

## APPLY WATER RESOURCE, WATER AND SANITATION SERVICES MANAGEMENT PRINCIPLES

**UNIT CODE:** CON/OS/CET/CC/08/6/A

### UNIT DESCRIPTION

This unit describes the competencies required to apply water resource management principles. It involves determination of hydrological processes, quantification of surface water, mapping of rock types and aquifers, establishment of suitable site for wells. It also involves conservation of environment and development of water harvesting structures. It also involves application of water policy, water and environmental law in water resource, water policy, water and sanitation services management and application of integrated water resources management (IWRM) principles.

This standard applies in water sector.

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b> These describe the key outcomes which make up workplace function.	<b>PERFORMANCE CRITERIA</b> These are assessable statements which specify the required level of performance for each of the elements. <i><b>Bold and italicized terms are elaborated in the Range.</b></i>
1. Determine hydrological Processes	1.1 <i><b>Concepts of Hydrological cycle</b></i> are identified based on WMO guidelines 1.2 <i><b>Precipitation types and forms</b></i> are identified based on WMO guidelines 1.3 Precipitation is determined based on the WMO guidelines 1.4 Evaporation rate is determined based on WMO guidelines 1.5 Stream flow is determined based on the WMO guidelines 1.6 Safety in hydrometry is observed based on OSH
2. Quantify surface water	2.1 Sites for installation of hydrological instruments are identified based on WMO guidelines 2.2 <i><b>Hydrological Instruments</b></i> are identified and installed based on WMO guidelines 2.3 <i><b>Hydrological data</b></i> is collected based on parameters to be measured 2.4 Hydrological data is analyzed and quantified based on the collected parameters
3. Map rock types and aquifers	3.1 <i><b>Tools and equipment</b></i> for mapping are identified based on physical properties and user preference

	<p>3 .2 <b>Rock types</b> are identified based on their origin</p> <p>3 .3 <b>Aquifer types</b> are identified based International Association of Hydro-geologists (IAH) guidelines</p> <p>3 .4 Rock types and aquifers are mapped based on their formation</p> <p>3 .5 Aquifers are mapped based on rock units</p>
4. Establish suitable site for wells	<p>4 .1 Suitable sites for wells are identified based groundwater potential</p> <p>4 .2 <b>Suitable methods for well site establishment</b> are identified based on user preference</p> <p>4 .3 Suitable well sites are established based on groundwater potential</p> <p>4 .4 Well site establishment report is prepared based on Water Resource Management rules (WRM) 2007*</p>
5. Conserve the Environment	<p>5 .1 Factors affecting water and soil conservation are identified based on natural and artificial activities.</p> <p>5 .2 Water and soil conservation measures are identified based on the identified factors</p> <p>5 .3 Types of land degradation are identified based on environment</p> <p>5 .4 Causes of land degradation are identified based on degradation types identified</p> <p>5 .5 Effects of land degradation are identified based on degradation types identified</p> <p>5 .6 Control measures are identified based on the identified factors</p>
6. Develop water harvesting structures	<p>6 .1 <b>Water harvesting techniques</b> are identified based on site conditions</p> <p>6 .2 Suitable sites for <b>water harvesting reservoirs</b> are identified based on geological structures</p> <p>6 .3 Simple water harvesting structures are designed based on the need</p> <p>6 .4 Simple water harvesting structures are operated and maintained based on standard operating procedures</p>

### RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Concepts of Hydrological cycle may	<ul style="list-style-type: none"> <li>• Evaporation</li> <li>• Condensation</li> </ul>

include but not limited to:	<ul style="list-style-type: none"> <li>• Precipitation</li> <li>• Transpiration</li> <li>• Surface run-off</li> <li>• Infiltration</li> <li>• Percolation</li> </ul>
2. Precipitation types may include but not limited to:	<ul style="list-style-type: none"> <li>• Orographic</li> <li>• Convective</li> <li>• Cyclonic</li> </ul>
3. Precipitation forms may include but not limited to:	<ul style="list-style-type: none"> <li>• Rain</li> <li>• Hail</li> <li>• Sleet</li> <li>• Drizzle</li> <li>• Fog</li> <li>• Mist</li> <li>• Snow</li> </ul>
4. Hydrological Instruments may include but not limited to:	<ul style="list-style-type: none"> <li>• Rain gauges</li> <li>• Evaporation pans</li> <li>• Current meters</li> </ul>
5. Hydrological data may include but not limited to:	<ul style="list-style-type: none"> <li>• Rainfall data</li> <li>• Evaporation data</li> <li>• Stream flow data</li> </ul>
6. Rock types may include but not limited to:	<ul style="list-style-type: none"> <li>• Igneous</li> <li>• Metamorphic</li> <li>• Sedimentary</li> </ul>
7. Aquifer types may include but not limited to:	<ul style="list-style-type: none"> <li>• Confined</li> <li>• Unconfined</li> <li>• Perched</li> <li>• Leaky</li> </ul>
8. Methods of well site establishment include but not limited to:	<ul style="list-style-type: none"> <li>• Metallic rod pegs</li> <li>• Hard wood pegs</li> <li>• Concrete pegs</li> <li>• Protected dug holes</li> </ul>
9. Water harvesting techniques include but not limited to:	<ul style="list-style-type: none"> <li>• Rock catchment</li> <li>• Roof catchment</li> <li>• Surface water catchment</li> </ul>
10. Water harvesting reservoirs may include but not limited to:	<ul style="list-style-type: none"> <li>• Dams (Earth, sand, concrete )</li> <li>• Water pans</li> <li>• Ponds</li> </ul>

