

*Appendix H*

# **COMPILATION OF KNOWN TECHNICAL STANDARDS**

## Standards of Installation

### INTRODUCTION

Stream level and rainfall gauges and other equipment associated with the flood gauge network has to be fit for purpose and provide BOM with sufficient and accurate data in a timely manner. Unless there is some certainty as to the quality of the information supplied, the quality of forecasts could be compromised.

Ideally, if a gauge is installed to BOM standards and guidelines for inclusion in the flood warning network and the site meets the performance requirements of BOM, the process becomes simpler for all.

At the moment, BOM requires installations to report within the ALERT framework and at the moment, only one manufacturer's products used. If performance specifications were provided and new technologies mandated opportunities for additional supplies would be created.

Benefits accrue from standardisation of specification and variety of offerings as outlined in DNRM's Standard Instrumentation Policy (DNRM 2013):

- There is greater confidence in the data acquired using Standard instrumentation
- Staff training is reduced
- Staff can transfer between regions without additional instrumentation training
- State-wide spares inventory is kept to a minimum
- Fewer spare parts need to be carried in the field
- Fewer servicing and calibration instruments are required
- Bulk buying reduces costs
- Research and development costs are minimised
- Related quality assurance protocols are reduced.

The challenge is to strive for a happy medium between standardisation and variety of equipment and technologies available that will resolve some of the problems that have been observed/concluded through the conduct of this review.

### THE PROBLEM

The Preliminary Findings Report (BEW553-TD-WE-REP-0010 Rev A 19/8/15) provided the following:

- BOM have responsibility for the flood warning service and rely on the FWN to provide this service, but do not have control of the 53 owners

of the network. This is a potential vulnerability in the ability of BOM to continue to provide a high quality service.

- Historically riverine monitoring and rainfall gauges have been installed for purposes other than flood warning (e.g. water management) but have since been incorporated into the FWN.
- The FWN has evolved over time with little governance. The assets which have been installed have variable standards of technical consistency and data reliability when it comes to flood warning and modelling purposes.
- There are no formal arrangements in place to identify and record resources available to forecasters other than those gauges formally accepted by BOM into the FWN. This reduces visibility of the role such resources play in supporting BOM's flood forecasting function.
- There are 2,924 gauges in the FWN. These comprise (based on BOM database): 1,038 ALERT stations; 843 Telemeter stations; 70 manual; 875 remote operator terminal; 98 AWS. There are 128 discrepancies between the type of gauges reported by council and that appearing in the BOM dataset.
- There are a range of communication systems in use. These include (based on feedback from respondents): 537 Carrier Based (Next G or FTP); 133 Fixed Line; 831 No Connection (Manual); 691 Radio; 85 Satellite; 647 Unknown. There are discrepancies between the BOM database and feedback from respondents.
- There are various owners of gauges in the FWN. These include: BOM (1,077); BOM shared (5); Queensland state government (553) [comprising DNRM (515), DSITI (26), MSQ (6), QLD Rail (5), DWLBC(1)]; State shared (40); Council (891); Council shared (with BOM) (12); NGRMG (Not for profit) (9); Water supply (287) (Sunwater, Seqwater, Gladstone Area Water Board); Private (19) or Private Shared (Stanbroke Pastoral Company, AQUAGEN, Powerlink QLD, Moreton Bay Systems); NSW (30); unknown (1).
- There are 53 owners of gauges in the FWN, comprising 38 Councils and 15 entities/departments.

