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METERING EQUIPMENT STANDARDS 2022

under the

WATER MANAGEMENT (GENERAL) REGULATION 2018

I, Graham Attenborough, by delegation from the Minister administering the *Water Management Act 2000*, approve the metering equipment standards listed in Column 2 of the table below, pursuant to the corresponding provisions of the *Water Management (General) Regulation 2018*, listed in Column 3 of the table below:

Column 1 Schedule	Column 2 Name of standard	Column 3 Provision
1	Storage Metering Equipment Standard	Clause 228 of the <i>Water Management (General) Regulation 2018</i>
2	Survey benchmark standard	Clause 228 of the <i>Water Management (General) Regulation 2018</i>
3	Storage curve standard	Clause 238L(9) of the <i>Water Management (General) Regulation 2018</i>
4	Secondary metering device Standard	Clause 228 of the <i>Water Management (General) Regulation 2018</i>

Dated this 29th day of September 2022.

Graham Attenborough
Chief Operating Officer
Department of Planning, Industry and Environment
By delegation

Explanatory note

These standards are made under clauses 228 and 238L(9) of the *Water Management (General) Regulation 2018*. The object of these standards is to specify the metering equipment standards for particular water supply work approvals. Specifically, the standards relate to storage metering equipment, survey benchmarks, storage curves and secondary metering devices.

Holders of water supply work approvals subject to a mandatory floodplain condition imposed under clause 238B of the *Water Management (General) Regulation 2018* must comply with these metering equipment standards.

METERING EQUIPMENT STANDARDS 2022

under the

WATER MANAGEMENT (GENERAL) REGULATION 2018

1 Name of this instrument

This instrument is the *Metering Equipment Standards 2022*.

2 Commencement

This instrument commences on the date it is published in the NSW Government Gazette.

3 Interpretation

(a) In this instrument:

accredited facility means National Associations of Testing Authorities (NATA) accredited laboratory.

Act means the *Water Management Act 2000*.

approved data logging and telemetry specifications means the data logging and telemetry specifications approved by the Minister under clause 10 of Schedule 8 of the Regulation, as in force from time to time.

AS/NZS means Australian/New Zealand Standards developed by Standards Australia.

Australian Height Datum (AHD) means the datum surface approximating mean sea level that was adopted by the National Mapping Council of Australia in May 1971, as prescribed by the *Surveying and Spatial Information Regulation 2017*.

DAS means the NSW Government's data acquisition service that acquires data from metering equipment.

Geocentric Datum of Australia (GDA) has the same meaning as it has in the *Surveying and Spatial Information Act 2002*.

installation Type 1 storage meter means a storage meter with a radar sensor and LID for storage metering constructed on an elevated platform.

installation Type 2 storage meter means a storage meter with a vented submersible pressure sensor and LID for storage metering constructed on an elevated platform.

installation Type 3 storage meter means a storage meter with a vented submersible pressure sensor and LID for storage metering constructed on an embankment.

local intelligence device (LID) means a device, such as a telemetry enabled data logger, or other telemetry-capable field device, which is able to connect to a meter and telemeter data to the DAS.

mAHD means the elevation in meters with respect to the AHD.

Map Grid of Australia (MGA) has the same meaning as it has in clause 5 of the *Surveying and Spatial Information Regulation 2017*.

measuring point means the point where a sensor sends or receives measurement information. For example, for radar sensors the measuring point is the 'face' or 'head' of the radar sensor.

PVC means polyvinyl chloride.

Regulation means the *Water Management (General) Regulation 2018*.

storage means any purpose-built dam or reservoir or natural basin that is nominated on a floodplain harvesting access licence to take water.

storage gauge board means a board used to indicate the depth of water in a storage.

uPVC means unplasticised polyvinyl chloride.

UV means ultraviolet.

- (b) Unless otherwise defined in this instrument, words and expressions that are used in the Act or Regulation have the same meaning in this instrument.

Note: the terms *adopted storage curve*, *point-of-intake metering equipment*, *secondary metering device*, *storage curve* and *storage metering equipment* are defined in the Regulation. The term *duly qualified person* is defined in the Act and further defined in the Regulation.

4 Standards

- (a) The storage metering standard is set out in Schedule 1.
- (b) The survey benchmark standard is set out in Schedule 2.
- (c) The storage curve standard is set out in Schedule 3.
- (d) The secondary metering device standard is set out in Schedule 4.

Schedule 1
Storage Metering Equipment Standard

Storage metering equipment requirements

1. Storage metering equipment must:
 - (a) include a water level sensor. The range of this sensor must be, at a minimum, equal to the depth of the storage.
 - (b) measure the level of water using the water level sensor. The measurement of the water level must be no more than ± 10 millimetres for any water level within the storage.
 - (c) have a Signal Output direct from the water level sensor. This output must be in a digital (SDI-12/Modbus) format.
 - (d) be able to be tested against a reference meter from an accredited facility, being a reference meter with known measurement parameters.
 - (e) contain a feature to enable the adjustment of all of the sensor's operational settings.
 - (f) be able to record and report all calibration factor adjustments.
 - (g) operate on nominal 12-volt direct current (DC) supply.
 - (h) operate on less than 20 milliampere (mA) average current draw.
 - (i) be DAS (data logger and telemetry unit) compatible. This compatibility must comply with:
 - (i) the relevant floodplain harvesting measurement parameters of the DAS, and
 - (ii) the approved data logging and telemetry specifications.
 - (j) be able to operate in a temperature range of between -5 degrees Celsius to +50 degrees Celsius.
 - (k) be an installation Type 1 storage meter, installation Type 2 storage meter or installation Type 3 storage meter.

