

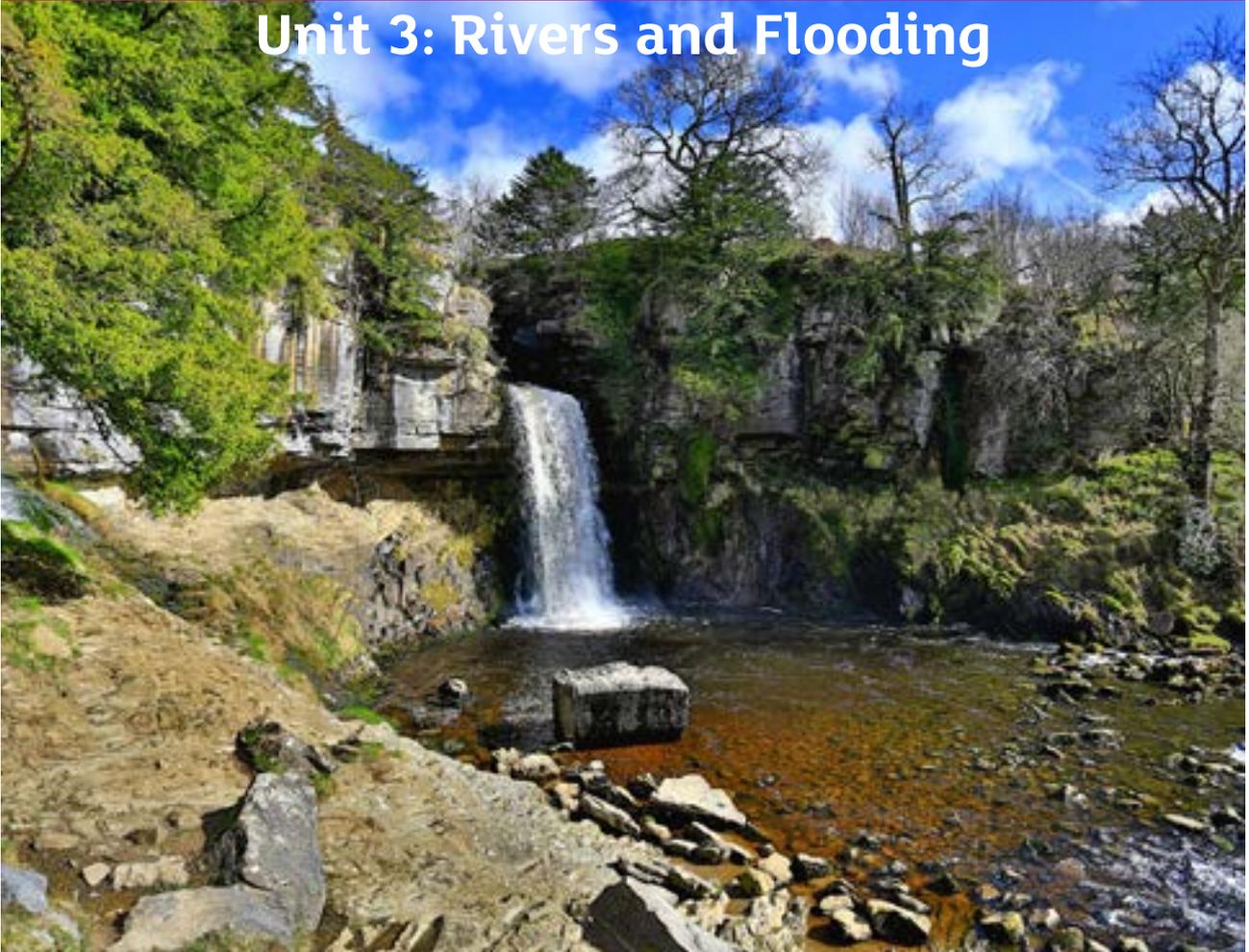
ELQ Geography

Entry Level Geography

Unit 3: Rivers and Flooding



Unit 3: Rivers and Flooding



Learning Outcome 1:

Demonstrate knowledge of the key components of the drainage basin and how a river changes downstream

Learning Outcome 2:

Know and understand the formation of river landforms

Learning Outcome 3:

Know how rivers can be managed to reduce the impact of and prevent flooding

Guidance notes

This resource includes information and suggested tasks relating to Entry Level Geography. This booklet has been produced to meet the requirements for Entry Level 3. Teachers should amend the material to suit the needs of their learners and the available resources.

