

Why is it important to manage drainage basins and catchment areas?	See mind map	4. CATCHMENT AND RIVER MANAGEMENT Importance of managing drainage basins and catchment areas <pre> graph TD DB((Drainage Basins)) DB --- A[are used for recreation e.g. water sports and holiday resorts] DB --- B[are sources of water for domestic, agricultural & industrial use] DB --- C[control water pollution] DB --- D[sustain plant and animal life/ecosystems] DB --- E[are used to construct permanent sources of water (dams) for human consumption and generation of hydroelectricity] DB --- F[provide food sources to people e.g. fish] DB --- G[control flow of water to reduce flooding] DB --- H[supply floodplains of large rivers with fertile soils for agricultural use] </pre>
What is the impact of people on drainage basins and catchment areas?	There are of course more impacts. You must be able to identify the impacts of people on diagrams or in case studies	Impact of people on drainage basins and Catchment areas <pre> graph TD C((Impact)) C --- D[WETLANDS] C --- M[Mining] C --- CFF[CITIES ON FLOODPLAIN] C --- DU[DOMESTIC USE] C --- V[VEGETATION] C --- Dams[DAMS] C --- A[AGRICULTURE] C --- WP[WATER POLLUTED] </pre> WETLANDS: DRAINING OF WETLANDS (Serve as sponges during flooding) MINING: Pollutes groundwater CITIES ON FLOODPLAIN: Decrease infiltration and can lead to flooding DOMESTIC USE: In informal settlements pollutes rivers VEGETATION: Removal can lead to flooding DAMS: Changes the flow of a river AGRICULTURE: Pesticides and fertilisers pollute rivers WATER POLLUTED: Industries, Sewage works

How must we manage drainage basins and catchment areas?

STRATEGIES:

Monitor water quality frequently

Municipalities must:

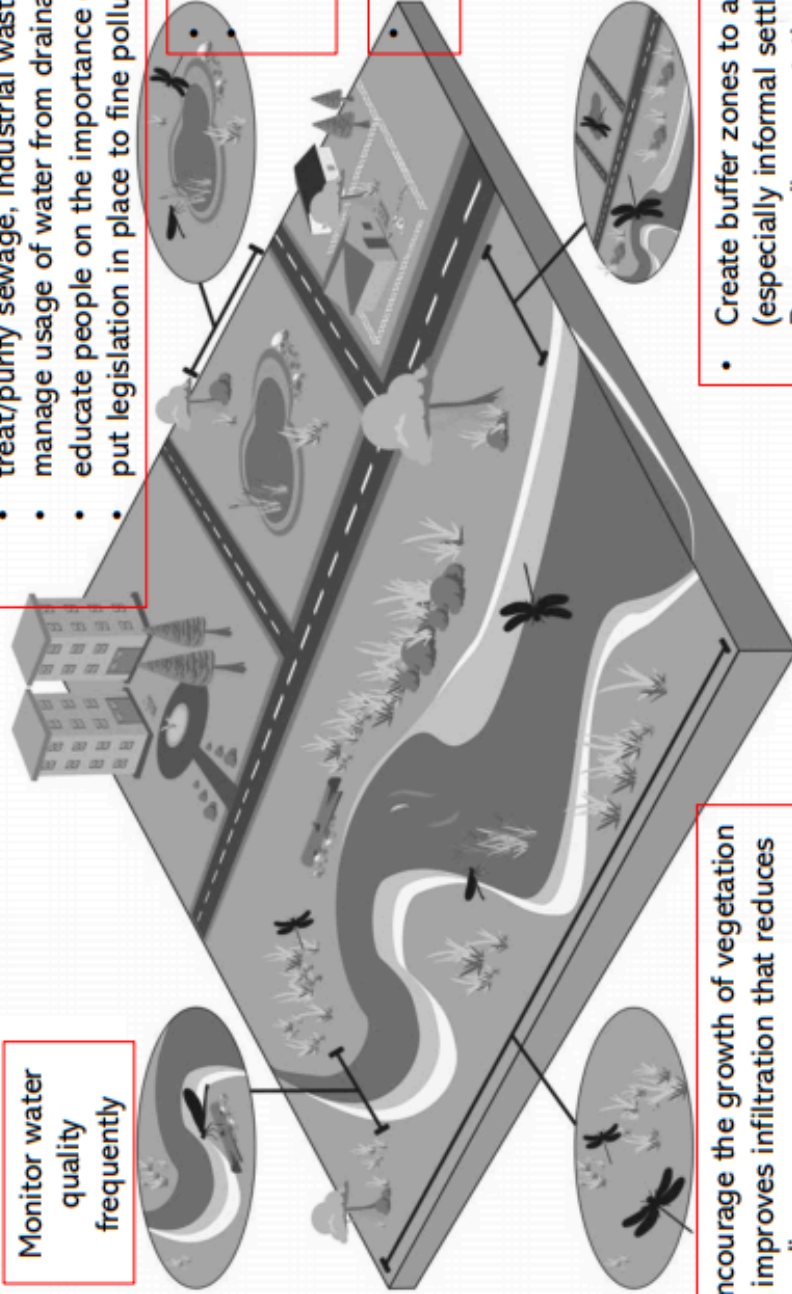
- treat/purify sewage, industrial waste water for re-use
- manage usage of water from drainage basins
- educate people on the importance of drainage basins
- put legislation in place to fine polluters

