GCSE GEOGRAPHY KNOWLEDGE BOOK

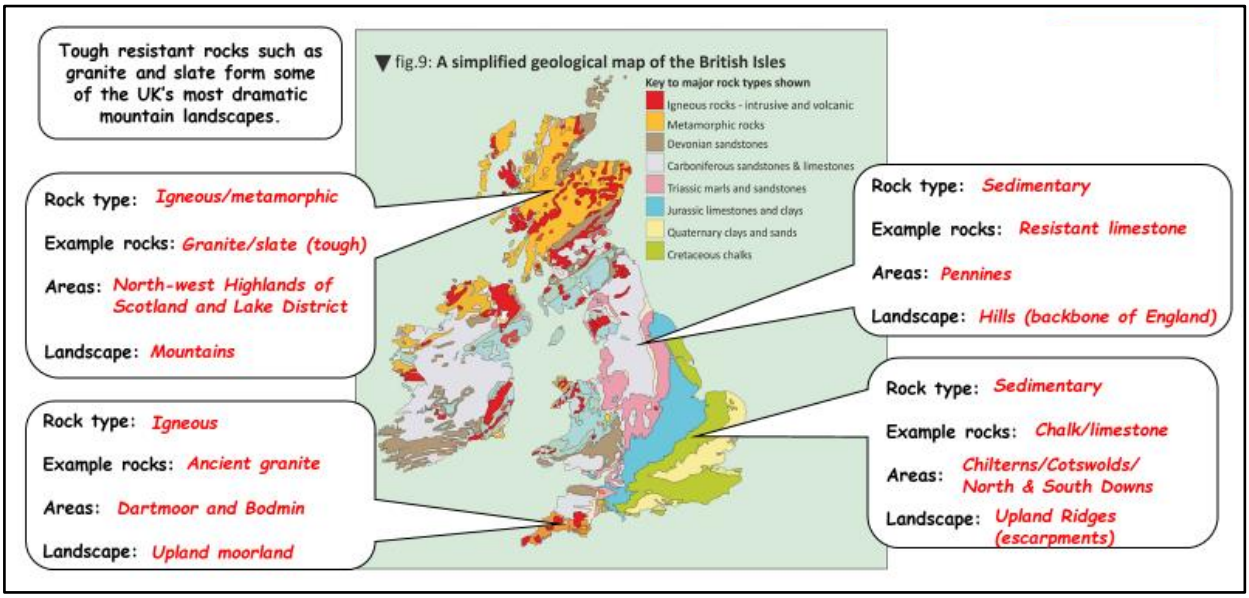
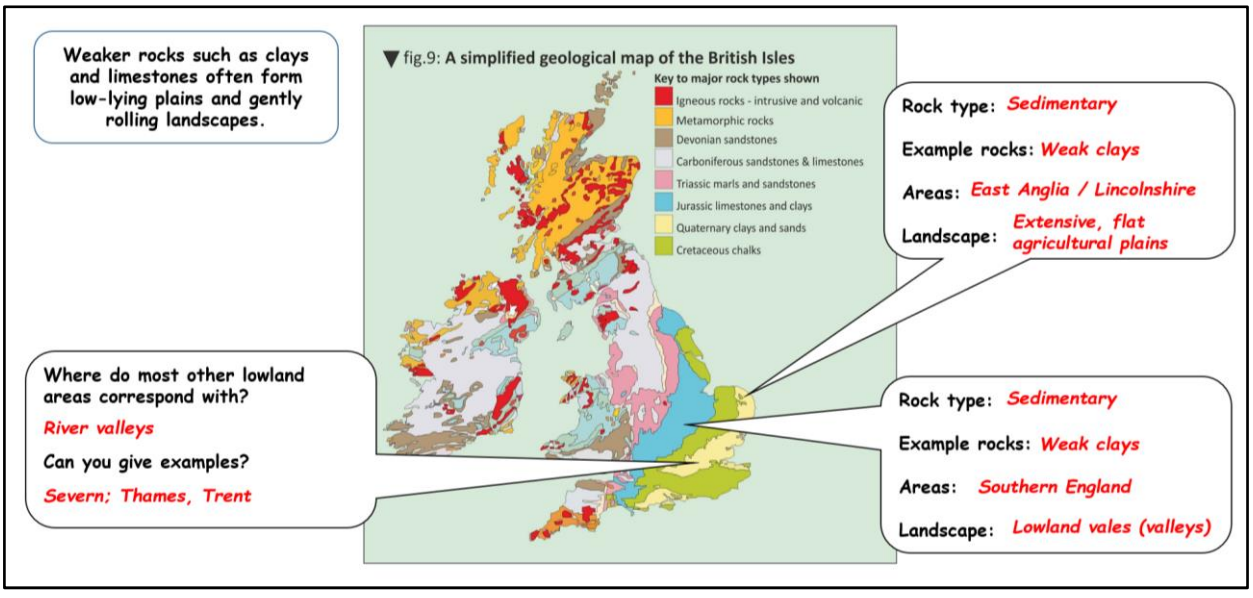
Unit 1:
Living with the Physical Environment

