Zig Zag Education

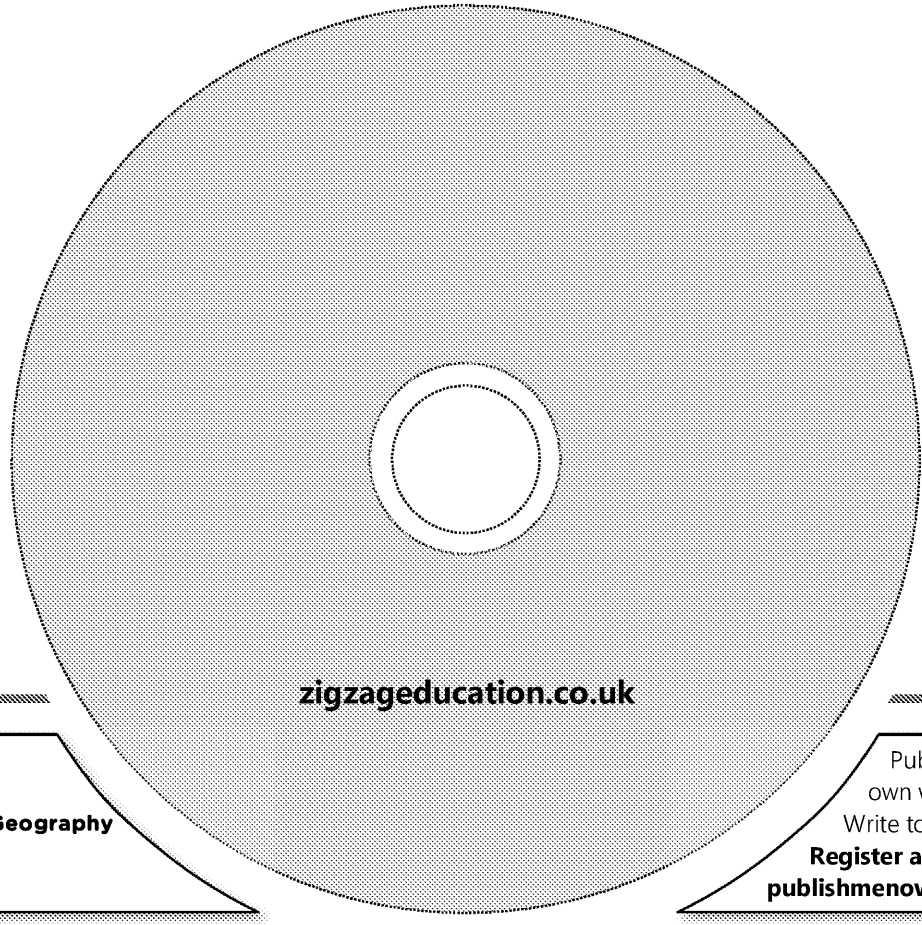
Geography

GCSE (9–1) | Edexcel B | 1GB0

GCSE Edexcel B

Dynamic Geography Activity Pack

The UK's Evolving Physical Landscape



AW5/ 6703

POD 6703

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Contents

Teacher's Introduction

The activities in this pack have been written to support the delivery of Topic 4: The U
the 2016 GCSE Edexcel B specification.

The activities cover the full range of subject content for the unit. The table on the fo
highlights the specification learning objectives, and provides an at-a-glance view of t
activity available within this resource.

- There are three activities for the compulsory Overview of Physical Landscapes.
- There are six activities for the optional subtopic Coastal Change and Conflict.
- There are four activities for the optional subtopic River Processes and Pressure

These dynamic geography activities allow students to explore the content of the un
skills. Exercises are designed to be thought-provoking, and cover a variety of in-dep
abilities.

A range of teaching situations and scenarios are covered, including:

- Homework and cover lessons
- Individual, small-group and whole-class activities
- A mix of visual, aural and kinaesthetic skills
- Differentiation: supporting lower-ability students while challenging students of

This pack contains:

- for each activity:
  - instructions for the teacher
  - instructions for students (if required)
  - any paper materials (e.g. worksheets) that are required
  - a list of equipment (e.g. computers, drawing materials) (if required)
  - in some cases examples and/or suggested answers are included; howe
    only
- A PowerPoint presentation to enable large, colour images to be displayed
  This will add clarity to a number of images, as well as providing a focus poi
  for group discussion.

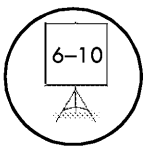
Sensitivity considerations: Due to the sensitive nature of some of the activities, espe
activities, it is advised that you ensure that you, or staff undertaking cover lessons, a
close connections with friends or relatives, or have themselves been personally affe

I hope you find this activity pack useful during your teaching.

A webpage containing all the links listed in this resource is conveniently
website at **zzed.uk/6703**

You may find this helpful for accessing the websites rather than typing

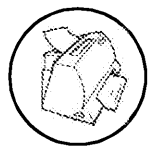
Symbols Key



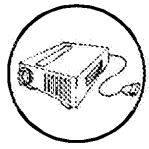
Slide ref.

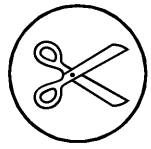

Internet access


Computer access


Printer


Computer suite


Projector


Craft materials

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Go to **zze**

Activity Overview Table: Physica

Lesson Number	Topic	Activity Title	Learning Objective	Description
1	Variation of Physical Landscapes	Bedrock Cartography	To understand how distinctive landscapes are created both through natural processes and through additional human influence.	Students identify distinctive upland and lo landscapes, and use geology and Ordnanc maps to identify features.
2		Geological Matchmaking	To explore the distribution of rock types within the UK and to understand and explain their formation.	Students are provided with photographs a and must match each to its corresponding type.
				(Individual version of the above)
3		Changes? What Changes?	Students use both modern and historical maps to evaluate how landscapes are modified by humans, and how such modification can lead to a distinctive landscape.	Students compare historical and modern aerial photographs to identify changing la and explain why the landscape is distincti
				(Individual version of the above)

[1] There is scope for the teacher to direct a whole-class activity by displaying maps to the class and facilitating a cl

Activity Overview Table: Coasta

Lesson Number	Topic	Activity Title	Learning Objective	Description
4	Coastal Landscapes	Map Exercise – Features and Processes	Students use map-work skills and their knowledge of the creation of different coastal landforms.	Small groups of students are provided wit and photographs of the Jurassic Coast an identify suitable locations for each photo the map, and complete mini fact files to e processes which created the depositional erosional features.
				(Individual version of the above)
5		Winter Storms – Research and Poster	Students research the storm damage to landscapes (rivers and coasts) resulting from the 2013–14 winter storms.	Students research the effects of the 2013 winter storms and produce a poster as a g
6		Coastal Erosion Debate or Consultation	Students understand the issues and pressures created by different stakeholders in the use of coastlines.	Students are assigned different roles, are with information on coastal erosion and p developments, and must debate the plan discussion of proposed coastal manageme practices in the region. The scenario is the a public consultation.
7		How Could That Affect Me?	Students discuss how different forms of coastal engineering and land use could alter the coastline.	A class discussion on how different natura human processes can affect erosion rates therefore, physical landscapes.
8		Brief the Prime Minister	Students consider the risks of coastal flooding posed by climate change.	Students research and prepare a briefing the Prime Minister, advising the governm risks from climate change which may be v in coastal areas.
9		Guess the Sketch	To identify and consolidate understanding of different factors and types of coastal protection.	Students are provided with factors and ty coastal protection. Working in pairs or sm groups, students draw the factor, and the student(s) must guess the factor.

Activity Overview Table: River

Lesson Number	Topic	Activity Title	Learning Objective	Description
10	River Processes	River Speed Dating	Students identify and explain different parts of a river, including stages, features, cross-section, bedload and features of deposition and erosion.	Students are provided with images and qu and rotate around the classroom providin answers, and discussing each image and p answers.
11		Flood Risk… or Not?	Students consider the ways that flood risk can be increased, both through natural and human causes.	Small groups of students are provided wit of images which need categorising based whether the flood risk is increased or redu each feature shown, and an explanation c
				(Individual version of the above)
12		Bank-Burst in the Lake District	Students research and discuss the various causes for the flooding in the Lake District during the winter of 2015–16.	Students undertake research on the causes flooding, and the effects of a flood from ri within the Lake District. Students then add details to a blank outline map.
13		Flood Scheme Presentation Board	Students must consider how different river engineering techniques can be used, as well as their advantages and disadvantages.	Students are given a map and photograph Brecon, and it is their job to produce a pro the form of a presentation board) in orde protect that town from flooding.

Activity 1: Bedrock Cartograph

Teacher's Instructions

This activity can be used as a cover lesson or homework.

Aim

In this activity, students will work individually to identify different landscapes and the processes which create them.

This activity allows students to:

- Use their knowledge to identify different landforms and processes.
- Practice their sketching skills.
- Consolidate and revise their knowledge.
- Identify gaps in their understanding.

QUICK-GLAN
Prior Knowle Physical lands
Additional M None
Feedback op Yes
Evaluation o Yes

Materials needed

- Photocopies of the worksheets, and the suggested answer pages and/or Peer-marking Grids (if required).
- The students may need to use their teaching notes or textbooks to help com
- Research should also be done online; therefore, you may wish to book a com

Structure of the activity

Section	Timing	Task
Prep done by teacher	5 mins	Photocopy the template sheets, answers, and Pe
Part 1: Written activity	40–50 mins	Students individually complete the activity.
Part 2: Feedback (optional)	10 mins	Students can complete the Peer-marking Grid, ei at the beginning of the following lesson. The students can be provided with a copy of the required.

Feedback and evaluation

Once written, provide a copy of the Peer-marking Grid so that students can asses

Students' Instructions

1. Study the photographs provided and complete the fact file for each landsca

2. Use the Internet to help you locate each example.
   - Ordnance Survey maps can be found at *https://www.ordnancesurvey.c* required to view some maps) or use Bing Maps and select 'Ordnance Su 1:50 000 scale maps (at different levels of zoom).
   - Geology maps can be viewed at *http://mapapps.bgs.ac.uk/geologyofbr*
   - Digimap for Schools – If your school has subscribed to Digimap for Scho

Location 1

Place Name: *Glencoe, Scotland*

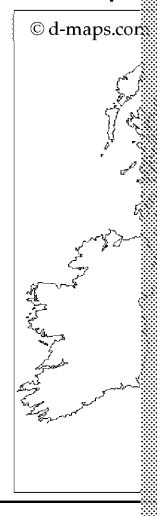
Type of Landscape:

Upland or Lowland Landscape?

Photograph:

Sketch Map (use an Ordnance Survey map):

Location on the Map:



Type of bedrock and its effects on the landscape:

Processes responsible for creating the landscape:

How have humans modified the landscape?

Location 2

Place Name: *Cauldron Snout, River Tees*

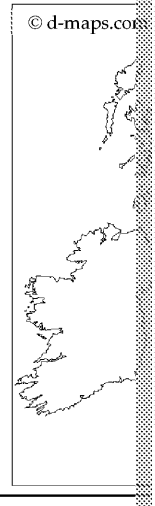
Type of Landscape:

Upland or Lowland Landscape?

Photograph:

Sketch Map (use an Ordnance Survey map):

Location on the Map:



Type of bedrock and its effects on the landscape:

Processes responsible for creating the landscape:

How have humans modified the landscape?

Location 3

Place Name: *The Broads, West of Great Yarmouth*

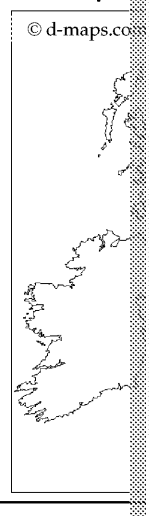
Type of Landscape:

Upland or Lowland Landscape?

Photograph:

Sketch Map (use an Ordnance Survey map):

Location on the Map:



Type of bedrock and its effects on the landscape:

Processes responsible for creating the landscape:

How have humans modified the landscape?

Location 4

Place Name: *Godlingston Heath, Studland*

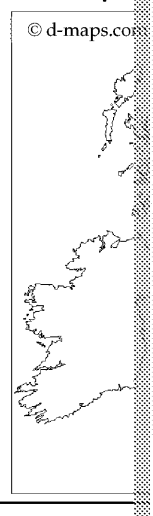
Type of Landscape:

Upland or Lowland Landscape?

Photograph:

Sketch Map (use an Ordnance Survey map):

Location on the Map:



Type of bedrock and its effects on the landscape:

Processes responsible for creating the landscape:

How have humans modified the landscape?

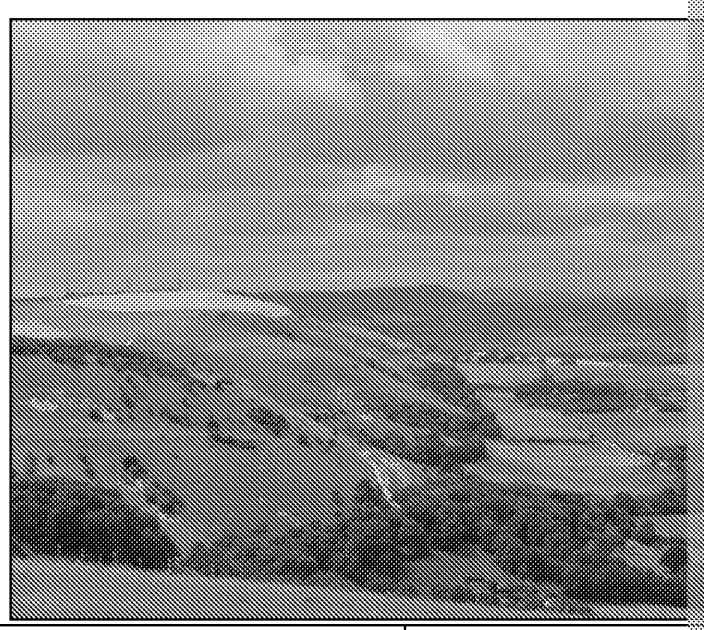
Location 5

Place Name: South Downs

Type of Landscape:

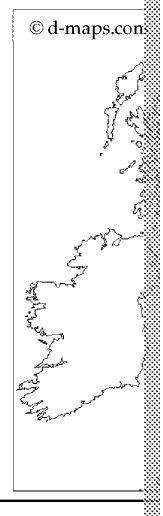
Upland or Lowland Landscape?

Photograph:



Sketch Map (use an Ordnance Survey map):

Location on the Map:



Type of bedrock and its effects on the landscape:

Processes responsible for creating the landscape:

How have humans modified the landscape?

Location 6

Place Name: *Dartmoor*

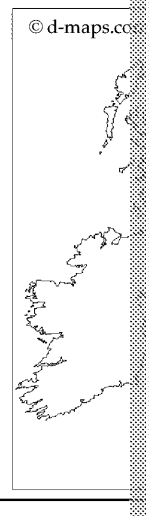
Type of Landscape:

Upland or Lowland Landscape?

Photograph:

Sketch Map (use an Ordnance Survey map):

Location on the Map:



Type of bedrock and its effects on the landscape:

Processes responsible for creating the landscape:

How have humans modified the landscape?

Location 1 – Suggested Answers

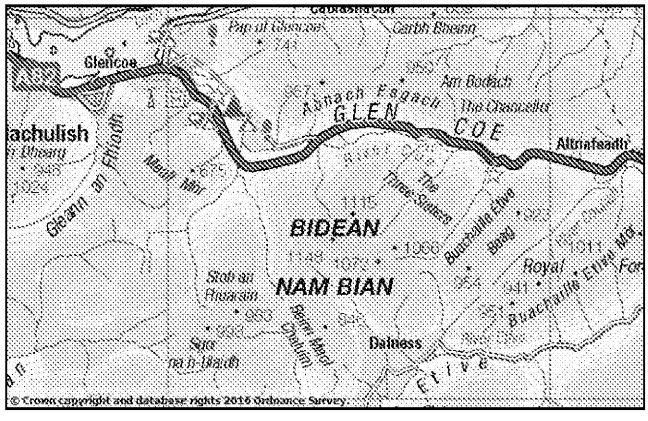
Place Name: *Glencoe, Scotland*

Type of Landscape: *Mountainous landscape (former volcanic), later shaped by*

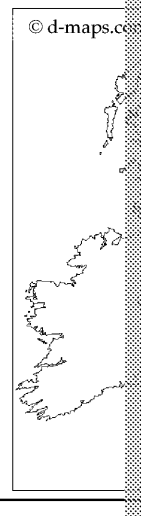
Upland or Lowland Landscape? *Upland*

Photograph:

Sketch Map (use an Ordnance Survey map):



Location on the Map:



Type of bedrock and its effects on the landscape:

Igneous intrusion – forms mountains, weathering of softer, sedimentary rock vicinity.

Processes responsible for creating the landscape:

Volcanic activity, including calderas.

Glaciation, e.g. abrasion, creation of glacial troughs and other features.

How have humans modified the landscape?

Roadbuilding, building of infrastructure and other human activity in the area

Evidence of afforestation with non-native conifer species.

Upland farming.

Location 2 – Suggested Answer

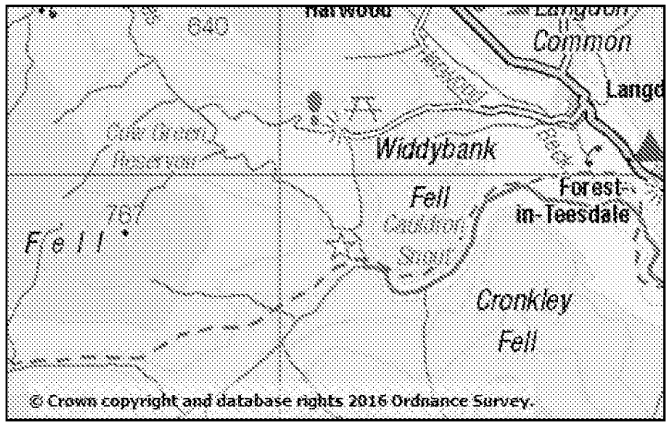
Place Name: *Cauldron Snout, River Tees*

Type of Landscape: *Fluvial – upper course of a river.*

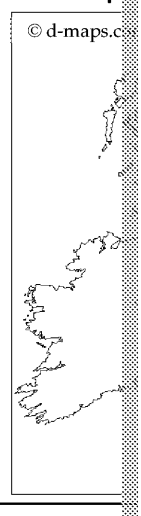
Upland or Lowland Landscape? *Upland*

Photograph:

Sketch Map (use an Ordnance Survey map):



Location on the Map:



Type of bedrock and its effects on the landscape:

Quartz-microgabbro (Great Whin Sill) – layer of hard rock creates differenti

Limestone in the vicinity – susceptible to erosion.

