

**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF NATURAL RESOURCES AND SPATIAL SCIENCES

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES SCIENCES

QUALIFICATION: BACHELOR OF NATURAL RESOURCES MANAGEMENT (NATURE CONSERVATION)	
QUALIFICATION CODE: 07BNTC	LEVEL: 6
COURSE: AQUATIC ECOSYSTEMS MANAGEMENT	COURSE CODE: AEM 610S
DATE: JULY 2019	SESSION:
DURATION: 3 HOURS	MARKS: 125

SECOND OPPORTUNITY EXAMINATION QUESTION PAPER

EXAMINER: Ms. S. Bethune
MODERATOR: Ms. N. Nashipili

INSTRUCTIONS

1. Write clearly and neatly
2. Answer all questions
3. Number the answers correctly

PERMISSIBLE MATERIALS

1. Examination Paper
2. Examination Script
3. The Criteria for Identifying Wetlands of International Importance
4. The Newspaper article "Neckertal experiment flops"
5. The Mini SASS Score Sheet.

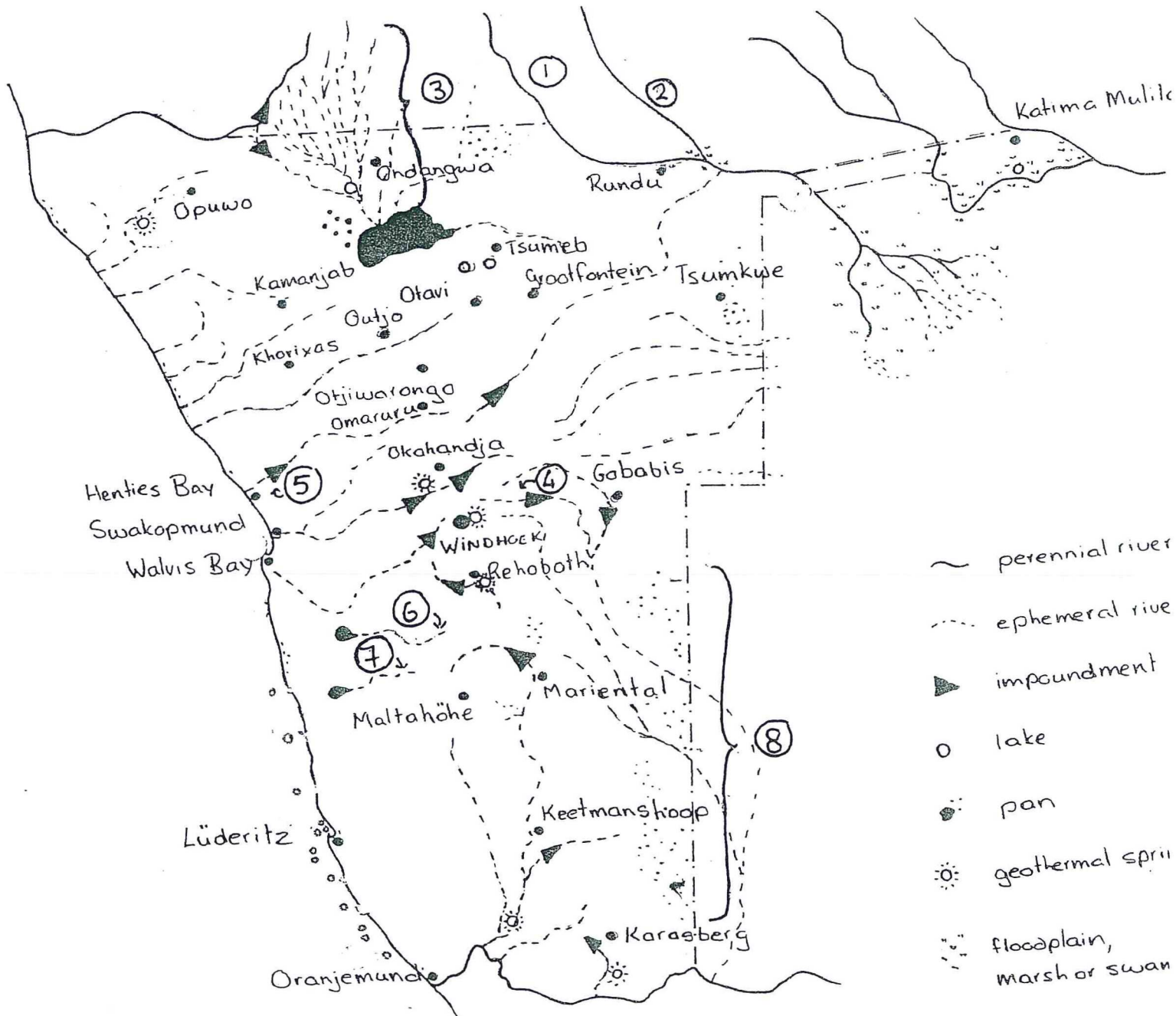
This paper consists of five (5) pages, including this front page.
As well as Ramsar Criteria (1p), newspaper article (1p) and Mini-SASS Score sheet (1p)