The list of resources is neither prescriptive nor exhaustive.

For the Introduction:

<https://www.bbc.com/bitesize/guides/zxvw4qt/revision/1>

http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/river_profiles_rev1.shtml

For river landforms:

<http://www.bbc.co.uk/education/guides/zkrdmp3/revision/2>

<http://www.coolgeography.co.uk/GCSE/AQA/Water%20on%20the%20Land/Waterfalls/LandformsWaterfalls.htm>

http://www.geography.learnontheinternet.co.uk/topics/river_upper_course.html

For flooding:

http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/river_flooding_management_rev1.shtml

http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/river_flooding_management_rev5.shtml

Introduction

A drainage basin is the area of drained by a river and its tributaries. Every drainage basin has a watershed, source, tributaries, mouth and confluence sites.

Fig 1 (below) is a sketch of a typical drainage basin with its five key components.

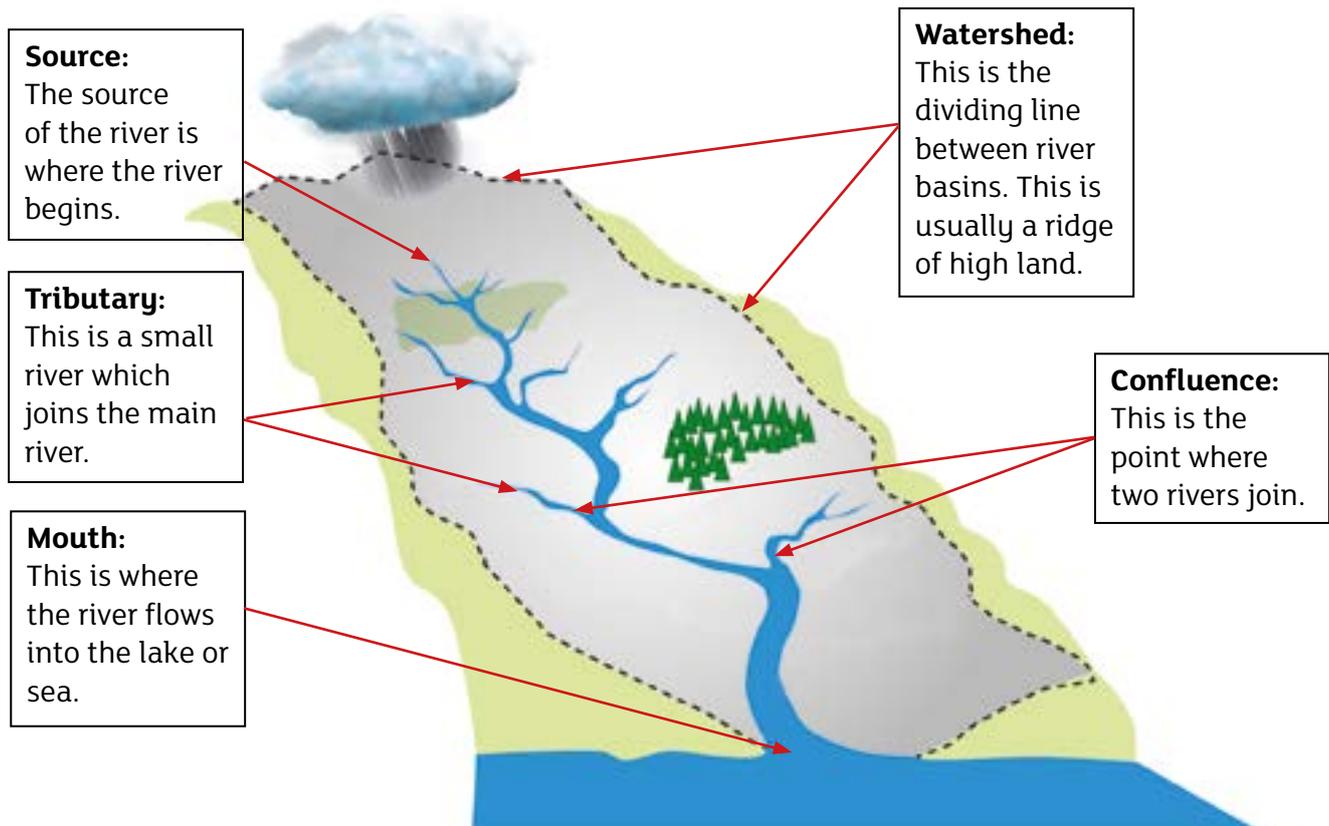


Fig 1: The Key Components of a Drainage Basin

Rivers flow downhill from their source to their mouth. As the river flows from its source to its mouth, there are a number of changes that takes place:

- The **depth** of the river increases. A river gets deeper as a result of increased vertical erosion. This means that the river wears away, or erodes, the river bed.
- The **width** of the river increases. A river gets wider as a result of increased lateral erosion (side to side). This means that the river wears away or erodes its banks.
- The **gradient** or slope of the river bed decreases. This means that the river becomes less steep. Gradient decreases because the river changes from eroding vertically at the source to eroding laterally the further the river moves away from the source.
- **Discharge** is the volume of water being carried by the river. The discharge increases as the river moves away from its source. This happens because as a river moves downhill, more tributaries join the main river. The more tributaries, the more water and therefore the higher the river discharge.

- All rivers carry materials, this material is referred to as the load. The river's load is made up of clay, silt, sand, gravel and boulders. The load changes as the river moves from its source to its mouth. It becomes smaller and rounder. This happens because as the river flows from the source to the mouth, particles in the load knock off one another. Each impact causes pieces of sediment to break off and so the load becomes smaller and more rounded.

River landforms

As a river flows from the source to mouth, landforms are created. Two landforms are waterfalls and meanders. Let's look at waterfalls first.

Waterfalls are found on rivers all over the world. Famous examples include:

- Niagara Falls on the border between Canada and USA;
- Victoria Falls on the border between Zambia and Zimbabwe;
- Angel Falls in Venezuela; and
- Iguazu Falls on the border between Argentina and Brazil.

A waterfall is created when a river flows over the edge of steep land made up of hard rock and wears away the soft rock below. This causes a step to form. Over time the soft rock at the bottom of the step will be eroded causing a **plunge pool** to form. The swirling water undercuts the hard rock above causing an **overhang** to form. The hard rock collapses because there is nothing to support it underneath. When the hard rock falls into the plunge pool, the rocks become smaller, smoother and rounder as they bash against each other over time. The waterfall keeps moving upstream each time the overhang collapses. This forms a steep-sided gorge.

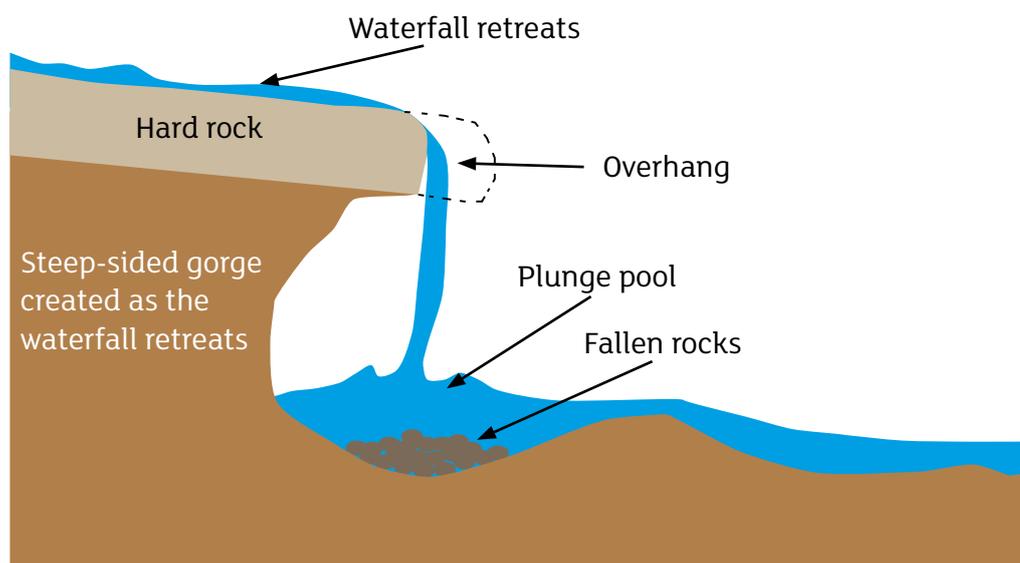


Fig 2 : The Formation of a Waterfall Source:



Fig 3: High Force Waterfall

Meander formation

Meanders are winding curves or bends in a river. When a river flows through a meander, the fastest current flows to the outside of the bend. This causes erosion to the river bank forming a **river cliff**. The river becomes deeper overtime on that side. On the inside bend of a meander, the water is flowing slower. This means that pebbles and sand is deposited forming a slip-off slope.

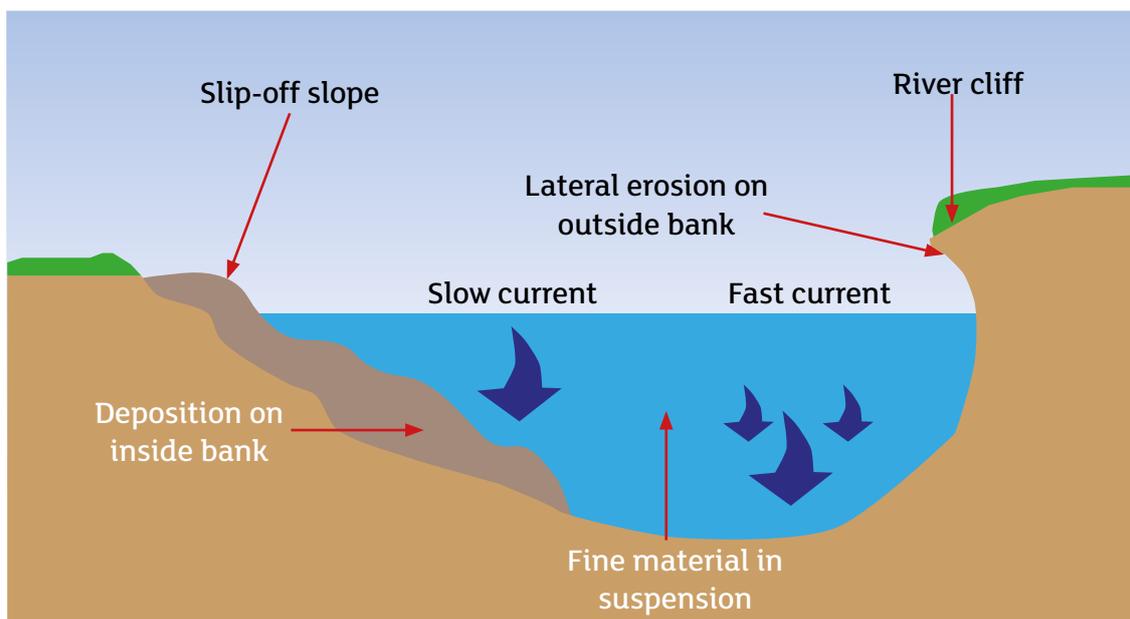


Fig 4: The Formation of a Meander



Fig 5: A Meander

Flooding

Floods can be defined as the overflow of water from a river.



Fig 6: A Flooded Village



Fig 7: Severe Flooding in Paris

There are both physical and human causes of floods.

PHYSICAL CAUSES	HUMAN CAUSES
<p>Heavy rain can cause floods. When it rains heavily, the soil soaks up the rain. It will reach a point where the soil will not be able to hold any more water so the 'extra' rain runs over the ground surface and straight into the river causing river levels to rise rapidly.</p> <p>Snowmelt can cause floods. When snow melts, the extra water makes its way into the nearest rivers and floods can occur.</p> <p>Steep slopes can cause floods. If a slope is steep, when the rain falls, it will not have time to soak into the soil below as the pull of gravity pulls the water down to steep slope fast into the river, causing river levels to rise rapidly.</p> <p>Lots of tributaries - if a river has many tributaries, there will be more water in the river network. The more water, the higher the chance of a flood.</p>	<p>Deforestation (cutting down of trees) causes floods. When trees are cut down, there are fewer trees to absorb the water so water reaches the river quickly and floods occur.</p> <p>Urban (built up) areas have many impermeable surfaces such as tarmac and concrete. This means that water can't pass through into the soil below. This means the water flows straight to the river and not into the ground.</p>



Fig 8: Deforestation

The Pakistan floods

In July 2010, major floods occurred in Pakistan. Pakistan is an Asian country that often experiences floods. In 2010, the heavy monsoon rains caused the rivers in Pakistan to burst their banks leading to widespread flooding. There were many impacts on people, property and the environment. The following is a list of the devastating impacts that hit Pakistan in 2010.

