



**NAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**Faculty of Health, Natural  
Resources and Applied  
Sciences**

School of Agriculture and  
Natural Resources Sciences

Department of Natural  
Resource Sciences

13 Jackson Kaujeua Street  
Private Bag 13388  
Windhoek  
NAMIBIA

T: +264 61 207 2141  
E: dnrs@nust.na  
W: www.nust.na

QUALIFICATION : <b>BACHELOR of NATURAL RESOURCE MANAGEMENT HONOURS</b>	
QUALIFICATION CODE: <b>08BNRMH</b>	LEVEL: <b>8</b>
COURSE: <b>INTEGRATED WATER AND WETLAND MANAGEMENT</b>	COURSE CODE: <b>IWW821S</b>
DATE: <b>JULY 2024</b>	SESSION:
DURATION: <b>3 HOURS</b>	MARKS: <b>110</b>

#### **FIRST OPPORTUNITY: QUESTION PAPER**

**EXAMINER:** *Ms. Shirley Bethune*

**MODERATOR:** *Mrs. Ndina Nashipili*

#### **INSTRUCTIONS**

1. Answer all questions on the separate answer sheet. Note choices.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.
6. Read all questions carefully before answering.

#### **PERMISSIBLE MATERIALS**

1. Non-programmable calculator.

#### **ATTACHMENTS**

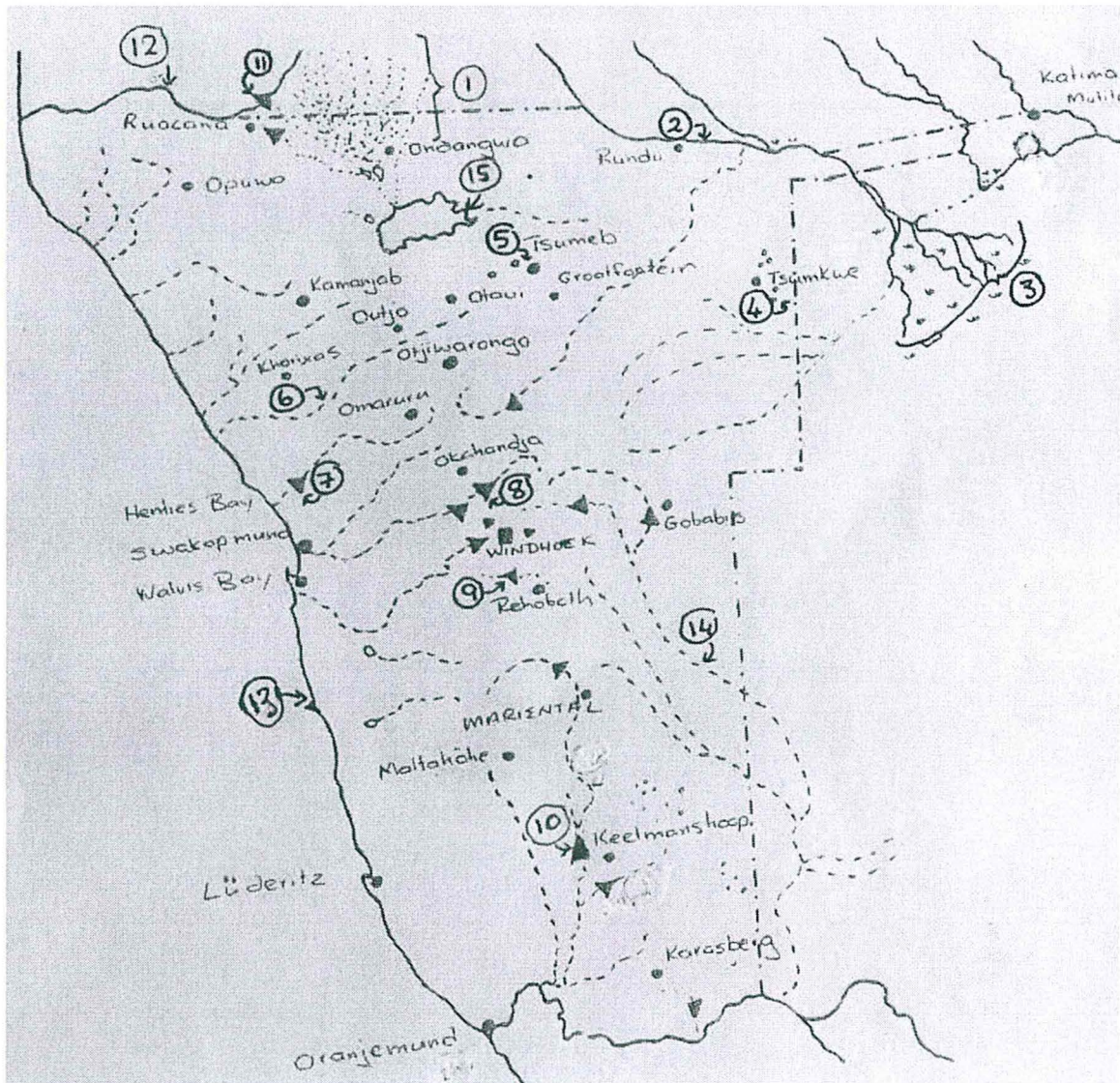
1. *The Criteria for Identifying Wetlands of International Importance* sheet.
2. *The Mini-SASS Data* sheet.

