Edexcel GCSE Geography B

Practical support to help you deliver this Edexcel specification

Edexcel GCSE Geography B offers an issues-based approach to the content and assessment, with the content split by Global and UK scale. As with all GCSEs, the guided learning hours is 120 hours over two years. This document provides a topic guide for teaching Component 2, Topic 4, and can be adapted by centres to fit their own contexts and teaching styles. It has been produced as an example approach and is not intended to be prescriptive. The topic guides indicate resources that you can use to support your teaching. These are only suggestions and you are encouraged to use a wide range of resources to suit the needs of your own students.

The advised teaching time for Topic 4: The UK's Evolving Physical Landscape, is 18 guided learning hours. This may require some blending together of the detailed content. In the guidance below, suggestions are made about contextualisation or stretch challenges that may be suitable for more able students, as well as expected lesson outcomes for those less able. Please note that these are suggestions only and not specific syllabus requirements.

The two- and three-year course planners suggest appropriate times to introduce this material. For example, in centres studying over three years, you might want to start studying Topic 4 in the second part of the Autumn term and in the Spring term of Year 9. If centres are following the two-year course plan, they may want to start teaching this topic in the second half of the Autumn term and in the first part of the Spring term of Year 10.

The topic is based around five enquiry questions.

- Enquiry question 1 covers the overview content for this topic and has two key ideas, which it is suggested is taught over three lessons. The content for this enquiry question will be assessed in question 1 of the UK Geographical Issues paper (2). As this is overview content, students will **not** be required to answer any extended answers of 8 marks on this content. Only questions of up to 4 marks are to be assessed on this content.
- Enquiry questions 2 and 3 cover the content for the sub-topic Coastal change and conflict. It is suggested that this is taught over seven lessons.
- Enquiry questions 4 and 5 cover the content from the sub-topic River processes and pressures. It is suggested that this is taught over seven lessons.

Synoptic linkages and case study nesting

It is suggested that you select located examples that complement the UK major case study in Topic 5.1. For example, if you are studying London or Sheffield in Topic 5 you could use located examples of river flooding and management for rivers in these cities.

There are opportunities to make links and revisit content from Component 1, Topic 1: Hazardous Earth, when studying the role of past tectonic processes in the formation of the UK's landscape. Synoptic links can also be made back to Component 1, Topic 1, when studying the consequences of climate change on marine erosion and deposition.

Topic Guide for Component 1, Topic 4: The UK's Evolving Physical Landscape

Introduction

Quick overview

This topic explores the processes that have formed the distinctive landscapes of the UK and how humans increasingly have to manage flood risks, both at the coast and near rivers.

An overview of the varied physical landscapes in the UK resulting from geology, geomorphic processes and human activity over time, plus two depth studies of distinctive landscapes: coastal change and conflict, and river processes and pressures. The topic is based around five enquiry questions:

- EQ1: Why does the physical landscape of the UK vary from place to place?
- EQ2: Why is there a variety of distinctive coastal landscapes in the UK and what are the processes that shape them?
- EQ3: What are the challenges for coastal landscapes and communities and why is there conflict about how to manage them?
- EQ4: Why is there a variety of river landscapes in the UK and what are the processes that shape them?
- EQ5: What are the challenges for river landscapes, people and property and how can they be managed?

The aim of this topic is to get an overview of the varied landscapes in the UK. Much of the coast and rivers content in this topic is familiar to teachers of GCSE Geography. What is less familiar is the overview of the UK landscape and the key idea that geology and past processes have influenced the physical landscape.

It is worth noting that students have an opportunity to become familiar with the concept around past tectonic processes in Component 1, Topic 1: Hazardous Earth. Although it is not necessary for students to have an in-depth understanding of the geology of the UK or glacial processes, they are required to know that there are geological variations across the UK and how glaciers have shaped the UK landscape.

Students are required to develop and use a range of geographical skills and mathematical skills whilst studying this topic.

The content covered whilst studying coasts and rivers will make up the important theoretical basis for the physical geographical investigation in Topic 6. Students should be given opportunities to formulate enquiry questions around either the coasts or rivers sub-topics.

In the guidance below, suggestions are made about contextualisation that may be suitable for more high achieving students. Please note that these are suggestions only and not the actual specification content.

Enquiry Question 1: Why does the physical landscape of the UK vary from place to place?

