Annexure B

Guideline for water users

Department of Water and Sanitation

COMPLIANCE MONITORING

GUIDELINES ON MEASUREMENT

OF THE VOLUMES OF WATER TAKEN FROM WATER RESOURCES FOR IRRIGATION PURPOSES

Water User

November 2017

WATER IS LIFE - SANITATION IS DIGNITY

water & sanitation

Department:
Water and Sanitation
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APPROVAL

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This document is approved by the Department of Water and Sanitation.

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CONTENTS

1. INTRODUCTION

1.1. Introduction

The goal of the National Water Resources Strategy II, 2013 (NWRS 2) is to ensure that water is efficiently and effectively managed for equitable and sustainable growth and development. The development of the Water Conservation and Water Demand Management (WCWDM) is one of the initiatives aimed at realising this goal. In addition, this strategy identifies Compliance Monitoring and Enforcement as one of the water sector priority focus areas for 2013-2018.

One of the challenges encountered in monitoring compliance to water use authorisations conditions is the lack of measuring of water abstracted and discharged across all sectors. Without measuring water abstracted and ultimately discharged in some instances, it is difficult to determine compliance to the authorised volumes and the overall water resources management function is hamstrung. Importantly, water users themselves cannot account for water used if they do not measure. The drought of 2016 resulted in water restrictions being imposed and again it was difficult to ensure compliance to these restrictions where water is not measured, particularly for those individuals outside of the areas under the control of Water Management Institutions (WMI).

Most water users issued with licenses through the NWA have a requirement to measure water used as a condition in the licenses. However, most water users exercising their water use as Existing Lawful Use do not have this requirement as a condition. The result of this is that water actually abstracted is difficult to determine.

1.2. Target audience of the guidelines

These guidelines are for a water user who is required to measure the water that the user takes from water resources for irrigation purposes. Water users who are required to measure must do so as directed by the conditions of water use authorisations or by notices issued by the responsible authority to water users instructing them to measure the water that they abstract.
Most water users exercising their water use under the Existing Lawful Use (ELU) do not have a requirement to measure water abstracted as a condition. The responsible authority may instruct such water users to install water measuring devices. Water Management Institutions (WMI) such as the Water user associations (WUAs), Irrigation Boards (IBs) and Agricultural Cooperatives may develop similar guidelines in their areas of operation.

1.3. The purpose and content of the guideline

This document contains guidance on the selection, installation and operation of measuring devices and recording and reporting of the measurements, to assist the water user in compliance to the regulations.

Although the water user is not required to comply with the guideline, adherence to the guideline will assist the water user to comply with the requirements of the regulations. Compliance with these guidelines does not imply compliance with the regulations.
More technical information on the types of measuring and recording devices and the selection, installation, operation and maintenance of appropriate devices and measurement systems can be obtained from the following Water Research Commission reports:

- Report No TT 248/05: Guidelines for Irrigation Water Measurement in Practice, March 2005.
- Part B(6.5): Knowledge base of measuring systems on Chapters 7and 8: The Measuring System contains guidance on the selection, installation, operation and maintenance of measuring devices.
- Report TT 550/12: Guidance for Sustainable On-farm and On-scheme Irrigation Water Measurement.
  Part B of the report contains in-depth information on the selection, installation and management of water measurement devices.

These documents are also available on the website: http://watermeter.org.za/uploads/Guidelines_for_irrigation_water_measurement_in_practice.pdf.

2. DEFINITIONS

Words used in this document which are defined in the National Water Act or the Regulations have the meaning given in the Act and Regulations unless another meaning is clear from the context.

Authority means the authority as defined in the Regulations. It includes CMAs, any person who fulfils the functions of a water management institution in terms of this Act.
Calibration is the determination of the relationship between the quantities observed and values reported by the measuring system.

A **measuring system** is the devices, pipe work, related equipment and structures that are necessary to measure and record the volumes of water taken.
It may include facilities for the operation and maintenance of the measuring system, verification of the accuracy of the measurements and calibration of open channel flow measurement systems.

Minimum or maximum flow rates are the minimum or maximum flow rates that may occur in operation and need to be measured.

Regulations are the regulations requiring that the taking of water for irrigation purposes be measured, recorded and reported.

Verification of accuracy is the confirmation that the quantities reported by a measuring system reflect the actual quantities with the required accuracy.

