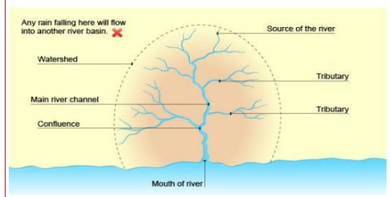
River Landscapes

Drainage Basin

An area of land drained by a river an it's tributaries.



What are the Features of Drainage basins?

Watershed: Highland or hill that separates one drainage basin from another
Confluence: the point where two rivers/streams meet/join
Tributary: a smaller stream or river that joins a bigger stream or river
Source: the starting point of a river or stream
Mouth: the point where a river leaves the drainage basin

Physical Processes

Weathering:

Weathering is the breakdown of rock by natural processes.
There are three key weathering processes that affect river valley's:

Mechanical (Freeze- thaw)	Water enters cracks in rocks and freezes when temperatures drop below zero; the water expands, putting pressure on the rock. This process of expanding and contracting causes the rock to break into smaller pieces.
Chemical (acid rain)	Slightly acidic rainfall, polluted by factories and vehicles, reacts with weak minerals causing them to dissolve and decay.
Biological weathering	The roots of plants grow in cracks and split the rock apart. Or burrowing animals break up rocks.

Mass movement:

Mass movement is the transfer of material down the valley/slope due to gravity.

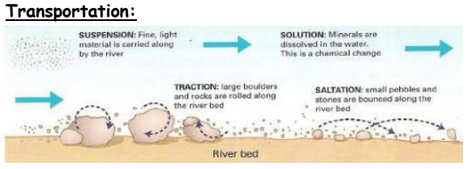
Soil creep	Individual particles soil move slowly down a slope due to gravity
Slumping	At the bottom of a valley slope the river erodes the valley side. Material above slides downwards rotating as it does often after times of heavy rain saturating the rock and soil making it heavy
Sliding	A slide happens when a section of soil or rock suddenly gives way and moves down a slope. The material moves as a single mass along a slippery zone. The slippery zone is often made up of wet sediment.

River erosion:

The action of water wearing away rocks and soil. There are four key processes of erosion.

Abrasion	Load is dragged by water wearing away the banks and bed of the river and causes most erosion
Attrition	Load collides with load and wears down/breaks up
Solution	Weak acid dissolves rocks such as Limestone
Hydraulic action	The shear force of the water trapping air in cracks fracturing the rock on the banks and bed of the river

Transportation:

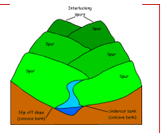


Deposition:

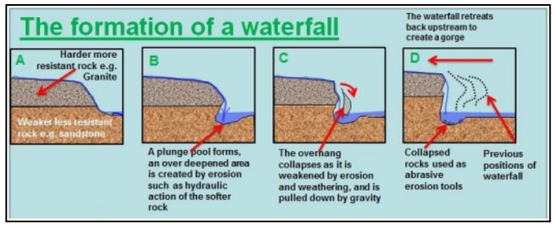
When a river loses it's energy deposition occurs. Heaviest material is deposited (dropped) first.

Interlocking Spurs—Upper Course

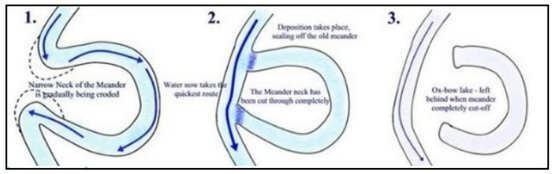
At the source rivers have less power and flow around hard rock valley slopes (spurs) instead of eroding them. The spurs then inter-lock from one side to the other.



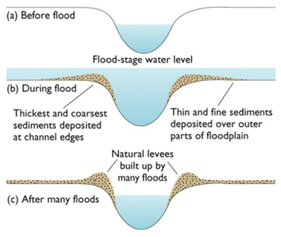
Waterfalls—Upper Course



Meanders and Ox Bow Lakes—Middle Course

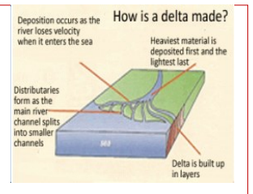


Levee and Floodplains—Lower Course



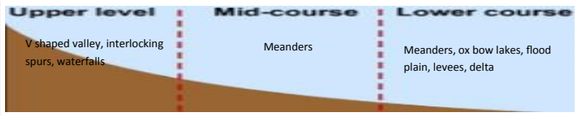
Delta—Lower Course

Water speed decreases near the sea. Material is deposited. Over time this builds up to create an area of new land - a delta. Deltas Because the river is now flowing slowly the channel fills up with sediment and the river splits into different streams, distributaries.



