



NQF Level: **3** US No: **116266**

# Assessment Guide

## Primary Agriculture

# Irrigation Systems




Assessor: .....


Workplace / Company: .....

Commodity: ..... Date: .....

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agriculture  
Department:  
Agriculture  
REPUBLIC OF SOUTH AFRICA



## Before we start...

This assessment guide contains all necessary activities and instructions that will enable the assessor and learner to gather evidence of the learner's competence as required by the unit standard. This guide was designed to be used by a trained and accredited assessor whom is registered to assess this specific unit standard as per the requirements of the AgriSETA ETQA.

Prior to the delivery of the program the facilitator and assessor must familiarise themselves with content of this guide, as well as the content of the relevant Learner Workbook.

The assessor, facilitator and learner must plan the assessment process together, in order to offer the learner the maximum support, and the opportunity to reflect competence.

The policies and procedures that are required during the application of this assessment are available on the website of the AgriSETA and should be strictly adhered to. The assessor must familiarise him/herself with this document before proceeding.

This guide provides step-by-step instructions for the assessment process of:

<b>Title:</b> Monitor the Operation and Maintenance of Irrigation Systems
<b>US No:</b> 116266 <b>NQF Level:</b> 3 <b>Credits:</b> 3

This unit standard is one of the building blocks in the qualification listed below. Please mark the qualification you are currently assessing, because that will be determined by the context of application:

Title	ID Number	NQF Level	Credits	Mark
National Certificate in Animal Production	49048	3	120	<input type="checkbox"/>
National Certificate in Plant Production	49052	3	120	<input type="checkbox"/>

Please mark the learning program you are enrolled in:

Are you enrolled in a:	Y	N
Learnership?	<input type="checkbox"/>	<input type="checkbox"/>
Skills Program?	<input type="checkbox"/>	<input type="checkbox"/>
Short Course?	<input type="checkbox"/>	<input type="checkbox"/>

### Note to Assessor:

If you are assessing this module as part of a full qualification or learnership, please ensure that you have familiarized yourself with the content of the qualification.

# 1

SO 1 AC 1-4

### Instructions to learner:

Practical experiment.

Learner Guide: Page 11

Facilitator Guide: Page 15

- ◆ Fill a garden pot with dry soil. Ensure the pot has drainage holes at the bottom.
- ◆ Weigh the pot with dry soil.
- ◆ Pour water into the pot until water starts running through the drainage holes in the bottom of the pot.
- ◆ Leave the pot until the water has stopped running from the drainage holes.
- ◆ Weigh the pot again.

1. What did the pot weigh before and after the water was added?

**Model Answer(s):**

*Before: Observe measurement  
After: Must be more than "Before" measurement*

2. Why is the weight of the pot different after water is added?

**Model Answer(s):**

### My Notes ...

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**2**

**SO 1 AC 1-4**

**Instructions to learner:**

Practical task.

**Learner Guide: Page 16**

**Facilitator Guide: Page 15**

- ◆ Get the operations table, the irrigation schedule and the pressure table from the irrigation manager on your farm and implement the schedule practically.
- ◆ Make notes for yourself as to what you did.
- ◆ Attach signatures and dates from your mentor, coach, or the irrigation manager confirming that you completed the task.

**Model Answer(s):**

Key notes must include:

*Times at which the valves are opened and closed for the different operations.  
How and when the pressure are checked and regulated.  
Stand times are observed.*

- *The correct operations and valves are opened / closed for the relevant days.*

**My Notes ...**

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**3****SO 1 AC 1-4****Instructions to learner:**

Individual assignment. Complete the questions.

**Learner Guide: Page 19****Facilitator Guide: Page 15**

Answer the following questions on worksheets that will be handed out by your facilitator.

