



NSW Government

NSW WATER EXTRACTION MONITORING STANDARDS

Standard specifications for flowmeters and monitoring instruments and their sites, used for measuring and monitoring bulk water diversions and extractions from water sources in New South Wales.

These standards have been developed by State Water and the Department of Natural Resources.

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1. STANDARD SPECIFICATION — FLOWMETER

This document defines the requirements of the NSW Government for a flowmeter used to measure and record water diversion or extraction from a water source.

DEFINITION:

A flowmeter is a device which is intruded or inserted into, or is attached to a water-diversion work, or which is intruded or inserted into, or is attached to its supply-and-distribution piping or channelling, to measure and record the flow of water diverted. It may measure and record the fluid velocity, the volumetric or mass rate of flow, and/or the accumulated total volume or mass of diversion. The passage of water through or past the flowmeter is indicated and recorded on a visible register and/or in a data logger.

SPECIFICATION:

The flowmeter must:

- 1.1. Progressively totalise the cumulative volume of water diverted, and display the accumulated total volume on a visible register at any time.
- 1.2. Display the accumulated total volume to an in service maximum permissible error of $\pm 5\%$ of the actual (true) accumulated total volume, and maintain that accuracy rate at any and all of the discharge rates of the diversion work as it is installed and operated.
- 1.3. Display the accumulated total volume in standard metric units.
- 1.4. Display the units of measurement adjacent to the accumulated-total-volume display.
- 1.5. Display the integers of an accumulated total volume in digital form.
- 1.6. Have sufficient capacity to record more than one year of flow measurement.
- 1.7. Be constructed so as to allow the incorporation or connection of data-logging equipment.
- 1.8. Where it incorporates or is connected to data-logging equipment, be compatible with the NSW Government's data-capture and processing systems.
- 1.9. Where it incorporates or is connected to data-logging equipment, have the capability of communicating stored data to external programs at any time.
- 1.10. Display on its register or registers at any time precisely the same value as the value recorded in any associated data logger.
- 1.11. Have no facility for manipulating or resetting a register or data logger, or for manipulating or disabling its flow-measurement, recording or display functions.
- 1.12. Incorporate a facility for sealing against manipulation and tampering.
- 1.13. Be constructed and installed so as to allow easy removal and dismantling for inspection of all components.
- 1.14. Be clearly and permanently marked with the name of its manufacturer and with a unique identifying number or alpha-numeric identifier.

2. STANDARD SPECIFICATION — FLOWMETER SITE

This document defines the requirements of the NSW Government for the site of a flowmeter used to measure and record water diversion or extraction from a water source.

DEFINITION:

The flowmeter site is the physical location of the installed flowmeter, and includes its immediate environment, and the means of access to it.

Where a water-diversion work is a mobile pump, used at more than one site, its associated flowmeter or flowmeters may have multiple flowmeter sites.

In this specification, a reference to a flowmeter includes its visible register where appropriate.

SPECIFICATION:

- 2.1. The flowmeter must be sited and installed at a place in the pipe, channel or conduit between the water source (river, lake or bore, etc.) and the first discharge outlet. There must be no flows into or out of the conduit between the water source and the flowmeter.
- 2.2. The flowmeter must be sited and installed so that its visible register is accessible to be read at any time.
- 2.3. A flowmeter pit or enclosure must have sufficient space to allow easy removal or dismantling of the flowmeter for inspection.
- 2.4. Flowmeter-access handrails, ladders and platforms must be fixed, and be constructed to comply with the Occupational Health and Safety Act, 2000, and regulations thereunder.
- 2.5. Where a high-voltage mains electricity supply is connected to the flowmeter or to any ancillary apparatus, it, its enclosure and its environs must comply with the Electrical Safety Act, 1945, and regulations thereunder.
- 2.6. The flowmeter site, and access to it, must be kept clear of any oil, grease, dirt, weeds, noxious fumes and hazardous materials.
- 2.7. The flowmeter site, and access to it must be clear of any unguarded moving machinery.
- 2.8. A vehicular access track must be provided from the nearest appropriate public road to the flowmeter site.
- 2.9. Access to the flowmeter site must not involve climbing any fences or gates, or passing through any streams, channels or gullies at any time.

