Consultation Feedback Log and Response

Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
	Comment	**Reference**			**Response**	
1	I noticed that the section 2.5 on definitions describe "shall" as a "mandatory" requirement. While under the Introduction, we have said clearly that this standard is non-mandatory, wonder if we should add at the bottom of Section 2.5: 2.5 Definitions Unless otherwise indicated, all definitions can be found in the Australian Water Information Dictionary at www.bom.gov.au/water/awid/. In this Standard: • 'may' indicates an allowable option; • 'shall' indicates a mandatory requirement; and • 'should' indicates a recommendation. It is noted that while the adoption of this Standard as a whole is deemed non-mandatory, when adopted, that the definitions described above are used in determining whether the expected performance requirements are being met.	2.5 Definitions / Introduction	presentation	Accept: in full	Should the word mandatory be reserved for the non-mandatory nature of the standard and not used within the standard in connection to shall?	
2	The basic & very robust telemetry system BOM use to collect real time data,is about to get a shake up!!!,there's talks about Eaton getting rid of elpro,which might not be their core business,but is a big part of ours in regards to getting data to BOM. This could open up a big can of worms, as if there's no servicing of equipment-shortly the whole network of gauges will have to be updated to another telemetry system, maybe a system that could be quality assured & is Realtime! The other question is, will it be funded & who will install the new system as BOM technical staff has been declining over the years. If your looking @ standardising system this is a good time to start the process, as there might be changes soon, that will force change. Its a great step to get the standards right, so that there will be more confidence in the data being collected from the vast amount of different companies supplying the data. Hopefully the clients get a answer soon from Eatons decision about Elpro industries, so we can get the standards right!	General comment	content	Accept: no action	general comment only	out
3(1)	My principle concern is the presence of many flow and dam level requirements in the river level metrics. I work with many hundreds of river level sites which are never gauged. Anyone performing maintenance at one of these stations would be forced to put N/A next to half of the requirements. An unintended consequence of not separating these requirements (level and level + flow), is likely to be that other mandatory river level requirements will also be ignored at these sites.	General comment	content	Accept: in part	ref to comments 3(2), 3(3), 3(4) and 3(5) for details	
3(2)	4.1m is for the below metric	3.2.2.4. rain-resolution	example	Accept: in full	Typo	

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3(3)	stream gauging ID; • stream gauging parameters; • gauge zero; • cease-to-flow level; • rating table name; • rating table value pairs; • minimum supply level; • full supply level; • total storage capacity; • accessible storage capacity; and • dead storage capacity. These are not level metadata requirements. It would be simpler to ensure compliance of level only and level+flow sites if their requirements were separated.		3.2.2.5. level-metadata	content	Accept: in part	From a functional point of view it was agreed by the TAG that there was no difference between a water level and a storage site. Even though there is a difference in the associated metadata. We could add guidance around which metadata elements applies to which data type	
3(4)	• stream gauging procedure; • flow control type; • rating table start date and time; • rating table relationship; and • rating table interpolation parameters. Again, it seems odd to include flow requirements in a river level metric. Most river level stations will have N/A for half of the requirements. This seems likely to result in the appearance of N/A for other requirements which really should be mandatory.		3.2.4.2. level-context	content	Noted	see comment 3(3); further discussion to clarify the approach taken.	Out
3(5)	I've re-read the below section. I was confused by the below section but actually all that needs to happen is the correction of the mathematical error. U (water level) = 20 + 3 mm = 23mm.		3.2.2.2. level-accuracy	example	Accept: in part	The calculation for combining uncertainties is from ISO 4373:2008(E) which uses a square law so that U (water level) = square root {(U datum)^2 + (U sensor)^2} but its not very clear so the formula and where it comes from should be presented	
4(1)	Why is the spec released as a non-mandatory document;		Application	presentation	Accept: no action	Under the Water Act 2007 (section 130, Part 7) the Director of Meteorology has the authority to issue National Water Information Standards by legislative instrument. The Bureau has chosen not to issue mandatory standards under this authority, but is instead working collaboratively with the water industry to develop and promote water information standards and guidelines.	
4(2)	From a procurement perspective, how do you envisage Councils using the specification to procure new flood warning river/rain stations. For example, from a councils perspective if we were to release tenders or quotes for a river gauging station using this standard as our functional specification, how do we assess tendered responses as conforming/non-conforming if we don't have the technical expertise. Is the Bureau able to offer technical assistance to assist Councils with assessment of conforming solutions; or can the Bureau assist with "deemed to comply" solutions , or certification processes for suppliers towards "pre-approved" systems to remove uncertainty.		Application	application	Noted	At this stage there are no plans for the Bureau to offer assistance for assessment of conforming solutions. Options for the future are to develop criteria for type approvals and/or, examples of acceptable solutions.	out

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4(3)	Has any consideration be given towards an overarching flood warning certification system for industry to improve certainty for everyone involved. For example, approved installers and maintainers of flood warning infrastructure to be used by the Bureau. There is insufficient competition in the market at present and this standard should largely resolve that.	Application	application	accept: no action	No. Not at this stage. Perhaps NIGL could offer certification training for assessors in the future however there are no plans at present.	out
4(4)	The standard seems to provide a framework for functional requirements without defining the underlying attributes required by the user. As a "data-user agency" for flood warning systems, will the Bureau develop pre-defined attributes for many of the parameters such as Section 3.2.1.2 - "Mediums/languages" and Section 3.2.1.3 "Data Formats".	3.2.1.2. data-formats	presentation	accept: in full	We will review terminology with an aim to use terms more commonly understood by industry and where possible adopt NIGL definitions. Otherwise new terms will be added to the glossary.	
4(5)	From the Bureau's perspective, how do we consider criticality of sites for new or replacement infrastructure. For example, are we strategically able to define the most suitable existing and/or future rain gauge sites for the purpose of calibrating radar data and how would this standard facilitate that? Does calibration of the radar systems require a higher "accuracy" of recorded data from a tipping bucket rain gauge, and if varying accuracies exist can the Bureau help define these?	2.2. Scope	content	Noted	The standard defines the minimum performance of infrastructure for the application of flood warning. There are a separate set of infrastructure requirements for the purpose of the calibration of radars.	out
4(6)	How does coming introduction of ALERT 2 interconnect with this standard. Where is this discussion currently at, what timeline exists for introduction of Alert 2, can existing ALERT canisters be upgraded to ALERT 2, does the Bureau have access to the underlying engineering designs of ELPRO Alert Canisters to enable industry to provide upgrade solutions? If we are looking to make major capital investments in flood warning systems tomorrow, should we be seeking ALERT 2 compatible infrastructure IF existing ALERT systems are not upgradeable? How can we get transparency around this.	Application	style	Noted	The standard is independent of technology. The standard is used to determine the performance requirements for a site. Once the performance requirements have been determined the technology such as ALERT2 that is capable of achieving that level of performance can be selected.	Out
5	Thanks for the opportunity to provide feedback on the draft Flood Warning Infrastructure Standard. On behalf of Ian Gordon (our FWCC member) who is currently on leave, I'd like to advise that we have no specific feedback on the draft Standard. Generally, it may prove too high-level and difficult to implement by local bodies managing flood warning infrastructure, without development of supporting work practices. I note this was a common theme during working group discussions. Email: 23/08/18	Application	application	Accept: in part	It is likely that further work will be proposed to develop guidance material to support the application of the standard	
6(1)	...required for tidal/storm-surge, riverine and flash flooding As many local government areas are in the coastal zone, it is imperative that the collection of tidal/storm surge information should be part of the total flood warning system. Currently, there are different government agencies that collect tidal/storm surge information. The collection of such information should also adhere to same performance-based principles.C21	2.2. Scope	application	Noted	Agree but at this stage the scope has been limited to riverine and flash flood applications. It is possible that the scope will be broadened with later revisions of the standard.	out

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6(2)	Flood warning infrastructure functional requirements matrix (Page 8): The "data use" components should be split into different sub-component. For instance, Data ingest, data storage and data display be divided so that their performance attributes can be further defined.		3.1. Performance matrix	content	Noted	Agree that splitting into sub components is the correct interpretation of the performance methodology. However in many cases it is the overall performance of the group of components that is more important than that of the individual components. e.g. one component may have a very long latency but that is ok if the other components compensate with shorter latencies. It can also be impractical to measure the attribute of individual components but relatively easy to measure the attribute of a group of attributes.	No
6(3)	If not explicitly stated, determine maximum design rainfall intensity for the site using the 2016 edition of Australian Rainfall and Runoff As the design rainfall in AR&R may change over time or local government may use local design rainfall, the specific 2016 version of AR&R should not be prescribed as the only source for design rainfall information. Note: All design rainfall is derived from the same AR&R methodology but may differ in the rainfall data source.		3.2.2. Interpretability	content	Accept: in full	We plan to broaden the allowable sources of data so will re word so that the 2016 edition will be one of a suite of offerings.	
6(4)	Level accuracy (uncertainty of measurement in the water level data) refers to: •how closely the measurement represents the true water level in relation to the pre-determined datum (e.g. AHD); •how the measurement considers atmospheric, salinity or other environmental conditions; •how reproducible the measurements are over time; and •how representative the measurements are of the level of the cross section where the measurement is observed and its relationship (rating curve) to the location where flow is measured. The accuracy of the level measurements depend on a number of factors and conditions. More importantly, any measurement should use a consistent reference datum.		3.2.2.2. Accuracy – Level	content	Accept: in part	Agree with addition of statement referring to relation to AHD. No. Environmental conditions are taken into account but its probably more something that is handled by NIGL. Such a reference may just be overcomplicating the message at the performance level. No. A rating curve is technology specific and in the performance methodology should only be referred to as an example of an acceptable solution.	
6(5)	Applicable gaugings are gaugings that apply to the current rating (where water level above gauge zero is obtained from the pre-determined rating curve)+C22; for example, gaugings captured prior to a shift in the rating are not applicable. It is important to note the use of the rating curve for determining the water level and the application of the rating curve is limited to a set period of time.		3.2.2.2. Flow	content	accept: in full	Agree. Will add both the statement in brackets and the second sentence.	

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6(6)	Data transfer (DT) site accuracy refers to the data and metadata in the data transfer files or messages, and the corresponding sources of error. •Site accuracy refers to the physical location of the station with standard coordinate system •Data can be incorrectly timestamped on receipt at the data-user agency if data were delayed during transfer. There is an inconsistency in documenting the location of all monitoring stations. A common coordinate system (e.g. GDA94 or GDA2020 MGA) need to adopted.		3.2.2.5. metadata	content	Noted	Applies to sensor metadata not data transfer components. Agree that the coordinate system (e.g. GDA94 or GDA2020 MGA) should be identified as a part of the meta data but not prescriptively specified at least in a performance based standard.	
6(7)	Level sampling (or alternatively, flow sampling) refers to how often the water level (or flow) is measured, and depends on how fast or slow the river rises. More frequent sampling and secondary sampling (e.g. manual staff gauge) are required to resolve the hydrograph of a rapidly rising river. For each level- or flow-sampling locations, a secondary sampling is required to ensure the performance based monitoring system has a backup.		3.2.2.3. Sampling resolution	style	Noted	This is a prescriptive method described by NIGL. The method can be used to set an automatic gauge and to ensure accuracy and enable a level of redundancy and reliability. It is one way of achieving the performance levels defined in this standard. It could be referred to as an example in the standard only.	out
6(8)	Infrastructure metadata refers to the metadata that are necessary to interpret measurements and the official name and number of the infrastructure. A consistent monitoring station name needs to be adopted.		3.2.2.5. Metadata – infra-metadata	content	Noted	Agree that consistent naming and numbering conventions should be followed but it is not the place of this standard to prescribe them. However, the elements need not be added to the context as they are detailed in the performance requirement and others may be added in time.	out
6(9)	Rainfall- or level- metadata refers to metadata that are necessary to interpret rainfall measurements. Physical information of the rainfall or water level station can be useful for interpreting the rainfall or water level measurement. For instance the height, vegetation clearance, sensor physical location in the water, etc.		3.2.2.5. rain-metadata or level-metadata	content	Noted	Agree that this information is important but it should not be included here. Physical information is included as contextual information in section 3.2.4.2	
6(10)	No example was provided.		3.2.2.5. and 3.2.4.2. metadata and contextual information	example	Accept: no action	Metadata and contextual information performance requirements consist of a list of elements being available only. Not sure that duplicating that list in examples is necessary.	
6(11)	VHF, 3G, NextG, ERRTS, ALERT1 or 2, etc. All these technology were briefly mentioned but their advantages/disadvantages were not discussed. Do any of these technologies have frequency spectrum or transmission range limitations? Staff gauge, flood gauge, height gauge, etc. A standard and consistent naming convention for all types of gauges need to be adopted (or reference to Australian Water Information Dictionary needs to be made).		4. Glossary	presentation	Accept: in part	Yes but these technologies including satellite require specialist expertise to assess/compare their relative strengths and weaknesses for a given application. NIGL don't cover the application of telemetry/data transfer for flood warning and neither will this standard but I acknowledge that there is a gap in available guidance in this area. The standard does refer to the limitations/minimum standards through examples. Agree we will adopt as far as possible the AWID terminology.	

