

ASSESSMENT GUIDE FOR ASSESSORS & FACILITATORS

Water Quality

Level 4

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Title:		Manage Water Quality Parameters					
Applied Title:		Manage Water Quality Parameters					
Field:		Agriculture and Nature Conservation					
Sub-Field:		Primary Agriculture					
SETA (SGB):		AgriSETA					
Skills Area:		Water Quality					
Context:		Citrus Production					
US No:	116322	Level:	4	Credits:	3	Notional Hours:	30
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Based on the Production Guidelines of:



Supported by:



Unit standard alignment and assessment tool development:

Cabeton Training and Development

Project coordinator:

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Directions

Please Note: There is a separate assessment guide for the learner. The learner must use this guide to prepare himself / herself for the assessment.

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 who 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 assessment guide for learners.

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 applicable during the execution of this assessment are available on the website of the Citrus Academy, contained in a document named Policies and Procedures for Assessment, and must be strictly adhered to. The assessor must familiarise himself with this document before proceeding.

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

US No:	116322	Level:	4	Credits:	3
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The step-by-step instructions agree and are conducted in concert with the steps described in the learner assessment guide. The steps are as follows:

Step	Description	Timeframe
1	Learner assessment contract	Before delivery of program
2	Learner Declaration of Authenticity	Before delivery of program
3	Diagnostic Assessment of Learning Assumed to be in Place	Before delivery of program
4	Assessment Plan for Gathering of Evidence	Before delivery of program
5	Learner Formative Assessment Activities	During delivery of program, assessment after delivery of program
6	Learner Summative Presentation	After delivery of program
7	Integrated Summative Assessment Tool	After delivery of program
8	Re-assessment Procedures	After completion of assessment
9	Documentation	After completion of assessment
10	Administration and Completion of Portfolio of Evidence	After completion of assessment

Step 1

Pre-Assessment Briefing and Checklist

A pre-assessment briefing for learners is held before the delivery of the program. Use the checklist below to ensure that all these points are addressed and discussed with the learners.

Pre-Assessment Briefing Checklist		
	√	X
Organise resources – people, equipment, venue, etc.		
Explain the purpose of the assessment		
Discuss the standards or criteria to be used		
Discuss assessment roles and accountabilities		
Decide on assessment venues		
Negotiate evidence required, and where or how this evidence may be gathered		
Explain the methods of assessment that will be used during the gathering and summing up of evidence		
Negotiate the date of submission for the activity workbook and the date for the summative assessment		
Discuss resources required for the assessment e.g. equipment, materials, etc.		
Explain the procedure if the learner is found to be not yet competent		
Explain the appeal and review procedures		
Identify any potential learning barriers and negotiate strategies to overcome these		
Complete and sign the assessment plan with the learner		

The learner and assessor must sign the **Learner Contract** in the learner assessment guide.

Step 2

Learner Declaration of Authenticity

The learner is requested to complete and sign the Declaration of Authenticity in the learner assessment guide. This should be checked and co-signed by the assessor.

The format is as reflected in the learner assessment guide.



Step 3

Diagnostic Assessment of Learning Assumed to be in Place

In the learner assessment guide, the learner is asked to indicate whether they have completed the learning assumed to be in place as prescribed by the unit standard.

The assessor must guide the learners through this step, explaining in detail the content of the mentioned learning areas, because names of learning programs do not always agree with the names of the unit standards, and learners might indicate the incorrect information.

If learners indicate that they have not yet completed the mentioned unit standards, the assessor should prescribe an action plan to allow the learner to obtain the skills required by recommending additional training, competence portfolios, or the relevant RPL assessment for the given unit standards.

The format is as reflected in the assessment guide for learners. Please read it and familiarise yourself with its content.



Step 4

Assessment Plan for Gathering of Evidence

A pro-forma assessment plan for this unit standard has been drafted in the learner assessment guide. Explain the plan to the learner and complete the dates and signatures as indicated.

The format for the assessment plan is as reflected in the assessment guide for learners. Please read it and familiarise yourself with its content. Make a note of the dates agreed upon in the table provided below.

Learner and Assessor Assessment Plan		
Unit Standard	Manage Water Quality Parameters	
Registration Number	116322	
<i>Step</i>	<i>Description</i>	<i>Completion / Submission Date</i>
Step 5	Learner Formative Assessment Activities	
Step 6	Summative Presentation	
Step 7	Integrated Summative Assessment	
Step 8	Re-Assessment Procedures	
Step 9	Documentation	
Step 10	Administration and Completion of Portfolio of Evidence	

Step 5

Learner Formative Assessment Activities

The Learner Assessment Guide contains comprehensive activities and worksheets that the learner must complete during the delivery of the learning program. It is imperative that these activities be completed as part of the learning process in order to give the learner the opportunity to develop the skills, knowledge and attitudes that are required for competence.

