

Exercise walk-through

2.4

Earth Resources

GAC Science

Method — Key knowledge: a local record combines physical, chemical and biological evidence

A **renewable** resource can be replenished on a relevant timescale, but use can exceed replacement. A **non-renewable** resource is not replaced fast enough on human use timescales. The **water cycle** involves evaporation, condensation, precipitation and movement or storage through runoff, infiltration and groundwater. A local reservoir is not a closed system: water can enter and leave its study boundary. Describe physical features, chemical measurements and living components separately before connecting them.

Method — Source A: text or task brief

Fictional local-environment record: a pond beside a school garden receives rainfall and a stream inflow; water leaves through an outlet and evaporation. During a defined observation period, inflow plus rainfall is estimated at 30 m^3 , outlet flow at 18 m^3 and evaporation at 7 m^3 . For this simplified budget only, ignore other changes and assume the estimates share the same period. No drinking-water safety claim is intended.

The site includes exposed layered rock, loose sediment, reeds and insects. A permitted report uses a teacher-supplied map for physical layout, dated water measurements for specified chemical indicators, and non-destructive records of organisms. A proposed water-use plan would remove another 12 m^3 during the same period. No permission or revised monitoring plan has been agreed.

Method — Source B: response or review record

Student report: “Water is renewable, so any extraction is sustainable. The pond is a closed water cycle and cannot lose storage. Reeds prove the water is safe for drinking. Layered rock proves every rock at the site is sedimentary and gives its exact age. We can decide from a website photograph alone, and need not cite where the map or water data came from.”

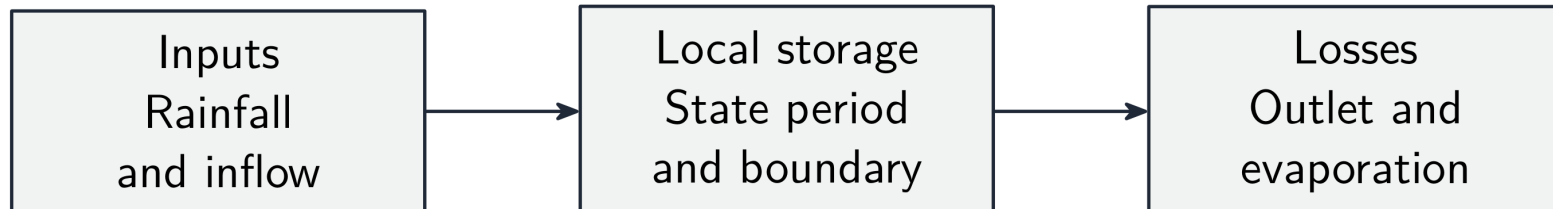
Method — Worked example: state the simplified boundary before calculating storage change

Known: estimated input 30 m^3 , outlet loss 18 m^3 and evaporation 7 m^3 . Why subtract losses from inputs? The simplified budget accounts for changes in storage within the pond boundary.

$$\Delta S = I - O - E$$

$$\Delta S = 30 - 18 - 7 = 5 \text{ m}^3$$

This estimate excludes other processes by assumption. It is not evidence that future extraction is sustainable or that the water is potable.



Exercises 2.1-2.3

2.1 Identify ONE physical feature and ONE biological feature recorded at the site. [2]

2.2 Explain why the pond is not a closed local water system. [2]

2.3 Calculate the simplified storage change before and after the proposed extra extraction. [3]

Exercises 2.1-2.3

2.1 Identify ONE physical feature and ONE biological feature recorded at the site. [2]

2.1

: pond/stream layout, exposed layered rock or loose sediment.: reeds or insects. Water indicators may be chemical observations, not organisms.

2.2 Explain why the pond is not a closed local water system. [2]

2.2

: water crosses the boundary through rainfall or stream inflow.: it also leaves through outlet flow or evaporation.

2.3 Calculate the simplified storage change before and after the proposed extra extraction. [3]

2.3

: storage change = inputs – outlet – evaporation – extraction.: without extraction, $30 - 18 - 7 = +5 \text{ m}^3$.: with proposed extraction, $30 - 18 - 7 - 12 = -7 \text{ m}^3$ for the stated period.

Exercises 2.4·3.1

2.4 Explain THREE limits on calling the extraction plan sustainable. [3]

3.1 Evaluate the remaining website, rock and water-safety claims with six points. [6]

Exercises 2.4-3.1

2.4 Explain THREE limits on calling the extraction plan sustainable. [3]

2.4

each: proposed extraction exceeds the simplified period's net replenishment; one period does not establish long-term supply/seasonal variation; omitted processes and estimates need checking or approval is absent. Accept environmental flow/ecosystem requirements as a relevant additional check, not as an already measured result.

3.1 Evaluate the remaining website, rock and water-safety claims with six points. [6]

3.1

each: reeds do not establish drinking-water safety; the record supplies no relevant safety assessment; layering alone does not classify all rocks or establish exact age; a photo cannot replace suitable field/data checks; cite map and measurement sources with dates/methods; connect physical, chemical and biological evidence without treating one as proof of all the others.

Exercise 3.2

3.2 Write an 80–110-word local-resource summary and proposed next step.

[8]

Exercise 3.2

3.2 Write an 80–110-word local-resource summary and proposed next step. [8]

3.2

Local analytic rubric, 8 ×: identify local evidence types; describe open boundary; give +5 m³ initial estimate; give −7 m³ proposed estimate; bound simplified assumptions; reject unlimited renewable use; reject drinking-water/rock-age proof; propose cited approved monitoring; coherent truthful 80–110 word response. Example: “The supplied pond record includes physical features, chemical measurements and living organisms. Water crosses its boundary, so it is not a closed local system. Under the simplified assumptions, inputs exceed outlet and evaporation losses by five cubic metres. Adding the proposed extraction would give a seven-cubic-metre storage decrease for that period. These estimates need checking and do not establish long-term sustainability. Renewable water can still be used faster than it is replenished. Reeds do not prove drinking-water safety, and rock layering does not establish every rock’s exact age. A permitted follow-up should cite its sources and improve comparable monitoring.”