Processes responsible for creating the landscape:

Intrusion of magma.

Hard rock – responsible for the waterfall.

The erosive power of the water creates the waterfall, in combination with th

How have humans modified the landscape?

The waterfall lies downhill from Cow Green Reservoir. Humans have built a d

the flow regime of the River Tees. There are footpaths nearby, such as the Pe

Survey map shows roads, settlement and a picnic site.

Location 3 – Suggested Answer

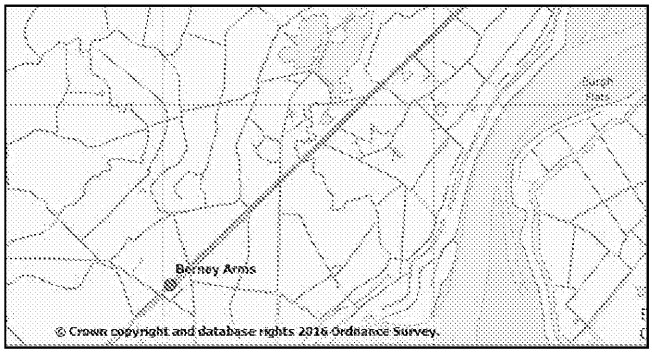
Place Name: *The Broads, west of Great Yarmouth*

Type of Landscape: *Agricultural*

Upland or Lowland Landscape? *Lowland*

Photograph:

Sketch Map (use an Ordnance Survey map):



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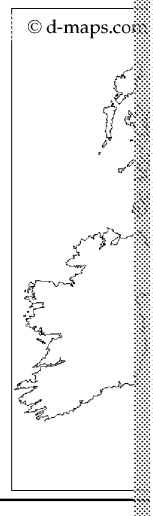


Type of bedrock and its effects on the landscape:

Sand and gravel, flat, easily eroded, soils may be deep.

Processes responsible for creating the landscape:

Deposition of sands and gravel, material settled on the seabed (shallow water

How have humans modified the landscape?

Converted the land to farmland (likely to have cut down trees first).

Planted crops.

Built many drainage ditches.

Built a railway line, infrastructure and settlement.

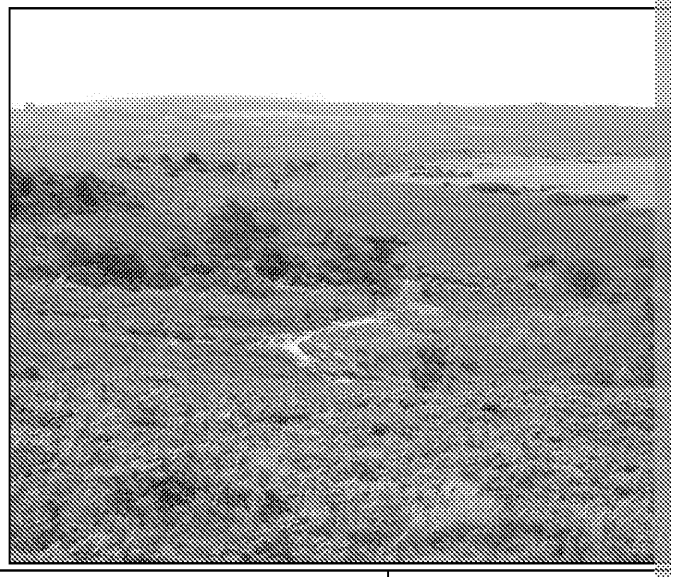
Location 4 – Suggested Answers

Place Name: *Godlingston Heath, Studland*

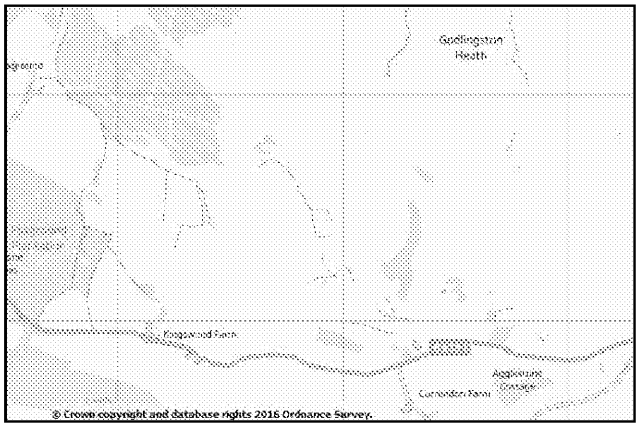
Type of Landscape: *Heathland (lowland heath)*

Upland or Lowland Landscape? *Lowland*

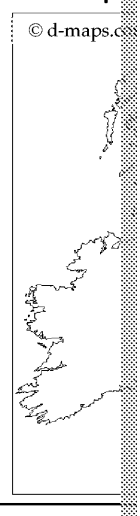
Photograph:



Sketch Map (use an Ordnance Survey map):



Location on the Map



Type of bedrock and its effects on the landscape:

Sands and clays – the sand makes the soil very free draining – leaching awa little surface water.

Processes responsible for creating the landscape:

This is not a natural landscape – formed as a result of deforestation and poo underlying sand deposits are also a factor.

Lack of interception, soil erosion.

How have humans modified the landscape?

Deforestation, followed by cropping and grazing, coupled with sandy soil mea Scrubby plants and trees, such as heather, gorse and birch trees took over – for animal bedding.

More recently, there are non-native pine plantations, oil wells and a golf cou settlement and infrastructure.

Location 5 – Suggested Answer

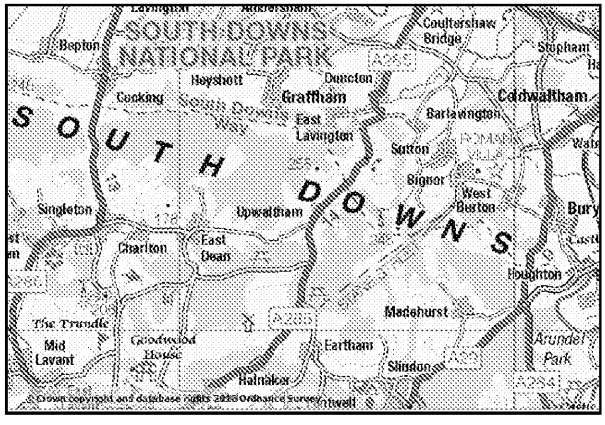
Place Name: South Downs

Type of Landscape: Downland – rolling chalk hills

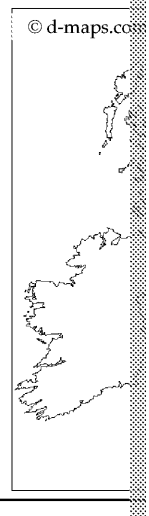
Upland or Lowland Landscape? Lowland

Photograph:

Sketch Map (use an Ordnance Survey map):



Location on the Map:



Type of bedrock and its effects on the landscape:

Chalk – soils are thin and stony, little surface water because chalk is very per

Processes responsible for creating the landscape:

The chalk formed under shallow seas, but there are also deposits of clay and
Erosion from surface water has also taken place, helping to create the undula
Down-slope mass movement processes are evident in the photograph – terra
sections of the slope.

How have humans modified the landscape?

The area is now designated as a national park; however, there is extensive set
the area, much built before its relatively recent designation.
Mixed farming is present in the area, e.g. crops and sheep.

Location 6 – Suggested Answer

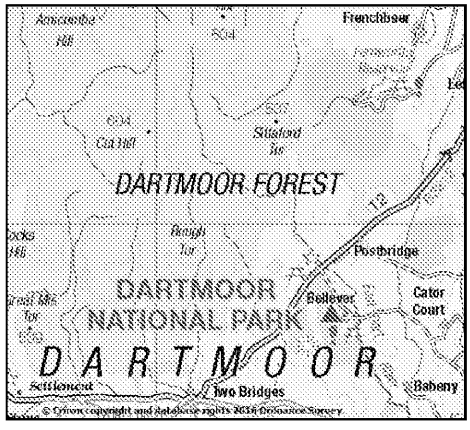
Place Name: *Dartmoor*

Type of Landscape: *Moorland*

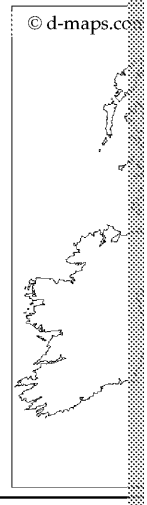
Upland or Lowland Landscape? *Upland*

Photograph:

Sketch Map (use an Ordnance Survey map):



Location on the Map:



Type of bedrock and its effects on the landscape:

Granite intrusions (igneous rock) – very hard rock – form outcrops where th
are eroded away, exposing the batholiths on the surface (called tors). Imperm

Processes responsible for creating the landscape:

Erosion of the granite bedrock is slow, so soils are thin and acidic.
The ground is likely to be marshy in places because the bedrock is impermeab
River valleys are present – fluvial erosion and depositional processes.
The landscape has been heavily modified by human activity.

How have humans modified the landscape?

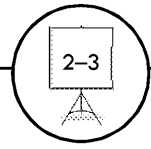
Past land clearance and farming have resulted in poor soils.
Limited settlement and associated infrastructure.
Upland sheep farming.
Afforestation with non-native conifer trees in some areas.
Grasses, bracken, heathers and some trees have become re-established.

Peer-marking Grid 1 – Bedrock Cartog

	Mark 1–5	C
Has the correct type and location of the landscape been completed?		
Is the sketch map neat and tidy? Is it clear what is shown on the map?		
Are the processes fully explored?		
Does the student have a good grasp of how humans have altered the landscape?		
Overall, has the student understood the how geology can affect the landscape?		
Total score	/25	

Activity 2: Geological Matchmak

Teacher's Instructions



Aim
In this activity, students will work in small groups to categorise photographs, descriptions and the formation of different types of rock.

This activity allows students to:

- Work in groups and share ideas and connections.
- Apply their knowledge of physical processes and geomorphology.
- Develop team-working skills.
- Develop analytical and problem-solving skills.
- Produce fact-file-style revision aids.

Prior Knowle
Rock types

Additional M
Scissors and

Feedback op
Yes

Evaluation o
No

Materials needed

- Provide each group with a copy of the images and facts. Photocopy the tem
- Photocopy the answer sheets.
- You may also wish to project the accompanying PowerPoint slide to provide

Structure of the activity

Section	Timing	Task
Prep done by teacher	5–10 mins	Photocopy the template sheets (A3) and Photocopy the answer sheets if required.
Part 1: Sticking and discussion	40–50 mins	Divide your students into small groups of The students need to study and discuss t stick the appropriate images onto the co
Part 2: Feedback	10 mins	Hand out the answer sheets to your stud answers and to ensure that they do not h can answer any queries that the students

Feedback and evaluation
Provide the answer sheets, and address any questions that the students have.

Chalk

1

INSPECTION COPY

2 Limestone

INSPECTION COPY

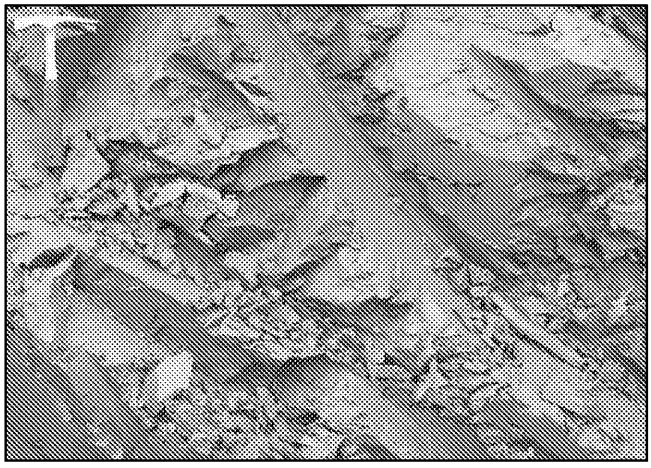
INSPECTION COPY

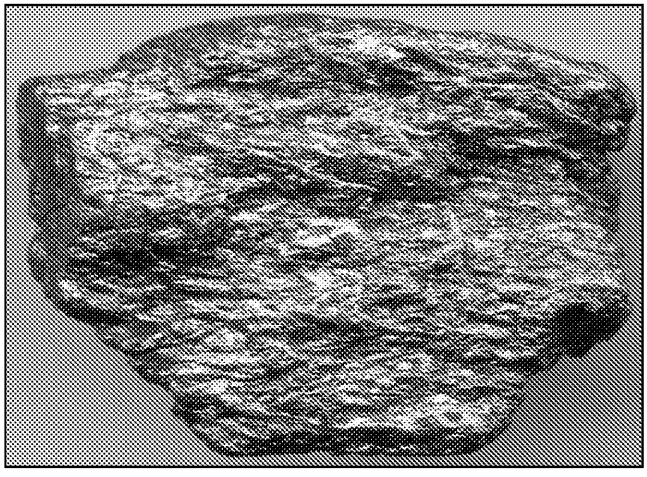
4 Granite

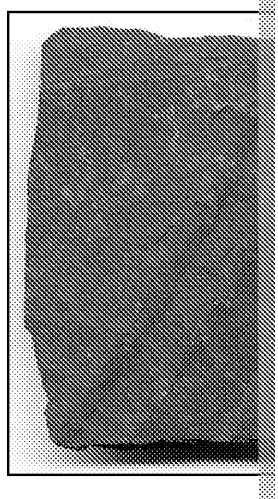
INSPECTION COPY

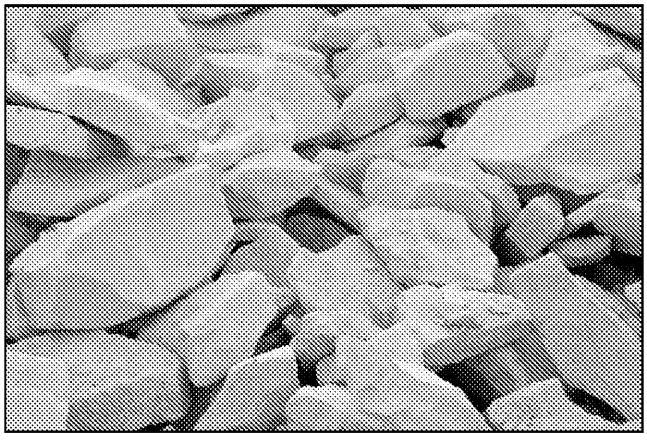
INSPECTION COPY

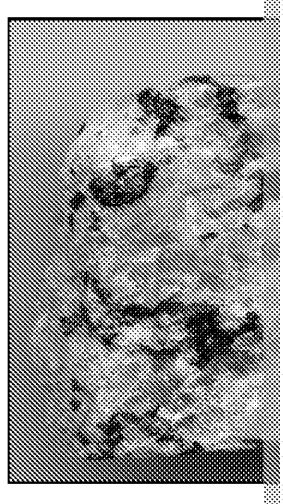
Rocks



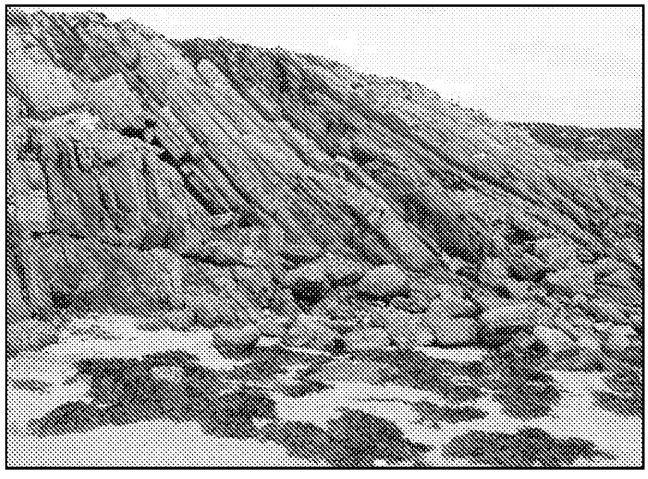


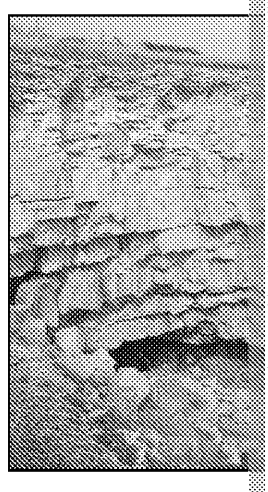


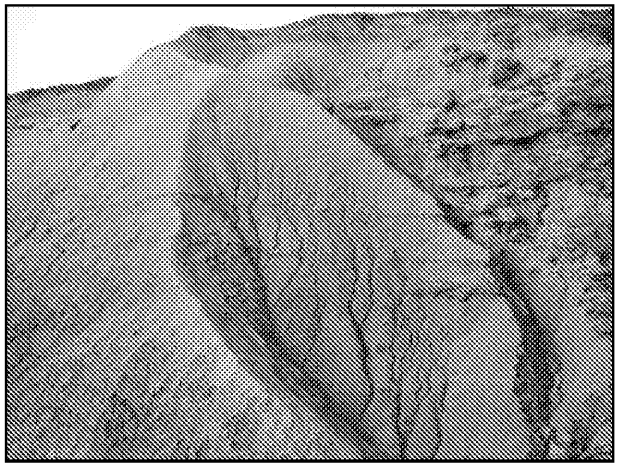


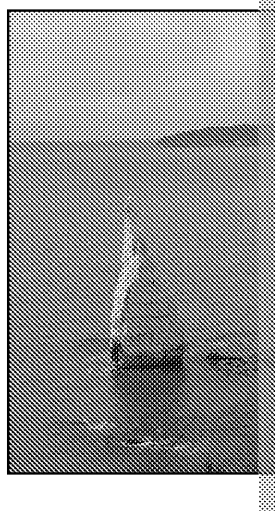


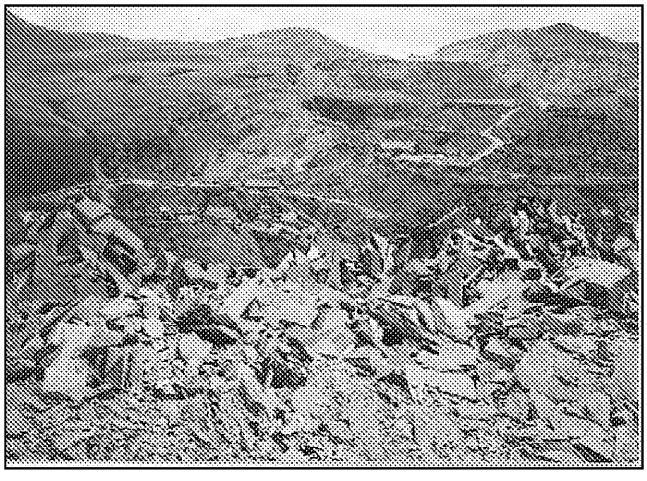
Landscapes

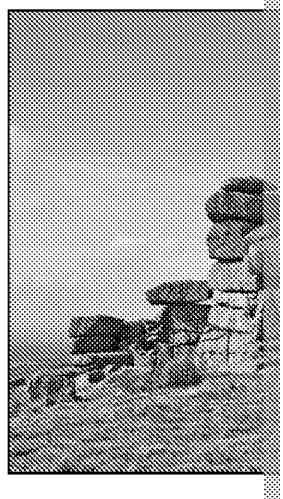












Information

	Sedimentary Rock
	Igneous Rock
	Metamorphic Rock
Can s	Large crystal structure because it cools slowly
Ca	Medium grain, but can be coarse
	The White Cliffs of Dover are made from this rock
Can	China clay is derived from this rock once it has decayed
	Can form marble when altered through metamorphism
Formed from	Formed from the alteration of sedimentary rock due to heat, e.g. near to a magma intrusion
	Can be deposited by a glacier (can be mixed with large fragments of rock)
Can be	Often formed of quartz, feldspar and mica
	Present at the surface, usually when overlaying rock has been eroded
Uplif	Particles interlock
The roc	Formed from an intrusion of rock underground, often in a batholith
Can produce	Large deposits are found in Snowdonia and the Lake District
Can be	Can form via compression
	Often contains fossils
Formed fro igneous r	Often formed during the Cretaceous period (the rock that this period is named after!)
	Can be grey, green or purple
	Large deposits are found in Devon and Cornwall
Easily erod	Formed from very fine particles
	Often formed from clays or volcanic ash
	The rock which forms Cheddar Gorge and Caves
	Can also form from evaporation
	Flints may be found within this rock
Ca	Forms at the bottom of the sea, often in warm water, away from land
There are v	Forms rock as pressure (and heat) is imposed from overlying deposits
Grains c	Used to make cement
Similar to chal	Rivers may flow underground within this rock. You might find stalactites and stalagmites form as water evaporates leaving rock behind (dripstone).
Can be mad	

