

Module C – Existing meters for surface water extraction using a small concrete rectangular weir measurement structure

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1.0 Application

Module C (this module) of the standard applies to existing meters which continuously measure the depth of water over a small concrete rectangular weir measurement structure, calculates the flow of water that is passing the weir, and record the volume of water that has passed the weir.

The existing meters measures the extraction of surface water.

The following words have an important meaning in the standard:

Must Indicates that a statement is mandatory; Australian standards use 'shall' where a statement is mandatory. For this standard, 'must' is used instead of 'shall'.

May Indicates the existence of an option.

2.0 Output requirement

As a minimum, the meter must generate an electronic pulse output each time a set volume of water passes the weir. The output must allow the meter to interface with a transmission device and/or data logger.

The department will notify the relevant person where these devices (data logger and/or transmission device) must be attached to the meter.

3.0 Measurement assurance requirements

The meter must, at a minimum, comply with the requirements outlined below.

A. A meter specified in Section 3.1 must be used.

B. A small concrete rectangular weir measurement structure must have a test/calibration certificate demonstrating:

- i) After manufacture and prior to being placed into service, the errors of new pressure sensors or depth/height measurement devices, are within $\pm 0.1\%$ of true value across the depth range of the sensor.
 - the sensor must be matched to the meter site. For example, for a meter site with a depth range of 3 meters, a sensor with a depth range of 5 meters would match the site. A sensor with a depth range of 30 meters would not match the meter site.
 - ii) The Certificate must show the serial number for the sensor.
-

C. Installation of the meter must comply with the requirements specified in Section 3.2.

D. Periodic maintenance of the meter must comply with the requirements specified in Section 3.3, and the requirements below.

- i) A small concrete rectangular weir measurement structure must have periodic testing and/or calibration of individual sensors forming part of the system.
-

E. Post-installation and before water is extracted through a new meter, the relevant person must engage an authorised meter validator to complete the actions in Section 4 and where the metering installation complies with the requirements of this standard, the authorised meter validator must provide a validation certificate to the relevant person.

F. On an ongoing basis, the relevant person must engage an authorised meter validator to complete the actions in Section 4 and where the metering installation complies with the requirements of this standard, the authorised meter validator must provide a validation certificate to the relevant person.

This process is called revalidation and must be completed within the 12-month period before, and by, the revalidation date published in Schedule 11 of the Water Regulation 2016 (Water Regulation).

G. Auditing may be undertaken by the department or its nominated representative. The details of auditing requirements are generally specified in departmental compliance monitoring plans, but the department may audit at any time and at any frequency deemed necessary.

3.1 Which meter can be used

At all times, the meter must have a clearly identifiable manufacturer’s serial number securely attached or imprinted on the controller.

The meter must use metric units e.g., kilolitres, megalitres.

3.1.1 Existing meters

The existing meter, shown in Table 1, can continue to be used subject to the other requirements of this module of the standard also being met.

The existing meter in Table 1, was confirmed to meet the specification under Measurement assurance Requirement B at the time these metering installations were installed and commissioned.

Table 1 - Existing meter

Meter type	Make	Model
Depth of water over a rectangular weir measurement structure	MACE	HydroMace + 3rd party pressure sensor

3.1.2 New meter – direct replacement

Where a new meter is required as a direct replacement for the existing meter, the meter shown in Table 2 can be used subject to the requirements of this module of the standard being met.

Table 2 - New meter – direct replacement

Meter type	Make	Model
Depth of water over a rectangular weir measurement structure	MACE	HydroMace, AgriFlo XCi or FloPro XCi + 3rd party pressure sensor

Where this direct replacement is not used, then a water meter conforming with the requirements of Module A – Water meters for surface and underground water of the standard must be used.

3.2 Installation

For the meter to comply it must meet all installation requirements of the department attached as Appendix C.

Extracted water must not bypass the metering installation.

