Geography

HOMEWORK

9B Ten changing coastlines.

Name

Tutor Group

Teacher

The homework booklet contains essential reading on

- **Ten coastlines around the world** plus a brief review of plate tectonics.

Your homework will be set and reviewed on ☑

☐ Monday ☐ Tuesday ☐ Wednesday

☐ Thursday ☐ Friday

People ● Place ● Pattern ● Process

In this homework booklet you will read about ten coasts and coastlines which are experiencing change, either through natural processes or human activity. Each week's reading will be followed up with a quick knowledge text in class.

Introduction: Ten Changing Coastlines, Part 1.

Coasts by their very nature are regions of change. Forming a narrow band between the land and the sea, coastlines have always been subject to the physical processes of both environments - terrestrial and marine. Ever since the oceans formed some 4 billion years ago their coasts have been in a stage of constant evolution: erosion in some places matched by deposition and growth elsewhere. It is likely that the coasts were the location for many great evolutionary events such as when life left the sea or when early mammals returned to the oceans to become whales and dolphins. Today the coasts are home to a vast number of human beings who are imposing new pressures and processes on this dynamic zone. Climate change threatens sea level rise and the loss of coastal communities, especially those built on reclaimed land or river deltas. Whatever we do over the next few generations our coastlines will continue to change and evolve.

#10 The bay of Fundy, Canada. 44°45' N, 66°20' W

Amazing tides. Located halfway between the Equator and the North Pole, Canada's Bay of Fundy has been declared one of North America's seven natural wonders. The unique shape and orientation of the bay, which separates Nova Scotia and New Brunswick, amplifies the daily tides to create the highest tidal range in the world. **Twice a day 100 billion tonnes of water are swept into the bay at high tide, twice the combined flow of all the rivers on the planet.**

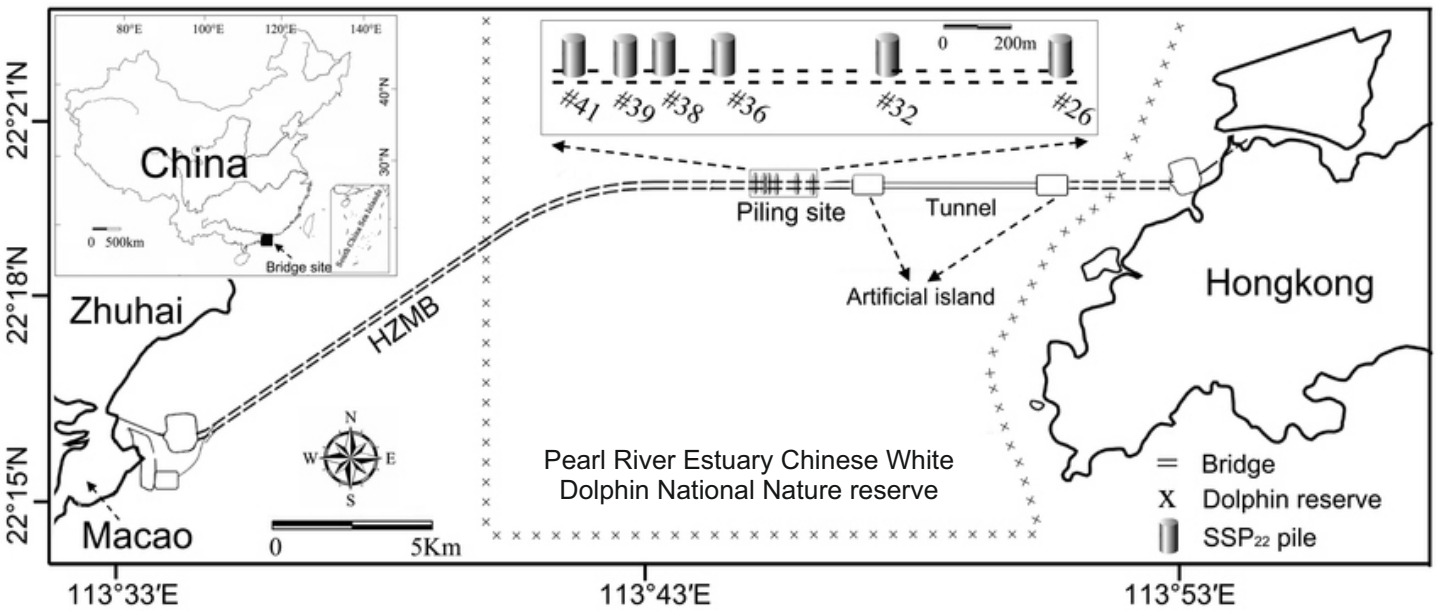
At the full moon, the tidal range can reach upwards of 16 metres, the height of a five storey building. The average tidal range globally is just one metre, with some coasts experiencing

with some coasts experiencing as little as 4cm. The second highest tidal range is found in Morecambe Bay, south of the Lake District. The range in this Irish Sea bay is 10.5 metres, with low tide exposing 310 km^2 of mud flats and sand banks.

Similarly in the Bay of Fundy, the retreating tide exposes vast expanses of mudflats at low tide. Fundy has become a significant resources of wading and migratory birds. At the entrance to the bay, large cetaceans gather to feed. The endangered Northern right whale can be seen feeding in the Bay of Fundy's waters. In 2003, the Canadian Coast Guard adjusted shipping lanes crossing the whale feeding areas at the entrance to the bay to lessen the risk of collision. **Many other marine mammals are found in the bay including fin whales, humpback whales, minke whales, Atlantic white-sided dolphin and the harbour porpoise.** To add to the interest of the bay, the sedimentary rocks of Fundy's coastline contain rich deposits of Jurassic dinosaur fossils.