Learners must complete all the activities in the workbook.

Learners must be encouraged to take control of their learning by indicating areas in the workbook where they experience difficulty.

Learners hand in the Learner Assessment Guide to the assessor or the facilitator, only if the facilitator is a subject matter expert, for the assessment of the formative assessment activities. The assessment of these activities must be done according to the prescribed benchmarks and according to the marking matrix that follows.

The learner must not move on to the next step before this step has been completed and learners show sufficient capacity and readiness for summative assessment. If problems areas are identified, the learner should be guided with a developmental action plan, which is documented separately and signed by the learner, the facilitator and the assessor.

Model answers are provided below.

Activity 1 – Group Discussion
Complete the worksheet below in your own words.
What is the main impact of physical water quality?
Clogging of emitters and filters. Too much suspended material also increases the backwash frequency of the filter system, rendering the system less efficient.
Why are clogged emitters detrimental to citrus production?
When an emitter is clogged or only partly clogged, the tree will not receive the correct volume of water and the yield and fruit size will be reduced. A partly clogged emitter is difficult to detect and will give the misleading impression that all is well.
Which factors will stimulate the growth of microbes in the irrigation system?
Any soluble organic material that can be utilised as a source of energy, like chelates, fulvates and humates and extracts of compost or any other organic material. Then also inorganic salts containing nitrates and phosphates.
The pH of the water is 7.85. List your assessments and actions to be taken to optimise this chemical water quality factor.
This water is alkaline. The concentration of bicarbonate will determine if the water can be treated economically to reduce the pH. Usually no treatment will be considered for micro-jet irrigation. When fertigation is used with drippers, acids can be used to lower the pH and serve as sources for N and P. Foliar applications of some fungicides must be acidified. Acids or buffers can be used. The efficacy of some foliar applications of nutrients can be improved by acidification but others must not be acidified.

Why is an EC of more than 150mSm ⁻¹ an important parameter in citrus production?
At an EC of 150nSm-1 the osmotic pressure is at –50kPa which is the maximum for water to be absorbed without the involvement of extra energy by the tree. The extra energy required for absorption will negatively impact on fruit size.
Why is an SAR value of >1 is a negative factor in citrus production?
When the SAR exceeds 1, it means that on an equivalent basis more sodium is applied than calcium plus magnesium. Too much sodium will destroy the structure of the soil.
What is the effect of a high concentration of magnesium on the potassium status of citrus trees?
Magnesium has a strong antagonistic action towards potassium. If the water contains too much magnesium it means that magnesium is applied with every irrigation cycle (the same as fertigation). This will suppress the absorption of potassium, creating too low levels of potassium, even deficiencies, resulting in decrease in fruit size and crop failure.
What are the two groups of dosing apparatus used to apply acids and disinfectants?
Passive action – Based on suction like a venturi type Active action – Based on a positive pumping action
Name three types of filters used to remove suspended solids from irrigation water?
Screen filters, mesh filters, sand filters and disc filters.

Activity 2 – Class Discussion

Hold a class discussion on the following topics and write down key notes of the conclusions that you reach.

How and why does one treat irrigation water?
How? By means of: • Sedimentation and filtration (physical properties) • Acids (chemical properties) for foliar sprays and fertigation • Disinfectants (biological properties) Why? • To improve the physical, chemical and/or biological composition • To reduce clogging • To improve water application • To improve efficiency of foliar sprays (especially pesticides) • To improve the efficiency of fertiliser absorption • To reduce the negative impact on the irrigation system • To reduce the negative impact on the soil • To reduce the negative impact on the tree • To reduce the negative impact on the environment • To improve economic returns
Are all pesticides more efficient if water at a pH of less than 6 is used for mixing the spray material? Motivate your answer.
No, it depends on the molecular structure and composition of the pesticide. Some are more efficient at pH values less than 7.00 but others might damage the foliage and fruit if the pH of the solution or suspension is reduced.
Lists four types of precipitates that can accumulate in emitters and irrigation pipes.
• Inorganic salts like calcium and or magnesium carbonate, showing a whitish colour • Red to dark and even black coloured deposits of iron and manganese as oxides or sulphides • Solids like sand, plastic cuttings and lubricants • Slimes and conglomerated material bind together by microbial activity

Activity 3 – Research and Discover

Research the questions below and write down what you discover.

According to the standard set by Netafim, the concentration of 60% nitric acid in the system should be 0.6%. Calculate the concentration if the acid available has a concentration of 50%.

