Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

DRAINAGE SYSTEM MAINTENANCE

PWODM401

Perform Drainage System Maintenance

RQF Level: 4

Learning Hours 50

Credits: 5

Sector: Construction and building services

Trade: Public Works

Module Type: Specific

Curriculum: CBSPWO4001-TVET Certificate IV in Public Works

Copyright: © Rwanda TVET Board

Issue Date: May 2023

<table>
<tr><td>Purpose statement</td><td colspan="6">This module describes the knowledge, skills, and attitude required to perform drainage system maintenance. It is intended for learners who are pursuing RQF level IV in Public Works. At the end of this module, the learners will be able to perform site investigation, and carry out open channel drainage maintenance for surface and subsurface drainage.</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="6">Cement concrete works, Non bituminous pavement construction, non-bituminous pavements maintenance.</td></tr>
<tr><td rowspan="6">Delivery modality</td><td colspan="2">Training delivery</td><td>100%</td><td colspan="2">Assessment</td><td>Total 100%</td></tr>
<tr><td colspan="2">Theoretical content</td><td>30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td colspan="2">Practical work:</td><td rowspan="3">70%</td><td rowspan="3">70%</td></tr>
<tr><td>• Group work and presentation</td><td>30%</td></tr>
<tr><td>• Individual work</td><td>40%</td></tr>
<tr><td colspan="3"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Perform site investigation	1.1. Drainage system defects are properly identified according to their types and sizes
	1.2. Materials, tools and equipment are appropriately selected in accordance with the work to be done.
	1.3. Boundaries of the defective area are properly marked in accordance with their sizes
	1.4. Reports are correctly produced according to the work done
2. Perform open channel drainage maintenance	2.1. Adequate identification of open channel defects as per water flow
	2.2. Proper reparation of open channel defect according to defects types
	2.3. Correct cleaning of tools, equipment and workplace as per the environment impact assessment (EIA)
3. Perform subsurface drainage maintenance	3.1. Adequate identification of subsurface drainage defects as per water flow

	3.2. Proper reparation of subsurface drainage defects according to defects types
	3.3. Correct cleaning of tools, equipment and workplace as per the environment impact assessment (EIA)

Intended Knowledge, Skills, and Attitude

Knowledge	Skills	Attitude
✓ Identify construction materials ✓ Differentiate Drainage construction tools and equipment ✓ Identify Maintenance technics ✓ Describe Construction materials ✓ Explain basic knowledge of surveying technics ✓ Determine quantities of materials required ✓ Recognize technical standards ✓ Interpret Technical drawing ✓ Maintain Health and Safety	✓ Interpret technical drawing ✓ Use surveying instruments ✓ Communicate at workplace ✓ Maintain drainage defects ✓ Demolish damaged area ✓ Perform subsurface drainage maintenance ✓ Make site investigation ✓ Apply ICT in reporting ✓ Report work done	✓ Use creativity and innovation throughout the work execution ✓ Pay attention in demolishing drainage defects ✓ Communicate effectively at workplace ✓ Demonstrate good leadership in managing the site ✓ Respect time during work execution

Course content

Learning outcomes	At the end of the module, the learner will be able to: 1. Perform site investigation 2. Maintain open channel drainage. 3. Maintain the subsurface drainage.

Learning outcome 1: Perform site investigation	Learning hours: 10

Indicative content

- **Identification of drainage system defects**
  - ✓ Defects description
  - ✓ Methods of defects correction
- **Selection of material, tools and equipment**
  - ✓ Types of material, tools and equipment
  - ✓ Uses of material, tools and equipment
- **Marking of defected area**
- **Making a report**
  - ✓ Identification of report elements
  - ✓ Elaboration of report

Resources required for the learning outcome

Equipment	Digital camera, computer, projector, white board
Materials	Paper, pen, timber, nails, warning tape, Water, Marker pen
Tools	Tape measure, hammer
Facilitation techniques	Demonstration and simulation, individual and group work, practical exercise, Individualized, trainer guided, brainstorming, four steps and group discussion
Formative assessment methods /(CAT)	Written assessment, oral presentation, performance assessment, Project based assessment