- There were approximately 1600 people who died during this 2010 flood.
- A lot of property was damaged for example 700 000 homes were damaged during the flood.
- More property such as bridges were destroyed. A total of 1000 bridges were affected during the 2010 flood.
- 160 000 km² of the total environment was affected during the 2010 flood. This accounts for about 20% of the country.
- Crops were also ruined during the flood as estimates suggest that about 6.5 million acres of crops were destroyed.
- People could not get enough food to eat. The flooding ruined farmland and crops. At least 6 million people needed food aid.

Managing Rivers

Rivers can be managed to reduce the impact of floods or to even try and prevent floods from happening in the first place. To do this, both hard and soft engineering methods can be used.

Hard engineering – This is the building of structures to prevent a flood from taking place. These are usually expensive options and usually have a greater negative impact of the surrounding environment.

Dams are one example of a hard engineering method.



Fig 9: Hoover Dam, USA

Dams are expensive structures that are built along the course of a river. These dams are walls that are built with the aim of controlling the amount of discharge from the river. Water is held back by the dam in an area called a reservoir and released in a controlled way. This controls flooding.

Soft engineering – This involves adapting to flood risks rather than trying to prevent a flood from happening or controlling the river. Soft engineering allows natural processes to deal with the rainwater. This approach accepts the natural processes of the river and seeks to work with it. One way to achieve this is by zoning the land use near a river. Fig 10 shows open space alongside the river. If this river floods then there will be no damage to property.



Fig 10: Open space beside a river allows it to flood without damaging property

Afforestation is another example of a soft engineering method. Afforestation is simply the planting of trees close to the river. This means that there will be more trees to absorb the rainwater when it falls and therefore lower river discharge. This is a relatively low cost option as it is not very expensive to implement and it also enhances the environmental quality of the drainage basin.



Fig 11: Afforestation

Activity 1

Resource A shows a diagram of a drainage basin.

Identify the five key components of the drainage basin by drawing an arrow and labelling them on the diagram below. Use the following words to help you.

watershed

source

tributary

confluence

river mouth



Resource A

Complete the following sentences by underlining the correct word to describe how river features change from the source to mouth. For each feature explain why it changes.

1. As a river flows from its source to its mouth it becomes **wider/narrower**.
This is because:

2. As a river flows from its source to its mouth it becomes **deeper/shallower**.
This is because:

3. As a river flows from its source to its mouth its gradient becomes **steeper/gentler**.
This is because:

4. As a river flows from its source to its mouth its discharge becomes **greater/less**.
This is because:

5. As a river flows from its source to its mouth its load becomes **bigger/smaller**. The load also becomes **more rounded/less rounded**.
This is because:

Activity 2

Photograph 1 shows a river landform. In the spaces provided, name the landform and briefly explain how it was formed.

Photograph 1

This river landform is called a

It is formed when:



Photograph 2

This river landform is called a

It is formed when:



Activity 3

Resource B shows flooding. The road and field beside it have been flooded. You can see buildings further along the road which are also flooded.



Resource B

Complete the speech bubbles to explain two physical causes of flooding and two human causes of flooding.

One human cause of a flood is..

One human cause of a flood is..

What are the causes of floods?

One physical cause of a flood is..

One physical cause of a flood is...

Choose a flood that you have studied.

Complete the table below to describe the impact the flood had on people, property and the environment.

Name of flood: _____

The impact the flood had on people	The impact the flood had on property	The impact the flood had on the environment

Rivers can be managed to reduce the impact of flooding and to prevent flooding.

Complete the following task to explain how one soft engineering method could reduce the impact of flooding and prevent flooding

A soft engineering method is to **build a dam/plant trees**.

This method works because:

A hard engineering method is to **build a dam/plant trees**.

This method works because:
