4 How have humans influenced river environments?

In all drainage basins, apart from those that are very remote and inaccessible, humans alter the landscape both directly and indirectly by altering the processes that shape the landscape. The different ways that humans change their environment may be at odds with one another and conflicts may result. There will also be conflict with the physical processes at work and as human populations within drainage basins increase, these conflicts are likely to become greater. Drainage basin management, or catchment management as it is often referred to, must take into account these potential conflicts and attempt to predict and resolve them. In this section we will consider both the direct and indirect ways in which humans can affect river environments.

How have people directly altered river channels?

Over the last one hundred years particularly, river channels have been altered mainly to prevent flooding, to aid transport, and to reduce erosion. These channel modifications are known as **channelisation** and result in a river that may have been altered in cross-section, gradient, and flow characteristics. The main techniques of channelisation are shown in Figure 1.74.

Name of technique	Impact on the channel
Resectioning	The depth and/or width of the channel is altered in order to alter the amount of water it can hold (its capacity).
Re-aligning or straightening	Part of the river channel is removed creating an artificial cut-off. Removing a section of the river means that the river is shortened. As a result, the gradient of the river bed is steeper. This increases the speed of flow in this stretch of the river.
Constructing levees	Flood banks confine the river flow within a smaller area.
Bank protection	This stabilises the banks and prevents erosion. Gabions (rock baskets) or concrete liners are commonly used.
Clearing	Clearing the channel of any obstructions including sediment and vegetation.

Figure 1.74 *Channelisation techniques and their impacts.*

ACTIVITIES

1. For each of the methods of channelisation shown in Figure 1.74, suggest how they would help to prevent floods.
2. What impact do you think these methods of channelisation would have on the plants and animals that live in or close to the river?

Most major rivers have been channelised to varying degrees. The River Trent that runs from its source at Biddolph Moor, just north of Stoke-on-Trent, to the Humber estuary has been channelised along certain sections in order to prevent flooding. When the Trent reaches Nottingham, the average flow is 54.3m^3/sec., though this varies considerably. During the last major flood in 1947 the average flow rose more than twenty times to 1132m^3/sec., whilst in the severe drought of 1975–76 it dropped to only 18m^3/sec.! The potential hazards from flooding have been made worse in Nottingham by the further growth of the urban area onto the floodplain. Figure 1.76 shows how little undeveloped floodplain remains in Nottingham. This causes more rapid surface run-off and a faster rise in river levels. However, changes made to the river channel and floodplain since 1947 have, so far, successfully reduced the impacts of flooding. See Figures 1.75 and 1.76.

Figure 1.75 *The River Trent at Trent Bridge in Nottingham where it has been widened and lined with concrete.*