**This paper consists of 3 pages including this front page.**

QUESTION 1. WETLAND MAP

1. Name this section of this seasonal river system
- 2 and 3 Name the river and where this endoreic river ends
4. Name these ephemeral lacustrine wetlands
5. Name this lacustrine lake
6. Name this westward flowing ephemeral river
- 7 – 11 Name the dams 7 and give the name of the river each one is on
- 12 Name this waterfall you visited.
- 13 Name this coastal Ramsar Site
- 14 Name this eastward flowing ephemeral river
- 15 Name this inland Ramsar Site.

(20)



[20]

## QUESTION 2. INTERNATIONAL WETLAND CONVENTION – RAMSAR

### 2.1 CHOOSE EITHER A OR B

- A The middle or lishana section of the Cuvelai System is largely unprotected and yet it is important as the main water supply to the Etosha Pan Ramsar Site. Use the attached Ramsar Criteria to prepare a **table**, to summarize **five** Ramsar criteria that it meets and then clearly motivate how it meets each. (10)

OR

- B You visited the Walvis Bay wetlands this year to help with the summer bird count, recall your experience and draw up a table, to briefly list each relevant criterion and to motivate how and why this Ramsar Site meets the Ramsar Criteria using the attached Ramsar Criteria.

- 2.2 Based on your experience on at the WWWD Day event in Opuwo, prepare a short newspaper article for "*The Namibian*" on this year's themes for World Wetland and Wetland days. Link it clearly to **four** main points from the messages of the Honourable Ministers of MEFT and MAWLR. Provide a catchy title. Describe the photograph you will use to illustrate your article and give a caption. (10)

[20]

## QUESTION 3. RIVER BASIN MANAGEMENT

### 3.1 NATIONAL LEVEL

- a) 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)
- b) Explain what is meant by Water Demand Management **and** why this it is important to implement Water Demand Management in Namibia. Motivate with clear examples. (3)
- c) Based on your own observations traveling back along the Kuiseb River after the coastal excursion, and what Mr. Paisley Gariseb told you at Rooibank, and from the lecture on the KBMC list **five** threats that the Kuiseb River Basin/ NamWater or the KBMC face. (5)

### 3.2 INTERNATIONAL LEVEL

- You were fortunate to meet Mr. Silvanus Uunona at the World Water and Wetland days event in Opuwo. Name the commission giving both the abbreviation and the full name that he is the acting Executive Secretary of, name the four sub-basins that we have in Namibia and discuss why international management of this river system is important to us in Namibia. (10)