Protect wetland areas
It acts as a sponge - slowly releases water reducing flooding

Monitor overgrazing to reduce erosion

- Encourage the growth of vegetation
- It improves infiltration that reduces flooding

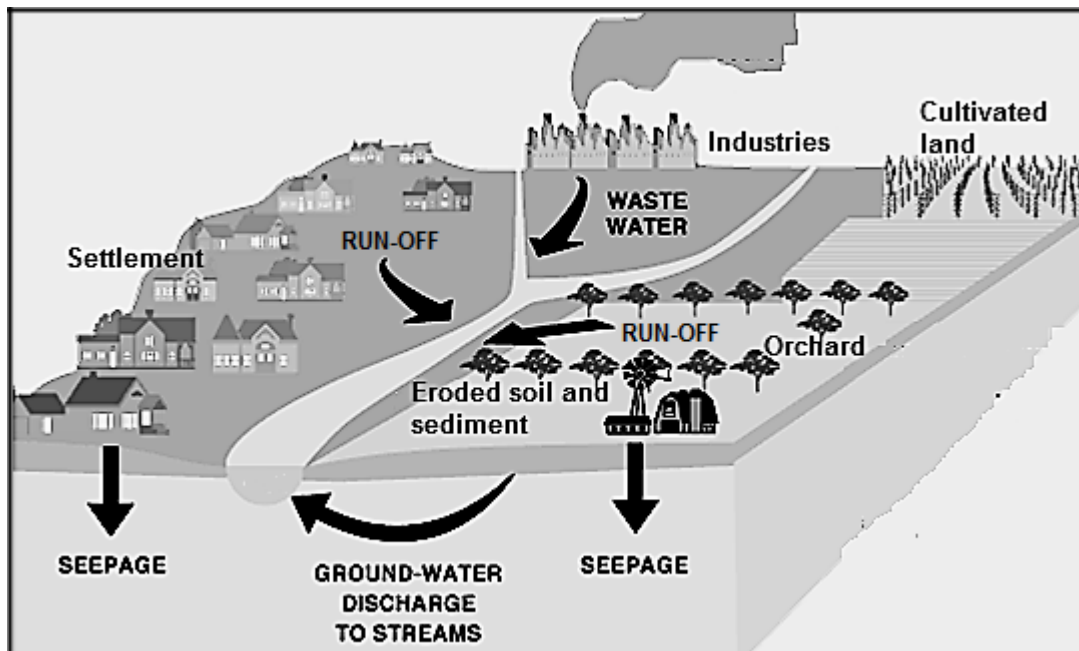
- Create buffer zones to avoid development (especially informal settlements) too close to rivers
- Remove alien vegetation – it uses lots of water