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7(1)	I have attached my comments in the document attached, my thoughts, it is a long complex document that not many people would read and understand. It needs to be simplified and written in plain English. It is also unclear who the audience is, clients wanting flood systems, vendors installing infrastructure or end users requiring the data for emergency management. The document needs to be written from one of these points of view, my view would be from the emergency management information perspective so those investing or considering investing in a network can understand the complexities and have an understanding of the costs and risks associated with not following the national guideline. DEW has recently priced a 10 site flood network based on a scope of works interpreted from these standards and the costs were prohibitive because you could not use the risk principle in the costing structure because the scope was very prescriptive and did not allow for the vagrancies encountered in the type of application that was being considered. In the end we were forced to review the costs to fit the network into the budget and use a risk based approach to justify why we were not compliant with the scope. The document should simply state the minimum standard for flood warning infrastructure, data communication and ingestion.	General comment	presentation	Agree in part	Agree. The doc is complex which reflects the complexity and diversity of flood warning systems across Australia. Agree. We aim to review the terminology used and where possible adopt that used by the NIGL and listed in the AWID or if nothing is available use commonly understood terms. It is the characteristics of the data required by the data user that are used to determine the minimum performance capability of the infrastructure. As such the intended audience is not the data user but in your terminology it is the clients wanting flood warning systems and vendors installing flood warning systems. The audience of the standard are expected to have hydrological, hydrographic and flood warning service level knowledge.	
7(2)	Graham Blair, Department of Environment, Water and Natural Resources (South Australia) Now the Department of Environment and Water	Acknowledgments	content	Accept: in full	Will make change to next version.	
7(3)	if it is non mandatory "The Standard presents non-mandatory industry-recommended performance requirements for the design, development and monitoring of fit-for-purpose flood warning infrastructure." why will it improve data accuracy etc if nobody adopts it or it is too prescriptive or costly to adopt as per our experience.	1. Introduction	style	Noted	Under the Water Act 2007 (section 130, Part 7) the Director of Meteorology has the authority to issue National Water Information Standards by legislative instrument. The Bureau has chosen not to issue mandatory standards under this authority, but is instead working collaboratively with the water industry to develop and promote water information standards and guidelines. Need more information about the 'too prescriptive' nature of the standard to respond other than to say in time it is hoped that innovation and competition will bring infrastructure costs down.	
7(4)	i am not sure this adds value nobody cares what model/method you adopt	1. Introduction	content	Noted	The method is different to the common prescriptive standards. So does need some description of what it is and how it works	
7(5)	i am confused as to who the standard is directed at, is it the client who wants a flood warning system, the infrastructure installer or the organisation(s) managing the emergency. the Hydrometric Guidelines are very clear about who, what and how, this document is less clear.	1. Introduction	audience	Noted	The output of the standard (minimum performance levels for a site) is directed at vendors installing flood warning systems. The use of the standard is directed at clients wanting to assess existing sites or set the performance for new ones.	

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7(6)	not sure i understand why (anticompetitive) this gets a mention here.	1. Introduction	style	Accept: no action	Its stated because its one of the benefits of a performance standard which addresses one of the requirements of the scope of this project and it's a current issue with flood warning infrastructure suppliers today. However as per response to 7(3) not sure if it needs to be a part of the standard.		
7(7)	not sure this statement actually makes any sense in a performance based standard especially as the standard will only provide direction on how to achieve the outcome if adopted not the actual product..	2.1. Purpose	style	Accept: no action	The standard provides more than direction it sets the minimum performance required to achieve the stated purpose. However I agree that it does not provide the actual product. The product or components of the infrastructure that would comply with the required performance can be determined comparing product spec with performance level determined.		
7(8)	i would have though mandatory would have been at the head of the list	2.5. Definitions	presentation	accept: in part	I'm not convinced this section is necessary however if its kept then agree it should be at the top of the list. Firstly because all requirements are mandatory and secondly I think the word mandatory should be reserved for references to standard being non-mandatory.		
7(9)	again i am confused, i would have thought that the level of flood risk and service expectations would be understood, therefore this standard is about matching equipment and communications etc to that understanding	3. Performance standards	application	accept: in part	I think your comment and the statement in the standard are both saying the same thing. Perhaps need to re-word the statement in the standard as its difficult to understand.		
7(10)	make sense to roll dot points 1 and 2 into one dot point	3.1.1. Performance matrix	style	Noted	The functional behaviour of the components types in dot point 1 (supporting data sensing/transfer) and dot point 2 (measurement and transfer instruments) are very different. So the dot point should remain separate.		

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7(11)	again is this standard is aimed at the installer of the network or the data user. are not these just attributes of the network?? and these are very aspirational without much clarity. where are the performance measures, eg deliver 5 minute data to BoM	3.1.2. Attributes	presentation	Accept: in part	As stated earlier the output of the standard is aimed at the installer of the network. The service developer/client would use the standard to set the performance levels and then the installer of the network would select/design the components that conform to the set levels. When worked through the output of the standard will provide exactly that kind of information. The standard is not aimed at the data user it is a tool that will enable infrastructure to provide data fit for the purpose of flood warning. Need to improve clarity	
7(12)	i am not sure any of this actually matters, surely the equipment would be maintained and operational before a flood and you would undertake a debrief after each flood top see what worked and what didn't.	3.1.2.3. Availability	style	Noted	The availability part of the standard is addressing exactly that question. It cannot be assumed that the equipment will be maintained and operational before a flood. At the Bureau we check data feeds in the lead up to flood events and it is not uncommon for sites to not be working. We have even had instances of new sites being installed without any commitment for maintenance. Rather than wait until after a flood to see what worked and what didn't, the requirements in this part of the standard are aimed at identifying and reducing the risks of unexpected failure of a site at the time when it is most needed, during an event.	
7(13)	this only needs a statement that reflects " all sites need to be maintained to	3.1.2.3. Availability	content	Noted	Its not just that sites need to be maintained, its that they need to be maintained in a way that ensures the infrastructure is in good working order at specific times which is when the data is most needed, during flood events. In this way flood warning differs from water monitoring which has an emphasis on continuous data collection where all periods of time are equally important.	
7(14)	Not sure even with the earlier description what this actually is or does	3.1. Performance matrix	presentation	accept: in full	The matrix is a tool used to develop performance standards. However it is included in the standard because it provides a picture of the relationship between functional requirements, attributes and components. I think it should remain in the standard but possibly in an appendix. Needs clarification	
7(15)	these are all great but belong in an appendix, a simple statement about what is required is all that is needed here, e.g the functional requirement, the document needs to be written in plain English.	3.2. Functional and performance requirements	presentation	accept: in full	We will review how we present and layout this information with a view to making it more easily understood and useable. Possible options: • replace examples with case studies or fully worked examples • have separate chapters for context/functional requirements, performance requirements and verification • add section on input data requirements and link to performance requirements only to set performance	

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8(1)	To assist Council's who don't necessarily have staff with the specific technical expertise to be able to determine whether proposed equipment meets the standard, can the BoM consider keeping a register of equipment that has been reviewed and found to comply with the requirements of the standard ie "acceptable solutions".		Application	application	Accept: in part	As the client, the council's role would be to apply the standard to determine the performance levels for the site. The vendor (provider of hydrographic services) would then select/design the components that would comply with the performance levels. It would be the vendors responsibility as a part of the component selection/design process to ensure that the verification needs of the standard are satisfied. In time it is likely that a library of acceptable solutions will be developed for a range of performance levels. However even with such a library clients will still need to first determine performance levels for new sites or sites being assessed. needs clarity	
8(2)	How would it be assessed whether equipment complies with the standard. Would there be an independent testing body or certification or would we be left to believe the brochures?		Application	application	Accept: in full	It would be the vendors responsibility as a part of the component selection/design process to ensure that the verification needs of the standard are satisfied.	
8(3)	How will greater variety of equipment be dealt with in maintenance where the Bom undertakes maintenance on behalf of Council's. Will the BoM still be able to cover mtce/testing of various equipment as they do with the current use of standard equipment?		Application	application	Accept: in part	If the vendor is different to the maintenance provider then the maintenance provider should be consulted at the equipment selection design phase of the project to ensure that they are capable of maintaining the new equipment.	out
8(4)	Is the standard going to include the physical infrastructure - towers, slabs, platforms, and cabinets etc which are Flood Warning Infrastructure that appear to not be included in draft.		3.2. Performance standards	style	Accept: in part	The standard does not include prescriptive standards for towers, slabs, etc. The standard requires that physical infrastructure be able to withstand and continue to operate within the environment to which it is exposed. The performance measure is that all physical infrastructure conform to governing relevant standards e.g. building codes. Need to be more specific with ref to dependent standards	

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9(1)	In summary, whilst we accept that the supplier market needs to be opened beyond the current limited equipment listing so that different technical solutions can be developed and adopted to enhance our flood warning intelligence, we do not believe that this document in its current form can or will facilitate that objective. In fact, the document is poorly constructed and very difficult to follow (and we say this despite our extensive knowledge of flood warning network systems).	whole standard	presentation	Accept: in part	We agree that this standard is complex and difficult to follow because - • performance based standards are novel (and we are not accustomed to using them) • the new type of standard required a new language • the layout of the standard reflected how we developed the standard not how it should be used We believe that we can make significant changes to the layout and where possible to the language to reflect common usage which will make the standard easier to follow and use. The standard (performance levels) will be a set of technical specifications that can be directly compared with equipment specifications. Further guidance may be provided around the application of the standard in a follow up project.	
9(2)	In a practical sense, the document will create more problems than it will fix. It appears to have gone way too far from the perceived 'prescriptive' and limited list of items currently accepted by the Bureau, to a wording and structure that is so open and unclear, and difficult to interpret, that the document is frankly unhelpful. It will more likely lead to deployment of equipment that diminishes, rather than enhances, network performance and sound forecasting decisions.	whole standard	presentation	Accept: in part	Refer to response to 9(1) regarding issues of clarity and interpretability. The purpose of the standard is to define the minimum performance required so that there will inevitably be a range of equipment that would conform to the standard. It would then be up to the agencies responsible for the infrastructure to choose from the various acceptable technical solutions. Agencies would still be able to select a single technical solution for their fleet if so desired.	
9(3)	The documents effective target audience will be equipment suppliers and Local Government Agencies, if either of these two audiences is struggling to interpret it; the document has failed in its primary purpose.	whole standard	audience	Accept: in part	Refer to response to 9(1) regarding issues of clarity and interpretability.	
9(4)	On a positive note, we support the need for a National Flood Warning Performance Standard; we simply believe that the current attempt needs some serious rework. This could be assisted by actively engaging some key stakeholder representatives (specifically from local government and industry) in the revised structuring and drafting of the specification in your follow-up processes.	whole standard	presentation	Accept: in part	We aim to re-work the standard with the current team base on the extensive feedback received during the industry consultation. We will aim to engage a wider audience in the follow up work to develop the guidance material for the application of the standard which we expect will have implications for the standard.	
9(5)	The advertising documentation has scope statements that are incorrect – for example 'non mandatory' and 'industry recommended performance specifications'. The Bureau is the leading forecast agency and hence the leading data user, and must have some 'minimum performance specifications' it will accept before it hosts gauge data on its web site, or makes critical flood warning decisions around data it receives from particular gauges. So there must be a level of 'mandatory' minimum specifications in the guidelines spelt out by the Bureau. Secondly – this should not be seen as a free-for-all from the supplier side, and we do not believe the industry wants a free-for-all in supply of equipment. Industry doesn't and shouldn't set the performance specifications – their role is to design and supply equipment that meets the standard required in order to meet the objective.	whole standard	presentation	Accept: in part	Ref to response 4(1) regarding the non-mandatory nature of the standard. 1. Although not clear to you based on your feedback, it is the purpose of this document to set the minimum performance specification for flood warning infrastructure. 2. Industry wont be setting the performance specifications, they will design and supply equipment that meets the performance specifications.	

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9(6)	Use of too much contemporary language – collectability, interpretability, availability, assurability, reproducibility, ingestability etc. Is this language necessary, does it provide value, or does it simply confuse the reader? Why not adhere to industry standard and understood language (as you have in other National and International Industry Guidelines), for example: Data capture and transfer, Data receipt and storage, Data accessibility, Quality assurance, Data integrity etc.	whole standard	presentation	Accept: in part	Where possible in the re-draft will will adopt terms from the NIGLS/WIID or commonly understood terms. However this is a new style of standard and in some cases certain aspects can only be adequately described using this new contemporary language. needs more explanation	
9(7)	Poorly explained examples and in fact, some examples are incorrect	3.2. Functional and performance requirements	example	Accept: in full	All examples will be revised to correct errors and improve clarity.	
9(8)	Glossary does not describe a number of key terms used.	4. Glossary	presentation	Accept	Ref to response 9(6).	
9(9)	Nothing about the option or consideration of multi-purpose use of flood warning equipment – e.g. rain gauges required to calibrate radars (tipping bucket sizes, location and spatial distribution across the range of terrain within a catchment). Other functional purposes of rain and river height gauges could include monitoring drought and climate change long term. There is an enormous investment out there in this equipment – in capital costs and operational and maintenance costs. All levels of government should seek to maximize its capacity for multiple purpose use.	whole standard	content	Noted	The aim of the standard is only to set the standard of infrastructure that would be capable of providing the data necessary to deliver a given standard of flood warning service. For other applications you will need to refer to their relevant standards/requirements. Infrastructure designed to be used for multi-purpose use will then need to conform to all the standards/requirements associated with each application. Radars are out of scope for the flood warning standard. Radar images are used for situational awareness (along with satellite images) and increasingly for short term prediction. Also excluded from the standard is satellite technology. These technologies are so complex that they will need their own specific standards that will relate the quality of their products to the various services that use them. The application of raingauges for the purpose of ground truthing/calibrating radars is also different to the application of flood warning. There are specific requirements for this application documented elsewhere.	out
9(10)	'Functional and performance requirements' are seemingly interchanged with 'design and service level requirements'.	3.2. Functional and performance requirements	presentation	Accept: in part	This is a clarity issue and will be addressed as a part of the revision of the standard. It must be particularly unclear for you to also include functional requirements in this comment. Performance requirements are not interchanged with, but in some cases are dependent on design or service level requirements. That is, a first step in evaluating a performance requirement is to get hold of the service level information relating to that site. So service level information can be regarded as input data to the performance requirement.	
9(11)	The following paragraph in Section 3.2 'Ingest latency - Performance requirement' is an example where the reader may struggle to interpret what the author is trying to communicate. If the reader needs to read and re-read a sentence, then perhaps the wording needs changing : The latency (of reporting) shall be equal to or less than the maximum allowable sampling interval (as determined in the Interpretability: Sampling resolution (rain sampling) requirement).	Section 3.2 - Ingest Latency	presentation	Accept: in full	Agree. Will rework this statement.	