Section C:
Physical Landscapes in the UK

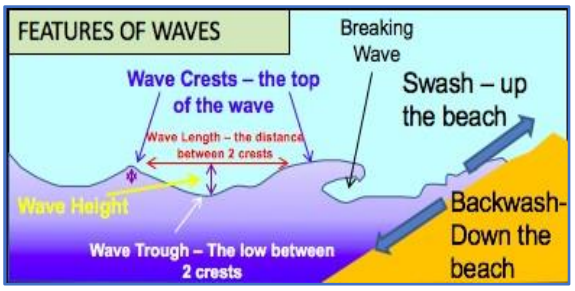
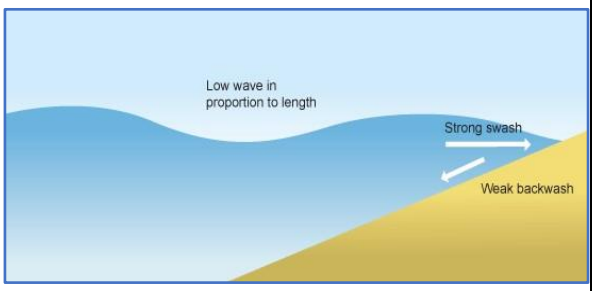
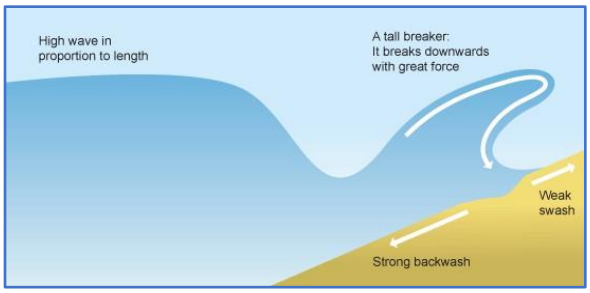
- Physical Landscapes
- Coastal Landscapes
- River Landscapes

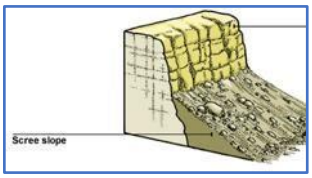
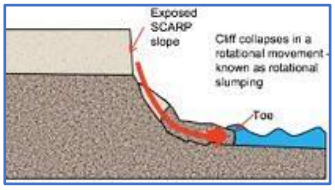
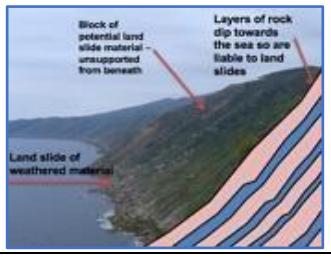
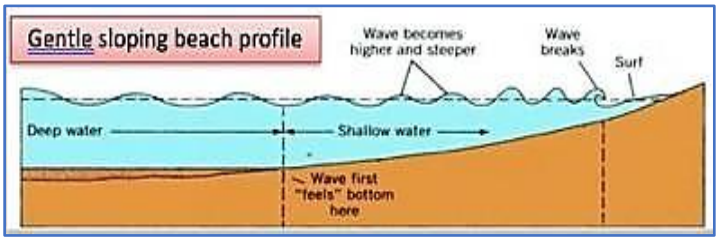
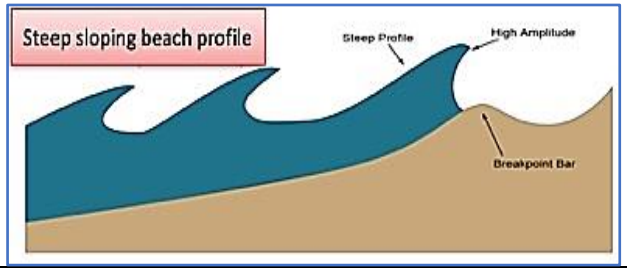
The information here is what all students MUST know. If you hope to get a GCSE grade 7-9, you will need to extend your knowledge through additional reading from your class notes, the online textbook, and revision guides. Use this sheet as a checklist to identify what is clear to you, what you need to work on, and what you can tick off once revised. **If you have any doubts or questions, please come and see your teacher** – we will be very happy to help!