Example Answer

Chalk

1

Sedimentary Rc

Forms at the bottom of the sea, often in warm water, away from land

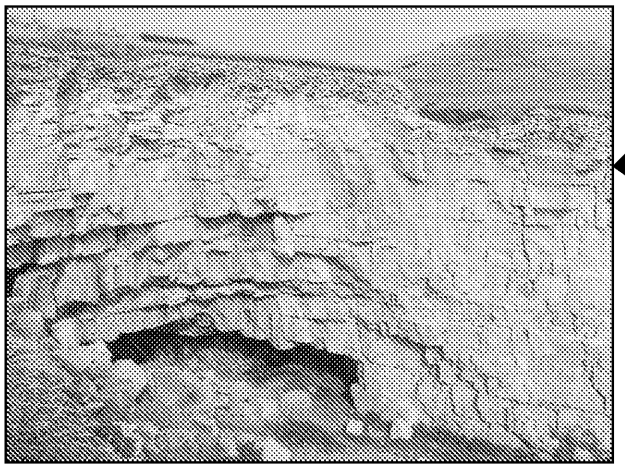
There are very
is

The White Cliffs of Dover are made from this rock

Forms rock as pressure (and heat) is imposed from overlying deposits

Often formed during the Cretaceous per
(the rock that this period is named afte

Example Answer



Limestone

2

Sedimentary Ro

Often contains fossils

The rock w
Gor

Can form 'pavements'

Can also f
evapo

Often yellow or grey in colour

Used to make cement

Rivers may flow underground within this rock. You might find stalactites and stalagmites form as water evaporates leaving rock behind (dripstone).

Example Answer

Clay

3

Sedimentary R

Can fort
cliffs, liab

Can be fired to make pottery, ceramics and bricks

Can be made from weathered (silicate) rocks

Can be redeposited by water

Can be deposited by a glacier (can be mixed with large fragments of rock)

Formed from very fine particles

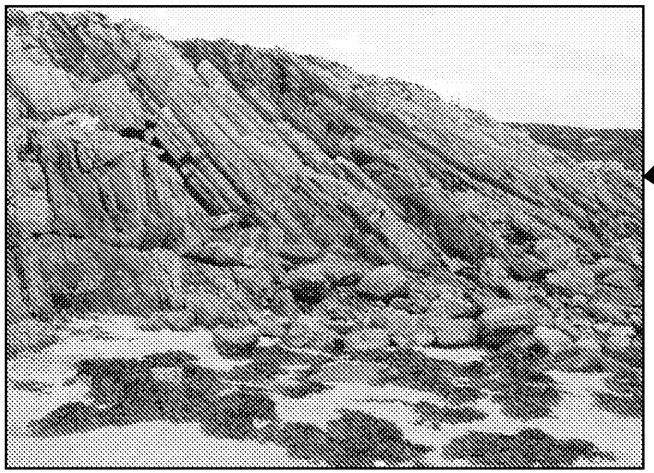
Example Answer

Granite

4

- Igneous Rock
- Often formed of quartz, feldspar and mica
- Present at the su overlaying roc
- China clay is derived from this rock once it has decayed
- The rock is slightly radioactive because of radon gas
- Large deposits are found in Devo and Cornwall

Example Answer



Schist

5

Metamorphic R

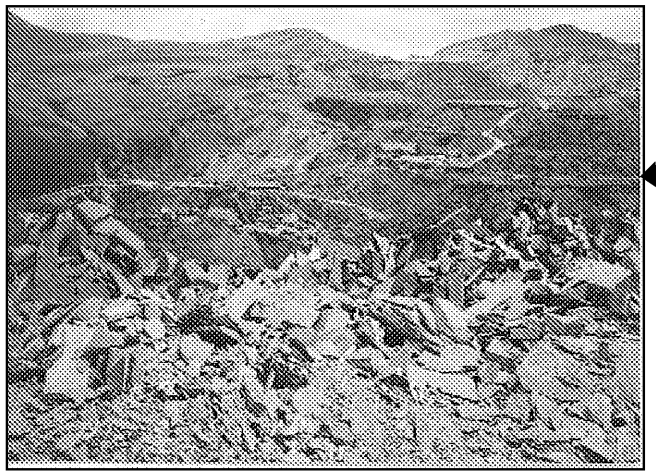
Can include mica

Particles may ar

Formed from the alteration of sedimentary, metamorphic or igneous rock due to heat – e.g. near to a magma intrusion

May be grey or silver in colc

Example Answer



6

Slate

Metamorphic R

Fine graine

Can form via compression

Can be grey, green or purple

Large deposits are found in Snowdonia and the Lake District

Formed from the alteration of sedimer rock due to heat, e.g. near to a magn intrusion

Activity 3: Changes? What Chan

Teacher's Instructions

There are many options for running this activity. This activity can be completed either individually or in small groups, either in class, as a cover lesson, or homework. Alternatively, the activity could be completed as a class discussion, led by the teacher.

QUICK-GLANC
Prior Knowled
None
Additional Ma
None
Feedback opp
Yes
Evaluation op
No

Aim
In this activity, students will compare old and modern maps in order to ascertain how human activity can modify natural landscapes, and discuss how landscapes can become distinctive due to the interplay of human and physical factors.

This activity allows students to:

- work in groups and share ideas and connections
- view and interpret maps (both historical and modern Ordnance Survey map
- engage with the class

Prior knowledge
The students should be familiar with the concept of distinctive landscapes.

Materials needed
Photocopies of the template sheets.
Access to Internet-enabled PCs – therefore, you may need to book a computer r

Structure of the activity

Section	Timing	Task
Prep done by teacher	5 mins	Photocopy the template sheets.
Part 1: Mapping task	30 mins	Divide the class into small groups, or suggest that undertaken alone. Alternatively, you can undertake this as a class di maps up in front of the class and lead discussion. template as you go along. Allow the students access to Internet-enabled co the task.
Part 2: Class discussion	10 mins	Discuss the class findings; ask for volunteers to sh suggested answers.

Feedback and evaluation
As noted above, facilitate a class discussion concerning how landscapes have bee form distinctive landscapes.

Student Template Sheet

Your task is to view both modern and historical Ordnance Survey maps in order t
have changed through human activity to form distinctive landscapes. Space is inc

A wide range of historical and modern Ordnance Survey maps can be found onli

If your school has subscribed to 'Digimap for Schools', this should be your first po
found at *http://digimapforschools.edina.ac.uk/help/historic*

Alternatively, you can view maps from the Ordnance Survey (*https://www.ordna*
registration required) or Bing Maps (*http://www.bing.com/mapspreview*) by sele
view.

Older maps can be viewed at *http://maps.nls.uk/* (you can use side-by-side and o
satellite imagery and also 'OS Opendata' maps) and *http://www.visionofbritain.o*

You can find a key to the Ordnance Survey six-inch (historical) maps at *http://ma*
modern 1:25,000 maps at *https://www.ordnancesurvey.co.uk/docs/legends/25k*
that the six-inch map symbols are rather different! For a start the maps are in bla
written in jagged italics!

Location: Creag Mhòr
Grid Reference: NN909443 or 56.578114 -3.7760782
Type of landscape:

Sketch of historical map	**Sketch**

What human activity do you think took place here in the past?

.....

.....

What activities do you think take place now?

.....

.....

How have humans altered this landscape?

.....

.....

.....

.....

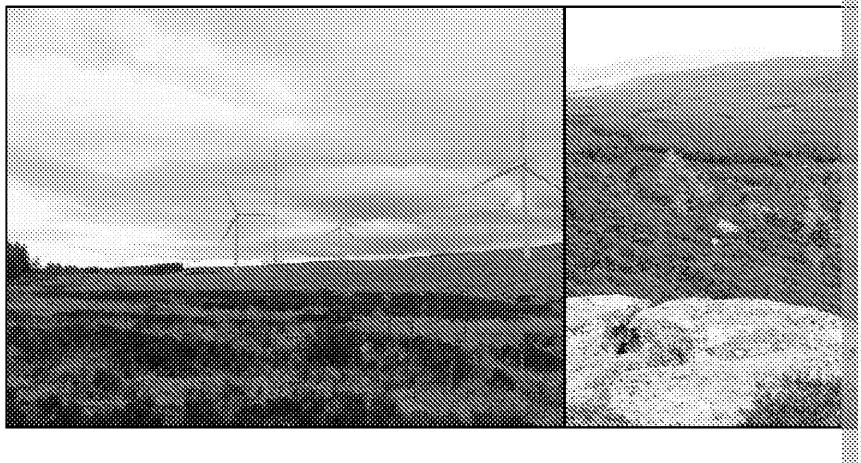
What makes this landscape distinctive?

.....

.....

.....

.....



Location: Stoborough Green
Grid Reference: SY913854 or 50.668776 -2.1235049
Type of landscape:

Sketch of historical map	**Sketch**

What human activity do you think took place here in the past?

.....

.....

What activities do you think take place now?

.....

.....

How have humans altered this landscape?

.....

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.....

.....

What makes this landscape distinctive?

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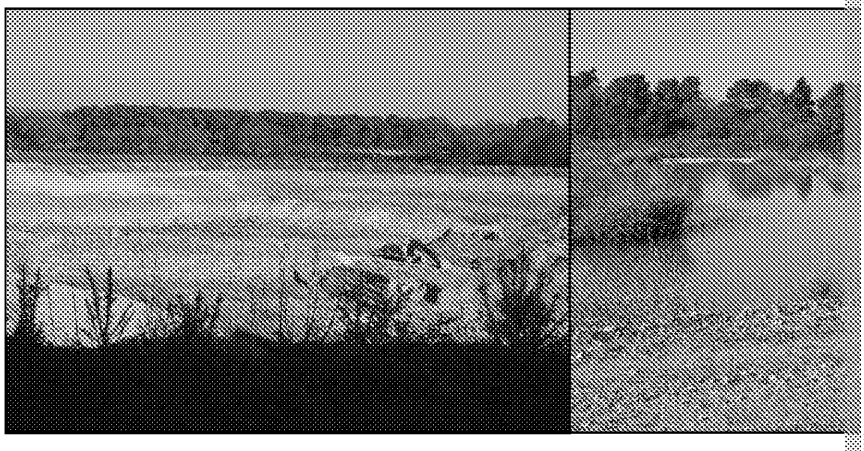

Location: Elan Village
Grid Reference: SN930647 or 52.270915 -3.5681748
Type of landscape:

Sketch of historical map	**Sketch**

What human activity do you think took place here in the past?

.....

.....

What activities do you think take place now?

.....

.....

How have humans altered this landscape?

.....

.....

.....

.....

What makes this landscape distinctive?

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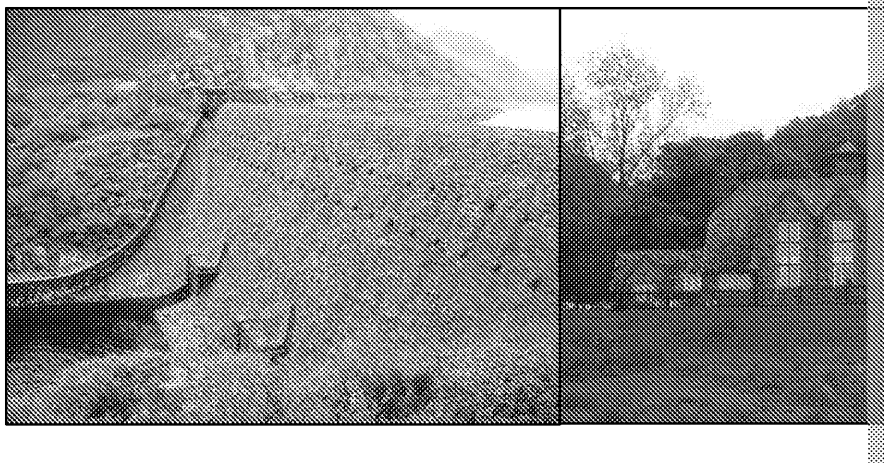
.....



Land-use Changes

Creag Mhòr – conversion of upland moorland to conifer forest (there is also evid
and the creation of a wind farm.

Stoborough Green – conversion of woodland to farmland, a quarry (clay pit) and
settlement on former farmland, and quarrying on heathland. Conversion of heat
forest.

Elan Village – conversion of upland moorland and farmland to the Elan Valley re
example), and the small settlement of Elan Village, originally built as a home for
dam. There is also conifer plantation in the area.

Activity 4: Map Exercise – Features and

Teacher's Instructions

This activity could be delivered in **two** ways, **EITHER** as a group class or cover lesson activity **OR** as an individual homework or cover lesson.

Aim

In this activity, students will work individually or in groups to identify photographs of different landforms of erosion and deposition. Students will then identify how these features were created, and choose suitable locations for each landform on a series of maps.

QUICK-GLANC
Prior Knowled Coastal erosio
Additional Ma None
Feedback opp Yes **Evaluation op** No

This activity allows students to:

- Work alone or in groups and share ideas and connections.
- Apply their knowledge of physical processes and geomorphology.
- Develop team working skills.
- Develop analytical and problem solving skills.
- Produce fact file style revision aids.

Prior knowledge

The students should have a detailed knowledge of coastal erosion and deposition each one. Therefore, the activity is best suited to be run at the end of a unit.

If a group activity is planned, this activity is best suited to being taught by the stu

Materials needed

- Provide each group with a copy of the maps and template sheets. Photocopy The template sheets can be left at A4.
- Photocopy the answer sheets.
- You may also wish to use PowerPoint to project the maps onto the board fo

Structure of the activity

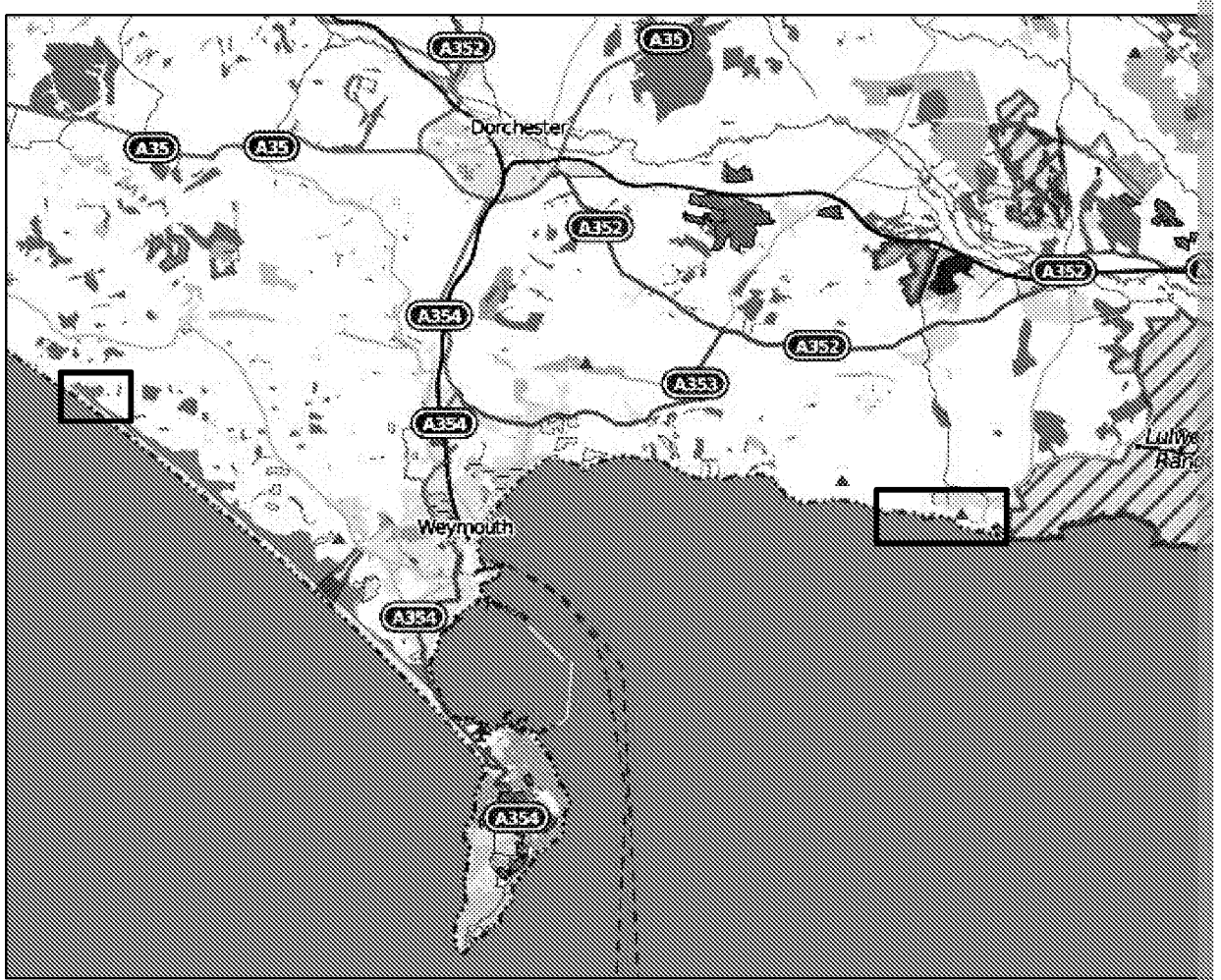
Section	Timing	Task
Prep done by teacher	5–10 mins	Photocopy the maps (A3) and template (A4). Photocopy the answer sheets if required.
Part 1: Writing and discussion	40–50 mins	Divide your students into small groups of three o The students need to study and discuss the maps the map for each photograph, and fill in the fact and its formation. Each student should be a scribe for at least two o
Part 2: Feedback	10 mins	Hand out the answer sheets to your students so answers and to ensure that they do not have any answer any queries that the students have on an

Feedback and evaluation

Provide the answer sheets, and address any questions that the students have.