3. STANDARD SPECIFICATION — FLOW-VERIFICATION SITE

This document defines the requirements of the NSW Government for a site to employ a portable flowmeter to measure the actual flow rate of water diversion or extraction from a water source.

DEFINITION:

The flow-verification site is the physical location in supply or distribution piping where a measuring instrument may be intruded, inserted or attached, to measure the flow of water. The site includes its immediate environment, and the means of access to it.

Where a water-diversion work is a mobile pump, used at more than one site, it may have multiple flow-verification sites.

A flow-verification site is required even if no flowmeter is installed.

SPECIFICATION:

- 3.1. The flow-verification site must be at a place in the pipe, between the water source (river, lake or bore, etc.) and the first discharge outlet. There must be no flows into or out of the conduit between the water source and the flow-verification site.
- 3.2. The pipe at the flow-verification site must run full.
- 3.3. The pipe at the flow-verification site must be straight, rigid and of unobstructed uniform circular cross-section for a length equal to twenty-five-times its internal diameter upstream, and five-times its internal diameter downstream of the flow-verification site, to stabilise the water flow.
- 3.4. The pipe at the flow-verification site must be made of sonically conductive material, and must be internally unlined, to allow the use of a portable external ultrasonic flow-verification instrument.
- 3.5. The flow-verification site must be at a place in the pipe, which is free of flow disturbance, vibration, and noise, which might affect the operation of a portable ultrasonic flow-verification instrument.
- 3.6. Where directed by the NSW Government, an access valve specified and supplied by the NSW Government must be fitted to the periphery of the pipe at the flow-verification site, the axis of the valve intersecting and being normal to the axis of the pipe, to allow the insertion of the measuring probe of a portable flow-verification instrument into the pipe.
- 3.7. There must be unrestricted access around the periphery of the pipe for a linear distance equal to two-times its internal diameter both upstream and downstream of the flow-verification site, to allow the external attachment of a portable ultrasonic flow-verification instrument.
- 3.8. A flow-verification site pit or enclosure must have sufficient space to allow the easy external attachment and removal of a portable flow-verification instrument at the flow-verification site.
- 3.9. A flow-verification site pit or enclosure must have sufficient space to allow the easy insertion or removal of the probe of a portable insertion flow-verification instrument.
- 3.10. Flow-verification site access handrails, ladders and platforms must be fixed, and be constructed to comply with the Occupational Health and Safety Act, 2000, and regulations thereunder.
- 3.11. If a high-voltage mains electricity supply is connected to any ancillary apparatus near or connected to the flow-verification site, it, its enclosure and its environs must comply with the Electrical Safety Act, 1945, and regulations thereunder.
- 3.12. The flow-verification site, and access to it, must be kept clear of any oil, grease, dirt, weeds, noxious fumes and hazardous materials.
- 3.13. The flow-verification site, and access to it, must be clear of any unguarded moving machinery.
- 3.14. A vehicular access track must be provided from the nearest appropriate public road to the flow-verification site.
- 3.15. Access to the flow-verification site must not involve climbing any fences or gates, or passing through any streams, channels or gullies at any time.

4. STANDARD SPECIFICATION — HOUR METER

This document defines the requirements of the NSW Government for an hour meter used as a non-flowmeter monitoring instrument to calculate (by calibration) and record water diversion or extraction from a water source.

DEFINITION:

An hour meter is a device which measures the time between successive events, and records and displays the elapsed time in hours or multiples of hours on a visible register, and/or in a data logger.

It is used to record the operating hours of moving machinery, such as a water pump or its motor, between its “Start” and “Stop” events. If the drive connections between a pump, its motor, and the hour meter are constant, an hour meter dedicated to the motor will measure and record the operating hours of the pump precisely.

It may be attached or connected to a water-diversion work other than a pump.