Key ideas

- 4.1: Geology and past processes have influenced the physical landscape of the UK.
- 4.2: A number of physical and human processes work together to create distinct UK landscapes.

Teaching approach over three hours

Lesson 1 (1hr)	The role of geology, past tectonic and glacial processes in the development of the UK's contrasting landscapes
Lesson 2 (1hr)	Why distinctive upland and lowland landscapes result from the interaction of physical processes
Lesson 3 (1hr)	Why distinctive landscapes result from human activity over time

Lesson 1: The role of geology, past tectonic and glacial processes in the development of the UK's contrasting landscapes

Overview

The first lesson could tackle 4.1a and b, where students develop an understanding of the role of geology, past tectonic and glacial processes in the development of upland and lowland landscapes of the UK.

- More able students could take three national parks with contrasting landscapes and create geographical guides to these areas.
- Less able students should be able to distinguish upland and lowland features.

Key concepts and processes

Upland landscapes of the UK, like the Lake District in north west England, are a result of predominantly hard rock geology of igneous and metamorphic rocks being moved by tectonic processes and shaped by glacial processes, resulting in mountainous landscapes.

You could use the Lake District as a classic example of an upland landscape in the UK. Students need to understand that this landscape has experienced over 500 million years of geological processes, which have produced a physical landscape of mountains and lakes of great scenic beauty. There are variations in the geology of the area, such as slate developed from sediments in oceans and seas. Volcanoes erupted creating igneous rocks, limestone was formed by the deposition of dead crustaceans and sandstone was created in desert conditions. Various minerals were also formed in joints and faults in the bedrock, which under intense heat and pressure were transformed into very hard, resistant rocks. The layers of rock formed were shifted and sculpted, first through different stages of folding and uplifting and then by the erosive actions of glaciers and meltwater. As a result, the topography of

the Lake District includes smooth U-shaped valleys and steep and sharp ridges, England's highest mountain and deepest and longest lakes.

Examples of upland scenery should also be drawn from other parts of the British Isles. One such example is Dartmoor, where intrusive volcanic landforms can be found. When magma is forced to the surface, only a small amount of the mass actually reaches that level. Most of the magma is intruded into the crust where it solidifies into a range of features, which are often exposed at the surface by later erosion such as batholiths.

Although students do not need to know the location of national parks, it may be a good idea to use the concept of national parks to study the specific landscapes associated with them. There is a link here with a Topic 8 key idea (8.6: The taiga wilderness areas need to be protected from over-exploitation by maintaining protected wilderness areas, national parks and sustainable forestry in the taiga).

Lowland areas of the UK are characterised by sedimentary rocks. A good example could be the Jurassic limestone landscape of the Cotswolds, formed around 210 to 140 million years ago (in warm tropical seas). More than a hundred million years later these rocks shifted and, as the continents moved, the rocks were tilted to shape the geological features that are now visible, such as escarpments, rolling hills, flat plains and valleys. Lowland areas such as the Lancashire and Cheshire plains were formed by ancient glaciers depositing rock debris, creating flat and fertile landscapes.

The integrated skill of using simple geological cross-sections to show the relationship between geology and relief will need to be developed in this lesson.

Students should be familiar from KS3 about the geological timescale and from science about the main characteristics of sedimentary, igneous and metamorphic rocks.

Students will need to know the location of the major rivers of the UK, e.g. Thames, Mersey, Trent, Severn, Tyne, Great Ouse, Wye, Spey, Tweed, Avon.

Guidance on teaching

- Students work in pairs, ideally sitting back to back, using an image of a geological cross-section of northern England. The student who can see the image will describe the shape and geological patterns to their partner, who should draw the cross-section based on their partner's descriptions. The idea is to get the students to look closely at the map to identify the relationship between the geology and topography and to devise descriptions.
- Students could be asked to set up and carry out a key term taboo exercise. The key terms associated with this lesson could be given on cards and students write three words that they would use to define these terms underneath the key term. These are put together so that in groups students can play taboo with key words: they describe the term, without using the words on the cards, and the rest of the group have to guess the term.

Using www.cotswoldsaonb.org.uk/userfiles/file/Publications/Landscapefinal.pdf (see Further reading below), students could work in groups or as homework to produce a walker's guide to the scenery and landscape of the Cotswolds.