#9 HKZM Bridge and Tunnel, China 22°25′ N, 114°10′ E

Whatever your opinion China, there is one thing that almost everyone agrees upon: when the Chinese really want to do something impressive the chances are they will, and usually at breakneck speed. **Spanning the entrance to the Pearl River, the Hong Kong – Zhuhai – Macau (HKZM) bridge and tunnel is a mammoth feat of engineering which took just 9 years to complete. Stretching for 55 kilometres and including a 6.9 km undersea tunnel the HKZM is the longest fixed sea connection on the planet.** The bridge was the brainchild of businessman Gordan Wu, who first proposed the bridge in the 1980s. However, construction had to wait until the British colony of Hong Kong, and Portuguese colony of Macau, were handed back to China in 1997 and 1999 respectively.



The bridge and tunnel link the three major cities of the Pearl River Delta and have reduced travelling time between Macau and Hong Kong from over 4 hours by boat to less than 40 minutes by road. It is just 30 minutes from Hong Kong to Zhuhai via the bridge. **Costing US$18.8 billion to build,the HKZM was opened to the public in October 2018.**

Since Macau and Hong Kong drive on the left-hand side of the road, but Zhuhai in mainland China drives on the right, the HKZM uses special viaducts to swap the traffic from one side of the bridge to the other on leaving Macau and Hong Kong and then swap them back on arriving at the far end of the connection. Only 10,000 private vehicle permits have been issued for using the bridge. Most people travel on the fleet of buses which make the crossing every five minutes, 24 hours a day.

#8 Funafuti atoll, Tuvalu, South Pacific 7°28' S, 178° 40' E

Tuvalu is an area of the Western Pacific made up of 6 coral atolls and 3 islands with a population of 11,689 people. Like many islands of the Pacific, Tuvalu's atolls formed above submerged volcanoes where coral sand has been deposited. It is on these rings of dead coral that human settlements have been built. 60% of the population live in 'urban' areas, mainly on the island of Funafuti. **This is not surprising, as there are only 25 square kilometres of land in Tuvalu, compared to over 900,000 km^2 of ocean.**

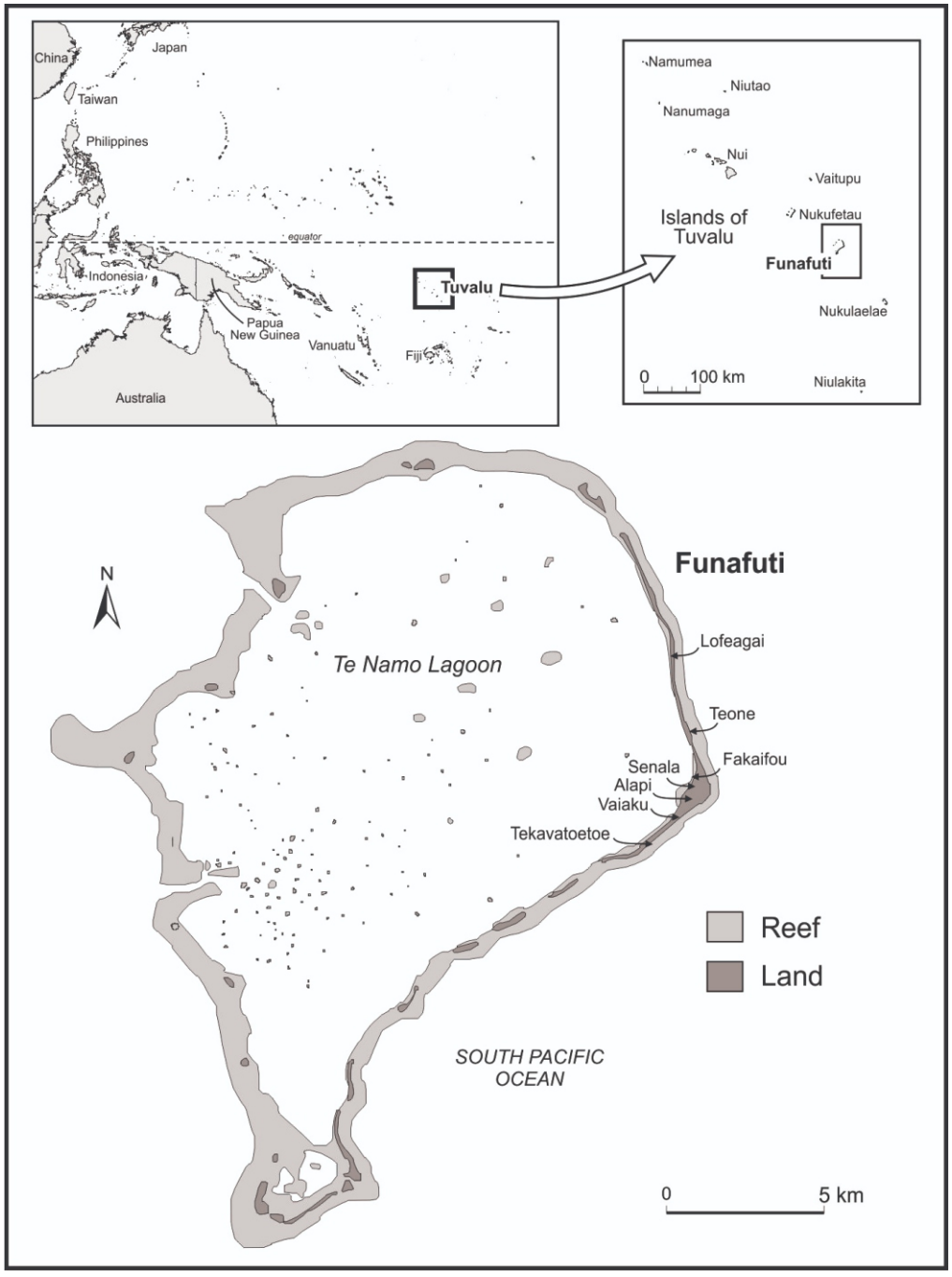
Tuvalu gained independence from the UK in 1978 but today the islands are under threat. They are 'sinking' as a result of sea level rises caused by climate change. Under climate change projections tropical seas are expected to warm, acidify and rise. Scientists project rises of up to several centimetres by the end of the century. This would be would be devastating economically. **Tuvalu's limited space means water supply and waste disposal are always a problem. To maintain sanitation and provide a reliable drinking water supply the islands are improving their harvesting of rainwater.**