SPECIFICATION:

The hour meter must:

- 4.1. Progressively totalise the operating hours of a work which is used to divert water from one water source only, and display the accumulated total elapsed operating hours on a visible register at any time.
- 4.2. Display the accumulated total elapsed operating hours of the work to an accuracy rate of $\pm 5\%$ of the actual (true) accumulated total elapsed operating hours.
- 4.3. Display the units of measurement adjacent to the accumulated-total-elapsed-operating-hours display.
- 4.4. Display the integers of the accumulated total elapsed operating hours in digital form.
- 4.5. Have sufficient capacity to record more than the equivalent value representing one year of flow measurement.
- 4.6. Where it incorporates or is connected to data-logging equipment, be compatible with the NSW Government’s data-capture and processing systems.
- 4.7. Where it incorporates or is connected to data-logging equipment, have the capability of communicating stored data to external programs at any time.
- 4.8. Display on its register or registers at any time precisely the same value as the value recorded in any associated data logger.
- 4.9. Have no facility for manipulating or resetting a register or data logger, or for manipulating or disabling its time-measurement or recording functions, or its driving mechanism.
- 4.10. Incorporate a facility for sealing against manipulation and tampering.
- 4.11. Be constructed and installed so as to allow easy removal and dismantling for inspection of all components.
- 4.12. Be clearly and permanently marked with the name of its manufacturer and with a unique identifying number or alpha-numeric identifier.

5. STANDARD SPECIFICATION — KILOWATT-HOUR METER (kWh METER)

This document defines the requirements of the NSW Government for a kilowatt-hour meter (kWh meter) used as a non-flowmeter monitoring instrument to calculate (by calibration) and record water diversion or extraction from a water source.

DEFINITION:

A kilowatt-hour meter (kWh meter) is a device which measures and records electrical energy consumed by an apparatus, and displays its value in kilowatt-hours on a visible register, and/or in a data logger.

A kWh meter, which is connected and dedicated to a motor which drives a water pump may record either the total energy, or in the case of some three phase motors, one-third of the total energy consumed by the motor to divert the water, depending on the electrical configuration of the pumping plant. With some configurations the energy recorded by the meter may be an even smaller, but constant, portion of the total.

In this specification, the energy consumption measured by a kWh meter is referred to as “total energy consumption” even if only a (known and constant) proportion of the total is measured.

SPECIFICATION:

The kWh meter must:

- 5.1. Must be of a type approved by and installed to the requirements of the relevant electricity distributor.
- 5.2. Progressively totalise the electrical energy consumption of a motor which drives a pump, which is used to divert water from one water source only, and display the accumulated total energy consumption in kilowatt-hours on a visible register at any time. It may record energy consumption by extraneous apparatus only where such consumption is consistent on a daily basis.
- 5.3. Display the accumulated total energy consumption to an accuracy rate of $\pm 5\%$ of the actual accumulated total energy consumption.
- 5.4. Display the units of measurement adjacent to the accumulated-total-energy-consumption display.
- 5.5. Display the integers of the accumulated total energy consumption in digital form.
- 5.6. Have sufficient capacity to record more than the equivalent value representing one year of flow measurement.
- 5.7. Where it incorporates or is connected to data-logging equipment, be compatible with the NSW Government’s data-capture and processing systems.
- 5.8. Where it incorporates or is connected to data-logging equipment, have the capability of communicating stored data to external programs at any time.
- 5.9. Display on its register or registers at any time precisely the same value as the value recorded in any associated data logger.
- 5.10. Have no facility for manipulating or resetting a register or data logger, or for manipulating or disabling its energy-measuring or recording functions, or its electrical connection, or its driving mechanism.
- 5.11. Incorporate a facility for sealing against manipulation and tampering.
- 5.12. Be constructed and installed so as to allow easy removal and dismantling for inspection of all components.
- 5.13. Be clearly and permanently marked with the name of its manufacturer and with a unique identifying number or alpha-numeric identifier.

6. STANDARD SPECIFICATION — REVOLUTION COUNTER (REV. COUNTER)

This document defines the requirements of the NSW Government for a rev. counter used as a non-flowmeter monitoring instrument to calculate (by calibration) and record water diversion or extraction from a water source.

DEFINITION:

A revolution counter (*rev. counter*) is a device which counts the revolutions made by a rotating machine, and records the accumulated total revolutions completed at any time. It sometimes displays that accumulated total expressed as revolutions, or as multiples such as thousands or hundreds of thousands of revolutions, on a visible register, and/or in a data logger.