Storage metering equipment materials

2. Storage metering equipment must comply with all of the following:
 - (a) materials must have a life expectancy of at least 10 years,
 - (b) fixings must be non-corrosive, including (but not limited to) screws, nuts, bolts, brackets, mounting poles, frames,
 - (c) screws and bolts must have locknuts or spring washers,
 - (d) commercially galvanised steel products which are cut, ground, or drilled must be coated in cold galvanising paint,
 - (e) electrical insulating materials must be used to prevent contact between dissimilar metals,
 - (f) materials must be suitable for the specific water type where those materials are partly or fully submerged in water,
 - (g) materials and components must be suitable to operate in an ambient temperature range of -5 degrees Celsius to +50 degrees Celsius,
 - (h) UV stabilised plastic style enclosures and fittings must be used,

- (i) heat shields must be used on all sides of metal enclosures, except on the bottom of the enclosures,
- (j) enclosures and components must have a minimum Ingress Protection Code of 65 (IP65) heat rating,
- (k) enclosures supporting vented pressure sensors must use a water breather membrane system,
- (l) a desiccant device must be used for meters with breathing tubes,
- (m) anti-roosting devices must be installed on solar panels, meter support arms, and other surfaces where birds may roost, and
- (n) conduits:
 - (i) must use heavy duty PVC for all electrical cabling,
 - (ii) must be supported by double sided galvanised steel saddles spaced at least 400mm apart, and
 - (iii) may be a uPVC conduit connecting the submersible pressure sensor to the enclosure.

Installation Type 1 storage meters using radar sensor

Note: see Figure 4 to this Schedule for a diagram of an Installation Type 1 storage meter.

3. An installation Type 1 storage meter must have a radar sensor that:
 - (a) is installed as close as practical to the storage low point.
 - (b) taking into account the radar beam angle, the radar head must be located to prevent beam interference at all depths from any structures or inlet/outlet water flow and turbulence.
 - (c) is enclosed to prevent tampering and damage.
 - (d) is installed clear of any debris that may flow from the inlet and outlet pipes.
 - (e) has arm hinges or arm support brackets designed to return the sensor measuring point to the exact original position following any maintenance.
 - (f) has a measuring point that is flush with the base of the protective covering.
4. An installation Type 1 storage meter must have a LID installation that:
 - (a) is housed in an enclosure which:
 - (i) is resilient to insect and water ingress,
 - (ii) uses a water membrane breather system,
 - (iii) has bird proof braiding on any exposed cables,
 - (iv) has heat shields installed, and
 - (v) has a door tamper-switch installed or a locking mechanism to which tamper seals can be fitted.
 - (b) is securely supported on a structure or post to minimise movement and vibrations.
 - (c) if supported on a post the specifications for the post must be:
 - (i) constructed using a pipe with a rectangular hollow section at least 75mm wide,
 - (ii) made of a minimum 3mm thick heavy-duty galvanised steel, and

- (iii) mounted outside of the walkway to allow safe and unobstructed pedestrian movement.
 - (d) has a uPVC conduit connecting the radar sensor to the enclosure which is supported by double sided galvanised steel saddles spaced at least 400mm apart.
5. An installation Type 1 storage meter must have tamper evident seals installed:
- (a) through the padlock provision on the LID enclosure door, and
 - (b) where the radar sensor arm support bracket first meets the elevated platform.

Installation Type 2 – elevated platform with a vented submersible pressure sensor for storage metering

Note: see Figure 5 to this Schedule for a diagram of an Installation Type 2 storage meter.

6. An installation Type 2 storage meter must have a submersible pressure sensor that is installed:
- (a) as close to the storage low point as practical,
 - (b) clear of storage inlet and outlet pipes,
 - (c) clear of any debris that may flow from the inlet and outlet pipes,
 - (d) with no sharp bends in the sensor cable that might restrict air flow in the vent tubes,
 - (e) with no low points in the sensor cable line where moisture may pool in the vent tubes,
 - (f) within a stillage pipe that:
 - (i) is secured to an elevated platform post,
 - (ii) is secured vertically,
 - (iii) terminates 50mm from the storage floor, and
 - (iv) has an endcap, and
 - (v) has a minimum of 6.0 mm drainage holes at least every 300 mm for the lower 2.0 m of the stillage pipe to permit the free passage of water through the pipe.
7. An installation Type 2 storage meter must have a survey measuring point 20mm from the end of the submersible pressure sensor stillage pipe end-cap.
8. An installation Type 2 storage meter must have a LID installation that:
- (a) is housed in an enclosure which:
 - (i) is resilient to insect and water ingress,
 - (ii) uses water membrane breather system with desiccant,
 - (iii) has bird proof braiding on any exposed cables,
 - (iv) has heat shields installed, and
 - (v) has a door tamper-switch installed or a locking mechanism to which tamper seals can be fitted.
 - (b) is securely supported on a structure or post to minimise movement and vibrations.
 - (c) if supported on a post the specifications for the post must be:
 - (i) constructed using a pipe with a rectangular hollow section at least 75mm wide,
 - (ii) made of a minimum 3mm thick heavy-duty galvanised steel, and