[20]

## QUESTION 4. WETLAND RESOURCES MONITORING

- 4.1 The owner of the Epupa Lodge where we camped has asked you if you can tell him about a simple biomonitoring method that he and his staff can use to compare the Health of the Kunene River above and below the Epupa Falls. Advise him of a suitable method that you have used. Carefully explain how it works, and what equipment you need. Explain how he and his staff should conduct this practical biomonitoring method, and using the mini-SASS data sheet explain how he should and calculate and interpret his results. Recommend good sites up and downstream that he could use. (16)

- 4.2 Explain what your results were at the Ete site 10 kms upstream of the falls and recommend a site downstream that he could use to compare with the upstream site at Ete. (2)

Explain why the water clarity at the site 10km upstream of Epupa was lower than at the site just downstream of the outlet from the Ruacana Hydro Power station. (2)

[20]

### QUESTION 5. ENVIRONMENTAL FLOWS

Internationally river basin management is the responsibility of River Basin Management Commissions like the Permanent Okavango River Basin Commission, OKACOM. Use what you have learnt about the Environmental Flows Assessment of the Okavango River, based on the OKACOM study led by Dr Jackie King, to answer the following questions.

- 5.1 Sketch a typical hydrograph, for the Okavango River at Rundu to show the four stages for the flood-pulsed Okavango River. (5)
- 5.2 Explain how the different levels of water use scenarios for the Environmental Flows Assessment on the Okavango River Basin were decided. (5)
- 5.3 Discuss the main social impact that was identified by the Environmental Flows Assessment of the Okavango River Basin. Quantify the losses in US\$, identified for each water-use scenario. (4)
- 5.4 What award did Dr Jackie King win for her work worldwide on environmental flows? (1)

[15]

### QUESTION 6. INTEGRATED WATER RESOURCES MANAGEMENT

- 6.1 Based on the river basin that you did your IWRM poster on, discuss water supply to your basin, who manages this, the main uses of the water and two main threats your chosen river basin faces. (7)
- 6.2 Integrated Water Resources Management includes linking **ground and surface water** supplies as well as linking **conventional and unconventional** water supplies. Write an essay to describe the Omdel groundwater scheme within the overall context of the central coastal water supply scheme, to show how these links are used to overcome the challenge of water supply in the desert. (8)


[15]

TOTAL 110

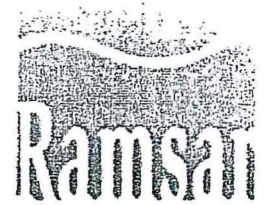


## Mini-SASS Data sheet

SITE INFORMATION TABLE			
River name:		Date (dd/mm/yr):	
Site name:		Collector's name:	
GPS co-ord Lat(S):	Long(E):	School/organisation:	
Site description: e.g. downstream of industry		Notes: e.g. weather, impacts, flow, etc	
pH:      Water temp: °C      Dissolved oxygen: mg/l      Water clarity: info at <a href="http://www.minisass.org">www.minisass.org</a>			

Ecological category (Condition)	River Category	
	Sandy Type	Rocky Type
 <b>NATURAL CONDITION</b> (Unchanged/untouched – Blue)	> 6.9	> 7.2
 <b>GOOD CONDITION</b> (Few modifications – Green)	5.9 to 6.8	6.2 to 7.2
 <b>FAIR CONDITION</b> (Some modifications – Orange)	5.4 to 5.8	5.7 to 6.1
 <b>POOR CONDITION</b> (Lots of modifications – Red)	4.8 to 5.3	5.3 to 5.6
 <b>VERY POOR CONDITION</b> (Critically modified – Purple)	< 4.8	< 5.3

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
<b>TOTAL SCORE</b>	
<b>NUMBER OF GROUPS</b>	
<b>AVERAGE SCORE</b> (miniSASS Score)	



# 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.