River management

Activity 39

FIGURE 1.6: CATCHMENT AND RIVER MANAGEMENT



1.6 Refer to FIGURE 1.6 showing catchment and river management.

- 1.6.1 What is the main source of waste water? (1 x 1) (1)
- 1.6.2 Discuss how the removal of the natural vegetation for human activities increased the eroded soil and sediments in the river. (1 x 2) (2)
- 1.6.3 Explain how run-off from both settlements and cultivated land decreases the quality of water of a river. (2 x 2) (4)
- 1.6.4 In a paragraph of approximately EIGHT lines, discuss why sustainable river management is important for all sectors of the economy. (4 x 2) (8)

Marking Guideline

1.6 Refer to FIGURE 1,6 showing catchment and river management.

1.6.1 What is the main source of waste water?

Industries (1) (1 x 1) (1)

1.6.2 Discuss how the removal of the natural vegetation for human activities increased the eroded soil and sediments in the river.

Lack of natural vegetation increases the runoff (2) (1 x 2) (2)

1.6.3 Explain how run-off from both settlements and cultivated land decreases the quality of water of a river.

SETTLEMENTS

Untreated sewage from settlement ends up in the river polluting the water and causing diseases (2)

Domestic waste water is released in drainage systems decreasing the quality of the water (2)

Grey water (dust, oil from roads) pollutes the river system (2)

Runoff from settlements carries waste material into the water (2)

[ANY ONE]

CULTIVATED LAND

Fertilizers used on farms is washed into the rivers causing eutrophication (2)

Pesticides used for crops is washed into the river polluting the water (2)

Soil erosion makes the water murky (2)

[ANY ONE]

1.6.4 In a paragraph of approximately EIGHT line, discuss why sustainable river management is important for all sectors of the economy.

SUSTAINABLE RIVER MANAGEMENT

Access to clean fresh water for future generations (2)

South Africa is a water scarce country (low unreliable rainfall) (2)

Better quality crops will be produced with higher yields (2)

Most industries need a good water supply to function productively (2)

Water is necessary for the production of products e.g. soft drinks, sweets, canned foods (2)

Higher exports with more profits from crops (2)

Healthier meat products with a better monetary value will be produced (2)

Rivers are a less expensive mode of bulk transport (2)

Good river management encourages eco-tourism/tourism/ recreation (2)

Good quality of water sustains farming/mining/fishing/forestry industry (2)

Maintaining rivers creates sustainable employment (2)

It allows for the generation of hydroelectricity which is an alternative source of power (2)

Decreases purification costs of drinking water (2)

Decreases water borne diseases therefore workforce is healthier (2)

It make water more affordable because there is less costs involved (2)

OR

UNSUSTAINABLE RIVER MANAGEMENT

Increases purification costs of drinking water (2)

Increases water born diseases therefore workforce is unhealthy (2)

Acidic water stunts plant growth (2)

Acidic water can hinder crop cultivation (2)

Contaminated water poses a health hazard (2)

Polluted rivers will affect the fishing industry (2)
Polluted rivers can contaminate oceans (2)

Activity 40

FIGURE 2.6: DEFORESTATION AND ITS IMPACT ON RIVER MANAGEMENT

GOING, GOING, GONE!

The current rate of deforestation worldwide is of great concern. Currently 12 million hectares of forests are cleared annually – an area 1,3 times the size of KwaZulu-Natal! Almost all of the deforestation occurs in the moist forests and open woodlands of the tropics. At this rate all moist tropical forests could be lost by the year 2050, except for isolated areas in Amazonia, the Zaire basin, as well as a few protected areas within reserves and parks. Some countries, such as Ivory Coast, Nigeria, Costa Rica and Sri Lanka are likely to lose all their tropical forests by the year 2030 if no conservation steps are taken.

DID YOU KNOW?

- The World Resources Institute regards deforestation as one of the world's most pressing land-use problems.
- An area of forest equal to 20 football or rugby fields is lost every minute.
- South Africa's climate is such that less than 0,5% of its surface area is covered with indigenous forest – great care should be taken to conserve the few forests we have.