- (iii) mounted outside of the walkway to allow safe and unobstructed pedestrian movement.
 - (d) has a uPVC conduit connecting the submersible pressure sensor to the enclosure supported by double sided galvanised steel saddles spaced at least 400mm apart.
9. An installation Type 2 storage meter must have tamper evident seals installed:
- (a) through the padlock provision on the LID enclosure door,
 - (b) through the top endcap and bottom endcap of the stillage pipe, and
 - (c) where the conduit meets the elevated platform.

Installation Type 3 storage meter – embankment deployment with a submersible pressure sensor

Note: see Figure 6 to this Schedule for a diagram of an Installation Type 3 storage meter.

10. An installation Type 3 storage meter must have:
- (a) a submersible pressure sensor that is:
 - (i) installed on an embankment that is uniformly graded.
 - (ii) installed at the storage floor level.
 - (iii) not installed in any localised sumps or low-points adjacent to the inlet and outlet pipes.
11. An installation Type 3 storage meter must have a submersible sensor stillage pipe that:
- (a) is installed straight and perpendicular to the embankment ensuring that there are no dips or low points in the cable to the sensor
 - (i) _____ is of a large enough bore to accommodate the sensor - nominally a 25mm nominal bore (33mm outside diameter).
 - (b) is supported to ensure little or no movement of the pipe to the following specifications:
 - (i) a minimum 2mm thick ‘extra-light’ duty galvanised steel supports adhering to AS/NZS 1163:1991, Cold-formed structural steel hollow sections, and
 - (ii) a galvanised steel ‘Downee-tee’ (or similar) fittings with minimum 10mm diameter bolts, and are minimum 80mm long.
 - (c) includes 6.0mm drainage holes every 300mm for the lower 2.0m.
 - (d) has a re-insertable ‘inner push rod’ which is a 20mm medium-duty UV PVC conduit adhering to AS/NZS 2053:2001, *Conduits and fittings for electrical installations General requirements*.
 - (e) is manufactured from:
 - (i) polyethylene material consisting of one continuous roll of polyethylene pipe adhering to AS/NZS 2033:2008, *Installation of polyethylene pipe systems on supports spaced at a maximum of 1.0m intervals*, or
 - (ii) heavy-duty galvanised steel material consisting of threaded and joined tubing lengths adhering to AS/NZS 3500:2018, *Plumbing and drainage Set on supports spaced at a maximum of 2.0m intervals*.

- (f) has a drain-waste-vent cowl endcap:
 - (i) with openings large enough to allow free flowing water,
 - (ii) that is insect-proof, and
 - (iii) that is either 50mm or 100mm in diameter.
- (g) feeds directly into an electrical pit.

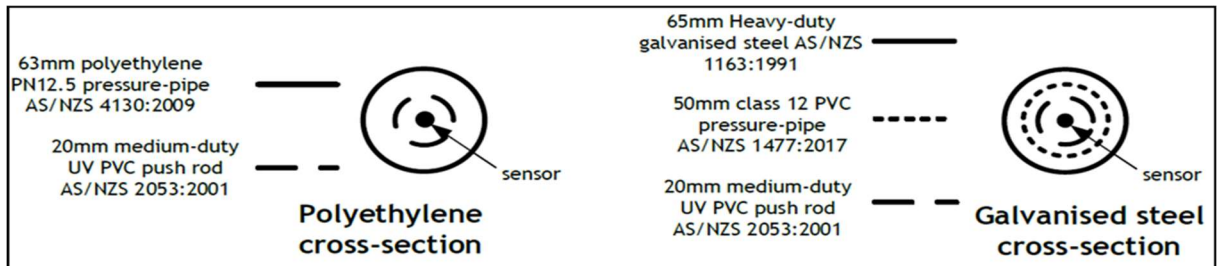


Figure 1: Stillage pipe cross section of polyethylene (left) and heavy-duty galvanised steel (right) that meet the requirements of clause 11.

12. An installation Type 3 storage meter must have two marker posts that:
 - (a) are installed 1.5m above ground,
 - (b) are installed at one-third even spacings adjacent to the stillage pipe, and
 - (c) use three reflective safety/hazards stickers, spaced 200mm apart.
13. An installation Type 3 storage meter must have the measuring point set back a minimum 20mm from the submersible pressure sensor stillage pipe endcap.
14. An installation Type 3 storage meter must have a sensor cable that is:
 - (a) tied to the ‘push rod’ conduit with 3.6mm UV stable zip-ties every 4.0m length of conduit, and
 - (b) protected by a 10mm rubber grommet where the cable exits the ‘push rod’ conduit.
15. An installation Type 3 storage meter must have a minimum of two 6.0mm drainage holes in the lowest section of ‘push rod’ conduit.