Consultation Feedback Log and Response

Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
9(12)	Example 1. The ERRTS canister can be set to time periods of sampling other than the 5 minute default the Bureau has adopted, and it can be altered to only report the change in water level to a range of different timeframes. In some cases the mixture of componentry (e.g. where a flood warning pressure sensor system is 'piggy backed' of another agencies bubbler system) may in fact dictate choice of a different sampling time interval on each of the separate devices. The performance specification is not therefore necessarily the exact latency or time period, but the ability in such a situation, to be able to vary the time period.	Section 3.2.1.1 , Example 1	content	Noted	The intent of the example was only to show the relationship between sampling time and latency of reporting and not imply that the sampling period could not be altered. The setting of sample time is dependent on how quickly water level can rise and will vary from one site to the next. 5 min is a commonly used sampling time but will be too slow for sites where water level rises very quickly and unnecessarily frequent for sites where the water level rises slowly. The requirement is about matching the sample time to this characteristic of the site (how quickly the water level can rise) and not whether the instrument can be configured to have different sampling times. If a manufacturer wants their equipment to be widely applicable then they should allow configurable sampling times. If the intent of the other agencies water monitoring activity is to resolve the entire hydrograph then sharing bubbler systems or sensors makes sense as they would also be using an appropriate sample time. If the intent is to resolve only part of the hydrograph (e.g. low flows only) then the sampling time and possibly the range may be inadequate for flood warning and a full secondary system will be required. The examples will be reworked to improve clarity as a part of the revision.	
9(13)	Example 2. The issue is that the frequency of polling can be modified quickly (automatic script or manually) during an event, to reflect the 'rate of rise' information required for the catchment location. Generally, TM reports are out to 3 hourly during quiet periods and stepped up as an event unfolds. This cuts down unnecessary data traffic and storage of information relating to water levels.	Section 3.2.1.1 , Example 2	content	Accept: in full	Yes I agree the standard should accommodate polling at different frequencies. Wording needs to handle this (variable discrete sampling) and event based sampling.	
9(14)	Performance requirement There are some salient differences between the Bureau's needs and other data-user agencies. The wording doesn't clarify the specific format needs of the chief forecaster.	Section 3.2.1.2 Interoperability	style	Noted	The Bureau is not considered to be any different from any other data user within the standard. The differences between data-user agencies will be just as great as between the Bureau and other agencies. The standard is performance based not prescriptive (tech/protocol specific). The perf requirement here is that data can be transferred from a site to the data users. What is important here is that the data requirements of the data users are addressed as a part of the site works.	

Consultation Feedback Log and Response

		Comment	Reference			Response	
Comment No.	Detail of comment received		ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
9(15)	Verification Last paragraph – Is this appropriate given some recent research highlighting problems with very high intensity shorter duration storms. So the specification should not simply be centered on the age old 1% AEP and total rainfall amount for that amount.		Section 3.2.2.1 Rain range	content	Accept: in part	I am unaware of the latest research and how it affects use of the 1 % AEP and corresponding rainfall amount. need to investigate	
9(16)	Range is also affected by the capacity of the particular instrument to accurately measure intensity duration regardless of what the manufacturer's specifications state – e.g. refer to PowerPoint presentation by John Gorman https://www.wmo.int/pages/prog/www/IMOP/TrainingMat/2011-Melbourne/Doc_3_3_Tipping-bucket-rain-gauge_JGorman.pdf assessing accuracy of HS, RIMCO and Envirodata tipping buckets. Siphons in tipping buckets make a big difference in this regard, so design of instrument is important.		Section 3.2.2.1 Rain range	style	Noted	I agree the design of the equipment is important but as this is a performance standard it is up to those using the standard to demonstrate that the selected equipment is capable of meeting the required performance.	
9(17)	Performance requirement The need for redundancies in system design is not reflected well in the documentation. For example the functional and performance requirement for 'Level Range' does not encourage or explain the importance of redundancies in sensor lines that perhaps should be instituted at agreed Forecast Locations under the service level agreements- i.e. separate high and low flow sensor lines with obvious measurement range differences.		Section 3.2.2.1 Range - water level	content	Accept: in full	Redundancy is only referred to in terms of exposure to environmental hazards.	
9(18)	Verification Measure freeboard to be: 0.6-1.0m for record lengths from 10 to zero years. 0.3-0.6m for record lengths greater than 10 years. Our advice is to try to pick the highest known flood from all sources – literature and local knowledge and then ensure that the platform or hut housing the equipment is located on a raised tower platform at minimum 3m above the highest known. If flood modelling information is available, and given climate change predictions, the instrumentation should be located at least above the 0.5%AEP and possibly the 0.2%AEP. In reality these are the severe floods that cause havoc with community safety.		Section 3.2.2.1 Range - water level	content	Agree: in part	This requirement refers only to the measurement range not the height of the instruments. The height of the instruments is dealt with in reliability. Generally though I agree with the approach. The standard sets a fairly conservative max range of 1% AEP + up to 1 m for new sites. Instruments would have to be above that which would in many cases may be in the range of 0.5% or above. Have never heard of the +3m rule with new sites but will consider.	
9(19)	The detail around equipment huts is very deficient. If the equipment hut fails, it doesn't matter what choice of equipment is located within them. A number of recorder huts have failed in recent flood events post 2010. It also does not adequately cover hydraulic load ratings for huts that are located close to or within the stream flood level (e.g. velocities & load resistance of structure and footings).		Sec 3.2.3.1 Reliability - Infrastructure	style	Noted	The standard is performance based so only refers to the hut being capable of protecting the instruments from all exposures. It asks those applying the standard to identify all risk exposures. So if the hut were in/near the stream the hydraulic risk should be identified and treated.	

Consultation Feedback Log and Response

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Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
9(20)	Local governments are not equipped to undertake comprehensive bench testing of the current standard range equipment, let alone a greatly expanded range. A greatly expanded range of equipment will also impact on the ability of contractors and local government officers to undertake maintenance and troubleshooting. They will require a greater range of spares and equipment and skills set.	3.2	style	Noted	Not sure if local gov should be responsible for bench testing. Local gov should be able to use the standard to 1. Characterise the site and 2. set the performance requirements. The vendor/installer role would then be to select equipment that conforms to the performance requirements. An intermediate output of the standard is a set of minimum performance levels which should be comparable/align to manufactures specification sheets. Its discussion between the network owners/vendors about requirements to constrain or limit the variety of equipment in the fleet.	
9(21)	These issues have driven other agencies such as DNRME & SunWater to limit the equipment range installed at their gauging facilities. They have also instituted independent testing of supplier equipment before settling on the final limited range installed in the field.	3.2. Functional and performance requirements	style	Accept: no action	It is hoped that such results would be shared amongst the flood warning community. Surely manufacturers would market themselves as having the equipment 1. that conformed to the standard and 2. that has been selected for the fleet of major organisations/authorities.	
10(1)	An interesting and detailed document. Again the focus on performance based metrics is welcome as is the width of the scope, from field to display.	whole standard	style	Accept: no action	Positive comment	
10(2)	The section on collectability; interpretability; reliability; and assurability is a bit heavy going. Are all of these concepts/terms necessary, especially from the user's perspective? For example, does the user need to know the difference between reliability and availability? Can this be simplified a bit or would it be better to separate those measures that are more user specific from those that may only be of interest to the provider.	3.1.2. Attributes	audience	Accept: in part	Agree we will simplify and separate user (hydrologist?) from provider (hydrographer?) information.	
10(3)	As per the comment made on page 9, setting minimum performance standards based on outcomes is difficult and often driven by what is realistic.	3.2. Functional and performance requirements	style	Accept: no action	Agree. The first step is at least identifying the required performance (max acceptable risk). Then even if the solution is limited by practicality the residual (less than acceptable) risk will be explicitly known. Where we are unable to identify performance we will rely on examples of acceptable solutions.	

Consultation Feedback Log and Response

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Comment No.	Detail of comment received		ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
10(4)	The pragmatic measure of level freeboard measurement, reflecting record length on page 15, is attractive. Is there a simpler way of using this with the measured maximum level to set standards rather than using the hard to calculate probability of recurrence/return period?		3.2.2.1. Level - range	content	Accept: in part	Is it that hard to calc where a data record exists? Additionally there is the problem of uncertainty. A strength of the recurrence interval is that this value can be compared between sites across the country.

there are some equations that are dependent on length of record and rank but i don't think they apply for rare floods. Need to investigate if they can be used to get a rough estimate that we could add a bigger factor of safety too. | |
| 10(5) | How well rainfall data represents the mean conditions over the area of interest (page 16) depends a lot on the number and density of measurements (from Agency and third party sites). I'm not sure this is covered here. Is this a weakness given the sensitivity of the outcome to estimates of rainfall? | | 3.2.2.2. rainfall-accuracy | content | Noted | By representativeness we are referring to how representative the local conditions for measuring rainfall are of the wider area. e.g. is it representative of the rainfall at that elevation or is it monitoring some extreme local phenomena that is unlikely to occur elsewhere in the area.

It is not referring to how well a single raingauge can measure the spatial distribution of rainfall across a wider area.

That is we are assuming that the conditions across the wider area are relatively constant. e,g, constant elevation. | |
| 10(6) | Given the nature and scale of the Australian landscape is there a need to apply some form of spatial risk assessment so different standards apply in catchments with the biggest risks? | | 2.2. Scope | content | Accept: no action | This question relates very closely to the original scope of this project which included tiered standards that would enable infrastructure that is fit-for-purpose and compatible with the level of flood risk.

We resolved that the level of flood risk is really handled at the flood warning service level (not in scope for this project) so that the service is developed to match the level of risk.

And that to deliver the service with the desired predictive capability you need a minimum network of sites which is a network design problem, also not in scope for this project. However at this point much discussion was had regarding whether sites within the network have different roles and so have different levels of importance. It was thought that by identifying the roles the sites have within the network that they could be ranked or tiered based on their contribution to the delivery of the flood warning network. e.g. how much would the service be impacted by the loss of a site. The counter argument was that if a key site failed then the remaining lesser sites that would be left to deliver the service would need to be equally as fit. So as compelling as the concept was the group resolved that at the network level all sites should be considered as equal.

