiltration decreases, the water table drops, reducing groundwater for wetlands, riparian vegetation, wells, and other uses.

From OEHHA (2006)

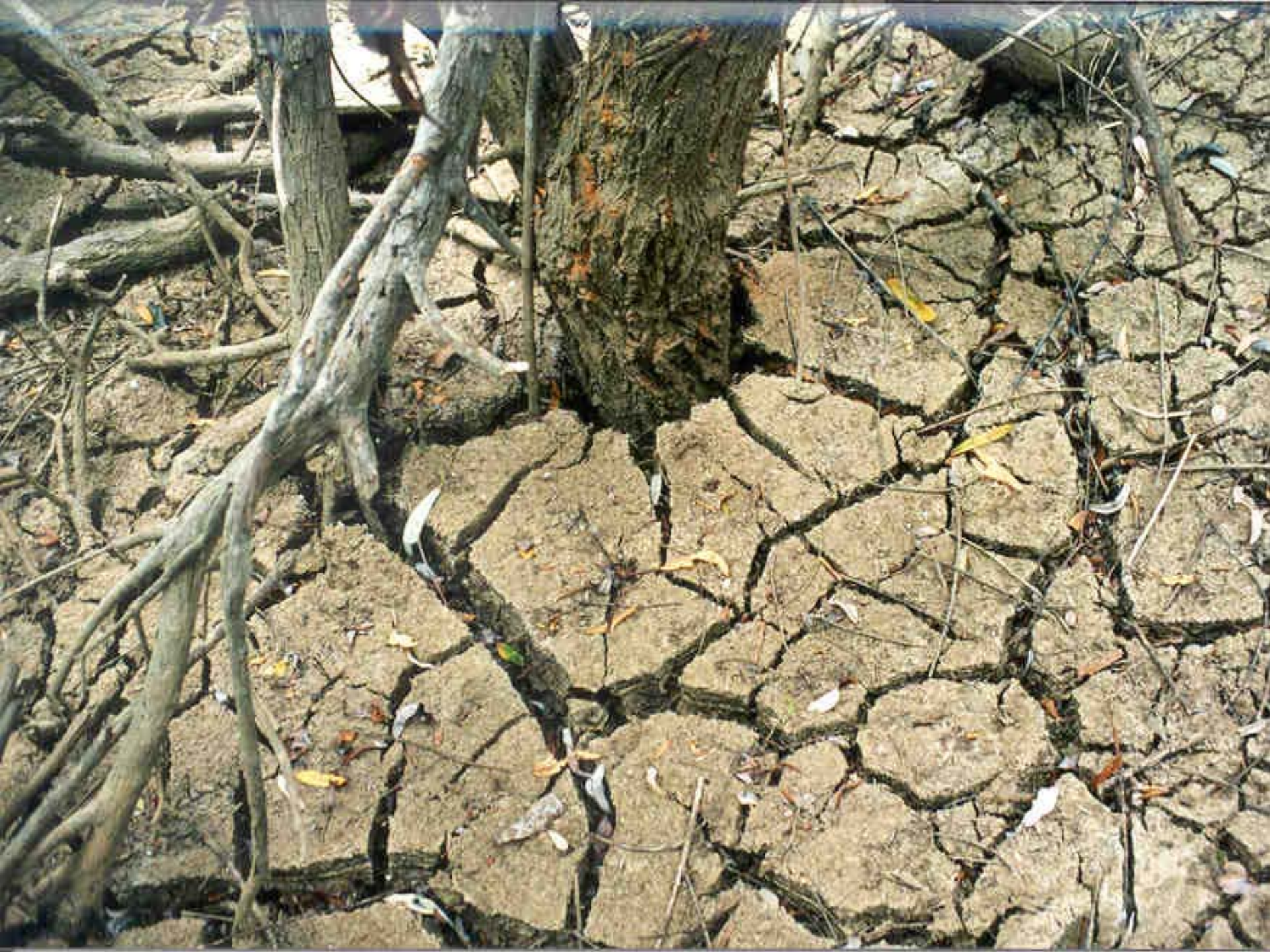
Increase in Bankfull Discharge

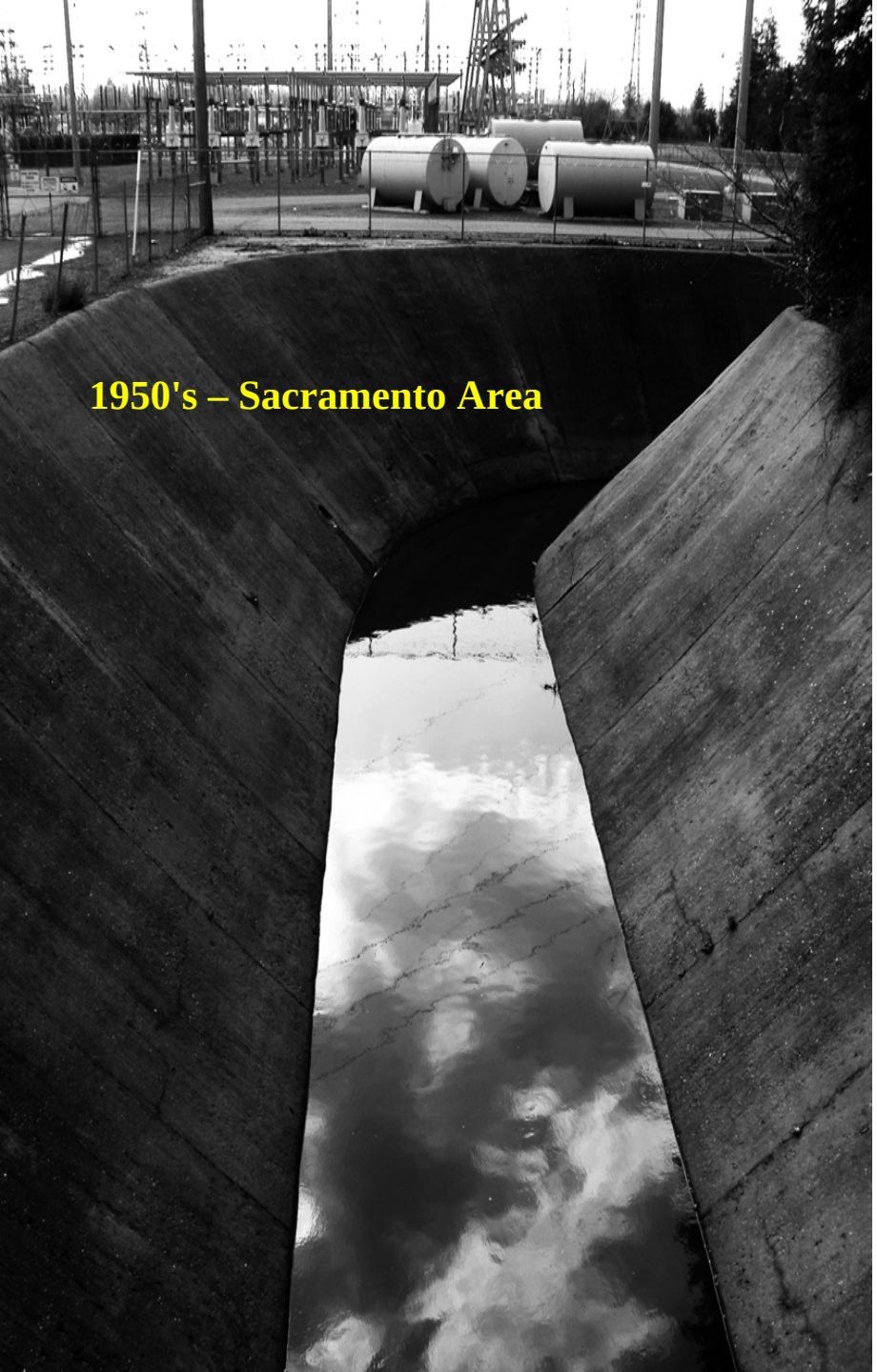
Urbanization tends to increase storm water runoff:

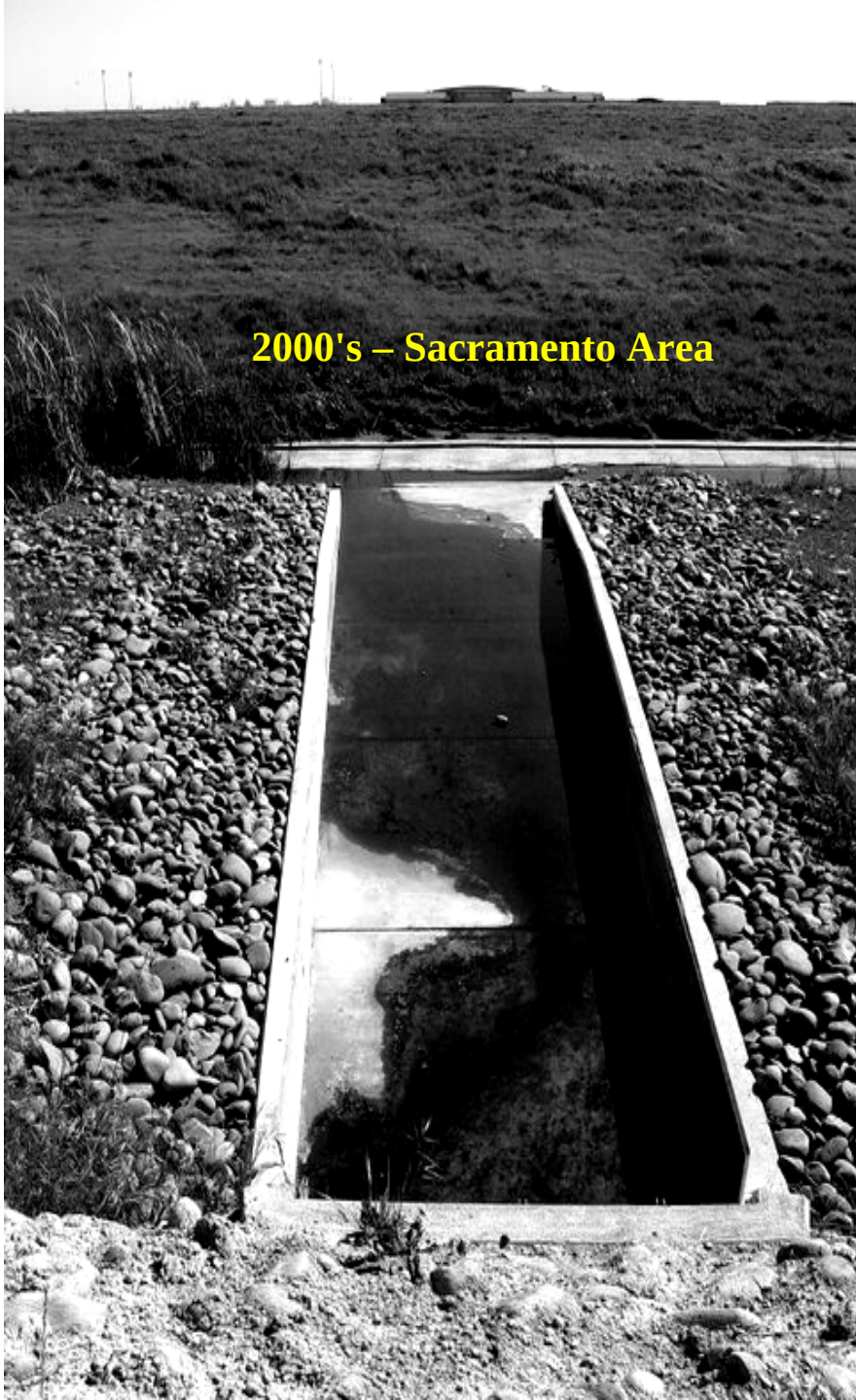
- peak flows
- volume
- frequency



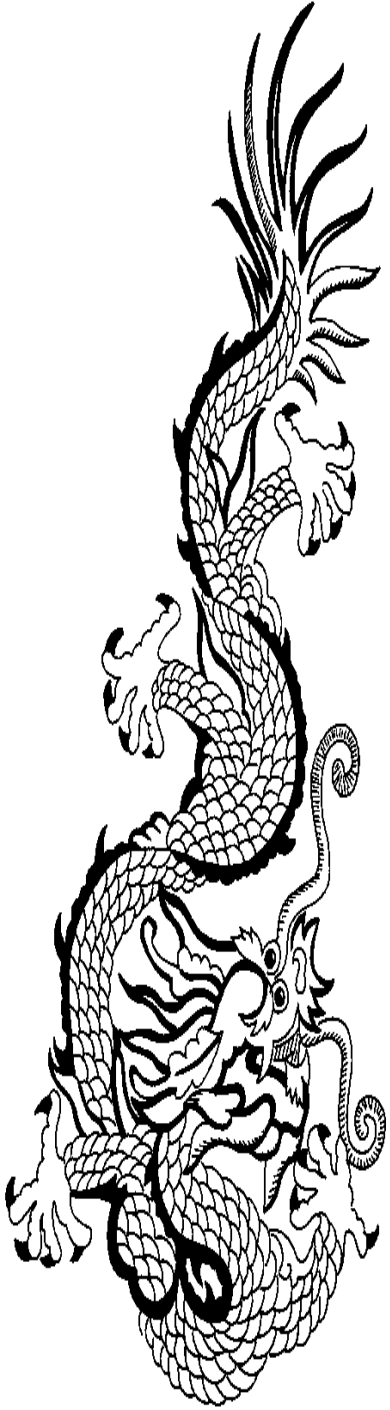
From Haltiner (2006)




1950's – Sacramento Area

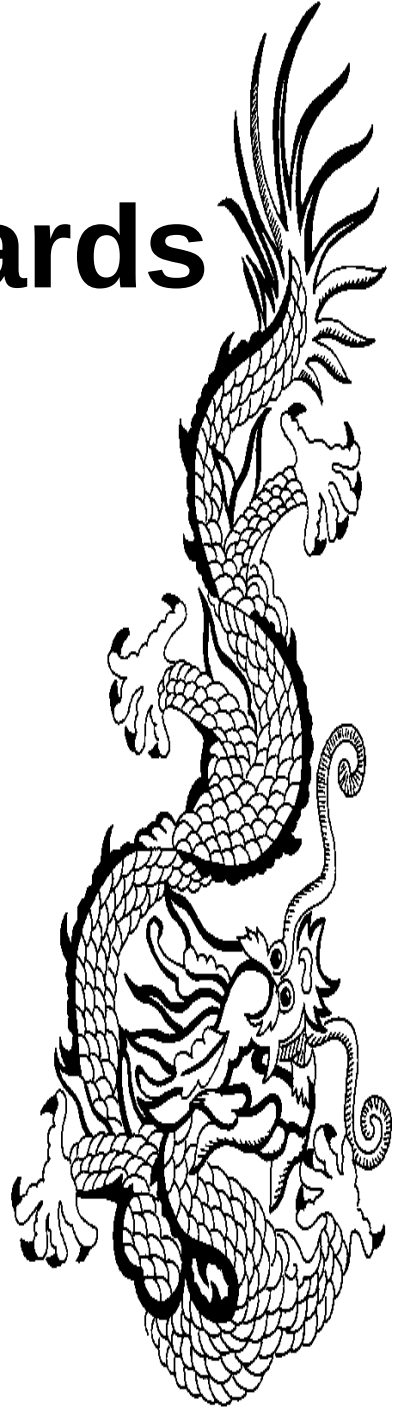

2000's – Sacramento Area

Replumbing the watershed.



Water Quality Standards

- Water Quality Standards are either:
  - Beneficial Uses (designated to specific waterbodies) plus water quality criteria; and/or
  - “Antidegradation”



