



National  
Qualifications  
2021 ASSESSMENT RESOURCE

**X826/75/11**

## **Environmental Science Supplementary source booklet**

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This booklet contains sources for use with Section 2.

### **Supplementary sources of information**

**Source A** is a sketch map showing the shingle banks and location of Settlement X.

**Source B** is an image showing forestry plantation on inland shingle banks, including gorse encroachment.

**Source C** is a table showing the SSSI designations in this area and reasons for their designation.

**Source D** is a list of particular risks to Scotland identified in the UK Climate Change Risk Assessment (2017).

**Source E** is a table showing the estimated costs of coastal engineering options at the estuary in 1996.

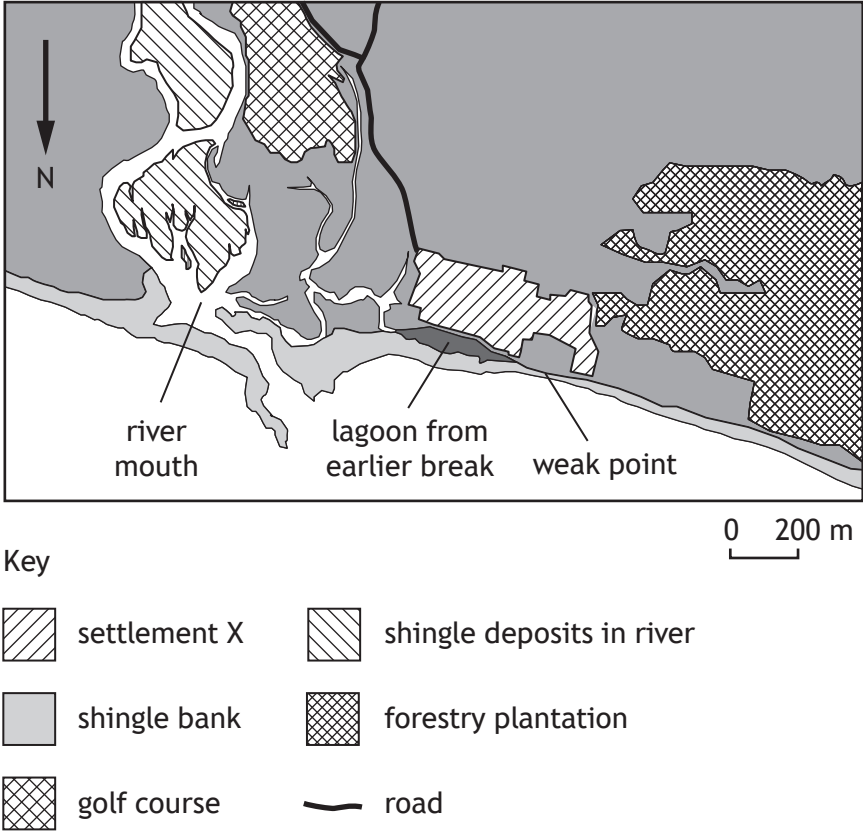
**Source F** is a graph showing the change in value of £100 between 1996 and 2020 when adjusted for inflation.

**Source G** is a table showing the advantages and disadvantages of coastal engineering approaches used to manage coastal erosion.



\* X 8 2 6 7 5 1 1 \*

Source A Sketch map showing the shingle banks and location of Settlement X



Source B Image showing forestry plantation on inland shingle banks, including gorse encroachment



Source C SSSI designations in the area and reasons for their designation

Designation	Feature	Species
Estuary SSSI and river SSSI	<ul style="list-style-type: none"> <li>• coastal geomorphology</li> <li>• river morphology</li> <li>• saltmarsh</li> <li>• shingle</li> <li>• wet woodland</li> </ul>	<ul style="list-style-type: none"> <li>• plant communities</li> <li>• Atlantic salmon, sea lamprey, freshwater pearl mussel, otter</li> <li>• butterflies — small blue, dingy skipper</li> </ul>