QUESTION 1 WETLAND MAP AND TERMINOLOGY

1.1 Study the map below:

(12)

- Name the two tributaries numbered, 1 and 2 of the Okavango River
- Name the river system numbered, 3
- Name the two dams numbered, 4 and 5 and the river each is on
- Name the two endoreic rivers 6 and 7 and the pan at the end of each
- Name the pan system numbered, 8



- 1.2 Give correct term for each of the following:
- a) A sandy riverbed that stores groundwater (1)
 - b) The artificial lake that forms behind a dam wall. (1)
- 1.3 Clearly distinguish between:
- a) A hemi-cenote sinkhole lake and a cenote sinkhole lake (2)
 - b) Epigean and Hypogean groundwater (2)
 - c) An indigenous invasive species and an alien invasive species (2)
- [20]**

QUESTION 2 RAMSAR

- 1.2 This year's theme for World Wetland Day is "Wetlands and Climate Change" Based on the guest lecture by Mrs Marina Coetzee, briefly discuss **five** impacts of climate change that affect our wetlands in Namibia. (5)
- 2.2 The Ramsar representative at MET has asked you to draw up a table to show that the Karst sinkholes and caves, would qualify as a future Ramsar Site, under the Ramsar category "*Karst and other subterranean Hydrological systems*". Prepare this Table, showing **five** relevant criteria and how the Karst sinkholes and lakes meet each. Be sure to give both the **common and scientific names of the biota** you use in your motivation. (10)
- [15]**

QUESTION 3 COASTAL WETLANDS

- 3.1 Say how the Walvis Bay wetlands Ramsar Site meets the **two** Ramsar criteria that deal specifically with birds. (2)
- 3.2 One per cent of the world's oceans produce 50% of the world's commercial fish production due to upwelling. Write an **essay** to describe the process of **upwelling**, including the main factors that cause it and how this improves our fishery. (8)
- [10]**

QUESTION 4 PERENNIAL RIVERS

- 4.1 One of the diseases that infects children playing in the vegetated floodplains alongside the Kwando River is **urinary** bilharzia. Sketch and accurately label the life-cycle of the parasite that causes this disease. (11)
- 4.2 Explain why and how the summer and winter flows of the Orange River have been reversed. (5)

- 4.3 Mini-SASS is a simplified, bio-monitoring method to assess the health of flowing rivers based on 13 groups of aquatic macro-invertebrates. Attached are the results from mini-SASS done by learners and students at a site on the Okavango River in 2018.
- a) Explain what a high group scores indicates. (1)
- b) Show how you calculate the average score, (3)
- c) Determine the ecological condition of the river at Popa. (1)
- [20]**

QUESTION 5 SEASONAL RIVER SYSTEM

- 5.1 The middle catchment or Iishana section of the Cuvelai is considered to be unique within southern Africa, discuss the different kinds of wetlands found there and where and when these receive water. (4)
- 5.2 Write a **paragraph** about the Namibian frog species that can survive its habitat drying out. Give the common and scientific names, say where they are found, how they survive the dry period, what this process is called and conclude with their socio-economic value. (6)
- [10]**

QUESTION 6 EPHEMERAL RIVERS

- 6.1 Why can we call our ephemeral rivers “linear oases”? (2)
- 6.2 a) Name **three** tree species that are typical of our westward-flowing ephemeral rivers. (3)
- b) Name **three** alien invasive plants that have spread down our ephemeral rivers. (3)
- 6.3 Name any **two** established **river basin management committees** that try to ensure that the water and other wetland resources of ephemeral rivers are conserved, used sustainably, monitored and managed well. (2)
- [10]**

QUESTION 7 LACUSTRINE WETLANDS

- 7.1 a) Name and briefly discuss the different layers in a stratified impoundment in summer. You may use a diagramme to illustrate your answer. (8)
- b) Based on your visit to Swakkoppoort Dam list **two, abiotic** parameters regularly monitored by NamWater in the dam and name instrument and units used for each. (4)
- c) Explain **either**:
- A.** The breakdown of stratification in autumn (at the end of summer) (2)
- or** **B.** The breakdown of stratification during summer

- 7.2 Read the attached newspaper article: “*Neckertal experiment flops...as lost water haunts Hardap Dam*”. Answer the following questions:
- a) Why was water released from Hardap Dam twice, two years ago? (1)
 - b) What volume of water in m³ was released and what happened to it? (2)
 - c) Why is the water released during this exercise now of concern to the water users at the Hardap irrigation scheme? (2)
 - d) Why is this water loss Important to the National Food Security situation in Namibia at present? (1)
- [20]**