[Adapted from
<https://www.environment.co.za/environmental-issues/deforestation.html>]

2.6 Refer to FIGURE 2.6, an extract based on the impact of deforestation on river management.

- | | | | |
|-------|---|---------|-----|
| 2.6.1 | What is <i>deforestation</i> ? | (1 x 1) | (1) |
| 2.6.2 | (a) By which year is it expected that almost all tropical forests will be lost? | (1 x 1) | (1) |
| | (b) The size of which province can be compared to the total area of forests being lost annually? | (1 x 1) | (1) |
| 2.6.3 | Name TWO negative consequences of deforestation on river systems. | (2 x 2) | (4) |
| 2.6.4 | Suggest TWO measures that can be put in place by the government and non-governmental organisations (NGOs) to manage river systems at risk due to deforestation. | (2 x 2) | (4) |
| 2.6.5 | Discuss the negative impact of poor river management practices on | | |

South Africa's future water supply.

(2 x 2) (4)

Marking Guideline

- 2.6 2.6.1 Deforestation is the removal of trees/natural vegetation/Cutting down of trees quicker than it can be replaced (1)
[CONCEPT] (1 x 1) (1)
- 2.6.2 (a) 2050 (1) (1 x 1) (1)
(b) KwaZulu-Natal/KZN (1) (1 x 1) (1)
- 2.6.3 Decreased carrying capacity (2)
River blockage (2)
Reduce water quality (2)
Rivers/dams become shallower (2)
Increases the stream load (2)
Disrupt ecosystem of the river (2)
Disrupt biodiversity in a river (2)
Increased flooding of river system (2)
Less infiltration (2)
Decrease in groundwater levels (2)
Reduction in base flow (2)
More evaporation dries soil out (2)
Greater erosion along river banks (2)
Lowering of levees (2)
More polluting of the rivers and eutrophication (2)
[ANY TWO] (2 x 2) (4)
- 2.6.4 Legislation to protect areas that are prone to deforestation (2)
Fines to those who illegally remove trees (2)
Implement more afforestation within the river system (2)
Create awareness of the negative impacts of deforestation (2)
Educate people on the importance of good river management systems (2)
Promote conservation and establish more protected areas to prevent deforestation (2)
Create a buffer zone for protection of natural forests (2)
Protect river banks from deforestation (2)
Rehabilitation of forests/afforestation (2)
Encourage recycling to reduce deforestation (2)
[ANY TWO] (2 x 2) (4)
- 2.6.5 Poor river management will result in less water being available (2)
Poor quality of the water will result in higher purification costs (2)
Water is unsafe for human consumption (2)
Increased siltation of dams will compromise water quality (2)
Shortage of good quality water would make it more expensive (2)
More run-off reduces groundwater supply (2)
Expensive to implement inter-basin water transfer schemes (2)

Less water for domestic, industrial and agricultural use (2)
[ANY TWO]

(2 x 2) (4)

Activity 41

FIGURE 1.6: IMPACT OF HUMANS ON DRAINAGE BASINS

VAAL RIVER UNDER PRESSURE

Sipho Masondo | The Times Live

The Vaal River and its catchment system are becoming increasingly toxic/ poisoned – posing a threat to health, the economy and food production in four provinces.

Water scientists and other experts describe the Vaal River – which supplies water to Gauteng, the country's economic and industrial powerhouse, as well as to farmers in Gauteng, North West, the Free State and Northern Cape – as 'in crisis' and 'under siege' by polluters. Since the 1990s, the Department of Water Affairs has pumped water from the Lesotho Highlands into the river to supplement the water supply. This water is increasingly needed to dilute the pollution.

Said Krige: 'We are using expensive drinking water to sort out the problem of pollution. Dilution is not a solution to pollution.'

The water in the Vaal River system will eventually cost far more to treat, leaving companies such as Sasol and Eskom to pay more for the chemicals needed to treat the water before they use it. This will increase their costs.

[Adapted from
www.timeslive.co.za]

1.6 Read the newspaper article with the heading 'Vaal River Under Pressure' in FIGURE 1.6 and answer the questions that follow.