A **water measuring device**, as defined in the regulations, includes the associated structures, equipment and other components necessary to measure and record the water quantities.

Water year is the water year that the authority applies in the area where the water use is exercised.

3. LEGAL REQUIREMENTS

3.1. Powers of the authority

The NWA gives powers to the National Government, acting through the Minister, to regulate the use, flow and control of all water in the Republic. To the end the Department established WMIs to, amongst others manage and control water use at local level. This Act also recognises the existence of Irrigation Boards and their functions. WMIs include the Catchment Management Agencies (CMAs), Water User Association and any institution responsible for international water management or any person who fulfils the functions of a water management institution in terms of the NWA.

For the purpose of this guideline document and the published regulations on water measuring, the authority is water management institution responsible for compliance monitoring and enforcement of the taking of water for irrigation purposes, being the Minister or a catchment management agency or other institution to which these powers and duties have been assigned in its area of operation.
According to Schedule 5 of the NWA, one of the functions of a WUA can be "to supervise and regulate the distribution and use of water from a water resource according to the relevant water use entitlements, by erecting and maintaining devices for measuring and dividing or controlling the diversion of the flow of water".
It is important to note that powers to perform these functions have to be delegated or assigned and therefore not all WMIs, including Irrigation Boards can perform the said functions.

3.2. Who should measure?

Water users may be required to measure water that they use through one of the following legal instruments:

- Water use authorisations (as a condition) or
- Notice to measure issued by the authority (to a single user or group of users)

The Minister has issued Regulations prescribing how water taken from water resources for irrigation purposes must be measured and reported. The Regulations prescribe how measuring devices must be selected, installed, operated, maintained and verified. The Regulations also prescribe how measurements must be taken and how they must be recorded and reported.

Water users who are required (either through license or notice) to measure the water that they take for irrigation purposes must comply with the published Regulations and these guidelines are to assist users in complying with the Regulations.
Water users who return excess water directly to the water resource, must measure the returned volumes such as water remaining at the end of a canal.
The Regulations do not prescribe all requirements of the measurement and reporting and therefore water users are advised to refer to the conditions in the water use authorisation and requirements of the authority in the notice. The guidelines herein shall become binding once referred to in the notice issues by the authority to the users.

3.3. Conflict with other requirements

If the water measurement requirements in the water use authorisation are more stringent or extensive than the Regulations and or the Notice, then the more stringent requirements will apply.

4. REQUIRMENTS FOR ALL MEASUREMENT TYPES

The requirements in this section seek to unpack the published Regulations (Government Gazette Notice 131 of 2017) and apply to both measurement of the flow in **full pipes** and measurement of **open channel flow.**
It is advisable that all measurement types/systems comply with the requirements in this guideline to ensure compliance with the Regulations or water use authorisation.

4.1. Scope of measurement

Water users are required to measure:

- Water abstracted from the water resource and
- Return flows

A water user who returns water directly to the water resource must measure both the volume taken and the volume returned. Please note that, the fact that return flows are measured does not imply that the returned volumes will be taken into account to determine the net volume that the user may take.

4.2. Accuracy of measurements

The measuring system must at all times measure the flow volumes within the accuracies stipulated in this guideline.
The measurements must be to the required accuracy over the full expected range of flow rates including water taken in excess of the authorised volumes.

4.3. Measuring location

The measuring device must be installed at the point where the water is taken from the water resource, as required by the Regulations or at the location stipulated in the water use authorisation. For return flows, the measuring device must be installed at the point where the water is returned to the water resource.
If it is not reasonably practical to do so then the approval of the authority in writing must be obtained for an alternative measuring arrangement that will result in the volumes taken from the water resource for irrigation purposes to be measured to the required accuracy.

Only off-takes that do not need to be measured are permitted between the water resource and the measuring installation.

4.4. The measuring system

The water measuring system must meet the meet the following requirements:

- It must be a self-registering device, as required by the Regulations,
- It must be suitable for the quality of the water to be measured, as required by the Regulations, including sediment and algae content,
- It must be able to record measured volumes with sufficient resolution for the method to be used to verify the accuracy of the measurements,
- The device must be able to record the cumulative volume in cubic metres or kilolitres,
- It must have an on-site display of the cumulative volume,
- The measuring device must have an output that is suitable for connection to a data logger,
- The measuring device or data logger must be able to be connected to a remote management or monitoring system,
- The devices must be linked to the alternative power source that is used for pumping in the absence of external power,

- The keeping of the cumulative volume in the recording device must be independent of an external power supply,
- If it is required by the water use authorisation then the measuring device must also be able to measure and record flow rates.