All maps © OpenStreetMap contributors. Tiles courtesy of Andy Allan

INSPECTION COPY



Student Sheet 1

Type of landform(s):

Location on the maps?

Landform of erosion or deposition?

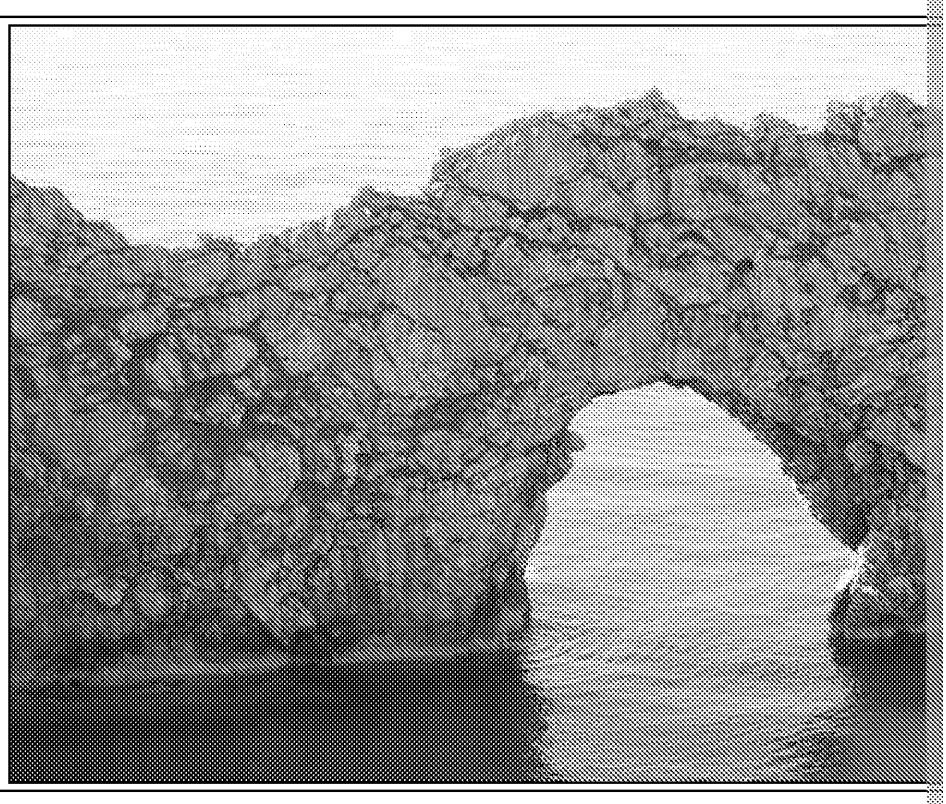
Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?

Briefly outline the process involved in the formation of the landform.

How might this landform alter in the future?

Student Sheet 2

Type of landform(s):



Location on the maps?

Landform of erosion or deposition?

Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?

Briefly outline the process involved in the formation of the landform.

How might this landform alter in the future?

Student Sheet 3

Type of landform(s):

Location on the maps?

Landform of erosion or deposition?

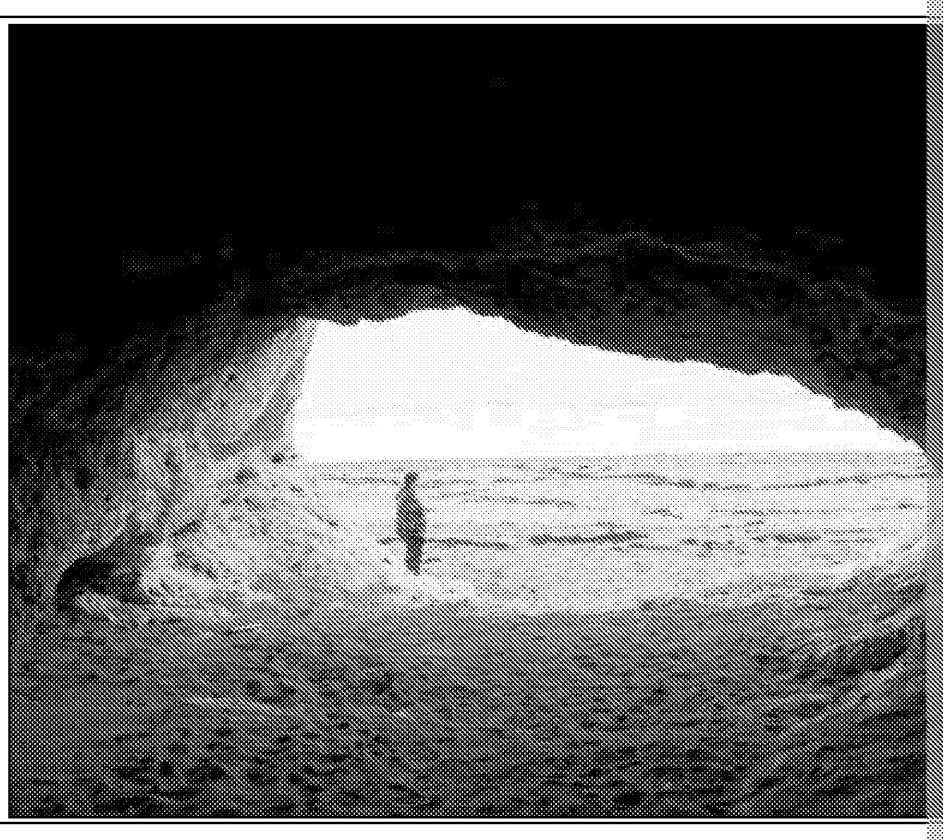
Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?

Briefly outline the process involved in the formation of the landform.

How might this landform alter in the future?

Student Sheet 4

Type of landform(s):



Location on the maps?

Landform of erosion or deposition?

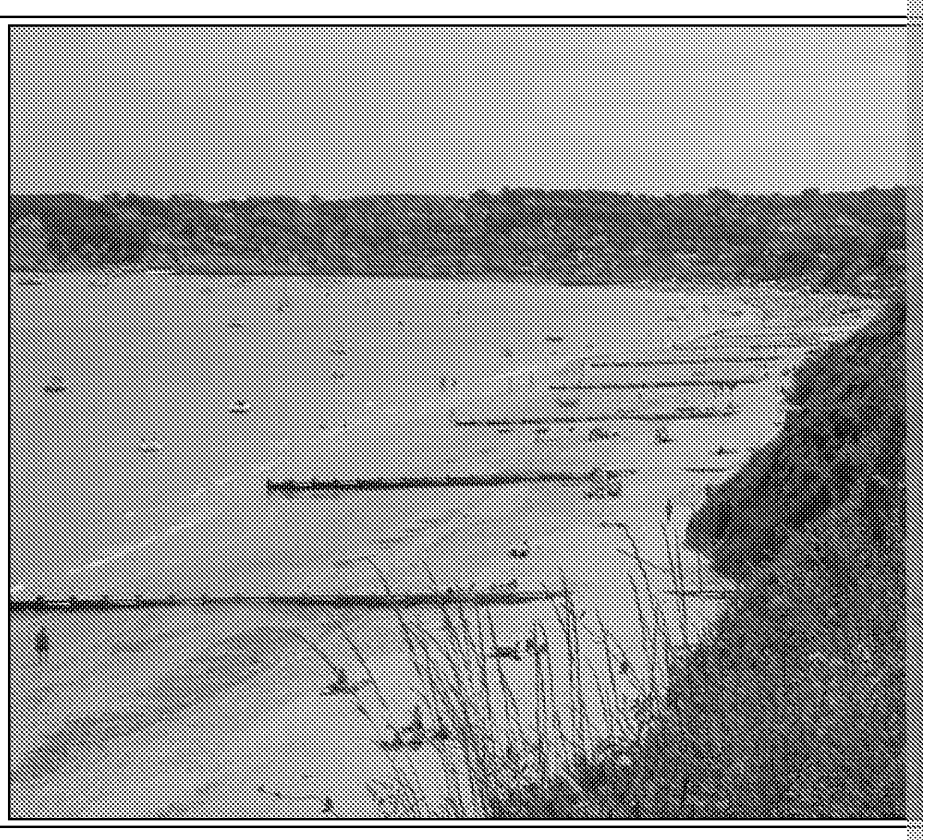
Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?

Briefly outline the process involved in the formation of the landform.

How might this landform alter in the future?

Student Sheet 5

Type of landform(s):



Location on the maps?

Landform of erosion or deposition?

Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?

Briefly outline the process involved in the formation of the landform.

How might this landform alter in the future?

Student Sheet 6

Type of landform(s):

Location on the maps?

Landform of erosion or deposition?

Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?

Briefly outline the process involved in the formation of the landform.

How might this landform alter in the future?

Student Sheet 7

Type of landform(s):

Location on the maps?

Landform of erosion or deposition?

Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?

Briefly outline the process involved in the formation of the landform.

How might this landform alter in the future?

Student Sheet 8

Type of landform(s):

Location on the maps?

Landform of erosion or deposition?

Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?

Briefly outline the process involved in the formation of the landform.

How might this landform alter in the future?

Student Sheet 1 – Answers

Type of landform(s): *Stack*

Location on the maps? *The small map of the headland and stacks*

Landform of erosion or deposition? *Erosion*

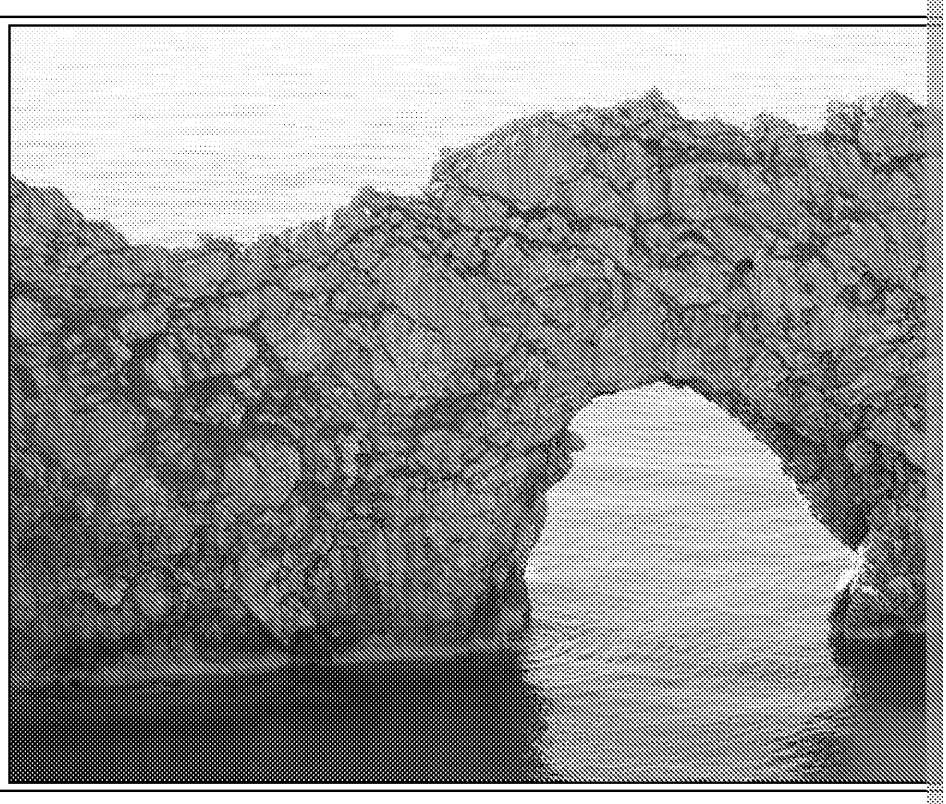
Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?
Abrasion, solution, hydraulic action

Briefly outline the process involved in the formation of the landform.
A weakness in the headland formed a crack (geo), which would have turned i
When the cave (or two caves on opposite sides) eroded all the way through th
When the arch collapsed, the resulting structure was the stack.

How might this landform alter in the future?
The stack will erode at the base (this is already taking place as the photo sho
stack will collapse – its material will be eroded away and form a stump.

Student Sheet 2 – Answers

Type of landform(s): *Arch*



Location on the maps? *At the end of one of the headlands.*

Landform of erosion or deposition? *Erosion*

Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?
Abrasion, solution, hydraulic action

Briefly outline the process involved in the formation of the landform.
A weakness in the headland formed a crack (geo), which would have turned i
When the cave (or two caves on opposite sides) eroded all the way through th

How might this landform alter in the future?
The overhanging rock will later collapse, forming a stack.

Student Sheet 3 – Answers

Type of landform(s): *Cove (accept bay)*

Location on the maps? *The large cove on the main map.*

Landform of erosion or deposition? *Erosion (although the beach is a feature o*

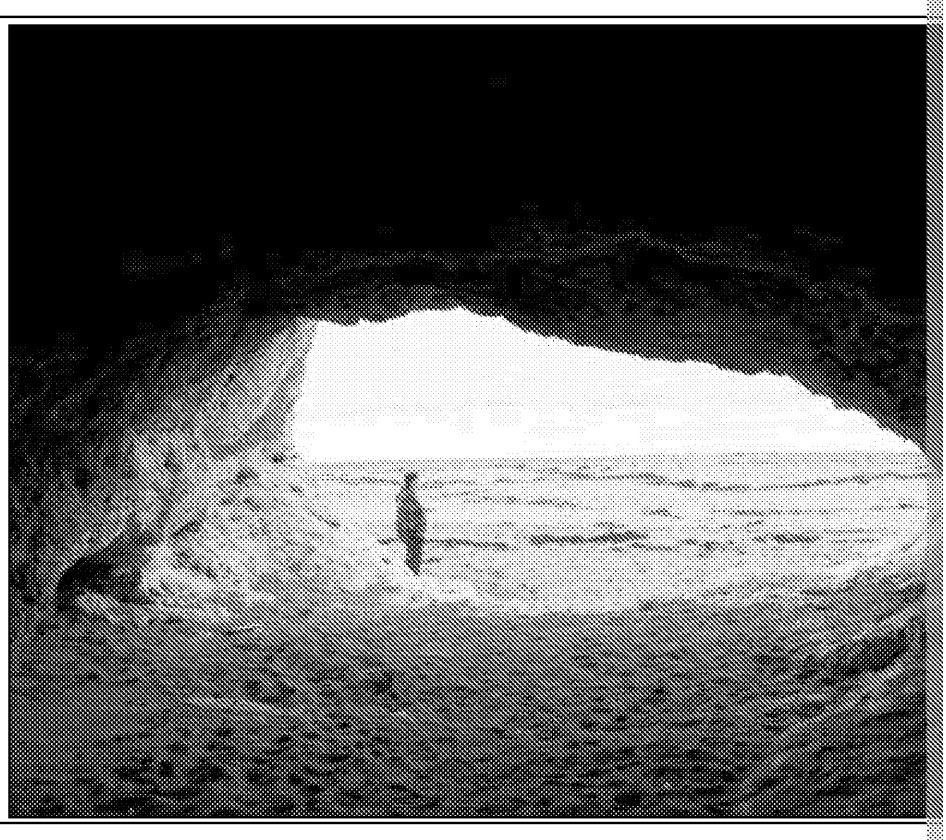
Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?
Abrasion, attrition, solution and hydraulic action.

Briefly outline the process involved in the formation of the landform.
This is a feature of a concordant coastline, where layers of rock run parallel t layer of hard rock, which is resistant to erosion. The sea eroded through the l was a weakness in the rock. As soon as the softer chalk behind was exposed t and this cove was formed.

How might this landform alter in the future?
The cove will erode further back into the land, and could widen as the layer away.