At the site level we addressed the fitness-for-purpose part of the scope by adopting a methodology that sets the minimum required performance that will achieve the max allowable risk to consider a site fit-for-purpose. | out |
| 10(7) | For the reader it would be helpful if the examples (good that they are included) indicate whether they have or haven't met the relevant criteria. Some seem to but others don't. | | 3.2 | example | Accept: in full | Agree we will indicate whether they have or haven't met the relevant criteria. | |

	Comment	Reference		Response			
Comment No.	**Detail of comment received**	**ref1 (Section /Attribute)**	**Themes**	**Type (Accept: in full, in part or no action/Noted)**	**Detail (work needed)**		**Scope (in/out)**
10(8)	I can see the logic of different sample periods, especially in Australia, but wondered if a single standard would be better. You would end up with more data (if it were 15 mins) and it would take up more space but it would allow for other analysis in the future and make things simpler. 15 min or daily by exception?	3.2.2.3. Sampling resolution	content	Noted	The standard is applied first by determining the min requirement and secondly by selecting suitable equipment that will meet that need. So it is possible that some agencies/jurisdictions may choose a standard period where that period meets the performance requirements for all their applications. In our case our scope covers both rapid and very slow responding situations so a standard period may be problematic given the sample periods will vary from less than 15 min to greater than a day.		
10(9)	It's a very detailed document and probably too detailed for my liking. I don't think there are any show stoppers, the variety of options they have listed in many places probably results from them have to accommodate so many different sources of data. I would prefer to see more explicit standards but that probably isn't possible with their network.	whole standard	content	Accept: in part	As a part of the revision we will be more explicit especially with regards to reliability by referencing dependent standards e.g. building standards.		
10(10)	Thanks for sharing – interesting to see how others are trying to tackle similar problems. Agree with the existing feedback from yourself and others. Also like the pragmatic intuitive solutions in the document – these help all have a clear common understanding of what is required. Would probably opt for a standard 15 minute interval recording so that there is consistency not only across the current network, but also importantly with the period of record so that your understanding of peak flows using extremes from 1960, 1979, 2000 etc. is based upon a consistent recording interval. Clear and consistent commenting of the record would also help for future generations trying to make sense of these rare, but important events.	3.2.2.3. Sampling resolution	content	Noted	Ref to response 10(8)		
10(11)	This sounds an enormous scope for an infrastructure / system based on so many different operators or providers. But agree - tackling only part of the chain would limit what you are able to achieve from the whole initiative.	2.2. Scope	content	Accept: no action	Agree that scope is large.		
10(12)	Interested to know how specific you can be in assigning accuracy eg whether this is a 'uniform expectation' whatever the range of levels/size of event being measured. For UK rivers this is particularly relevant for flow measurement (consistent accuracy is unrealistic in turbulent / out of bank conditions.)	3.1.2.2 interpretability Accuracy Page 6	content	Accept: no action	Agree that accuracy will vary with range. There is no expectation of uniform accuracy within the standard. The required performance in terms of accuracy is determined based on the accuracy requirements of the flood warning service. The achievable accuracy will be the accuracy obtained during flood conditions, e.g. at the highest threshold defined as a part of the service.		
10(13)	Is this feature about logging intervals only eg 15min, hourly etc? Interested to know whether BoM have any ambitions to see a subset of sites / critical sites etc with 'always on' data access eg to support more digital services to end users. Perhaps this is covered under availability...	3.1.2.2 Interpretability Sampling resolution (interval)	content	Noted	No the standard doesn't cover the trend towards 'always on' data access. It only covers having sufficient data available to meet the service needs.		
10(14)	Interested to know how this is specified and whether the standards will deal with user needs being potentially different at different times eg before or during a developing flood incident	3.1.2.3 Availability return to service	content	Accept: no action	Yes. Infrastructure is to be returned to service based on the level of failure and the impact of failure on the delivery of the flood warning service.		

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Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)		Scope (in/out)
10(15)	EA in UK would be keen to see the range of performance indicators that you have or intend to set out with your infrastructure operators	3.1.2.4 Assurability Performance indicators	content	Accept: no action	At this stage - • regular check signals from event (water level and rainfall) sensors and battery voltage sensors - alerting on inactivity • heartbeats from data collection systems - alerting on inactivity		
10(16)	Highlighted word : minimum Comment: EA experience was this proved a real challenge in many cases. ie we can't define the minimum requirement of a monitoring attribute (accuracy etc) that is needed to meet a certain standard of outcome (eg flood warning accuracy or quality). We felt it really suggests a need for R&D in this area e.g. to undertake some kind of sensitivity assessment and isolate the part played by monitoring/data in meeting a certain standard of outcome (such as flood warning quality) versus other contributing factors such as the weather forecast data, the model attributes and performance, human skill/interpretation and added value..probably lots more!	3.2 first para	content	Noted	It is agreed that generally speaking it is probably not possible to define the relationship between measurement accuracy and service accuracy. However for some specific situations (including those where accuracy is particularly important), such as the routing of flow using a hydrologic model, the accuracy of the flow data/rating tables at upstream and downstream sites can be the major source of uncertainty. If we assume that flow is the only significant source of uncertainty then you would expect that they should at least be less than the service uncertainty. In the standard because there are 2 rating table conversions assumed, each should be equal to 1/2 the service uncertainty. If the uncertainty in the flow (rating table) data is greater than that of the forecast data then the infrastructure is not capable of meeting this requirement. Because accuracy is often limited by the site conditions it may not be possible to improve flow accuracy. In such cases the forecast accuracy would need to be relaxed. If there are other significant sources of uncertainty such as in rainfall runoff/routing then flow uncertainty would need to be much less than forecast uncertainty. As it is uncertain what the value should be in this case and as mentioned it may not be possible to define without R&D) and because there is only 1 rating table conversion I have assumed 1/2 (the other 1/2 represents all the other sources of uncertainty). Even if the assumption is not acceptable around this requirement, the uncertainty in the flow must be less than the uncertainty in the service.		
10(17)	Highlighted word: maximum intensity specifications of the instrument Comment: As usual the instrument capability can often be the limiting factor in the upper measurement range. In specifying your performance requirement based on design intensities do you have a feel for whether these exceed instrument capabilities? - since these are pretty standard values based on the particular kit in use.	3.2.2.1 Range verification	content	Accept: no action	We have only looked at 1 case study at this point and it didn't exceed the capability of the instrument. The kit is usually a TBRG and across the county different bucket sizes are used to account for the max possible intensity.		
10(18)	Maximum intensity specification: Do you need to list the calibration/verification requirements for the gauges? e.g. verification of the calibration every x number of years within 5% of actual rainfall (via a dosing verification system).	3.2.2.1 Range verification	content	Accept: no action	Instrument manufacturer specifications should be sufficient for the Range verification. Calibration every x number of years would fit better against the maintenance requirement. However at this stage the maintenance requirement is set at a higher level and doesn't include this level of detail.		

Consultation Feedback Log and Response

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10(19)	Rainfall standards (ISO and CEN) are currently being produced and likely to require more stringent procedures for gauge calibration and field verification. TBR's most likely will need dynamic calibration to meet requirements.		3.2.2.1 Range verification	content	Accept: no action	Again this relates to maintenance but because it is only treated at height level we don't include this sort of detail.	
10(20)	Highlighted words: known and required levels and flows Comment: Does this imply a significant demand on users identifying these upper limits at all your various locations. EA in UK faced a similar scenario - specifying a certain upper standard like this (based on probability of recurrence/return period) - but consequently creating extra work for users to quantify these values at each measurement site (since information is not readily available). is this your experience too?		3.2.2.1 Level range	content	Accept: in part	Agree it will create extra work. The aim is to provide a range of means by which an upper limit can be identified including (AEP, recorded high water marks/period of obs, site cross section/floodplain topography, etc	
10(21)	Highlighted: The upper limit of the range shall be equal to or greater than the maximum known and required flood levels Comment: Would it be better to state the upper limit shall be greater than 1% AEP as per the example. Max known and required could be interpreted differently depending on site requirements.		3.2.2.1 Level range	presentation	Accept: in part	Agree that the wording needs to be made easier to understand. The maximum known is meant to cover the highest recorded level and the maximum required is meant to cover non-recorded expected levels such as AEP values. The upper limit needs to be the highest of the maximum known and maximum required. If there is no max known or required or the highest of the 2 is below the 1%AEP level then the minimum value that the upper limit can be is 1% AEP.	
10(22)	Highlighted word: true rainfall Comment: Would you agree there is a difficulty in determining this true rainfall or giving any kind of confidence to estimates (each measurement by whatever means is just another version of 'truth'). Confidence in capturing 'true' rainfall is perhaps best assured by having a rigorous standard and procedures for accrediting a gauge, maintaining, calibrating, making independent verification checks etc		3.2.2.2 Accuracy	content	Accept: in part	Agreed that real performance is strongly dependent on those factors mentioned. We are seeking to have a little bit on this within the introductory part of the Standard.	
10(23)	Highlighted : How reproducible the rainfall data are over time (stationarity) is assessed by the maintenance requirement, which includes calibration to a standard and maintenance of siting conditions (see Availability: Maintenance requirement). Comment: I guess this answers previous comment!		3.2.2.2 Accuracy Note	presentation	Accept: in part	This separation of context and note is confusing. Context and note to be combined.	
10(24)	Nice to see this section. Its one of the most important factors. In the UK we require registration of raingauges with periodic inspection (3 yearly) to ensure the gauges still meet the WMO CIMO criteria. I can share inspection forms if that is of interest.		3.2.2.2 Accuracy verification	content	Accept: no action	Inspection and maintenance forms that specifically refer to attributes are worthwhile collecting from various sources and include in a future work on guidelines on specific issues.	

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10(25)	Highlighted : associated uncertainty designation shall be available across the full design range Comment: Is this proposing a single value for uncertainty, irrespective of the range/size of flood?. (I may have misunderstood). In EA UK we had difficulty with the notion of expressing this uncertainty especially where conditions move from in-bank to out of bank flows as the magnitude of a flood increases.	Flow accuracy performance requirement	content	Noted	The intent in the comment is to convey the changes in uncertainties across the range. No we are not proposing a single value for uncertainty. It could be provided as a part of the rating table. Using the NIGL's, gaugings are assigned a quality code which map to uncertainties. The provider of the ratings could then provide at least estimates of uncertainties (perhaps into broad categories) for the different segments of the rating table. e.g. in-bank <5%, out of bank < 15%, above highest gauging >20%	
10(26)	Highlighted: For a rating curve Comment: Do you set any requirements for validating the rating curve/relationship and how do you verify that ratings are suitably checked and maintained.	Flow accuracy verification	content	Accept: no action	It is realised that rating is a key source of uncertainty and a specific guidelines (future work) is expected to be on the rating curves. These are set/defined in the NIGL's which are another non mandatory set of guidelines. The standard refers to these guidelines.	
10(27)	Highlighted : Gaugings, rating tables, and extensions shall be established and maintained in accordance with the National Industry Guidelines for hydrometric monitoring. Comment: Answers previous comment	Flow accuracy verification notes	content	Accept: in part	The linkages to NIGL om rating curves will explicit in such guidelines We will be more explicit in our references to the NIGL's e.g. to specific section within NIGL.	
10(28)	(similar to an earlier comment or observation) Coping with a need for a wide range of sampling intervals for whatever parameter (rain, levels..etc) according to local circumstances seems to place quite a demand on (who?) the users (or providers?) to do the assessments necessary to identify what is most appropriate for each measuring location. I can see that a range of sampling interval is needed though!	3.2.2.3 Sampling resolution	application	Accept: no action	This is part of the PR for each site. Worthwhile mentioning that flood events vary and TOC TTP also vary for a catchment depending on the rainfall pattern. Yes we acknowledge that there will be quite a bit of work to gather all the necessary input data (site characterisation data). Initial thoughts are that this would be done by the users (hydrologists) in order to set/determine minimum allowable/acceptable performance levels. The providers (hydrographers) would then design/select/determine the solution in terms of instruments/config/infrastructure that would meet the performance level.	

Consultation Feedback Log and Response

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10(29)	There are a high number of sample options listed here. Do you really need sample intervals less than 15minutes? The EA have pretty much standardized on 15minute interval for all river gauges with the exception of a few rapid response sites where faster sampling is required. Storage costs and power required have improved significantly in recent years and I don't believe there is a benefit in sampling less. Sticking to few options also makes data archiving (and any future migration to other systems) simpler.	3.2.2.3 verification table rain	content	Accept: in part	The need to satisfy flash flood warnings is there?	Yes we need to include sample intervals of less than 15 min because the scope of this standard covers both riverine and rapid response. If the standard is to remain performance based with respect to this requirement then yes we do need at least a range of sample options. However the sample options only represent the minimum allowable/acceptable performance. It is in the verification part of the standard that the actual solution is designed/selected/determined. For example a 15 min sample interval will likely satisfy the performance requirement for all riverine (not rapid) response sites. We will better explain how the standard works in the next version.	
10(30)	As mentioned previously you could simplify this table to only 3 options. <5mins, 5mins and 15mins.	3.2.2.3 verification table level and flow	content	Noted	We still have manually read gauges which may meet PR for very large basins.	
10(31)	Highlighted : Context - capability of the sensor Comment Isn't this fairly standard eg 0.2mm - or is your experience that providers are using a range of equipment/sensors with a range of capabilities? Comment 2: different outputs depending on gauge type. EA standardized on 0.2mm but depends on sensitivity and range you are trying to measure.	3.2.2.4 Data resolution	content	Accept: no action	The other staffer seems to answer what has been noted. The Bureau is still using 0.5mm and 1mm buckets.	
10(32)	would it be of value to know type of sensor/kit in use? (Comment could apply to other data types) Comment2: Agreed. Helpful when looking at hysteresis. Especially with rainfall data.	3.2.2.5 rain metadata	content	Accept: in part	Need to understand what is meant by hysteresis of rainfall data? (follow up) Yes but we have made a distinction in the standard between metadata (to interpret measurements) and contextual information (to support data verification and fault identification and diagnosis). This is regarded as contextual information.	

Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
10(33)	Have you considered setting a user requirement type standard for this. Certain sites/priorities might drive different choices over what technology to employ - to meet the highest reliability / resilience requirements where needed. Eg you are proposing a % reliability for networks	DT- site reliability	content	Noted	Add a third consideration - depending on user design requirement I think the technology choices would be governed largely by the cost to achieve the minimum recognised standard. From the point of view of the standard it doesn't matter which technology is chosen as long as it meets the min recognised standard for that technology. The minimum recognised standard is the equivalent or an approximate to the probability (of successful operation) and the % reliability is - % reliability = Probability (operate) * Probability (withstand) where operate refers to design/workmanship/function and withstand refers to being able to withstand the environment in which it is located. e.g. radio telemetry: Operate = say 99.5% (fade margin 15db min standard, comms standard, good workmanship) withstand = 90% {environment - lightening: unlikely = rare (<1%), unlikely (<10%), likely (>10%) (likelihood of risk)} reliability = 99.5% * 90% = 89.5%	
10(34)	Highlighted: equal to or greater than 99.95% Comment: Interested in how you settled on this and how it would be applied. Over a rolling timeframe? of what period? eg this is less than 1 day downtime in a year	network reliability	content	Accept: in full	Standard values we have come across. Worth adding acceptable down time in addition of percentage availability I accept that a single % is a poor measure of reliability when what is required really is a bias toward the infrastructure being highly available during flood events and much less so at other times (during benign conditions). So the availability should be referenced to flood events (including the lead up) and specifically how much data can be tolerably lost. The length of a flood event could be defined using the catchment response (re: sampling time) and the amount of data tolerably lost could be related to the % of data that could be lost in a rising limb (e.g. 1 data point in rising limb = 1/8- P(failure) = 0.125 and P(success) = say 87%. I believe typical % values are in the range of 99.5% which may be ok to use here for non flood event times over say a 1 year period. We could also include with that requirement reliability of 87% during flood events (period related to catchment response).	

	Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)		Scope (in/out)
10(35)	Highlighted: provided network availability is equal to or greater tan 99.9% comment: Similarly did you consider setting a performance requirement around reliability of data transfer from a site. Perhaps this would have a greater dependency on the efficacy of maintenance regimes than the network reliability.	3.2.3.2 maintenance	content	Accept: no action	3.2.3.1 Reliability / DT-site reliability captures this. DT is Data transfer (from site) No but we could. Refer 10(34)		
10(36)	Highlighted: access difficulty Comment: Presume this could include local conditions at time of fault. eg during flood incident, may be inaccessible or unsafe to investigate and fix.	3.2.3.3 Return to service	content	Accept: in full	Yes. As this is related to Return to Service this is reasonably implied but will add "including extra difficulties during and immediately after flooding" to be explicit.		
10(37)	was this intentionally blank?	3.2.3.5 metadata latency example	example	Accept: no action	Refer to 6(1) Yes. As the metadata and contextual information requirements are quite straight forward and only include a list of elements there seems to be no added value in having examples other than completeness.		
11(1)	I welcome the principle of adopting a performance based standard – this should allow flexibility in terms of equipment selection where standard solutions are not fit for purpose.	General comment	style	Accept	Very positive		
11(2)	There has been quite a bit of change recently in BOM's preferred tower/footing design – I can't see reference to how these designs will be chosen for individual locations. How will this be managed?		style	Accept: no action	Technical guidelines for specific detailed tasks are outside the scope of the Standards, but worth keeping in mind and progressing.		out
11(3)	Has consideration in regards to equipment technology choice based on longevity (wet transducer vs. bubbler units) been made – in my experience the difference in operational lifespan is considerable, not to mention the reduced cost of repairs (loss of transducer vs loss of capillary line). The issue being end clients may not realise the ramifications of choosing a cheaper sensor alternative.		content	Accept: in part	Life cycle costing and asset management will take care of that need. The Standard will request good asset management practices.		
11(4)	One suggestion could be to have sensor manufacturers apply for a 'BOM approved' certification – ensuring a list of approved products is available (a bit like the European 'CE' or Australian 'Tick' symbols)…		application	Noted	Bureau could support translation of detailed equipment specifications into performance information. Not have certification responsibility. Possible options for the future are to develop criteria for type approvals and/or, examples of acceptable solutions however this is out of scope for the current project.		out
11(5)	Battery level should be included as part of the data sensing row in the functional requirements matrix.		content	Noted	This to be incorporated into maintenance. Battery level is treated under support systems - power and the reporting of current value under performance indicators.		
11(6)	I have some questions around how this standard will be adopted and applied: Will this standard be used to apply for new funding by gauge owners? Will it be part of the station/sensor ID application process?		application	Accept: in full	Clarification required: Yes, guidance to be prepared		in
11(7)	While most of this information would normally be captured by gauge owners (council for example), capturing all of it seems quite exhaustive – will the onus be on the gauge owner to capture this information? There is a lack of clarity on who is to supply this detail (e.g. a contractor writing a tender or quotation would be hard pressed to define a design based off this standard without significant overhead)		audience	Accept: no action	Roles and responsibilities and governance are will be included at a high level in the next version of the standard		out

Consultation Feedback Log and Response

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Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
11(8)	Will stations falling short of this standard be accepted by BOM for display on their website? This could affect old sites and in particular non-ALERT stations (3G/4G/satellite telemetered sites).		application	Accept: no action	While accepting for operational needs, there could be clear indication of that site not fully meeting performance requirements. There is a plan to indicate failed sites and how soon they will come back online. A similar approach could be taken for performance gaps.	out
11(9)	This standard will vastly change the maintenance outcomes for gauges if a large variety of equipment is used throughout the Australia wide gauge network (will the Bureau continue to provide any maintenance?)		application	Accept: no action	The impact on maintenance and upgrade is yet to be worked out. The Bureau has no capacity to provide maintenance.	
11(10)	Has any thought been given to expanding the standard to predictive technologies (forecasting)		application	Noted	There are already other standards related to prediction in terms of errors, methods, etc.	out
11(11)	Where does ALERT 2 fit into this standard?		style	Accept: no action	It is a new technology - the Performance Standards are technology agnostic.	out
12(1)	Document is long and difficult to read through and apply to sites. Feeling that some of the wording can be shortened or changed to make it easier to read. Requirements become complicated when they link back to other requirements. Overall it is very time consuming to apply this standard to a site.	General comment	presentation	Accept: in full	Check for dependent requirements. Guidelines on application would satisfy some of the needs mentioned. Agree. The plan going forward is to • simplify the language and align where possible to NIGL/WIID terminology • provide guidance on how to use the standard • list required input data and develop workflow • re format to align with useability guidance In addition there is a further piece of work to develop tools/documents to aid/simplify the application of the standard.	
12(2)	(CONTEXT) ''Notes'' section deviates from the topic – introduces 'flow' and 'rating tables', this can lead to confusion. Suggest be concise and leave out non-essential related information.	3.2.1.1 (Latency of reporting)	presentation	Accept: in full	Worthwhile to state which data is covered by this and which is not clearly. The notes could be covered under what is not covered. This will make a connection to this attribute better and avoid confusion.	
12(3)	Suggest do not use the word 'Datum' as this can be confused with site/ level datums. Choose another word such as measurement or data point etc.	3.2.1.1 (Latency of reporting) Functional requirement	presentation	Accept: in full	Datum for data is not a common use. We distinguish between a measurement and data so shall replace datum with data point.	

	Comment		Reference		Response		
Comment No.	Detail of comment received		ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
12(4)	Prefer a statement like 'Each data point (or measurement) should be available to the data user in a timeframe that is appropriate for the flood warning use/service'		3.2.1.1 (Latency of reporting) Functional requirement	content	Accept: in part	The suggested statement sounds more functional. However, what is appropriate time frame for flood warning use/service becomes a question and may not be answered by the performance requirement directly? Also the way it is currently worded - are we prepared to wait up to a day just because it is slow moving river and we only need daily data? There are 2 issues here. 1 is around the language and meaning and the other is around the linking of latency to sampling time. There is a strong link to sample time but as suggested here it could be much shorter than being equal to sample time e.g. some fraction of sample time. The reason it was set to be so wide was to accommodate polling where the full timeseries is collected (not collecting just the current value). In timeseries polling the latency of the most recent data might be in order of minutes but the oldest data would as old as the polling interval. If we reduce the window to 1/4 or even 1/10 times sample time then polling (collecting of timeseries data) will not meet the standard. Some FTP data may also not meet the standard. In addition we could employ latency and reporting criteria for response categories here e.g. as suggested in comment 10(30) for sampling; very rapid, rapid, riverine, slow riverine The suggested statement is ok provided we add, 'the time frame appropriate for flood warning use is equal to . . . . (see above)'	
12(5)	More guidance is required to link the instrument specification to verification of the requirements		3.2.1.1 (Latency of reporting) Performance requirement	application	Accept: in full	Is this a general need? If the Functional and Performance requirements are clear, wouldn't the technical person be able to make the link? Agree. The approach to verification was not consistently applied but will be rectified in the next version of the standard. The verification method should clearly enable instrument specifications to be related to performance levels.	
12(6)	The instrument specifications are not the source of the limitation for this example. The server back end is generally the limiting factor.		3.2.1.1 (Latency of reporting) Performance requirement	application	Accept: in full	One question: is "instrument specification" the right word to use for communication method? Agree. This requirement lumps all the sources of latency into one as it would be difficult to assess the latency associated with each component. The back end will be the largest source of uncertainty in some cases especially FTP, polled telemetry. In terms of verification need to not just require instrument specs but also agency turn around times for ex FTP, polled telemetry and proprietary systems.	
12(7)	(Example) 3rd dot point – 'upper limit new site = 5.5m'; Does not seems to make sense given information above it.		3.2.2.1 (Range) Level Range	example	Accept: in part	With highest record = 7.1m, how did we get 5.5m using AS 3778.2.1-2001? Example section is not clear. Each dot point was a separate example. Will rectify in next version of standard.	

	Comment		Reference			Response	
Comment No.	Detail of comment received		ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
12(8)	Are the service level requirements the Bureau SLS or??		3.2.2.1 (Range) Level Range	presentation	Accept: in part	should we say performance requirements instead of service level requirements? Yes. The Service Level Specifications (SLS) contain the forecast accuracy and lead time requirements. The Bureau owns the doc but it is agreed by all members of the FWCC. These requirements are an input to the standard and will be better explained in the next version.	
12(9)	Tiered approach to freeboard doesn't make sense as the level range is determined by the measuring equipment used and site characteristics such as channel capacity and topography of the landscape outside of the main channel. The site characteristics wouldn't be expected to change significantly after 10 years (yes erosion could occur but that is essentially a random process). Is the proposal that after 10 years, it would be appropriate to change equipment? Why after 10 years? Given that flood forecasting is mostly concerned with unlikely and rare events, there is no reason to assume that after 10 years sufficient high flows have occurred to be able to confidently reduce the freeboard and consequently the range.		3.2.2.1 (Range) Level Range	content	Accept: in part	This is to reflect the fact that with time the site get settled in and we are aware of the site behaviour to become more confident (in general). True that we may not have experienced a high enough flow to know how the site handles high flows. More explanation required. Freeboard is applied as a factor of safety only in a similar way as it is applied in the ADR Handbook 7: Managing the floodplain. Where there is a long data record there is more certainty around the upper limit (highest known flood levels, AEP) and so a lower factor of safety is required. Uncertainty is much higher for short data records so a higher factor of safety is needed. 10 years was an attempt to distinguish between short and long data records/histories. Perhaps a better value would be 20 or more years. No there is no need to change equipment after 10 years. This needs to be better explained in the next version.	
12(10)	Extreme caution should be using applying "the highest flood threshold" if this is intended to refer to the "major flood level" using the Bureau definition as there is insufficient metadata recorded about how these nominated water levels were derived. E.g. Gawler River at Gawler West the major flood level is less than 5% AEP level		3.2.2.1 (Range) Level Range	content	Accept: in part	The flood classifications are based on impact or consequences and we do not expect clear relationships between them and return periods (likelihood). It may be useful to use consistent terminology and keep using flood classifications rather than thresholds as appropriate. A part of this requirement is to relate the upper limit to significant levels as a kind of due diligence. e.g. the upper limit should be at least above 1 %AEP which likely would be above all significant levels such as flood thresholds or classifications. If there is a recorded high water mark that is well above the 1% level then the upper limit should be above the high water mark.	
12(11)	Opportunity to have tiers e.g. Tier 1 – 0.2% AEP flood level ; Tier two – range of known events only		3.2.2.1 (Range) Level Range	content	Noted	The flood warning service is focused on impact rather than likelihood or frequency of flooding. Further, "tier" concept has been superseded by "fit-for-purpose" concepts to have the required flexibility.	

Consultation Feedback Log and Response

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Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
12(12)	Disagree with level and flow being lumped. In many cases, the level range may be fit-for-purpose but the flow range may not be particularly if it is not measured at the site but derived from physical gaugings. Disaggregation of these criteria would also better consideration of the factors affecting the flow range	3.2.2.1 (Range) Level Range	content	Noted	It is not fully lumped as such. The accuracy of rating curve determines if a site is used for flow estimates or not. The lumping of flow and level does have some drawbacks. Perhaps if we identify where they need to be applied differently and spell out those areas, it would make it easier to accept. For example, we have separated level and flow for accuracy for good reasons. Agree that there would be differences between the 2 sites but think that they would be best reflected in the flow accuracy requirement.	
12(13)	Appropriate freeboard varies with the location of the site in a catchment e.g. for sites on the floodplain with small channel capacity 1 m freeboard above the 1% AEP is excessive	3.2.2.1 (Range) Level Range	content	Accept: no action	Freeboard to be determined on a case by case basis	
12(14)	(Verification) (Example 2) 4th Dot point : U (Water Level) = U (Datum + Sensor) = +- 20.3mm this should be 23mm	3.2.2.2 (Accuracy) Level Accuracy	example	Accept: in part	The calculation for combining uncertainties is from ISO 4373:2008(E) which uses a square law so that U (water level) = square root {(U datum)^2 + (U sensor)^2} but its not very clear so the formula and where it comes from should be presented	
12(15)	Service level requirement not specified?	3.2.2.2 (Accuracy) Level Accuracy	content	Accept: in full	A small section on what is meant by design and service level requirements as part of the introductory sections would be useful. There appears to be confusion between SLS and Service level requirement. May be use the explanation that it is the requirement against a specific site as provided in the SLS. Agree. What is meant by these terms will be included as part of introduction but it will also be listed as a data input along with alternatives if unavailable in a data input table.	
12(16)	What if there is no downstream site with a flood threshold?	3.2.2.2 (Accuracy) Level Accuracy	application	Accept: in full	Need to spell out how we deal with sites without a design or service level requirement identified. Agree. Need minimum standard where no thresholds exist. Should use NIGL for datum and use nominal uncertainty from ISO 4373:2008(E) for U (water level) e.g. < +/- 1% range (class 3).	
12(17)	(Context) 3rd dot point on page: Rainfall runoff assumptions. Suggest reword this statement, using the word uncertainty 3 times in a short space is hard to read. The uncertainty in the forecasting tool is equal to the uncertainty in the flow uncertainty.	3.2.2.2 (Accuracy) Flow Accuracy	presentation	Accept: in full	Reword this section making it clear what is meant by prediction uncertainty and mention the contribution of flow uncertainty to prediction uncertainty. Review the use of the term "notes" under the Context area.	

