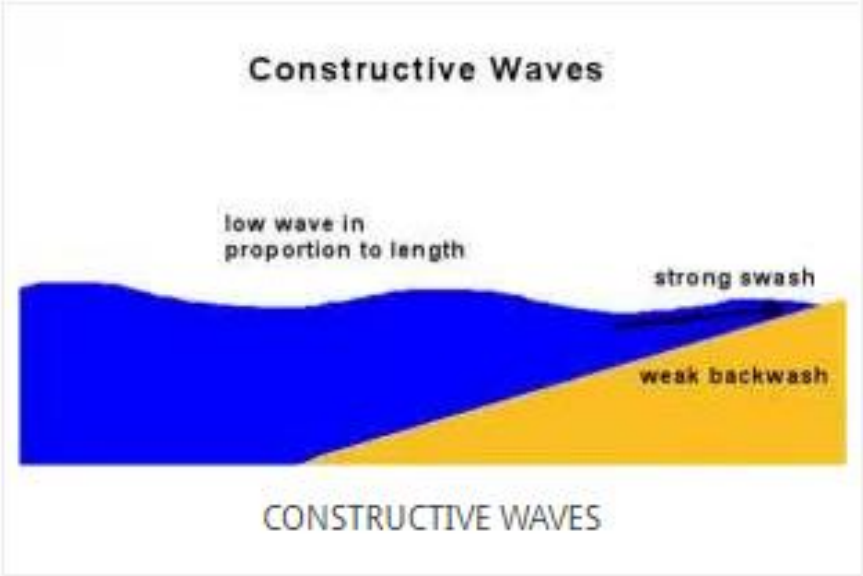
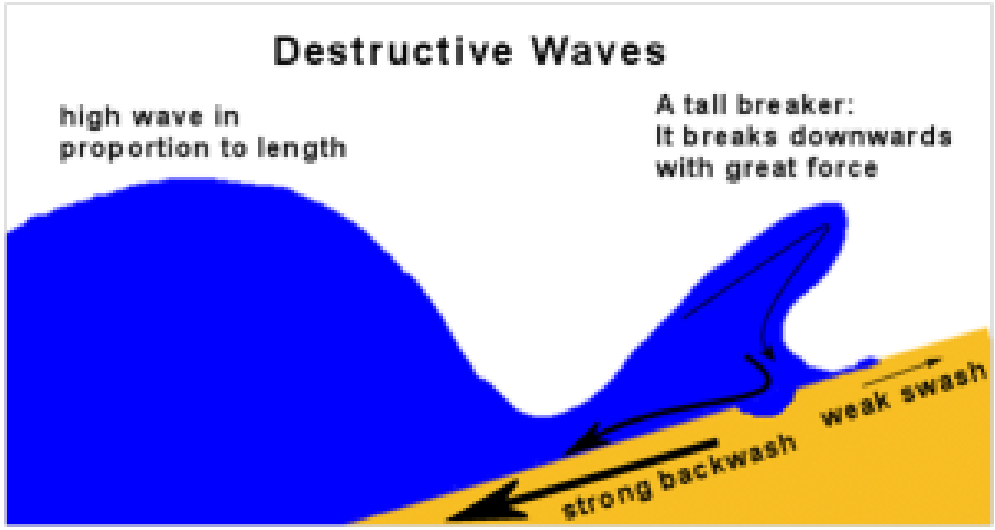
Subject	Geography	**Year Group**	10	**Sequence No.**	4	**Topic**	Coasts