0.6% means 0.6ml of the acids per 100ml water

If the concentration is less than 60% the volume of acid must be increased by the same factor namely $60 \div 50 = 1.20$

Therefore 0.6ml of a 60% acid = 0.72ml of a 50% acid

Therefore apply 0.72ml acid per 100ml water, or 72ml per 10l water, or 720ml per 100l for a shock treatment to dissolve precipitates

Why is nitric acid the preferred acid in lowering the pH of irrigation water?

Nitric acid also contains nitrates, which is also an essential plant nutrient. All nitrate salts are soluble in water and the precipitates will dissolve better.

What is the meaning of a maintenance and corrective treatment?

A maintenance treatment will keep the pH at the desired level all the time.

A corrective or shock treatment is introduced to correct the condition which accumulated over a period when no maintenance treatments were administered.

Describe the terms chlorine and chloride.

Chlorine is an instable and active ion and is a strong oxidising agent that will oxidise organic material and kill living cells.

Chloride is the stable form and an anion that combines with cations like potassium to form the salt potassium chloride. At mild concentrations, chloride has no disinfectant or killing properties. Only at high concentrations it acts as an agent that will kill or suppresses microbial activity.

Name the three common water quality treatment processes.

Filtration, acidification and disinfection.

Can all chemical water quality factors be improved? Motivate your answer.

No, not for irrigation water applied to citrus. The cost to treat any chemical water quality factor is usually too high for irrigation purposes. Only when the acidification process can be supported by the addition of a nutrient like nitrate and/or phosphate, chemical treatment to lower the pH of irrigation water for drip irrigation can be justified.

Acidification of water used to apply pesticides is usually justifiable due to the cost of pesticides, the cost of the damage caused by them and the degree of improvement in efficacy.

Sometimes the cost of acidification can also be justified when nutrient sprays are applied.

What is the best method to determine the volume acid required to acidify the water to a certain pH?

The best method is to do a titration with the water and acid to be used.

Name the best method to evaluate the chlorination process.

To measure the concentration of active chlorine at the most distant emitter after the reaction period is completed, when the total system is treated. If only a part is treated, then the concentration at that part after the prescribed reaction period had elapsed.

Describe in short what "relevance of measurements" means.

It refers to the need for taking relevant measurements that result in meaningful data and information.

What chemical water quality factors can accurately be measured on the farm or in the orchard?

pH and EC

Activity 4 – Worksheet

Complete the worksheet below.

Two water sources are available for irrigation. Source A is of good quality with an EC of 30mSm^{-1} and source B has an EC of 130mSm^{-1} . How can the volume of irrigation water with an acceptable quality be increased?

By mixing equal volumes of the two sources, the resultant EC will be about $30+130\div 2 = 80\text{mSm}^{-1}$ which is very close to an ideal water for irrigation of citrus.

A lower EC can be obtained by mixing 6 volumes of A with 4 volumes of B and the estimated EC will be $6\times 30+4\times 130\div 10 = 70\text{mSm}^{-1}$

Estimate the EC of the mix when two waters with an EC of 100 and 50mSm^{-1} are mixed in a ratio of 1 to 2.

The estimated EC will be $1\times 100+2\times 50\div 3 = 66,7\text{mSm}^{-1}$.



Activity 5 – Report Interpretation

Study the analysis report below (courtesy of BemLab; Stellenbosch), and answer the questions that follow.

Origin	Lab No	pH	EC (mS/m)	OP* (kPa)	Na	K	Ca	Mg	Fe	Mn	Cl	CO ₃	HCO ₃	SO ₄	B	Adj.SAR	Langelier Index	Class	Total Bacteria / 1ml	Coliforms / 100ml	E. coli / 100ml	COD mg / l
BH.M	1	8.8	249	89.64	353.3V	3.4	23.4	77.9	3.13	0.11	670.6V	92.3	205.7	24	0.25	8.12H	0.51	C4-S2	1040	0	0	25

OP* - Osmotic Potential H = High V = Very High

The Classification of the water has the following meaning:

C4: Very high salinity water – not suitable for irrigation under normal conditions

S2: Medium sodium water – will present an appreciable sodium hazard in fine textured soils unless gypsum is present in the soil.

S3: High sodium water – will require special management, viz. high leaching and organic matter additions as well as good drainage. Chemical amendments may be required to replace exchangeable Na, but may not be feasible.

S4: Very high sodium water – generally unsuitable for irrigation except at C1 and perhaps C2, where gypsum can be applied.

Comments:

With sodium concentrations greater than 200mg/l, severe problems with sodium toxicity is expected. The water is not suitable for irrigation.

With chloride concentrations greater than 260mg/l severe problems with Cl toxicity is expected. The water is not suitable for irrigation.

Langelier Index:

A positive value for the Langelier index indicates a tendency for calcium carbonate to precipitate, whereas a negative value indicates that the water will dissolve calcium carbonate. The later water is regarded as aggressive corrosive. If there is a tendency for calcium to precipitate it will result in a higher SAR value than the value shown in the table above and the sodium hazard with use of this water will therefore be greater.