	<ul style="list-style-type: none"> <li>• Man- made lakes</li> </ul>
11. Types of laws may include but not limited to:	<ul style="list-style-type: none"> <li>• Criminal</li> <li>• Civil</li> </ul>
12. Water laws may include but not limited to:	<ul style="list-style-type: none"> <li>• Riparian</li> <li>• Prior appropriation</li> </ul>

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

### Required Skills

The individual needs to demonstrate the following skills:

- Applying fundamental operations (addition, subtraction, division, multiplication)
- Using and applying mathematical formulas
- Logical thinking
- Problem solving
- Applying statistics
- Drawing graphs
- Using different measuring tools
- Communication
- Analytical
- Organizing
- Decision making
- Planning
- Supervising
- Time management
- Technical skills:
  - Reporting
  - Mapping
  - Data logging
  - Data analysis
  - Instrumentation
- First aid
- Performance appraising
- Record keeping
- Operation and maintenance

### Required knowledge

The individual needs to demonstrate knowledge of:

- Hydrology
- Hydrogeology

- Geology
- Meteorology
- Community development
- Instrumentation
- Technical specifications
- Statutory regulations
- Occupational health, safety
- Quality Assurance
- Standard operating procedures
- Analytical methods
- Statistics

### EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

<p>Critical aspects of Competency</p>	<p>Assessment requires that the candidate:</p> <ol style="list-style-type: none"> <li>1.1 Identified Concepts of Hydrological cycle based on WMO guidelines</li> <li>1.2 Identified Precipitation types and forms based on WMO guidelines</li> <li>1.3 Determined Precipitation based on the WMO guidelines</li> <li>1.4 Determined Evaporation rate based on WMO guidelines</li> <li>1.5 Determined Stream flow based on the WMO guidelines</li> <li>1.6 Observed Safety in hydrometry based on OSH.</li> <li>1.7 Identified sites for installation of hydrological instruments based on WMO guidelines</li> <li>1.8 Identified hydrological instruments and installed based on WMO guidelines.</li> <li>1.9 Collected hydrological data based on parameters to be measured.</li> <li>1.10 Analyzed and quantified hydrological data based on the collected parameters</li> <li>1.11 Identified tools and equipment for mapping based on physical properties and user preference</li> <li>1.12 Identified rock types based on their origin</li> <li>1.13 Identified aquifer types based International Association of Hydro-geologists (IAH) guidelines.</li> <li>1.14 Mapped rock types and aquifers based on their formation</li> </ol>
---------------------------------------	---

	<p>1.15 Mapped aquifers based on rock units</p> <p>1.16 Identified suitable sites for wells based groundwater potential</p> <p>1.17 Identified suitable methods for well site establishment based on user preference</p> <p>1.18 Established suitable well sites based on groundwater potential</p> <p>1.19 Prepared well site establishment report based on Water Resource Management rules (WRM), 2007*</p> <p>1.20 Identified factors affecting water and soil conservation based on natural and artificial activities.</p> <p>1.21 Identified water and soil conservation measures based on the identified factors</p> <p>1.22 Identified types of land degradation based on environment</p> <p>1.23 Identified causes of land degradation based on degradation types identified</p> <p>1.24 Identified effects of land degradation based on degradation types identified</p> <p>1.25 Identified control measures based on the identified factors</p> <p>1.26 Identified <b>water harvesting techniques</b> based on site conditions</p> <p>1.27 Identified suitable sites for <b>water harvesting reservoirs</b> based on geological structures</p> <p>1.28 Designed simple water harvesting structures based on the need</p> <p>1.29 Operated and maintained simple water harvesting structures based on standard operating procedures</p> <p>1.30 Identified types of laws based on the legal system</p> <p>1.31 Identified types of water laws based on Constitution of Kenya 2010*, Water Act 2016* and Water Resource Management Rules (WRM) 2007*</p> <p>1.32 Applied water laws based on Kenya constitution 2010, Water Act 2016* and Water Resource Management Rules (WRM) 2007*</p> <p>1.33 Identified pillars of IWRM as per Dublin guidelines</p> <p>1.34 Identified principles of IWRM based on Dublin principles</p>
--	--

	<p>1.35 Applied principles of IWRM based on Dublin guidelines</p> <p>1.36 Adhered to gender mainstreaming based on IWRM principles</p> <p>1.37 Identified applications/Implications of IWRM in Kenyan Context based on the situation/ need</p>
2.0 Resource Implications	<p>The following resources should be provided:</p> <p>2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place</p> <p>2.2 Measuring equipment</p> <p>2.3 Materials relevant to the proposed activity or tasks</p> <p>2.4 Geolab</p> <p>2.5 Field equipment</p> <p>2.6 Petrographic microscope</p> <p>2.7 Hand lens</p> <p>2.8 Clinometer</p> <p>2.9 GPS receiver</p> <p>2.10 Maps</p> <p>2.11 Steel file / steel knife</p> <p>2.12 Metal rod</p>
3.0 Methods of Assessment	<p>Competency in this unit may be assessed through:</p> <p>3.1 Direct Observation</p> <p>3.2 Demonstration with Oral Questioning</p> <p>3.3 Written tests</p> <p>3.4 Interview</p> <p>3.5 Oral questions</p> <p>3.6 Third party report</p>
4.0 Context of Assessment	<p>Competency may be assessed through:-</p> <p>4.1 Accredited institution</p> <p>4.2 On-the-job</p> <p>4.3 Off-the-job</p> <p>4.4 Industrial attachment</p> <p>4.5 Field study report</p>
5.0 Guidance information for assessment	<p>Holistic assessment with other units relevant to the water sector, workplace and job role is recommended.</p>