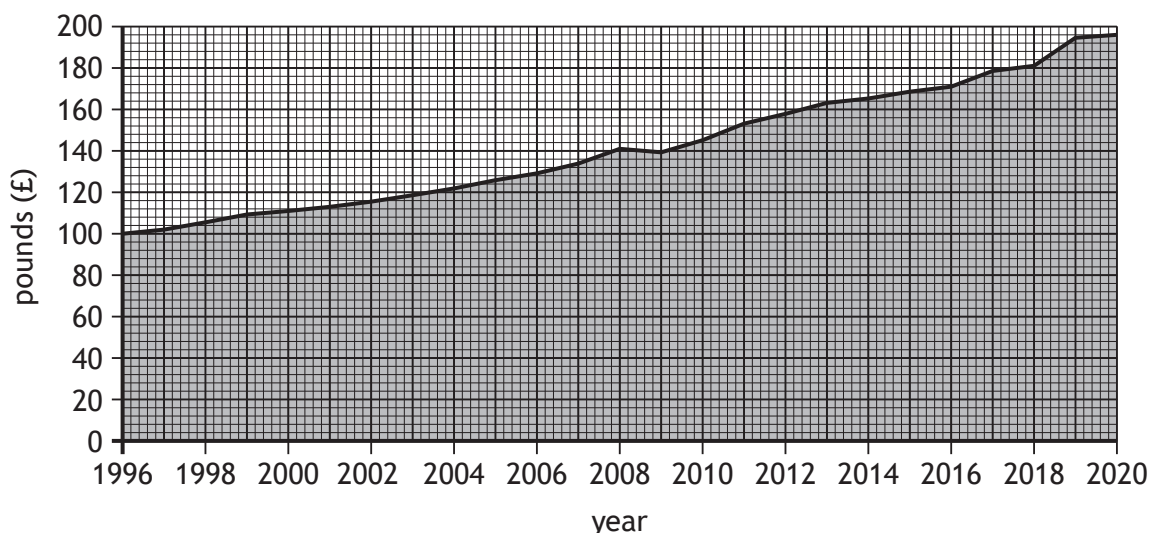
Source D Particular risks to Scotland identified in the UK Climate Change Risk Assessment (2017)

- Species and habitats, from the changing climate
- Soils and natural carbon stores
- People, communities, and buildings, from flooding
- Coastal areas, from sea level rise combined with extreme weather events
- Marine species, from coastal changes
- Health and wellbeing

Source E Estimated costs of coastal engineering options at the estuary in 1996

Offshore breakwater	Rock armour	Rock groynes	Beach nourishment (over 50 years)	Emergency work (over 50 years)
£1.85 million	£6.84 million	£1.94 million	£3.59 million	£776,554

Source F Change in value of £100 between 1996 and 2020 when adjusted for inflation



**Source G Advantages and disadvantages of coastal engineering approaches used to manage coastal erosion**

<b>Approach</b>	<b>Advantages</b>	<b>Disadvantages</b>
Breakwater — placed 200 m offshore, near weak point	<ul style="list-style-type: none"> <li>• one-off construction</li> <li>• minimal maintenance once in place</li> <li>• will trap shingle coming downriver</li> <li>• will break the waves and absorb their energy</li> <li>• habitat potential for marine species eg lobsters, mussels</li> </ul>	<ul style="list-style-type: none"> <li>• requires seabed survey and modelling</li> <li>• lengthy planning and construction processes</li> <li>• below-water construction, with disturbance of sea bed</li> <li>• may act as barrier to species such as sea lamprey and salmon</li> </ul>
Rock armour — large boulders placed in front of shorefront shingle banks	<ul style="list-style-type: none"> <li>• easy to maintain</li> <li>• will break the waves and absorb their energy</li> </ul>	<ul style="list-style-type: none"> <li>• financial and environmental impacts of transporting rock</li> <li>• visual impact if imported rocks differ from local geology</li> </ul>
Rock groynes — mesh cages containing rocks, placed at right angles to the coast	<ul style="list-style-type: none"> <li>• will trap shingle carried westwards by coastal currents</li> </ul>	<ul style="list-style-type: none"> <li>• minimum height of 6.5 m, plus extensive below-ground engineering</li> <li>• visual impact</li> <li>• reduces localised erosion but enhances it further along coast</li> <li>• disruption of coastal processes</li> <li>• disturbance of species could threaten SSSI status</li> </ul>
Beach nourishment — local shingle deposits are moved back into place, or replacement of lost shingle	<ul style="list-style-type: none"> <li>• not visually intrusive if the same materials are used</li> <li>• allows natural geomorphological processes to continue</li> </ul>	<ul style="list-style-type: none"> <li>• impacts of transporting shingle</li> <li>• disturbance of shingle and species could impact SSSI status</li> <li>• requires constant monitoring and maintenance</li> </ul>
Emergency work only		<ul style="list-style-type: none"> <li>• would require planning to provide short-notice to Settlement X residents</li> <li>• could not be scheduled to protect species such as sea lamprey and salmon or nesting birds</li> </ul>

**[END OF SUPPLEMENTARY SOURCE BOOKLET]**

*Acknowledgement of copyright*

Source B Image of shingle: © Copyright Anne Burgess and licensed for reuse under [creativecommons.org/licenses/by-sa/2.0](https://creativecommons.org/licenses/by-sa/2.0)