3.2.1 Configuration

The meter must be configured to meet these general requirements:

- the internal data logger must be enabled
- logged data must not be lost, deleted, or reset during maintenance or validation
- measurement interval must be 5 minutes or less
- logging interval for measurements must be 60 minutes or less
- date and time must be set to Australian Eastern Standard Time by synchronising the device clock with an electronic device (e.g., computer, or mobile tablet device)
- where software/firmware enhancements occur, these must be upload to the device
- prior to update of software/firmware, the configuration setting, the logged data, and the device totals must be downloaded. Where this information is lost because of the update it must be uploaded to the device after the update is complete.

3.3 Maintenance

The meter must be maintained to meet department requirements.

Maintenance requirements for the meter are attached as Appendix C.

The authorised meter validator must prepare a maintenance report as per section 3.3.1.1.

The relevant person must keep a maintenance log as per section 3.3.1.2. This must be provided to the authorised meter validator during any process of revalidation or when the meter is faulty.

3.3.1 General requirements

3.3.1.1 Maintenance – authorised meter validator

The following activities must be performed by an authorised meter validator during any process of revalidation (validation – ongoing) or when the meter is faulty. A maintenance report on these activities, confirming completion, must be provided to the relevant person with the validation certificate.

Solar panel(s)

- Check solar panel for build-up of material such as dust and bird droppings.
- Check solar panel has tri-spikes (or similar barrier mechanism) installed on the top of the solar panel to reduce the accumulation of bird dropping on the front face of the panel.
- Clean with a wet soft brush or cloth (do not use steel bristle brushes).
- Check solar panel is orientated to the North at the appropriate incline angle, and the panel must not be shaded by trees or structures.

Metering equipment

- Where visible and safe to do so, confirm electrical cables and connections are in good working order.
- Confirm register/display is clear and readable.
- Where it is safe to do so, confirm there are no leaks in the structure.
- The meter has an internal battery; inspect the 'replace battery by date' on the meter. Replace the battery, where required, and record on a tag attached to the meter or write inside a display housing door or lid, replace battery by dd/mm/yyyy. Use permanent ink or label with permanent ink.
- Complete other maintenance for the metering installation as required by the department – Appendix C.

3.3.1.2 Maintenance – relevant person

The following maintenance activities must be performed by the relevant person annually, at a minimum. It is good practice to perform these maintenance activities on a more frequent basis. A maintenance log of these activities, confirming completion, is to be provided to the authorised meter validator during any process of revalidation (validation – ongoing) or when the meter is faulty. The maintenance log will assist the authorised meter validator in developing the required maintenance report. The maintenance log is a compilation of a series of maintenance records. A blank maintenance record is available in Appendix B.

Emplacement / installation / site

- Keep grass/vegetation around the site at a reasonable height.
- Clear away excess vegetation and debris.
- Confirm the site complies with Workplace Health and Safety requirements to ensure the safety of workers and visitors.
- Confirm the integrity of emplacement and fencing.
- Treat weed and vermin issues.

Solar panels

- The solar panel must be checked regularly for build-up of material such as dust and bird droppings.
- This activity must be undertaken as often as is necessary to keep the panel clean.
- Clean with a wet soft brush or cloth (do not use steel bristle brushes).

Metering equipment

- Where visible and safe to do so, confirm electrical cables and connections are in good working order.
- Confirm register/display is clear and readable.
- Confirm there are no leaks in exposed structure, and that extracted water is not bypassing the meter, where it is safe to do so.
- Confirm that you believe the meter is recording the volume of water extracted correctly.
- Confirm the meter and installation has mechanical tamper-evident seals, and that none of these seals are broken.

4.0 Validation

4.1 Validation certificate

Where the metering installation meets the requirements of this module of the standard, a validation certificate must be given to the relevant person within 20 business days of an inspection of the meter by an authorised meter validator.