- So far, at least 250 gauges have been identified that do not form part of the FWN network. Major owners include: TMR; Seqwater; Bundaberg Regional Council; Hinchinbrook Shire Council; Lockyer Valley Regional Council, Barcaldine Regional Council, Blackall Tambo regional council, Logan City Council; BMA, Glencore, Peabody, Anglo American, Peabody, Vale, Wesfarmers, QCoal and other mining and energy companies. South West NRM Ltd has also installed and maintains a number of gauges in the Murweh and Paroo region.
- 96% of council respondents consider the overall accuracy of stream and rainfall gauges currently in use is satisfactory. 96% of council respondents consider the overall timeliness of stream and rainfall gauges data available is satisfactory.
- There is no single entity responsible for the FWN in Queensland. The current model, which has evolved with little governance, involves distributed ownership across 53 organisations with the operations and maintenance task varying significantly in scope, frequency and quality.
- There is no specific model for the governance of the FWN. There is governance and strategy around the hydrometric network of individual organisations that contribute to the FWN, but not of the FWN as a whole. This appears to be a result of a legacy of distributed ownership, irregular funding and ill-defined responsibility for the FWN.
- There are no consistently applied standards for instrumentation, monitoring and data collection for the FWN. The major owners have their own standards and are similar, but there are differences between owners.
- One of the difficulties identified with implementing standards for FWN instrumentation is that gauges often serve a number of purposes, and flood warning may not be the primary purpose.
- There is no rating, hierarchy or assessment within the FWN database that assigns more confidence to certain gauges than others, for example based on the O&M regime or the type of equipment installed.
- There is only one supplier of ALERT equipment, so the lack of commercial competition and opportunity for innovation could be a problem in the future. This could be overcome by moving towards performance specification rather than product (technology) specification.
- There is currently no accreditation system for instrumentation used in the FWN
- The lack of a manual gauge board at many telemetry or ALERT gauge sites makes calibration more difficult
- Implementation guidelines are required for new flood warning gauge installations that: demonstrate need; determine funding sources; establish and seek budgets; assess capacity and support requirements; conduct site assessment; implementation plan; commissioning and certification.
- Key Performance Indicators (KPIs) for the FWN do not currently exist, although BOM and DNRM have some KPIs for their systems. The prime KPI relating to the number/percentage of that gauges function during a severe weather event does not appear to exist.
- The leading cause of reliability problems reported from the respondents was communication dropouts and aged equipment.
- Some gauge sites within the FWN do not satisfy current Occupational Health and Safety (OHS) requirement. In some situations these will need to be entirely relocated, in other situations modifications to the existing installation will be sufficient.
- AS3778 is the Australian Standard for stream measurement and location of gauges. In many situations the standard is not followed and the positioning of gauges is generally opportunistic and may not reflect a uniform hydraulic condition and hydraulic control. In such cases the gauge reading is a proxy for a better hydraulic condition upstream or downstream.

Taking the above points in combination, it suggests gaps can be filled by guidelines and standards for instrumentation. The Bureau will provide requirements and recommendations to councils if councils speak directly to them. BOM has its own standard drawings and specifications as would DNRM and some other major organisations. However, for a gauges installed by councils or contractors acting for councils, their installations are based on their own assessments of need and noting design elements of other installations. The contracting groups that provide installations and consulting to the councils mostly base their systems/gauges on specifications put together by these groups.

Where the design sits outside of this specification, there is a lack of standard to help a council. However, these projects would usually sit outside BOM's charter, i.e. flash flooding, SCADA development, customised measurement (velocity sensors, swapping over redundant communication systems combinations, camera and flashing sign systems). In these cases, there are some guidelines but mostly the final decision/assessment criteria are up to council to ascertain. This level of uncertainty is not helpful.

A further question needs to be asked is whether future installations should continue with the current model of relying on available and suitable equipment or force the equipment supplier industry to engage in technical change to supplier more advance/robust/accurate instruments through the establishment of performance specifications.

The present approach is informed by available literature and practice

## AVAILABLE LITERATURE

The following list of available literature is not exhaustive and includes as an example, a supplier installation guide.

Title	Author	Published/Date	Comment
Flood Warning Manual 21	Australian Emergency Management Series	CoA 2009	Describes the purpose of flood warning, predictions and comments on the need for manual backup, and sets the context for prediction systems
Service Level Specification for Flood Forecasting and Warning Services for Queensland	Aust BOM	CoA 2013	Describes the flood forecasting and warning services and provided by BOM the BOM's roles. It outlines priority targets and the role of Queensland's Flood Warning Consultative Committee
National Industry Guidelines Hydrometric monitoring	Aust BOM	WISBF GL 100-2013	The series contains 10 parts of which Part 3: Instrument and Measurement Systems Management applies.  This Part nominates those elements that need to be incorporated into instrumentation records and calibration and metrological information, and how to deal with non-conformities
Aust Govt response to the BOM's capacity to respond to future extreme weather ... events ...	Aust BOM	2013, incorporates Minister's Foreward	Includes responses and agreements to a series of priority actions (PA):  PA 2b: upgrade the flood monitoring system  PA 4: agree clear allocation of responsibilities  PA6: explore NexGen Forecast and Warning Systems
National Guidelines for the National Flood Risk Information Program	Not known	Not known	The paper outlines the need for accessible flood risk information. This is predominately derived from flood studies that rely on historic data. This implies a need to maintain and expand databases of rainfall and river records as it is these that are relied upon for flood emergency modelling.
Measurement of water flow in open channels	Standards Australia	AS 3778-2001 Part 6	The standard is identical to and reproduced from ISO 11011-2:1983, <i>Liquid flow measurement in open channels</i>  Part 6 provides standards for measuring devices, instruments and equipment.  The standard discusses particular issues and recommends avoidance measures but does not set accuracy standards