Skills and links to fieldwork

(1) Photograph analysis – photographs of upland and lowland landscapes should be used by students to identify the main features.

(2) Simple geological cross-sections should be used to show the relationship between geology and relief.

Further reading

- A geological map of the UK and Ireland: www.thegeologytrusts.org/pub/our-earth-heritage/gb-ipr_123-16ctgeologymap/
- The British Geological Survey website contains a wealth of information and a good interactive Geology of Britain viewer: www.bgs.ac.uk/discoveringgeology/geologyofbritain/viewer.html?src=topNav
- The Lake District National Park website has information about the geology and landscape of the Lake District: www.lakedistrict.gov.uk/learning/geology
- Information on lower glacial landscapes: www.bbc.co.uk/schools/gcsebitesize/geography/glacial_landscapes/human_activity_glaciated_areas_rev3.shtml
- Information on the landscape of the Cotswolds: www.cotswoldsaonb.org.uk/userfiles/file/Publications/Landscapefinal.pdf

Lesson 2: Why distinctive upland and lowland landscapes result from the interaction of physical processes

Overview

This lesson tackles the key idea 4.2a so that students develop an understanding of why distinctive upland and lowland landscapes result from the interaction of physical processes: weathering and climatological, post-glacial river and slope processes.

- More able students could research how glaciers today, in places like the Alps, are currently forming the landscapes found in the UK.
- Less able students should understand the main processes that have contributed to the formation of upland and lowland regions of the UK.

Key concepts and processes

Students will need to develop an understanding of how many upland areas are distinctively glaciated landscapes and are characterised by glacial landforms, such as U-shaped valleys, corries, arêtes and hanging valleys. All of these have been formed as a result of the processes of abrasion and plucking. More recently, misfit streams now occupy some of the valleys and the shape of the valleys has been modified by scree as a result of freeze/thaw weathering.

The lowland areas across the UK are characterised by flat fertile plains formed by glacial deposits, like the Lancashire and Cheshire plains.

Students will need to appreciate there are a variety of different lowland landscapes across the UK. In the north of England, the Lancashire and Cheshire plains were formed from moraines deposited by glaciers creating fertile lowlands.
In the south of England, there are rolling landscapes, where chalk escarpments, flat plains and dry valleys have formed in areas like the Cotswolds and the Downs.

Rivers and hydrological processes are the main forces in creating classic lowland landscape features such as meanders, oxbow lakes, flood plains and deltas, like those found along the lower course of the River Severn. An understanding of post-glacial river and slope processes will be needed. It will therefore be necessary to cover how mass movements, such as mudflows, landslips and soil creep, occur on slopes under different conditions. River processes will be covered later on in this topic.

Skills and links to fieldwork

The integrated skill (3) of locating key physical features on outline UK maps needs to be covered in this lesson. It may be a good idea to make use of OS maps and photographs to identify, describe and contrast upland and lowland landscapes.

Guidance on teaching

- Using photos and maps, students could complete a comparison alley exercise, as per Figure 1 below, to identify and describe the main differences and any similarities between contrasting upland and lowland landscapes. It might be a good idea to give students a list of key words, i.e. landforms available, to help them.

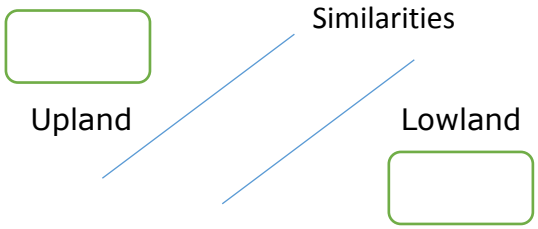

Figure 1: Comparison alley exercise

- Glacial processes could be covered using a card sort exercise. The formation of a corrie could be used to introduce the idea of plucking an erosion. The stages of the formation could be cut up and students asked to arrange them in the correct order. Students could use this information to answer SAMs (1) P2, Q1(b).
- Mass movement exercise – students could be given an information sheet outlining the main types of mass movement. They then would see a variety of images of slopes where there has been mass movement and they would have to attribute the type of mass movement and give their reasons.

Lesson 3: Why distinctive landscapes result from human activity over time

Overview

This lesson should tackle the key idea 4.2b, helping students understand why distinctive landscapes result from human activity (agriculture, forestry, settlement) over time.