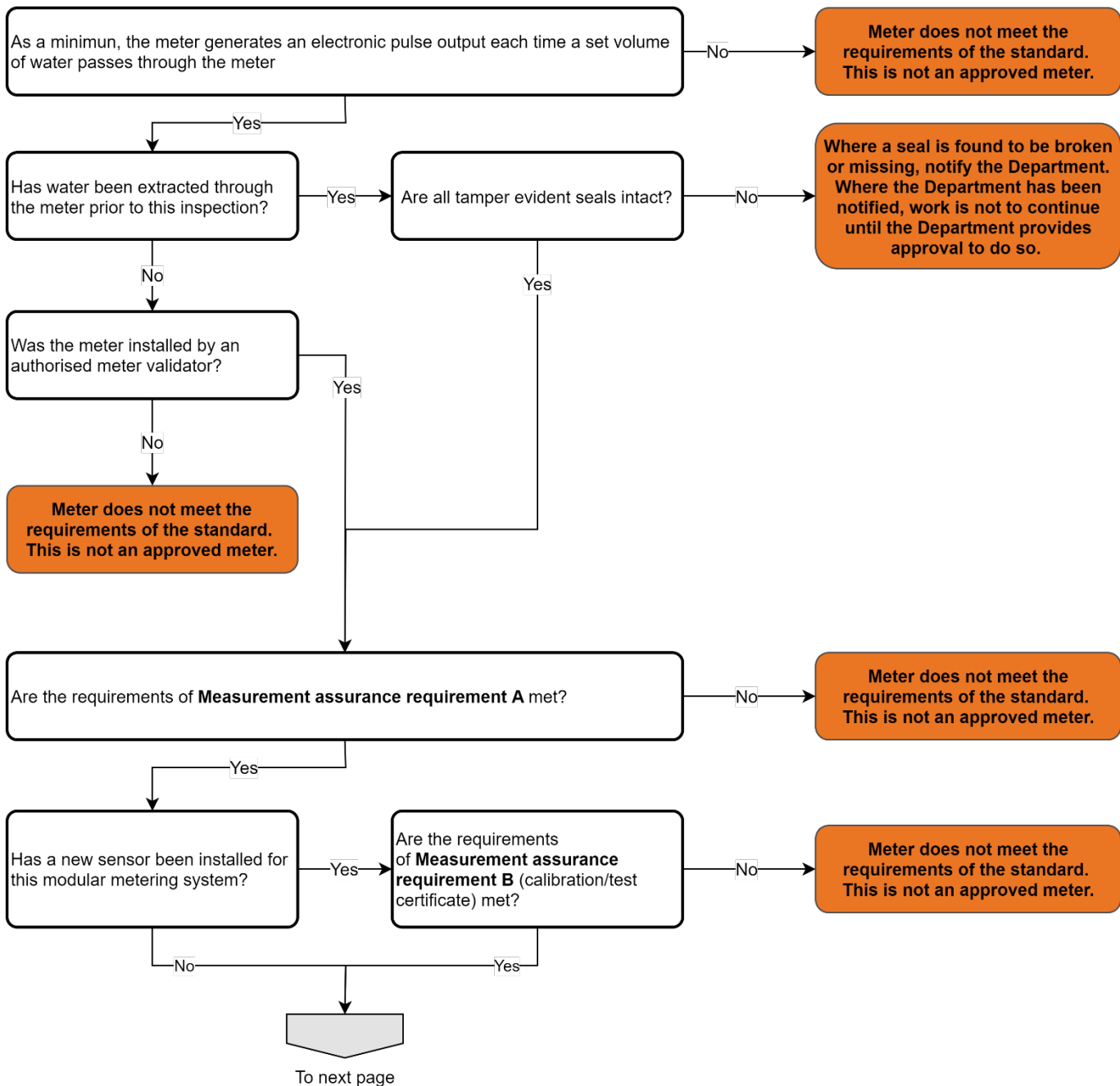
The relevant person must give a copy of the validation certificate to the Department within 20 business days of receipt of the validation certificate.

