# UK Landscapes 2: Rivers

## River processes shape the land and create landforms

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion</td>
<td>Wearing away of the land</td>
</tr>
<tr>
<td>Corrosion</td>
<td>Load in the river rubs against the channel</td>
</tr>
<tr>
<td>Attrition</td>
<td>Rocks smash together getting smaller &amp; smoother</td>
</tr>
<tr>
<td>Solution</td>
<td>Chalk &amp; limestone dissolved into the water</td>
</tr>
<tr>
<td>Hydraulic Action</td>
<td>Force of the water</td>
</tr>
<tr>
<td>Transportation</td>
<td>Movement of eroded material</td>
</tr>
<tr>
<td>Traction</td>
<td>Large rocks rolled along the bed</td>
</tr>
<tr>
<td>Salination</td>
<td>Pebbles bounced along the bed</td>
</tr>
<tr>
<td>Suspension</td>
<td>Silt carried along the flow</td>
</tr>
<tr>
<td>Solution</td>
<td>Dissolved in the water so carried along</td>
</tr>
<tr>
<td>Deposition</td>
<td>Load is dropped as water slows due to less water, more load or when shallower</td>
</tr>
</tbody>
</table>

## Channel
A groove in the land in which the river flows—made up of the bed & banks

## Cross profile
Side view of a section of a valley & channel

## Long profile
Side view of the whole length of a river from source to mouth showing height above sea-level, gradient & shape

## Load
The material the river carries eg stone & silt

## River basin
The area of land that drains into a particular river & its tributaries. A River basin boundary is the watershed

## Tributary
A smaller river that flows into a larger one

## Lateral erosion
Direction of erosion that widens the channel

## Vertical erosion
Direction of erosion that deepens the channel

## River course
The path the river takes divided into the upper, middle and lower which have distinctive characteristics

## Thalweg
Path of the fastest flow in a river

## River cliff
Steep sided bank of a river caused by erosion

## Slip off slope
Build up of load caused by deposition on the side of a river

## Discharge
The volume and speed of the water in metres per second (cubemeters)

## Landforms
A particular on the surface of the earth usually created by erosion and/or deposition

## Long and cross profiles on a TYPICAL river

### Waterfall & Gorge formation
**Waterfall** when a river flows over a steep drop. **Gorge** A deep, narrow valley with very steep or vertical rocky sides. When a river flows over hard rock followed by soft rock. The softer rock is eroded quicker, creating a step. As water goes over the step it erodes more of the softer rock. A steep drop is eventually created which is called a waterfall. **Hydraulic action** causes the channel to be deeper beneath the waterfall (plunge pool). The hard rock is eventually undercut by hydraulic action & abrasion as the water splashes back. The overhang becomes unsupported & collapses. This repeats again & again over time which means the waterfall retreats backwards upstream & leaves behind a steep vertical sided gorge.

### Floodplain formation
**Floodplain** wide and flat valley floor: **Lateral erosion** on the outside of meanders widens out the valley making it wider & flatter. When a river **floods** onto this area, the water slows down due to increased friction & deposits the load it is transporting. This builds up the flood plain making it higher & forming deep fertile soil.

### Levee formation
Leves: raised embankments either side of the river channel. The courser material is deposited first closest to the channel as it is heaviest, the finer material is transported further over the floodplain. Over time, after repeated flooding, the deposited material builds up creating levees along the edges of the channel.

### Meander formation
**Meander** bend in a river. The current is faster (thalweg) on the outside of the bends because the river channel is deeper so there is less friction to slow the water down. So more erosion takes place on the outside of the bend forming river cliffs. The current is slower on the inside of the bend because there is more friction as the river channel is shallower. Load is deposited here and forms slip-off slopes.

### Oxbow Lake formation
**Oxbow Lake** freestanding curved shaped body of water. Erosion causes the outside bends to get closer until there’s only a neck (small bit of land) between the two bends. Eventually the river breaks through this land, usually during a flood and the river flows along the shortest course. Water still flows in the bend but as its slower, load is deposited in the entrance & exit and eventually cuts off the meander forming an oxbow lake.
Factors effecting Discharge

