Streams and Running Water
Streams are part of the hydrologic cycle.

Stream: body of running water that is confined in a channel and moves downhill under the influence of gravity.

Cross-section of a typical stream
1) Channel Flow

2) Sheet Flow

Drainage Basin: area of a stream and its' tributaries.

Tributary: small stream flowing into a large one.
Divide: ridge seperating drainage basins.

Drainage Patterns
1) Dendritic: resembles tree branches
> occurs on uniformly resistant rock

2) Radial: streams diverge outward from a central point
> occurs on conic shapes, like volcanoes

3) Rectangular: steams have sharp bends
- due to presence of faulting, river follows the fault

4) Trellis: Parallel main streams with right angle tributaries
> occurs on valley and ridge geomorphologies

5) Deranged: not patterned
>characterized by swamps and disappearing streams
>associated with Karst and sometimes glacial depositional areas

Factors Affecting Stream Erosion and Deposition

1) Velocity = distance/time
   Fast = 5km/hr or 3mi/hr
   Flood = 25 km/hr or 15 mi/hr
   Figure: Fastest in the middle of the channel
   a) Gradient: downhill slope of the bed of the stream
      = <u>High-Low</u>
        distance between points

      - very high near the mountains
      - 50-200 feet/ mile in highlands, 0.5 ft/mile in floodplain

   b) Channel Shape and Roughness (Friction)
      > Figure
      - Lots of fine particles – low roughness, faster river
      - Lots of big particles – high roughness, slower river (more friction)

High Velocity = erosion (upstream)

Low Velocity = deposition (downstream)

Figure> Hjulstrom Diagram

What do these lines represent?

Silt and clay are hard to erode, and typically stay suspended

2) Discharge: amount of flow
   Q = width x depth x velocity = m3/s or cfs
   - increases downstream

   Why? 1) Flow out of ground via stream bed
   2) Small tributary streams can be huge near the floodplain (Figure 10.10)

Stream Erosion

How?

1) Hydraulic Action (Figure)

2) Solution: dissolved in water- slow process

3) Abrasion: grinding away by friction – sand and gravel
   - Potholes- formed by abrasive action

Stream Transportation of Sediment – Figure

1) Bedload – stream bottom load – big stuff
   Moves by: 1) Traction- rolling, sliding, dragging
   2) Saltation – bouncing

2) Suspended Load- light enough stuff to remain in moving water (silt & clay, sometimes sand)

3) Dissolved Load – soluble products of chemical weathering

Stream Deposition

Bars: ridge at sediment, usually sand (Figures)

- Sand bars can migrate with floods

Competence: Maximum size of particle carried by the stream

Capacity: amount of particles carried by the stream

Figure– Placer Deposits: found in streams where running water has mechanically concentrated heavy sediment

Braided Streams > Vs. Meandering Streams
Braided streams lots of sediment form > sinuous curves
Interconnected rivulets > faster velocities in center, slower to outside, promotes deposition (Point Bars)

Figures- Meandering
Meanders typically produce erosion on the outside, and deposition on the inside of the stream. (Figures)

Meander Cutoff- typically occurs during flood stage (Figures)
Oxbow Lake- Figures

Flood Plains – broad strip of land built up in sedimentation on either side of a stream channel.

- Figure- various types of deposits
- Figure-Natural levees – low ridges of flood- deposited sediment

Deltas

- River opens into ocean - not always - need a good shelf for deposition
- Biggest one empty into stable seas/ Gulfs
  (Nile, Mississippi)

Combine effects of waves, tides, and river flow determine the shape of a delta

1. River dominated – strong flow of freshwater – protected from distributaries – Bird's foot of Mississippi

2. Tide Dominated – freshwater discharge is overpowered by tidal currents that mold sediments into long islands parallel to the river flow and perpendicular to the trend of the coast Ganges – Bay of Bengal

3. Wave dominates – generally smallest - smooth shorelines punctuated by beaches and sand dunes

➔Has a primary exit channel

Alluvial fans are related to deltas, except for the stream is intermittent, and it opens into a dry valley.

Flooding

Recurrence Interval

Urban Flooding

Flash Flooding

Controlling Floods

Stream Valley Development

1) Downcutting (Figure) – upstream

2) Base Level- downstream

- Lateral erosion

Stream Terraces – Figures

Incised Meanders-Badlands of Dakotas

Superimposed Streams – larger rivers in Appalachians