A *rev. counter* sometimes displays the accumulated total as elapsed time in hours at a specified rotational velocity. It is used to record the operating hours of machinery, such as a water pump or its motor, between its “Start” and “Stop” events. If the drive connection between the pump and its motor is constant, a rev. counter driven by the motor will measure and record the operating hours of the pump precisely, *only if the motor is operated at its specified rotational velocity*. The units recorded and displayed by such a *rev. counter* are referred to, and are generally labelled as “hours”, but are directly related to the accumulated total completed revolutions of the motor, and are not true hours, *except at the rotational velocity of the motor as specified by its manufacturer*.

SPECIFICATION:

The rev. counter must:

- 6.1. Progressively totalise the completed revolutions or indicated operating hours of a pump, which is used to divert water from one water source only, and display the accumulated total completed revolutions or elapsed indicated operating hours on a visible register at any time.
- 6.2. Display the accumulated total completed revolutions or the elapsed indicated operating hours, to an accuracy rate of $\pm 5\%$ of the actual (true) accumulated total completed revolutions, or elapsed indicated operating hours at the rotational velocity specified by its manufacturer.
- 6.3. Display the units of measurement adjacent to the accumulated-total-completed-revolutions or elapsed-operating-hours display.
- 6.4. Display the integers of the accumulated total completed revolutions or elapsed indicated operating hours in digital form.
- 6.5. Have sufficient capacity to record more than the equivalent value representing one year of flow measurement.
- 6.6. Where it incorporates or is connected to data-logging equipment, be compatible with the NSW Government’s data-capture and processing systems.
- 6.7. Where it incorporates or is connected to data-logging equipment, have the capability of communicating stored data to external programs at any time.
- 6.8. Display on its register or registers at any time precisely the same value as the value recorded in any associated data logger.
- 6.9. Have no facility for manipulating or resetting a register or data logger or for disabling its revolution-counting or recording functions or its driving mechanism.
- 6.10. Incorporate a facility for sealing against manipulation and tampering.
- 6.11. Be constructed and installed so as to allow easy removal and dismantling for inspection of all components.
- 6.12. Be clearly and permanently marked with the name of its manufacturer and with a unique identifying number or alpha-numeric identifier.

7. STANDARD SPECIFICATION — MONITORING INSTRUMENT SITE

This document defines the requirements of the NSW Government for the site of a monitoring instrument, other than a flow meter, used to calculate and record water diversion or extraction from a water source.

DEFINITION:

The monitoring-instrument site is the physical location of the installed monitoring instrument, and includes its immediate environment, and the means of access to it.

Where a water-diversion work is a mobile pump, used at more than one site, its associated monitoring instrument or monitoring instruments may have multiple sites.

In this specification, a reference to a monitoring instrument includes its visible register where appropriate.

SPECIFICATION:

- 7.1. The monitoring instrument must be sited and installed so that its visible register is accessible to be read at any time.
- 7.2. A monitoring-instrument pit or enclosure must have sufficient space to allow easy removal or dismantling of the monitoring instrument for inspection.
- 7.3. Monitoring-instrument-access handrails, ladders and platforms must be fixed, and be constructed to comply with the Occupational Health and Safety Act, 2000, and regulations thereunder.
- 7.4. Where a high-voltage mains electricity supply is connected to the monitoring instrument or to any ancillary apparatus, it, its enclosure and its environs must comply with the Electrical Safety Act, 1945, and regulations thereunder.
- 7.5. The monitoring-instrument site, and access to it, must be kept clear of any oil, grease, dirt, weeds, noxious fumes and hazardous materials.
- 7.6. The monitoring-instrument site, and access to it must be clear of any unguarded moving machinery.
- 7.7. A vehicular access track must be provided from the nearest appropriate public road to the monitoring-instrument site.
- 7.8. Access to the monitoring-instrument site must not involve climbing any fences or gates, or passing through any streams, channels or gullies at any time.

GLOSSARY

Actual flow: The exact rate-of-flow of water in a conduit.

Assessment: A determination of water usage calculated from observed secondary data such as non-flowmeter monitoring instruments and crop statistics, and volumes of water diverted obtained from installed flow meters or calibrations performed.

Conduit: The physical path of the flow of water, from the point of diversion from the water source. A conduit may be open (channel or flume) or closed (pipe), or a combination of both. The cross-sectional shape of a pipe may or may not be circular.

Calibration: The reconciliation of a measurement recorded by a non-flowmeter monitoring instrument, with a simultaneous flow verification.