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Comment No.	Detail of comment received		ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
12(18)	Flow uncertainty should be linked to quality coding of the rating segments. There is significant risk in assuming a 10 % uncertainty particularly at the high flow end of the scale. It is common standard practice for straight line extrapolation above the highest gauging for a site. Although this is an acceptable standard, It often leads to overestimation of a rating as it does not account for backwater affects and a reduction in slope in high flows. This is particularly relevant for riverine catchments that are slower to respond and have a limited slope (e.g. lower Bremer/Angas/Torrens/Tatiara). There is also inherent risk in determining uncertainty in a new rating (i.e. newly constructed flood monitoring site) that is purely theoretical and has not been validated by flow gaugings.		3.2.2.2 (Accuracy) Flow Accuracy	content	Accept: in full	Does the use of rating table require a specific guideline or is the NIGL adequately cover? Noting the high flow problem for flood warning, there could be some merit in either having a specific guideline for high flows or use the review opportunity to add more material on the NIGL. Agree. it should be linked to the quality coding of the rating segment. There should be no assumption of 10%. This is a clarity issue with the explanation in the standard. We will address this in the next version. A synthetic rating is ok as long as it has corresponding uncertainty estimates. The important thing is that the uncertainty in the forecast is informed by the uncertainty in the rating. e.g. if there is no uncertainty with the rating then there can be no performance targets around forecast accuracy.	
12(19)	RE design requirement: It is common that in high flows the water level will often exceed the rated structure and spill over the primary channel. There are numerous examples of this, which in turn has consequences on flow uncertainty. Eg. modelled flow of 20 cumecs = 2.496m, quality code (uncertainty/disclaimer) = 101 Poor theoretical .		3.2.2.2 (Accuracy) Flow Accuracy	content	Accept: no action	Coupled with comment above - 12(19) Ideally we could assign an uncertainty to the codes e.g. +/- 20% (which is referred to in NIGL as equivalent of ungauged.	
12(20)	To rectify uncertainties in high flows and routing water level it is recommended to resource high flow/flood gaugings for the flood monitoring network sites (service level agreement?). Sites that have been adopted in the flood monitoring network, will often have other primary functions (e.g. resource monitoring, low flow catchment monitoring). This means that high flow gauging are often not resourced or prioritized by the organisation that is operating the site.		3.2.2.2 (Accuracy) Flow Accuracy	application	Accept: no action	Are there other governance/roles and responsibilities matter that need addressing either as issue or companion documents? The funding of high flow gaugings/rating extensions etc is a significant issue. Although funding issues are out of scope here the standard is highlighting the link between forecast and flow accuracy. The issue should hopefully be considered as a part of flood warning site establishment and upgrades.	out
12(21)	Is a rainfall gauge in a catchment with a 16 hour response is a sampling interval of 60 minutes really best-practice? Opportunity here to develop tiered criteria e.g. Tier 1: event based sampling with measurement triggers e.g. 0.2 mm rainfall OR regular polling on the following intervals – catchments with TTP < 6 hours = 10 minutes; TTP < 24 hours 15 minutes; TTP < 7 days = 60 minutes; TTP > 28 days = 24 hours Tier 2: Regular sampling based on current table (p25)		3.2.2.3 (Sampling Resolution) Rain - Sampling	style	Noted	The information, instead of using the tier concept could be introduced as fit-for-purpose considerations. The development of the Standard has moved away from the use of "tiers" very early for several reasons. I think the suggestion here is that the current table be replaced with event based sampling using a 0.2mm bucket (the current industry standard). The references to polling I think are really referring to reporting. Given we currently measure with a resolution of 0.2mm having a standard set at such large bulk values seems to be a step backwards. However the requirement is based on the user needs or how the data is used. Its worth noting that the current table only represents the minimum performance levels and that at the verification stage a 0.2mm TBRG would conform to all of the performance levels listed.	

Consultation Feedback Log and Response

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Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
12(22)	PR is not quite right as valuable information for flood warning can be supplied before the hydrograph is resolved i.e. the hydrograph might exceed the moderate flood level so the minor flood level would be on the rising limb of the hydrograph. Suggest "the maximum sampling interval shall be sufficient to support adequate flood warning time for that catchment"	3.2.2.3 (Sampling Resolution) Level - Sampling	presentation	Accept: in full	I think the comment is referring to the sampling interval being too large or coarse so that important events are not resolved or are resolved too late. Agree this is possible and consideration should be given to the need to resolve fine detail when determining sample interval. We will revise the PR to incorporate this detail.	
12(23)	Would precision be a better term than resolution?	3.2.2.4 Data resolution (Level Resolution)	presentation	Noted	They have well defined different meanings. The use is coming from a data user perspective	Out
12(24)	The 'flood threshold' = design or service level requirement?	3.2.2.4 Data resolution (Level Resolution)	presentation	Accept: in full	Need to have consistent use of design, service requirement, threshold, etc.	
12(25)	WHAT IS THE RESOLUTION OF THE FLOOD THRESHOLD???? This is not referring to the target peak accuracy in the Bureau SLS is it? Where would this information typically come from?	3.2.2.4 Data resolution (Level Resolution)	presentation	Accept: in full	Need to explain this better. We do need to resolve the peak sufficiently well.	
12(26)	RE verification – what if there is no downstream site	3.2.2.4 Data resolution (Level Resolution)	application	Accept: in full	This question has come up before. Talking about the highest flow in the nearest downstream site is meant to provide a conservative estimate. Should suggest estimating a conservative estimate of high flows if there are not design flow, etc and no downstream site to consider. Refer to response to 12(16).	
12(27)	Is it intended that we do 1 then 2 – they don't seem like steps	3.2.2.4 Data resolution (Level Resolution)	presentation	Accept: in full	Should be clear about what input data are gathered first and what calculations are required to be done.	
12(28)	Some guidance on an acceptable range for numerical resolution of the water level would be appreciated	3.2.2.4 Data resolution (Level Resolution)	content	Accept: in full	Some guidance under verification could be provided	
12(29)	Last 5 elements on this list refer to reservoirs – this should be made explicit	3.2.2.5 Metadata (level – meta data)	presentation	Accept: in full	Others have also commented on this list being mix of various metadata requirements	
12(30)	It is unclear what is intended by some of these terms e.g. measurement status, difference between stream gauging ID and measuring point ID (which one is the site?), stream gauging parameters, data type (this is in reference only to level does it refer to water level in lakes vs estuarine vs river channel?)	3.2.2.5 Metadata (level – meta data)	presentation	Accept: in part	Flood metadata is a separate guideline - using NIGL material Kema prepared. Will probably refer to explanatory notes for flood warning metadata under the regulation when they are finished.	

Consultation Feedback Log and Response

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13(1)	The Standard is supported in principle by MHL. This document provides a systematic approach i.e. consideration of context, functional requirement, performance requirement and verification method for the development of a flood warning system. However, the way the document is currently written the functional and performance requirements are dictated by the user (and site requirements) rather than the document defining the required standards. In our understanding, on this basis it would better be defined as a guideline rather than a standard.	General comment	style	Accept: in part	It is non-mandatory standard. It is a standard because assessment against it will be made. Guidelines don't require assessment against. Needs further clarification Although not clear in the current version the intent is that the standard be used to 1. set performance levels against each requirement 2. provide means to verify equipment specs/tech solutions against the performance levels	
13(2)	Given that the objective is to provide robust and sustainable flood warning infrastructure for the future, MHL is concerned that: ▢ The audience reading the document would not have enough background knowledge to make selections from the examples provided. ▢ There may be limitations on the ability for users to actually apply this document to their projects given it is non-specific. In general the examples in each section go further in specifics than the preceding information guide. ▢ Multiple items are already covered in the BoM hydrometric guidelines and the Australian Standards ▢ Unclear relationship with the BoM hydrometric guidelines. Where the project will require changes to data collection / supply not currently subject to OEH/MHL network maintenance arrangements, or SLS/BoM supply arrangements, these will require OEH/MHL scoping. Any scoping study will include relevant capital, development and operational costings.	General comment	style	Accept: in full	Detailed guidance is planned for applying for existing infrastructure, how to translate this into specification for new equipment. We will make the linkages to NIGL. We will talk to MHL about the current network maintenance arrangements and look for linkages and potential to draw from that.	
13(3)	The degree of terminology in the document is high. Where cross-referencing exists between related attributes, suggest add section number and/or page number references. This would assist the reader with similar and overlapping terms.	Cross-referencing between attributes in the document, in particular Section 3	presentation	Accept: in full	Detailed explanations of new terms used will be provided. Cross reference will be make clear and detailed.	
13(4)	'Examples' in report: Many examples would benefit from the 'workings' being shown more explicitly with clear logic/calculation shown. A number are unclear in interpretability/ or read as a series of information dot points without clear working or conclusion.	Global – 'Examples' in report	example	Accept: in full	Examples will be dealt better and as steps rather than dot points.	
13(5)	Suggest label all tables and figures numerically (Table 1, Figure 6 etc). Suggest reference in text of Standard.	Global – Table and Figure headings	presentation	Accept: in full	Formatting will be improved	

Consultation Feedback Log and Response

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Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)		Scope (in/out)
13(6)	This word 'Mandatory' appears to contradict the foreword (p iii) which says the document presents a non- mandatory performance requirement. Suggest choose a more flexible word (eg "Shall = indicates industry best practice") Also, Suggest to reorder 'may', 'shall', 'should', order to 'may', 'should', 'shall' to reflect the implied hierarchy.	s2.5 Definitions pp4.	presentation	Accept: in full	This section is being expanded to clarify this.		
13(7)	Suggest consider using a multi-colour scheme, instead of grey -on-grey shading, and grey text. It was very difficult to read and interpret with some meaning lost. Re: "unique functional requirement" and "lumped functional requirement". The dependencies between the components is implied but not explicit. Is there a way to offer assistance to the reader in the comments or the table design? Comments on hydrometric monitoring standards noted that "station" should be used when referring to monitoring equipment.	S3.1, Table, pp. 8 (matrix)	presentation	Accept: in full	The table to be improved in format.		
13(8)	'Functional requirement' refers to 'datum'. Is 'datum' the intent here? The 'Performance requirement' only appears to refer to rainfall. Water level should be specifically referred to. The latency criteria appears problematic (for example in NSW Coastal Zone catchments with relatively faster TOC). (Eg ~6 hr TOC = need for 15min sampling interval (as per separate Table pp.25)). The latency criteria would then require 15 minute communications. However, the current BoM / OEH / MHL agreement in NSW for NSW Coastal Zone requires 1 hr communications latency for Priority 1 WL stations.	S3.2.1.1 Latency	content	Accept: in part	Datum can be confused with AHD reference. Data point to be used.		
13(9)	'Performance requirement' – suggest insert words "that can be sampled" after "The maximum rainfall intensity" to clarify the intent.	S3.2.2.1 Range - rain	presentation	Accept: in full	Will introduce more plain English terms for clarity		
13(10)	'Performance requirement' – suggest insert words after "The upper limit of the …. required flood flows": Insert: "It is noted that, given maximum upper limits are typically derived from design (eg 1%) (rather than observed) flood levels, that regularly reviewing the availability of new design flood information is a key requirement for operational networks. The availability of current, updated design flood information is a key constraint in network design and operation."	S3.2.2.1 Range - level	presentation	Accept: in full	Good suggestion.		
13(11)	Verification' – Freeboard is not presently used in citing MHL/OEH stations defined as BoM Priority 1 in the NSW Coastal Zone.	S3.2.2.1 Range - level	content	Accept: no action	Freeboard is used here as a general allowance for uncertainty. Item to be discussed with TAG?		
13(12)	Please provide reference for the freeboard guideline sizes. These should align where possible with State based Flood Planning Guidelines for example, the NSW Flood Prone Land Policy.	S3.2.2.1 Range - level	content	Accept: in full	Worthwhile to bring in similar policy guidelines that could help better define requirements Ref used was ADR Handbook 7: Managing the floodplain		
13(13)	'Example' As per the description, a statement if freeboard is excluded in included should be added.	S3.2.2.1 Range - level	example	Accept: in full	Will add statement.		
13(14)	Examples The examples could not be clearly understood with working omitted.	S3.2.2.2 Accuracy – level	example	Accept: in full	All examples to be shown as working calculations		