- 1.6.1 Name TWO provinces that are dependent on the Vaal River as a water source. (2 x 1) (2)
- 1.6.2 Give TWO possible reasons why the Vaal River is becoming increasingly toxic/poisoned. (2 x 1) (2)
- 1.6.3 According to the article, water is pumped into the Vaal River to dilute/reduce the pollution. Explain why this is not a sustainable solution. (2 x 2) (4)
- 1.6.4 Explain, in a paragraph of approximately EIGHT lines, why the cost of food and electricity could increase in future if pollution of the

Vaal River is not controlled.

(4 x 2) (8)

Marking Guideline

1.6.1 Gauteng (1)/North West (1)/Free State (1)/Northern Cape (1)
[ANY TWO]

(2 x 1) (2)

1.6.2 Mining waste dumped in the river (1)
Industries pollute the river (1)
Chemicals used for farming flows into the river (1)
Untreated sewage entering the river (1)
Domestic waste from settlements along the river (1)
[ANY TWO]

(2 x 1) (2)

1.6.3 Water that should be used as drinking water is wasted (2)
Pollution continues on daily basis (2)
The problem will not be solved, only lessened/temporary solution (2)
It is a costly process (2)

[ANY TWO]

(2 x 2) (4)

1.6.4 **FOOD (AGRICULTURE)**

Costly to buy purified water (2)
Farmers will have to buy more chemicals to purify water (2)
Chemicals costly to purchase (2)
Production costs increase (2)
Cost of chemicals will be included in food prices (2)
Polluted water will reduce productivity for the farmers (2)
Food more costly to maintain profit margins (2)
Polluted water reduces soil fertility (2)
Reduction in crop yields creating a greater demand for food (2)
Costly to purchase fertilisers to maintain soil fertility (2)
Less food produced (2)
Food prices increase (2)

ELECTRICITY (ESKOM)

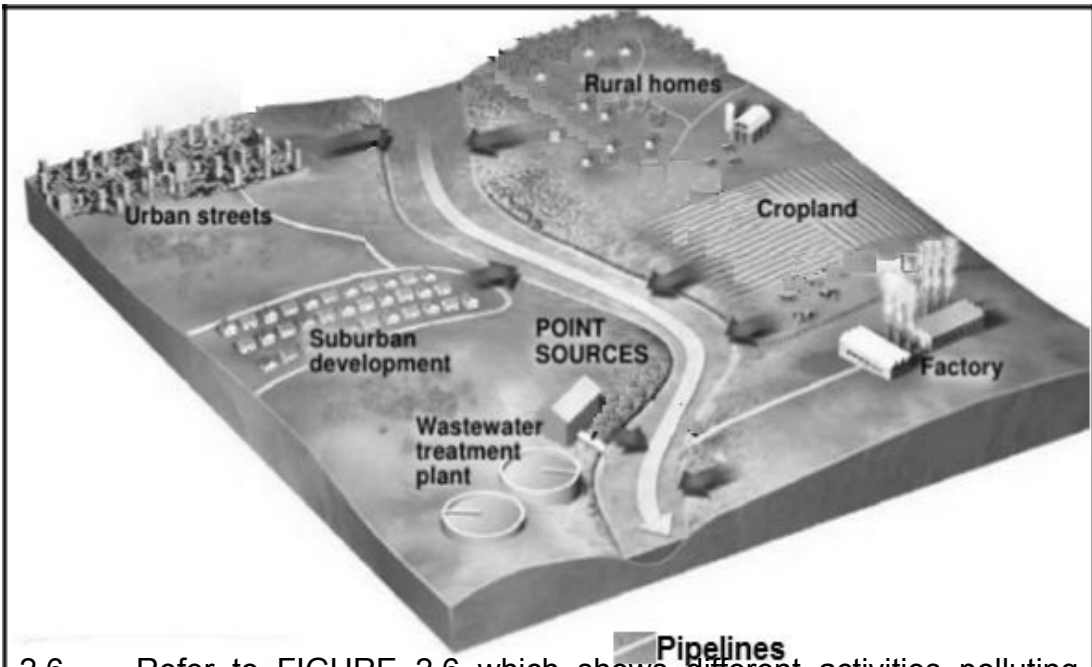
Costly to purify water for use in electricity generation (2)
Cost will be included in electricity prices (2)
Costs will increase the price of electricity during production (2)
Less clean water to generate hydro electricity (2)
Electricity shortage will inflate the price (2)