Cyclones are also becoming more common. Between 1970 and 1990 Tuvalu was struck by 3 cyclones. In the years since 1990, the country has been ravaged by 13 tropical storms. 2015's Cyclone Pam caused widespread destruction, with 90% of all crops on Nui and Nukefetau islands being lost. The damage caused was estimated at $US10 million. In 2017, Tuvalu had a total GDP of just $US40 million. Tuvalu simply cannot afford the rebuild after such terrible losses.

The Government responded to storm surges by constructing more protective sea walls. However, sea walls are only a temporary solution. During king tides the

sea water simply bubbles up through the porous coral rock.

Alternative protective measures include the planting of mangrove trees and the protection of coral reefs. The reefs act as natural buffers by reducing wave energy. Japanese researchers have artificially reared molluscs called *foraminifera* that match with the sand found on the atoll's beaches. These may help restore the natural balance of sedimentation.



The slow growth rates of coral means Tuvalu's reefs are difficult to replace and reefs take longer to grow than building sea walls. In addition the symbiotic *zooxanthellae* alage, which provide over 95% of the corals' food are at risk from coral bleaching. This occurs when surface temperatures rise. The coral expels the algae making it turn white. Without a fall in temperatures the coral soon starves to death. **Many fear that if climate change is not tackled quickly and decisively then Tuvalu may have to abandoned altogether, an entire nation made into refugees.** This is particularly tragic as the 11,000 people of Tuvalu have contributed so little to the greenhouse gases that are raising global temperatures.

The challenges of population growth, pollution, sustainability and climate change on Tuvalu are as great as on any place on the planet.

Homework Nº2: Set date Check date

Learning about the meaning and spelling of key plate tectonics words.

For **Homework 2** you must read the following key words and definitions and practise the spelling. You must be ready to spell these words and remember what they mean for next week's homework check.

Practise the spellings on the next page. Fold this page in half along the dotted line to hide the words while you spell them.

Coast (coast)	the continually changing interface between the land and water.
Wave (wave)	A movement of energy through the surface layers of water caused by friction between the wind and the sea.
Destructive wave (des-truc-tive wave)	A steep, high frequency wave which causes a net loss of material from the beach as the backwash is stronger than the swash.
Constructive wave (con-struc-tive wave)	A low height, low frequency wave where the net movement of material is up the beach as the swash is stronger than the backwash.
Fetch (fetch)	Distance wind has travelled over open water to create waves.
Longshore Drift (long-shore drift)	The net movement of sediment in a zig-zag motion along a coast, when the direction of swash is at an angle to the coastline.
Swash (swash)	The running of water up a beach under the momentum of a breaking wave.
Backwash (backwash)	The movement of wave water back down a beach to the sea.
Hard engineering (hard en-gin-eer-ing	Solutions to the problems of resource management involving building of structures such as sea walls.
Soft engineering (soft en-gin-eer-ing)	Solutions to problems of resource management involving working with nature, such as allowing salt marshes to form.

Practise your spellings

Practise your spellings on this page. Spelling the word on the line above the definition and then check. If you get it wrong you can try again.

the continually changing interface between the land and water.

A movement of energy through the surface layers of water caused by the wind.

A steep, high frequency wave which causes a net loss of material from the beach.

A low height, wave where the net movement of material is up the beach.

Distance wind has travelled over open water to create waves.

The net movement of sediment in a zig-zag motion along a coast.

The running of water up a beach under the momentum of a breaking wave.