Beneficial Uses Used to Protect California Wetlands & Streams

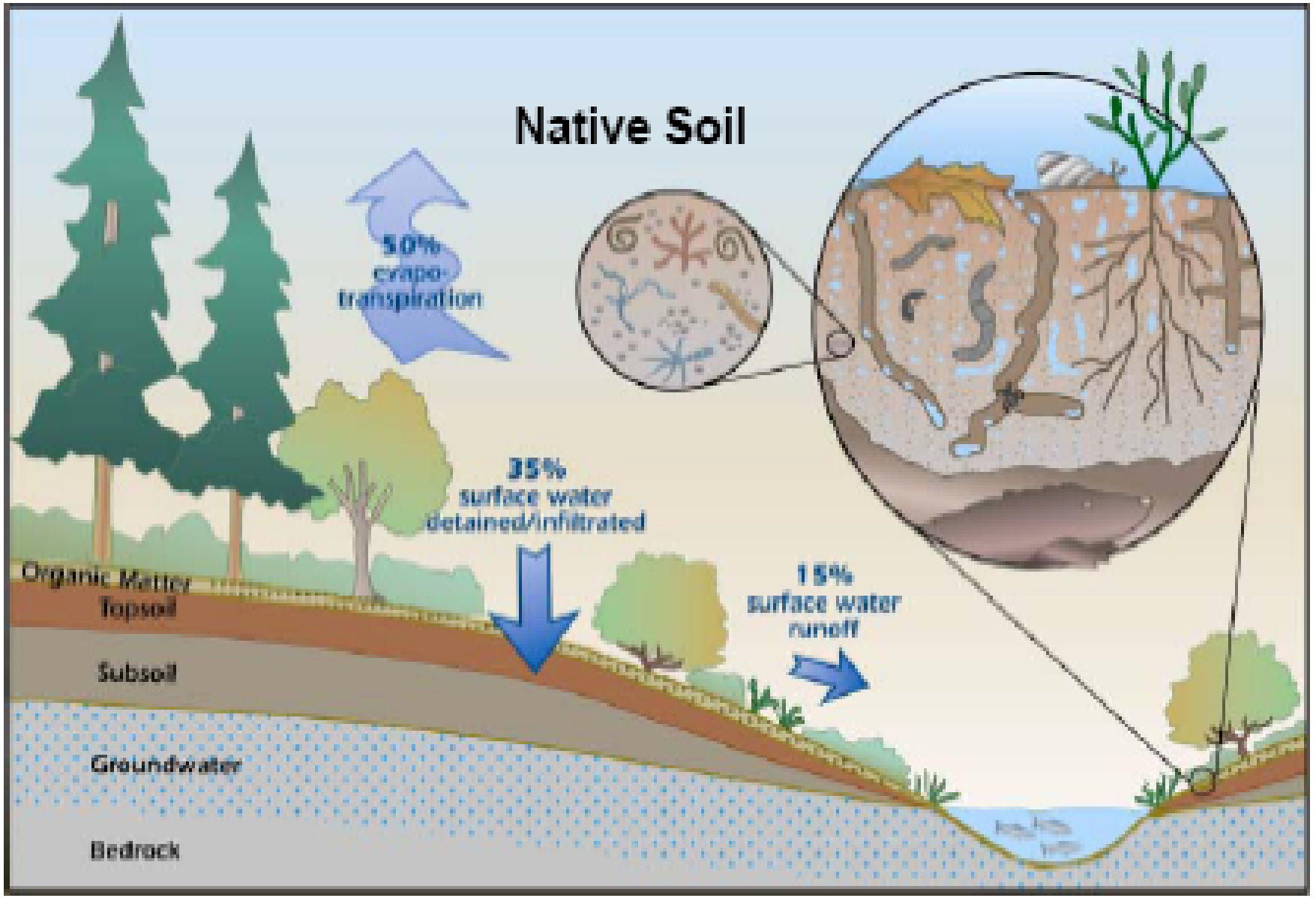
- **AGR** – Agricultural Supply
- **FLD** – Flood Peak Attenuation/Flood Water Storage
- **FRSH** – Freshwater Replenishment
- **GWR** – Groundwater Recharge
- **MAR** – Marine Habitat
- **MUN** – Municipal and Domestic Supply
- **RARE** – Preservation of Rare and Endangered Species
- **REC-1** – Water Contact Recreation
- **REC-2** – Non-Water Contact Recreation
- **SHELL** – Shellfish Harvesting
- **SPAWN** – Fish Spawning
- **WARM** – Warm Freshwater Habitat
- **WILD** – Wildlife Habitat
- **WQE** – Water Quality Enhancement

