

River Basin Management

# CHOOSING THE SITE FOR DAMS



# Choosing a site!

Once a social and economic need for a dam has been established, other factors need to be considered before construction can go ahead. A Climate survey is conducted as well as a survey of the catchment area (for example relief, geology, water supply and land use). The dam site is hugely important in determining how successful it will be. The site has to take account of several **PHYSICAL** and **HUMAN** factors.



**Work in pairs.** For each of the categories listed below, discuss and decide how it might determine a dam's site. Be prepared to feedback.

Rock type

Water supply

Tectonic activity

Valley shape

Permeability of rock

temperature

Nearby cities

Historical sites

Accessibility

Valuable farmland within drainage basin

Relief of the land

Wildlife habitats

# Physical Factors

Draw a spider diagram or table to describe and explain the important site factors as we work through the next few slides

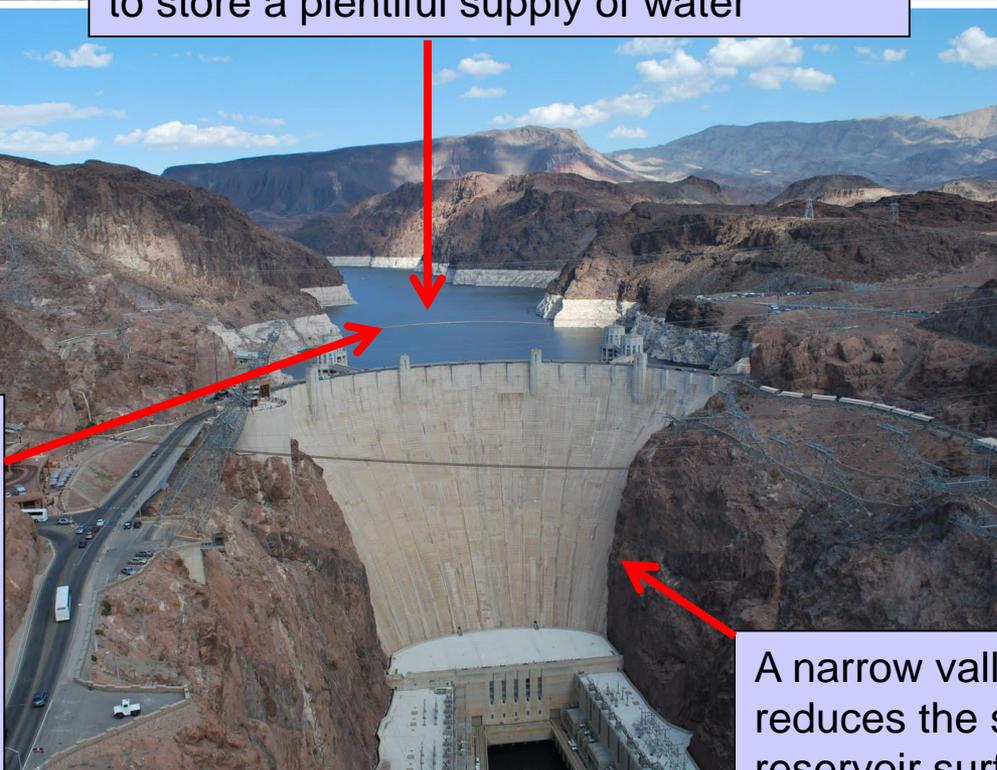
## 1. Valley Shape

Valley should be deep enough to allow it to store a plentiful supply of water



The canyons of the Upper Colorado River in the USA are narrow which reduces cost (e.g. Glen Canyon Dam only 475m wide)

A narrow valley also reduces the risk of water being lost through evaporation as there is less surface area of reservoir for the sun to affect.



A narrow valley (V-Shaped) reduces the size of the dam and reservoir surface area which cuts down costs in building.

# Physical Factors

## 2. Rock Type

The rock should be impermeable so it does not allow water to seep through from the reservoir above it.

The rock has to be strong enough to support weight of dam and the water contained in the reservoir.



The reservoir behind the Three Gorges Dam in China weighs more than 39 trillion kilograms (42 billion tons).

# Physical Factors

## 3. Temperature

Dams should be preferably built where temperatures are reasonable low to reduce rates of evaporation

The Merowe Dam in Sudan has evaporation losses of up to 1,500,000,000 m<sup>3</sup> per year as a result of the high temperatures within the drainage basin



# Physical Factors

## 4. Water Supply

The dam should be in an area where it is fed by rivers which have a plentiful water supply, usually from precipitation in the mountains or snowmelt. This gives enough water to store. Fast flowing rivers also allow the generation of HEP

High winter snowmelt in the Upper Course of the Colorado River in the USA gives a regular input of water so reservoirs are regularly topped up



# Physical Factors

## 5. River Load

Load of river (the amount of material it carries) should be low to prevent silting up of the reservoir and clogging up of the dam.