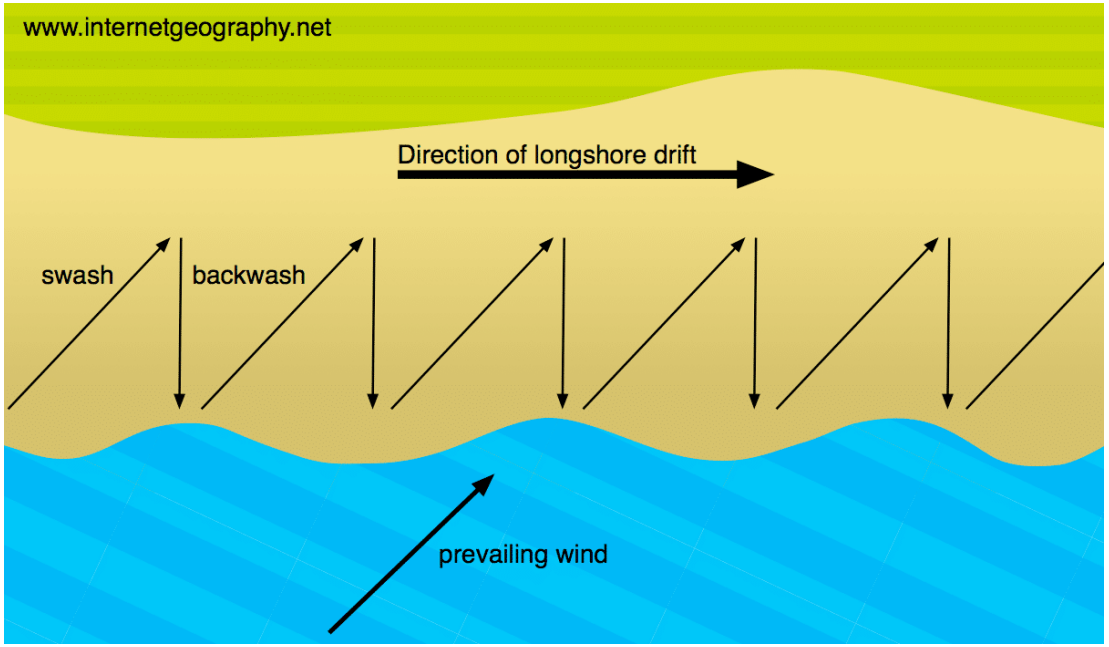
Retrieval	Core Knowledge	Student Thinking
What do teachers need retrieve from students before they start teaching new content?	What specific ambitious knowledge do teachers need teach students in this sequence of learning?	What real life examples can be applied to this sequence of learning to development of our students thinking, encouraging them to see the inequalities around them and 'do something about them!'
The words constructive and destructive from year 8 hazards topic.	Types of waves: Fetch of the wave – the longer the wave fetch the greater the erosive energy of the wave. **CONSTRUCTIVE WAVES** Constructive waves are **low energy** waves that **deposit** (drop) materials on a coast. As the waves approach a coast, the friction between the waves and the sea bed causes the waves to **slow down** at some distance from the coast. The waves break **gently** over a long distance. **Swash** (incoming wave) is **more powerful** than backwash (outgoing wave), this means more materials are carried up and deposited (dropped) on the coast than are removed. Over time, the beach is **built up**. This is a good thing because it means it's harder to erode the coastline and plenty of space for tourists. • Constructive waves are not as frequent (common) as destructive waves they reach the coastline every 6-9 minutes	From the knowledge gained in this topic students will understand how coastal processes help to create the landforms we see along the coast. Students will explore how problems associated with coastal erosion can be combated. They will also look into a career they could have linked to the knowledge aquired. They will do this through the following activities: • How to protect yourself from coastal erosion. • The dangers of coastal erosion.

	• They are long waves, so they roll onto a beach, they don't crash onto the beach • They create a wide gently sloping beach • They are low waves (1metere)  **DESTRUCTIVE WAVES** Destructive waves are **high energy** waves that erode a coast. They are common along steep sloping coasts where they break with a great force over a short distance. The **backwash** (outgoing) wave is **more powerful** than the swash (incoming). More **materials are removed** than are deposited (dropped) on the coast. Over time, the coast is **eroded away** because the beach is small.	• Understand why the UK coastal landscape looks the way it does. • Understand the dangers of mass movement and what to look out for. • Understand the most effective and cost-effective ways to manage a coastline. • Geography jobs - **Flood and Coastal Management Officer.** Knowing the best location to protect and how to protect it. • Real life examples of – Swanage, Holderness coast (Mappleton and Spurn point), Happisburgh (Norfolk). • Decision making exercise of what to do to protect Happisburgh in Norkfolk.

Recap erosion from the rivers topic in year 10 and the coasts topic from year 9 to help understand that weathering and erosion are different. In addition, recap of	• They are frequent (common) between 10-15 waves hit the coastline per minute • They are tall waves (up to 3meteres) this means when they hit the coast they have further to fall and erode the beach • Destructive waves form a narrow and steep beach  Weathering: Weathering describes **the breaking down or dissolving of rocks and minerals on the surface of the Earth in situ**. The difference between weathering and erosion. When the smaller rock pieces (now pebbles, sand or soil) are moved by these natural forces, it is called erosion. So, **if a rock is changed or broken but stays where it is, it is called weathering. If the pieces of weathered rock are moved away, it is called erosion**. The cliffs are constantly under attack from weathering processes • Mechanical weathering.	

