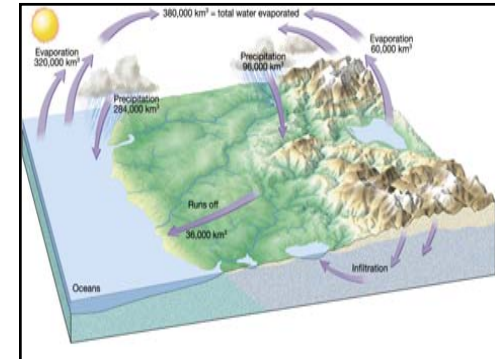


STREAM SYSTEMS and FLOODS

The Hydrologic Cycle

- Precipitation
- Evaporation
- Infiltration
- Runoff
- Transpiration



The Hydrologic Cycle

- Oceans not filling up
- Evaporation = precipitation
- System is balanced
- Runoff is the streams

RUNNING WATER

- Comes from precipitation
- Transports sediment
- Erode channels

DRAINAGE BASIN

- Area that drains into a stream
- Separated by drainage divides
- Tributaries contribute water to trunk stream



THE WORK OF STREAMS

- Erosion
- Transportation
- Deposition

EROSION

- Lifting loose particles
- Abrasion
- Dissolution

CONTROLS OF EROSION

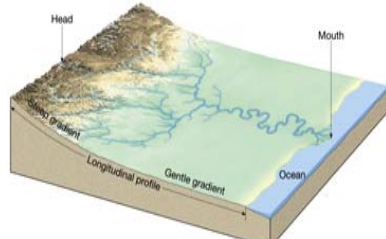
- Depends on velocity
 - Gradient
 - Channel characteristics
 - Discharge

GRADIENT

- Slope of channel
- Vertical drop / channel length

Stream Gradient

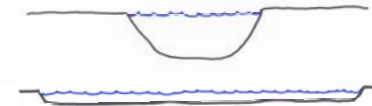
- Slope of channel along length of stream
- Changes from head to mouth of stream



CHANNEL CHARACTERISTICS

- Shape
- Size
- Roughness
- Gradient

CHANNEL SHAPE



- Same cross sectional area
- Channel perimeter about doubled

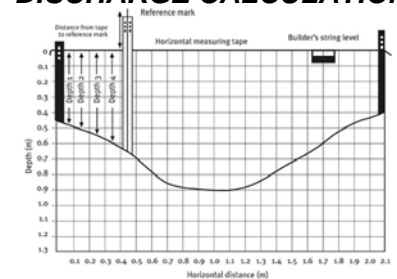
DISCHARGE

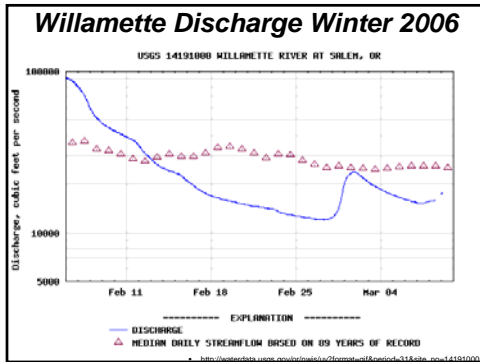
- Volume of water flowing past a point in a certain amount of time
- Increases downstream
- Cross sectional area x velocity
- Gaging station

GAGING STATION



DISCHARGE CALCULATION





FLOODS

- River rises above normal bank retainment
- Described as 'Flood Stage'
- Measured in feet above bank full discharge
- Floods occur periodically—due to weather variations
 - Rainfall
 - Snowmelt
 - Uncommon events like landslide or lava dams



RECURRENCE INTERVAL

- 100 year flood—1% chance of occurrence in a given year
- 20 year flood—5% chance
- 500 year flood—0.02% chance

Types of Floods

- Riverine floods
 - Slow events from protracted rainfall
 - Fast events from sudden rainfall
- Coastal floods
 - Storm surge
 - High tide
 - rainfall
- Catastrophic floods