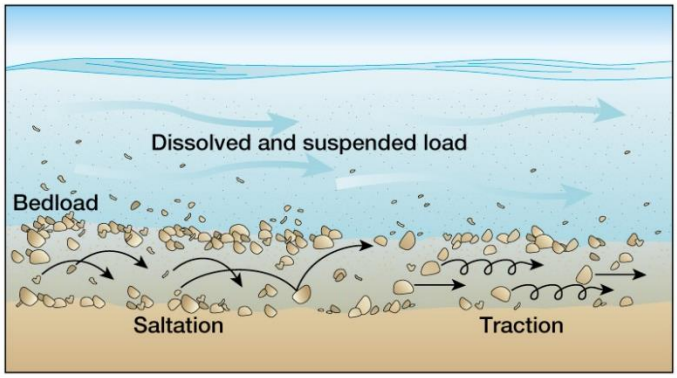
UK PHYSICAL LANDSCAPES

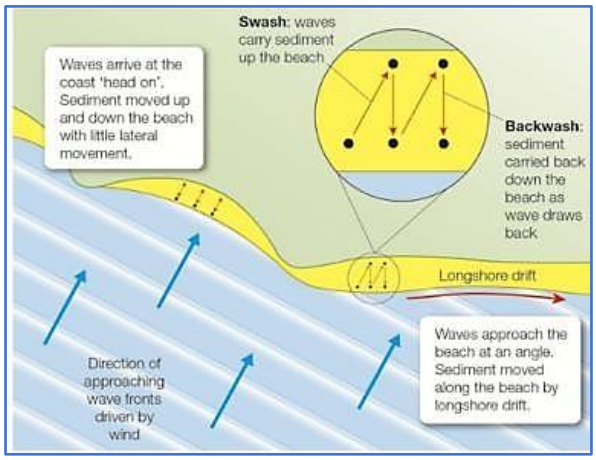
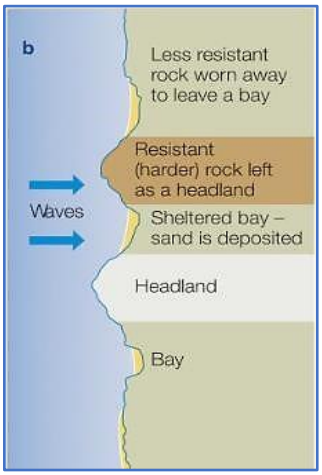
Key content	**What you need to know**
Upland Areas	
Lowland Areas	
UK river systems	The UK has extensive river systems. Most sources are in the mountains which often radiate out towards the coast. The longest river in the UK is the River Severn (352km). Its source is in the Cambrian Mountains in Wales. The river Thames is 344km in length.

COASTAL LANDSCAPES

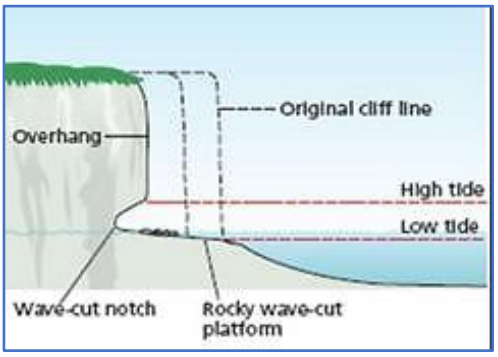
Key content	What you need to know
Types of waves	**Waves** are formed by the wind blowing over the sea. **Friction** with the surface of the water causes **ripples**, which build up to form waves. **Fetch** = distance of open water over which the wind blows. The greater the fetch, the more powerful the wave. **Swash** = movement of wave up the beach. **Backwash** = movement of wave back to sea.  **Constructive waves** - low energy waves that 'construct' (build up) the beach by transporting and depositing material. Low wave height, long wave length, strong swash and weak backwash.  **Destructive waves** - high energy waves that 'destroy' the beach (remove material). High wave height, short wave length, weak swash and strong backwash. 
Weathering	**<u>The weakening of rocks by the weather.</u>** There are three types: **1. Mechanical (physical) weathering:** the physical break-up of rocks. Creates small rock fragments called **scree**. e.g. freeze-thaw (water collects in cracks; freezes and expands at night, breaking rock apart; ice thaws by day; more water collects in larger crack; process repeats).  **2. Chemical weathering** – acids in rainwater dissolve rock (chalk and limestone). **3. Biological weathering** – due to plants and animals. Roots of plants grow in cracks in rocks and break them apart; animals can burrow into weak rocks.

