Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

discharge: the volume of water passing a point in a river each second, in m^3/s (cumecs); lag time: the time between peak rainfall and peak discharge

2.2

peak discharge = **45** m^3/s; peak rainfall in hour 4, peak discharge in hour 10; lag time $= 10 - 4 =$ **6** hours

2.3

concrete, tarmac and roofs are impermeable, so rain cannot infiltrate and runs off over the surface quickly; drains and sewers carry water straight to the river

2.4

nitrates and phosphates in the fertilizer feed fast algae growth (an algal bloom); the algae die and bacteria decompose them, using up the oxygen in the water; fish cannot get enough oxygen and die (eutrophication)

2.5

hard: e.g. embankments/levees raise the river banks; they protect a large built-up area but are expensive and can move the flood downstream; soft: e.g. floodplain wetlands or zoning; cheaper and good for wildlife, but need land and may not stop a very large flood

3.1

(a) urban: peak at hour 8, so lag $8 - 4 = 4$ h; rural: peak at hour 14, so lag $14 - 4 = 10$ h; difference = **6** hours

(b) any two, explained: impermeable surfaces stop infiltration, so more of the rain becomes fast surface runoff; drains carry water quickly to the river, so the water arrives together and the peak is higher; the forest intercepts rain and stores it in soil, so the rural water reaches the river slowly over a longer time

3.2

Mark with the markbands: [9-10] focused on the command term, detailed and accurate knowledge, well-developed explanation, specific named examples (places, dates, numbers), balanced evaluation and a supported conclusion; [7-8] mostly focused, good knowledge and examples, some evaluation; [5-6] relevant knowledge and examples, explanation partly developed, little evaluation; [3-4] general knowledge, few examples, mostly description; [1-2] little that is relevant. Points that may be included: Three Gorges Dam (Yangtze): flood control: the reservoir can store flood water and lower the risk to cities downstream; about 22.5 GW of hydroelectricity, which replaces coal and cuts CO_2; larger ships can reach Chongqing, which helps trade inland; costs: about 1.3 million people were moved, many losing farmland and communities; cultural sites and towns were flooded; the dam traps sediment, so the delta and coast downstream get less sediment and can erode; landslides on the reservoir banks and pollution in the still water; floods can still come from tributaries below the dam, so it does not remove flood risk; conclusion: large benefits for energy and flood control at national scale, but heavy costs for local people and ecosystems; the balance depends on who is judging

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