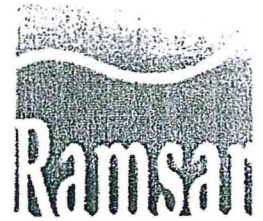
QUESTION 8 PALUSTRINE WETLANDS

- 8.1 a) Name the geothermal spring near to Swakoppoort Dam **and** (1)
- b) The one on the Fish River in Southern Namibia, that are popular with tourists. (1)
- 8.2 Discuss **three** threats faced by groundwater-fed springs and seeps in the Greater Waterberg Landscape area **and** recommend what farmers in the area should do to conserve these wetlands. (4)
- 8.3 a) Describe the wetlands where the endemic *Nothobranchius capriviensis* occurs, (1)
- b) Give its common name, (1)
- c) Name the conservancy where it is found. (1)
- d) Say why its conservation status should be upgraded by the IUCN to “Endangered”. (1)
- [10]**

QUESTION 9 AQUACULTURE

- 9.1 Member of the future Kamutjona Conservancy have asked you as a fishery scientist at Kifi to advise them on the fish they should use for their community-based, fish farm next to the Okavango River.
- a) Give the latin and common names of **two** indigenous fish species you recommend? (2)
 - b) Give **three** reasons why you recommend these species? (3)
- 9.2 Draw a **table** to clearly distinguish between extensive and intensive fish production, in terms of what the fish will be used for, the type of habitat needed, the fish yield, their food and their propagation. (5)
- [10]**

TOTAL - 125



The Criteria for Identifying Wetlands of International Importance

Group A. Sites containing representative, rare or unique wetland types

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Group B. Sites of international importance for conserving biological diversity

Criteria based on species and ecological communities

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Specific criteria based on waterbirds

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Specific criteria based on fish

Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

Specific criteria based on other taxa

Criterion 9: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

Neckartal experiment

... as lost water haunts Hardap Dam

flops

• LUQMAN CLOETE

ABOUT 3,5 billion litres of water released in August 2017 from the Hardap Dam to feed the N\$5,7 billion Nerckatal dam project, 123 kilometres away, evaporated before reaching the intended destination.

At the current NamWater rate of N\$15 per cubic metre, the water that was released from Mariental's Hardap Dam on two occasions would have cost about N\$52,5 million.

The Namibian understands that the first dispatch of 1,5 billion litres of water released on 10 August 2017 did not even reach Gibeon, which is 93 kilometres (km) south of Hardap Dam.

The other 2 billion litres released on 27 August the same year dried up before reaching the village of Berseba, about 30 kilometres from the Neckartal Dam.

Done despite a warning given by then agriculture minister John Mutorwa in a letter dated 22 August 2017, some officials



It will be an unacceptable and unpardonable excuse if the agreed amount of water does not reach Neckartal Dam.

— John Mutorwa

in the ministry went ahead to release the water.

"It will be an unacceptable and unpardonable excuse if the agreed amount of water does not reach Neckartal Dam," Mutorwa warned in his letter to the former executive director, Nehemia Abraham, who is now the NamWater chief executive.

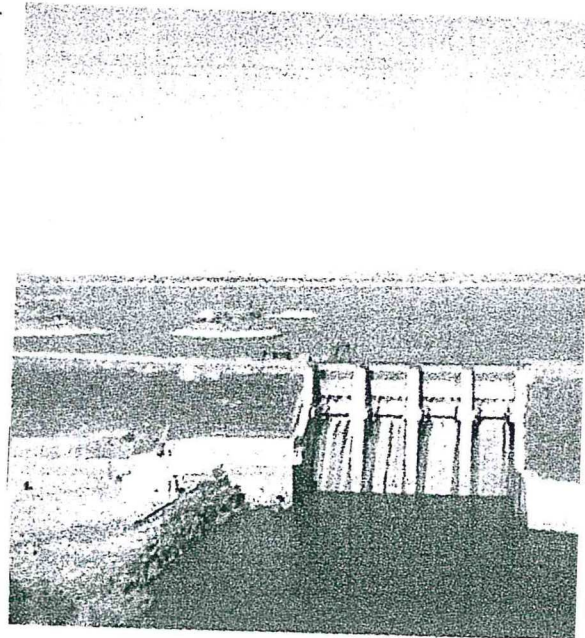
Mariental, a town about 250km south of Windhoek, uses about 800 million litres a month.

In theory, the lost water would have been enough for the town for about four months.

The level in the Hardap Dam that supplies water to Mariental residents and the Hardap Irrigation Scheme farmers is now about 23% compared to the same period last year when it was at 47%.