Activity 5 – Report Interpretation (continued)

Fill in the table below based on the report. For each factor, indicate whether it poses a low hazard or a high hazard. Motivate your answer each time.

Factor	Unit	Low Hazard	High Hazard	Motivation
pH			X	The high pH will reduce the efficacy of pesticides and even nutrient sprays. It will also promote clogging of emitters.
Bicarbonates	me per litre		X	The same as above. The carbonates and bicarbonates are responsible for the high pH and precipitation of calcium and magnesium.
	mg per litre		X	
Calcium	me per litre	X		Very low concentration and in view of the high sodium, must be applied to the soil in some or other way.
	mg per litre	X		
Manganese	mg per litre	X		No hazard and no treatment required.
Iron	mg per litre		X	The high concentration combined with the microbial activity will cause clogging. Aeration of the water prior to filtration should remove the oxidised iron.
EC	mS per m		X	The EC is too high and combined with the high sodium content will cause a major hazard to the soil. The suitability of this water for citrus production is doubtful.

Make recommendations based on the values in the report regarding the following:

	Measurement	Assessment	Actions
pH	8.8	Too high	Acidify when use for foliar applications of pesticides.
EC	249mS/m	Too high and not really suitable for irrigation of citrus.	Consider mixing with better quality water. Otherwise no treatment available to desalt this water economically. Actually not suitable for foliar applications either.
SAR	8.12H	Very high	If this water has to be used, apply calcium to the soil and ensure that the SAR of the soil does not deteriorate.
Calcium	23.4	Very low in relation to the sodium.	If this water has to be used, apply calcium to the soil and ensure that the SAR of the soil does not deteriorate.

Magnesium	77.9	Low to moderate hazard	Monitor the Mg and K levels in the soil and leaves, and adjust the application of potassium accordingly.
Chloride	670.6V	Too high	This would offer a major problem with osmotic pressure and salinity. Monitor the EC of the soil and Cl concentration in the soil and leaves.
Boron	0.25	Low and should offer no problem.	None required

Judging by the classification of the water is the water suitable for irrigating citrus or not? Motivate your answer.

The class indicates a C_4S_2 water, which indicates a high salinity hazard combined with a moderate sodium hazard. The water will offer multiple problems such as:

- At an EC of $249\text{mS}\cdot\text{m}^{-1}$ the estimate OP is -82kPa which is already higher than -50kPa and the trees will require energy to absorb the water. Fruit size will be a problem
- The high pH will aggravate clogging, reduce efficiency of foliar applications and even soil applications of fertilisers.
- To counteract the high concentrations of Na and Cl a lot of other chemicals like calcium need to be applied. This will increase the EC and OP even more.
- The high SAR will destroy the structure of the soil.
- The high concentration of iron increases cost due to treatments to remove the iron and maintenance of emitters due to clogging hazard.

This water is not suitable for irrigation of citrus with conventional systems and almost all soil types.

Activity 6 – Interview an Expert

Interview an expert on the farm where you are completing your practical duties and obtain answers to the following questions.

No model answer provided due to variance in circumstances.

What measurements are taken for the water quality management system?

Why are these measurements taken for the water quality management system?

Are all the measurements that are taken relevant to the water quality management system?

How accurate are the measurements that are taken? Explain why it is considered this accurate.

How frequently are water samples taken and analysed?

What dictates how frequently the water is analysed?

How often is data collected from water quality tests assessed?

How often is water quality reported on?

How is water quality reported on?

Activity 7 – Report Interpretation

The report below (courtesy of Central Analytical Laboratories) contains the results of three water samples taken on one farm. Make suggestions regarding the corrective actions that should be taken on the basis of the report. Motivate your answers.

REPORT ON THE ANALYSES OF WATER SAMPLES

Laboratory number	9116	9117	9118
Your reference number	Borehole	Dam	Canal
Suspended material (mg per litre)	<1	139	42
pH	8.23	6.55	7.72
Electrical conductivity (mSm ⁻¹)	251	55	39
Total dissolved solids (mg per litre)	1597	355	259
Potassium (me per litre)	0.01	0.01	0.02
Calcium (me per litre)	4.22	3.14	2.12
Magnesium (me per litre)	7.24	1.02	0.94
Sodium (me per litre)	14.18	1.37	0.82
Chloride (me per litre)	11.32	2.08	1.18
Sulphate (me per litre)	4.33	1.87	1.07
Bicarbonate (me per litre)	6.16	1.48	1.65
Carbonate (me per litre)	1.21	0.00	0.00
Boron (mg per litre)	1.21	0.03	0.09
Nitrate-N (mg per litre)	1.50	3.50	0.04
Ammonium-N (mg per litre)	2.05	0.00	0.00
Sodium adsorption ratio (SAR)	5.92	0.95	0.66
Class (USDA)	C ₄ S ₂	C ₂ S ₁	C ₂ S ₁
Total bacterial count (colonies per ml)	10	25 000	500

Source	Corrective Action	Motivation
Borehole	This water is not suitable to irrigate citrus or to be used for foliar sprays.	The EC and concentrations of sodium, magnesium, chloride, sulphate and bicarbonate and total salt are too high. The SAR and Class confirm this stressing the high sodium hazard.