Mass movement	**<u>The downward movement of material under gravity, due to</u> <u>weathering.</u>** Learn 3 types: 1. **Rockfall:** fragments of rock break away from a cliff due to **freeze-thaw weathering**.  2. **Rotational slip (slumping):** Weak rock saturated with **rainwater** becomes too heavy and slips away ('slumps') under gravity (*e.g. Scarborough, 1993*).  3. **Landslide:** Occurs where rock layers point downhill. Entire layers of rock are therefore vulnerable to sliding away as a result of weathering (*e.g. Beachy Head, 2001*). 
Coastal processes - EROSION	**<u>The wearing away of rock, stones and soil by waves, rivers, glaciers</u> <u>and the wind.</u>** There are 4 types at the coast: **Hydraulic action** – the sheer force of the water crashing against the cliff **Abrasion** – rocks and pebbles thrown against cliff by waves **Attrition** – rocks and pebbles knock against each other, becoming smaller and smoother **Solution (corrosion)** – chemicals in water dissolve rock (limestone) Three factors affect the ***<u>rate of erosion:</u>*** 1. **Fetch** - distance of sea over which wind blows. Longer fetch = larger, more powerful waves 2. **Geology (rock type)** – softer rocks (e.g. clay) erode faster than harder rocks (e.g. limestone, sandstone, chalk). 3. **Beach profile (steepness)** – *gently sloping beaches* lead to more friction between the wave and sea bed, slowing the wave down and reducing wave energy. *Steeper beaches* reduce friction between wave and sea bed, making wave energy and wave speed high.  

Coastal processes – TRANSPORT-ATION	**<u>The movement of eroded material.</u>** How material gets moved depends on its size and the energy of the waves. 4 ways: **Traction** – large pebbles rolled along seabed **Saltation** – particles too heavy to be suspended bounce along seabed **Suspension** – particles suspended (carried) in water **Solution** – limestone/chalk material dissolved in water 

Longshore drift – *a key transportation process*	• LSD moves sand and rock along the beach in a **zig-zag pattern**. • Waves move material up the beach **(swash)** at an angle set by the **prevailing wind**. • The **backwash** brings material back to sea at a **right angle** to the beach, under **gravity**. • Process repeats to create **beaches, spits, bars, lagoons and tombolos.** 
Coastal erosion landforms	**<u>Landform – a feature of the landscape created by the erosion, transportation or deposition of material</u>** ***<u>Erosion landforms</u>*** include: **1. Headlands and bays** • Less resistant (softer) rock erodes more quickly than more resistant (harder) rock. • Areas of more resistant rock therefore stick out to form headlands • Areas of less resistant rock erode further inland between the headlands to create bays or beaches. • Sand is deposited due to the shelter provided by headlands. 

2. Wave-cut notches

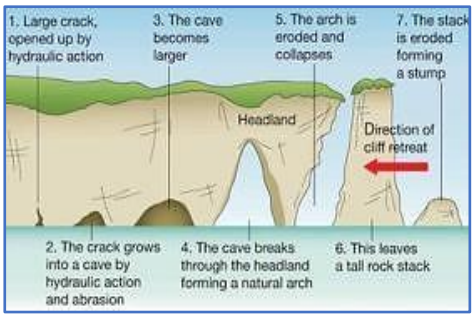


- Formed by wave erosion (hydraulic action and abrasion) at the base (bottom) of the cliff.
- The notch increases in size, causing the land above to collapse.
- This is how cliffs retreat (move inland).
- The process leaves behind a wave-cut platform.

3. Wave-cut platforms

- Wave-cut notch (see above) grows, leading to cliff overhang and eventually cliff collapse.
- Cliff retreats over time to leave behind a wave-cut platform
- Wave-cut platform is generally smooth due to the process of abrasion.

4. Caves, arches, stacks and stumps – all occur at *HEADLANDS*, and in *this order*:



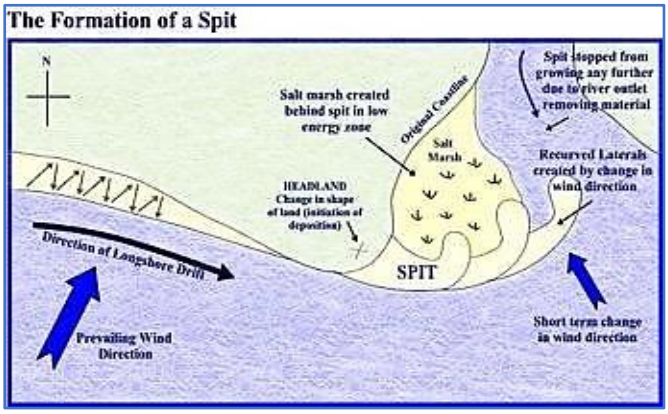
- **Cracks** are opened up by hydraulic action.
- Cracks widen by hydraulic action and abrasion to form a **cave**.
- Cave erodes through to other side of headland to form an **arch.**
- Continued erosion leads to widening of arch and collapse of above material into sea under gravity.
- A **stack** is left behind.
- Stacks are eroded until their collapse, creating a **stump**.