Student Sheet 4 – Answers

Type of landform(s): *Cave*



Location on the maps? *At the back of one of the beaches.*

Landform of erosion or deposition? *Erosion*

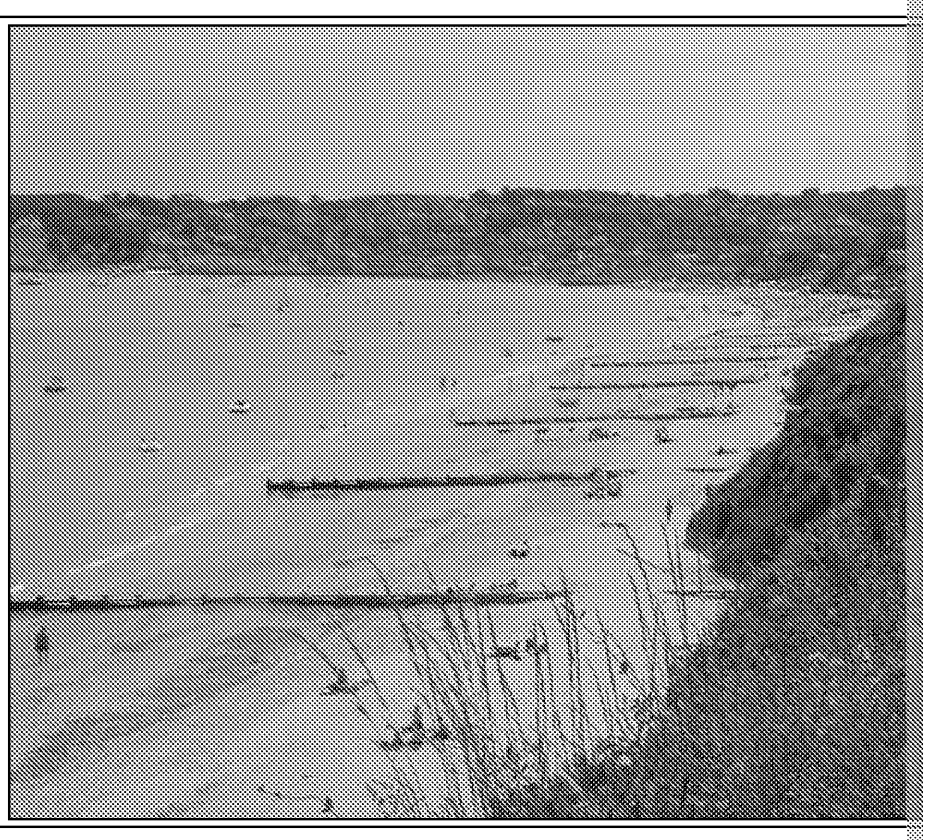
Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?
Solution and hydraulic action.

Briefly outline the process involved in the formation of the landform.
Waves impacting on the cliff have caused a lot of erosion from hydraulic actio pressure into the rock. The cave would have started life as a small crack, whi erosion continued.

How might this landform alter in the future?
The cave will enlarge. If located in a headland, it might enlarge into an arch. blowhole in the roof, as erosion continues upwards (hydraulic action).

Student Sheet 5 – Answers

Type of landform(s): *Bay*



Location on the maps? *The narrowly-curving bay.*

Landform of erosion or deposition? *Deposition to build up the beach (especial*
erosion to erode inland between headlands.

Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?
Deposition, attrition, longshore drift (abrasion, solution, hydraulic action for

Briefly outline the process involved in the formation of the landform.
Material from upstream is deposited as energy in the water is lost. These feat
coastlines, where bands of rock are at right angles to the sea. The soft layers
form inland, while the resistant headlands remain.

In this example, the flow of sediment moves along the coast; these groynes ar
to stop the beach material from being eroded away through the process of lo

How might this landform alter in the future?
Without the groynes in place, the beach material would be eroded. This would
cliffs, and land would be lost to the sea. With the groynes in place, the beach

Student Sheet 6 Answers

Type of landform(s): *Headland*

Location on the maps? *One of the headlands (this is Peveril Point).*

Landform of erosion or deposition? *Erosion*

Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?
Abrasion, solution and hydraulic action

Briefly outline the process involved in the formation of the landform.
Where there are discordant coastlines, the layers of hard rocks are eroded slo layers. The hard rocks form headlands and the softer layers form bays. Headl coastlines too.

How might this landform alter in the future?
Due to wave refraction, a number of features could form on its sides such as stacks and stumps. As the headland retreats, a wave-cut platform might for

Student Sheet 7 Answers

Type of landform(s): Bar (a lagoon is formed behind) (also accept spit, as one

Location on the maps? The long ridge of sand, slightly offshore.

Landform of erosion or deposition? Deposition

Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?
Deposition, longshore drift

Briefly outline the process involved in the formation of the landform.
The coastline sharply changes in direction, such as from a headland. Longshor material, which occurs out to sea following the directional change. The preva angle, slightly onshore. This is called a spit. The spit forms a bar when the spi headlands together.

How might this landform alter in the future?
The bar is dependent on the supply of sediment, and also changes in wind di shape and position is likely to shift slightly.

Student Sheet 8 Answers

Type of landform(s): *Notch and wave-cut platform*

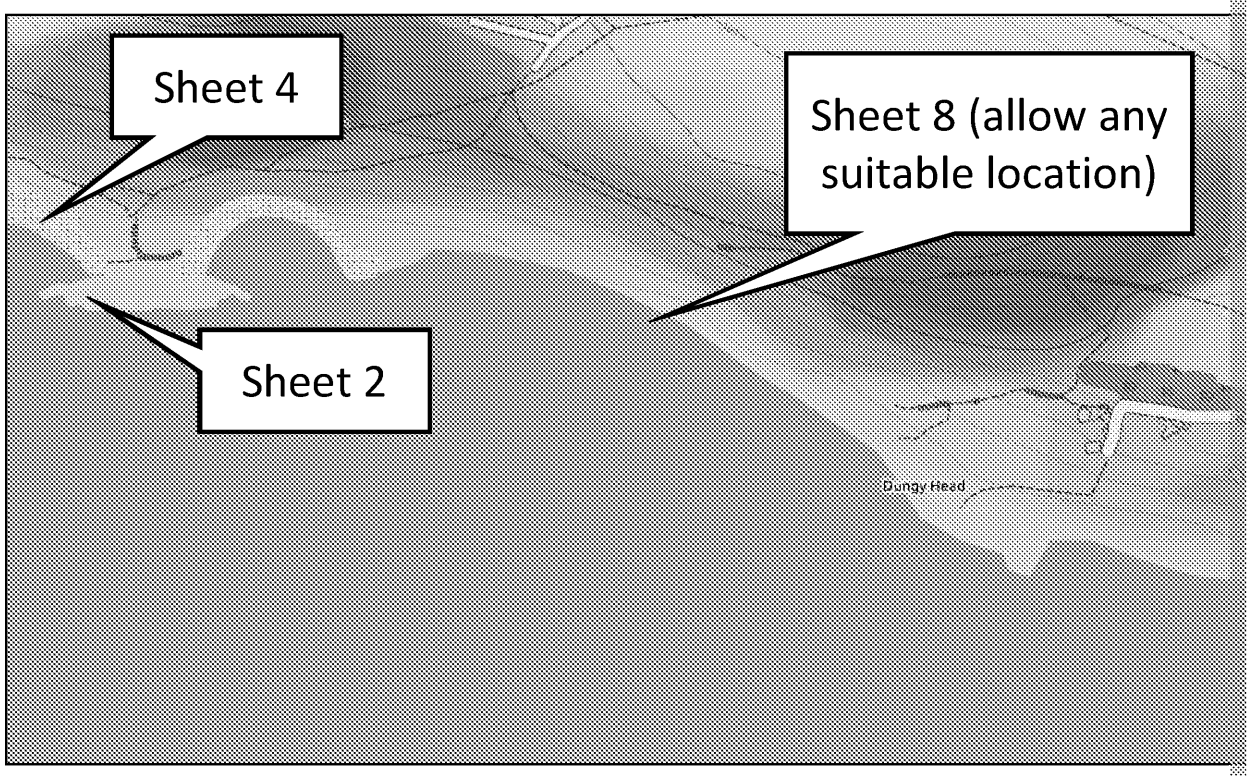
Location on the maps? *Anywhere where the sea meets land (without a beach*

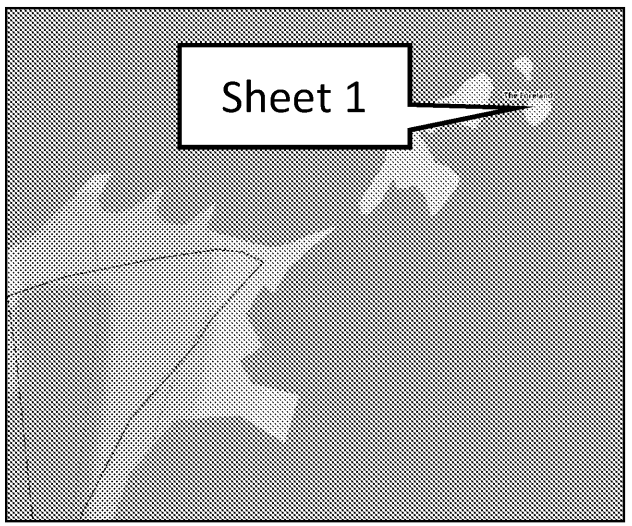
Landform of erosion or deposition? *Erosion*

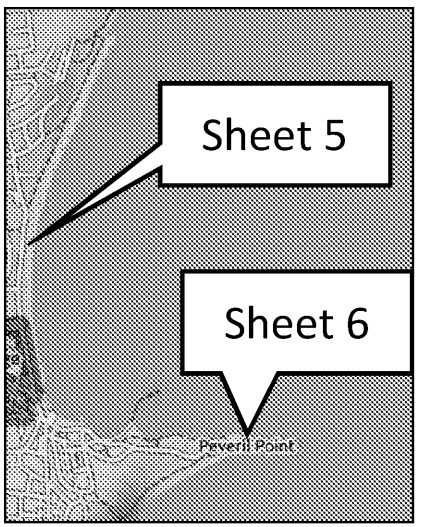
Processes involved (e.g. abrasion, attrition, solution and hydraulic action)?
Abrasion, solution and hydraulic action (some attrition of eroded material)

Briefly outline the process involved in the formation of the landform.
Undercutting occurs at the base of the cliff as the waves pound against it (hy pebbles and beach material around at the base. When the overhang (notch) b rock above, the edge of the cliff collapses. This material is then eroded away. cut platform is left behind.

How might this landform alter in the future?
The cliff will continue to retreat backwards, meaning that the wave-cut plat







Activity 5: Winter Storms – Research

Teacher's Instructions

Aim

In this activity, students will work individually to research and produce a poster showing the causes of, and effects on coastal areas during UK winter storms.

This activity allows students to:

- work alone to present the findings of their research
- research and learn about a potential case study for use within an exam

QUICK-GL
Prior Know None
Additiona Camera - c
Feedback Yes **Evaluation** Yes

Structure of the activity

Section	Timing	Task
Prep done by teacher	10 mins	Photocopy the poster templat Photocopy Peer-marking Gric Procure the materials liste
Part 1: Student research	20–30 mins	The students research their c
Part 2: Poster creation	30–40 mins	The students design thei
Part 3: Feedback	10 mins	Once written, provide a copy of the Peer-markin each other's work

Feedback and evaluation

- Peer-marking can be used – provide copies of the Peer-marking Grid.
- Individual posters can be marked by the teacher.

Optional extensions/amendments

To shorten this activity, the research can be implemented as a 20 minute-ho

Students' Instructions:

This activity requires you to create a poster detailing how one coastal area of yo
winter storms. An excellent example would be the UK winter storms of 2013–14,
western coastlines of the UK, including the North Wales Coastline and Cornish co
coastal features, human made structures such as sea walls, as well as causing da
example, in the eastern part of the UK such as Norfolk) where coastal defences w
erosion took place and houses were lost to the sea.

Using the Internet to help you research your chosen example, complete the post

A great source of geology maps is the British Geological Survey – you can view m
http://mapapps.bgs.ac.uk/geologyofbritain/home.html to determine whether th
discordant.

For inspiration, you can look at this BBC news article from January 2014 at *http:/*
25639777

Name and date of the storm:

Cause of the storm:

Were waves constructive or de
were sub-aerial processes invo

Description of the storm and the damage caused

Effects of climate change

Insert before and after photos here

Peer-marking Grid 2 – Winter Storms – Research and Poster

	Mark 1–5	
Has a suitable example been used with enough scope and interest for a poster-based activity?		
Are the causes of the storm fully explored?		
Has the student fully explored the damage caused to the coastline?		
Has the student discussed the type of wave, and sub-aerial processes involved?'		
Has climate change been fully considered?		
Total score	**/25**	

Activity 6: Coastal Erosion Debate or C

Teacher's Instructions

Aim
In this activity, students will work in teams to discuss the need to build new coastal defences, to evaluate the trade-offs for, and conflicts between, stakeholders.

This activity allows students to:

- work in groups; practise their debating and assertion skills
- adapt to new, evolving information
- provide individual input into a discussion

Prior Kno
Coastal er

Additiona
None

Feedback
Yes
Evaluatio
No

Background
This activity centres on a consultation event or debate which takes place betwee
local residents.

The focus area is part of the country where there is rapid coastal erosion due to
clay) – such as Norfolk or the East Coast, where coastal erosion can erode sever

The decision has been made that a 'do-nothing' approach will be taken for the n
that small settlements will be unprotected; however, larger towns will continue
line' policy.

This policy has proved unpopular with local residents in smaller villages, farme
farmland will be lost to the sea. In addition, there will be no renovation of the e
protecting the small villages. These are in a state of disrepair, and are currently
proposed. They will be completely destroyed within five years.

New defences are also planned for a new power-generation site 'upstream' – pr
rate of erosion for farmers and villagers due to sediment starvation.

A local dredging company wishes to start dredging sand within a few hundred
one of the towns. Understandably, residents are nervous.

The students are given various roles – coastal managers, owners of the energy in
defend their decisions, and residents, farmers and other landowners, who would
saving their homes and businesses.

Structure of the activity

Section	Timing	Task
Prep done by teacher	10 mins	Photocopy and cut up the grid which lists the roles a person (two or three times depending on the numb have).
Part 1: Student familiarisation	15 mins	Divide up your class into two groups. Assign each member of the group a different role a grid to each team. If required, two students could b Explain that each student will introduce themselve the case that is presented on the card. Provide each group with a copy of the map (prefera After giving students time to read and understand map, provide the class with a summary of the scen 'background' section.
Part 2: Discussion	40–50 mins	Every 5–10 minutes, you will need to ask the group a new part of the agenda.
Part 3: Feedback	5 mins	Facilitate a brief class discussion to evaluate the ac suggest very different actions?

Feedback and evaluation

While the role play is taking place, ensure that each student is contributing to th necessary prompts. Ensure that all students have a chance to speak, or that spec over the conversation.

At the end, discuss how the students found the activity, how well they thought it things differently.

Agenda

1. Each student will give an overview of their position from the cards.
2. Residents and business owner response (i.e. not the owners of the energy in company) (these people take it in turn). These concerns should be social, ec
3. The council responds to the queries.
4. The owners of the dredging company and the energy installation respond.
5. The local residents and business owners try to sway the council to reconside expensive flood defences.

The Council Planner (x2)

You have drawn up the management plan to this stretch of coastline in a time of austerity and government cutbacks. Defences are very expensive and, although you would like to, you do not have the resources available to protect small villages.

After cost–benefit analysis has been undertaken, it is seen to be simply not economically viable to protect them.

Instead, the large tourist town and promenade up the coast will be protected, and existing sea walls, groynes and rock armour will be maintained.

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The UK is facing ar
tensions with existing
and the UK's nuclear r
(already) extended liv
to open a new LNG
fu

With planning permis
to be protected by ha
your site need

Homeowner 1 (Village 1)

You have lived in the village all of your life. You are settled there, and all of your friends and family live nearby.

You are shocked by the proposals, for you would lose your home, and the community that you are fond of would be broken up. You fear that the compensation that you would receive for your house would be far below its market value – you were hoping to downsize upon retirement to free up some cash.

You desperately seek that at least some form of defences is maintained.

Homeowner 2 (down
install

You have recently mo
live there for the fores
the existing defences
bought your house, a
there were no plan

With these developm
only last another 10 ye
new threat of dredgi
that will have

Pub/Café/Hotel Owner

You own a large establishment on a prominent coastal location. Over the years, you have witnessed the coastline retreating. As more houses and establishments are lost, tourists are less likely to arrive in the village, meaning that you have fewer customers. Also, the loss of wetlands may affect the number of birdwatchers who currently flock to the village.

Your business is the central heart of the village – without it, it is likely that people will move away at a faster rate.

Campsite and

You own a clifftop c
year, a few pitches ar
The erosion is espe
cannot lease out p
sections of c

There is no suitabl

Property Maintenance Company (Village 1)
You are the owner of a property maintenance company. As cliffs retreat, your services are becoming less required – not only as there are fewer houses, but also people are not spending money on renovations on property that may soon be lost to the sea.

Manager of a
The existing sea defe
wetland habitats for s
maintenance, thes
catastrophic conseque
of birdwatchers also
the

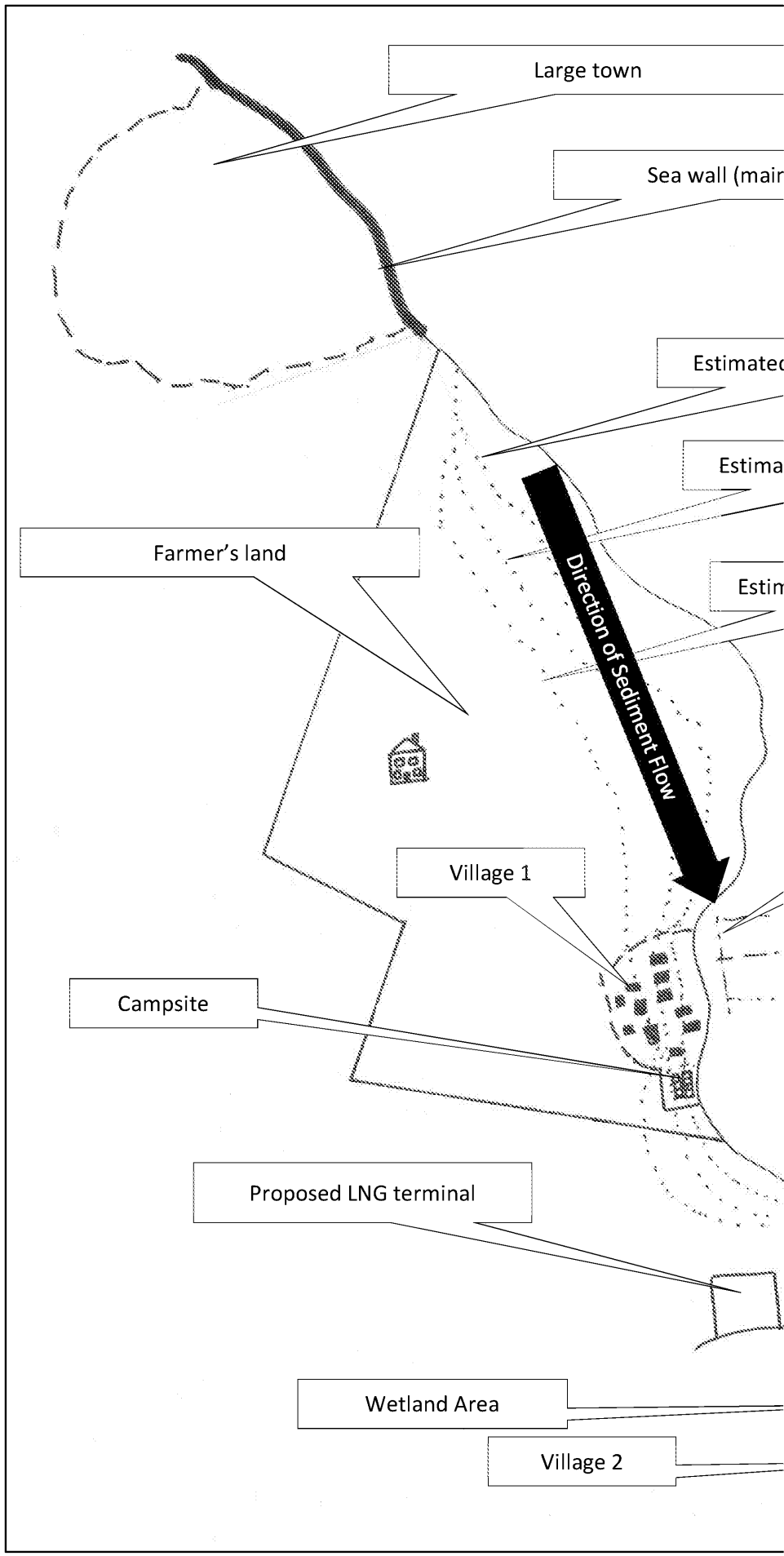
You would welcome t
such as beach nouris
the main

Farmer
Every year you lose valuable farmland to the sea. With low profits from farming your income is tight, and losing land doesn't help.