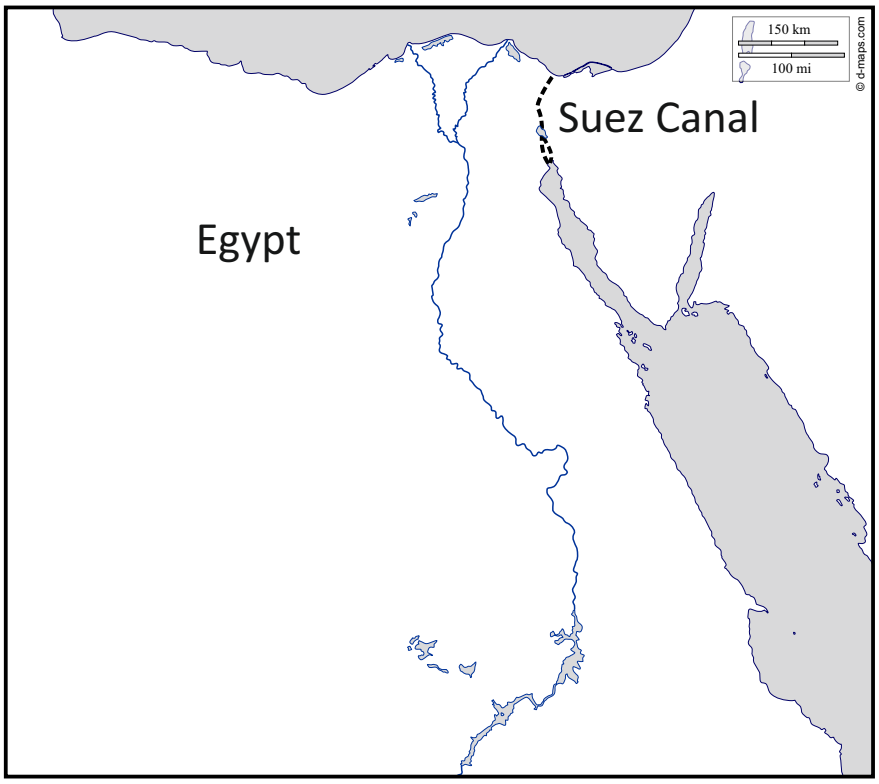
The movement of wave water back down a beach to the sea.

Solving the problems of resource management by building structures.

Solving the problems of resource management by working with nature.

Changing Coastlines, Part 2.

#7 The Suez Canal, Egypt. 30°27' N, 32°20'E



Shortening journeys.

The Suez Canal is a sea-level waterway in Egypt, connecting the Mediterranean Sea to the Red Sea, through the Isthmus of Suez. Constructed by the Anglo-French Suez Canal Company between 1859 and 1869, it officially opened on 17th November 1869.

The canal offers ships a more direct route between the North Atlantic and northern Indian Ocean via the Mediterranean and Red Sea, thus avoiding the long strip around the Cape in South Africa. It extends from the northern terminus of Port Said to the southern terminus of Port Tewfik at the city of Suez, on the Red Sea. The canal is 193.3 km in length, 24 metres deep and 205 metres wide, handling the movement of almost 100 ships per day.

So important was the Suez Canal that France and Britain almost went to war with Egypt in 1956 after the Egyptian President Nasser nationalised the canal. Inthe early 21st century, the Suez Canal suffered from reduced traffic due to piracy out of Somalia. Instead or risking the Red Sea route, many US shipping companies choose to take the long route round the southern tip of Africa, Between 2008 and 2010, it was estimated that the canal lost 10% of traffic due to the threat of piracy.

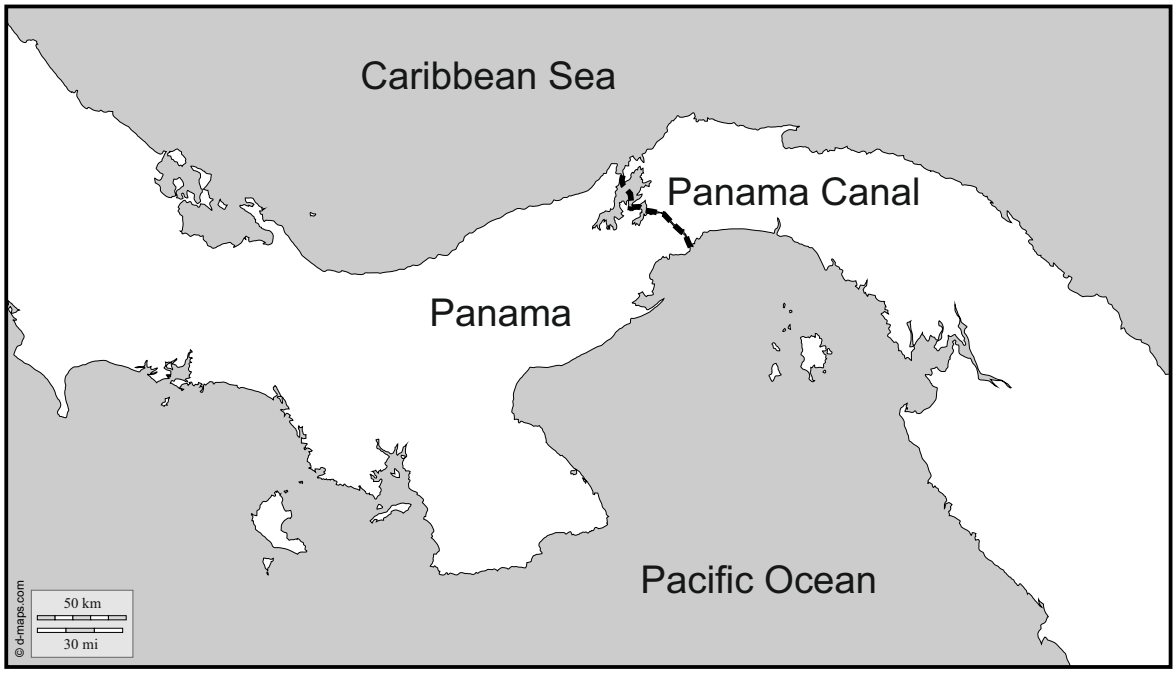
However, **in 2015 the Egyptians opened a new channel for the canal. Stretching for 35 km and lying parallel to the old canal, the new channel allows for an increase in traffic from 49 to 97 ships per day. It was estimated that this would increase government revenues from canal tolls from $US5 billion to $US 12.5 billion per year.** With it's new capacity the Suez canal is able to handle more traffic and larger ships than the Panama Canal.