Title	Author	Published/Date	Comment
Standard Instrumentation Policy	DNRM	WRM/WMP007 Version 3, 2013	Defines the standard instrumentation to be used for water monitoring activities .  Appendix A nominates instruments endorsed for core monitoring projects.
Water Monitoring and Data Collection Standards	DNRM	WMO010 (Ver 2.1 March 2007	Contains a list of External Standards including AS/NZS, As, DNRM, Qld EPA, BOM,  Appendix A refers to the accuracy of time series data  Appendix B refers to the accuracy of intermittent data
Transport and Main Roads Specifications - MRTS233 Provision of Roadway Flood Monitoring Systems	Qld DTMR	June 2015	The standard defines the design, supply, installation, testing and commissioning, performance, documentation, training and maintenance requirements for roadway flood monitoring systems.  The standard refers to a number of other reference documents (AS, AS/NZS & MRT), sets functional and performance requirements and standards for all components including instruments, power and transmission of data.
A national approach to water information standards	Johnston L (BOM) Robinson (NSW OoW)	Paper presented to 16th Australian Hydrographers Association Conference Melbourne. 21-23 August 2012	Discusses the approach to collecting and managing water information, and standards to provide a formal basis for date interoperability and quality. A method for the agreement and adoption of standards if presented.
Absolute Shaft Encoder Model AD375MA Instruction Manual	Hydrological Services Pty Ltd	Undated	Provide installation and maintenance details including set up and specifications.

## COMMUNITY OF PRACTICE

The success of the existing flood warning hydrometric network is due to the competency of field hydrographers. The Australian Hydrographers Association [www.aha.net.au](http://www.aha.net.au) provides a community of practice, and its Journal contains information on practice, technical and research matters. It has conducted regular conferences since at least 2002.

The AHA is active in the BoM Water Information Standards Business Forum. The AHA has

several Technical Reference Groups to address guidelines relating to ADCP, Data, Training, and Field procedures. Technical reference groups have included:

- Standards terminology
- Hydrometric / ADCP standards
- WDTF development and support
- Update on Standards Database
- Water data quality control requirements
- Hydrometric standards
- Value adding to data

- Hydrographic training

Several guidelines have been published that are accessible to its members.

## TENDER REQUIREMENTS

Specifications for the supply and installation of hydro-meteorological equipment should include as a minimum:

Scope of work and critical site selection criteria, background to each site outlining in-service conditions including the required flood immunity of the site, expressed as AEP and a level in AHD. If the site is designated as a critical site, it should be provided with a flood immunity of 0.2% AEP. A lesser immunity may be acceptable or difficult to achieve. This should be determined at the time of approval for funding. The exact location of each station is usually decided on site prior to construction in consultation with the landowner, council and BOM, but should seek to achieve the required flood immunity.

The specification should nominate the type of installation (rain and/or stream, location of stream hydraulic control, water level measurement type (alternatives available), a list of equipment approved by BOM and where possible the minimum performance requirements. Ideally installation specifications should move from nominated equipment to performance measures to allow more entries into the market place. This will improve price competition.

A description of the access route, directions and photographs should also be provided as part of the tender specification.

The tenderer should provide as a minimum

- Breakdown of lump sum prices
- Schedules of rates and prices including preliminaries, design, procurement/packaging/shipping, site works and contingency (stating the circumstances that would warrant release of additional funds)
- Experience of tenderer and suppliers
- Current commitments
- Key personnel
- Contractor profile
- Quality system
- Plant and equipment (description, function, make and model, rated capacity and data sheets nominating accuracy, performance expectations, maintenance requirements and expected design life under in-service conditions)
- Schedule of insurances
- Duration of maintenance period and inclusions/exclusions
- Schedules of hourly/daily rates for tenderer's personnel and plant
- Occupational health and safety certifications
- Construction and installation methodologies
- At the conclusion of site works, the contractor should provide an installation and commissioning report and BOM's testing and acceptance certifications.
- If after installation, site conditions are such that the expected levels of service, service intervals, maintenance requirements and design life can't be achieved, the reasons for that opinion and revised expectations shall be included in the contractor's commissioning report. Additional advice at the time from BOM would be desirable.
- The commissioning report should include surveyed location detailed (latitude, longitude and elevation to AHD of the site, similar details for the stream sensor and the stream hydraulic control upon which a rating

can be developed. Cross sections shall be surveyed above, at and downstream of the control at locations nominated by a hydrographer.