1. Why do plants extract different amounts of water every day?

**Model answer (s)***Climatic conditions like wind, sun, rain, humidity and cloud cover change every day.*

2. Name some of the instruments we use to assess the rate of water extraction by the plant.

**Model answer (s)***Evapotranspiration pan, tensiometers, probes*

3. Describe what happens when you pour water into a pot of dry soil.

**Model answer (s)***The dry soil soaks up the water until it is saturated. As soon as the soil is saturated, the excess water leaches out.*

4. Describe the concept of mm/m.

**Model answer (s)***This refers to the mm of water per meter of soil. The term mm of water relates to a volume of water per area of land.*

5. Name the three components of the irrigation schedule.

**Model answer (s)***The table of operations, the schedule table and the pressure table.*

6. Define and describe the following terms:

- Field Capacity
- Permanent Wilting Point
- Plant Available Water
- Easily Available Water
- Effective Root Depth
- Operations Table
- Irrigation Schedule
- Pressure Table

**Model answer (s)**

Field Capacity	<i>Field capacity ( FC ) is defined as the depth of water per meter of soil when all free water drained out of the saturated soil. This is regarded as the "full" point of the soil reservoir.</i>
Permanent Wilting Point	<i>The Permanent Wilting Point ( PWP ) is described as the depth of water per meter soil where most plants will wilt permanently. This is the point where plants will not recover after 12 hours if they are watered. This is the "empty" point of the soil reservoir.</i>
Plant Available Water	<i>Plant Available Water ( PAW ) is defined as the depth of water per meter of soil between Field Capacity and Permanent Wilting Point. Thus <math>PAW = FC - PWP</math>.</i>
Easily Available Water	<i>Of the PAW about 50% is easily assessable to the plant this is called the Easily Available Water. If more than the easily available water is extracted the plant will start to stress. This stress can show in symptoms like the wilting of flowers or leaves. However should the water balance be corrected the plant will stop to stress.</i>
Effective Root Depth	<i>The term Effective Root Depth ( ERD ) is used to describe the depth of the roots that extract the water from the soil. This effective root depth is usually 600 mm for citrus.</i>
Operations Table	<i>The table of operations is a table containing the blocks that are operated together.</i>
Irrigation Schedule	<i>The schedule table is a table that list when and how long each operation must be executed.</i>
Pressure Table	<i>The pressure table is a table that lists the infield pressure for every block.</i>

7. What problems should you look out for in blocks in low-lying areas and what can be the causes?

**Model answer (s)**

*Blocks in low lying areas can be over irrigated and become water logged. The problem can be block pressure incorrectly set, mainline draining into the block*

8. What problems should you look out for in blocks in high-lying areas and what could be the causes?

**Model answer (s)**

*Blocks in higher areas tend to be under irrigated because of lower mainline pressure or mainlines taking more time to fill at start up.*

**4****SO 3 AC 1-4****Instructions to learner:**

Individual assignment. Complete the questions.

**Learner Guide: Page 34****Facilitator Guide: Page 17**

Answer the following questions on worksheets that will be handed out by your facilitator.

1. What is an evaporation pan used for?

**Model answer (s)***The evaporation pan is used to determine the amount of water evaporation.*

2. What type of pan is used and recommended by the Weather Bureau?

**Model answer (s)***The class A pan.*

3. What is the rain gauge used for?

**Model answer (s)***A rain gauge is used to measure the amount of rain.*

4. What does the tensiometer determine?

**Model answer (s)***A tensiometer measures the osmotic pressure in the soil. This is directly related to the amount of water in the soil.*

5. Define osmotic pressure.

**Model answer (s)***Osmotic pressure refers to the pressure required by plant roots to draw water from the soil.*

6. What are probes and what are they used for?

**Model answer (s)***Probes are electronic instruments that measure the amount of water in the soil. Various types of probes are available, using waves, signals or neutrons to measure the amount of water in the soil.*

7. Describe how you would take readings from the following equipment and record the relevant data:
- E-pan
  - Tensiometer
  - Rain gauge
  - Probe