Dam	This water is suitable to irrigation citrus as well as for foliar applications. The factors that need to be addressed in this water are the suspended solids and the high microbial count.	The 139mg/litre suspended material combined with the high microbial count is a major clogging hazard. Filtration will remove the suspended material but the water needs to be treated with chlorine to reduce the numbers of bacteria.
Canal	This water is also suitable to irrigate citrus as well as for foliar applications. However pH adjustment is required for certain pesticides.	This water contains low concentrations of all measured and relevant parameters except for the pH that might be too high for certain pesticides.

Activity 8 – Evaluation

Evaluate the effectiveness of the corrective actions for dam and canal water in the table below, stating the expected outcome and commenting on why you consider the corrective actions to be effective or not.

Factor and Finding	Reason for Corrective Action	Corrective Action	Expected Outcome	Comments on Action Taken
Dam Water				
Suspended solids	The mass of 139mg per litre offers a major clogging hazard	Filtration by means of a sand and disc filter unit	Concentration to be less than 50mg/l	When micro-irrigation is practised, filtration is a must. Filtration by sand filter followed by a disc filter should be effective.
High bacterial count	Major clogging hazard caused by slimes that will aggregate the suspended material.	Chlorination. Continuously apply calcium hypo chlorite at a rate of 3 mg free chlorine per litre water	The treatment should control the bacteria. Also ensure that nothing that will stimulate the bacterial growth is spilled into the dam.	The high count could justify a continuous monitoring of the bacterial counts in the piping as well as inspection of the debris during flushing of the laterals will be required.
Canal Water				
High pH	Needs acidification when foliar feeds and fungicides are applied	Apply Bladbuff until the colour remains red.	When the colour turns red, the pH should be ± 5.00. Check to ensure that the solution reaches the desired pH.	An easy and reliable method once the correct dosage is applied.
Suspended solids = 85mg per litre	Moderate clogging hazard	Filtration	Concentration to be less than 50mg/l	When micro-irrigation is practised, filtration is a must. Filtration by sand filter followed by a disc filter should be effective.

Activity 9 – Class Debate

Hold a class debate on the following subject:

Water quality management is addressed well in the region where our citrus farm is located.
versus

Water quality management is addressed poorly in the region where our citrus farm is located.

Ensure that you argue the debate by supplying information and statistical analysis regarding the following criteria related to water quality and water quality management:

- Physical factors
- Chemical factors (dissolved oxygen, ammonia, pH, salinity, super saturation, pollutants, heavy metals)
- Microbiological characteristics (E. coli, Vibrio sp., Salmonella sp., algal blooms, and possible diseases)
- Biological processes (photosynthesis, nitrogen cycle, decomposition, energy budgets)
- Operational technical systems (aeration, filtration, protein skimming, screening, bio-filtration, degassing, nutrient stripping and sterilisation (ozonation, UV sterilisation, chlorination))

Make keynotes on both sides of the argument below.

No model answer provided due to own interpretation.



Marking Matrix and Assessor Report for Formative Assessment Activities
Formative Evidence Collection Summary for Unit Standard 116322 – Level 4

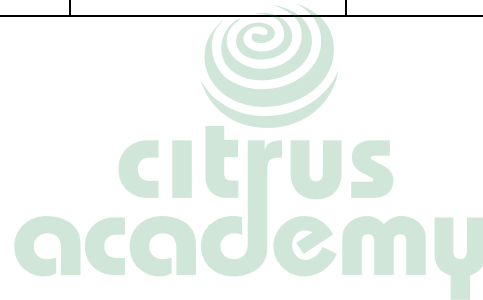
	<i>Action Required from Learner to Develop Competence</i>	<i>Competence Assessments</i>	<i>Standard for Activity</i>	<i>Allocation of Marks</i>	<i>Feedback to Learner and Comments on Evidence</i>
<i>Specific Outcome 1: Correctly assess, analyse and evaluate data and decide on corrective actions within operational technical systems independently to well-defined but possibly unfamiliar problems</i> <i>Range:</i> Physical factors include but are not limited to such as temperature, suspended solids, plankton, clay turbidity, etc. Chemical factors include but are not limited to dissolved gasses such as oxygen, ammonia, pH. Dissolved solids include but are not limited to salinity, super saturation, pollutants, and heavy metals. Microbiological characteristics include but are not limited to E. coli, Vibrio sp., salmonella sp., algal blooms, and possible diseases. Biological processes include but are not limited to photosynthesis, nitrogen cycle, decomposition, and energy budgets. Operational technical systems include but are not limited to aeration, filtration, protein skimming, screening, bio-filtration, degassing, nutrient stripping, sterilisation such as ozonation, UV sterilisation and chlorination, etc.	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct A signature and commentary from the supervisor / coach / mentor or facilitator in learner Workbook	As per model answer sheet	