4.5. Installation of the measuring system

Measuring devices must be installed according the manufacturer's specifications, as required by the regulations and the following must be considered:

- It is recommended that measuring devices be installed according to the authority's requirements in this document.
- The measuring system must be installed so that the measuring and recording mechanisms are sealed and secured so as to be reasonably free from damage or vulnerability to tampering and sabotage, as required by the regulations.
- The devices must be installed and sealed, as much as is reasonably possible, in such a way that it is not possible to remove, bypass or tamper with the devices without leaving evidence.
- The measuring system must be installed in a way to enable in-site verification of the accuracy of the system.
- The measuring device must have a clearly visible manufacturer's serial number securely attached or imprinted on the device.
- The measuring device should be installed in such a way that all stamps, labels, seals and displays are easily accessible and visible for inspection purposes.
- The devices must be supplied with the manufacturer's installation, operation and maintenance manuals, which must be kept with the records of the installation of the devices.
- The measuring device or system must be calibrated at a sufficient number of points over the full range of flow rates.
- If verification is required, it must be done at a sufficient number of points over the full range of flow rates.

An installation certificate should be prepared for each device and signed by the water user and the contractor to confirm that the meter installation has been completed.

4.6. Commissioning

The measuring system must be commissioned and certified by a suitably qualified person after each installation or change which may affect the accuracy of the system.

4.7. Recording the installation

The water user must keep a record of the installation and any modifications that may affect the accuracy of the measuring system.
The following information must be recorded for each installation or alteration of the measuring system:

- Descriptions of the structures and measuring and recording devices;
- A description of the measuring method or technology and flow range;
- The calibration parameters and the values;
- The verification results indicating the parameters on which the verification depends and their values;
- The flow range of the measuring system;
- The manufacturers, device types and manufacturers' serial numbers of the devices;
- A description of the remote monitoring and management system, if installed, including a description of the system and its operation, the manufacturer, system type and serial numbers;
- The installation or alteration date;
- The coordinates of the location of the measuring points
- A drawing of the irrigation system indicating installation (measuring points), with relevant photographs;
- The recorded cumulative volumes before and after each installation, maintenance, repair or refurbishment;
- The flow range measurement and certified accuracy of the measuring device;
- The names and contact information of the persons doing the installation and commissioning;
- Verification certificate;
- The name and contact information of the verifier;
- The name and contact information of the supplier of the devices; and
- The records must be kept and provided to the authority when required.

5. MEASURING FLOW IN FULL PIPES

5.1. Guidance

5.1.1. Selecting, locating and installing the measurement system

It is important to do a site investigation to determine the appropriate measuring system to install. The following items are important in the site investigation, selection and design of the measuring system:

1. Range of expected flow rates
2. Head loss across the measuring system
3. Accessibility
4. Water quality

5. Operation and maintenance
6. Calibration and verification of the accuracy of the measuring system

Measurement in full pipes is done with meters and associated devices.
Meters must be selected on flow range and not on pipe size and considering water quality in order to work effectively.
All measuring devices have specified minimum and maximum flow rates within which it has to operate. The minimum and maximum flow rates to be measured at each location have to be specified.
The water quality can affect measuring device with physical and organic impurities (algae, sands, sediments). If the water quality is poor and the selected device will not be able to let the debris past, filtration elements have to be installed upstream of the measuring location.

5.1.2. Measuring location

The installation is influenced by the location of the measuring devices, It is necessary to consider remoteness, subjectivity to floods, accessibility for maintenance and protection of vandalism.

5.1.3. Installing the measuring device

- Meters must be installed according the manufacturer's specifications; the device should be supplied with the manufacturer's installation and maintenance manual. The device should be installed in the position and orientation recommended by the manufacturer, supplier or designer, to ensure that it operates as intended.
- There should be no air or vapour in the water, since this can cause damage to components or incorrect measurements.
- If the water quality is poor and the selected device will not be able to let the debris past, filtration elements have to be installed upstream of the measuring location to protect the measuring device. These filters should be installed so that they do not interfere with the effective operation of the device and should be easily accessible for maintenance and cleaning.
- There should be enough clearance around the installation for easy maintenance, calibration and removal of the device, if necessary. A concrete slab should be put around the area to stop excessive growth of grass and weeds, and to protect the device in case of veld fires. In general, the site should be easily accessible.
- If necessary and possible, install connections for in-field calibration or verification permanently so that they are in place when required. These may include pressure tappings, inspection inlets or positioning guides for current meters.