**Model answer (s)**

E-pan	<i>The reading of the evaporation pan is taken at 08:00 every morning. Taking a measurement is as simple as reading the water level from the scale on the side. Before a reading is taken the scale must be wetted by dipping your finger into the water and wetting the scale at the water level.</i>
Rain gauge	<i>The reading from the rain gauge is taken by reading the amount of water of from the scale on the side.</i>
Tensiometer	<i>Located on the tensiometer is a gauge resembling a pressure gauge. A reading is taken from this gauge.</i>
Probe	<i>The probe is lowered in to a tube in the ground and the correct tube number is noted on the data logger. The data logger will take a reading that can be downloaded onto a computer later on.</i>

Complete the table below:

<b>Date</b>	<b>Rainfall</b>	<b>Water Level Before Regulating</b>	<b>Water Level After Regulating</b>	<b>Calculations</b>	<b>Evapo-transpiration</b>
2006/01/06			50		
2006/01/07		68	68	<b>(68-50)/2+0</b>	<b>9</b>
2006/01/08	20	56	76	<b>(56-68)/2+20</b>	<b>14</b>
2006/01/09		98	98	<b>(98-76)/2+0</b>	<b>11</b>

Using data and other relevant information on the farm you work on, describe how you would do the following:

1. Draw up a water balance sheet.
2. Use the system application rate and data from the water balance sheet to determine the stand-time.
3. Schedule the irrigation using tensiometers.
4. Schedule the irrigation using probes.
- 5.

**Model answer (s)**

Key Concepts to Observe:

*The water balance sheet can be in the format of the example in the leaner guide. Is important to note that the evapotranspiration or water use is accurate. Calculations and the cumulative water use must also be correct. The water use is divided by the system application rate (mm/h) to give the stand time in hours. Either the day on day water use or the weekly water use can be used. The scheduling using tensiometers and probes should focus on keeping the soil water balance between the parameters of field water capacity and easily assessable water.*



8. In general terms what should the tensiometer readings be kept at?

**Model answer (s)**

*-10 kPa and – 50 to – 60 kPa.*

9. Describe how you would take a reading with a probe.

**Model answer (s)**

*A reading is taken in the field by inserting the probe into the tube. Care must be taken to key in the right tube number. Once the probe has logged the date, the probe can be removed and the cap replaced on the tube.*

10. Describe the maintenance required for an E-pan.

**Model answer (s)**

*Grass and weeds around the pan must be kept short. Wind must be able to move freely through the top 100 mm. Weeds and bush must be kept clean so that no shadowing occur. When algae are present the pan must be cleaned. The water is removed and the pan cleaned. When the pan is re-filled it must be calibrated.*

11. Describe the maintenance required for a rain gauge.

**Model answer (s)**

*Grass and weeds around the gauge must be kept short if the rain gauge is dirty it can be washed out and rinsed. Cracked or broken rain gauges must be replaced.*

12. When must the tensiometer be reset?

**Model answer (s)**

*When the reading dropped below -100 kPa*

13. How would you fill the tensiometer with water?

**Model answer (s)**

*The lid on top of the tensiometer is screwed off and the tensiometer is filled with water.*

**5****SO 5 AC 1-5****Instructions to learner:**

Individual assignment. Complete the questions.

**Learner Guide: Page 40****Facilitator Guide: Page 19**

Obtain the irrigation schedule from your farm and complete the questions below:

1. Explain step-by-step what you would instruct your team members to do to implement the schedule.

**Model answer (s)**

1. Draw up a work program.
2. List all appropriate tasks for each member.
3. Note comments on the tasks performed.

2. Draw up a checklist of critical checkpoints with a time schedule of when you will check on the system.

**Model answer (s)**

*No model answer provided, depends on systems information.*

3. Draw up a trouble shooting list for different problems that might occur on the system.

**Model answer (s)**

*The trouble shooting list can be plain list, listing the effect and cause. It should concentrate on the problems associated with the different components of the irrigation system and possible remedies.*

*For example: the following problems are associated with pumps and can be rectified by:*

1. Cavitation: check suction pipe, check water level, check if pump is fully primed.
2. Overloading: is the overloading caused by too many blocks open or eminent mechanical failure.
3. Under loading: is the pump cavitating or are too few valves open.
4. Likewise, the filter system, pipe system and infield irrigation can be listed with the different problems.