Marking Matrix and Assessor Report for Formative Assessment Activities

Formative Evidence Collection Summary for Unit Standard 116322 – Level 4

	<i>Action Required from Learner to Develop Competence</i>	<i>Competence Assessments</i>	<i>Standard for Activity</i>	<i>Allocation of Marks</i>	<i>Feedback to Learner and Comments on Evidence</i>
Specific Outcome 2: Demonstrate a thorough understanding of the reasons, impacts and implications of specific corrective actions related to water quality	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct A signature and commentary from the supervisor / coach / mentor or facilitator in learner Workbook	As per model answer sheet	
Specific Outcome 3: Implement corrective actions related to the quality of water and water quality systems	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct A signature and commentary from the supervisor / coach / mentor or facilitator in learner Workbook	As per model answer sheet	
Specific Outcome 4: Evaluate the effects of corrective actions or adjustments on the water quality requirements	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct A signature and commentary from the supervisor / coach / mentor or facilitator in learner Workbook	As per model answer sheet	
US CCFO: Identifying	Attends all lessons, activities, practical and completes activities and workbook as per instructions	Attendance register and facilitator report	Learner must at least be present and no negative commentary about the learner should be made in the facilitator report.	N/a	
US CCFO: Working					
US CCFO: Organising					
US CCFO: Communicating					
US CCFO: Science					

Marking Matrix and Assessor Report for Formative Assessment Activities Formative Evidence Collection Summary for Unit Standard 116322 – Level 4					
	<i>Action Required from Learner to Develop Competence</i>	<i>Competence Assessments</i>	<i>Standard for Activity</i>	<i>Allocation of Marks</i>	<i>Feedback to Learner and Comments on Evidence</i>
US CCFO: Demonstrating					
US CCFO: Contributing					
US CCFO: Identifying					



Assessment Feedback Form – Activity Workbook			
		Comments / Remarks	
Feedback to learner on assessment			
Feedback from learner to assessor			
Learner's Signature		Date:	
Assessor's Signature		Date:	



Step 6

Learner Presentation

Before the summative task 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 this section in the learner assessment guide. The learner and assessor must sign off this section to acknowledge that this step was completed.

- Use the planning and questioning format below to help you collect evidence for foundational and embedded knowledge as prescribed by the outcomes of the unit standards.
- Provide the questions as listed to the learners as a guide.
- Ensure that you apply the exact same methodology for each learner in order to ensure that VACS principles are adhered to.
- The benchmark for learner competence is an 85% overall test score.
- Only a suitably qualified and registered assessor who is ALSO a subject matter expert in this specific field can mark this assessment tool for learner assessment.
- If no such a person can be found to assess the learner, then it is advised that a qualified assessor consults with the appropriate subject matter expert prior to the assessment in order to establish key points for competence and / or uses model answers as supplied by a subject matter expert to allocate marks. The subject matter expert should be consulted for any answers that the assessor might have queries on.
- Use a header in the following format for each presentation:

Unit Standard:	116322	NQF Level:	4
Learner Name			

- The assessor should use the questions below as a marking matrix and to gather evidence and to check for completeness.

Question	Score
Identify the water source on the farm where you are performing your practical work.	3%
List all the water quality factors and categorise them according to chemical, physical or biological factors.	4%
Identify whether these factors will impact on crop production, the irrigation system, or sustainable soil productivity.	3%

<i>Question</i>	<i>Score</i>
Obtain values for the following factors for the water that you are investigating: • pH • EC • SAR • Ca • Mg • Cl • B • N • Total suspended solids • Dissolved oxygen	10%
Assess the water quality and decide on required corrective actions.	20%
What type of filtration system will have to be installed if this water is to be used for irrigation purposes? Be very specific regarding type of filter and pore sizes.	5%
What should the result and advantages of your actions on the water?	10%
What is the clogging hazard of the water and what can you do about it?	5%
Would you aerate the water? If yes, how and why?	5%
Would you consider acidification of the water? If yes, how and why?	5%
Would you disinfect the water? If yes, how and why?	5%
Would you chlorinate the water? If yes, how and why?	5%
How often will you perform these tests on the water in future?	5%
What will you test routinely on the water in future?	5%
What will you do with the data that you obtain from each of these water tests?	5%
If you were in charge of water quality management, what would you report and to whom would you report it?	5%

Step 7

Integrated Summative Assessment Tool

One assessment tool is provided in this step, being:

1. Attitudes and Attributes Assessment Tool

This assessment tool has been drafted in its entirety and follows below. It must be copied and completed for every learner in the same manner and according to the same procedure.