- More able students could start to develop the cartographic skills of determining and understanding the relationship of human activities and gradient.
- Less able students should use a range of cartographic skills by using the key, scale and grid references to identify human activities.

Key concepts and processes

There is a need to develop an awareness that very little of the landscape in the British Isles is now in a truly natural state, because over thousands of years humans have settled and cleared the land to make way for agriculture, and later industry. This land clearance for agriculture, forestry and settlements has modified the natural landscape, as this has exposed the rocks to more recent processes of weathering and erosion.

Guidance on teaching

It is likely that students will have developed a range of OS maps through their studies of Geography at KS3. It might be a good idea to develop an OS map activity to recap and revisit, and further build on these skills. This could result in an exercise where students study three OS map extracts showing farming, forestry and settlement respectively. Students should identify the main land uses and suggest reasons why.

Further reading/useful resources

- Map website: www.ordnancesurvey.co.uk/education-research/teaching-resources/
- Free digital maps for schools (ArcGIS maps): http://digimapforschools.edina.ac.uk

Key vocabulary for EQ1

Geological	Tectonic	Glacial
Quaternary Cretaceous period Carboniferous period Precambrian Jurassic Batholith Intrusion Igneous Metamorphic Sedimentary Impermeable Escarpments Dykes Sills Laccoliths Chalk Carboniferous limestone Clay Granite Schist Slate weathering	Continental drift Magma Basalt	Abrasion Plucking Moraine Corrie/cirques/cwms Arêtes Glacial troughs/U-shaped valleys Truncated spur Hanging valleys Roche moutonnées Drumlins Crag and tail Till Erratics Post-glacial

Sub-topic: Coastal change and conflict (Enquiry Questions 2 and 3)

This sub-topic is based around enquiry questions 2 and 3:

- EQ2: Why is there a variety of distinctive coastal landscapes in the UK and what are the processes that shape them?
- EQ3: What are the challenges for coastal landscapes and communities and why is there conflict about how to manage them?

Key ideas

- 4.3: Distinctive coastal landscapes are influenced by geology interacting with physical processes.
- 4.4: Distinctive coastal landscapes are modified by human activity interacting with physical processes.
- 4.5: The interaction of human and physical processes present challenges along coastlines and there are a variety of management options.

Teaching approach over seven hours

Lesson 1 (1hr)	How are coastal landscapes influenced by geology?
Lesson 2 (1hr)	Marine erosional processes and landforms
Lesson 3 (1hr)	The Holderness coast – causes of coastal retreat
Lesson 4 (1hr)	Longshore drift and depositional features
Lesson 5 (1hr)	How human activities are influencing coastal processes
Lesson 6 (1hr)	The causes and effects of coastal flooding
Lesson 7 (1hr)	Defending the coast

Key concepts and processes

Following on from the previous EQ, students need to focus on the concept that there are geological variations within a small locality, such as in the Swanage area. Here there are alternating bands of soft (clay) and hard rocks (chalk and limestone). As a result of the contrasting geology, distinctive coastal landscapes have formed: rocky coastal landscapes in areas of hard rock, and soft sediment coastal landscapes in areas of soft rock. The concept of differential erosion needs to be covered and that this results in the formation of a discordant coast, where the alternating hard and soft rocks are at right angles to the coast. Where the alternating bands of hard and soft rock run parallel to the coast, like those at Lulworth Cove, then a concordant coast is formed. The skill of using BGS geology maps should be integrated here to identify the contrasting geology and resultant landforms. The harder chalk rocks are where the headland can be found and the softer clay rocks are where the bays are situated. The Geology of Britain viewer is a great online source for this: www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html.

Students need to be able to identify, describe and explain the formation of the following distinctive coastal landforms formed by erosion: headlands, bays, caves, arches, cliffs, stacks and wave cut platforms. Students are required to study (have knowledge of) **a located example** of one coastal landscape. It may be a good idea to introduce this example here, in order for specific examples of coastal landforms to be studied, such as those along the Holderness coast. For example, you could look at the cliffs, stacks and arches at Flamborough Head. Another well-resourced located example is the Isle of Purbeck in Dorset.