Coastal deposition landforms

<u>Deposition: the dropping of material under gravity due to a loss of energy.</u>

1. **Beaches** – formed by material transported and deposited by **constructive waves**.

2. **Spits** *(learn in this order):*

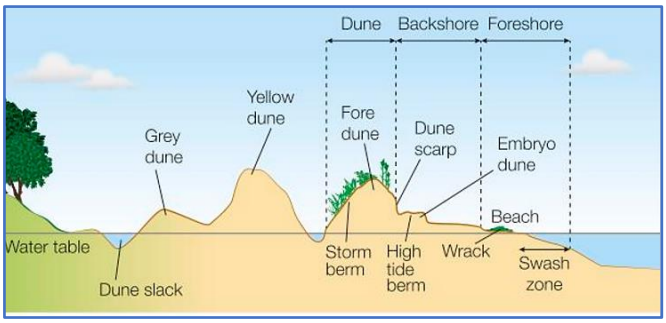


- Spits are long fingers of sand or shingle stretching out to sea.
- They occur where there is a sudden change in the coastline's direction, often at a river estuary or headland. Longshore drift transports sediment along the coastline until the change in direction.
- Then, the sediment gets deposited out to sea to form an extension of the land. This is because the change in coastline slows the water's velocity (speed).
- Salt marshes form in the sheltered waters behind the spit. The water's energy is low so plants can take root.
- The spit has a 'recurved' end due to a temporary change in the prevailing wind direction.

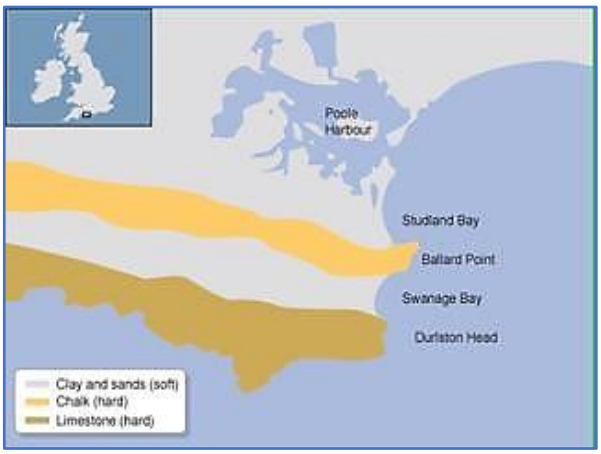
3. Bars are formed where a spit grows across a bay to connect two headlands.
A lagoon is formed behind the spit.

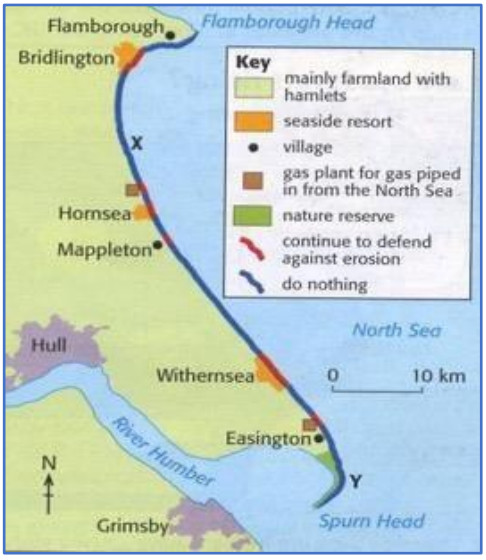
4. **Tombolos** are formed where spits grow out to sea to connect small islands to the mainland.

5. **Sand dunes** *(learn in this order):*

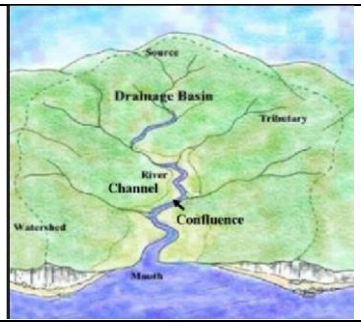


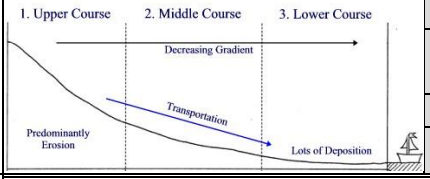
- Hills of sand that form at the back of the beach
- They form around **obstacles** thrown onto beach by storm waves (rocks, wood, seaweed).
- Sand blown up the beach gets deposited around the obstacles, forming an **embryo dune**.
- The embryo dune is then colonized by plants known as **pioneer species**. Main pioneer species = **marram grass**.
- Over time, roots of marram grass **stabilise** the dune (hold it together), creating a **fore dune**.
- There may be another storm, depositing new material in front of the fore dune.
- **Another embryo dune** can be created and the process repeats.