Learners must not be given these tools in preparation for summative assessment. This corresponding step in the Learner Assessment Guide is a direct reflection of these tools and is drafted in a format that is appropriate to the learner's level of language competence.

1. Attitudes and Attributes Assessment Tool

- Use this rating scale to judge the learner's CCFO competence according to the unit standard.
- The learner's entire performance and all the stages of learning, as well as all gathered evidence must be considered for this section.
- It is advised that the assessor consult with facilitators, mentors, coaches and supervisors in order to ensure that an objective rating is allocated.
- A rating between 1 and 5 should be given, as follows:

Rating	Description
1	No evidence can be found
2	The evidence found is weak and this is still a major development area for the learner
3	The evidence found meets the average expectation for a learner on this level
4	The evidence found is of a high quality and exceeds the average standard expected
5	The evidence found is outstanding and the learner attitudes and traits are very well developed

- Learner must be given constructive feedback on each rating.
- Ensure that you apply the exact same methodology for each learner in order to ensure that VACS principles are adhered to.
- The benchmark for learner competence in this tool is 3:5 in EVERY CCFO.

At the end of this step, an assessment feedback form is provided which must be completed and signed by the assessor, learner and moderator, where applicable.

Attitudes and Attributes Assessment Tool

Use the following rating table in this assessment:

Rating	Description
1	No evidence can be found
2	The evidence found is weak and this is still a major development area for the learner
3	The evidence found meets the average expectation for a learner on this level
4	The evidence found is of a high quality and exceeds the average standard expected
5	The evidence found is outstanding and the learner attitudes and traits are very well developed

CCFO Criteria	Rating
Identifying – The learner can identify problems and deficiencies correctly.	
Working in a Team – The learner is able to work well as member of a team.	
Organising – The learner works in an organised and systematic way whilst performing all tasks and tests.	
Communicating – The learner is able to communicate his or her knowledge orally and in writing, in a way that shows what knowledge he or she has gained.	
Demonstrating – The learner is able to show and perform the tasks required correctly.	
Contributing – The learner is able to link the knowledge, skills and attitudes that he or she has acquired in this module of learning to specific duties in their job or in the community where he or she lives.	
Science – Learner is able to utilise and use science and technology effectively	
Collecting – Learner can effectively gather information	



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

Step 8

Re-Assessment Procedures

- Note that only outcomes on which the learner was found not yet competent must be re-assessed.
- The same procedures in steps 6 and 7 are repeated.
- The tool must be adapted at discretion of the assessor. Best practice is not to present the exact same format and questions if possible.
- Use your expertise and judgement to ensure that the method of re-assessment remains integrated and relevant to the expected outcomes.



Step 9

Documentation

The following documentation is addressed in this step:

1. Learner and assessor information reports;
2. Assessor report and summative evidence collection summary;
3. Learner assessment re-actionnaire;
4. Assessor's assessment review and improvement document;
5. Assessment appeal form

1. Learner and Assessor Information Forms

The learner information form is in the assessment guide for learners. The assessor information form follows. These forms must be completed for each individual learner and placed in the learner's portfolio of evidence.

2. Assessor Report and Summative Evidence Collection Summary

This report follows after the information report. Use it to summarise the findings during assessment. Please complete the copy of this report that is in the learner assessment guide.

3. Learner Assessment Re-Actionnaire

A pro-forma for the learner assessment re-actionnaire is included in the learner assessment guide. Ask the learner to complete this form and sign it.

4. Assessor's Assessment Review and Improvement Document

The assessor is expected to complete the assessor review of the assessment process, using the pro-forma document of which an example follows. Please complete the copy of the document in the learner assessment guide. This document must be discussed with the learner and any learner commentary should be recorded.

5. Assessment Appeal Form

The assessment appeal form is also provided in the learner assessment guide. Assist the learner to complete the document if necessary.

The learner must be requested to sign-off all reports and documents before they are placed in the portfolio of evidence.