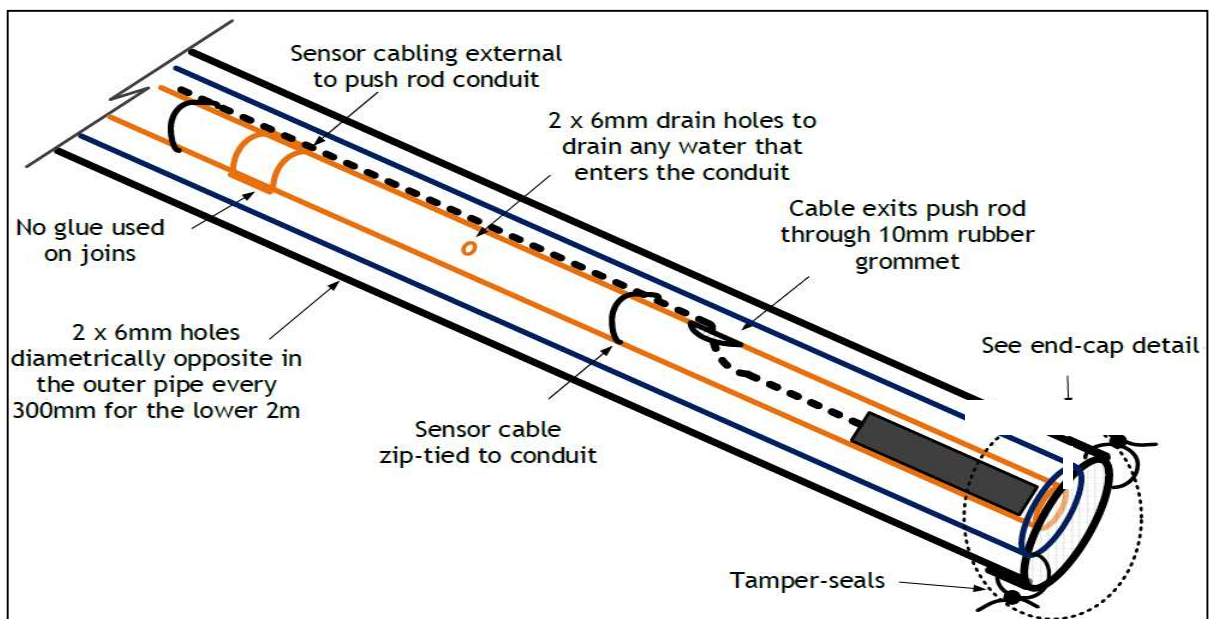


Figure 2: Stillage pipe endcap that meets the requirements of clauses 14 and 15.

16. An installation Type 3 storage meter must have a LID installation that:
- (a) is attached to a secure structure, eg concrete/brick wall, wall of a permanent structure or within a shelter OR
 - (b) is supported by a post and bollards installed:
 - (i) at least 1.5m above ground, and
 - (ii) with a concrete footings of at least 25 MPa sufficiently large to support the structure securely
 - (c) is supported by a post to minimise movement and vibration, and the support post must be:
 - (i) constructed using a pipe with a rectangular hollow section at least 75mm wide, and made of at least 3mm thick heavy-duty galvanised steel, and
 - (ii) installed in at least a 100mm diameter hole to a depth of at least 600mm below the surface.
 - (d) when installed in trafficable areas (vehicular or animal) the support post must have a minimum of two 100mm diameter bollards to provide the LID with protection:
 - (i) which both must have three reflective safety/hazard tape stickers, placed 200mm apart,
 - (ii) bollards must be located 500mm from the LID post, facing towards traffic,
 - (iii) bollards must be a maximum of 1.5 m apart and be positioned so as to be approximately equally spaced either side of the LID post
 - (e) has an electrical pit:
 - (i) with dimensions of at least 800mm (L) x 500mm (W) x 400mm (D),
 - (ii) be positioned such as to minimise ingress of water, and
 - (iii) that is fitted with tamper evident seals.
 - (f) has a uPVC conduit connecting the submersible pressure sensor to the enclosure supported by double sided galvanised steel saddles spaced at least 400mm apart.
 - (g) is housed in an enclosure which:
 - (i) is resilient to insect and water ingress,
 - (ii) uses a water membrane breather system with desiccant,
 - (iii) has bird proof braiding on any exposed cables,
 - (iv) has heat shields installed, and
 - (v) has a door tamper-switch installed.
17. An installation Type 3 storage meter must have tamper evident seals installed:
- (a) through the padlock provision of the LID door enclosure,
 - (b) through the top endcap and bottom endcap of the stillage pipe, and

(c) where the conduit meets the elevated platform.