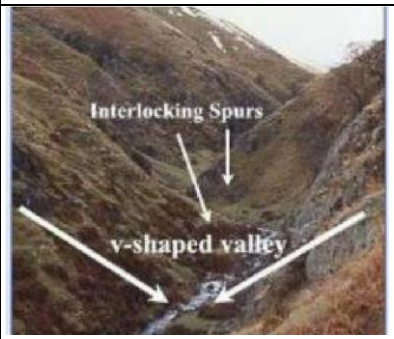
Coastal landforms case study: Swanage	***Swanage is on the south coast of England.*** **Headlands and bays** have formed due to **bands of chalk** (hard), **clay** (soft), and **limestone** (hard). Southern stretch of coastline is **concordant** (straight) as it is made of one rock type (limestone) – see map. Eastern stretch of coastline is **discordant** (uneven) due to bands of hard and soft rock – see map. **Spits** have formed across the **sheltered bay at Poole Harbour**. 
Coastal management - hard engineering	**Artificial (concrete or steel) structures to stop waves or reduce their energy** *General advantages (+)*: Effective at reducing erosion; lasts a long time. *General disadvantages (-)*: Expensive and high maintenance costs; an eyesore (looks ugly); interferes with natural processes to cause problems elsewhere along coast. **Sea wall:** vertical structures that **reflect** wave energy back out to sea (+) Protects base of cliffs; can be built very tall (-) Limits beach access; does not reduce or absorb wave energy – just reflects it  **Rock armour (rip-rap):** Big rocks dropped on beach to **dissipate** (break down) wave energy (+) Looks more natural (-) Beach access difficult; expensive to purchase and transport  **Groynes:** Wooden and concrete structures built at right angles to the sea. Designed to prevent **longshore drift** and build up the beach. (+) Creates a wide beach – a natural sea defence (-) Terminal groyne syndrome – rate or erosion increases along coast after the last groyne because less sand reaches here  **Gabions:** Metal cages filled with small rocks which **dissipate** wave energy. (+) Cheaper than other hard management strategies (-) Not as strong or long-lasting  **Revetments:** sloping wooden features that break up waves but let sediment and water pass through (+) Cheaper than a sea wall (-) Can be destroyed by big storms – not suitable where wave energy is high 

Coastal management - soft engineering	A more sustainable (environmentally friendly) approach to coastal management. Works with, not against, natural processes. *General advantages (+)*: Cheaper than hard engineering; looks more natural; better for beach access and therefore tourism. *General disadvantages (-)*: Does not last as long as hard engineering; requires regular maintenance; less effective than hard engineering at reducing rates of erosion. **Beach nourishment (rebuilding; replenishment):** building up the beach by replacing sand lost to sea (+) A natural sea defence – beaches dissipate wave energy (-) Sand needs replacing after storms which bring destructive waves  **Sand dune regeneration:** allowing sand dunes to regenerate (rebuild) by planting **marram grass** which stabilises sand (+) Absorbs wave energy; creates new habitats, very cheap. (-) Easily damage d by people and weather; time consuming to plant grass  **Sand dune fencing:** constructing fences to help trap sand and encourage new dunes to form (+) and (-): Same as sand dune regeneration **Managed retreat (doing nothing):** A deliberate policy of allowing the sea to flood or erode an area of low-value land. Technically soft engineering as natural processes are allowed to take place. (+) No costs involved; creates habitats for wildlife (-) People lose land and property; they may need to be compensated; not suitable for towns and cities 
Coastal management case study - Holderness	***Holderness:*** North east coast of Yorkshire, north east England, north east of Hull -Fastest eroding coastline in Europe (1m / month). Made of boulder clay. -A rock groyne was built to protect the town of Mappleton. -This led to terminal groyne syndrome further south along the coast, causing slumping on the cliffs. -Farmers of livestock lost their land, business and livelihood. -Farmers were refused insurance cover; lost a legal battle against the government for compensation. 