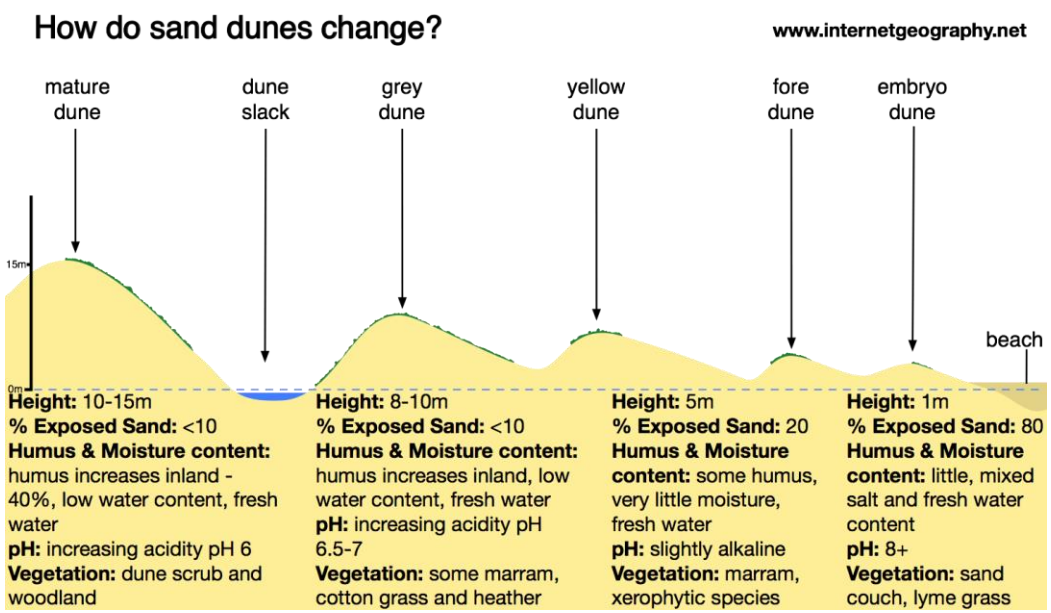
what processes occur in coastal areas from year 9.	- Freeze thaw. Water collects in cracks or holes (pores) in the rock. At night this water freezes and expands and makes the cracks in the rocks bigger. When the temperature rises and the ice thaws, water will seep deeper into the rock. After repeated freezing and thawing, fragments of rock may break off and fall to the foot of the cliff (scree). - Salt weathering. Seawater contains salt. When the water evaporates it leaves behind salt crystals. In cracks and holes these salt crystals grow and expand. This puts pressure on the rocks and flakes may eventually break off. • Chemical weathering. Carbonation: Rainwater absorbs CO2 from the air and becomes slightly acidic. Contact with alkaline rocks such as chalk and limestone produces a chemical reaction causing the rocks to slowly dissolve. • Biological weathering. This is due to actions of flora (plants) and fauna (wildlife). Plant roots grow in cracks in the rocks. Forcing them apart. Animals such as rabbits burrow into weak rocks such as sands forcing the rocks apart. Types of mass movement • Rockfall. Rocks become loosened due to freeze thaw. The rocks fall down individually the slope and at the bottom you are left with lots of broken pieces of rock, we call this scree (rubble). • Landslide. This occurs when there has been a lot of rainfall, cliffs made of soft rock will slip down a plane of the cliff. This is because the rocks under the soil don't soak up water, so a layer of water is left under the soil. Making it easier for a large part of soil to slide down the cliff. • Mudflow or mudslide. These occur on steep slopes, this happens suddenly and they are fast. These occur when there has been a period of rain and soils are full of water. There aren't usually many plants on the cliffs, so there is nothing to hold the soil together. At the top a hollow will	

The 4 types of erosion from the rivers topic.	appear as mud moves downwards. Material will move from there and eventually spread outwards and gather where the cliff is less steep. • Slump. This happens when there has been lots of rainfall and the cliff is full of water. They are similar to landslides but they only occur when the cliff is curved. The 4 types of erosion and how they influence the coast. **Hydraulic Action** This is the force and power of the water that pounds away at the coastline. **Abrasion** This is when the materials (rocks etc) that are carried by a wave hit the coastline. As the material hits the coast is scrapes away material from it. **Attrition** This is when materials carried by waves smash into each other, as they hit each other they break apart becoming smaller and smoother. **Corrosion/solution** This is when the waves are carrying chemicals in them, when these chemicals hit the coastline depending on the type of the rock they can dissolve the rock away. Longshore drift (LSD). Longshore drift is the movement of material along the shore by wave action. It happens when waves approach the beach at an angle. The swash (waves moving up the beach) carries material up and along the beach. The backwash (waves moving back down the beach) carries material back down the beach at right angles. This is the	