Flood effects


- Infrastructure damage
- Disease
- Crop and food supply
- Natural vegetation

Flood Control

- Containment
- Water management
- Flood-plain building restrictions

Levees

- Pink is levees
- Brown is hill lines



<http://www.mvd.usace.army.mil/mrc/ret/index.php>



SUMMARY OF CHANGES FROM HEAD TO MOUTH OF STREAM

- Channel gradient
- Channel size
- Discharge
- Velocity of flow—controlled by
 - Gradient
 - Channel shape
 - Discharge

THE WORK OF STREAMS

- Erosion
- Transportation
- Deposition

TRANSPORTATION

Three modes of moving material

- In solution = **Dissolved load**
- **Suspended load**
- Sliding, rolling, bouncing = **Bed load**

DISSOLVED LOAD

- From groundwater, runoff and channel
- Supplies ocean with minerals in solution

SUSPENDED LOAD

- Most of material transported
- Sand, silt, clay
- Larger particles in flood

BED LOAD

- Too large to keep suspended
- Grinds channel and downcuts

TRANSPORTATION

- Competence
- Capacity

COMPETENCE

- Size of particles
- Depends on velocity
- Velocity is proportional to the square of competence

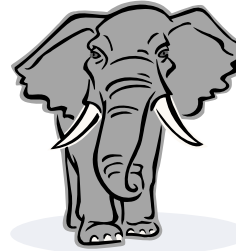
CAPACITY

- Amount of material
- Depends on discharge

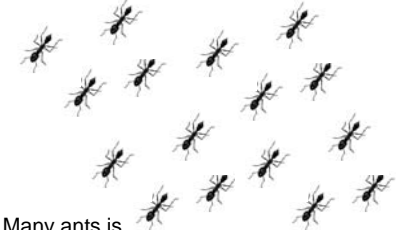
Competence vs. Capacity



- Elephant has greater competence
- Can carry heavier loads



Competence vs. Capacity



- Many ants is greater capacity

The Work of Streams

- Greatest competence with greatest velocity
- Greatest capacity with greatest discharge
- Maximum during floods

The Work of Streams

- Erosion
- Transportation
- Deposition

Bedrock Channel

- High gradient
- Many rapids and waterfalls

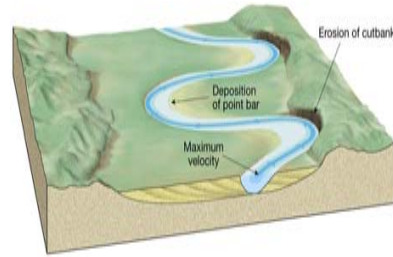


• <http://www.paul.chesterfield.britnet.net.co.uk/pages/landscapes12.htm>

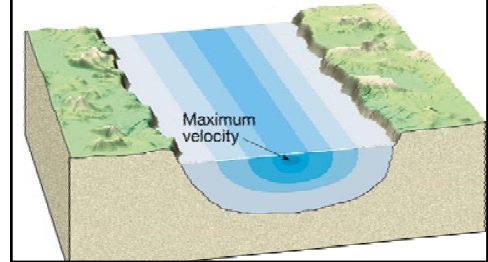
DEPOSITION

- Slowing of velocity
- Largest particles deposited first
- ALLUVIUM

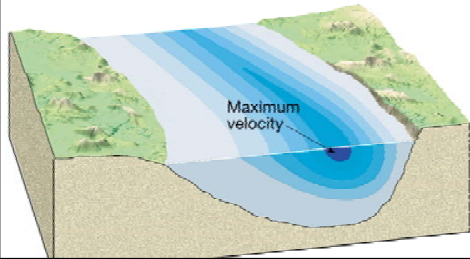
Alluvial Channel



High Velocity in Center

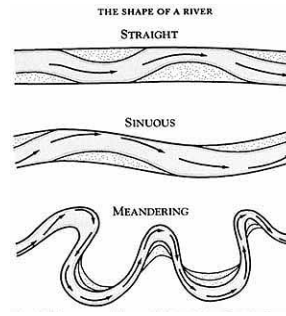


Velocity displaced around meander curve



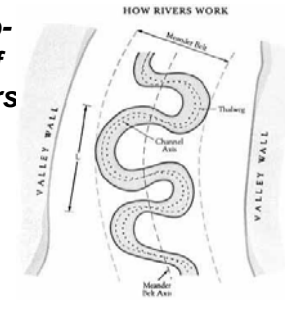
Channel Pattern

Natural progression to more meandering channel character



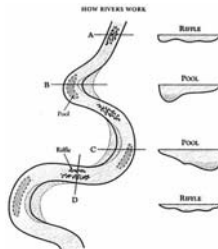
<http://www.ucpress.edu/books/pages/6664/6664.ch04.html>