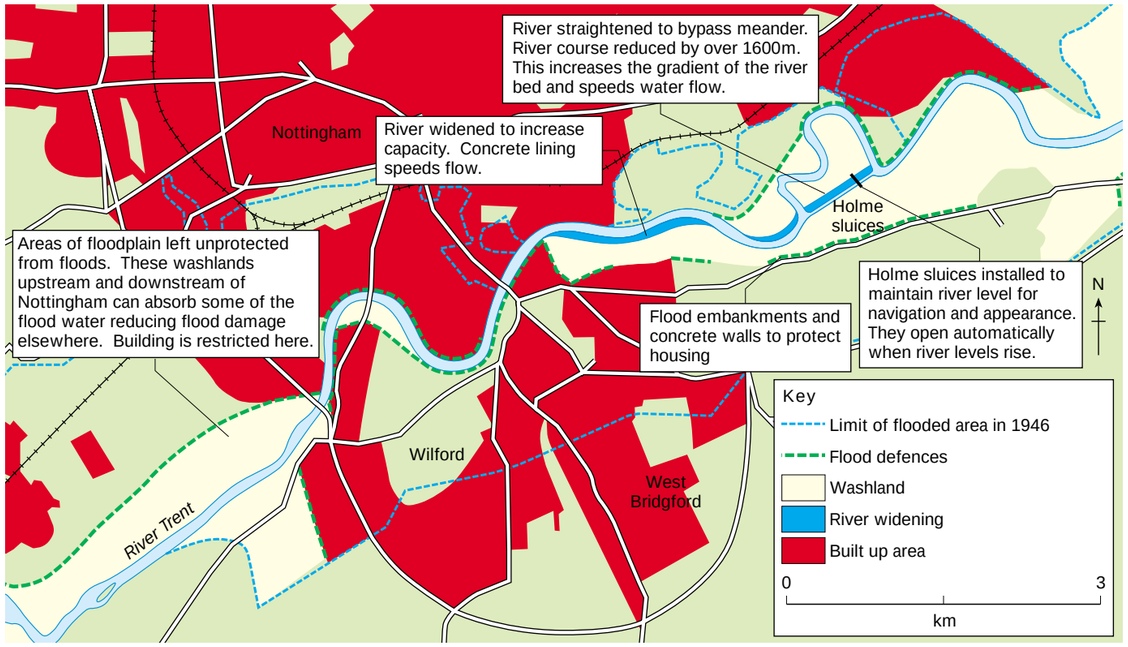

Figure 1.76 *Channelisation of the River Trent in Nottingham has reduced the risk from flooding.*

Regulating river flow: The use of dams

Whilst channelisation of river channels may extend over great lengths, the building of a dam takes place at a specific location. However, the impact of the dam is usually not confined solely to that location. Most dams are built in narrow, upland valleys but they can be built in lowland areas where local conditions are suitable, for example Rutland Water in the East Midlands. This site was chosen for proximity to demand, and relies on a supply of water pumped from local rivers for its water supply rather than the direct flow of a single river.

In the second half of the 19th century, the numbers of large dams (those 15 m high or more) escalated as technology developed. There are now more than 45,000 large dams worldwide. They were often, and sometimes still are, seen as prestige projects and indicators of engineering excellence. However, studies set up to evaluate the success of such projects suggest that the advantages of dam construction may no longer outweigh the disadvantages. The number of large dam projects undertaken has started to decline in the last two decades, though one particular development in China is still progressing and is attracting a great deal of interest because of the unimaginable size of the project.

ACTIVITIES

1 Dams and reservoirs are often described as being multipurpose. Make a list of the reasons why dams may be built.
2 Suggest why most dams are built in upland areas. Why might lowland locations still be considered?

The Three Gorges dam

The largest and one of the most controversial dams being built at present is the Three Gorges Dam on the Yangtze river in central China. The dam was first proposed more than 80 years ago, construction started in 1993 and it is not expected to be finished until 2009. The final cost is expected to be around £45 billion. The scale of the resettlement programme and the possible environmental impacts of the enormous dam have caused great political and public debate both abroad and, more recently, within China itself. Pressure from environmental groups and doubts about the effectiveness of the scheme have caused some investors and foreign consultants to pull out.

A major concern is the large amount of sediment carried by the Yangtze which will be trapped behind the dam. In order to reduce sedimentation rates, it is likely that sediment-rich water which arrives mainly during the four-month flood season will be released from the dam and only water flowing into the reservoir between floods will be stored. The irony is that this will reduce its effectiveness as a flood control measure. Figures 1.77 and 1.78 give two alternative views of the project.

The Three Gorges dam – who will benefit?

The sheer scale of the Three Gorges Dam daunts the imagination. No fewer than 1.3 million people are to be forced to leave homes which have been inhabited for centuries along the stretch of river between Chongqing and the brash new city of Yichang. Four cities, eight towns, and 356 large villages will be submerged, along with countless farms and acres of land. The dam's purpose is to control the devastating annual floods along the world's third longest river, to generate electricity for China's development and thus to cut pollution by replacing 50 million tons of raw coal combustion every year.

An enormous human tragedy is in the making as the Chinese government will almost certainly have to send in troops to get the peasants out of their ancestral homes over the next eight years.

People complained that the compensation offered for their homes was far below the amount they need to buy apartments in the blocks that are under construction. The gleaming new cities are rising all along the Yangtze above the 536ft (160m) mark to which the waters will rise.

Figure 1.77 *Extracts from 'The Three Gorges Dam – who will benefit?' by Michael Sheridan.*
Source: The Sunday Times, *14 March 1999.*

Advantages of the scheme include:

- Reduced flood risk in the lower reaches of the Yangtze. Recurrence interval for floods increased from ten years to 100 years.
- The dam will generate 84.68BkW of hydro-electric power a year.
- The resettlement programme will benefit local people because of the economic development that will take place in the region.
- Relocated people will maintain and improve their standard of living.
- Navigation will be improved and there will be scenic views from the boats.
- Endangered animals such as the Chinese river dolphin will be protected in reserves.

Figure 1.78 *Wang Rushu: Senior Engineer, Three Gorges Project Development Corporation, Yichang, China.*