[ANY FOUR - ACCEPT OTHER REASONABLE ANSWERS. MUST REFER
TO BOTH ESKOM AND AGRICULTURE]

(4 x 2) (8)

Activity 42

FIGURE 2.6: DIFFERENT ACTIVITIES POLLUTING WATER RESOURCES



2.6 Refer to FIGURE 2.6 which shows different activities polluting water resources.

- 2.6.1 What is *river management*? (1 x 1) (1)
- 2.6.2 Name ONE way in which the factory pollutes the river. (1 x 1) (1)
- 2.6.3 Explain the importance of the wastewater treatment plant in river management. (2 x 2) (4)
- 2.6.4 State TWO ways in which fertilisers from the crop land can impact on the ecology of the river. (2 x 2) (4)
- 2.6.5 Outline the negative impact of water pollution on the economy of a country. (2 x 2) (4)

Marking Guideline

2.6.1 Using river resources in a sustainable way so that it will still be available in the future (1)

[CONCEPT] (1 x 1) (1)

- 2.6.2 Chemical waste/waste water could be released in the river (1)
- Acid rain caused by air pollution by the factory could end up in the river (1)

[ANY ONE]

(1 x 1)
(1)

2.6.3 Waste water will be treated/purified at the wastewater treatment plant so that

it could be re-used/recycled (2)

More fresh water resources will be available (2)

The purified water will prevent and eliminate diseases (2)

Protect aquatic ecosystems (2)

[ANY TWO]

(2 x 2) (4)

2.6.4 Aquatic life threatened (2)

Imbalance of the ecosystem (2)

Reduced biodiversity (2)

Increased nitrate encourages growth of algae/eutrophication (2)

Reduced oxygen levels (2)

[ANY TWO]

(2 x 2) (4)

2.6.5 Less clean/pure water resources for primary and secondary economic

activities (2)

Less clean water results in water restrictions (2)

Water treatment is expensive and increases the cost of water (2)

Finding alternative water sources will become costly (Accept examples) (2)

Less goods produced for home and export market (2)

Decreases the productivity of farming/manufacturing (2)

Negative influence on stock farming as the number of animals will be reduced (2)

Poor water quality will negatively influence tourism due to the fear of diseases by drinking poor quality water (2)

Fewer tourists will mean less income for the country (2)

[ANY TWO]

(2 x 2)
(4)

Activity 43

FIGURE 2.6: MANAGING CATCHMENT AREAS AND DRAINAGE BASINS

South Africa needs to balance the demand for water with the availability of water.
There are a number of ways in which to prevent the overexploitation of water resources:

- Removing alien vegetation
- Interbasin transfer schemes
- Managing groundwater supplies
- Recycling water
- Conserving wetlands
- Preserving vegetation cover

[Adapted from www.dwaf.gov

2.6 Study FIGURE 2.6, which lists some tips from the Department of Water Affairs for the sustainable management of catchment areas and drainage basins in South Africa, and then answer the questions that follow.

- | | | | |
|-------|--|---------|-----|
| 2.6.1 | Define the term <i>overexploitation</i> . | (1 x 1) | (1) |
| 2.6.2 | What is a <i>catchment area</i> ? | (1 x 1) | (1) |
| 2.6.3 | Explain how removing alien vegetation will help prevent the overexploitation of water resources in South Africa. | (2 x 2) | (4) |
| 2.6.4 | How does the conservation of wetlands contribute to the sustainable management of a drainage basin? | (1 x 2) | (2) |
| 2.6.5 | Discuss the importance of preserving vegetation cover in a drainage basin. | (3 x 2) | (6) |