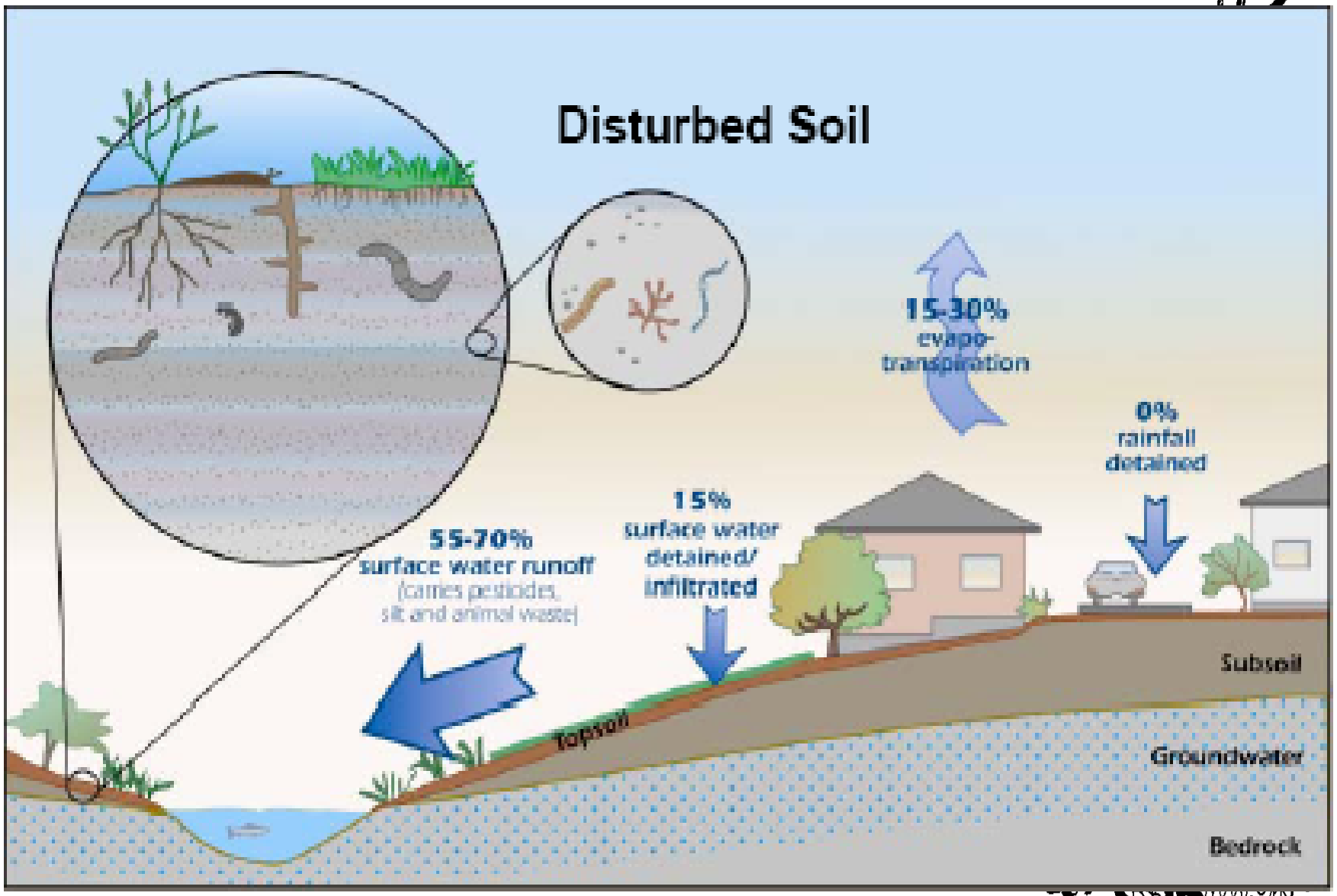
Beneficial uses (BUs) and wetlands / streams

- BUs are:
  - designated in the Basin Plans to a specific waterbody at a specific location
  - are not easily translated to some key wetland/stream functions and values
  - frequently it takes a suite of BUs to cover “wetland functions and values” (often includes gaps and overlaps)

