



GEO.HU12 Increasing Water Supply: Large-Scale Engineering Schemes

AQA 8035 · Calculators not allowed · about 50 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** State the country where the Lesotho Highlands Water Project is located, and the South African region that receives its water.

(Total for Question 1 is 1 mark)

- 2** Give one primary physical feature that must be built to store water in the Lesotho Highlands Water Project.

(Total for Question 2 is 1 mark)

- 3** Describe briefly how tunnels are used in the Lesotho Highlands Water Project to move water from Lesotho to South Africa.

(Total for Question 3 is 2 marks)

- 4** Describe one economic benefit to Lesotho from hosting the Lesotho Highlands Water Project.

(Total for Question 4 is 2 marks)

- 5** Give one environmental cost associated with building large dams and reservoirs in the Lesotho Highlands Water Project.

(Total for Question 5 is 1 mark)

- 6 Explain briefly why Gauteng benefits from the Lesotho Highlands Water Project in terms of water security for households and industry.

(Total for Question 6 is 2 marks)

- 7 Explain TWO social costs experienced in Lesotho as a result of the construction of reservoirs for the Lesotho Highlands Water Project.

(Total for Question 7 is 3 marks)

- 8 Label the main features shown in this simplified diagram of a large-scale transfer scheme similar to the Lesotho Highlands Water Project: A. dam reservoir, B. tunnel through mountains, C. hydroelectric power station, D. inter-basin transfer outlet to recipient region. Provide the correct feature name for each letter.

Figure (to be drawn): Simplified diagram: highland reservoir behind a dam, arrows showing tunnels through mountains, small power station symbol below dam, pipe leading to plains labelled recipient region

(Total for Question 8 is 4 marks)

- 9 Using the Lesotho Highlands Water Project as an example, suggest one reason why the construction costs of large-scale water transfer schemes are very high.

(Total for Question 9 is 2 marks)

- 10** Calculate the following. A reservoir created by a dam stores 1,200 million cubic metres of water. Each year 200 million cubic metres are transferred to Gauteng for use. How many years would it take to transfer an amount equal to half the stored volume? Show your working.

(Total for Question 10 is 2 marks)

- 11** Explain how hydroelectric power included in the Lesotho Highlands Water Project provides a benefit to Lesotho beyond royalty income from water sales.

(Total for Question 11 is 3 marks)

- 12** Give TWO financial or economic drawbacks that Lesotho or South Africa may face because of the Lesotho Highlands Water Project.

(Total for Question 12 is 3 marks)

- 13** Suggest one way the negative social impacts of displacement caused by dam construction could be reduced in a future large-scale transfer scheme.

(Total for Question 13 is 2 marks)

- 14** Explain TWO reasons why large-scale inter-basin water transfer schemes like the LHWP can be controversial between donor and recipient countries.

(Total for Question 14 is 3 marks)

15 Use the Lesotho Highlands Water Project and other relevant examples to answer this question.

'Evaluating the costs and benefits of large-scale water transfer schemes shows that benefits outweigh costs.' To what extent do you agree with this statement?

'Evaluating the costs and benefits of large-scale water transfer schemes shows that benefits outweigh costs.' To what extent do you agree with this statement? Use evidence in your answer.

(Total for Question 15 is 8 marks)

Mark scheme · GEO.HU12 Increasing Water Supply: Large-Scale Engineering Schemes

Question 1

- **B1** Lesotho; Gauteng (South Africa) or equivalent phrasing
- **Answer: Lesotho; the water is transferred to Gauteng in South Africa.**

Question 2

- **B1** a dam (e.g. a reservoir dam) or reservoir, oe
- **Answer: A dam (forming a reservoir).**

Question 3

- **B1** water flows through long man-made tunnels drilled through mountains, oe
- **B1** tunnels transfer stored water downhill or across a watershed into South Africa, providing a controlled route for inter-basin transfer, oe
- **Answer: Water is passed through long man-made tunnels drilled through the highland mountains; the tunnels convey stored water downhill and across the watershed into South Africa as part of the inter-basin transfer.**

Question 4

- **B1** Lesotho receives income from water royalties or payments from South Africa, oe
- **B1** this income can be used to invest in infrastructure and public services in Lesotho, oe
- **Answer: Lesotho receives income from water royalties paid by South Africa; this revenue can be used to invest in national infrastructure and public services.**

Question 5

- **B1** habitat loss or flooding of land/river valleys, oe
- **Answer: Habitat loss from flooding river valleys when reservoirs are created.**

Question 6

- **B1** the project provides a reliable extra source of water to Gauteng, reducing supply shortages, oe
- **B1** this supports domestic use and allows factories and mines to maintain production, reducing economic disruption, oe
- **Answer: The LHWP supplies a reliable additional source of water to Gauteng, reducing shortages; this secures household supplies and allows industry and mining to continue operating without water-related interruptions.**