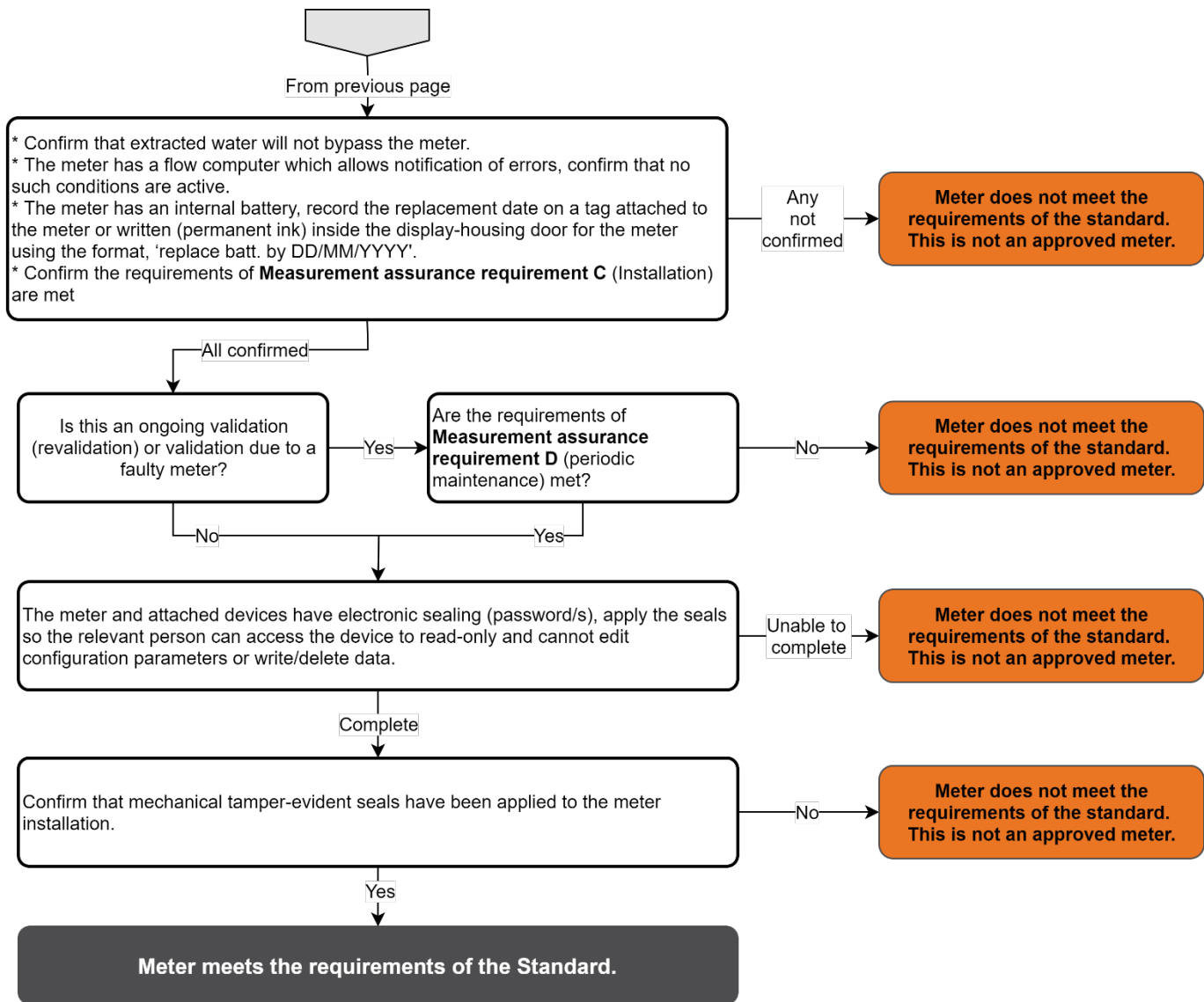
Where the metering installation does not meet the requirements of this module of the standard, the authorised meter validator must provide the relevant person with a validation notice explaining why and any potential modifications that could allow the metering installation to become compliant. The relevant person or the authorised meter validator may provide a copy of this notice to the Department.

The Department validation form for this module is *W2F119C Module C - Water meter validation*.

Figure 1 describes the process and actions that must be completed by an authorised meter validator when undertaking a process of validation.

Figure 1 - Validation





4.2 Tamper-evident sealing

Irrigation Australia Limited have published national guidelines on tamper-evident sealing of water meters for CMI's. The following requirements provide additional requirements under this module of the standard.