Development of meanders



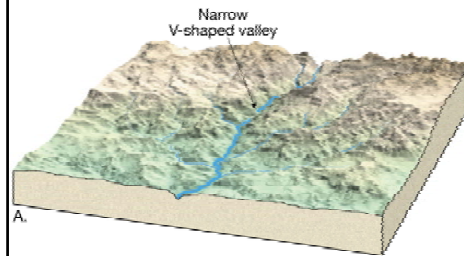
<http://www.ucpress.edu/books/pages/6664/6664.ch04.html>

Development of Meanders

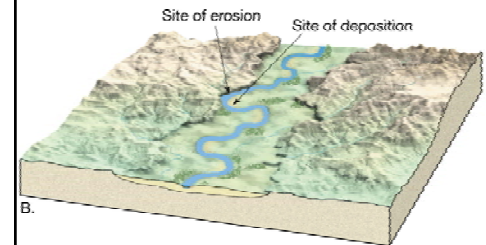


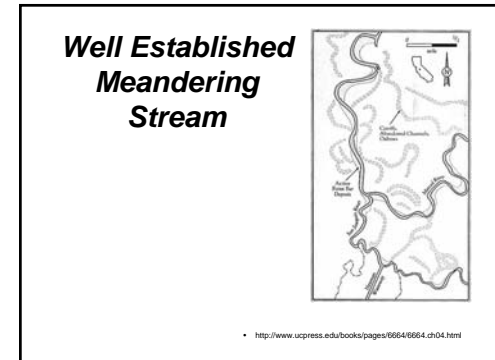
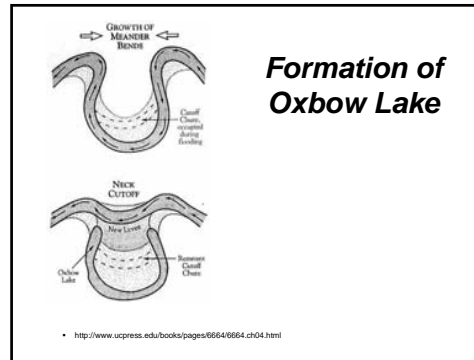
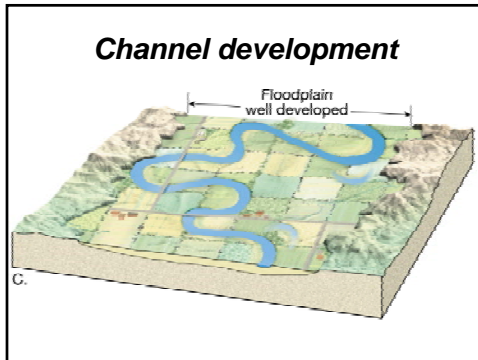
<http://www.ucpress.edu/books/pages/6664/6664.ch04.html>

Channel development

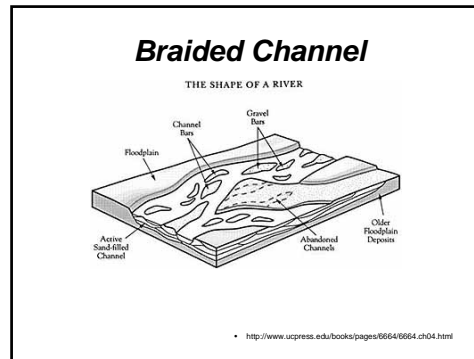


Channel development





- ### Channel Pattern
- High Gradient
 - Highly variable discharge
 - High, coarse sediment load
 - Braided channel develops



- ### Deposition by Streams
- Delta
 - Where stream enters standing body of water
 - Velocity slows, drops its suspended load
 - Lengthens the stream
 - Distributaries
-
- <http://earth.usa.int/images/archive/white.htm>

- ### Glaciers
- Rivers of ice
 - Moving downslope or out from accumulation center
 - Distinctive erosional and depositional landforms