#6 The Panama Canal, Panama. 9°4' N, 79°40' W

Connecting oceans. The Panama Canal is an artificial 82 kilometre waterway in the Central American country of Panama. **The canal connects the Pacific Ocean with the Atlantic, via the Caribbean Sea. Without the Panama canal, ships would have to take a massive detour around the southern tip of South America, if they were sailing the popular Asia – US East coast trade route This would take 11 to 14 days compared to just over 11 hours to pass through the Panama Canal.** The American Society of Civil Engineers has ranked the Panama Canal as one of the seven wonders of the modern world.

Canal locks are located at each end of the canal to lift ships up to Gatun Lake, an artificial lake created to reduce the amount of excavation work required for the canal, 26m above sea level, and then lower the ships at the other end. The size of the locks determines the maximum size ship that can pass through. These dimensions were referred to as *Paramax* (the maximum size for the Panama canal.) As ships got larger some were unable to pass through the canal locks and so were unable to travel between the Pacific and Atlantic without an expensive detour. These ships were called *post-Panamax* or *super-Panamax.*

The 'Third Set of Locks' project was completed in 2016. This doubled the capacity of the Panama Canal by adding a new lane of traffic in addition to increasing the width and depth of the lanes. New locks allow larger ships to pass through the cannel. Newly designed ships, called *New Panamax*, are about one and a half times the previous maximum size. They can carry over twice as much cargo as the old *Paramax* ships.

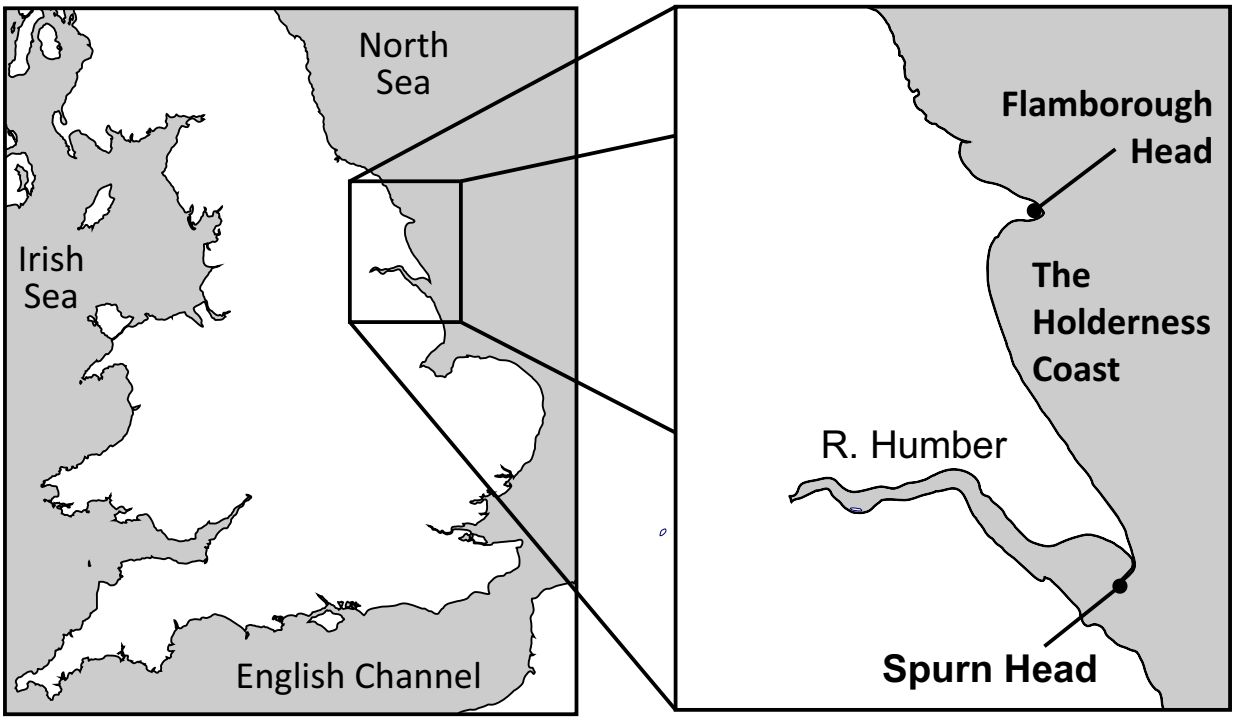


Changing Coastlines, part 3
#5 The Holderness Coast, UK. 53°54′ N, 0°10′ W

Fastest eroding coastlines. Along the Yorkshire coast from Flamborough Head to Spurn Head spit, **the Holderness Coast is eroding faster than anywhere else in Europe.** The coastline loses an average of two metres of land every year. **Twenty nine villages have been lost to the sea since the days of the Roman Empire.** In late-Roman times, the surf broke three miles further east.

Underlying the Holderness Coast is bedrock made up of Cretaceous Chalk. However, in most places this is covered by glacial till deposited over 18,000 years ago during the last glacial maximum. It is this soft boulder clay that is being rapidly eroded. There are two main reasons for this: the first is the result of the strong prevailing winds creating longshore drift which moves material south along the coastline. The second factor is that the cliffs are made of soft boulder clay called glacial till. This erodes rapidly and is vulnerable to mass movement when wet. **Major landslides occur on the cliffs of East Yorkshire every six to seven years.**

Geologists found some 100m stretches of the Holderness coast were losing enough cliff to fill two-and-a-half Olympic swimming pools a year. However, this is not an issue confined only to the UK. **One stretch of the coastline in Washington, USA known as Washaway Beach, is eroding at a rate of over 30 metres per year,** putting coastal communities at risk. The problem of coastal erosion is only likely to accelerate in the future. With continued climate change, storms, rising sea temperatures and melting polar ice will all contribute to a global rise in sea levels.