4.2.1 Mechanical seals

The sensors must have mechanical tamper evident seal(s) applied so that they cannot be removed or disconnected, without breaking the seal(s)

The logger must have mechanical tamper evident seal(s) applied so that it cannot be moved, opened, or the sensors cannot be disconnected, without breaking the seal(s).

Where the meter has an external power supply, this connection/s must have mechanical tamper evident seals so that the device cannot be disconnected from the power supply.

4.2.2 Electronic sealing

Where the meter has a default password from the factory, the authorised meter validator must change the password.

Where the authorised meter validator is uncertain if the relevant person knows the password, they must change the password. The relevant person must not be able to edit, delete or upload, logged data, including configuration settings.

5.0 Meter reading

As detailed in Section 2.0 Output Requirement, as a minimum, the meter must generate an electronic pulse output each time a set volume of water passes through the meter. The output must allow the meter to interface with a transmission device and/or data logger.

The department can require data loggers to be fitted to any meter to facilitate more efficient meter reads.

A data logger is a low power device designed to collect and temporarily store readings from a variety of outputs in remote or unattended locations. A logger has an inbuilt clock that timestamps the data entry to allow for data review later.

Installing data loggers on meters allow for the retrieval of more comprehensive water extraction information. Loggers are installed to:

- minimise the time spent on meter reading
- minimize the cost of meter reading
- capture time and event data
- monitor for water extraction compliance.

Information on data logger requirements can be found in the Guideline – Data logger specifications for water meters. A link to this document can be found in section 5.

Metered entitlement holders are required to provide a meter reading to the Department in accordance with a meter reading notice given under the Water Regulation 2016 and in accordance with the *Queensland Non-urban Water Metering Policy for Unsupplemented Water Extraction 2019*. It is likely that data loggers will be required where:

- water extractions are subject to time and/or passing flow and/or rate of take conditions
- it would support more effective and efficient meter reads.

6.0 Workplace health and safety laws

The *Work Health and Safety Act 2011* (WHS Act) provides a framework to protect the health, safety and welfare of all workers at work. It also protects the health and safety of all other people who might be affected at work.

The WHS Act places the primary health and safety duty on a person conducting a business or undertaking (PCBU). The PCBU must ensure, so far as reasonably practicable, the health and safety of workers at the workplace. Duties are also placed on officers of a PCBU, workers and other persons at a workplace.

With the above requirements in mind, note that a metering installation can be visited by a range of people throughout its service-life. These could include:

- the PCBU
- workers (including an authorised meter validator, fabricators and fitters, mechanics, electricians)
- authorised officers of the department.

7.0 Disclaimer

Nothing in the standard is intended to contradict the manufacturer's operating and installation directions that would void manufacturer's warranty or that would indirectly or directly result in loss or liability for which the Department expressly disclaims responsibility.

Any contradiction between the standard and the *Water Act 2000* or Water Regulation 2016 will be managed by the following hierarchy, in order: (i) the *Water Act 2000*, (ii) the Water Regulation 2016, and (iii) the standard.

8.0 References and useful links

Department Regional Development, Manufacturing and Water, 2019, *Queensland Non-urban Water Metering Policy for Unsupplemented Water Extractions 2019*, Queensland Government, Brisbane, 7 June 2021, <https://www.dnrme.qld.gov.au/?a=109113:policy_registry/water-meter-non-urban-unsupp.pdf>.

Irrigation Australia, 2021, 'Certified Meter Installer & Validator', Brisbane, viewed 7 June 2021, <<https://www.irrigationaustralia.com.au>>.

Murray-Darling Basin Authority, 2021, 'Compliance and enforcement documents', viewed 7 June 2021, <<https://www.mdba.gov.au>>.

Legislation

Water Act 2000 (Qld). Retrieved from <<https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-2000-034>>.

Queensland Water Regulation 2016 (Qld) Retrieved from <<https://www.legislation.qld.gov.au/view/pdf/inforce/current/sl-2016-0216>>.

9.0 Further information

Further information on water metering is available on the Queensland Government website at <<http://www.business.qld.gov.au>> or call 13 QGOV (13 74 68).