Marking Guideline

- | | | | |
|-------|--|---------|-----|
| 2.6.1 | Over-exploitation means to overuse and potentially destroy a resource (1)
[Concept] | (1 x 1) | (1) |
| 2.6.2 | A catchment area is the whole drainage basin, where a river system is found/the entire area drained by a river system (1)
[Concept] | (1 x 1) | (1) |

- | | | | |
|-------|--|---------|-----|
| 2.6.3 | Alien plants reproduce at a high rate (2)
Alien plants take over indigenous vegetation (2)
These plants use too much water (2)
By removing alien vegetation, less water will be used up (2)
[ANY TWO. ACCEPT OTHER REASONABLE EXPLANATION] | (2 x 2) | (4) |
| 2.6.4 | Wetlands are a natural storage place for water and supply water to drainage basins (2)
Wetlands help to purify water (2)
Water will be available during dry times in a wetland (2)
[ANY ONE. ACCEPT OTHER REASONABLE ANSWERS] | (1 x 2) | (2) |
| 2.6.5 | Slows down flow of water (2)
Allows for infiltrations (2)
Maintains groundwater levels (2)
Plant roots anchor soil (2)
Prevents erosion plus silting of rivers (2)
Prevent sheet flow plus flooding (2)
[ANY TWO. ACCEPT OTHER REASONABLE EXPLANATION] | (3 x 2) | (6) |

Activity 44

FIGURE 2.6: CATCHMENT AREAS IN SOUTH AFRICA

CASE STUDY ON RIVER MANAGEMENT: SOUTH AFRICAN CATCHMENTS AREAS

Covering many South African river basins, the 'Working for Catchments' programme operates in all major catchment areas.

65% of South Africa receives less than 500 mm average annual rainfall, meaning that drought is an ever-present risk in South Africa.

Future projections indicate that by 2025 the country's water requirements will outstrip water supply unless urgent steps are taken to manage the resource more sustainably. There are already major problems of water supply and water quality, with an estimated 8 million South Africans currently having no access to potable water.

[Adapted from http://www.panda.org/about_our_earth/about_freshwater]

- | | | | |
|-------|---|---------|-----|
| 2.6 | Read the extract in FIGURE 2.6 based on river catchment areas in South Africa. | | |
| 2.6.1 | What is a <i>catchment area</i> ? | (1 x 1) | (1) |
| 2.6.2 | What evidence in the article indicates that drought is an ever-present risk? | (1 x 2) | (2) |
| 2.6.3 | Give ONE reason for the destruction of catchment areas. | (1 x 2) | (2) |
| 2.6.4 | Suggest TWO steps that need to be taken by the government and non-governmental organisations (NGOs) to manage catchment | | |

- | | | | |
|-------|--|---------|-----|
| | areas that are at risk. | (2 x 2) | (4) |
| 2.6.5 | Discuss the negative impact of poor catchment management practices for South Africa. | (3 x 2) | (6) |

Marking Guideline

- 2.6.1 A catchment area is the entire drainage basin of a river from where it receives water (1)[CONCEPT] (1 x 1) (1)
- 2.6.2 65% of South Africa receives less than 500 mm average annual rainfall (2)(1 x 2) (2)
- 2.6.3 Removal of natural vegetation (2)
- Desertification (2)
 - Monoculture/Poor farming techniques (2)
 - Over-utilisation of water (2)
 - Livestock farming in catchment areas destroys the vegetation (2)
 - Veld fires (destroy vegetation which increases erosion) (2)
 - Removal of water from upper reaches for the purposes of water transfer (2)
 - Location of industries on river banks (2)
 - Mining activities impact on groundwater (2)
- [ANY ONE] (1 x 2) (2)
- 2.6.4 Wetlands must be conserved and restored (2)
- Legislation is necessary to control what is discharged into the rivers (2)
 - Fines for dumping into and littering of rivers (2)
 - Clearing of vegetation and planting of alien trees must be controlled (2)
 - Construction and settlement on the floodplain must be avoided (2)
 - Afforestation to reduce run-off and erosion (2)
 - Constant testing to monitor the state of the river (2)
 - Buffering of rivers (2)
 - Conserve natural vegetation along rivers (2)
 - Awareness campaigns (2)
- [ANY TWO] (2 x 2) (4)
- 2.6.5 Water shortages (2)
- Polluted water Increases exposure to health hazards (2)
 - Price of water will increase (2)
 - Production costs will increase (2)
 - Food production will decrease/Low agricultural yield (2)
 - Food prices will increase (2)
 - Less area to grow crops (2)
 - Reduced quality of water due to increased pollution (2)
 - Decreases biodiversity (2)
 - Increases risk of flooding (2)
 - Negative impact on rivers for recreation/tourism (2)
- [ANY THREE] (3 x 2) (6)