An understanding of the causes and characteristics of destructive waves and the marine erosion processes of abrasion, hydraulic action, attrition and corrosion are required to explain the formation of the distinctive coastal landforms. In order to explain coastal retreat, students are also required to understand the role of sub-aerial processes and mass movements: landslides, rock falls and slumping. This refers to the disintegration of rock through the processes of weathering (such as freeze-thaw and thermal expansion) and the impact of wind and rain.

The Holderness coast is a great example of coastline that is experiencing rapid coastal retreat. There are lots of good sources of information that would enable

students to calculate the mean rate of coastal erosion. A good website containing data measurements of erosion collected along the East Yorkshire coast by the East Riding Council is www.urbanrim.org.uk/data-summary.htm. Also shown are calculations of annual rates of erosion and total cliff loss.

An understanding is needed of how sediment is transported through longshore drift and the role this and constructive waves play in the formation of coastal landscapes of deposition – namely spits, beaches and bars. Once again students could draw on specific examples of these from their located example, for example the spit at Spurn Point at the southern part of the Holderness coast.
As part of the study of the located example, students are required to know the different human activities that go on along the coast and how these affect and cause change to the coastal landforms. Students will be required to identify these on 1:25 000 and 1:50 000 OS maps. This skill should be integrated into lessons when studying these landforms.

For EQ3, students must study the increasing risks from coastal flooding and the implications of climate change on marine erosion and deposition. This should be followed by focusing on the threat this poses to people and the environment, and the different approaches to how this threat can be managed by hard engineering and soft engineering. A look at the more sustainable strategic realignment approach as part of Integrated Coastal Zone Management (ICZM) is also required. Students will be required to use OS maps, GIS and simple cost-benefit analysis to investigate coastal defence options.

If centres are opting to do the investigating coastal change and conflict geographical investigation, it is important that during the relevant lessons students are introduced to the concepts around 'Investigating the impact of coastal management on coastal processes and communities'. Students should be given the opportunity to explore the kinds of enquiry questions that can be investigated through fieldwork and the data collection techniques. This will form essential preparation for Topic 6. Ideally students will go out and collect their primary data during this time.

Guidance on teaching

The content for the Coasts sub-topic is familiar to many teachers. It is well-resourced in most centres and teaching and learning methods are well-established.

Here are some teaching and learning ideas to consider:

- Key terms exercise – students are given detailed information about one coastal process or feature. A 'find someone who' exercise could then be done, where students move around the room with a list of key terms and find someone who can explain each one to them. Students should develop a list of defined key terms from this exercise.
- A card sort exercise to sequence the processes in the formation of stacks and stumps. This could lead to a storyboard exercise, where labels are added to images for a geographical guide to coastal landforms.
- A living graph exercise. In groups, students sort a series of statements relating to weather reports and events on to the appropriate parts of a graph showing seasonal variation in coastal erosion, in order to gain an understanding of how seasonality and storm frequency are linked to coastal erosion.

- To help students understand the process of longshore drift and spit formation, they could be asked to write a script to accompany a silent video showing the formation of a spit.
- To build up information about their located example, students could be given a base map of the area, which they annotate with the key information about the main physical processes and landforms and human activities. Using this information and extra research, students create a geographer's guide to the area; this could be in the form of a leaflet, website or brochure.
- When studying coastal defences, students could collate information from textbooks or from information posted around the classroom in a table like the one below:

Technique	Purpose	Cost	Benefit

They could colour code the techniques for hard and soft engineering methods. This information could be used as the basis for a mini decision-making exercise, where students are asked to write a bid for a stretch of coastline on their located example, for a grant for a coastal management strategy. Guidance could be given on extended writing techniques and how students should assess and evaluate methods, and justify their choices.

Further reading/useful resources

- GCSE Bitesize case study of the Holderness coast: www.bbc.co.uk/schools/gcsebitesize/geography/coasts/coastal_management_rev3.shtml
- British Geological Survey: Coastal erosion of the Holderness to Spurn Head coast www.bgs.ac.uk/research/climatechange/environment/coastal/coastalErosion.html
- British Geological Survey: Coastal erosion UK geohazard note: www.bgs.ac.uk/downloads/start.cfm?id=249
- This video from GCSE Bitesize shows the formation of a spit: www.bbc.co.uk/education/clips/z7h4d2p