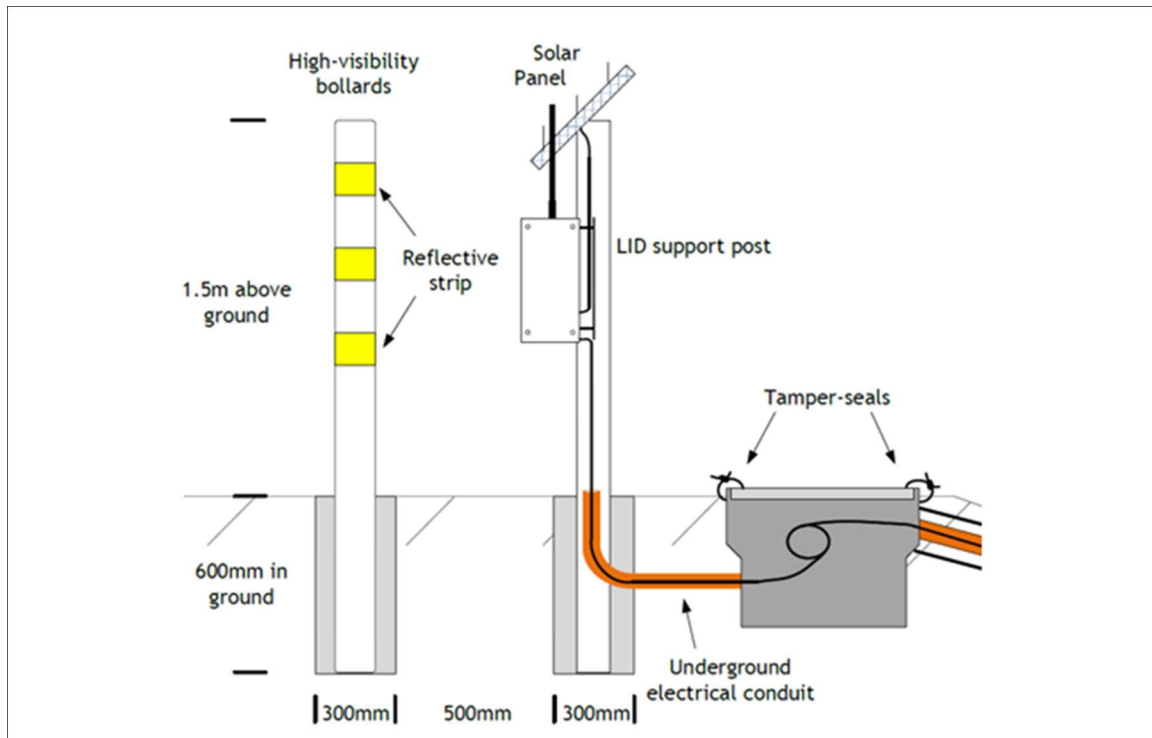


Figure 3: LID installation arrangement that meets the requirements of clauses 16 and 17.