5.1.4. *Operation and maintenance*

- The user must operate and maintain the measuring system in accordance with the requirements and specification of the manufacturer of the measuring device and the requirements and conditions in this document, as required by the regulations.
- The user must regularly inspect and maintain the system to ensure continuous operation of the measuring system and the accuracy of the system.
- The user must take all reasonable steps to avoid loss of data.

5.1.5. *Verification of the accuracy of the measuring system*

- The accuracy of the measuring system must be verified by a suitably qualified person, as required by the Regulations.
- If verification is done off-site or in-site then it must be done in such a way that the accuracy of the installed measuring system is certified.
- Reference measurement equipment used in the verification of the accuracy of the measuring system must be of a suitable accuracy, certified by an accredited laboratory according to the requirements of the manufacturer of the measuring device.

5.1.6. *Operating and maintaining the measuring device*

- The water user shall be sure the device operates as accurately as possible, that it remains accurate over time and that a maintenance schedule and verification system are in place.
- The system must be inspected regularly for damage and signs of wear to ensure that the device is correctly measuring flow volumes and that the recording device and any telemetric system correctly record the measurements.
- Recalibration may be necessary, either due to general wear or due to changes in the distribution system (and therefore flow conditions).
- Servicing that may affect the accuracy of the measuring device should be done by a suitably qualified person.
- The water user shall record the date, time, volume registered and device description any time that seals are broken and re-installed.
- If the readings are taken manually, it must be ensured that display unit can be easily read and that the person taking the readings has been trained to do so correctly.
- If electronic equipment is used to collect data, the equipment must be properly protected against the elements, especially lightning and frost.
- The data obtained from the measuring devices should be critically evaluated, requiring benchmarks against which it can be compared (water requirements

for a specific season, gross irrigation requirements of the various crops). A purpose-made module has been developed for the Water administration system-WAS program (WRC Report No.513/1/97) to perform these calculations once the necessary data has been captured in the database.

5.1.7. Verifying the accuracy of the measuring system

The water user must have the measuring installation verified after each installation, refurbishment or maintenance activity that may affect the accuracy of the measuring installation.
In order to ensure that a device is accurate at a specific installation, it is strongly recommended that all measuring devices be checked or calibrated in the field after installation. Experience has shown that even if a device comes with a calibration certificate from the manufacturer it is not guaranteed that the device will perform accordingly in the field.
If meters are used outside of their recommended ranges, inaccurate readings will occur. Their accuracy can also deteriorate over time due to wear. The accuracy of the device must be verified at intervals of not more than five years or when the authority directs the user to do so, as required in the Regulations.
A journal of calibrations and verifications and verification certificates should be kept.

6. MEASURING FLOW IN AN OPEN CHANNEL OR PARTIALLY FULL PIPE

6.1. Guidance

6.1.1. Selecting, locating and installing the measurement system

There are benefits in converting the open channel flow measurement to full pipe flow measurement. Measurement of open channel flow, including half full pipes, is done with measuring structures and associated devices.
The measuring structures are usually constructed. They are very much site specific and need trained and experienced installers. It is important to do a site investigation to determine the appropriate measuring system to install.
The following items are important in the site investigation, selection and design of the measuring system:

- Channel gradient, shape and construction
- Range of expected flow rates
- Backwater effects
- Expected debris and siltation
- Expected weed and algal growth
- Head loss across the measuring system
- Accessibility
- Operation and maintenance
- Calibration and verification of the accuracy of the measuring system

The installation should provide for the calibration and verification of the system.

6.1.2. Operating and maintaining the measuring system

Frequent inspection and maintenance are highly recommended. Open channel flow measuring installations must be inspected regularly and maintained. Such frequency is not regulated as it may be determined by various factors. Maintenance and repairs must be done timely, by qualified and experienced persons.