You may have to sell your farm, as if its size is further reduced, it would be too small to economically function.

Manager of
You have been gr
thousands of tons of s
material, and there

While local residents
your claims that the
from your activitie
contrary, and hence



Activity 7: How Could That Affect

Teacher's Instructions

Aim

In this activity, students will take part in a class discussion concerning different forms of costal defence, and human modifications of landscapes, and consider how humans are impacting physical processes.

This activity allows students to:

- share ideas and connections with the class
- revise and consolidate their knowledge of coastal processes and human modification
- be confident to discuss their answers in front of their peers

QUICK-GLANC
Prior Knowled
None
Additional Ma
None
Feedback opp
Yes
Evaluation op
No

Prior knowledge

This activity is best suited to be run after the teaching of key ideas 4.4 and 4.5.

This activity is best undertaken by the students' regular Geography teacher.

Materials needed

Photocopies of the template sheet to be filled in throughout the discussion.

Structure of the activity

Section	Timing	Task
Prep done by teacher	5 mins	Photocopy the template sheets.
Part 1: Class discussion	25–30 mins	Use the PowerPoint presentation to show the cla Ideas are provided through the suggested discuss Discuss with the class: • what the image shows (and is this useful activ • which natural processes are being altered? • whether the changes are beneficial to human living in coastal areas? • the direct effects of human activities on the n any unintended, indirect effects or processes
Part 2: Feedback	5 mins	Discuss how the class found the activity, and disc need to revise.

Feedback and evaluation

End of activity discussion, as noted in the box above.

Student Question Sheet

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Is this beneficial t

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Which natural pro

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What are the dire environment?

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What are the indi environment?

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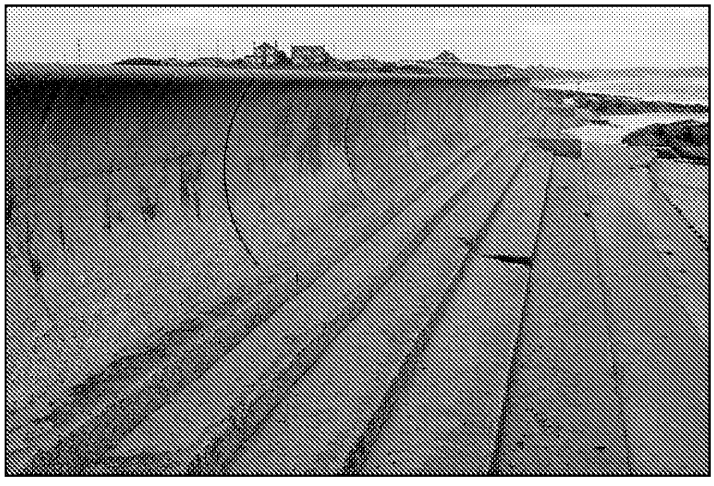

What does the im

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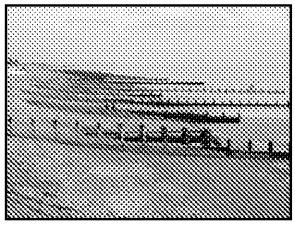
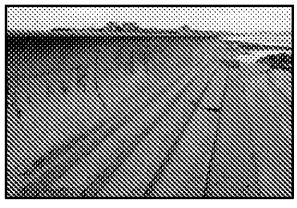
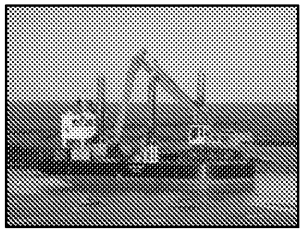
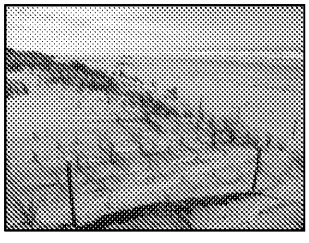
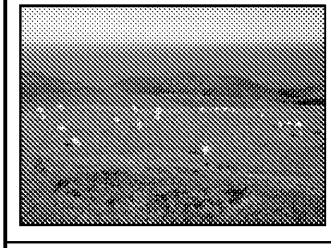
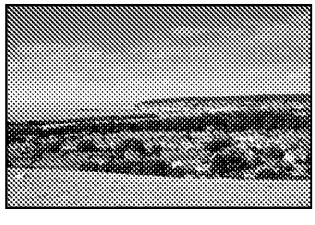
Suggested Discussion Points

	• Groynes – used to stop sediment from being er leisure activities and to reduce coastal erosion front of the cliffs or land). • Works by capturing sediment moving along the • Can 'starve' the coast further down the coastli (including the cliffs and beach deposits) (indire created.
	• Sea wall – used to deflect the power of waves, flooding and erosion. Used where 'hold the line front of settlement. • Halts the natural erosion of the cliffs for the life be said that hard coastal engineering projects ' • Indirect effects can include increased beach ero reflected downwards onto the beach. Similarly of erosion further down the coast.
	• Dredging – used to obtain sand and gravel; for construction material or as beach nourishment. • Some people argue that this decreases sedime system; therefore, increased coastal erosion oc thinner. • May damage local ecosystems – the areas phys of material released into the water entering fis and reducing light to the seabed. • Deeper water offshore can create larger, more the shore (indirect effect).
	• Dune regeneration – used to produce a natural the land. • The stalks of grasses (planted) act as a barrier t the sand to pile up. The grasses grow upwards, surface rise. • The area is often fenced off to stop the disturb • Valuable habitats are created (indirect effect), (often rare) species to increase.
	• Farming on the clifftops – to provide us with fo as wheat and vegetables. • Can increase runoff, and, therefore, the erosion natural vegetation and effects on biodiversity. • Nutrients from animal waste, pesticides, weed the sea, affecting ecosystems (indirect effect).
	• Settlements – where people live and spend tim • Increases runoff – storm drains and urban surfa erosion), and can cause pollution and litter, aff effect). Fishing trips (for pleasure and commer • Natural ecosystems in the area are heavily mo extensive beach modification reprofiling.

Activity 8: Brief the prime Mini

Teacher's Instructions

Aim

In this activity, students will complete a piece of work on the risks of coastal flooding to UK coastlines due to climate change. This piece of writing will follow the format of a parliamentary briefing.

QUICK-GLANC
Prior Knowled Coastal floodin
Additional Ma None
Feedback opp Yes
Evaluation op Yes

This activity allows students to:

- undertake a piece of extended writing
- practise their summarising skills
- practise peer-marking others' work
- recall information on the effects of climate change on UK coastlines
- provide exemplar material and practice using maps
- practise writing for different audiences with different purposes

Prior knowledge

This activity is designed as a consolidation activity, and so students must have co climate change and coastal regions.

Materials needed

Photocopies of the student instructions, briefing paper template, and peer-mark

Structuring the lesson

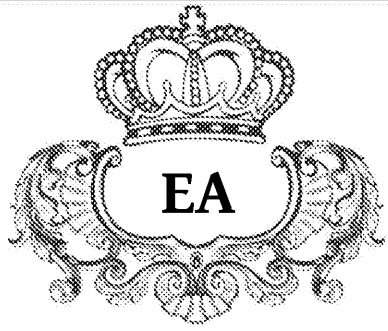
Section	Timing	Task
Prep done by teacher	5 mins	Photocopy the student instructions, briefing marking grid
Part 1: Writing	55 mins	Students use the student instructions to fill
Part 2: Evaluation	5 mins	Students swap briefing papers and mark eac marking grids.

Feedback and evaluation

Feedback comes from the peer-marking exercise in part 2.

Optional extensions/amendments

Students do not have to use the template provided for their briefing, and can wr computer. If conducting this activity in class, students wishing to make their own computer.



Dear ……..……..,

You have been commissioned to write a briefing paper for the Prime Mini
climate change on coastline flooding. This will help the PM discuss the iss
coastal protection at upcoming political meetings.

A briefing paper is essentially a summary document, providing the PM w
may need to know when discussing the topic. Political leaders often use b
junior staff, as they do not have time to read and research all the issues.

Content of the briefing paper is to include:

- Brief background information
  - Key facts: population living in coastal areas, risks (and threats) ar
  - How big the problem is
  - When the effects will become realised
- How one region could be affected
  - Map of one affected region
  - Explanation of the effects
- Causes
  - Storm frequency
  - Sea level rise
- Changes to sediment flows
  - Erosion
  - Deposition
- Threats
  - People (social and economic)
  - Environment
- Solutions
  - Coastal engineering
  - Managed retreat and other management plans

As this is a political briefing, you must try to be as succinct as possible in y

Please include any facts, graphs or images that might be useful.

Regards,

C Floody

Charlie Floody
Research Commissioning Manager,
The Environment Agency

The Environment Agency

Climate Change and Its Effects on Coast

Overview

- .....
- .....
- .....
- .....
- .....
- .....
- .....

This briefing paper will: .....

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Background

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Map of your

The Environment Agency

How region(s) of the UK could be affected

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Causes of increased coastal flooding

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Changes to sedi

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The Environment Agency

Threats to people and the environment from increased coastal flooding	Possible solution coastal flooding
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Peer-marking Grid 3 – Brief the Prime Minister

	Mark 1–5	
Does the style of the report feel right? Is the tone and language appropriate – is it succinct – to the point?		
Have the causes been fully described?		
Has an example of an affected region been fully explained?		
Have the threats to people and the environment been fully explained?		
Do you think that the suggested solutions are acceptable or feasible?		
Total score	**/25**	

Activity 9: Guess the Sketch

Teacher's Instructions

Aim

In this activity, students will play a drawing game in small groups to sketch factors and forms of coastal engineering so that their teammates may guess them.

This activity allows students to:

- work in groups
- think laterally
- practise visual presentation
- increase the memorability of concepts and forms of coastal engineering

QUICK-GLANC
Prior Knowled
Coastal engine
Additional Ma
Stopwatch/tim
Feedback opp
Yes
Evaluation op
Yes

Structure of the activity

The students should be divided into groups of six, and each group split into two t

Section	Timing	Task
Prep done by teacher	5 mins	Photocopy the concept cards.
Part 1: Preparation for the game	5 mins	The students are given five minutes to get famili looking up any concepts they are unfamiliar with might represent them visually. Students then cut out the list of concepts and pla
Part 2: Playing the game	15 mins	Students decide which team goes first. In the tea sketch first, while the other two guess. The othe The sketcher pulls the concept from the hat. The sketch the concept, and their teammates have to correctly guess in the minute, they get a point.* manage to guess, the word is not revealed, and i

Optional extensions/amendments

As an extension activity, students could be asked to make a mind map of the key write definition cards of the concepts.

If the teacher wishes, part 1 could be conducted as a homework task.

* If the teacher feels generous, they may allow students to 'pass' on concepts th this may make the game a lot shorter, as the teams may run out of words. Ideall to pass, as part 1 should have allowed them to prepare for the game.

Concepts to sketch

HARD ENGINEERING	SOFT ENGINEERING	
SLOPE STABILISATION	BEACH NOURISHMENT	
DO NOTHING	STRATEGIC REALIGNMENT	
INTEGRATED COASTAL ZONE MANAGEMENT	REVETMENTS	
HOLD THE LINE	ADVANCE THE LINE	

Activity 10: River Speed Datin

Teacher's Instructions

Aim

In this activity, students will work in groups to discuss the features and characteristics of a river at different stages of the long profile.

This activity allows students to:

- work in groups and share ideas and connections
- revise and consolidate their knowledge of changes along a river's long profile

QUICK-G
Prior Kn Stages o
Additio Bell - op
Feedba Yes
Evaluat No

Structure of the activity

- Divide the class into six equally sized groups.
- Ensure each group has a different coloured pen or pencil.
- Place a different worksheet on each table or desk.
- Each group will take it in turns to answer the bullet-point questions on each
- Every five minutes, you will ring a bell or announce that each group must m
- Each group will write a couple of answers onto each sheet.
- Each group will also discuss some of the previous answers provided by prior

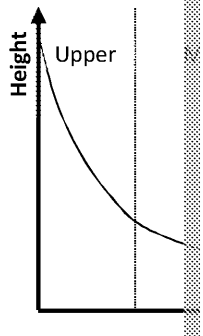
Section	Timing	Task
Prep done by teacher	5 mins	Photocopy activity sheets onto A3 paper, and place e across the classroom. Photocopy answer sheets (A4 paper).
Part 1: Student discussions	35 mins	Explain to the class the structure of the activity and d Each group will rotate around the various stations, a discussing the previous group's answers. Announce or ring a bell to indicate that each group w
Part 2: Teacher discussion and feedback	20 mins	You could run through each completed worksheet, d fill in any gaps in the students' knowledge.

Feedback and evaluation

- You can hand out the answer sheets at the end for revision purposes.
- You can discuss the answers with the class – the different colour pens can b group's answers.

Sheet 1

1. Using the
stage of t
photogra



2. Identify the features shown in the photograph.

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3. How were the features shown in the photograph created?

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4. Describe the shape (cross-section) of the river channel in this photograph.

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5. Describe and explain the size of the bedload at this stage of the river.

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6. Name and describe **two** other landforms that you might find in a river of thi

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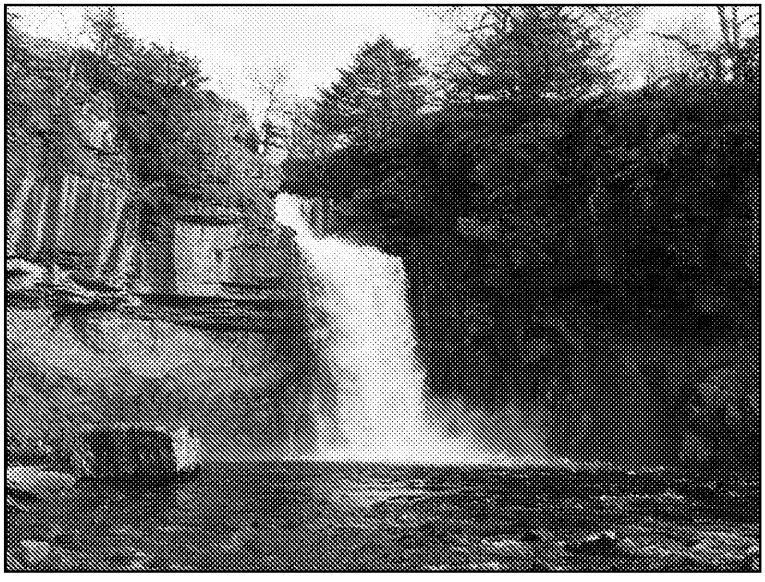
Sheet 2



1. Using the
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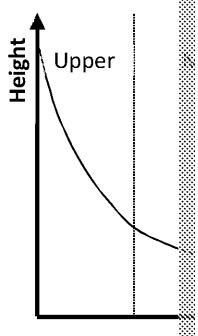

2. Explain the formation of the waterfall shown in the photograph.

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3. Identify the types of erosion that are likely to take place in this stage of a riv

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4. Why is there more erosion than deposition at this stage of a river?

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5. Explain why there is likely to be a lot of friction (and, therefore, turbulence)

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6. Compare the width of the river at this stage compared to other stages.

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Sheet 3

1. Using the d
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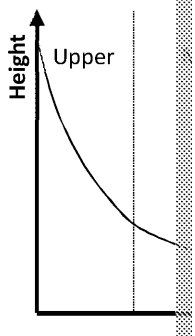

2. Name and describe the formation of the feature shown in the photograph.

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3. Identify the areas of deposition and erosion on the bend of the river, and ex

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4. Describe and explain the width and depth of the river's cross-section at this

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5. What is the main form of transportation at this stage of the river?
Why?

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6. Why is there more water in this stage of the river than at the previous stage

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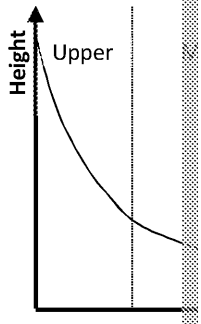
Sheet 4

1. Using the di
of the river s



2. Name the feature located in the photograph. Is this a landform of erosion o

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3. Using the outline map of the UK, identify suitable locations for this landform

4. At low tide, large mudflats are like
where might be a 'low tide' in this
are likely to be mudflats.

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5. What is the main size of particle in

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6. Name at least **two** other features which are likely to be found at this stage o

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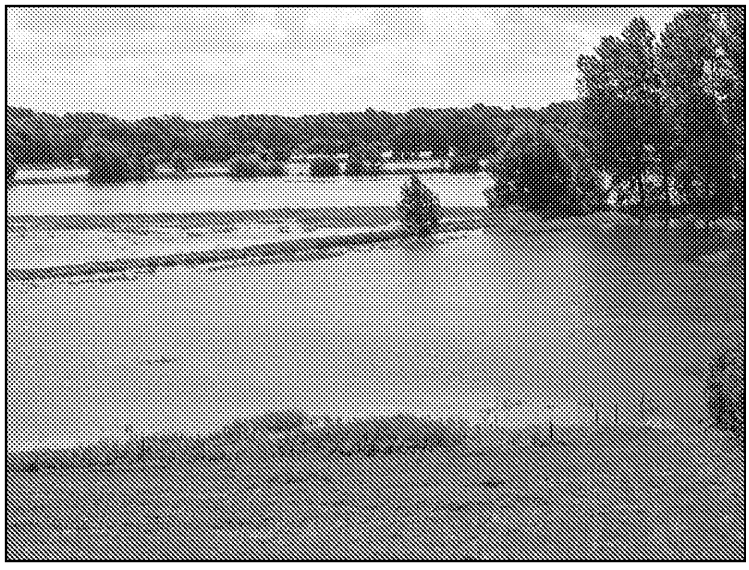
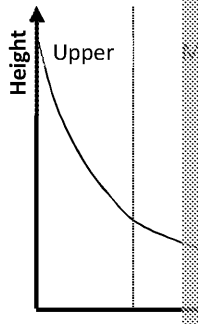
Sheet 5



1. Using the d
of the rive



2. Name and explain the formation of the feature found in the photograph.

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3. Explain the function of the feature shown in the photograph.