Recap of the 4 types of transportation of sediment from the rivers topic.	result of gravity. This process slowly moves material along the beach and provides a link between erosion and deposition. The material is transported through suspension, traction, solution and saltation. Longshore drift provides a link between erosion, transportation and deposition.  Longshore drift contributes towards the formation of a range of depositional landforms such as spits and onshore bars. For example, spurn Point is a coastal spit formed by the transportation of coastal sediment by longshore drift along the Holderness Coast. This material is then deposited at the mouth of the Humber Estuary. Coastal landforms.	

Recap of the word landform from rivers. A landform is a feature on the Earth's surface. Depositional landforms - Constructive waves Longshore drift must be understood to know why a spit forms.	Depositional landforms: BEACHES A sandy beach is usually formed in sheltered bays, where low energy, constructive waves transport material onto the shore. The swash is stronger than the backwash, so the material is moved up the beach. SPIT A spit is a landform of coastal deposition. It is an extended stretch of beach material that sticks out to sea and is joined to the mainland at one end. Longshore drift moves material along a coastline. Where the coastline changes direction or the power of the waves is reduced, material being transported by the sea is deposited. Where rivers or estuaries meet the sea deposition often occurs. The deposited sediment usually builds up over the years to form a long ridge of material (usually sand or shingle). Such a ridge is called a spit. Spurn Point on the Holderness Coast is an example of a coastal spit. Sand dunes The conditions required for sand dune formation are: • a large supply of sand • a large flat beach • time for the sand to dry, so an extensive tidal range is needed • an onshore wind (wind blowing from the sea to the land) for sand to be transported to the back of the beach • an obstacle for the dune to form against, e.g. pebble or driftwood	

Recap transportation from rivers which can be linked to aeolian transportation.	Aeolian transportation is when the wind transports sediment. Wind transports sand in 3 ways. These are: • suspension - sand is picked and carried within the wind. • Saltation – grains of sand bounce along in the win as they are alternatively raised and dropped. • Creep – sand grains collide with each other and push other grains along. How are sand dunes formed? 1. When there are obstacles, such as driftwood, the heaviest grains of sand will settle against the obstacle and create a small mound/ridge. Lighter grains of sand will be transported further and settle on the opposite side of the obstacle. 2. Eventually, the side of the obstacle facing the wind piles up, making that sand on that side of the obstacle very steep. The pile of sand on this side becomes unstable and collapses 3. When this happens the lighter grains of sand fall down the other side of the obstacle. It carries on slipping until there is an angle of 30-34 degrees. 4. Because winds blow on to the beach regularly, this process keeps on happening. This means that the sand dune it self can migrate up the beach. 5. After a long time the sand dune can get so big that it becomes the obstacle . So more smaller dunes start to form in front of it. 6. The height of a sand dunes depends on the strength of the wind. Stronger winds create taller sand dunes Succession of sand dunes and the characteristics:	

Longshore drift and how a spit is formed must be understood to know how a sand bar is formed.	 Sand bars A sand bar is created when there is a gap in the coastland with water in it. This could be a bay or a natural hollow in the coastland. The process of longshore drift occurs and this carries material across the front of the bay. Material is pushed up onto beaches at a 45 degree angle when the swash brings it onto the coastline. The backwash takes it back out towards the sea at a right angle to the coast. Through this process material is constantly moved along the coastline. The deposited material eventually joins up with the other side of the bay and a strip of deposited material blocks off the water in the bay. The area behind the newly formed bar is known as a lagoon.	