Learning outcome 2: Perform open channel drainage maintenance	Learning hours: 20

Indicative content

- **Identification of open channel defects**
  - ✓ Types of open channel
  - ✓ Flow in open Channel
  - ✓ Defects in open channel
    - Types of Open Channel defects

- Causes of defects

- **Repairing of open channel defects**
  - ✓ Demarcation of working area
  - ✓ Addressing the obstacles
  - ✓ Positioning signs for safety measures
  - ✓ Performing maintenance procedures
- **Cleaning tools, equipment and workplace**
  - ✓ Types of waste
  - ✓ Cleaning Techniques
  - ✓ Removing ravage materials
  - ✓ Maintaining of tools and equipment

Resources required for the learning outcome	
Equipment	Levelling instruments, Trucks, Low bed, Air compressor, Compactors, Excavator, Wheel loader, Backhoe, Dumper, Concrete plant, Concrete mixer, Concrete vibrator, Concrete pump, Stone crusher machine, Lift machine, Crane machine, Bull dozer.
Materials	Timber, Paints, Water, Paraffin, Burner, Bitumen, Fuel, Aggregates, Quarry Dust, Stones, Laterite/Marrum, Cement, Sand, Nails, Pegs, Warning tape, Marker pen, Geotextile, Pipes, Warning tape, Wire Mesh, Gabion Cages
Tools	Rammer, Wheelbarrow, Construction lines, Rulers, Spade, Shovel, Hoe, Pickaxe, Machete, Axe, Trowels, Spirit level, Hammers, Squares, Brooms, Bucket /Basin, Metallic bucket, Bull float, Rakes.
Facilitation techniques	Demonstration and simulation, individual and group work, practical exercise, Individualized, trainer guided, brainstorming, four steps and group discussion
Formative assessment methods /(CAT)	Written assessment, oral presentation, performance assessment, Project based assessment

Learning outcome 3: Perform subsurface drainage maintenance	**Learning hours: 20**
Indicative content	

- **Identification of sub-surface drainage defects**
  - ✓ Types of sub-surface channels
  - ✓ Defect of sub-surface channels
    - Types of defects
    - Origin of defects
- **Repairing of sub-surface drainage defect**
- **Cleaning tools, equipment and workplace**
  - ✓ Types of waste
  - ✓ Cleaning methods
  - ✓ Removing ravage materials
  - ✓ Maintaining tools and equipment

Resources required for the learning outcome

Equipment	Levelling instruments, Trucks, Low bed, Air compressor, Compactors, Excavator, Wheel loader, Backhoe, Dumper, Concrete plant, Concrete mixer, Concrete vibrator, Concrete pump, Stone crusher machine, Lift machine, Crane machine, Bull dozer.
Materials	Timber, Paints, Water, Paraffin, Burner, Bitumen, Fuel, Aggregates, Quarry Dust, Stones, Laterite/Marrum, Cement, Sand, Nails, Pegs, Warning tape, Marker pen, Geotextile, Geogrid, Pipes, Warning tape, Wire Mesh, Gabion Cages
Tools	Rammer, Wheelbarrow, Construction lines, Rulers, Spade, Shovel, Hoe, Pickaxe, Machete, Axe, Trowels, Spirit level, Hammers, Squares, Brooms, Bucket /Basin, Metallic bucket, Bull float, Rakes.
Facilitation techniques	Demonstration and simulation, individual and group work, practical exercise, Individualized, trainer guided, brainstorming, four steps and group discussion
Formative assessment methods /(CAT)	Written assessment, oral presentation, performance assessment, Project based assessment

Integrated/Summative assessment

XYZ Company Ltd has signed a contract with KIGALI City to replace the drainage system (culvert) passing across Nyamirambo to City Centre section. The project consists of replacing all old drainage system

crossing that section and install new one at a slope of 3%. As a technician who works for XYZ Company Ltd, you are required to install the culvert at 3m in 8hrs and construct the surrounding of the culvert for its protection. During the installation you are required to respect the surveying data set by surveyors as well as a proper communication with the lift operator. Drawings, materials and equipment are provided.