## 6

SO 2 AC 1-4

### Instructions to learner:

Individual assignment. Complete the questions.

Learner Guide: Page 45

Facilitator Guide: Page 21

Complete the questions below:

1. Name the five components of the pump system that must be inspected?

#### Model answer (s)

1. Pumps
2. Filters
3. Valves
4. Pipes
5. Emitters

2. Describe how you would clean and inspect a sand filter.

#### Model answer (s)

*On sand filters, open the filter and remove the sand. If the same sand is going to be re-used, wash the sand properly to break up any cakes that have formed and to clean out debris trapped in the sand. Wash the inside of the filter before replacing the sand. In some cases, the sand has to be replaced, which is also done when the filter is opened and cleaned. The irrigation manager will advise when the sand must be replaced. When the sand has been removed inspect from a sand filter check the inside of the filter. At the bottom of the filter are perforated pipes or buttons. Visually inspect these for wear and tear. The material between the perforations tends to break, thus letting sand into the irrigation system. Report any suspicious pipes and buttons to the irrigation manager.*

3. Describe how you should clean disc filters. What should you be looking for when cleaning the filters?

#### Model answer (s)

*Filters can be cleaned by removing the filter element or cartridge, as follows:*

- Loosen the filter element
- Remove the individual discs
- Scrub each disc with a brush and water
- Replace in the same way and with the same amount in the filter element
- Reinsert the filter element into the filter
- Close the lid

*Clean and inspect the filter elements for signs of wear and tear.*

4. Name three other items that are associated with filters that need to be inspected.

**Model answer (s)**

- *Hydraulic valves*
- *Diaphragms*
- *Tubing*
- *Lid seals*
- *Secondary filters*

5. Name the three items that should be inspected with regards to infield irrigation. Describe the specific points that should be noted.

**Model answer (s)**

- **Valves** – *Check that valves open and close properly and that they do not leak. Check the gland packing for leaks and tighten it if necessary. Open hydraulic valves and inspect the rubber diaphragm for wear and cracks, and check the pilot valves. The pilot valves should regulate the pressure at the set value. Visually inspect the pilot valves for signs of leaks and wear.*
- **Emitters** – *The best evaluation of emitters is by means coefficient of uniformity (CU) test, which aims to ensure that all emitters are operating uniformly. Perform a visual inspection of the emitters and be on the look out for emitters that are spraying poorly or are blocked. Observe the spray pattern to see if it is overlapping or if dry spots occur. Micro-jets can be opened and cleaned, and drippers can be tapped lightly to loosen blockages. Do not hit or pierce the dripper as this will cause damage.*
- **Pipes** – *Visually inspect pipes for leaks and their general condition.*

6. Name the function of the following:

**Model answer (s)**

- |                       |   |
|-----------------------|---|
| <i>Amp meter</i>      | <i>It measures the electrical current that is used by the pump.</i> |
| <i>Volt meter</i>     | <i>It gives the voltage reading of the electrical system.</i>       |
| <i>Pressure gauge</i> | <i>It gives a reading of the system pressure.</i>                   |
| <i>Flow meter</i>     | <i>It gives the system flow rate.</i>                               |

7. Name the factors that should be considered when normal operating characteristics are determined for a pump and motor.

**Model answer (s)**

*Normal water levels, clean filters and the correct number of blocks open.*

8. Describe how you would adjust the pressure on a block fitted with a hydraulic valve.

**Model answer (s)**

*Adjust the pilot valve on the hydraulic valve to increase or decrease the water pressure. To decrease the pressure, turn the nut on top of the pilot valve anticlockwise. This will close the valve thus reducing the pressure. To increase the pressure, turn the nut clockwise. This will open the valve and increase the pressure. Note that the actuation of the valve by the pilot takes a few minutes. Adjust the pilot only a little bit at a time and wait for the pressure to stabilise before it adjusting again.*

**7****SO 4 AC 1-4****Instructions to learner:**

Individual assignment.