Appendix A – Glossary of terms

Term	Definition
Authorised meter validator	A person who is accredited by Irrigation Australia Limited as a ‘certified meter installer and validator’. A list of people with this accreditation can be found by clicking the ‘certified meter installer and validator’ tab at, < https://www.irrigationaustralia.com.au/ > Alternatively, this person can be appointed by the department, where they have the necessary expertise or experience to perform this function
CMI	An authorised meter validator who is accredited by Irrigation Australia Limited as a ‘certified meter installer and validator’. A list of people with this accreditation can be found by clicking the ‘certified meter installer and validator’ tab at, < https://www.irrigationaustralia.com.au/ >
Data logger	A low power device attached to the meter which is designed to collect and store readings (in this instance a pulse or group of pulses from the meter). The device has an inbuilt clock that timestamps each reading, allowing the data to be downloaded and reviewed later. Some meters have this functionality built into the meter.
Existing meter	A metering installation which was installed and commissioned prior to the commencement of this module of the standard
New meter – direct replacement	A meter which was installed and commissioned after the commencement of this module of the standard
Relevant person	Can be a water authorisation holder, or the owner of works used for taking or interfering with water, or the person nominated to represent them in departmental systems
Small concrete rectangular weir	A concrete measurement structure with a crest less than 2 meters in width, which changes the water flow characteristics and is used to measure the volumetric rate of water flow.
Surface water	<ul style="list-style-type: none"> a. water in a watercourse or lake, or b. water in a spring not connected to water to which the Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017 applies, or c. overland flow water, other than water in a spring connected to water to which the Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017 applies
Transmission device	A device that transmits readings (in this instance a pulse or a group of pulses from the meter) to a central data store where it can be reviewed in near-real time. The device has an inbuilt clock that timestamps each transmission. This process is sometimes referred to as telemetry.
Validation	A set of activities performed by an authorised meter validator, that includes: inspecting the meter to confirm it complies with this module of the standard confirming the meter is installed in compliance with this module of the standard and is maintained to an acceptable state of repair. Providing confidence that the meter will operate within an acceptable range of error under normal operating conditions.

Appendix B – Maintenance record template (Module C)

Maintenance Record – Meter Serial No:		Date of maintenance:
Emplacement / Installation / site	Keep grass/vegetation around the site at a reasonable height	<input type="checkbox"/> Completed <input type="checkbox"/> Not required at this inspection
	Clear away excess vegetation and debris	<input type="checkbox"/> Completed <input type="checkbox"/> Not required at this inspection
	Confirm the site is WHS compliant – safe for workers and visitors	<input type="checkbox"/> Completed
	Confirm integrity of emplacement and fencing	<input type="checkbox"/> Completed
	Treat weed and vermin issues	<input type="checkbox"/> Completed <input type="checkbox"/> Not required at this inspection
Solar panel/s	The solar panel must be checked regularly for build-up of solids such as dust and bird droppings - this activity must be undertaken as often as is necessary to keep the panel clean. Clean with a wet brush or rag (do not use steel bristle brushes)	<input type="checkbox"/> Completed <input type="checkbox"/> Not applicable
Metering equipment	Where visible and safe to do so, confirm electrical cables and connections are in good working order	<input type="checkbox"/> Completed <input type="checkbox"/> Not safe to do so <input type="checkbox"/> Not applicable
	Confirm register/display is clear and readable	<input type="checkbox"/> Completed
	Confirm there are no leaks in structure and that extracted water is not bypassing the meter, where it is safe to do so	<input type="checkbox"/> Completed <input type="checkbox"/> Not safe to do so <input type="checkbox"/> Not possible
	You believe the meter is correctly recording the volume of water extracted	<input type="checkbox"/> Confirmed <input type="checkbox"/> Notified department – faulty meter
	The meter installation has mechanical tamper-evident seals, and none of these seals are broken	<input type="checkbox"/> Confirmed <input type="checkbox"/> Notified department – faulty meter
Name of person who completed this maintenance:		Signature:
Tick one: <input type="checkbox"/> Water authorisation holder <input type="checkbox"/> Employee <input type="checkbox"/> Contractor		Date:

Appendix C – Individual meters: Departmental requirements

Appendices

MACE – XCi & HydroMace

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MACE – XCi & HydroMace

The following requirements do not replace the XCi Product Manual or the HydroMace Product Manual. The manual is essential for the successful installation, commissioning, operation, and maintenance of this device, and must always be used.