Recap – types pf erosion for erosional landforms	Erosional landforms Bays and Headlands WHAT IS A HEADLAND? A headland is a cliff that sticks out into the sea and is surrounded by water on three sides. Headlands are formed from hard rock, that is more resistant to erosion, such as limestone, chalk and granite. Headlands form along discordant coastlines where bands of soft and hard rock outcrop at a right angle to the coastline (see image below). Due to the different nature of rock erosion occurs at different rates. Less resistant rock (e.g. boulder clay) erodes more rapidly than more resistant rock (e.g. chalk). The bands of soft rock, such as sand and clay, erode more quickly than those of more resistant rock, such as chalk. This leaves a section of land jutting out into the sea called a headland. The areas where the soft rock has eroded away, next to the headland, are called bays. Sandy beaches are often found the sheltered bays where waves lose energy, and their capacity to transport material decreases resulting in material being deposited. Where the geology alternates between strata (bands) of soft and hard rock are called **discordant coastlines**. A **concordant coastline** is where the same rock runs along the length of the coast. Concordant coastlines tend to have fewer bays and headlands. Along the coastline of Dorset, there are concordant and discordant coastlines. The concordant coastline runs from west to east along the south coast. The discordant coastline runs from Studland Bay to Durlston Head as the geology changes from clay and sands, to chalk, to clay and sands again to limestone.	

Processes of erosion for caves, arches, stacks and stumps. Recap of example of a coastline (Dorset) from year 9 coasts. Processes of erosion for wave-cut platforms.	When headlands erode, they create distinct features such as caves, arches, stacks and stumps. Caves, arches, stacks and stumps. 1. **Cracks** are widened in the headland through the erosional processes of hydraulic action and abrasion. 2. As the waves continue to grind away at the crack, it begins to open up to form a **cave**. 3. The cave becomes larger and eventually breaks through the headland to form an **arch**. 4. The base of the arch continually becomes wider through further erosion, until its roof becomes too heavy and collapses into the sea. This leaves a **stack** (an isolated column of rock). 5. The stack is undercut at the base until it collapses to form a **stump**. Wave – cut platforms A wave-cut platform is formed when the following occurs: The sea attacks the base of the cliff between the high and low water mark. A **<u>wave-cut notch</u>** is formed by erosional processes such as abrasion and hydraulic action - this is a dent in the cliff usually at the level of high tide. As the notch increases in size, the cliff becomes unstable and collapses, leading to the retreat of the cliff face. The backwash carries away the eroded material, leaving a wave-cut platform. The process repeats. The cliff continues to retreat. Using an example of a place to show the landforms above. Swanage.	

The words hard and soft engineering from river management. Ways to overcome the challenges that our oceans face from the year 9 coasts topic, links to management strategies studied.	Management of the coast. Hard engineering. Uses artificial (not natural) structures , such as sea walls to protect the coast. Soft engineering. This uses more environmentally friendly ways that work with natural processes to protect the coast. Managed retreat. This allows the coast to retreat (go back into the land) and allows some of the sea to flood over the land Types of hard engineering. **ROCK ARMOUR** Piles of large boulders dumped at the foot of a cliff. The rocks force waves to break which absorbs the energy and protects the cliffs. The rocks are brought by barge to the coast.  **COST:** £200,000 per 100m **Advantages:**	

	-They are cheap and easy to maintain -They can be built in months rather than years. -Can provide interest to the coast -Often used for fishing **Disadvantages:** -Rocks are usually used from other parts of the coastline or abroad e.g. Norway. Other countries can get annoyed about this. -They can be a hazard for people getting to the beach. -Can be expensive to transport -Do not fit in with the local geology (rocks) -Can be obtrusive and litter can be dropped. **EXAMPLE: Walton on the Naze in Essex** **SEA WALL** It is a concrete or rock barrier against the sea. It is placed at the foot of cliffs or the top of a beach. It has a curved face to reflect the waves back into the sea.  **COST:** £5000- 10,000 per metre **Advantages:** -The sea walls can last for years which is good economically -Often has a promenade for people to walk along -They do not stop longshore drift so they don't disadvantage other beaches	

Disadvantages:
-Can look ugly and they can stop people getting to the beach.
-Very expensive to build and repairs are expensive.
-The concrete is ugly to look at and they can destroy habitats.
EXAMPLE: Dawlish in Devon

.GROYNES
They are timber or rock structures built out to sea from the coast. They trap sediment being moved by longshore drift and enlarge the beach. The wider beach acts as a buffer to reduce wave damage.