Lack of vegetation in parts of the Colorado River Basin encourages high erosion rates therefore many of the streams have high sediment loads which deposit in the lakes and take up space, reducing the capacity to hold water and making the water muddy, so it has to be passed through expensive filtering systems

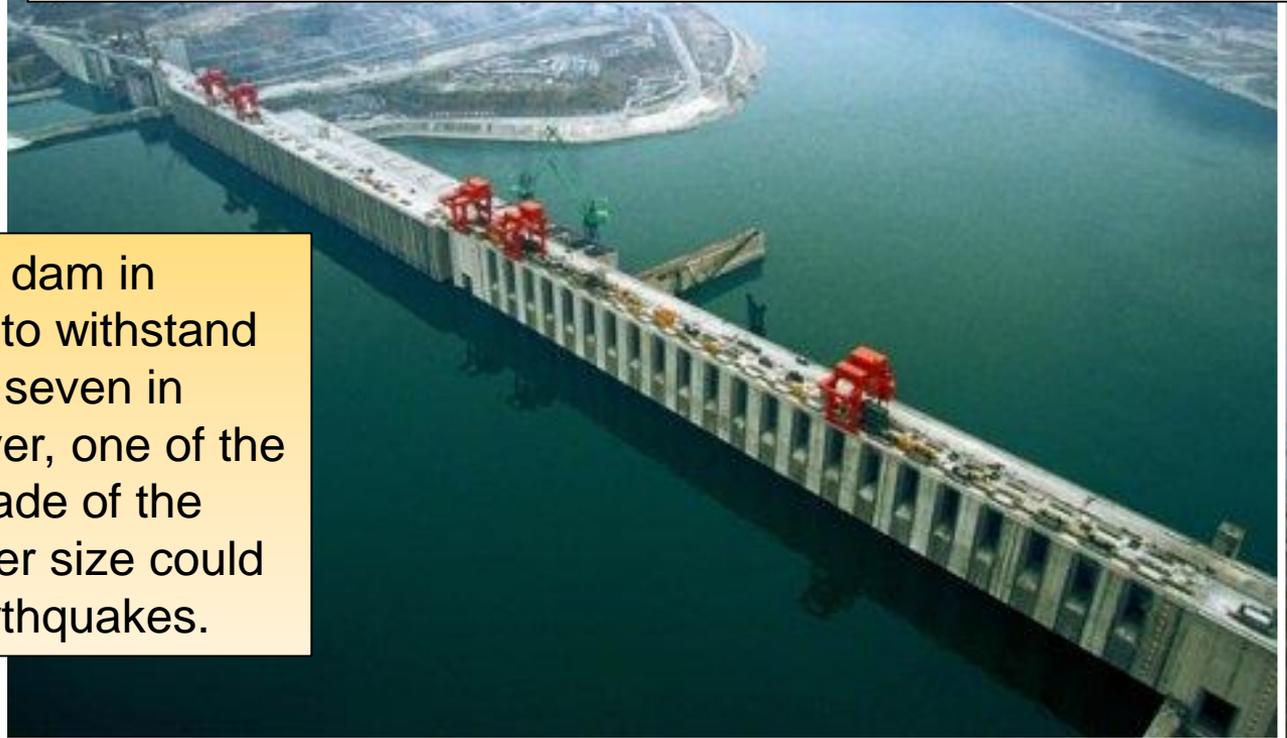


# Physical Factors

## 6. Stable, Solid Foundations

The site should provide a stable, solid foundation for the dam. It should be free from subsidence which would cause a dam to sink, or should avoid areas where tectonic activity is high, with potential earthquake damage causing the dam to rupture, releasing massive amounts of floodwater.

The Three Gorges dam in China is designed to withstand earthquakes up to seven in magnitude. However, one of the many criticisms made of the dam is that its sheer size could actually trigger earthquakes.



# Human Factors

## 1. Land Use

The current land uses in the drainage basin have to be considered. For example, will the reservoir flood towns and villages? If so, the residents will need to be displaced, offered new settlements and compensation.

Also, the dam should avoid the destruction of valuable farmland which provides a food source and income for the country.

Brazil's Belo Monte Dam complex is designed to divert 80% of the Xingu River's flow, devastating an area of over 1,500 square kilometres of Brazilian rainforest while resulting in the forced displacement of between 20,000 - 40,000 people.



# Human Factors

## 2. Historical Interest



If there are archaeological sites or areas of cultural / historic interest in the drainage basin, there is a danger that a dam and its reservoir could flood these sites, causing such heritage to be lost forever.

As a result of the construction of the Aswan dam on the river Nile, much of Lower Nubia region was submerged under the reservoir created by the dam, destroying monuments and archaeological sites.

# Human Factors

## 3. Communications / Road networks

The dam site needs to be accessible during construction and once in operation. There needs to be existing road access to the site or the potential to build new roads / widen existing ones.

The dam should however avoid disrupting existing road and rail networks as these can be expensive to re-route.

The Grand Renaissance dam is under construction in Ethiopia with temporary access and permanent roads with total length of 122.7 km being constructed, and Assosa-Guba road having to be re-routed.



# Exam Type Question

**Explain** the human and physical factors that have to be considered when selecting sites for dams and their associated reservoirs

(8)



## How to Answer:

Do the physical factors first:

- Describe the factor in detail
- Explain its importance
- Give an example to illustrate

Then do the same for the human factors

# Mark Scheme



## Physical factors might include:

- Geologically stable area away from earthquake zones/fault lines.
- Solid rock foundation for weight of dam.
- Narrow valley cross-section to reduce dam length.
- Large, deep valley to flood behind dam to maximise amount of water storage.
- Lack of permeability in rock below and around reservoir to prevent seepage.
- Low evaporation rates.
- Large catchment area above dam to provide reliable water supply.

## Human factors might include:

- Cost of dam construction.
- Proximity of urban area for water and electricity.
- Proximity of agricultural areas for irrigation.
- Cost of displacing people.
- Cost of compensating farmers and home owners.
- impact on communications.
- Unstable political situation and internal conflict eg Zimbabwe.