Consultation Feedback Log and Response

	Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)		Scope (in/out)
13(15)	Rather than try and abbreviate AS 3778, the user should just go directly to the AS document.	S3.2.2.2 Accuracy – flow	presentation	Accept: in full	Use of hyperlinks would help		
13(16)	'Performance requirement' The sentence is confusing and difficult to interpret. Suggest to reword. Should this be lower than? Examples What is the meaning of the 4.1m? There should by "±" inserted before 6%	S3.2.2.4 data resolution – rain pp29	presentation	Accept: in full	Will re word and correct errors.		
13(17)	Sampling interval of 15 min totals seems too course, wouldn't at least 6 minute or instantaneous would be better if IFD analysis is to be undertaken. The example is unclear with working omitted.	S3.2.2.4 data resolution – rain pp29	content	Accept: in full	Review sample interval determination methodology provide better explanation of example		
13(18)	Examples The example is unclear with working omitted.	S3.2.2.4 data resolution – level pp31	example	accept: in full	Examples are being expanded		
13(19)	"Context Suggest replace text 'without degradation' to "continue to operate for a prescribed period". All infrastructure will be subject to some degradation during its design life. Suggest add words "It is noted that a significant number of infrastructure components exist in the system and total reliability is a function of all components when operating as a system".	S3.2.3.1 reliability	presentation	Accept: in full	Change to be included		
13(20)	Performance requirement "Not acceptable" square – suggest choose another word here?	S3.2.3.1 reliability	presentation	Accept: in full	Possible alternatives, "Review location" or "Review/relocate"		
13(21)	Example 3 Ten years is unlikely to be feasible –suggest modify to 3-5 years. In our experience landowner access agreements, even with the NSW Crown to host stations on crown land are <5 years with regular renewal. With landowners these are subject to annual automatic renewal with 12 months notice prior to notice of vacating, or similar.	S3.2.4.1 assurability compliance	content	Accept: in full	Suggest remove the specific period and just say an "agreed defined period"		
13(22)	Example 4 The Telstra NextG network is a critical service in many stations. However, Service level agreements may be negotiated by entire NSW Clusters or Head of Departments. They are unlikely to name dependent infrastructure by hydrometric gauge owners or set performance % (eg noted that the numbers 99.9% and 99.95% are stated in preceding pages).	S3.2.4.1 assurability compliance	content	Accept: in part	Move such a detailed discussion to a governance type guidance document. The example looks valid though?		

Consultation Feedback Log and Response

Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
	Comment	**Reference**			**Response**	
13(23)	Suggest to include a definition for uncertainty: An estimate of all contributing errors within a measurement, combined in a statement. Or An indication of how wrong a measurement may be. Source: Bentley R.E. 2005, Uncertainty in measurement: the ISO guide. Australian Government National Measurement Institute. It might also be worthwhile, to define in the glossary "validation", "verification" and "calibration", which are used throughout the guidelines and can mean different things in water measurement. Could refer to International vocabulary of metrology – Basic and general concepts and associated terms (VIM).	Glossary	presentation	Accept: in full	Good suggestion about the sources to use.	
14(1)	High level comment: The standard is quite a complex read – it takes a few readings to get across the first sections and how it is meant to be applied. There may be a simpler way to present it – I did not find the matrix to be particularly intuitive and it didn't help me contextualise the remainder of the standard or how to apply it.	General comment	presentation	Accept: in full	Will aim to improve language, format, include section on applying the standard and section on dependent data in next version.	
14(2)	The standard frequently refers to design or service level requirements/agreements. This needs further discussion and explanation. It seems that these service level requirements are an important component of the standard, as they constitute quite a few of the functional or performance requirements. Who sets these and defines appropriate requirements therein? Are they coordinated, and by whom? Are they essentially a next level above the standard, where more stringent specific requirements are defined? The standard needs to explain explicitly where they fit in and how they interact with the standard. Needs a narrative around the FWIS requirements, design requirements and service level requirements.	General comment	presentation	Accept: in full	Consider making this explanation as part of the "Work Flow"	
14(3)	The first column in the tables in section 3.2 doesn't work for me – you lose real estate in the table, and it is not repeated when tables continue over more than one page which diminishes the value of having it. Also, the abbreviation of element names in this first column should be avoided – adds unnecessary complexity	General comment	presentation	Accept: in full	Reformatting planned	
14(4)	Term usage and definitions: I strongly suggest maintaining consistency between the FWIS and National Industry Guidelines for hydrometric monitoring (included in AWID). In the current update of the guidelines we are expanding the glossary – Kema or I can share with you for reference. For example, we will include definitions for validation, verification and calibration – there should be consistent usage of these terms, since the audience will cross over to a large extent.	General comment	presentation	Accept: in full	Glossary to be a consolidated effort	

Consultation Feedback Log and Response

Comment		Reference			Response		Scope (in/out)
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)		
14(5)	One thought: Consider stating up front the range of data that users will need to gather before embarking on an assessment of a flood warning site. Some guidance on how to gather the elements will help – with examples for new sites vs established sites. Data needed includes design rainfall, catchment area, time to peak, measurement uncertainties, instrument specification information, service level thresholds?? etc…. If you set these out up front it would then allow the hydrographer to plug in the numbers to determine whether the various meet the performance requirements. Or maybe another way to do this is to have case study 'worked examples' in a separate part of the document. You may then be able to simplify the body of the standard by removing the examples and putting them together elsewhere??	General comment	example	Accept: in full	Work Flow and Input data being developed Possibility of replacing examples with case study to be determined.		
14(6)	I'm distracted by the use of cm as a unit in examples. My practice has always been to use either metres or mm only.	General comment	presentation	Accept: in full	SI units to be used. cm not common. We also one instance of dm.		
14(7)	For some elements there is quite a lot of repetition between the context, the functional requirement, the performance requirement and the verification. I appreciate there is a difference between these, but it can be subtle in some cases – one example is 'support reliability'.	General comment	presentation	Accept: in part	Thinking of having a common context where applicable. FR and PR need to be repeated for completeness as some users may only want to look at one. It is a reference document. Re formatting may help with this.		
14(8)	need to reference the whole series, not just the glossary (part 0). Note that we intend to publish revised versions early in 2019 - would be good if you can reference the updated names.	2.4 References	presentation	Accept: in full	Will aim to provide specific references to sections within NIGL's		
14(9)	Data ingestion: Not sure that this term is widely used or understood in the hydrological community, in relation to data (even though we use it in the Bureau)	3.1.1 Components	presentation	Accept: in part	Clarify why this term has been picked? Raise with TAG		
14(10)	lumped v unique - not clear what this means at first reading (or second, third!). It doesn't appear to be relevant in the rest of the standard - can it be left out?	Matrix	presentation	Accept: in full	Needs explanation. This is a way of avoiding duplication as suggested before.		
14(11)	(with reference to the use of the word "datum") do you mean measurement value?	3.2.1 Functional requirement	presentation	Accept; in full	Data point is suggested by others as well		
14(12)	Words highlighted: data transfer medium, nodes, presentation, medium These terms need explanation - include here, or add them to the glossary. Do you mean form or format when referring to presentation or medium?	3.2.1.2 Interoperability	presentation	Accept; in full	To be included in Glossary		
14(13)	Highlighted the words: or derived from the received data file or message. Comment: agree with including this allowance, as the information about data transfer will generally be self evident...	3.2.1.3 Data transfer metadata	presentation	Accept: in part	Should the term "enable measurements to be ingested" be more specific "measurement to be ingested and interpreted"?		
14(14)	Highlighted word: data decoding Would benefit from more explanation. The examples just say yes or no for data decoding, but what does this mean?	3.2.1.3	example	Accept: in full	data decoding examples could be added to explain what is expected to be covered under that		
14(15)	Highlighted word: design rainfall Who sets this design, and on what basis?	3.2.2.1 rain-range	presentation	Accept: in full	This is part of the site design. It will be the flood forecasting model developer. The location of the site and its priority and its contribution to the forecasting will be the criteria		

Consultation Feedback Log and Response

Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
14(16)	Highlighted: 2016 edition of Australian Rainfall and Runoff also refer to the Bureau's IFD web pages, http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016	3.2.2.1	presentation	Accept: in full	The Bureau references to IFD to be included	
14(17)	use larger font for this image	3.2.2.1 range, figure	presentation	Accept: in full	This figure may require redrafting	
14(18)	Highlighted: design level or flow Needs more explanation as to how this is set - a risk based approach. 1% may raise cost above what is feasible/reasonable	3.2.2.1 verification	application	Accept: in full	There is a section planned on input data that could include discussion on design criteria	
14(19)	Highlighted: design or service requirement Again, this is prominent in setting the requirement - see general comment on the role of service level requirements and relationship to the standard	3.2.2.2 Accuracy	application	Accept: in full	As above comment and response	
14(20)	Highlighted word: better lower than (i.e. lower uncertainty)	3.2.2. 2 Accuracy	presentation	Accept: in full	lower is better than better	
14(21)	Highlighted the words: Set of NIGL sections..Non-conformance shall be documented... These sections of the national industry guidelines are largely recommendations (that is, 'should' statements) rather than mandatory requirements (that is 'shall' statements). For example, the guidelines include allowances for other orifice heights, so what constitutes a 'yes' for this factor in the table above??	3.2.2.2 Accuracy	presentation	Accept: in full	Instead of using the word "compliance", if the term "meets the recommended practice guidelines" is used, it would be more acceptable	
14(22)	Don't use good, fair, bad. Use the categories you have set in the table - low, medium, high...	3.2.2.2 Accuracy	presentation	Accept: in full	Agree	
14(23)	performance requirement The highlighted words: The water level uncertainty shall be equal to or less that the design or service level requirement Comments: Essentially saying this is set elsewhere..	3.2.2.2 level accuracy	application	Accept: in full	what is meant by design level will be explained as part of input data collected	
14(24)	use "lower" than " better"	3.2.2.2 level accuracy, verification	presentation	Accept: in full	agree	
14(25)	Highlighted words: if not explicitly stated Comment: where? by whom?	3.2.2.2 level accuracy, verification	application	Accept: in full	If design considerations are explained first, readers will relate to references to service level requirements	
14(26)	NIGL doesn't include a method for determining uncertainty	3.2.2.2 level accuracy, verification	presentation	Accept: in full	This reference to be removed	

Consultation Feedback Log and Response

		Comment	Reference		Response		
Comment No.	Detail of comment received		ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
14(27)	use "lower" than " better" (second occurrence)		3.2.2.2 level accuracy, verification	presentation	Accept: in full	agree	
14(28)	what about conformance? where is that documented?		3.2.2.2 level accuracy, verification	application	Accept: in full	Perhaps need clarity on the role of metadata here under assurability. Use meeting guidelines instead of conformance Need to be consistent with ref to compliance/conformance/meeting etc. This comment highlights the question of where conformance/non conformance info will reside. We have it in the contextual information but it could reside elsewhere (assessment info for all sites in database available to data user) if available to data user	
14(29)	what is a design threshold here? Is it the maximum level recording, or flood classifications? Define in glossary, or better still explain here in direct terms.		3.2.2.2 level accuracy, verification example 1	application	Accept: in full	As above to be explained as part of workflow/data inputs	
14(30)	I'd use either metres or mm		3.2.2.2 level accuracy, verification example 2	presentation	Accept: in full	Remove reference to dm	
14(31)	23 mm if direct sum and not 20.3mm		3.2.2.2 level accuracy, verification example 2	presentation	Accept: in full	Not direct sum but square root of squared terms. Working to be included and ref to method.	
14(32)	Highlighted word: (NIGHM) give a specific reference (e.g. part, section) - note that we are revising these at the moment - updated versions to be published early 2019		3.2.2.2 level accuracy, verification example 3	presentation	Accept: in full	Improved reference to NIGL in the introduction	
14(33)	highlighted word: forecasting tool not defined or explained - likely to be interpreted differently by different people.		3.2.2.2 flow accuracy	presentation	Accept: in full	Item for Glossary and introduction on how the data could be used?	
14(34)	Highlighted words: The uncertainty in the flow data shall be sufficiently small to enable water level prediction with uncertainties that satisfy the design or service level requirement. Comment: again, referring to requirements set elsewhere		3.2.2.2 flow accuracy functional requirements	application	Accept: in full	Better introduction about input (design) considerations	
14(35)	Highlighted words: Ascertain that site has been established and is maintained in accordance with the National Industry Guidelines for hydrometric monitoring. Comment: Very broad requirement!		3.2.2.2 flow accuracy verification	presentation	Accept: in part	Better terms to use could be "Find evidence" or "Compile evidence" instead of "ascertain" We have used this broad requirement widely through the document. What we would like to know is has vendor/provider adopted NIGL's into SOPs. If this is the case it is also assumed that the vendor/provider has trained staff with the skills and knowledge to use and understand the NIGL's. So the response to this requirement is Yes/No.	