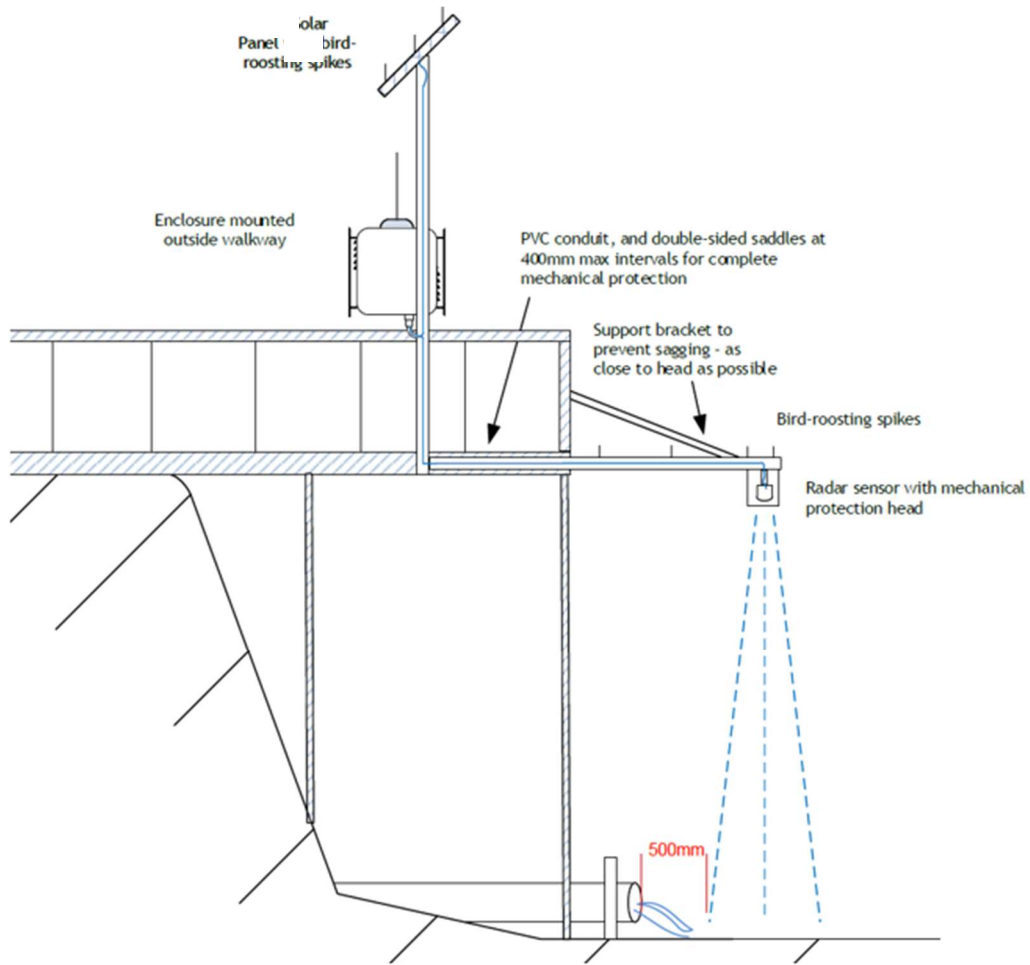


Figure 4: Installation type 1 storage meter - elevated platform with a radar sensor for storage metering.

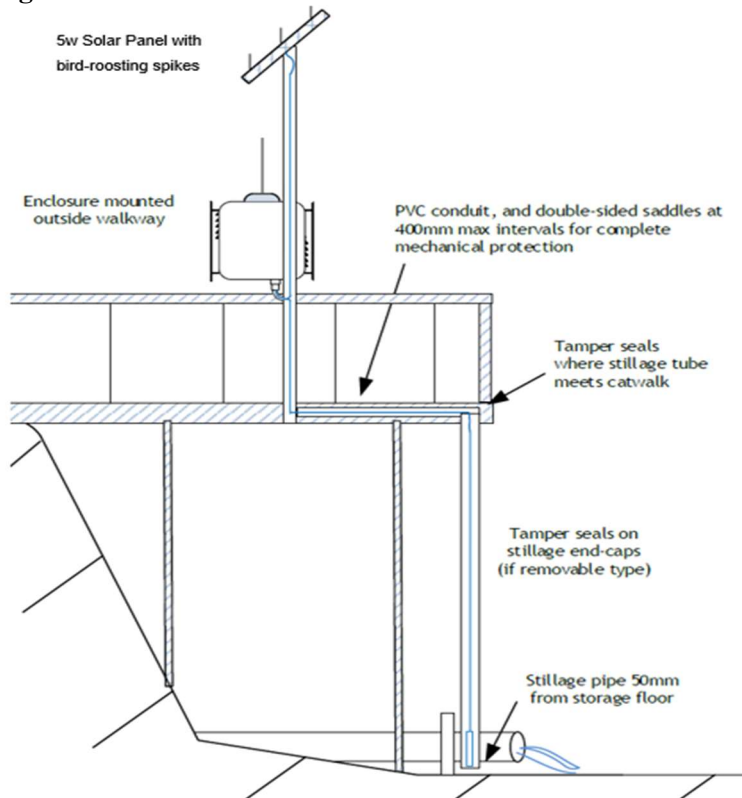


Figure 5: Installation Type 2 storage meter - elevated platform with a submersible pressure sensor for storage metering.