Assessor Information Form			
Unit Standard	116322		
Program Date(s)			
Surname			
First Name			
Company Name			
Job / Role Title			
Home Language			
Gender	Male	Female	
Race	African	Coloured	Indian/Asian White
Employment	Permanent	Non-permanent	
Disabled	Yes	No	
Date of Birth			
ID Number			
Contact Telephone Numbers			
Email Address			
Postal Address			

Assessor Report and Summative Evidence Collection Summary for Unit Standard 116322 – Level 4

<i>Description</i>	<i>Evidence Gathered</i>		<i>Benchmark</i>	<i>Competent / Not yet Competent</i>	<i>Feedback and Comments</i>
	Foundational and Embedded Knowledge	Practical Skills, Underpinning Knowledge and Reflexive Competence			
Specific Outcome 1: Correctly assess, analyse and evaluate data and decide on corrective actions within operational technical systems independently to well-defined but possibly unfamiliar problems <i>Range:</i> Physical factors include but are not limited to such as temperature, suspended solids, plankton, clay turbidity, etc. Chemical factors include but are not limited to dissolved gasses such as oxygen, ammonia, pH. Dissolved solids include but are not limited to salinity, super saturation, pollutants, and heavy metals. Microbiological characteristics include but are not limited to E. coli, Vibrio sp., salmonella sp., algal blooms, and possible diseases. Biological processes include but are not limited to photosynthesis, nitrogen cycle, decomposition, and energy budgets. Operational technical systems include but are not limited to aeration, filtration, protein skimming, screening, bio-filtration, degassing, nutrient stripping, sterilisation such as ozonation, UV sterilisation and chlorination, etc.	Summative Presentation	CCFO Rating Scale	85% competence in all areas		

Assessor Report and Summative Evidence Collection Summary for Unit Standard 116322 – Level 4					
Description	Evidence Gathered		Benchmark	Competent / Not yet Competent	Feedback and Comments
	Foundational and Embedded Knowledge	Practical Skills, Underpinning Knowledge and Reflexive Competence			
Specific Outcome 2: Demonstrate a thorough understanding of the reasons, impacts and implications of specific corrective actions related to water quality	Summative Presentation	CCFO Rating Scale	85% competence in all areas		
Specific Outcome 3: Implement corrective actions related to the quality of water and water quality systems	Summative Presentation	CCFO Rating Scale	85% competence in all areas		
Specific Outcome 4: Evaluate the effects of corrective actions or adjustments on the water quality requirements	Summative Presentation	CCFO Rating Scale	85% competence in all areas		
Embedded Knowledge: The learner is able to demonstrate a basic knowledge of: - Names and functions of all the various components of water supply and quality systems - Attributes of water related to water quality - The requirements of organisms related to their water need - The purposes of maintaining relevant water quality for living organisms - Measurement and recording technique - Water purification techniques and systems - Relevant legislation related to the feeding			Overall minimum test score of 85%		

Assessor Report and Summative Evidence Collection Summary for Unit Standard 116322 – Level 4					
Description	Evidence Gathered		Benchmark	Competent / Not yet Competent	Feedback and Comments
	Foundational and Embedded Knowledge	Practical Skills, Underpinning Knowledge and Reflexive Competence			
and care of living organisms 8. Relevant legislations related to water use and environmental issues 9. Interpersonal skills related to communication 10. Sensory and documented cues related to water quality 11. Sensory cues related to the water requirements and use of water by living organisms					
Unit Standard CCFOs: - Identifying - Working in a Team - Organising - Communication - Demonstrating - Contributing - Science - Collecting	N/a	Rating Scale	Minimum rating of 3:5 in each criteria or overall average of 3:5		

Assessor's Assessment Review and Improvement Document	
Issues	Comments
Did the assessment go according to plan?	
Did anything unexpected happen?	
Were you pleased with the assessment decision; i.e. was it what you expected?	
How could the process have been carried out more efficiently?	
How could the process of assessing the knowledge be improved?	
How could the Performance Observation checklist be improved?	
Was the evidence you gathered sufficient to make a judgment of competence?	
Was the way you obtained feedback from the learner effective?	
Were you pleased with the way you communicated your decision to the learner? If not, how could this have been improved?	
How would you improve the assessment process?	

Any learner has the right of appeal against any not-yet-competent decision by the assessor. If the learner wishes to appeal, please assist him / her to complete the form below.

Appeal Form			
I hereby appeal against the outcome of my assessment.			
Date:			
Learner's Name:			
Assessors Name:			
Organisation:			
Assessment Details: Criteria, role, standards Used, etc.			
Issue to be Reviewed:			
Learner's Signature		Date:	
Assessor's Signature		Date:	

Step 10

Administration and Completion of Portfolio of Evidence

All the documents or copies thereof, as prescribed previously, must be kept on file as part of the learner portfolio of evidence.

Learner's portfolio of evidence must be readily available for internal and external moderation and verification by the appropriate practitioners, until after the verification process has taken place. The portfolio of evidence may then be kept or returned to the learner according to the service provider's policy.

The prescribed learner results form should be submitted to the ETQA or the National Learner Database as per the SETA procedure.