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4. At this stage, levees may be found. Explain their formation.

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5. Explain why there might be fertile farmland at this stage of the river.

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6. 'This is an excellent place for building houses – the land is perfectly flat.' Exp
partially incorrect.

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Sheet 6

*This photograph was taken at the **lower** stage of a river.*

1. Name and explai
shaped lakes in t

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2. Explain the large
this stage of a riv

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3. Why is there the most water and the highest velocity of water at this stage

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4. Why is the sediment smoothest and most rounded at this stage of the river?

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5. Explain how this landscape may look in several thousand years' time.

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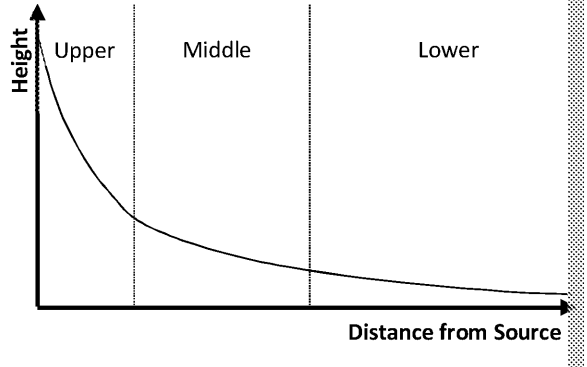
6. Sketch the cross-section of the river through one of the meanders.

Sheet 1: Suggested Answers

1. Using the diagram below, identify the stage of the river shown in the photo



Upper stage

2. Identify the features shown in the photograph.
Interlocking spurs

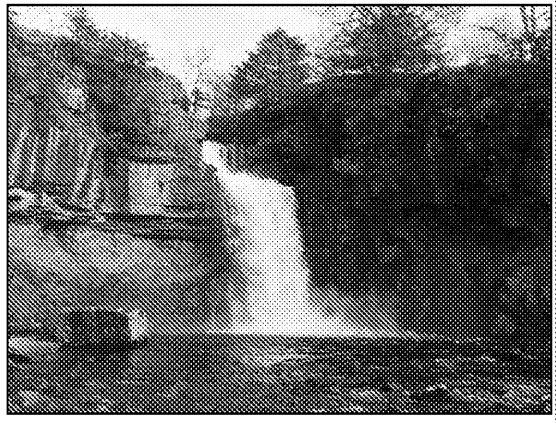
3. How were the features shown in the photograph created?
In the upper course of a river, the gradient of the land is steep, i.e. moun areas of harder rock, which are more resistant to erosion, the river chan path of least resistance.

4. Describe the shape (cross-section) of the river channel in this photograph.
The channel is V-shaped because the river is a long way from the sea. The causing vertical, downwards erosion. As the channel erodes downwards, r exposed to weathering, falls into the channel, and is transported away do saltation when there is high discharge).

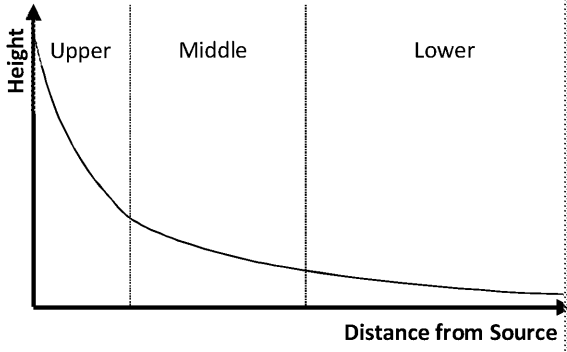
5. Describe and explain the size of the bedload at this stage of the river.
The limited quantity of bedload is large and angular. Material is freshly er channel for long enough for erosion (e.g. attrition) to occur.

6. Name and describe **two** other landforms that you might find in a river of thi
   - *Waterfalls*
   - *Rapids*

Sheet 2: Suggested Answers



1. Using the diagram below, identify the stage of the river shown in the photo



Upper stage

2. Explain the formation of the waterfall shown in the photograph.
Waterfalls occur when a layer of hard rock overlays a layer of soft rock. D underlying soft rock to erode faster. Undercutting occurs as water splashe action erodes behind the waterfall (plunge pool also develops). The waterf harder rock collapses (forms a gorge with steep sides when retreats, plun

3. Identify the types of erosion that are likely to take place in this stage of a riv
   - *Hydraulic action*
   - *Abrasion*
   - *Solution*

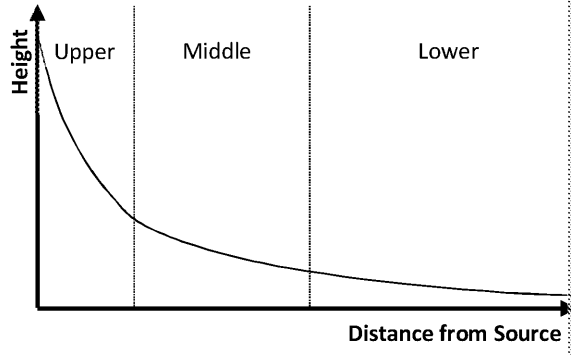
4. Why is there more erosion than deposition at this stage of a river?
The river has a lot of energy in the river due to its steep gradient. This ke suspension, where it is not deposited, and the energy is the source of eros

5. Explain why there is likely to be a lot of friction (and, therefore, turbulence)
The bedload is large and angular; therefore, the flow of water is impeded The wetted perimeter is lower due to the small size of the channel – ther water in contact with the bed and banks than at the other stages of a riv

6. Compare the width of the river at this stage compared to other stages.
The width is narrower than the other stages because of the vertical erosio erosion at the lower stages.

Sheet 3: Suggested Answers

1. Using the diagram below, identify the stage of the river shown in the photog



Middle stage

2. Name and describe the formation of the feature shown in the photograph.
Meanders. Meanders start out as riffles – shallower, turbulent sections. D water will flow around the riffle. This causes erosion (undercutting) on th centripetal forces. Material is deposited on the far side of the river due to in the river due to this erosion, which increases on the outside of the bend faster. Deposition occurs on the shallow inside of the bend where water is pronounced as erosion continues.

3. Identify the areas of deposition and erosion on the bend of the river, and ex
Erosion on the outside of the bend, where water is flowing fastest. Erosion where flow is slower.

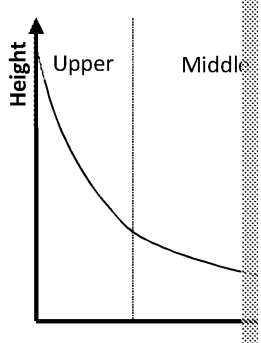
4. Describe and explain the width and depth of the river's cross-section at this
The river is wider because there is greater lateral erosion as the steepness is more water in the river as more water enters the channel from tributa deeper.

5. What is the main form of transportation at this stage of the river?

Why?
Suspension – material has had time to become eroded, e.g. attrition. This of fine particles from the river's bed and banks. Flow is faster than the up material to be held in suspension.

6. Why is there more water in this stage of the river than at the previous stage
Water has been added from tributaries.

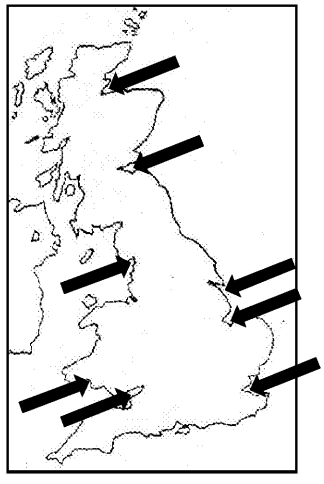
Sheet 4: Suggested Answers



1. Using the diagram below, identify the stage of the river shown in the photo
   Lower stage

2. Name the feature located in the photograph. Is this a landform of erosion o
   An estuary – a feature of deposition.

3. Using the outline map of the UK, identify suitable locations for this landform
   This map is not exhaustive.



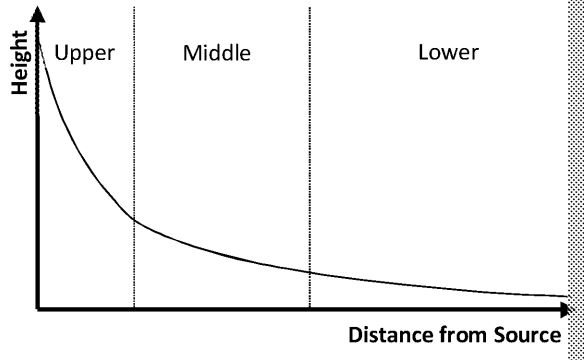
4. At low tide, large mudflats are likely to be exposed. Explain why where migh
   river, and why there are likely to be mudflats.
   The river is close enough to the sea to have a tidal influence – as the tide
   saltwater, and at low tide, the only water in the estuary may be fresh wa
   At the mouth of a river, a lot of deposition occurs, e.g. water slows and lo
   incoming sea water, and chemical changes when fresh and salt water mee
   stick together, become heavier and fall out of suspension.

5. What is the main size of particle in this river?
   Small (fine-grained) – the material has been in the river for a long time
   time to occur.

6. Name at least **two** other features which are likely to be found at this stage o
   - *Floodplains*
   - *Levees*
   - *Oxbow lakes*
   - *Deltas*

Sheet 5: Suggested Answers

1. Using the diagram below, identify the stage of the river shown in the photo



Lower stage

2. Name and explain the formation of the feature found in the photograph.
Floodplain. During periods of very high discharge, more water flows in the support, so water spills over the banks and onto the land surrounding it. channel subsides, water flows back into the channel. A wide floodplain of layers of alluvium from successive floods. Material is deposited on the flood water flows slowly or stands still, meaning that suspended material falls

3. Explain the function of the feature shown in the photograph.
To temporarily store excess water during high discharge events.

4. At this stage, levees may be found. Explain their formation.
As water spills onto the floodplain during a storm, material is deposited. deposited first, and land close to the channel. Over time, piles of material

5. Explain why there might be fertile farmland at this stage of the river.
Soils are deep and made of nutrient-rich alluvium.

6. 'This is an excellent place for building houses – the land is perfectly flat.' Exp partially incorrect.
Floodplains are fairly flat – this is the correct part of the statement. Whi to build a house on, the practice is not advisable as the floodplain will con

Sheet 6: Suggested Answers

*This photograph was taken at the **lower** stage of a r*

1. Name and explain the formation of the crescent-shaped lakes in the photog
   Oxbow lakes. Form when the necks of meanders are eroded and the river side. Most of the flow will take the easiest route, and, therefore, depositio off section. Eventually, deposits span the cut-off and the crescent-shaped from the river.

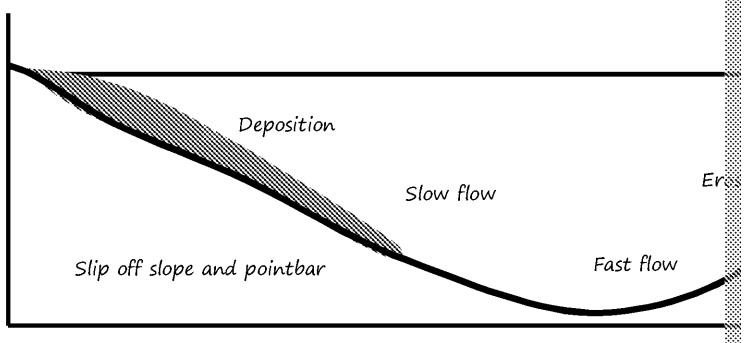
2. Explain the large size of the wetted perimeter at this stage of a river.
   The channel in the lower course is wide and deep – therefore, there are l riverbed which are in contact with the water.

3. Why is there the most water and the highest velocity of water at this stage
   Many tributaries have added water to the river at this point, adding weig large cross-sectional area at the lower stage; therefore, there is relatively bed and banks, which are a source of friction. Load is also more rounded.

4. Why is the sediment smoothest and most rounded at this stage of the river?
   Material has been in the river for a long time and has been subjected to a loads collide with each other, breaks off sharp corners and overall reduces also worn down from abrasion and solution.

5. Explain how this landscape may look in several thousand years' time.
   The existing meanders will likely be oxbow lakes, and new meanders will h The existing oxbow lakes are likely to have been filled in from sediment w

6. Sketch the cross-section of the river through one of the meanders.



Activity 11: Flood Risk... or No

Teacher's Instructions

This activity could be delivered in **two** ways:

EITHER as an individual homework or cover lesson, **OR** as a group activity.

QUICK-GL

Prior Knov
Causes of f

Additiona
A3 paper, s

Feedback
Yes
Evaluation
Yes

Aim
In this activity, students will work individually or in groups to identify how natural and human-caused factors increase or decrease flood risk.

This activity allows students to:

- use their knowledge to determine whether a factor increases or decreases the risk of flooding
- work as a team
- use analytical and problem-solving skills

Structure of the activity

Section	Timing	Task
Prep done by teacher	5 mins	Photocopy the instructions and diary pages, and the
Part 1: Written activity	50 mins	Divide the class up into even numbers of students – g Provide a copy of the images to each group. Each group will cut out the images, and discuss whic decrease the flood risk. The students will stick the images showing natural a increase the flood risk at the left edge of one sheet. with the factors that decrease flood risk on the othe The students will then write out a title for each facto natural, and briefly explain why each factor is likely t risk to an area.
Part 2: Feedback (optional)	10 mins	Students can check their answers against the answe marking Grid, either at the end of the lesson, or at th following lesson.

Feedback and evaluation

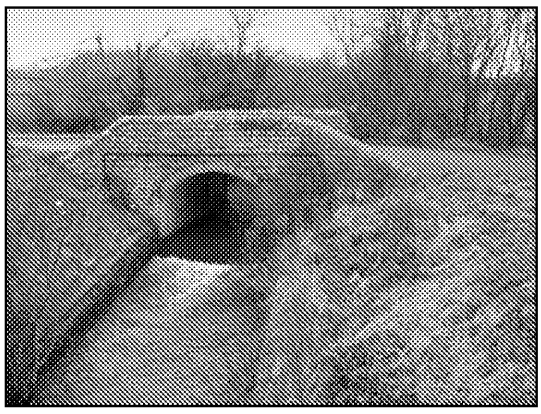
- Once written, provide a copy of the Peer-marking Grid so that students can
- Alternatively, you could collect in the tasks and mark them as a normal piec

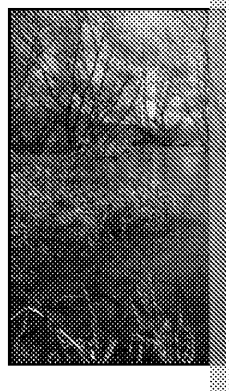
Students' Instructions

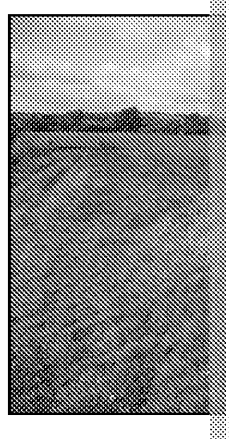
- Either on your own or in small groups, cut out the images.
- Decide which image show factors which will increase flood risk, and which s risk.
- Stick all of the images which show factors that increase the risk of flooding o of A3 paper.
- Repeat with the images that show factors that decrease the risk of flooding o
- Write out the title of each factor, whether it is natural or human, and give a factor increases or decreases the flood risk.