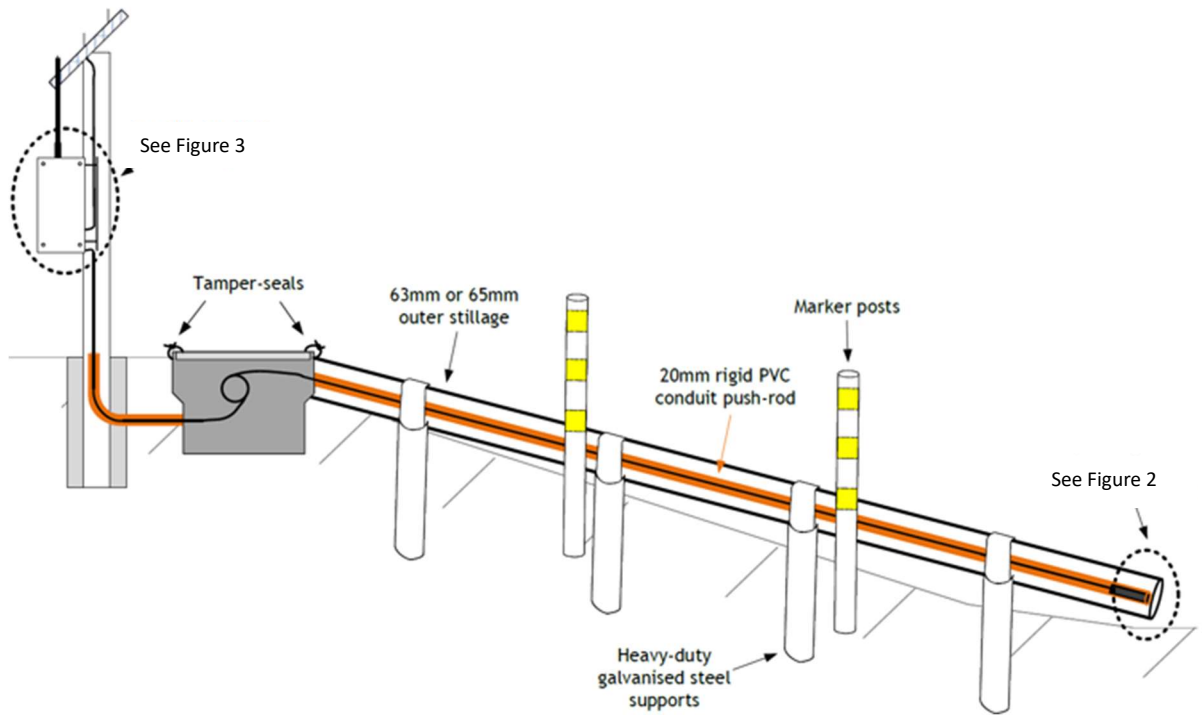
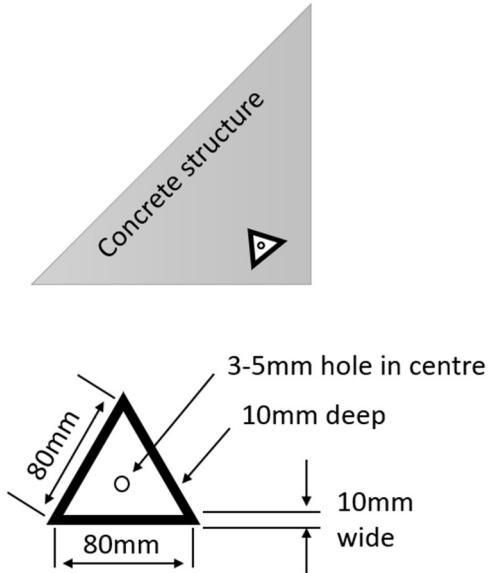
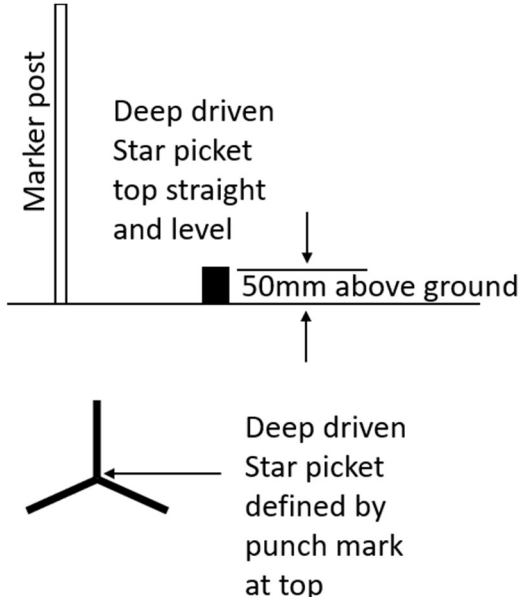


Figure 6: Installation Type 3 storage meter - embankment deployment with a submersible pressure sensor for storage metering.

Schedule 2
Survey benchmark standard

1. Survey benchmarks must be referenced to AHD levels and:
 - (a) GDA 2020 coordinates, or
 - (b) MGA 2020 coordinates.
2. At least three survey benchmarks must be installed for each storage as follows:
 - (a) one primary benchmark must be referenced using a continuously operating reference system (CORSnet-NSW) global navigation satellite system (GNSS) observations to transfer AHD levels and GDA2020 coordinates to the site (primary benchmark), and
 - (b) two secondary benchmarks must be referenced using real time kinematics (RTK) or other survey techniques, recognised in Part B, Section 2 of the Standards and Practices for Control Surveys, to transfer AHD levels and GDA2020 coordinates between the primary and secondary benchmarks.
3. Survey benchmarks must use a survey mark that meets the requirements of a survey mark type set out in the following table:

Survey mark type	Image of mark
<p>(a) Type 17—"Bench mark" token must be:</p> <ol style="list-style-type: none"> (i) a non-corrodible token at least 32mm in diameter and 1.5mm thick with a 5mm hole in the centre, with "BENCH MARK" permanently stamped, engraved or etched on the upper surface, (ii) secured using a non-corrodible nail, spike, rivet or screw, and (iii) permanently painted and coloured so that it is highly visible, clearly identifiable and easily located. 	<p style="text-align: center;">Dimensions are in millimetres</p> <p>The diagram illustrates the physical specifications of the benchmark token. It is a circular token with a diameter of 32mm. The words 'BENCH MARK' are stamped on the top surface. A central hole has a diameter of 5mm. The token is 1.5mm thick. It is shown being secured to a surface with a nail. A dimension line indicates that the distance from the top edge of the token to the center of the hole is 34mm.</p>

<p>(b) Type 18—Chiselled triangle must:</p> <ul style="list-style-type: none"> (i) be an equilateral triangle with sides at least 80mm long, 10mm wide and 10mm deep and chiselled into concrete, (ii) have a 3-5mm diameter hole in the centre, and (iii) be permanently painted and coloured so it is highly visible, clearly identifiable and easily located. 	
<p>(c) Type 19—deep driven steel star picket fence post must:</p> <ul style="list-style-type: none"> (i) be identified with a marker post, (ii) have a punch mark made by a centre punch tool or similar tool at the top, (iii) have a top that is straight and level, and (iv) be permanently painted and coloured so it is highly visible, clearly identifiable and easily located. 	