Key vocabulary for EQ2 and EQ3

EQ2	EQ3
Arch Backwash Bay Beach Concordant coast Constructive wave Deposition Destructive wave Discordant coast Erosion	Hard engineering Holistic approach ICZM (Integrated Coastal Zone Management) Strategic retreat Coastal flooding Coastal management Soft engineering Groynes Sea walls

Fetch	Beach replenishment
Geological structure	Rip-rap
Hard rock coast	Beach replenishment
Headland	Slope stabilisation
Longshore drift	'Do nothing'
Mass movement	Strategic realignment
Soft rock coast	
Spit	
Stack	
Swash	
Stump	
Sub-aerial weathering processes Weathering	
Landslide	
Rock fall	
Slumping	
Freeze-thaw weathering	
Joints	
Faults	
Caves	
Cliffs	
Wave-cut platform	
Seasonality	
Storm frequency	
Prevailing wind	
Bars	

Sub-topic: River processes and pressures (Enquiry Questions 4 and 5)

This sub-topic is based around enquiry questions 4 and 5:

- EQ4: Why is there a variety of river landscapes in the UK and what are the processes that shape them?
- EQ5: What are the challenges for river landscapes, people and property and how can they be managed?

Key ideas

- 4.6 Distinctive river landscapes have different characteristics formed by interacting physical processes.
- 4.7 River landscapes are influenced by human activity interacting with physical processes.
- 4.8 Some rivers are more prone to flood than others and there is a variety of river management options.

Teaching approach over six hours

Lesson 1 (1hr)	The landscape changes on the long profile of a river
Lesson 2 (1hr)	River processes and landforms
Lesson 3 (1hr)	How are river landscapes influenced by human activity?
Lesson 4 (1hr)	River flooding on a named river
Lesson 5 (1hr)	The risks of river flooding
Lesson 6 (1hr)	Managing the flood risk

Key concepts and processes

This sub-topic should start by developing an understanding of how river landscapes change through their catchment area and along their long profile. Students need to know changes in valley type and profile and the river channel characteristics from close to the source in the upper courses, through the middle courses and through to the lower course close to the mouth of the river.

British Geological Survey (BGS) geology maps should be integrated into lessons to show the relationship between geology (rock type) and the changes along the long profile of a river.

The Bradshaw model could be used to study the channel changes along a river's course. This study should focus on the channel shape (width and depth), valley profile, gradient, discharge, velocity and sediment size and shape. Students will need to focus on the main features of the differing valley shapes and valley floor profiles, and be able to identify valley cross-sections from contour lines on 1:25 000 and 1:50 000 OS maps.

If centres are doing the river processes and pressures investigation, 'Investigating how and why drainage basin and channel characteristics influence flood risk for people and property along a river in the UK', in Topic 6, then it is suggested that students should be introduced to the fieldwork data collection methods of how to measure changes in channel characteristics. Students should also be given the opportunity to explore the kinds of questions that can be investigated through fieldwork. Ideally it is at this point students will go out and collect their primary data.

Following this, OS maps and photographs could be used to identify specific landforms, and an understanding of the erosional processes of abrasion, hydraulic action, attrition and corrosion is needed to explain the formation of river landforms of water falls and interlocking spurs. The role of geology and differential erosion will need to be explored in the formation of waterfalls.

Students will need an understanding of how rivers transport sediment, through traction, saltation, suspension and solution, and how and why rivers deposit material and create specific landforms of flood plains, levees and deltas. Students will need to gain an understanding of how sediments should vary in size and shape in different parts of the river catchment. Introduce links to fieldwork and how this could be

investigated using powers of indices of angularity and roundness. If possible, this could be done in a practical way, where students might use rock samples and measure their angularity and roundness using a chart or formula, such as Power's Scale of Roundness Chart (http://www.earthstudies.co.uk/Geography/Individual%20Research%20in%20Geography%20G3/Powers%20Scale%20of%20Roundness.html).

Roundness formula: $R = 2r \times 1000 / L$

R = Cailleux roundness
r = average radius of curvature (obtained from chart)
L = average length of pebbles (in sample)

A good source of fieldwork ideas can be found on the Royal Geographical Society (RGS) website: www.rgs.org/OurWork/Schools/Fieldwork+and+local+learning/Fieldwork+techniques/Rivers.htm.