Calibration factor: A factor calculated from the results of a calibration. It is expressed as a volume (in standard units), per unit recorded by the non-flowmeter monitoring instrument.

Conversion factor: Where an *in-situ* flowmeter records accurately, but in non-standard units (gallons, acre-feet, etc.), a conversion factor is calculated, and applied to volumes recorded, to convert the recorded units. It is expressed as a volume (in standard units), per unit recorded by the flowmeter.

Correction factor: Where an *in-situ* flowmeter records with a consistent degree of inaccuracy, in standard units, a correction factor is calculated, and applied to volumes recorded, to correct the inaccuracy. It is expressed as a volume (in standard units), per unit recorded by the flowmeter.

Conversion/correction factor: Where an *in-situ* flowmeter records with a consistent degree of inaccuracy, in non-standard units, a combined conversion/correction factor is calculated and applied to volumes recorded, to convert the recorded units, and to correct the inaccuracy. It is expressed as a volume (in standard units), per unit recorded by the flowmeter.

Data logger: An electronic device, which captures and stores information pertaining to physical events or conditions, for later retrieval. The storage of the data may be time or event based. Data may include pump “start” and “stop” events, rates of flow, and accumulated volumes.

Diversion: The diversion of water away from its normal or natural flow path or location in a water source. It may be returned to the water source after being used for non-consumptive purposes. (If it is diverted away from its source for consumptive purposes, it is referred to as *Extraction*.)

Extraction: The diversion of water away from its normal or natural flow path or location in a water source, for consumptive purposes.

Flowmeter: A device which is intruded or inserted into, or is attached to a water-diversion work, or which is intruded or inserted into, or is attached to its supply-and-distribution piping or channelling, to measure the flow of water diverted, and to record the accumulated total diversion.

Flowmeter site: The physical location of the installed flowmeter, including its immediate environment and the means of access to it.

Flowmeter verification: The reconciliation of a measurement recorded by an *in-situ* flowmeter, with a simultaneous flow verification. In exceptional circumstances, a flowmeter may be taken from its *in-situ* location in the field, and installed for verification in a hydraulics laboratory. Only the physically smallest flowmeters may be verified this way. Normally, flowmeters are verified *in-situ* in the field.



Flow verification: The process of measuring and verifying the rate-of-flow of water in a conduit.

Flow-verification site: The physical location in supply or distribution piping where devices may be intruded, inserted or attached, to measure the flow of water. The site includes its immediate environment and the means of access to it.

Flow-verification instrument: An instrument used to measure and verify the rate-of-flow of water in a conduit.

Hour meter: A device which measures the elapsed time between “start” and “stop” events of a water-diversion work, such as a pump or its motor, and records the accumulated total operating hours.

Kilowatt-hour meter: A device which measures the electrical energy consumed by a motor which drives a water pump, and records the accumulated total energy consumption.

Meter accuracy +/-5%: A reading of between 95% and 105% of the actual flow.

Monitoring instrument: A device, not being a flowmeter, such as an hour meter, kilowatt-hour meter or revolution counter, which is used to calculate the volume of water flowing through a conduit, where the rate-of-flow is known.

Monitoring-instrument site: The physical location of the installed monitoring instrument, including its immediate environment and the means of access to it.

Register: That part of a meter, where the result of its internal calculating function is displayed for viewing and/or interpretation (the operator/machine interface). It may be incorporated into the main body or frame of the meter (the transducing component), or separate and/or remote from it.

Revolution counter: A device which counts the number of revolutions made by a rotating machine, such as a water pump or its motor, and records the accumulated total revolutions completed.

Tailwater: Water remaining unused after diversion through a water supply work and irrigation system.

Water source: Any river, lake, estuary or place where water occurs naturally on or below the surface of the ground, including coastal waters of the State, as defined in the *Water Management Act, 2000* (Dictionary).

Water supply work: A water pump, bore, tank, dam, pipe, channel, bank, levee or weir that is constructed or used for the purpose of taking water, capturing run-off, storing water, conveying water, diverting water or impounding water, as defined in the *Water Management Act, 2000* (Dictionary). In this document, it may also include a flowmeter or a monitoring instrument.

Water supply work approval: Authorisation under the *Water Management Act, 2000* to construct and use a specified water supply work at a specified location.