RIVER LANDSCAPES

<table>
<tr><td>Key content</td><td>What you need to know</td></tr>
<tr><td>Drainage basin</td><td> 

This is an area drained by a river and its tributaries.
• The source of the river is in the highlands and it is joined by tributaries at confluences as the river flows downstream.
• The edge of a drainage basin is marked by highlands and is known as the watershed.
• The river eventually flows through its channel to the mouth where it meets the sea.</td></tr>
<tr><td>River profiles</td><td> 

<table>
<tr><th>FEATURE</th><th>Upper</th><th>Middle</th><th>Lower</th></tr>
<tr><td>Channel</td><td>Shallow, narrow, rough, straight</td><td>Wider, small meanders</td><td>Wide, deep, large meanders</td></tr>
<tr><td>Valley</td><td>Steep, V – Shaped</td><td>Small floodplain</td><td>Flat floodplain</td></tr>
<tr><td>Sediment (load)</td><td>Rough boulders</td><td>Pebbles, gravel</td><td>Sand, silt and clay</td></tr>
</table></td></tr>
<tr><td>Weathering</td><td>• Weathering is the breakdown of rock by biological, chemical and freezethaw weathering.
• Biological weathering is where rocks are boken by tree roots and burrowing animals
• Chemical weathering is where rocks are dissolved by acids
• Freezethaw weather happens when water gets into cracks, freezes and expands and then breaks the rock in two</td></tr>
<tr><td>Mass movement</td><td> Weathered material is moved down a valley slope by mass movement including soil creep, slumping and landslides.</td></tr>
<tr><td>River processes</td><td>Erosion is the wearing away of the bed and banks of a river. This is done by hydraulic action, abrasion, attrition and chemical. Transportation is the movement of sediment downstream by traction, saltation, suspension and solution. Deposition happens where there is low energy and the river drops the sediment to build up new land.</td></tr>
<tr><td>Erosion</td><td>• Hydraulic action – the sheer force of water wears away bed and banks
• Abrasion – material in the river scrapes the bed and banks
• Attrition – Large material bumps into each other and breaks into smaller parts Chemical – acid in the water dissolves rocks</td></tr>
<tr><td>Transportat-ion</td><td>• Traction – large boulders rolled along the bed
• Saltation – sand and gravel bounced along the bed
• Suspension – small material floating in the water
• Solution – dissolved material in the water</td></tr>
<tr><td>V-Shaped valleys</td><td> 

• Formed where a river erodes vertically by hydraulic action and abrasion.
• The river cuts into the valley, weathering then breaks up the sides of the valley and mass movement carries it downslope to leave the V-shaped valley.
• Where the river winds around hard rock it leaves interlocking spurs.</td></tr>
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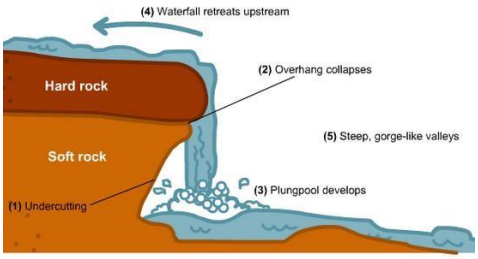
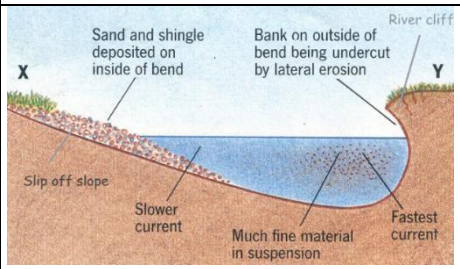
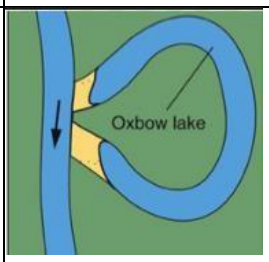
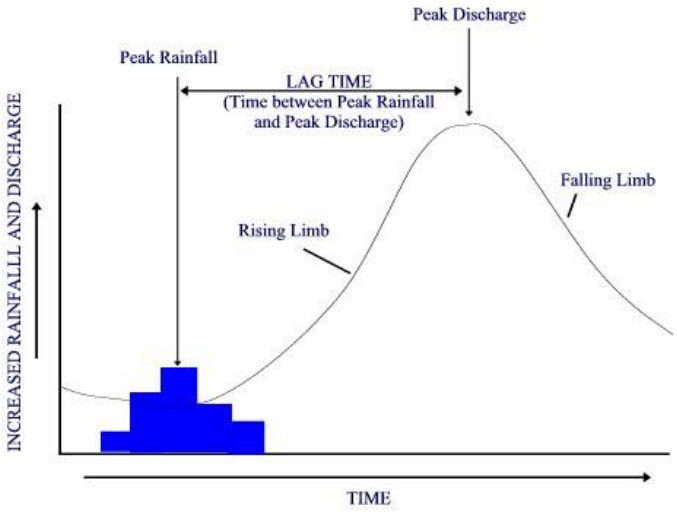
Waterfall and gorge		• Formed where a river flows over *hard and soft rock*. The soft rock is easily eroded by *hydraulic action and abrasion* to leave a deep *plunge pool* and overhanging hard rock. The hard rock collapses under gravity and the process starts again. • After many collapses the waterfall moves upstream cutting a steep sided *gorge.*
River meander		• Formed in the *middle and lower course* where the river begins to erode laterally (side to side). • Water flows faster round the outside bank and erodes the bank and forming a *river cliff* where the bank collapses into the river • Water flows slowly around the inside bank and deposits material building up new land on the *slip off slope or point bar*
Ox-bow lake		• Water flows more quickly around the outside / concave bank of the river and erodes the bank. • Where two meanders are close they erode towards each other narrowing the *meander neck* • Whent they meet the river takes the fastest, straightest route The old meander is cut off by deposition as there is very little flow to carry the material
Riffles and Pools	• Pools – areas of deep water at the outside bank of a meander caused by erosion • Riffles – areas of deposited gravel inbetween meanders where flow is slower causing material to be dumped	
Floodplain and levees		• Floodplains form in the middle and lower course where lateral erosion by meanders wears away hillsides to leave a flat valley floor. • The edge of the floodplain is marked by the *bluff line* where the land starts to rise. • *Alluvium* (river deposits) builds up on the floodplain each time the river floods. The largest material is dropped closer to the river and this forms a bank called a *levee*. • The smallest material (clay) is dropped at the edge of the floodplain and is very boggy resulting in the formation of a marsh
River estuary	• Form where the river meets the sea in areas where sea levels have risen • Land is deposited to form mudflats and these in time form saltmarshes	
Causes of flooding	• Flooding happens when rainfall rapidly reaches the river causing it to overflow • Physical factors: Heavy rain; saturated soil; impermeable geology; steep slopes • Human factors: Deforestation; drains; impermeable surfaces (eg. concrete)	