However, for use of this meter under this module of the standard the following requirements must be met, as a minimum, and have been formulated from recommendations/advice in the manual and where required with input from the manufacturer.

Requirements to be confirmed by validation type	
Existing meter installation – new logger and or new sensor/s installed as direct replacement	Section 2.0, Section 3.0, Section 4.0, Section 5.0, Section 7.0, and Section 9.0
Ongoing (revalidation) or Faulty meter (maintenance) – existing meter installation - new or replacement sensors only and no new logger	Section 2.0, Section 3.0, Section 4.0, Section 5.0, Section 7.0, Section 8.0, and Section 9.0
Ongoing (revalidation) or Faulty meter (maintenance) – existing meter installation - new logger only and no new or replacement sensors Ongoing (revalidation) or Faulty meter (maintenance) – existing meter installation - no new or replacement logger and no new or replacement sensors	Section 4.0, Section 5.0, Section 6.0, Section 7.0, Section 8.0, and Section 9.0

Note: The requirements only reference the XCi but these requirements must also be met with the HydroMace. Where the requirements cannot be met with a HydroMace, this has been noted.

1.0 Key terms

Term	Definition
pressure sensor	A stand-alone third-party sensor/s
XCi	The MACE AgriFlo XCi or FloPro XCi including connected sensors.
Logger	The controller/logger component of the XCi

2.0 Authorised Meter Validator

From 1 December 2022, a CMI must have completed training by MACE for the XCi within the previous 2 years to perform the activities in the following table. The training record/certificate must be provided with the validation certificate where a new sensor is installed.

Activity	CMI	Training by MACE
Installation of new sensors	✓	✓

3.0 Measurement assurance requirement B

New pressure sensors must be calibrated after manufacture and prior to installation, and the manufacturer must certify that the sensor will measure depth within $\pm 0.1\%$ of true value across the depth range.

The new sensor must be provided with a calibration certificate showing:

- date of the calibration test
- the serial number of the reference device
- the sensor type, manufacturer part number, and the serial number for the sensor
- the depth range over which the sensor was tested
- the calibration results confirming $\pm 0.1\%$, or, that the sensor has 'passed' the test.

The new sensor must withstand temperatures from -50°C to $+50^{\circ}\text{C}$ and relative humidity's of 100% (without condensation) in a non-operating condition.

4.0 Installation

4.1 General

The logger must:

- Water damage – be mounted above known flood peak levels. The logger must NOT be submerged.
- Sunlight - be mounted so that the LCD faces in a direction away from direct sunlight (i.e., LCD must face South).
- Cable damage – have all cables appropriately routed through electrical conduit when not enclosed in any mounting pole.
- Insects and moisture – have a non-curing sealing compound (e.g., duct-seal-putty) installed down the first 5 to 10 cm of electrical conduit or the mounting pole where cables are enclosed, to prevent insect/moisture ingress.
- Power – have an alternate DC source of 16-30V DV connected to the logger power regulator to charge the internal battery (i.e., a mains powered trickle charger or a solar panel, where mains power is not available). The cables from the solar panel/charger to the logger must be enclosed in electrical conduit when not enclosed in any mounting pole (also see Insect and moisture requirement above).
- Solar panel - have tri-spikes installed on the top of the solar panel to reduce the accumulation of bird droppings on the front face of the panel; and the solar panel orientated to the North at the appropriate incline angle, and the panel must not be shaded by trees or structures.

4.2 Pressure sensor

The sensor cable must not:

- have any connections between the sensor and the logger (so the sensor cannot be disconnected inadvertently or to facilitate fraud).

The sensor must:

- be installed in a stilling well/pipe.
- connect to the logger, where measurements must be logged
- obtain power from the logger.

5.0 Configuration

5.1 Site ID

Must be the logger serial number.