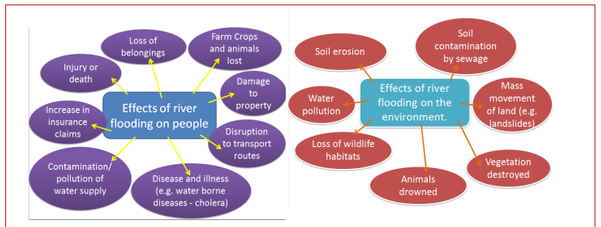
The Course of the River

The long profile of a river change s according to the Bradshaw model



Upper course	Middle course	Lower course
Shallow Narrow Slow flowing Little erosive power Angular rocks/sediment Large sediment size Small discharge	Reasonably deep Reasonably wide Increasing velocity Some erosive power Some angular and rounded rocks/ sediment Average sediment size Increasing discharge	Deep Wide Fast flowing Great erosive power Rounded rocks/sediment Small sediment size Large discharge

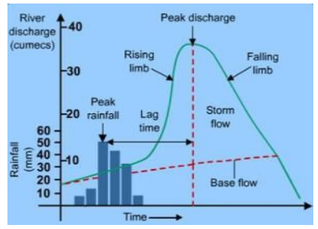
Impacts of River Flooding



How does the Environment Agency Manage Flood Risk?

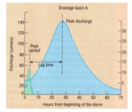
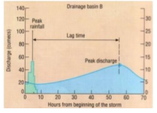
The Environment Agency makes Catchment Management Plans, manages rivers and land use, controlling developments in flood plains, building flood defences as well as helping people to prepare and giving warnings.

Physical and Human Factors Affect Hydrographs



Rising limb = indicates discharge increases a few hours after rainfall.
Peak flow = Discharge reaches max levels.
Recession (falling) limb = indicates a fall in discharge once the water has passed downstream.
Lag time = time from peak rainfall to peak discharge

A hydrograph is a way of showing how a river responds to a rainfall event showing the relationship between rainfall (mm) and discharge (m3/cumecs).

		
Precipitation	Heavy, rapid rainfall or snow melt	Gentle rainfall or snow melt
Geology	Impermeable rock	Permeable rock
Drainage basin size	Small, with lots of tributaries, so rain reaches river quickly	Wide and elongated drainage basin, so rain reaches river slowly
Soil, slopes	saturated, impermeable rocks such as clays; steep slopes	Permeable rock allowing infiltration, such as sandy materials; gentle slopes
vegetation	Deforested area, very little interception	Large woodlands intercept large amounts of rainfall
Towns/cities	Urban areas, Impermeable surfaces	Rural areas, permeable surfaces
Antecedent conditions	Heavy rainfall, saturated land	Little rainfall, capacity to soak up rain

Human and Physical Cause of Flooding

Human Causes	Physical causes
• urbanisation, because towns and cities have more impermeable surfaces • deforestation, because removing trees reduces the amount of water intercepted and increases run-off • Climate change, leading to increased snow melting • Climate change leading to extreme weather conditions • Poor dam construction	• heavy rainfall/long periods of rain • snowmelt • steep slopes • impermeable rock (doesn't allow water through) • very wet, saturated soils

Increasing UK Flood Risk

Flooding is a natural occurrence but since 1998 severe flooding has occurred somewhere in the UK every year sometimes twice in a year. The main reasons for this are as follows:

1. Increased population = more housing. Building on the cheaper land of the flood plain has put 2.3 million houses at risk of flooding.

2. Land use changes with urban developments = more impermeable surfaces which increases surface run-off.

River Management

Hard engineering—Involves building artificial structures which try to control rivers.

Method	Description	Advantage	Disad
Dams and reservoirs	Large concrete walls build across the river. Water is stored behind the dam and the discharge is controlled.	Can generate HEP. Long lasting and effective.	Disturbs animal habitats. Settlements and farmland lost. Extremely expensive.
Channelisation	The river is widened and deepened so it can carry more water. The river can also be straightened so water moves through the area faster.	Long lasting and requires minimal maintenance.	Unnatural and visually intrusive. Greater risk of flooding downstream.

Soft engineering—Involves using natural processes to control river flooding.

Method	Describe	Advantage	Disad
Washlands	Low value areas of land are allowed to flood.	Deposited silt may enrich soil. Cost effective.	Land is lost. Can not be built on.
Floodplain zoning	The government introduce policies on where to build.	Cost effective.	Does not help the housing shortage.

What Decisions are Made Before Building Flood Defences?

Because flood defences are so expensive the EA works out which would be most effective with limited environmental damage by conducting an impact assessment (residents, business, transport, wildlife and habitats) and a cost -benefit analysis (value for money). In 2000, severe flooding of the river Severn affected 140 in Bewdley so local residents and businesses want to improve the flood defences. The EA worked a number of possible options including the costs and benefits:

Costs	Benefits
Do nothing therefore £0 Maintenance of banks £0.2m Storage dams 1km upstream £15m Demountable aluminium flood defences, 2.7m high costing £6.9m	Little benefit except £0 spent Bank collapse prevented Volume of water retained wouldn't prevent a 100yr event £0.5m 150 properties protected, 24hr warning required £7.5million