Flood hydrographs

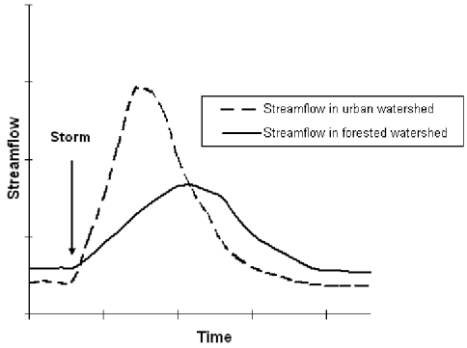


- Shows how a river responds to rainfall
- Peak rainfall – the time of the highest rainfall
- Peak discharge = the time and amount of peak flow
- Lag time = the length of time between peak rainfall and peak discharge
- Rising limb = shows the river rising in discharge (flow) as more water enters the river
- Falling limb = river level dropping after peak dischagre

Flood hydrographs (2)

The table above shows the factors that give different shaped graphs. Where lots of water reaches the river quickly the river will respond quickly and there will be a high peak in rainfall

Steep graph with high peak	Gentle graph with low peak
Lots of overland flow due to: Heavy rain Urban area Clay soil Impermeable rock (eg. granite) Saturated soil Steep slopes	Little overland flow: Light rain Forest Sandy soil Chalk Dry soil soaking water Gentle slopes



Hard engineering

These are artificial ways people try to stop flooding:

- Dams and reservoirs = Dam (wall) constructed across valley and a large lake (reservoir) holds back the water until it is safe to release the water
- Straightening = making a straight path for the river to speed flow through built up areas
- Embankments = raising the banks so a river can hold more
- Flood relief channels = an additional channel that by-passes towns and cities when the river is over-flowing

Soft engineering

These are natural ways people try to stop or limit flooding:

- Flood warnings and preparation = forecasts and emergency procedures to keep people safe
- Flood plain zoning = allowing only areas of a floodplain that are at less risk of flooding for building
- Planting trees = (afforestation) trees intercept rainfall, help water soak into the soil and stores water on leaves
- River restoration = restoring wetland areas in upland areas can stop flooding in towns and cities in the lower course

Example of flood management	**Where:** • River Cherwell, Banbury, 50km N. of Oxford **What:** • 2.9KM embankment alongside M40 to create a flood storage area • New pumping station • Creation of Biodiversity area of ponds and lakes to store water **Why:** • Flooding in 1998 damaged 150 homes; caused £12.5m damage; shut roads and railway station; **Issues:** • Social = Raised A361 avoids disruption to travel; new footpath and park areas; reduced fear of flooding • Economic = £85m benefit to local businesses; protected 441 houses and 71 businesses • Environmental = Disturbed existing wildlife, but created new parks; new planting areas; new wetland areas in the Biodiversity Action Area