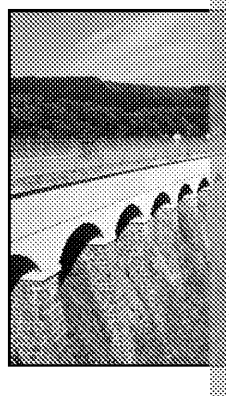
For example:

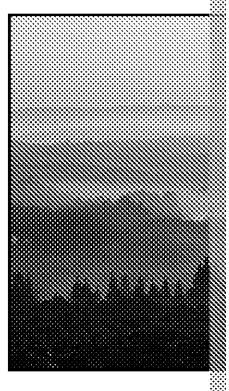
Image	Title	Natural/Human	Expl

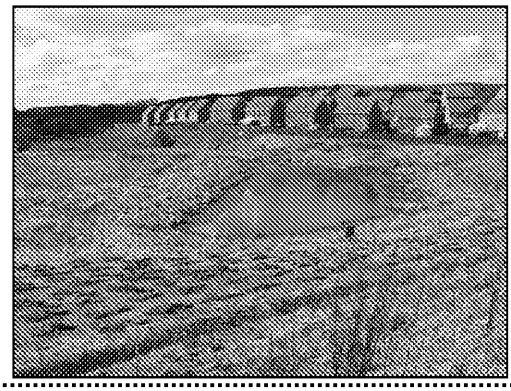


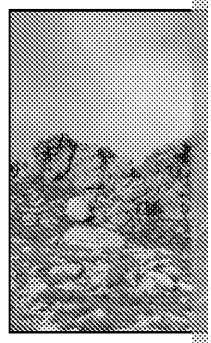


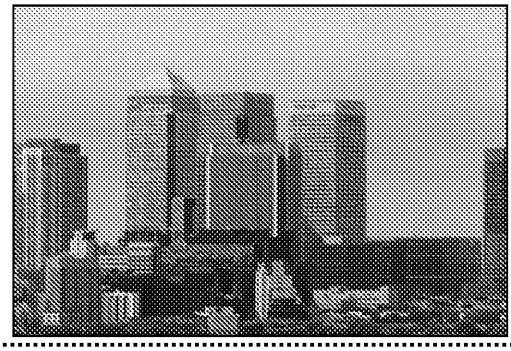


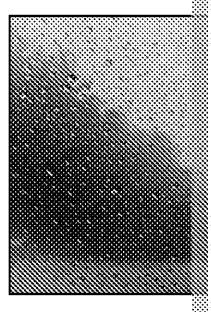


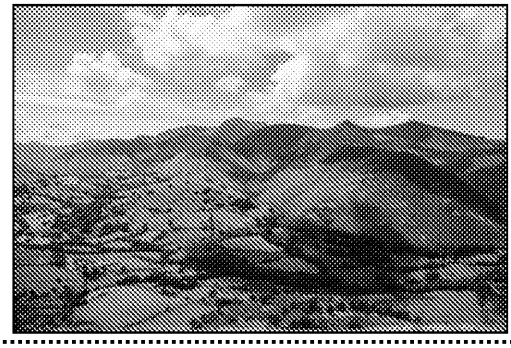


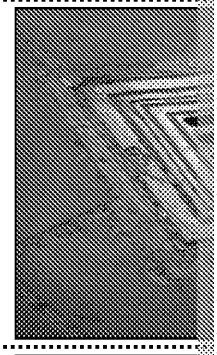


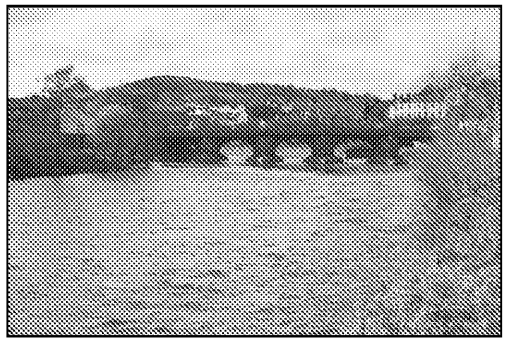


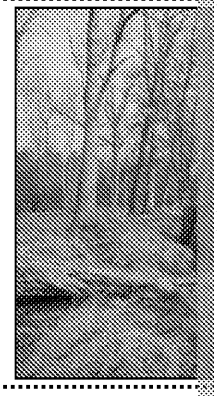


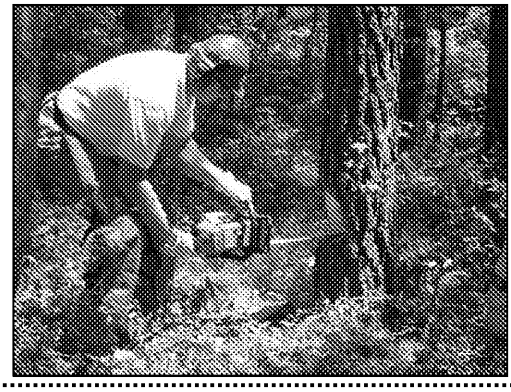








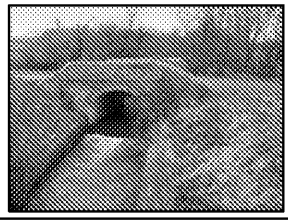
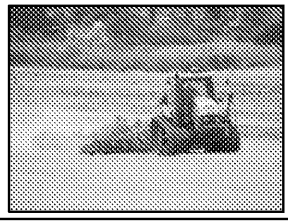
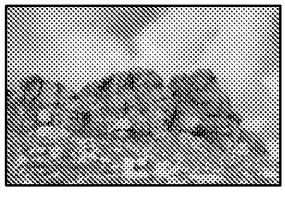
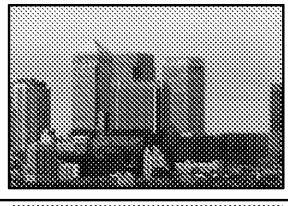
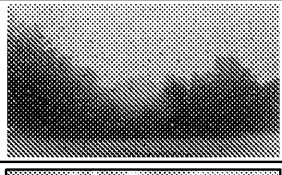
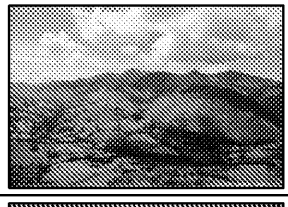
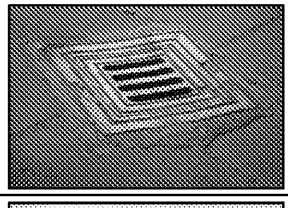




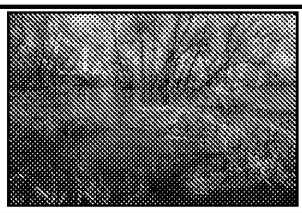
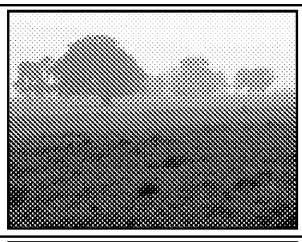
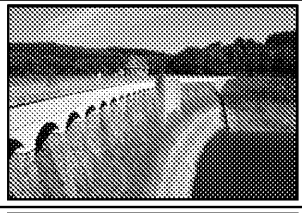
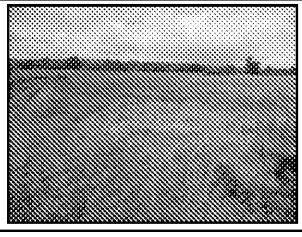
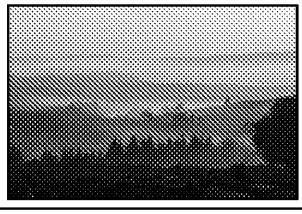
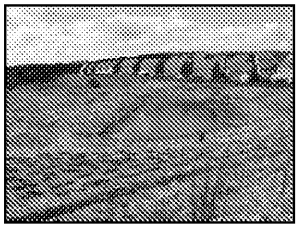
Peer-marking Grid 4 – Flood Risk... or Not?

	Mark 1–5	
Are the photos all positioned on the correct pages?		
Are the titles correct?		
Are the classifications into natural or human correct?		
Have suitable explanations been provided?		
Is the presentation and layout neat and tidy?		
Total score	**/25**	

Increases Flood Risk: Suggested An

Image	Title	Natural/Human	
	Channel straightening	Human	Water arrives channel was
	Ploughing	Human	Soil is bare vegetation at be compacted straight into
	Granite soils – thin	Natural	Granite is im into the rock surface. This, weathering pr is likely to ra
	Urban areas	Human	Urban areas water into st enters rive intercepted –
	Storms / heavy rain	Natural	When rainfall into the so rainfall. Wat
	Upland areas / steep slopes	Natural	Slopes quickl
	Drains	Human	Storm water
	Impediment of river flow	Human	The feet of water. Water
	Deforestation	Human	Interception flow is more l water enters lag tim

Decreases Flood Risk: Suggested Ans

Image	Title	Natural/Human	
	Wetlands and floodplains	Natural	Allows a water, o
	Drizzle or light rain	Natural	When rai time for O
	Dams and reservoirs	Human	Floodwater can be do
	Woodland and forests	Natural	Provide a water a
	Flat land	Natural	Water is l
	Semi-natural landscapes	Natural	With the hydrologi way. Ther lack of hard the lag tim
	Soakways / SUDS (Sustainable Urban Drainage Systems)	Human	Instead drains, th stored in t into the s reduces the the speed
	Natural meandering river	Natural	Without straighter water downstr that large

Activity 12: Bank-burst in the Lake

Teacher's Instructions

This activity could be used as a homework or cover lesson.

Aim

In this activity, students will undertake research on the flooding in the Lake District during the winter of 2015–16, and produce a poster and timeline, which could be used as a useful revision tool.

This activity allows students to:

- undertake research
- review, collate and interpret data and news reports
- produce a timeline
- display findings in a clear, coherent style

QUICK-GLANC

Prior Knowled
Causes of flood

Additional Ma
Felt-tip pens, A

Feedback opp
Yes

Evaluation op
Yes

Structure of the activity

Section	Timing	Task
Prep done by teacher	10 mins	Photocopy the template sheets (map and timelin and peer-marking grid.
Part 1: Research and poster creation	50 mins – 1 hour	Each student will undertake research and comple
Part 2: Feedback	10 mins	Provide the peer-marking grid to the students fo work.

Feedback and evaluation

Peer-marking grids can be used for students to mark each other's work. Alternat posters and mark them yourself.

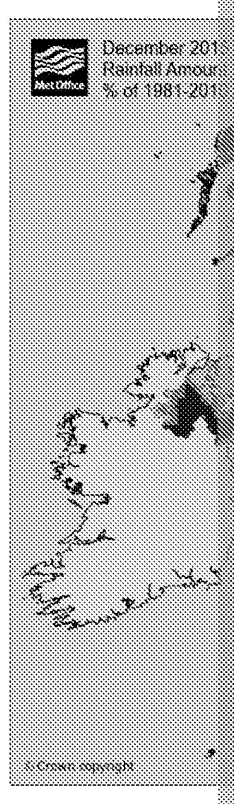
Optional extensions/amendments

Option to set the research task as a homework activity.

Students' Instructions

Your task is to research the flood events experienced on at least one river in the
the winter storms of 2015–16. You will undertake research online, and fill in a po
District is a popular tourist destination. Despite the flooding, local businesses an
were keen to pass on the message 'Cumbria is open', despite roads being damag
lengthy diversions.

There is a wealth of data available online – a great place to start is looking at news articles; for example, the BBC, the *Westmoreland Gazette*, other newspaper sites, and the Met Office.



Start by taking a large sheet of paper – your teacher may give you a large sheet of A2 paper, or two sheets of A3 which can be joined together.

Glue the map in the centre, and the timeline at the bottom of your poster.

Choose a river or affected region in Cumbria – examples include:

- Keswick (River Greta)
- Glenridding (Glenridding Beck)
- Kendal (River Kent)
- Pooley Bridge (River Eamont)

As you can see from the map, large parts of the UK experienced significantly higher than average rainfall in December 2015 (including intense rainfall events), and ground was already saturated from antecedent rainfall.

- For your chosen region, complete the timeline with details of the flood ever
  where was flooded, what were the consequences and actions, facts and oth
  were flooded several times throughout the winter.
- Locate your chosen river or location on the map and label it. As you underta
  to find information and examples concerning the district as a whole – draw
  them and add details such as the costs and damage caused, and how this ha
  will build up a picture of the damage caused to the region.
- Have a look at the website *http://www.loweswatercam.co.uk/151205_Storm*
  Use this to help you explain the difficulties experienced by local residents.
- In the space around the map, describe and explain the following:
  - The physical causes of the floods (include antecedent conditions)
  - How humans may have increased the risk of flooding in the region
  - How the region could be physically, socially and economically affected
    of the storm)
  - How local businesses and residents coped with the floods – what were
- Include photos and graphs (e.g. hydrographs or rainfall data) with your answ
  they show!

The Lake District: Cumbria

Timeline

Peer-marking Grid 5 – Bank-burst in the Lake District

	Mark 1–5	
Has the student fully researched the topic of flooding in Cumbria – is the timeline and map filled in?		
Do you think the student has fully understood how the floods have impacted local people?		
Are the natural and human causes of flooding explained?		
Are the impacts of the flooding clearly stated?		
Are the clean-up operations clearly discussed?		
Total score	/25	

Activity 13: Flood Scheme presentatio

Teacher's Instructions

Aim

For this activity, students need to imagine that they are engineers working on behalf of Brecon Town Council. It is their job to produce a proposal (in the form of a presentation board) to protect Brecon from flooding.

The board must outline the students' proposed scheme, and highlight the costs and benefits of the scheme – environmental, social and economic.

This activity allows students to:

- play the role of flood engineers, facilitating team-working skills
- develop ideas and apply knowledge in an unfamiliar situation

QUICK-
Prior Kn Flood-d
Additio Camera paper, s
Feedba Yes
Evaluat Yes

Structure of the activity

Section	Timing	Task
Prep done by teacher	10 mins	Photocopy the instructions, maps and images. Procure the materials listed above.
Part 1: Instructions and familiarisation	5 mins	Divide the class into small groups – three or four Provide each group with a photocopy of the instr Provide each group with a large sheet of paper o the other equipment.
Part 2: Poster creation	40–50 mins	The students design their poster.
Part 3: Feedback	10 mins	After the students have finished their presentatio plan you think is best suited for Brecon, and awar

Feedback and evaluation

- The posters can be used as a wall display, or you could photograph them an or website.
- Individual posters can be marked by the teacher.

Students' Instructions

You and your team members are engineers who have been selected to produce a
Town Council. You are competing with the other teams in your class to find the n
management strategy for the town of Brecon. Brecon lies on the confluence of t
As a result, Brecon has seen a long history of flooding. The main areas which floo
Brecon, along the rivers Usk and Honddu.

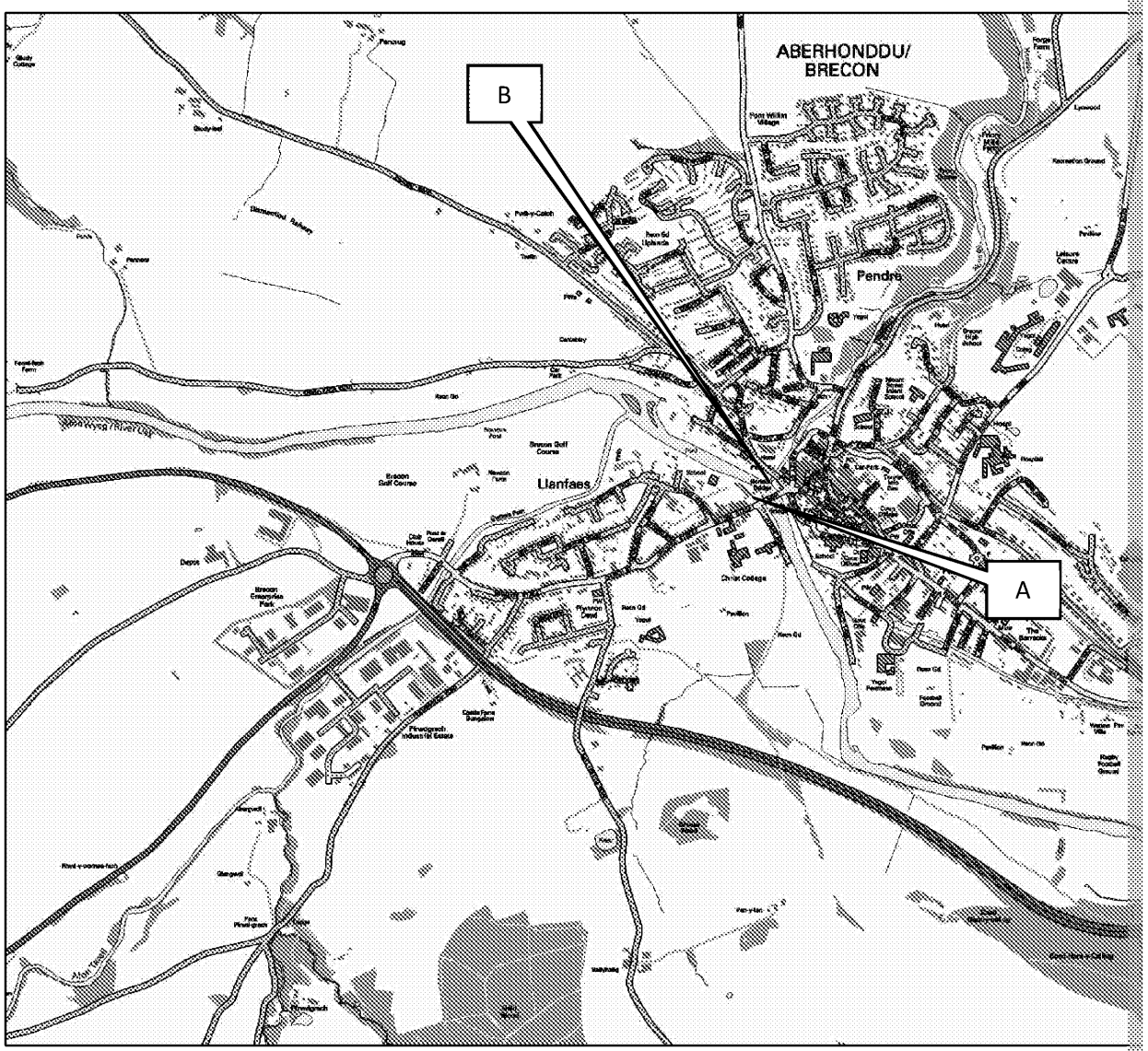
1. You must first discuss any current flood-engineering works that have taken p
studying the maps and photographs (e.g. channel straightening), and decide
enhance these. Study the maps and images.

2. Decide what new measures you would like to implement and their locations
environmental, social and economic costs and benefits. You may choose fro
techniques, or employ a mixture of the two.

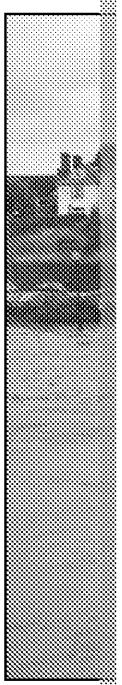
3. Stick a copy of the map with contours, rivers and settlements in the centre o

4. Mark the locations of your proposed defences on the map.

5. Draw an arrow from each proposed development on your map, and in a box
the scheme – the environmental, social and economic costs and benefits. Re
able to sell your plans, but you will need to be truthful about the costs! An e



The bridge marked A on the map – floodwall seen behind



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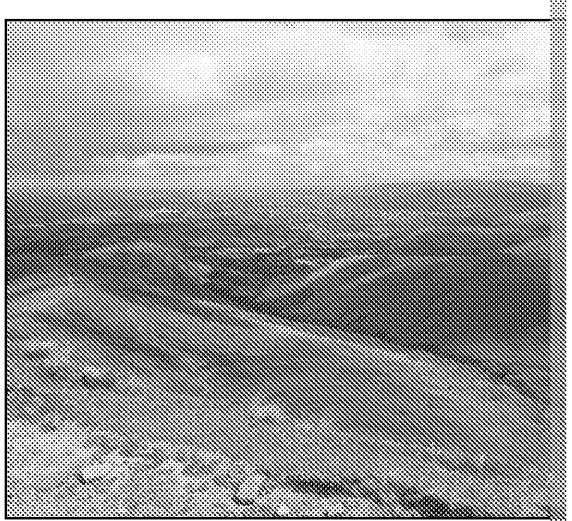

Brecon seen from the mountain Pen y Fan – 886 metres (2,90