

1  **Running Water**

Earth 9th Edition – Chapter 16

2  **Running Water: summary in haiku form**

The hydro cycle –
water returns from the sea.
All "toilet to tap."


3  **Key Concepts**

- The hydrologic cycle
- Streams and stream flow
- Transportation of sediment by streams
- Deposition of sediment by streams
- Types of stream valleys
- Drainage networks
- Floods and flood control

4  **Hydrologic cycle**

- The hydrologic cycle is a summary of the circulation of Earth's water supply
- Processes involved in the hydrologic cycle
 - ☒ Precipitation
 - ☒ Evaporation
 - ☒ Infiltration
 - ☒ Runoff
 - ☒ Transpiration

5  **The hydrologic cycle**

6  **Sources of Earth's water**

7  **Earth's Water and the Hydrologic Cycle**

8  **Water Phase Changes**

9  **Running water**

- Begins as sheetflow
 - ☒ Infiltration capacity is controlled by
 - Intensity and duration of rainfall
 - Prior wetted condition of the soil
 - Soil texture
 - Slope of the land
 - Nature of the vegetative cover
 - ☒ Sheetflow develops into tiny channels called rills

10  **Running water**

- Streamflow
 - ☒ Two types of flow determined primarily by velocity
 - Laminar flow
 - Turbulent flow
 - ☒ Factors that determine velocity
 - Gradient, or slope
 - Channel characteristics including shape, size, and roughness

11  **Running water**


- Streamflow
 - ☒ Factors that determine velocity
 - Discharge – the volume of water moving past a given point in a certain amount of time
- Changes from upstream to downstream
 - ☒ Profile
 - Cross-sectional view of a stream
 - Viewed from the head (headwaters or source) to the mouth of a stream

- 12 **Running water**
- Changes from upstream to downstream
 - ☒ Profile
 - ◆ Profile is a smooth curve
 - ◆ Gradient decreases downstream
 - ☒ Factors that increase downstream
 - ◆ Velocity
 - ◆ Discharge
 - ◆ Channel size
- 13 **Longitudinal profile of a stream**
- 14 **Running water**
- Changes from upstream to downstream
 - ☒ Factors that decrease downstream
 - ◆ Gradient
 - ◆ Channel roughness
 - Base level and graded streams
 - ☒ Base level is the lowest point to which a stream can erode
- 15 **Running water**
- Base level and graded streams
 - ☒ Two general types of base level
 - ◆ Ultimate (sea level)
 - ◆ Local or temporary
 - ☒ Changing conditions causes readjustment of stream activities
 - ◆ Raising base level causes deposition
 - ◆ Lowering base level causes erosion
- 16 **Adjustment of base level to changing conditions**
- 17 **A waterfall is an example of a local base level**
- 18 **Running water**
- Stream erosion
 - ☒ Lifting loosely consolidated particles by
 - ◆ Abrasion
 - ◆ Dissolution
 - ☒ Stronger currents lift particles more effectively
- 19 **Running water**
- Transport of sediment by streams
 - ☒ Transported material is called the stream's load
 - ☒ Types of load
 - ◆ Dissolved load
 - ◆ Suspended load
 - ◆ Bed load
 - ☒ Capacity – the maximum load a stream can transport
- 20 **Running water**
- Competence
 - ◆ Indicates the maximum particle size a stream can transport
 - ◆ Determined by the stream's velocity
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- 26 **Running water**
- Deposition of sediment by a stream

- ◆ Caused by a decrease in velocity
 - Competence is reduced
 - Sediment begins to drop out
- ◆ Stream sediments
 - Generally well sorted
 - Stream sediments are known as alluvium

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- Deposition of sediment by a stream
 - ◆ Channel deposits
 - Bars
 - Braided streams
 - Deltas
 - ◆ Floodplain deposits
 - Natural levees – form parallel to the stream channel by successive floods over many years

28  **Formation of natural levees**

29  **Running water**

- Deposition of sediment by a stream
 - ◆ Floodplain deposits
 - Back swamps
 - Yazoo tributaries
 - ◆ Alluvial fans
 - Develop where a high-gradient stream leaves a narrow valley
 - Slopes outward in a broad arc

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- Deposition of sediment by a stream
 - ◆ Deltas
 - Forms when a stream enters an ocean or lake
 - Consists of three types of beds
 - Foreset beds
 - Topset beds
 - Bottomset beds

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- Stream valleys
 - ◆ The most common landforms on Earth's surface
 - ◆ Two general types of stream valleys
 - Narrow valleys
 - V-shaped
 - Downcutting toward base level
 - Features often include rapids and waterfalls

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- Stream valleys
 - ◆ Two general types of stream valleys
 - Wide valleys

- Stream is near base level
- Downward erosion is less dominant
- Stream energy is directed from side to side forming a floodplain

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42  **Running water**

- Stream valleys
 - ◆ Features of wide valleys often include
 - Floodplains
 - Erosional floodplains
 - Depositional floodplains
 - Meanders
 - Cut bank and point bar
 - Cutoffs and oxbow lakes

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44  **Erosion and deposition along a meandering stream**

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45  ***Stream Processes and Floodplain Development***

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46  ***Oxbow Lakes***

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47  **Running water**

- Incised meanders and stream terraces
 - ◆ Incised meanders
 - Meanders in steep, narrow valleys
 - Caused by a drop in base level or uplift of the region
 - ◆ Terraces
 - Remnants of a former floodplain
 - River has adjusted to a relative drop in base level by downcutting


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48  **Incised meander on the Colorado River**

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49  **Multiple terraces along the Bow River, Cochrane, Alberta**

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- Drainage networks
 - ◆ Land area that contributes water to the stream is the drainage basin
 - ◆ Imaginary line separating one basin from another is called a divide

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51  **Drainage basin**

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52  **Drainage basin of the Mississippi River**

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53  **Running water**

- Drainage pattern
 - ◆ Pattern of the interconnected network of streams in an area
 - ◆ Common drainage patterns
 - Dendritic
 - Radial
 - Rectangular
 - Trellis

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54  **Drainage patterns**

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- Headward erosion and stream piracy
 - ◆ A stream can lengthen its course by either
 - Building a delta
 - Headward erosion
 - ◆ Headward erosion may result in stream piracy – the diversion of the drainage of one stream into another

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- Formation of a water gap
 - ◆ A water gap is a notch where a river cuts through a ridge that lies in its path
 - ◆ Two possible methods of formation
 - Antecedent stream – stream existed before the ridge was formed
 - Superposed stream – stream let down upon a preexisting structure

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- Floods and flood control
 - ◆ Floods are the most common and most destructive geologic hazard
 - ◆ Causes of flooding
 - Result from naturally occurring and human-induced factors



58  **Running water**


- Floods and flood control
 - ◆ Types of floods
 - Regional floods
 - Flash floods
 - Ice-jam floods
 - Dam failure



59  **Running water**

- Floods and flood control
 - ◆ Flood control
 - Engineering efforts
 - Artificial levees
 - Flood-control dams
 - Channelization
 - Nonstructural approach through sound floodplain management



60  **End of Chapter**