



**PAMIBIA UNIVERSITY**  
**OF SCIENCE AND TECHNOLOGY**

**FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES**

**DEPARTMENT OF NATURAL RESOURCE SCIENCES**

<b>QUALIFICATION: BACHELOR of NATURAL RESOURCE MANAGEMENT (NRM)</b>	
<b>QUALIFICATION CODE: 07BNRS</b>	<b>LEVEL: 7</b>
<b>COURSE CODE: WWR711S</b>	<b>COURSE NAME: WATER AND WETLAND RESOURCES MANAGEMENT</b>
<b>SESSION: JUNE 2025</b>	<b>PAPER: THEORY</b>
<b>DURATION: 2.5 HOURS</b>	<b>MARKS: 120</b>

<b>FIRST OPPORTUNITY EXAMINATION QUESTION PAPER</b>	
<b>EXAMINER(S)</b>	Mrs. C NTESA
<b>MODERATOR:</b>	Ms. N NASHIPII

<b>INSTRUCTIONS</b>
<ol style="list-style-type: none"><li>1. Answer ALL the questions.</li><li>2. Read all the questions carefully before answering.</li><li>3. Make sure your name and surname, question number and the date appear on the answer script.</li><li>4. Please ensure that your writing is legible, neat and presentable.</li></ol>

**ATTACHMENTS**

1. The Criteria for Identifying Wetlands of International Importance sheet.

**THIS QUESTION PAPER CONSISTS OF 4 PAGES (Including this front page)**

### QUESTION 1

Write short notes to define the following terms:

- 1.1. Endoreic river system (1)
- 1.2. Biological corridor (2)
- 1.3. Linear oasis (2)
- 1.4. Estuarine wetland (1)
- 1.5. Resource accounting in the context of wetlands (2)
- 1.6. Eutrophication (1)
- 1.7. Stratification (1)

[10]

### QUESTION 2

Clearly *distinguish* between the following terms.

- 2.1. Lotic and lentic wetlands (2)
- 2.2. Palustrine and lacustrine wetlands (2)
- 2.3. Cenote and hemi-cenote sinkholes (2)
- 2.4. Perennial rivers and ephemeral rivers (2)
- 2.5. Hypogean groundwater and Epigean groundwater (2)

[10]

### QUESTION 3

Give a correct word/term/name for the following:

- 3.1. A wetland system that flows every year, but only during the rainy season. (1)
- 3.2. The average amount of water that flows down a particular river, per year, expressed either as a depth (in millimetres) of water spread evenly across the entire drainage basin or as a volume (in cubic metres) of water flowing past a given point. (1)
- 3.3. A name given to a marine zone that is more than 200 m deep and is beyond the continental shelf. (1)
- 3.4. The largest floodplain lake in Namibia. (1)
- 3.5. A layer of water in a dam that gets enough light for photosynthesis. (1)
- 3.6. The measure of how muddy the water is or the measure of suspended solid particles in the water. (1)
- 3.7. An IUCN conservation status that refers to a species with at least a 50% chance of going extinct in 10 years. (1)
- 3.8. A physical construction or wall across a river, blocking the flow. (1)
- 3.9. The area around an impoundment where vegetation cannot re-establish itself due to water level changes. (1)
- 3.10. The river basin with the highest tree diversity in Namibia. (1)

[10]

#### QUESTION 4

**Name** a Ramsar Site that is found and protected within the following protected areas.

- a) Namib-Naukluft Park
- b) Etosha National Park
- c) Tsau Khaeb National Park (Sperrgebiet)
- d) Bwabwata National Park

[4]

#### QUESTION 5

The Ramsar Convention has set specific criteria for wetlands to qualify as “wetlands of international importance (Ramsar Site)”. These criteria are based on ecological, botanical, zoological, limnological, and hydrological significance. **Choose** one of the listed Ramsar Sites and use the attached Ramsar criteria to draw up a table to show **how** and motivate **why** it meets four of the Ramsar Criteria.

- 1) Walvis Bay Lagoon
- 2) Sandwich Harbour
- 3) Etosha Pan

[8]

#### QUESTION 6

Upwelling is an oceanographic process that occurs when deep, cold, and nutrient-rich water rises to the surface. Along the Atlantic Coast of Southern Africa, particularly off the coast of Namibia, upwelling plays a crucial role in supporting marine life and local economies. **Discuss** the ecological and socio-economic importance of upwelling, specifically in relation to the Atlantic Ocean.

[5]

#### QUESTION 7

- 7.1. Based on your excursion to the Okavango River Basin and class discussions, (8)  
**describe** the flood dynamics of the Okavango River system. **Explain** how these seasonal floods create different habitats and increase ecological productivity, supporting biodiversity in the basin.
  
- 7.2. The spread of alien invasive species in Namibia’s rivers, such as Kariba Weed (12)  
(*Salvinia molesta*), poses a serious threat to biodiversity and ecosystem health, particularly in the Eastern Caprivi floodplains of the Zambezi River System. **Discuss** four control mechanisms that can be used to manage or reduce the spread of this invasive species and **critically evaluate** the effectiveness and disadvantages of each method.

[20]

**QUESTION 8**

*Compare* and *contrast* the Upper, Middle, and Lower catchments of the Cuvelai River System with reference to their location, rainfall patterns and variability, type and frequency of flow (perennial, seasonal, or ephemeral), and key hydrological features and processes. In your response, *describe* the distinct characteristics of each catchment.

[12]

**QUESTION 9**

*Describe* the process of water stratification in summer and how it changes in winter.

[12]

**QUESTION 10**

*Critically explain* what the Mini-SASS technique is and its purpose in water quality monitoring. *Describe*, in detail, *how* the method is practically applied in the field, including the equipment used, sampling procedure, and *how* results are interpreted.

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**QUESTION 11**

*List* and *explain* the four (4) Dublin Principles that guide the implementation of Integrated Water Resources Management (IWRM) and critically *evaluate how* these principles are applied in the Namibian context.

[16]



# 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.