The current drought means there was not enough rain to replenish the lost water.

NECKARTAL:
continued on page 2



The Namibian
Friday 3 May 2019

NECKARTAL — FROM PAGE 1

Documents seen by *The Namibian* show that the agriculture ministry requested NamWater in July 2017 to release water for use in the construction of the Neckartal Dam.

Andries Kok, the NamWater acting chief in the south wrote to stakeholders on 23 July 2017 informing them that a meeting chaired by the water utility's chief executive officer had resolved, after considering all options and financial impacts, that releasing water from the Hardap Dam was the most viable option to solve the water shortage at the Neckartal Dam construction project.

"It is estimated that after the release of water, sufficient water is available to continue irrigation for 18 months as from 1 August. In the event of the 2017/2018 runoff during the 2017/2018 rainy season into the

Hardap Dam, the situation will be addressed after the 2017/2018 rainy season with stakeholders," Kok's letter read.

Kok confirmed yesterday that the agriculture ministry had ordered the release of water from Hardap Dam in 2017 for the Neckartal Dam construction site.

He, however, said the Hardap Dam was likely to receive an inflow in the 2019/2020 rainfall season that falls between October 2019 and March 2020.

In the letter dated 22 August 2017, minister Mutorwa called for a scientific process to tackle the water needs of Neckartal.

The director of water supply and sanitation in the agriculture ministry, Leopold Niipare, last Friday told *The Namibian* that he was not aware of the water that was released from the Hardap Dam to supply the Neckartal Dam project. Critics now blame the low level at Hardap Dam on

the millions of water lost as result of the decision in 2017 to feed Neckartal Dam.

A farmer in the Hardap region, who prefer not to be named, on Monday said he was concerned that if the dam level reached 10%, there wouldn't be enough water for their irrigation scheme.

"Irrigation plots will be closed, and workers sent home because there would only be enough water for the residents of Mariental," he remarked.

According to the farmer, the low level at the dam might affect lucern production at the Hardap Irrigation Scheme.

Namwater's Kok said the dam would be able to supply water for irrigation purposes until February 2020, and for domestic use until December 2020.

According to Kok, Hardap Dam's level could be as low as 5,5% in February 2020, which is about 16 million cubic metres,

and 1,7% in December 2020 in case of an insufficient inflow.

"When the level reaches 1,7%, we will install a pump in the dam basin from where we will pump water to the purification plant," Kok added.

The irrigation farmer is worried that low levels mean live-stock farmers will have to rely on lucern imports and will pay a higher price.

"Already, lucern is scarce at Hardap... more animals will die," the farmer added.

The Food Security Situation report of March 2019 reveals deteriorating grazing conditions being experienced in most parts of the country amidst poor and below average rainfall led to 63 712 animals dying in six months.

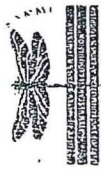
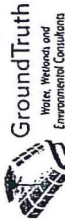
The Hardap and Kavango West regions are the least-affected regions, estimated to have lost below 60 animals combined.

Mini SASS Score Sheet

Popa Rapids site:

SITE INFORMATION TABLE	
Date (dd/mm/yr):	25 April 2018
Collectors name:	AEM Students
River name:	Okavango River
GPS co-ordinate:	S 18 07 312 E 21 34 986
Comments / Observations	Swift flow over rocky rapids

Co-ordinates as lat/long (e.g. 29°30'25" S / 30°45'10" E) OR as decimal degrees (e.g. 29.50694°S/30.75277°E)



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KZN WILDLIFE



Water Research Commission

Scoring

- On the table below, circle the sensitivity scores of the identified insects.

GROUPS	SENSITIVITY SCORE
Flat worms	3
Worms	2
Leeches	2
Crabs or shrimps	6
Stoneflies	17
Minnow mayflies	5
Other mayflies	11
Damselflies	4
Dragonflies	6
Bugs or beetles	5
Caddisflies (cased & uncased)	9
True flies	2
Snails	4
TOTAL SCORE	
NUMBER OF GROUPS	
AVERAGE SCORE	

Interpretation of the miniSASS score: Although an ideal sample site has rocky, sandy, and vegetation habitats, not all habitats are always present at a site. If your river does not have rocky habitats use the sandy type category above to interpret your scores.

Ecological category (Condition)	River category	
	Sandy Type	Rocky Type
Unmodified (NATURAL condition)	> 6.9	> 7.9
Largely natural/few modifications (GOOD condition)	5.8 to 6.9	6.8 to 7.9
Moderately modified (FAIR-condition)	4.9 to 5.8	6.1 to 6.8
Largely modified (POOR condition)	4.3 to 4.9	5.1 to 6.1
Seriously/critically modified (VERY POOR condition)	< 4.3	< 5.1