4. Survey benchmarks must use the survey codes set out in the following table.

	Point description	Survey Code
(a)	Benchmark	BM1, BM2, BM3
(b)	Temporary benchmark	TBM1

5. Survey benchmarks must achieve an accuracy of within:

- (a) 30 mm horizontal GDA2020, and
- (b) 50 mm vertical AHD.

Schedule 3
Storage curve standard

1. A storage curve must be developed from a volumetric or LIDAR survey of the storage that is referenced to AHD levels and GDA2020 coordinates.
2. A non LIDAR based volumetric survey of a storage undertaken after 1 November 2020 must:
 - (a) use the survey codes set out in the following table:

	Point description	Survey Code
(i)	Benchmark	BM1, BM2, BM3
(ii)	Temporary benchmark (if needed)	TBM1
(iii)	Embankment internal crest	EMB_IC
(iv)	Embankment external crest	EMB_EC
(v)	Embankment internal toe	EMB_ITOE
(vi)	Dam (full supply) top water level	DTOPWL
(vii)	Dam lowest point (near outlet)	DLP
(viii)	Existing surface	ES
(ix)	Change of grade	CG
(x)	Borrow pit batter top	BPTOP
(xi)	Borrow pit batter toe	BPTOE
(xii)	Structure invert	IL
(xiii)	Dam meter (optional)	DMETER

- (b) be presented on a survey Layout Plan which must include all of the following:
 - (i) storage ID,
 - (ii) storage location,
 - (iii) survey benchmark ID,
 - (iv) north point,
 - (v) survey method,

- (vi) ground surveyed point locations,
 - (vii) level annotation for key infrastructure levels (e.g. pipe inverts),
 - (viii) contours of at least 0.5m intervals,
 - (ix) location of embankment longitudinal section,
 - (x) coordinates of the storage centroid – Easting, Northings and MGA Zone, and
 - (xi) temporary local farm benchmarks.
- (c) be presented on a Longitudinal Section which must include:
- (i) embankment longitudinal section profile,
 - (ii) chainages at intervals of no more than 100m,
 - (iii) design freeboard,
 - (iv) storage full supply level,
 - (v) existing crest levels, and
 - (vi) design crest level.
3. The storage curve produced must show:
- (i) reduced level in m AHD in 10 cm increments from storage base to storage crest level,
 - (ii) storage Volume in megalitres, and
 - (iii) storage Surface Area in Ha.

Schedule 4
Secondary metering device standard

1. The following devices are approved as secondary metering devices:
 - (a) a storage gauge board that meets the requirements of this standard.
 - (b) storage metering equipment that meets the requirements of the Storage Metering Equipment Standard (Schedule 1).
2. A storage gauge board must:
 - (a) be in a single or in a multiple staged configuration.
 - (b) comply with the requirements in section 7.1 of Australian Standard AS 3778.6.5.
 - (c) be constructed from durable material resistant to corrosion in alternating wet and dry environments with legible, unambiguous markings resistant to wear and fading.
 - (d) have 0.01m (10mm), 0.1m (100mm) and 1.0m measurement increments to allow a full reading to be undertaken (except for gauge boards installed before 1 November 2020, which may have only 100mm measurement increments).
 - (i) Boards installed before 1 November 2020 with 100mm measurement increments will need to be replaced with gauge plates that match the current standard by 31 December 2025.
 - (e) have successive 0.01m (10mm) incremental alternating black and white strips on a white background.
 - (f) have a width, increment markers and numbering of a size that can be read easily from a location that can be safely accessed on an elevated platform or storage embankment.
3. A storage gauge board must:
 - (a) dependant on storage conditions, be set at the lowest accessible level in the storage.
 - ↔(i) gauge boards can be installed in increments as conditions permit until such time as the full range of water levels from storage floor to full supply level is covered
 - (b) be in a location that can be easily and safely accessed for maintenance and readings during wet weather or flooding events.
 - (c) measure from the lowest accessible floor level in the storage to the top of the storage embankment level.
 - (d) be secure, stable, and must not be able to move without intervention.
 - (e) be levelled in as vertical.
 - (f) be fitted with at least one tamper evident seal on securing fasteners.
 - (g) for multiple staged storage gauge boards:
 - (i) be located so that the highest, or last, increment is accurately levelled and aligned to the lowest, or first, increment on each successive (higher) board, and
 - (ii) have the bottom of the gauge board at the floor of the storage set such that the lowest gauge height is greater than 0.00 m.
4. A storage gauge board must:
 - (a) be referenced to an AHD levelled survey benchmark.
 - (b) have the GDA2020 or MGA 2020 coordinates of the gauge board determined.
 - (c) for multiple staged gauge boards only:

- (d) have a gauge board level reading on the top most gauge board levelled to m AHD,
 - (i) have the GDA2020 or MGA 2020 coordinates of the top most gauge board determined
 - (ii) have the top most level on the top gauge board selected such that the level of bottom of the lowest gauge board will be greater than 0.00 m.