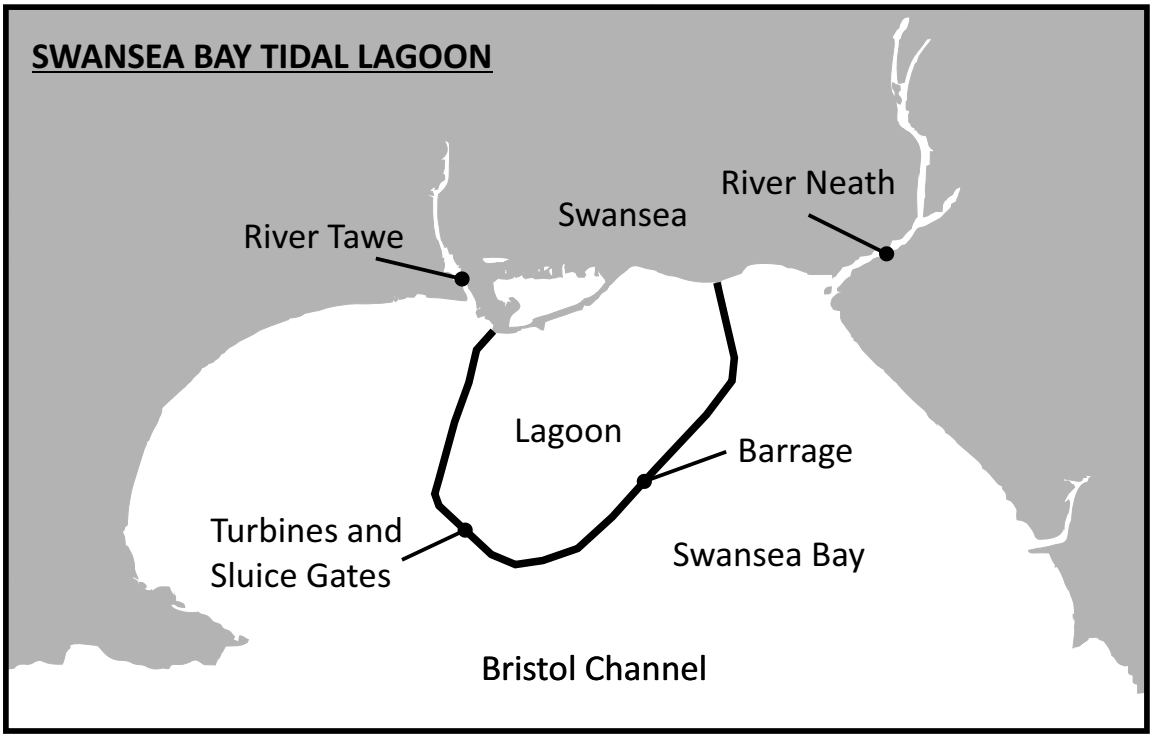


#4 The Swansea Bay Tidal Barrage, Latitude: 51°34'60" N, 3°53'60" W

Swansea Bay is a bay surrounded by two headlands situated on the southern coast of Wales, near the eponymous city of Swansea. **Swansea Bay (along with the rest of the Bristol Channel and Morcambe Bay) has the second highest tidal range in the world. This means that there is a difference of over 10.4 metres between the high and low tide water levels.** This offers a potential for electricity generation.

A proposal has been put for a tidal lagoon to be constructed. Firstly, a large lagoon is created (a sheltered area of sea water separated from the main ocean by a barrier) by building a 9.5 kilometre long breakwater made of neoprene, sand and rock armour. **As the tide rises, the tidal gates are closed and the difference in water levels can then be used to turn up to 26 turbines built into the barrier, thereby generating electricity. Then as the tide fall, the returning water from the lagoon, generates a second batch of electricity. This happens twice a day and has the potential of generating enough electricity to power 155,000 homes. The electricity would be green and renewable and produce no greenhouse gas emissions once construction was finished.**

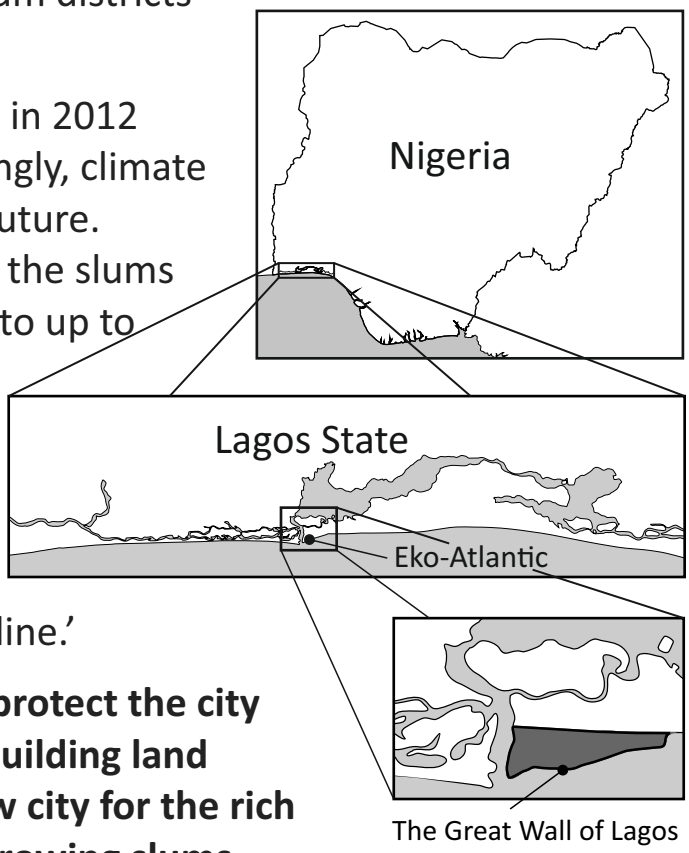
However, the project is controversial. This is partly due to the amount of subsidy required to make the project viable compared to burning gas or using offshore wind farms. Other fear the potential damage to an Area of Outstanding Natural Beauty. This has led to the plans being rejected so far by the government. However the Welsh government and opposition parties plan to go ahead with the scheme should they get the chance.