The inspections and maintenance must:

1. Check and repair leaks.
2. Keep the approaching channel clear.
3. Check and repair channel erosion and subsidence.
4. Check water level readings against a reference and periodically check the structure and reference against survey benchmarks.

6.1.3. Calibration

The system must be calibrated as part of the installation. The system must be calibrated regularly and after any event or change that could affect calibration to ensure sufficient accuracy of all measurements.
Calibrations must be done at sufficient flow points to ensure sufficient accuracy.
The water user must keep calibration records, showing dates, adjustments made and reasons for adjustments.

6.1.4. Verifying the accuracy of the measuring device

The water user must have the measuring installation verified after each installation, refurbishment or maintenance activity that may affect the accuracy of the measuring installation.
The accuracy of the device must also be verified at intervals of not more than five years or when the authority directs the user to do so, as required in the Regulations.
The measurements must be accurate to within ±5% of the actual flow, which is determined by the accuracy of the measuring installation, including some pipe work and the way in which the measuring device is installed. If the measuring device is taken away for verification, sufficient pipe work must be included in the verification to ensure that the accuracy of the installation is verified.
A journal of calibrations and verifications and verification certificates should be kept.

7. DATA MANAGEMENT

7.1. Measuring and record keeping

The Regulations require that records of all data obtained from a water measuring device, including the measurements, be kept for five years.
To provide proof to the authority of compliance with the regulations, the water user should also keep records of any damage to the installation or loss of the device and of repairs and refurbishment of the measuring installation that may affect the accuracy or loss of measurements.

A water user must keep a record of all the data obtained from the water measuring device: record the volumes measured for each calendar month at the end of the month or at the frequency and times stipulated in the water use authorisation, instruction to measure or other requirement to measure, for at least five years. Within seven days from the last day of each month or stipulated period, use the records to provide the authority with the measured volume and any other information required in a way and a format required by the authority.

This can take place manually or telemetrically, depending on the situational requirements.

7.2 Records of compliance

The water user must keep the records of the installation, operation, maintenance and the verification of the accuracy of the measuring system.
A journal of calibrations and verifications and verification certificates should be kept.
The authority may direct the water user to provide proof of compliance with the Regulations, for which the user will need these records.
The installation must provide for the calibration and verification of the system.

7.3 Submission of measurement records

Data to be submitted:

1. Water management area
2. Identification of the water user
3. Identification of the provider of the data
4. Property on which the water is taken
5. Identification of the resource from which the water is taken
6. Location of the measuring installation
7. Identification of the measuring installation
8. Measuring device manufacturer's identification
9. Period for which the volume was measured
10. Identification of the licence, general authorisation, verification certificate, permit, court order or notice in terms of which the measurement must be taken
11. The purpose for which the water is taken (irrigation)

12. Volume taken during the month or other period required by the authorisation
13. Volume returned directly to the resource during the period
14. Net volume taken (difference between the volume taken and the volume returned directly)
15. Cumulative volume for the water year

The data must be submitted within 7 days after each month

8 SUBMITTING RECORDS

Records should preferably be submitted on-line but may also be submitted on paper. The online system to which records may be submitted can be found on the website for measurement information system. *A template for manual or paper submission is attached in* ***Annexure A.***

National Compliance Information Management System (NCIMS)>
https://www.dwa.gov.za/dir_ws/NCIMS/

Annexure A: *A template for manual or paper submission*

WATER USER DETAILS	
Water User ID: (Not sure about this)	
Water User Name:	
WMA: (If we have property details or spatial ref, we can determine)	
License No.: (AUTHORIZATION TYPE: LICENSE, GENERAL AUTHORIZATION ....)	
License Conditions: (Not sure about this)	
PROPERTY DETAILS	
Property Name:	
Property Description:	
Latitude (South):	
Longitude (East):	
WATER USER CONTACT DETAILS	
First Name:	
Last Name:	
Tel: (012-3367947)	
Cell:	
Address:	
Email:	

SUPPLIER DETAILS

Supplier Name	Contact Person Name & Surname	Telephone	Cell	Fax	Email

METER DETAILS					
Meter Name	Device Type	Installation Date	Flow Rage	Verification Freequency	Last Date of Verification

METER READING DETAILS					
Distribution System Type(Canal/Lined Canal/Unlined Canal):					
			January		
Measuring Point	Meter Name	Device Type	Data	Unit (KL/M3)	Volume
			(yyyymmdd)	Kiloliters	