An understanding of how meanders and oxbow lakes form in the lower courses of rivers is needed – how as the flow of a river passes over deep pools, it develops a faster, more erosive flow on the outside bend of the meander. Whereas, on the shallower inner bank of the river, riffles cause the flow of the river to slow down and deposit sediments on the point bar. As meanders develop, the erosion of the outside bend tends to move them slowly downstream and downslope. The sinuosity of the meander may become more pronounced, with the erosion of the outer bank and deposition on the inner bank producing an increasingly narrow neck of land between the start and end of the meander. At times of flood this neck can be eroded away, giving the river channel a straighter, shorter route downstream. Initially, the truncated loop forms a curve lake like the horns of an ox, cut off from the main channel by deposition. Over time the still waters may infill with sediment and vegetation, and the lake may only be visible as a shallow depression or detected by variations in vegetation. It will be necessary for students to be able to identify river landform features on an OS map as part of integrated skill 16.

How discharge changes throughout a storm will need to be studied alongside the features of a storm hydrograph. It will be necessary for students to be able to identify and explain lag time, the rising limb, peak discharge, the falling limb and base flow on a storm hydrograph. They will need to be able to explain the effects of the basin size, drainage density, rock type, land use, relief, soil moisture and rainfall intensity on the shape of storm hydrographs from contrasting catchments.

A located example or a river that has recently flooded is needed. Some good examples of named rivers and floods include the 2009 Cockermouth flood, when the rivers Cocker and Derwent flooded, or the Somerset floods of 2014 when the Somerset Levels flooded along the Rivers Parrett and Tone. It will be necessary to explore the physical and human causes of the floods and how people, property and the environment were affected.

Following on from this, students will need to study how flood risks can be managed by hard and soft engineering. A cost-benefit analysis will be needed in order to evaluate the effectiveness of the different methods. You can use old and new OS maps to look at building and communication development, and GIS needs to be integrated here to investigate the impact of policy decisions.

Guidance on teaching

The content for the river processes and pressures sub-topic is familiar to many teachers. It is well-resourced in most centres and teaching and learning methods are well-established.

Here are some teaching and learning ideas to consider:

- In order to contrast river landscapes, students could be given a variety of resources, including map extracts, photos, descriptions and data measurements from a located river. In groups students will need to sort these into three categories for the upper, middle and lower parts of the river landscape. Using this information, students will then be able to contrast the river landscapes between the upper, middle and lower course of rivers.
- The main physical processes and features need to be established and could be tested using a taboo exercise. The key terms associated with this could be given on cards and students write three words that they would use to define these terms underneath the key term. These are put together so that in groups students can play taboo with the key words. They have to describe the term without using the words on the cards and the rest of the group have to guess the term.
- Formation of landforms such as waterfalls and meanders could be done as a storyboard, which establishes the sequence and processes involved. Using this information, students could attempt SAMs (1) P2, Q3(a)(ii).
- Students could study the effects of a recent flood, such as the Cumbrian floods of 2015, and do a piece of extended writing summarising the effects and evaluating the main causes. They could write a response to SAMS (1) P2, Q4, then, using the marks scheme, peer assess and then re-draft and create a model answer to this question.
- Students could summarise a range of different flood management strategies in a table like the one below:

Technique	Purpose	Cost	Benefit

They could then prepare a report for the Environment Agency suggesting the best flood defences that could be used in an area recently flooded (e.g. Kendal in Cumbria), within a given budget. Students could be given guidance on how to write extended responses that assess and evaluate the different methods and justify conclusions.

Further reading

- The story of the Cumbrian floods in 2009 and 2015:
  http://news.bbc.co.uk/local/cumbria/hi/people_and_places/newsid_8378000/8378388.stm
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Key vocabulary for EQ4 and EQ5

EQ4	EQ4 (cont…)	EQ5
Deposition Drainage basin Erosion Flood plain Geology Hydrograph Impermeable Spurs Levee Long profile Cross profile Lower course Middle course Upper course Meander Oxbow lake River cliff Sediment load Slip-off slope Pools Riffles	Waterfall Weathering Channel shape Valley profile Gradient Discharge Velocity Hydraulic action Abrasion Attrition Solution Interlocking spurs Deltas Lag-time Soil type Slope Drainage basin shape Antecedent conditions	Deforestation Flood risk Hard engineering Integrated river management Urbanisation Flood walls Embankments Flood barriers Flood plain retention River restoration