**Q2 [PEQ 1947]**

**(a) Study Figure 1. Explain how the GIS map shown could assist decision-making about managing coastal erosion. *(10 marks)***



**What to put in your answer**

* Good answers might start with a brief definition of GIS as digital mapping software which can be manipulated to show multiple layers/many types of information.
* Make reference to all layers on Figure 1, although you can focus on some more than others.
* Remember your answer should focus mainly on Figure 1, but good candidates could make reference to their own examples of flood risk management and/or their own use of GIS.
* The geology layer shows areas prone to erosion (clay) and more stable areas (sandstone); this could indicate areas likely to need most protection.
* Populated areas shows people at risk; areas with no or low population might not need protection, or might not be worth protecting — the same is true of the infrastructure layer.
* Good answers would pick up on the key word ‘decision-making’ and name some decision-makers such as local councils or DEFRA.

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| **Level 3** | 8–10 marks | Structured answer. Detailed reference to map layers from figure, linked to explanations of how the information could aid decision-making, i.e where/how to defend or not; likely to refer to specific decision-makers and/or examples. Uses geographical terminology. Written language errors are rare. |
| **Level 2** | 5–7 marks | Some structure. Some reference to Figure 1 and map layers; may be narrow or unbalanced; there are some explanations of using the data to assist in managing the coast. Some terminology. Written language errors are minor. |
| **Level 1**  | 1–4 marks | Little structure. A few descriptive comments linked to Figure 1, with limited reference to coastal erosion may describe what GIS is in general terms only. Geographical terminology not apparent. There are frequent written language errors. |

**STUDENT A**A GIS is a multi-layered digital map tool that can show a huge amount of information. Google Earth is like a simple GIS because you can add and remove information from it to make a custom map. The map layers on Figure 1 are really useful for people deciding on coastal management to manage erosion. First, geology. This is incredibly useful because some areas have soft rocks like the boulder clay on Holderness which is amazingly easily eroded. Other places like Flamborough Head have much harder rock which is incredibly resistant so erosion isn’t even a problem. Faults are easily eroded as they are weaknesses in the cliff and these need massive protection.

Some of the maps link together. This is what you can do with GIS because you can change the map to overlay lots of information and get rid of information you don’t want. Some areas on this coast have settlements, roads, soft rocks but no existing defences. These areas could be the ones that need protecting from erosion. There is a headland on the left with no defences but probably hard rocks and no settlements/roads. Areas like this don’t need to be protected. It would be good if another map was added showing the rate of coastal erosion. This is because in areas like Holderness it can be up to a few meters a year (they really need defences) but in other places hardly any erosion happens. It could also show very valuable features like the gas terminal at Easington or places that are protected like SSSIs. This would help decide if protection should happen.

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**STUDENT B**

GIS is very useful when making decisions about protecting coasts from coastal erosion. It can be used to work out a cost–benefit analysis. Cost–benefit analysis works by working out the costs of defences. For sea walls this can be £5,000 per metre or £5 million of 1 km. To be build the defences would need to save £5 million worth of buildings, houses and land from being eroded away. This can be seen in Figure 1 where in some places there are roads and towns at the coast. These are probably worth protecting but some other areas are not. The costs of building defences like sea walls and groynes would save money in the long-run. Also in Figure 1 there are some places with sea defences already. These maybe don’t need protection unless the walls are old and falling down so that other places should be looked at more carefully. GIS can help identify places which need coastal defences as the map shows things that need coastal defences as well as areas that could be managed using strategic retreat because there is little of value there.

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**(b) Describe the results of your fieldwork and research into the impacts of coastal development and changing land use. *(15 marks)***

**What to put in your answer**

* Think about the key words in the question.
* A balance of fieldwork and research is needed; this does not have to be 50/50 but both primary data collection and secondary research need to be covered.
* This question is focused on results, i.e. what you found out (not planning or collecting data). It is important to consider which part of the enquiry process the question is about. Be specific about your results, quoting some data.
* You need to choose results that relate to ‘coastal development and changing land use’. Take this phrase as a whole, because most developments would change land use.
* The key focus of the question is on ‘impacts’. Impacts can be positive or negative, and many students see them as social, economic or environmental. This is a useful structure to keep in your mind.
* Your fieldwork and research will have included methods such as land use maps (which show change and development, especially when compared with older maps), conducting questionnaires and environmental surveys which focused on impacts.

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| **Level 4** | 13–15 marks | Structured account. Balance of fieldwork and research with reference to a range of results. Some details with reference to own work/real places and focus on the impacts of development and change. Uses appropriate terms and exemplification to show understanding. Written language errors are rare. |
| **Level 3** | 9–12 marks | Structured. Some balance of fieldwork and research. Uses examples of places and own work with some details of results. There is some reference to change/development at the coast. Uses terminology. Written language errors are minor. Maximum of 10 marks if only fieldwork or research. |
| **Level 2** | 5–8 marks | Some structure. Generalised description of some fieldwork/results, likely to be unbalanced and lacks a focus on coastal development and change. Some geographical terminology is used. There are some written language errors. |
| **Level 1** | 1–4 marks | Little structure. Description of fieldwork at the coast, limited or no reference to results or change/development. There are frequent written language errors. |

**STUDENT A**

Dubai has seen a huge amount of development along its coast over the last decade. As a fieldwork and research investigation my college examined the Dubai Marina and Palm Island areas.

A landuse survey in Dubai Marina showed that most of the area was occupied by the marina itself which was dug out of the coastal desert plus high rise buildings. Most of these are apartments. Dust surveys were conducted by leaving sticky cards in the area for 2 days. The results showed that over 80% of the cards were dust covered. This is due to the area still being under construction. The area has created jobs, plus new housing and contributed to economic growth. There is air pollution in the form of dust but this might lessen once the development is finished.