Question 7

- **B1** displacement of communities due to flooding of land for reservoirs, oe
- **B1** loss of farmland or grazing land, affecting livelihoods, oe
- **B1** cultural or social disruption for relocated communities, e.g. loss of ancestral sites or community networks, oe
- **Answer: Communities were displaced when land was flooded to make reservoirs, leading to loss of farmland or grazing and damage to livelihoods, and relocation caused social and cultural disruption such as loss of ancestral sites and community networks.**

Question 8

- **B1** A: dam or reservoir
- **B1** B: tunnel(s) through mountains or transfer tunnel
- **B1** C: hydroelectric power station or power plant
- **B1** D: inter-basin transfer outlet or transfer to Gauteng/recipient region
- **Answer: A: dam or reservoir; B: tunnel through mountains (transfer tunnel); C: hydroelectric power station; D: inter-basin transfer outlet to the recipient region (Gauteng).**

Question 9

- **B1** because of expensive engineering work required, e.g. building large dams, tunnels through hard rock and long transfer infrastructure, oe
- **B1** linked detail, e.g. remote highland locations increase transport and labour costs, oe
- **Answer: Because of the costly engineering: constructing large dams and long tunnels through hard rock is expensive, and remote highland locations increase transport and labour costs.**

Question 10

- **M1** $0.5 \times 1,200 = 600$ million cubic metres and $600 / 200$ seen, oe
- **A1** 3 years cao
- **Answer: 3 years. Working: half of 1,200 million m³ = 600 million m³; $600 / 200 = 3$ years.**

Question 11

- **B1** hydroelectric power supplies electricity for domestic use and industry in Lesotho, oe
- **B1** this reduces dependence on imported electricity or fossil fuel generation, lowering energy costs or improving energy security, oe
- **B1** surplus electricity can be sold or used to power local development, supporting economic growth, oe
- **Answer: The hydroelectric power provides electricity for domestic use and industry in Lesotho, reducing reliance on imports and fossil fuels and improving energy security; surplus power can be sold or used to support local development and economic growth.**

Question 12

- **B1** very high initial construction costs leading to long-term debt, oe
- **B1** ongoing maintenance and repair costs for dams and tunnels, oe
- **B1** economic dependence on a single large project or on payments that might be renegotiated, oe
- **Answer: High initial construction costs causing long-term debt; ongoing maintenance and repair costs for the complex infrastructure; and a risk of economic dependence on payments that could be renegotiated or reduced.**

Question 13

- **B1** resettlement with fair compensation and provision of equivalent land, housing and services, oe
- **B1** linked detail, e.g. involving affected communities in planning and providing training or livelihoods support, oe
- **Answer: Provide resettlement with fair compensation and equivalent housing and services, and involve affected communities in planning while offering training and livelihoods support to replace lost incomes.**

Question 14

- **B1** questions over who benefits most, e.g. recipient region gains water while donor region may suffer local costs, oe
- **B1** disputes about adequate compensation or royalties for displaced people and affected communities, oe
- **B1** political and environmental concerns, e.g. changes to river flow affecting downstream users and international agreements, oe
- **Answer: They can be controversial because of disagreements over who benefits most, with the recipient region gaining water while local donor communities bear costs; disputes arise about fair compensation and royalties for displaced people; and political and environmental concerns exist over altered river flows affecting downstream users and international relations.**

Question 15

- **Level 3** (7-8): A detailed, balanced evaluation that uses specific, accurate reference to the LHWP and at least one other example or general evidence; weighs economic, social and environmental costs against benefits such as water security, hydroelectric power and income, and reaches a clear, justified judgement about the extent to which benefits outweigh costs.
- **Level 2** (4-6): A clear evaluation with some specific reference to the LHWP or another example; both costs and benefits are considered but the analysis may be less developed or less well balanced; a conclusion is given but may lack full justification.
- **Level 1** (1-3): Some relevant points about costs or benefits are made, with limited or generalised detail and little evaluation; a simple or unsupported conclusion may be given.
- **Indicative content:**
 - Benefits: provides reliable water supply to high-demand urban and industrial regions (e.g. Gauteng), supporting economic activity, jobs and public water supply security.
 - Benefits: hydroelectric power generation provides energy for the donor country (Lesotho), improving energy security and offering a revenue stream from electricity sales.
 - Benefits: royalty payments and associated infrastructure investment can provide significant government income for the donor country and funds for development projects.
 - Costs: social costs include displacement of communities, loss of farmland and cultural sites, and long-term social disruption for relocated people.
 - Costs: environmental costs such as habitat loss, altered river flows downstream, changes to aquatic ecosystems and sedimentation issues in reservoirs.
 - Costs: very high construction and maintenance costs leading to long-term debt burdens; financial risk if projected payments are renegotiated or shortfalls occur.
 - Evaluation points: weigh the scale and distribution of benefits against localized but severe social and environmental harms; consider time scale, e.g. long-term economic gains versus immediate social displacement.
 - Evaluation points: consider alternatives or complementary measures, such as demand management, water recycling and smaller-scale projects, and whether a mixed strategy reduces risks.
 - A supported judgement should state whether, for the context used, the economic and supply benefits justify the social and environmental costs, or whether costs outweigh benefits, with evidence and reasoned justification.