COST: £150,000 (at every 200m)
Advantages:
-Creates a wider beach, which can be popular with tourists.
-Provide useful structures for people interested in fishing.
-Not too expensive and they can last for 40 years.
Disadvantages:
-It stops longshore drift which can reduce sand on beaches and they can also cause increased rates of erosion on other beaches.
-They are unnatural and unattractive
EXAMPLE: Eastbourne in Sussex

	GABIONS Wire cages filled with rocks that can be built up to support a cliff or provide a buffer against the sea.  **COST:** £50,000 per 100m **Advantages:** -Cheap to produce and it uses local pebbles. -They can last for 20-25 years. -Can improve the drainage of cliffs -Will eventually become vegetated (plants will grow there) and it will become part of the landscape **Disadvantages:** -For a while they can be unattractive -They can cost £30,000 to repair. -Cages only last 5-10 years before they rust and sea birds might trap their feet in them. -Damaged gabions are unattractive and people might cut themselves. **EXAMPLE: Thorpeness in Sussex** Soft engineering. **Dune regeneration:**	

What is it?
This is when sand dunes are artificially created or when old sand dunes are improved. It is important for this to be done because the dunes act as a barrier between the sea and the land. It absorbs the wave energy which protects the land from the sea.

Cost: £200-2000 per 100m

Example: Calgary Bay, Scotland

Advantages and disadvantages:
Sand dunes protect the land behind them.
Tourists may not go to the area during restoration.
They are popular picnic and walking areas.
Fertilisers have to be added for the sand dunes to grow.
Often volunteers transplant the grass to regenerate the dune.
The sand dunes are habitats for Chiffchaffs.
The grass can be damaged by storms.
People often trample on the dunes
They can be damaged easily after storms

Beach nourishment:

	What is it? It is when sand or shingle (pebbles) are added to a beach to make it higher or wider. The sediment (sand/shingle) is brought in from the local area so that it blends in with the beach. It is usually transported to the beach by a barge (big boat). There are two types of beach nourishment BEACH RECHARGE: This is where sediment is taken from a bay and placed at a beach that is losing sand. BEACH RECYLING: This is the removal of sand from a down-drift area and returning it up-drift. **Cost:** Up to £500,000 per 100m **Example:** Eastbourne, Sussex **Advantages and disadvantages:** A wider beach with lots of room for tourists and attract more tourists. When doing re-nourishment people can't go to the beach. It is natural and blends with the environment. The beach re-nourishment protects the sea wall which reduces the maintenance costs. Protects people living at the seafront in their expensive properties. It costs £300,000 to hire a dredger (big tractor) to do the beach re-nourishments. **Managed retreat (coastal realignment):**  **What is it?** Managed retreat is when the sea is allowed to flood or erode an area of low-value land (Land that isn't very valuable and/or not many people live there). With a	

	managed retreat the natural process of erosion is allowed to occur. It means that money can be spent protecting more valuable areas of land. **Cost:** Free unless you pay people compensation for moving. **Example:** Essex, marshes **Advantages and disadvantages:** It may reduce the risk of flooding further down the coast. When people are re-located to allow the land to flood they have to find new houses. It is cheaper to use than any other strategy. When some areas are destroyed then some habitats can be ruined. It can create new ecosystems which can attract different plants and animals It doesn't stop coastal erosion or sea level rise **Beach re-profiling:**  **What is it?** Beach re-profiling is when the beach is re-shaped artificially using beach materials. In the winter, a beach is lowered by destructive waves. However, after the winter, bulldozers move the sand back up the beach. Making the beach steeper means that it's harder for the waves to reach any cliffs as the waves have further to travel and are fighting against gravity. **Cost:** £1000 per 100m **Example:** Norfolk, England	

	Advantages and disadvantages Residents feel safe and protected from the sea. Bulldozers may mean that people can't get on the beach. The cost of repair if no protection is £125 million, whereas with beach re-profiling it is £30 million over 25 years. A steep beach may look un-natural. Habitats are protected Doesn't change the character or feel of the area Can be ineffective after a big storm Real life example – Holderness coast. The village of Mappleton is under threat by coastal erosion along the coastline by 1998, the main road running through the village was only 500m from the cliff top and in places it is now only 50m. The village is under threat due to the easily eroded boulder clay (glacial till) which makes up the cliff line. The area suffers from erosion rates of up to 2m per year To reduce the amount of erosion threatening Mappleton, 2 rock groynes were constructed in 1991 to encourage the build-up of beach in front of Mappleton by trapping longshore drift. This meant that waves would break on the beach rather than attacking the cliffs. The groynes have successfully slowed the rate of erosion in the area and the homes and businesses there are protected. The knock-on effects.	

	• Problems for further down coast - Those living south of Mappleton village have experienced the 'knock-on' effects of the coastal management. • The sediment is no longer building up their beaches and so erosion has sped up down the coastline. • This is putting homes and businesses at risk in places like Withernsea where erosion is up to 10m a year. • Also Spurn Point Spit is not being replenished by new sediment coming along the coast by LSD.	