**Learner Guide: Page 48****Facilitator Guide: Page 23**

Draw up a concept maintenance plan, keeping in mind the life expectancy and the replacement of equipment.

**Model answer (s)**

*The example given in the learner guide can be used as a basis. The learner must be able to adapt the program for the specific equipment on the farm.*

**8****SO 4 AC 1-4****Instructions to learner:**

Individual assignment

**Learner Guide: Page 50****Facilitator Guide: Page 23**

Draw up a contingency plan for emergencies on your farm.

**Model answer (s)**

Learners must focus on events such as floods, fire, breakdowns, pipe bursts and chemical spills. Learners can use the guidelines set out in the learner guide. The plan must also include the specific tasks given to certain personnel as well as safety drills.

# Summative Test and Attitude & Attribute Evaluation

**B**efore the knowledge test is undertaken, the learner must be reminded of what is expected from him / her in terms of summative and reflexive competence. Read and explain to the learner, the **Preparation for Your Final Assessment** section in the learner workbook. Learners and assessor should sign off this section to acknowledge that this step was completed.

Please set up a knowledge test from the questions given as a guideline to learners and supply each learner with a test sheet.

Supply each report with the following heading:

<b>Unit Standard:</b>	116266	<b>NQF Level:</b>	3
<b>Learner Name:</b>			

Explain to a new member of the team how to read and implement an irrigation schedule on the farm.
Explain to a new member of the team what "irrigation scheduling" is and why it happens.
Explain the terminology to a new member of the team and explain to them what is expected from them: <ul style="list-style-type: none"> <li>• Stand time</li> <li>• Flow rate</li> <li>• Start time</li> <li>• Stop time</li> <li>• Pressure</li> <li>• Electric measurements such as Volt, Amp</li> </ul>
How would the irrigation schedule be adapted if: <ul style="list-style-type: none"> <li>• It rained 5 mm last night</li> <li>• The berg wind is going to blow today at 30km/h</li> <li>• There is a frost warning for this morning</li> </ul>
Explain which parts of the system have to be checked and maintained.
Explain when these parts of the system have to be checked and maintained.
Explain how these parts of the system must be checked and maintained.
Explain the start-up and shut-down procedures of the irrigation system.
Explain the shut-down of the irrigation system after the completion of the irrigation season.

Explain which measurement instruments are used on the farm to determine the irrigation schedule.

Give a brief explanation of how these instruments work.

Explain which problems you might encounter with the instruments.

Explain the reporting system on the farm for any problems or faults encountered with the irrigation system.

Explain which irrigation system emergencies you could expect and how you would react if it occurred. (An example of an emergency is when floods occur)

Explain the safety regulations that people have to adhere to when working with the irrigation system.

### Assessment Feedback Form

Comments / Remarks	
<p>Feedback to learner on assessment and / or overall recommendations and action plan for competence:</p>	
<p>Feedback from learner to assessor:</p>	
<p><b>Assessment Judgement</b> You have been found:</p> <p><input type="radio"/> Competent</p> <p><input type="radio"/> Not yet competent in this unit standard</p>	<p>Actions to follow:</p> <p><input type="radio"/> Assessor report to ETQA</p> <p><input type="radio"/> Learner results and attendance certification issued</p>
<p><b>Learner's Signature:</b></p>	<p><b>Date:</b></p>
<p><b>Assessor's Signature:</b></p>	<p><b>Date:</b></p>
<p><b>Moderator's Signature:</b></p>	<p><b>Date:</b></p>