Technical information:

i. Culvert: 1m length and 100cm diameter (Culverts are available)
ii. Lane width: 3.5m Transverse
iii. Slope: 3% Longitudinal slope: varying according to the section 4 to 12% Asphalt
iv. Sub-base layer: 20cm thickness (laterite)
v. Layer: 5cm thickness (Blinding concrete)

Resources

Equipment	Levelling instruments, Trucks, Low bed, Air compressor, Compactors, Excavator, Wheel loader, Backhoe, Dumper, Concrete plant, Concrete mixer, Concrete vibrator, Concrete pump, Stone crusher machine, Lift machine, Crane machine, Bull dozer.
Materials/ Consumables	Timber, Water, Fuel, Aggregates, Quarry Dust, Stones, Laterite/Marrum, Cement, Sand, Nails, Pegs, Warning tape, Marker pen, Geotextile, Geogrid, Pipes, Warning tape, Wire Mesh, Gabion Cages
Tools	Rammer, Wheelbarrow, Construction lines, Rulers, Spade, Shovel, Hoe, Pickaxe, Machete, Axe, Trowels, Spirit level, Hammers, Squares, Brooms, Bucket /Basin, Asphalt metallic pan, Metallic bucket, Bull float, Rakes.

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1. Perform site investigation (30%)	Drainage system defects are properly identified according to	Drainage system defects are identified			7

	their types and sizes	Causes of drainage system defects are mentioned			5
		Solutions of drainage system defects are proposed			5
	Materials, Tools and equipment are appropriately selected in accordance with the work to be done.	Materials are selected			2
		Tools are selected			5
		equipment are selected			2
	Boundaries of the defective area are properly marked in accordance with their sizes	Boundaries of the defective area are marked			5
	Reports are correctly produced according to the work done	Reports are produced			7
2. Perform open channel drainage maintenance (35%)	Adequate identification of open channel defects as per water flow	Open channel defects are identified			5
	Proper reparation of open channel defect according to defect type	Open channel defects are repaired			5
	Correct cleaning of tools, equipment and workplace as per the environment impact assessment	Tools are cleaned			5
		Equipment are cleaned			5
3. Perform subsurface drainage maintenance (35%)	Adequate identification of subsurface drainage defects as per water flow	Subsurface drainage defects are identified			5
	Proper repairing of	Subsurface drainage			5

	subsurface drainage defects according to defect type	defects are repaired			
	Correct cleaning of tools, equipment and workplace as per the environment impact assessment	Tools are cleaned			5
		Equipment are cleaned			5
Total marks					78
Percentage Weightage					100%
Minimum Passing line % (Aggregate):					70%

References

1. H.J. Nijland, F.W. Croon and H.P. Ritzema (2005). Subsurface Drainage Practices: Guidelines for the implementation, operation and maintenance of subsurface pipe drainage systems.

2. Cavelaars, J.C., Vlotman, W.F. and Spoor, G. (1994). Subsurface Drainage Systems. In: H.P.Ritzema (Editor-in-Chief), Drainage Principles and Applications, International Institute for Land Reclamation and Improvement (ILRI), ILRI Publication 16, Wageningen, The Netherlands, pp. 827-929

3. Framji, K.K., B.C. Garg, and S.P. Kaushish, (1984). Design Practices of Open Drainage Channels in an Agricultural Land Drainage System: A Worldwide Survey. ICID, New Delhi. 343 pp.

4. Food and Agriculture Organisation of the United Nations (1980). Drainage Design Factors. Irrigation and Drainage Paper No. 38. 1980. FAO, Rome. 52 pp.