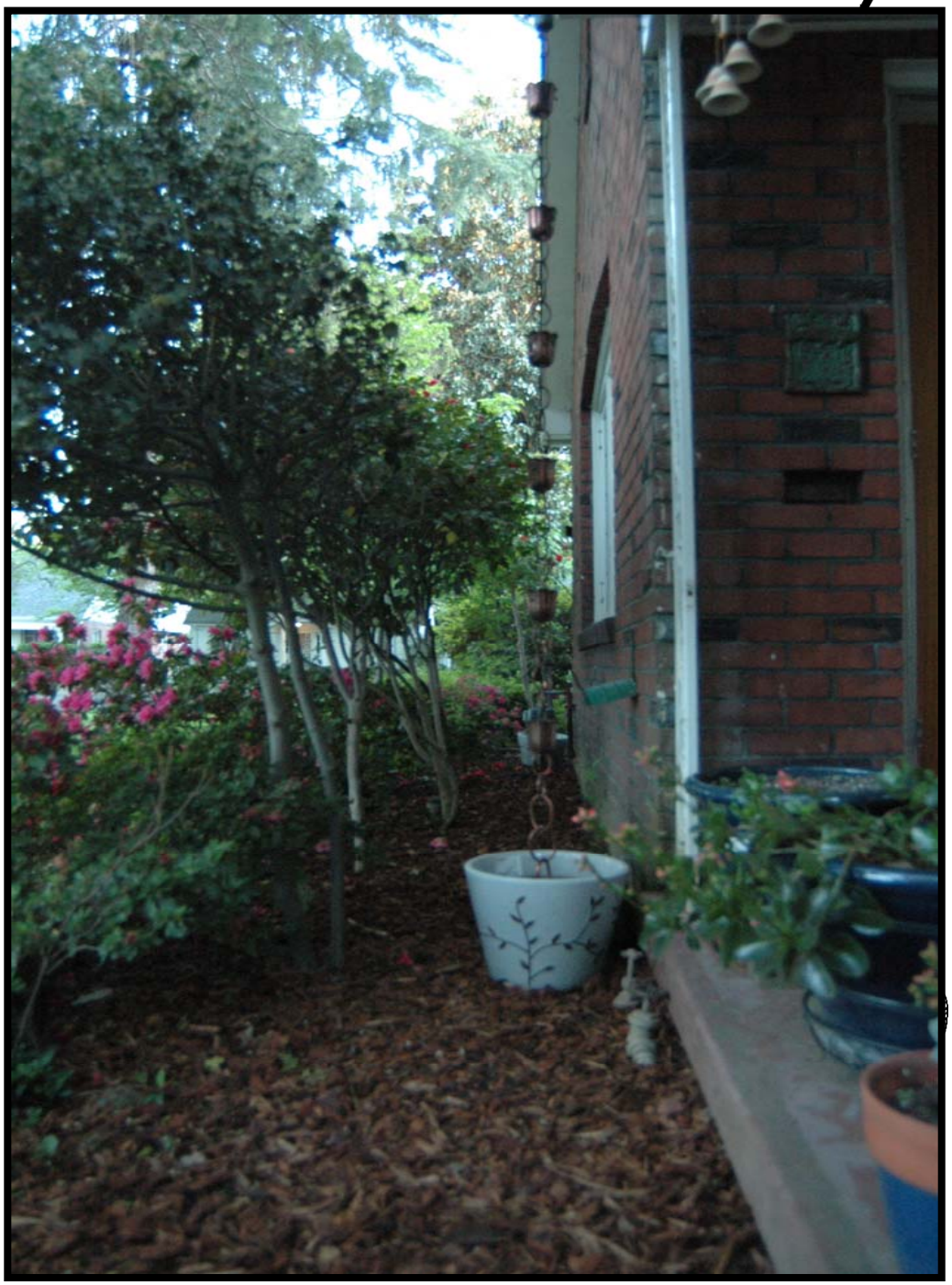
Examples of Recharge Measures

- Soil quality improvement (porosity)
- Native and drought tolerant vegetation
- Trees
- Permeable pavement
- Riparian buffers
- A general reduction of connected, impervious surfaces in runoff pathways
- Disconnected downspouts/rain chains/rain barrels
- Bioretention


Native Soil
50%
evapo-
transpiration
35%
surface water
detained/infiltrated
15%
surface water
runoff
Organic Matter
Topsoil
Subsoil
Groundwater
Bedrock


Disturbed Soil
15-30%
evapo-
transpiration
0%
rainfall
detained
15%
surface water
detained/
infiltrated
55-70%
surface water runoff
(carries pesticides,
silt and animal waste)
Subsoil
Topsoil
Groundwater
Bedrock

Rain chains and mulch combo



School Parking Lot, Portland OR

Sustainability Tests

- **Resource** – protection to enhancement and reuse (“runoff is a resource”)
- **Technical** – complex, technological standard-based to simple, natural, performance-based solutions
- **Institutional** – centralized, subsidized approaches to decentralized, self-supporting approaches
- **Community** – healthy individual, societal cost driven equations to healthy community, community opportunity equations


Before


After

PHOTO: RIVERSIDES STEWARDSHIP ALLIANCE

Manzanita Village

University of California Santa Barbara

Greg Gearheart
916-341-5892
ggearheart@waterboards.ca.gov