A postal questionnaire survey was completed on the Palm Jumeirah artificial islands. The results showed that 34 out of the 42 people who answered were happy with their new villa/apartment but about 10 of them said the area was too crowded. Half said there were few services close to where they lived. Everyone said the Palm was attractive. Overall people seem pleased with the new development.

In newspapers and on television the Palm has been criticized for its environmental impact. A National Geographic DVD was used to research this. National Geographic scientists found that the Palm had not reduced biodiversity in the area although it might be too early to tell. An issue of stagnant water was mentioned in the DVD. Our college tested this using a digital dissolved meter to compare water from Dubai Creek, the Marina, around the Palm and from the beach at Jumeirah. The Creek and Marina had the lowest levels. The Palm and beach area both had high levels which suggests the Palm has not made the water stagnant.

Dubai is an example of coastalisation. Our landuse survey was compared to old maps of Dubai and this shows that the area studied has changed from a desert fringing a deserted coastline into an urbanised area. Because of this the environment has been totally changed

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**STUDENT B**Hornsea on the Holderness is an example of a coastal place that has seen a lot of change over the years. Close to Hornsea is Hornsea Mere. This is a lake which is important for bird life. It changed to become an SSSI in 1983 and this is one of the reasons Hornsea is protected from erosion.

There is also a new shopping centre called Hornsea Freeport. This has provided jobs for people in Hornsea and encourages visitors to the area but it might cause traffic congestion.

Closer to the beach the town council has recently invested a lot of money in the promenade making it much more attractive for visitors and there is also a new leisure centre. Both of these attract people to the town including locals and visitors.

Right on the coast there are lots of new sea defences. These include a groyne field on the beach to stop longshore drift and maintain the beach, plus rip-rap to break up storm waves. There is also a concrete bull-nose sea wall and flood wall and flood gates. The coast here can be flooded by very high waves as well as eroded. These are all new and have changed the land use. The beach does not look very good and walking along it is hard because of the groynes in the way. This was found out by doing landuse maps and environmental impact surveys.

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**(c) Using named examples, explain why such a wide range of different coastal engineering techniques are in use. *(10 marks)***

**What to put in your answer**

* Use named and located examples. You may have completed fieldwork on coastal engineering (defences) — if so, include it.
* You will know that there are a wide range of coastal engineering techniques such as groynes, rip-rap, sea walls, gabions, offshore breakwaters, slope stabilisation and even beach nourishment. There is no need to cover all of these; be selective and do not get lost in description.
* Keep in your mind the command word ‘explain’ — why do we not see the same type of coastal defences everywhere?
* Answer: because of a range of factors which include cost (some types are too expensive for what they are designed to protect), physical processes (groynes might interfere with longshore drift), appearance (rip-rap and gabions are often described as ‘ugly’), geology (soft rock coasts often need in-cliff drainage and slope grading) and amenity use.

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| **Level 3** | 8–10 marks | Structured answer. Uses relevant examples with some details. Techniques are chosen to explain why different engineering techniques are used. Uses appropriate geographical terminology. Written language errors are rare. |
| **Level 2** | 5–7 marks | Some structure. Some use of more generic examples; several different techniques referred to; less focus on reasons why different choices are made; descriptive towards the bottom of this level. Uses some geographical terminology. There are some written language errors. |
| **Level 1**  | 1–4 marks | Little structure. Likely to describe several different types of coastal management with limited link to the question. Geographical terminology rarely used. There are frequent written language errors. |

**STUDENT A**There are a wide range of different coastal management strategies because all coasts are different. They have different users with different needs and different geology and physical processes.

An example is Newbiggin in Northumberland. In 2007 £10 million was spent on 500,000 tonnes of new sand for beach nourishment and an offshore breakwater.

This was chosen because the beach had been eroded over the years as mining subsidence had caused the sea bed to sink offshore. The beach was black with coal, also left over from mining in the past. The offshore breakwater does not interfere with beach access like groynes might, but breaks waves offshore so they can’t erode the new sand. At the same time the promenade was improved, new steps down to the beach added and a new playground was built. This was because the scheme also aims to improve tourism so is multi-purpose.

At Mappleton on the Holderness coast a different strategy was used. About £2 million was spent in 1991 on two rip-rap groynes. The cliff was also re-profiled from vertical to about 40°.

This strategy was chosen because Mappleton’s beach had been lost due to groynes constructed further up the coast. The rip-rap groynes trapped sediment and rebuilt the beach so it could dissipate wave energy before it reached the cliffs. Landslides were a problem in the boulder clay cliffs so slope regrading reduced the risk of this, especially during periods of storms and heavy rain. Mappleton is not a tourist place so the visual impact of the defences was not really considered like it was at Newbiggin.

On some coasts the problem is not erosion but flooding. The Dutch Delta Project uses dykes and flood barriers e.g. the Haringvliet Sluice because the threat is from rising sea levels and storm surges as much as erosion.

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**STUDENT B**
There is a very wide range of coastal defences and these are used in lots of different places.

The first type is sea walls. These are concrete and can be up to 4 m high. Sometimes they have steps at the front to break up waves and a curve bit at the top to throw the wave back out to sea. They are expensive to build.

Groynes can be used to stop longshore drift. These are wooden walls built thousands of metres out to sea. They help trap sand and build up the beach.

Rip rap and gabions can be used as well which are big rocks just dumped in lines to dissipate wave energy or arranged in metal cages and stacked up a bit like a sea wall to dissipate wave energy.

In other places they use beach nourishment. This is when sand is pumped onto the beach to make the beach larger. This is good for tourists as it looks better than groynes and it doesn’t affect areas further down the coast but it might have to be done every year so is expensive.

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