

How can rivers be managed?

To be able to identify different management strategies, distinguishing between hard and soft engineering (4-5)

To be able to give the advantages and disadvantages of different management strategies, distinguishing between hard and soft engineering (6-7)

To be able to give a detailed argument, quoting specific advantages and disadvantages of different management strategies to back up your point (8-9)

Literacy Target:

Give written arguments for and against river management strategies

Hard & Soft Engineering Techniques

- **Hard Engineering** is a method of river flood management which involves major construction work such as building artificial structures to control flooding.
- **Soft Engineering** is a method of river flood management which works with natural river processes.

HARD ENGINEERING

DAMS & RESERVOIRS

(hold back & release water in a controlled way)



ADVANTAGES

1. Controls the discharge of the river.
2. Held back water in reservoir can be used to generate hydroelectric power;
3. Held back water in reservoir can be used as drinking water.

DISADVANTAGES

1. Very expensive;
2. Requires large amounts of land;
3. Eroded material is deposited in the reservoir and not along the river's natural course so farmland downstream can be less fertile.

STRAIGHTENING OF RIVER

(The river's course is straightened by removing meanders)



ADVANTAGES

1. Water is moved away quickly, protecting immediate area;
2. Long-lasting.

DISADVANTAGES

1. Altering river channel may lead to flooding downstream, as water is carried there faster;
2. Could lead to more erosion downstream because the water's flowing faster.

EMBANKMENTS

(Raised river banks)



ADVANTAGES

1. Can be used as a riverside path for pedestrians;
2. Concrete embankments stop river bank erosion;
3. Earth embankments provide a habitat for plants & animals.

DISADVANTAGES

1. Expensive
2. They are often not built high enough;
3. Concrete embankments look unnatural and spoil the view.

FLOOD RELIEF CHANNELS

(Building new artificial channels which are used when a river is close to maximum discharge)



ADVANTAGES

1. Homes close to main river safer as flood water is diverted away from them;
2. Can be used for water sports.

DISADVANTAGES

1. Requires large amount of land;
2. Extremely expensive.

SOFT ENGINEERING

WARNING SYSTEMS

(news reports or sirens give warning of flood)



ADVANTAGES

1. Relatively cheap;
2. May allow people time to prepare their home (e.g. move possessions and valuables upstairs) and evacuate.

DISADVANTAGES

1. Warnings don't stop a flood from happening.
2. Living in a place that gets lots of warnings could make it difficult to get insurance.
3. People may not hear or have access to warnings.

PREPARATION

(Buildings modified and people prepared)



ADVANTAGES

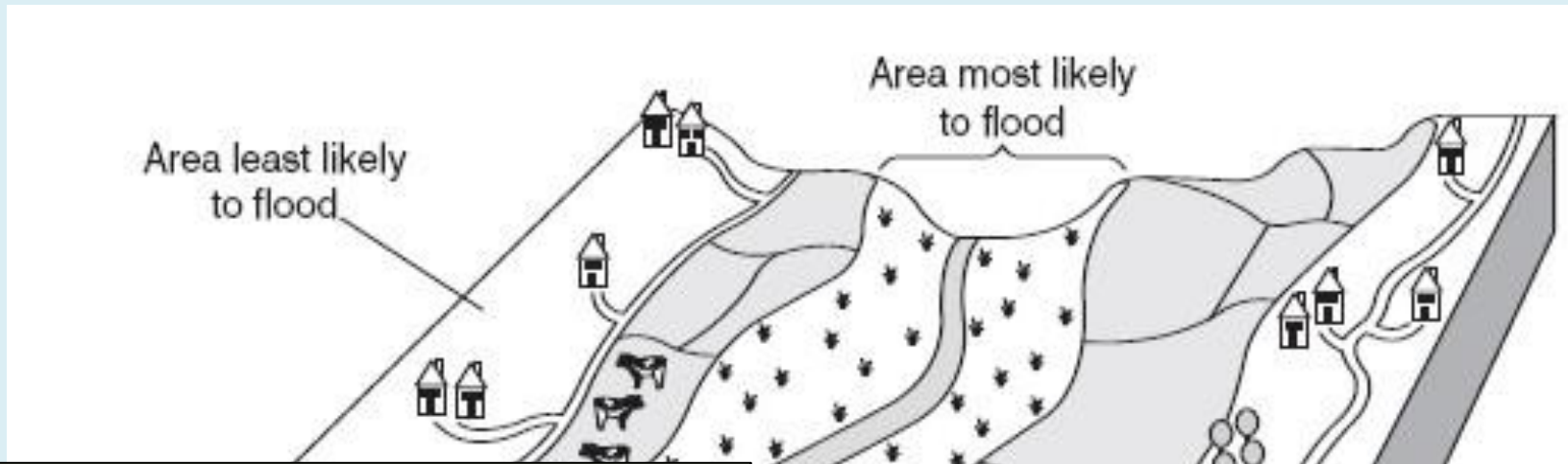
1. The impact of flooding is reduced — buildings are less damaged and people know what to do when a flood happens.
2. People are also less likely to worry about the threat of floods if they're prepared.

DISADVANTAGES

1. Preparation doesn't guarantee safety from a flood.
2. It could give people a false sense of security.
3. It's expensive to modify homes and businesses.

FLOODPLAIN ZONING

(control development close to floodplain)



ADVANTAGES

1. Cheap;
2. Sustainable;
3. Reduces surface run-off, because less tarmac near river.
4. The impact of flooding is reduced — there aren't any houses or roads to be damaged.

DISADVANTAGES

1. Local people may not be happy, particularly if there is a housing shortage;
2. The expansion of an urban area is limited if there aren't any other suitable building sites.
3. It's no help in areas that have already been built on.

PLANTING TREES

(plant trees in drainage basin - afforestation)



ADVANTAGES

1. Relatively low cost option;
2. Improved quality of environment;
3. Trees absorb water, reducing infiltration and run-off.

DISADVANTAGES

1. Conifers may make soil acidic;
2. May spoil the view if too densely planted;
3. Increased fire risk.

RIVER RESTORATION

(Where a river's course has been changed artificially, river restoration can return it to its original course)



ADVANTAGES

1. River restoration uses the natural processes and features of a river, such as meanders and wetlands, to slow down river flow and reduce the likelihood of a major flood
2. River wildlife ecosystems return.
3. Little maintenance is needed as the river is left in its natural state.

DISADVANTAGES

1. Local flood risk can increase.
2. people prefer the reliability of hard engineering constructions to protect their properties from flooding.

Hard & Soft Engineering Techniques

Write a leaflet to inform York Council about different flood control techniques.

Your leaflet must include:

- **Definitions** of hard and soft engineering
- **Examples of hard engineering** – including a description, costs and benefits
- **Examples of soft engineering** – including a description, costs and benefits