#3 The Great wall of Lagos, Nigeria. 6°27'55" N, 3°24'23" E.

The Great Sea Wall. Lagos, the capital city of Nigeria is the largest in Africa. The city has grown rapidly since its beginnings as a fishing and trading port, growing from 300,000 in 1950 to 22 million plus today. The city is built on the landward side of a coastal lagoon. Its location makes Lagos susceptible to flooding resulting from storms and coastal surges. Nigeria is an Emerging and Developing Country (EDC) with Lagos home to 12% of the country's population. Two thirds live in poor-quality housing in the many slum districts of the city.

Widespread coastal and river flooding in 2012 displaced over two million people. Worryingly, climate change brings the risk of larger storms in future. Those most affected in 2012 were living in the slums of the city, like Makoko. This area is home to up to 300 000 peoples living in shelters positioned directly above water or built on homemade islands of sawdust and rubbish. Residents live in fear of eviction under a government programme which claims to confront 'environmental indiscipline.'



The Great Wall of Lagos

The Great Wall of Lagos was built to protect the city from coastal storm surges and to create building land needed for the Eko-Atlantic project: a new city for the rich and middle classes, away from the ever-growing slums.

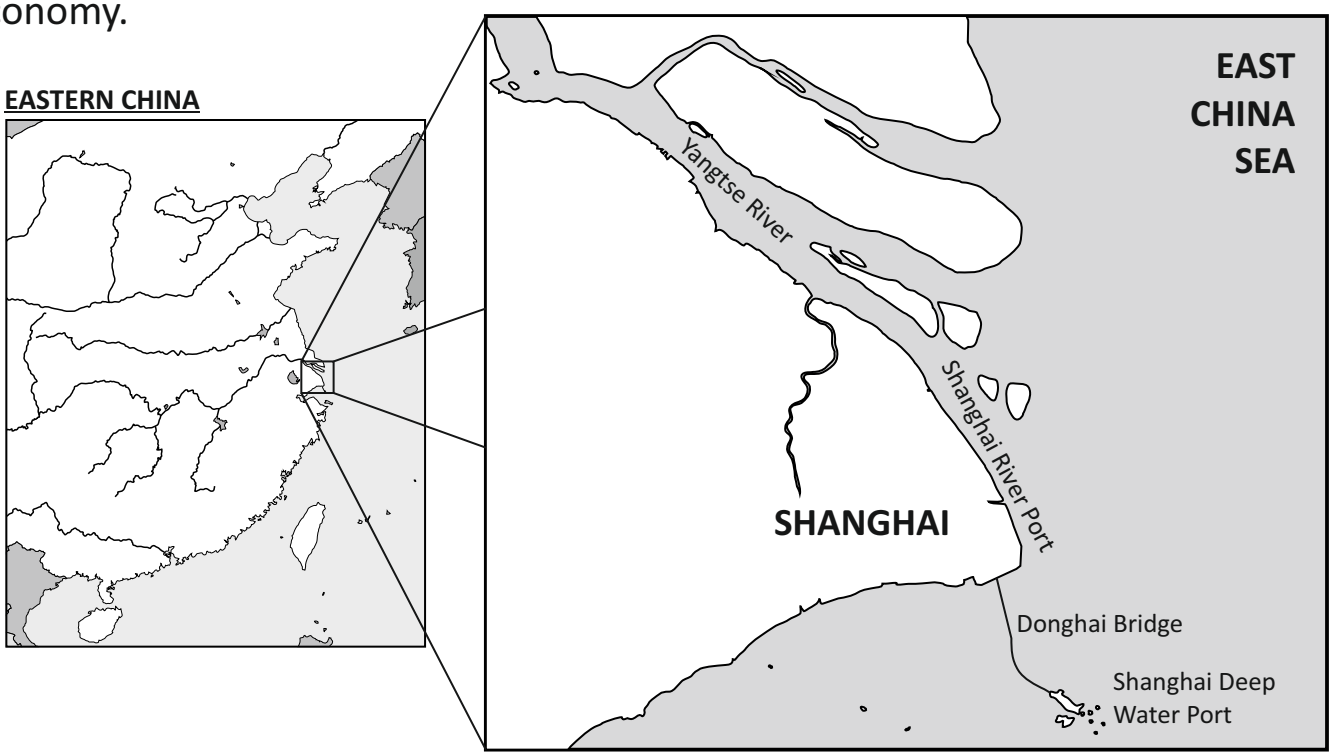
Computer modelling estimates that the Great Wall could protect the city from a 1 in 1,000-year storm surge. **The sea wall, rising 8 metres above the sea, stretches for 8.5 kilometres along the coast. It is topped with a 12.5m wide promenade. The wall is made up of 100,000 reinforced concrete 'accropodes'.** These five tonne interlocking multi-faceted blocks are built on site and then lowered into the correct position using GPS. Sand is then pumped behind the wall to create the land for the new city. The creation of the wall has required significant offshore dredging for sand impacting local fisheries through pollution sea bed damage. Eko-Atlantic is intended to raise the quality of life in Lagos and make it a 'world city' and desirable destination. Eko-Atlantic will be, they say, an 'oceanfront wonder'. However, prices make the apartments unfordable to even people earning average middle-class incomes.

Changing Coastlines, part 4

Shanghai, China Latitude: 31°13'11" N, 121°29'13" E

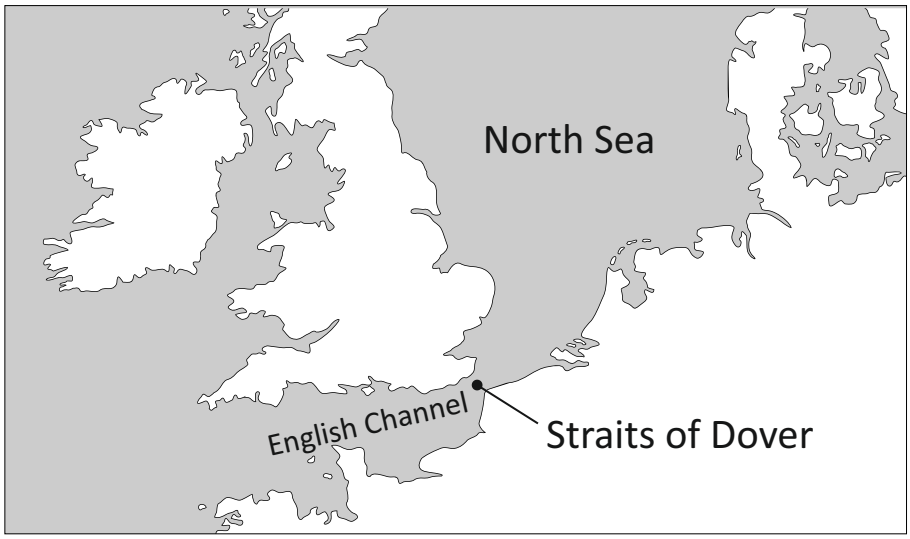
The world's busiest port. The Port of Shanghai, located in the vicinity of Shanghai, comprises a deep-sea port and a river port. **The deep water port is built on several islands to the south of the Yangtse River mouth and connected to the mainland by the Donghai Bridge, a combined road and rail crossing which stretches for over thirty-two kilometres.** In 2010, Shanghai overtook Singapore to become the world's busiest container port. Shanghai's port handled 29.05 million TEUs (Twenty foot Equivalent Units, basically large shipping containers), whereas Singapore's was a half million TEU's behind . **In 2016, Shanghai port set a historic record by handling over 37 million TEUs. By way of comparison, Felixstowe, Britains busiest container port, handled just 3.85 million TEUs in 2017.**

The Port of Shanghai faces the East China Sea to the east, and Hangzhou Bay to the south. It includes the confluences of the Yangtze River, Huangpu River (which enters the Yangtze River), and Qiantang River. The Port of Shanghai is a critically important transport hub for the Yangtze region and the most important gateway for foreign trade. The Yangtze river flows through the rapidly developing hinterland of Anhui, Jiangsu, Zhejiang and Henan provinces. These areas have a dense population alongsie a strong industrial base and well-developed agricultural sector. In 2014 the Shanghai authorities proposed building a second bridge to the deep-water port, an indication of the importance of the port is to the Chinese economy.



#1 The Straits of Dover. 51°0'N, 1°27' E.

The busiest shipping lane in the world. The Dover Strait is the world's busiest shipping lane. 500-600 ships a day pass through the narrow strait between the UK and France. Cargoes include oil from the Middle-East to European ports, as well as commodities from North and South America en route to European customers. **Most of the bananas eaten in Europe must pass though the straits on their way to the Dutch ports of Antwerp, Vissigen and Rotterdam. In total around 200,000 vessels pass through the Dover Straits every year.**



The Strait of Dover, which is considered to be the busiest maritime route in the world, has been a mainstay of the European shipping network for many years. **In spite of its narrowness, at just 33 kilometres, the Strait's geographic location makes it an essential shipping route.** Vessels wanting to cross to English harbours or enter European ports must pass through the straits. For ships entering the North and the Baltic Seas through the English Channel, passing through the Dover Strait is also unavoidable, unless they wish to sail the more dangerous and longer route around Scotland. Being the busiest international seaway in the world, several important regulations have been established to aid the passage of vessels through the Straits during the past four decades.

Over the years, the Straits have witnessed many accidents and collisions. As part of the introduction of Collision Regulations in 1960, the straits came under full radar surveillance. **Maritime authorities also operate a Traffic Separation Scheme (TSS). Two shipping lanes run through the strait with inward traffic using the northern land and outward-bound traffic using the southern lane. This helps ships avoid collisions**. **However, ships must also avoid the cross-channel ferries making the regular run from Dover to Calais.** The opening of the Channel Tunnel in 1994 reduced cross-channel traffic but the Straits remain a navigational feat for the many ships' captains which pass by every day.

Homework Reviews: 1 to 3

Review Number One: Changing Coasts, part 1		✓ ✗
1		
2		
3		
4		
5		
Review Number Two: Coastal spellings	score	
1&2		
3&4		
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Review Number Three: Changing Coasts, part 2	score	
1		
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	score	

Homework Reviews: 4 to 6

Review Number Four: Changing Coasts, part 3		✓ ✗
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Review Number Five: Changing Coasts, part 4		
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Review Number Six: Changing Coasts, part 5		
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