Activity 45

- 2.5 Refer to the extract on catchment and river management.

A RIVER OF POLLUTION FLOWS THROUGH OUR LAND

The Olifants River is one of Southern Africa's most important river catchments. The river is critical to the economies of both South Africa and Mozambique. The 30 dams along the course supply three provinces with water in times of drought. Ten million people rely on this river for water.

The water from the Olifants River irrigates farms in western Mpumalanga and powers Eskom's coal-fired power stations in the area. The river flows through Limpopo's platinum belt, supplying water to valleys that otherwise would be dry. The river cuts through the Drakensberg irrigating farms in the Lowveld, providing water to the Kruger National Park and finally joining the Limpopo River in Mozambique.

The above-mentioned activities have had a negative impact on the quality of water in the river. Management strategies implemented so far have proven to be ineffective. This puts the water of the Olifants River in danger of being declared too contaminated (polluted) to be used. Strategies need to be put in place to improve the quality of water in the river in order to ensure a sustainable source of water.

[Adapted from
<https://mg.co.za/article/2017-04-13-00-a-river-of-sewage-chemicals-metals-flows-through-our-land/>]

- | | | | |
|-------|--|---------|-----|
| 2.5.1 | What is <i>river management</i> ? | (1 x 2) | (2) |
| 2.5.2 | According to the extract, how many people rely on the Olifants River for water? | (1 x 1) | (1) |
| 2.5.3 | Quote evidence from the extract indicating how water from the Olifants River is used. | (2 x 1) | (2) |
| 2.5.4 | What negative impact would Eskom's coal-fired power stations have on the Olifants River? | (1 x 2) | (2) |
| 2.5.5 | In a paragraph of approximately EIGHT lines, explain FOUR strategies that could be implemented so that the Olifants River becomes a sustainable source of water. | (4 x 2) | (8) |

Marking Guideline

2.5

2.5.1 The management of water sources (2)

[CONCEPT]

(1 x 2) (2)

2.5.2 Ten million (1)

(1 x 1) (1)

2.5.3 30 dams along the course supply three provinces with water'

' irrigates farms' (1)

' powers Eskom's coal-fired power stations' (1)

' supplying water to valleys' (1)

' irrigating farms' (1)

' providing water to the Kruger National Park' (1)

[ANY TWO]

(2 x 1) (2)

2.5.4 Water will be polluted (accept examples) (2)

Quality of the water decreases (2)

It raises the temperature of the water (2)

It will influence the aquatic ecosystems negatively (accept examples)(2)

Negative impact on biodiversity (2)

[ANY ONE]

(1 x 2) (2)

2.5.5 Create a buffer zone to prevent development too close to the river (2)

Implement legislation to discourage pollution of the river (2)

Issue fines for illegal dumping/polluting of the river (2)

Monitoring/testing the quality of the water to ensure it is suitable for domestic and industrial use (2)

Educate farmers on sustainable farming methods (2)

Educating people about the importance of river management (2)

Awareness campaigns to prevent dumping and pollution of river (accept examples) (2)

Encourage or promote the planting of trees to reduce surface run-off or soil erosion (2)

Protect natural vegetation to reduce surface run-off or soil erosion (2)

Promote recycling of waste water before releasing back into river (2)

Conserve wetlands to preserve the quality of the water (2)

[ANY FOUR]

(4 x 2)

(8)