Water reaches a river quickly by surface run off, when it flows overland. If water infiltrates into the ground it flows to the river slowly by through flow. Discharge is effected by human & physical factors in the drainage basin. Surface run off is increased if the ground is baked hard in hot dry weather or has become saturated by heavy & prolonged rainfall as infiltration is reduced. Impermeable rock eg granite & man-made surfaces such as tarmac as well as steep relief also reduces infiltration & increases surface run off. The water reaches the channel quicker & therefore increases discharge. Trees vegetation reduce discharge as roots absorb water & leaves intercept rainfall slowing down the rate it reaches the floor. Flooding - when there is too much discharge for the channel to hold, so it flows onto the surrounding land. Therefore, factors that increase discharge increase the risk of flooding. Hydrographs show changes in discharge at a certain point of a river & the amount of rainfall over a specific period of time. The baseflow of the river is the normal discharge. The rising limb shows the rapid increase due to rainfall reaching the channel via surface runoff and the throughflow. Peak discharge occurs when the river reaches its highest level. The time difference between the peak rainfall and the peak discharge is known as the lag time. The shorter the lag time the greater chance of a flood. The recession limb shows the time it takes to return to base flow. The shape of the hydrograph is influenced by the different factors in the drainage basin that either increase or decrease discharge.

V shaped valley & interlocking Spurs

V shaped valley: Narrow valleys with high steep sides Interlocking spurs: A series of V shaped valleys that overlap each other creating a pattern

Powerful vertical erosion in the upper course erodes downwards creating steep sides to V shaped valleys. The rivers are not powerful enough to erode laterally and wind around the hill sides of more resistant rock forming hillsides that overlap (interlock) in a zip like pattern

Flood Management Scheme—Somerset Levels

Why were flood defences needed on the Somerset Levels:

- Somerset Levels is an area of low flat land lying below sea level that frequently floods. During Dec 2013 & Jan 2014 200% of average winter rainfall fell. Flood risk increased due to urbanisation in the Bridgwater and Taunton areas increasing surface run-off & increasing discharge
- Routine dredging that allowed channels to hold more water did not take place. The flooding caused many impacts
- Roads closed A361 from Burrowbridge closed for 3 months. Main train-line to and from SW interrupted. (Paddington—Penzance)
- 11,500 hectares of farmland covered. 1,000s remained underwater for whole winter & took up to two years to recover
- Villages isolated eg Muchelney 150 properties affected, 40 completely flooded
- 96% of Somerset businesses were badly affected by road closures. Residential property - £20 million. Environment Agency, emergency services and local government response - £19.3 million. Other areas of Somerset were affected too: visitors were put off visiting Minehead/Exmoor thinking it also suffered from the flood. Total cost to UK £147 million
- Massive impact on mental health for residents who lost possessions, home etc

Flood Defence Scheme

20 Year Flood Action Plan (FAP) was put in place by the Environment Agency, community and other organisations. The FAP includes:

- Embankments, pumping stations, sluice & flood gates & coastal defences across Somerset were repaired before the following winter
- 8km of the River Tone & Parrett was dredged in Oct 2014 & there are plans for regular dredging
- The carrying capacity of the Kings Drain has been increased
- A stretch of Drayton Road will be raised by 1.2m to maintain road access to Muchelney, and culverts installed near Beer Wall to allow flood water to pass under rather than over the A327.
- The temporary defence at Weston Zoyland has been replaced with a new sheet piled wall
- Future flood barrier is being considered to protect Bridgwater.

Benefits: social/economic/environmental

- People’s homes, possessions & business will be better protected
- The FAP reassures people that action is being taken & could Improve mental health issues caused by the flooding
- Less interruption in travel resulting in a loss of business
- Construction & maintenance will create jobs

Costs:

- Dredging will impact on marsh habitats eg wading birds
- The total cost of the scheme will cost over £100 million
- Interruption to travel whilst the roads are being raised and culverts installed

Soft Engineering: schemes that work with the river to reduce risk of flooding Examples:

- Flood warnings (reduce damage as people prepare), preparation eg sandbags, afferstasion, (intercept & absorb water from soil) and zonning (allows low value land to be flooded) & high value to be built further away. Benefits: cheap, easy, more sustainable as have less impact on the environment, easy to maintain, doesn’t negatively impact down stream. Disadvantages: take long time to take effect, don’t always stop a flood

Hard Engineering: man made structures to control the flow of rivers & reduce flooding Examples: dams (control the flow), channel straightening (water flows passed an areas quicker, walls & channel deepening (can hold more water. Benefits: reliable (people feel reassured), works immediately, effective, can prevent flooding completely, can be used for other things eg reservoirs) can be used for HEP & leisure

Storm Hydrograph