When a validation certificate is issued for the XCi, it must link:

- the logger serial number (Site ID), to the
- water resource extraction authorisation number(s), to the
- works number(s) for extraction occurring against an authorisation, to the
- latitude and longitude for the meter location
- the serial number(s) for the sensor(s) connected to the logger.

Where the controller card is replaced, the serial number for the new card must be linked to the metering installation with a validation certificate. The new serial number must be permanently recorded inside the logger using a label or tag.

5.2 The XCi channels

The XCi uses channels to enable various measurements to be made and other parameters to be calculated. There are three types of channels:

- Connected sensor channels – these channels output the measured value based on the signal received from physically connected sensors wired to the logger.
- Calculated channels – these channels use the measured values (connected sensor channels) and apply an algorithm(s) to output calculated values.
- System channels – these channels use system values direct from the logger.

5.2.1 XCi – Metering – small concrete rectangular weir measurement structure

CONFIGURATION 3: Measurement of depth of flow over a concrete rectangular weir, with flowrate calculated using a depth to volume algorithm for the weir.

- A pressure sensor signal is converted to a depth output by the logger using a 'depth channel'.
- The depth output is then used to calculate flowrate via a 'flowrate channel' by using a pre-configured algorithm for the structure.

For these existing weirs treat them as a suppressed rectangular weir $\rightarrow Q = 1.84 * L * h^{1.5}$, where:

Q = discharge (kL/second); L = weir width (m); and h1 is the upstream height measured by the pressure sensor (m).

Following are minimum requirements for 'Channels' to be configured and confirmed for the metering installation.

Channels	Channel type	Configuration 3
Depth	Connected sensor	✓
Flowrate (using weir)	Calculated	✓
Total flow	Calculated	✓ The 'non-resettable' check box must be ticked.## The 'total positive flow' check box must be ticked.

Channels	Channel type	Configuration 3
Net flow total	Calculated	✓ The 'non-resettable' check box must be ticked.## The 'all values' check box must be ticked.
Device battery voltage#	System	✓
Device external voltage#	System	✓

Essential meter health elements, i) the logger internal battery and alternate DC power source voltage, making it easier to identify if the meter is/when the meter became faulty.

Essential tamper-evident/prevention elements, i) stopping unauthorised persons from resetting the XCi totals; either inadvertently or to facilitate fraud.

6.0 Pressure sensor check

The sensor 'offset' must be confirmed and checked. The offset is the level that the sensor is positioned relative to the crest of the concrete rectangular weir.

Where the water level is over the sensor, the reading must also be confirmed against another measurement device. For example, a tape or ruler.

Where the water level is not over the sensor, the sensor must be confirmed to be reading correctly against another measurement device. For example, submerging the sensor and confirming the level matches that of a tape or ruler.

Where the sensor fails the check, a new sensor must be installed.

A report on this activity, confirming completion, is to be provided to the relevant person with the validation certificate.

7.0 Output

Where the department requires meter health as an output from the meter:

The logger must have a FloSI card installed. To have a validation certificate issued, where an XCi:

- is installed after this document came into effect - it must have a card installed as part of validation post-installation
- was installed prior to the effect of this document - it must have a FloSI card installed as part of the next process of validation for the XCi.

The FloSI Card provides output from the XCi for interface with third party transmission devices.

A WebComm card may be used where the department confirms this is possible. This card provides cellular output from the XCi to the Department's nominated data platform.

Where the department requires pulse output only:

The logger must have a Pulse I/O card installed. To have a validation certificate issued, where an XCi:

- is installed after this document came into effect - it must have a Pulse I/O card installed as part of the process of validation, post-installation
- was installed prior to the effect of this document - it must have a Pulse I/O card installed as part of the next process of validation for the XCi.

The Pulse I/O card provides output from the XCi for interface with third party transmission devices.

8.0 Maintenance

8.1 Battery replacement

The XCi internal battery must be replaced every 5 years, as a minimum, regardless of perceived battery status.

The logger control panel battery must be replaced when the internal battery is replaced, regardless of perceived battery status.

8.2 Pressure sensor

The pressure sensor must be checked (6.0 Pressure Sensor Check).

Where the sensor fails, a new sensor must be installed.