	Comment		Reference		Response		
Comment No.	**Detail of comment received**	**ref1 (Section /Attribute)**	**Themes**	**Type (Accept: in full, in part or no action/Noted)**	**Detail (work needed)**		**Scope (in/out)**
14(36)	Highlighted: DT (for Data Transfer) Don't abbreviate - adds unnecessary complexity.	3.2.2.2 DT-site-accuracy	presentation	Accept: in full	Check for other confusing abbreviations		
14(37)	Risk of misinterpreting (of missing)	3.2.2.2 DT-site-accuracy	presentation	Accept: in full	add "of"		
14(38)	Highlighted words: primary measured data FYI, in the national industry guidelines we've defined this as "Data recorded on-site, or observed or collected first hand. Also known as raw, unedited or original data."	3.2.2.2 DT-site-accuracy	presentation	Accept: in full	Better cross referencing to NIGL is planned. My understanding is that this definition includes metadata. If so then I disagree with the descriptor 'raw' being also included. To me this data is better described as real as it is in real engineering units.		
14(39)	Words highlighted: Data can be translated to SI units on receipt provided the translation set metadata are maintained and updated in only one location. Comment: This is unclear to me - do you want to re-word this as a requirement: The data translation metadata shall be maintained and updated in only one location.	3.2.2.2 DT-site-accuracy	presentation	Accept: in full	The importance of having a single point of truth to be described		
14(40)	words highlighted: upstream of the location Did you mean"upstream of the nearest location"? Need to define this better as there could be many answers for a rain gauge at the top of a catchment	3.2.2.3 Sampling resolution	presentation	Accept: in full	Agree. Need to clarify		
14(41)	Sampling interval (max) and not min?	3.2.2.3 Sampling resolution verification table last column	presentation	Accept: in full	It was meant to be minutes. But should also indicate that they are max allowed or acceptable values		
14(42)	Highlighted words: at least four times the number of characteristics Comment: are there minimum two characteristics between base flow and peak (initial rise and point of inflection) or are you counting base flow and peak as well, making it four characteristics? Or are there other characteristics (like maybe bank overflow point)? Could you say # data points to be taken between base flow and peak shall be at least 16 (or 8 if that's what you mean) or four times the number of characteristic to be detected (whichever is greater).	3.2.2.3 level and flow sampling performance requirement	presentation	Accept: in full	Improved Figure to explain? Total of 4 characteristics including base flow and peak. There are as many characteristic as you can or want to identify but need 2 data points per char. then we add factor of safety to make it 4 points per char. Suggestion sounds ok.		
14(43)	Highlighted item: The maximum allowable sampling interval shall be equal to or less than: two options/approaches given here, depending on whether regular or event monitoring. However, the examples only look at the first one. Add an example of working out the minimum change for event sampling.	3.2.2.3 level and flow sampling performance requirement	example	Accept: in full	Examples are being expanded and restructured (in general)		

Consultation Feedback Log and Response

	Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)		Scope (in/out)
14(44)	Highlighted word: peak Comment: what peak height are we using here? (minor flood level??) - need to specify, otherwise impossible to derive a distance that we need to divide by the # of measurements	3.2.2.3 level and flow sampling performance requirement	presentation	Accept: in full	The primary motivation is provide sufficient sampling resolution to get the trace correctly. Choose the hydrograph that has the maximum rate of rise from base flow to peak. If all hydrographs have the same rate of rise then choose the one with the lowest significant rise that needs to be observed.		
14(45)	Comment about the maximum allowable sampling interval: the table below is the same as the rain sampling interval table - but not clear to me the relationship between the sampling intervals given and the performance requirement detail on the previous page. Dividing the times to peak by 16 gives similar but different sampling intervals. Do you expect people to use the table or apply the perf requirement concepts? Needs some explanation I think... Also, there is no example on applying this to event monitoring (max change)	3.2.2.3 performance requirement verification	content	Accept: in full	The table is a guide only and not prescriptive		
14(46)	Highlighted item: The numerical rainfall resolution is a measure of the detail in which rainfall measurements are expressed, and is governed by the capability of the sensor. Comment: might as well talk about it with reference to tipping bucket rain gauges, since commonly used? i.e., in the case of a TBRG it is the equivalent rainfall per bucket tip.	3.2.2.4 Data resolution Context	presentation	Accept: in part	Would say, for example, in the case of TBRG		
14(47)	Highlighted word: greater than should be less than, the way this is written? i.e. numerical resolution of 0.2 mm is OK provided it is less than the calculated uncertainty of measurement for the design rainfall 1.68 mm in the example	3.2.2.4 Data resolution Performance requirement	presentation	Accept: in full	Introduce the word "small" in the functional requirement Functional requirement: The numerical resolution shall be sufficiently small to enable expression of the smallest change in the rainfall data that can be known with certainty. It is to ensure there is no confusion as "greater" resolution often implies smaller value of resolution. With this addition, can use "lower than"		
14(48)	Highlighted "greater than" comment: lower than?	3.2.2.4 Data resolution Verification	presentation	Accept: in full	Same as above		
14(49)	service level threshold 4.1m why is it given here, whats relevance?	3.2.2.4 Data resolution Example	presentation	Accept: in full	Agreed that the service requirements should be on level not rainfall		
14(50)	complete this example by concluding that the instrument resolution is sufficient (step 3 of the verification process)	3.2.2.4 Data resolution Example	example	Accept: in full	Examples to be expanded to include working and show whether they meet the standard or not.		
14(51)	a tricky distinction between what's necessary to interpret measurements and what's used to verify data. What's the value in separating metadata and contextual information? I'd put them together.	3.2.2.5 Metadata	content	Noted	Purpose and contribution to attributes different? There is advantage in treating them separately		

Consultation Feedback Log and Response

	Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
14(52)	Site metadata used: site metadata or infrastructure metadata - be consistent in how you refer to it.	3.2.2.5 Metadata	presentation	Accept: in full	Should be infrastructure.	
14(53)	Only site name and site ID given: need more than these to interpret measurements. e.g. what about units, data/time, data type (to enable correct interpretation, interpolation etc), quality/status. Arguably you also need zero gauge, cease to flow, rating info and others to correctly interpret the measurement.	3.2.2.5 Metadata Performance Requirement	presentation	Accept: in full	Infrastructure metadata is about the site only, the other metadata are required for corresponding measurements? This is only to enable identification of the site correctly? More explanation required?	
14(54)	metadata elements given - time series ID, data type, data decoding these may need another look, to align with the Category 11 metadata requirements (Kema). Elevation also important for rain	3.2.2.5 Metadata rain metadata Performance requirement	content	Accept: in full	Will align with Cat 11 metadata requirements	
14(55)	Example not given ?	3.2.2.5 Metadata rain metadata example	example	Noted	Metadata requirements consist only of a list of metadata elements. With the restructuring of the Examples section, this will be revisited.	
14(56)	"or derived from the received data file or message" this is an addition not included in the infrastructure metadata or rainfall metadata element - any reason only included here?	3.2.2.5 Metadata level metadata	content	Noted	It is included in all. We do have these for others as well? Further clarification to be sought	
14(57)	The Exposure Levels given : these are all referring to levels of atmospheric exposure - whereas the levels presumably apply to the terrestrial and human types too. Also, note that all of these levels will be experienced over time at a given location, so which do you choose??	3.2.3.1 Reliability	content	Accept: in full	One options is to remove these from the exposure level column and have under the atmospheric column. Need to have similar descriptors for terrestrial and human exposure types. Terrestrial: Severe: flood inundation Extreme: fast flows dislodging Human: Severe: bullet holes Extreme: excavation cutting lines The intent of the requirement is to define a minimum level of reliability by prescribing levels of treatment to be applied to the different levels of exposure. A serious issue as highlighted in the comment is that all of these exposure severities could be experienced at a site which leads to the conclusion that all of the treatments should be applied at all sites. The necessary and lacking information in the table is likelihood. Another issue is that reliability should be broken into 2 parts: 'of operation' and 'to withstand' (see 10(33) and 10(34)) and the table really focuses on only the withstand part. An alternative approach would be to adopt the common risk methodology. To do this we could remove the table and list the exposures and state that the risk of each exposure be assessed and require that all risks greater than a given likelihood such as unlikely be treated.	

Consultation Feedback Log and Response

Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
14(58)	state what these cells represent. If they are exposure 'requirements', what do they mean in practice? What does redundant mean in this context?	3.2.3.1 Exposure Matrix	content	Accept: in full	Could we use the term "withstanding capability" instead of "exposure requirements" Is it "Prepare Alternate siting" rather than "Redundant" as regular redundancy is meant to cover other situations such as communication loss and not meant to cover damage from exposure. The cells provide a representation of the treatments to be applied for a given exposure level to achieve a minimum standard of reliability. It doesn't really make sense to apply a treatment to reduce a severity. It should be to reduce a risk. See response to comment (14(57)). In this context redundancy represents the highest level of treatment. It means to have duplicate components or functions. It is to be applied as a means of increasing reliability where the exposure risks cant be removed or the operate reliability cant be achieved.	
14(59)	"minimum recognised standard or guideline defined": are these defined for each technology? E.g., what is the minimum standard reliability for 3G? Refer to where these can be found.	3.2.3.1 DT-Site reliability	content	Accept: in part	Need to decide how far we go in providing supporting material Also some wording improvement could help when we use words such as "that data transfer technology"?	
14(60)	Highlighted item: Reliability: poor (voice prioritised over data during emergency events) is that to say that the minimum recognised standard for 3G is that data should be available regardless of voice traffic?	3.2.3.1 DT-Site reliability	content	Accept: no action	This is stating that 3G may not be suitable and the next comment states that alternate data transfer method may be required.	
14(61)	Functional requirement uses the words "capable of reliably" and Performance requirement uses "highly reliable" Comment: vague distinction between functional and performance requirement (not sufficiently distinct?)	3.2.3.1 Ingest-reliability	content	Accept: in full	Functional Requirement: The data-user agency systems shall be capable of reliably receiving, ingesting, storing and displaying data. Performance Requirement: The data-user agency data receipt, ingest, storage and display systems shall be capable of meeting expected reliability requirements	
14(62)	site or infrastructure maintenance? Use consistent term.	3.2.3.2 Maintenance Context	presentation	Accept: in full	Need to explain the differences. Site and infrastructure are key separate components. Matrix defines site as a component and infrastructure as a sub component. There is a conflict in that the standard defines the instruments and infrastructure at a site as infrastructure but within a site there is a distinction between instruments and infrastructure.	
14(63)	a fairly meaningless statement - it could be sustained at an unsatisfactory level of performance.	3.2.3.2 Functional requirement	presentation	Accept: in full	Wording needs improvement	

	Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)		Scope (in/out)
14(64)	The use of the word "catastrophic" sounds a bit dramatic!	3.2.3.3 Service response matrix	presentation	Accept: in full	Others have used the following categories: Minor defect, Major defect, Faulty, Unusable instead of failure levels. Will revise terminology. Could simply use minor, moderate and major.		
14(65)	Alternative required: adopt plan b comment: needs more explanation as to what the standard is requiring here	3.2.3.3 Service response matrix	content	Accept: in full	An alternate method should be available when required. If a medium impact gets 'top priority' then a high impact should at least get the same. Needs review.		
14(66)	Highlighted item: availability of funding when required Comment: will be a difficult factor to assure, given the long horizon of asset replacement programs vs funding generally negotiated in FY cycles	3.2.3.4 Asset replacement	presentation	Accept: in full	Replace the dot point: availability of funding when required with: documented mechanism for asset replacement funding		
14(67)	It will be problematic making these specific performance requirements - the water regulations requires data providers to give metadata with the data. It also has a caveat that organisations aren't required to give information that they believe is already in the Bureau's possession. On this basis, we could talk about high and low frequency provision of metadata in the context of flood. High frequency comes with each data point. Low frequency is given once and again when changed. We've used the following words in the draft explanatory notes for category 11 metadata:	3.2.3.5 Context Performance requirement	content	Accept: in full	Will be included		
14(68)	High frequency of provision Some metadata and contextual information should be provided (or be available to the Bureau) in real-time along with each flood data point, to ensure correct identification and interpretation of the data value. These are typically elements which can change from one data point to the next (such as measurement date and time) or are used to link the data point with other contextual information (such as measuring point ID).	3.2.3.5 Context Performance requirement	content	Accept: in full	Will be included		
14(69)	Low frequency of provision Other items of metadata and contextual information can be given once initially, and then again only when changes occur. These elements are less subject to change, and provide detail about aspects of the monitoring site or measurement procedure. They can include essential information about how to interpret the data, such as rating tables and cease-to-flow values.	3.2.3.5 Context Performance requirement	content	Accept: in full	Will be included		
14(70)	compliance management system: this is very broad. Unless more explicitly defined it will be difficult to assess whether organisations meet this criteria or not.	3.2.4.1 Compliance Functional requirement	content	Accept: in full	This is related to the comment in a TAG meeting about "deployment" considerations. Perhaps start using "documented against accepted industry practice" or something similar		
14(71)	please refer to my comment on 3.2.2.5 metadata	3.2.4.2 Contextual information	presentation	Accept: in full			

Consultation Feedback Log and Response

	Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)		Scope (in/out)
14(72)	please note that all these terms and definitions should be reviewed to align with existing AWID definitions. We don't want to be creating new definitions for the same concept already defined. AWID includes the glossary used in the National Industry Guidelines for Hydrometric Monitoring.

Please liaise with Kema on this. | 4 Glossary | presentation | Accept: in full | Fully agree | | |
15(1)	One key point that was raised during discussions was the lack of an clear explanation for the table headings in the pre-amble i.e. Context, Functional Requirement, Performance Requirement and Verification. I realise it has been defined in the Glossary but a 'How to' is probably worthwhile in the pre-amble.	General comment	application	Accept: in full	A 'how to' section will be added to the standard		
15(2)	Overall a very difficult document to read and understand	General comment	application	Accept: in full	We will add sections to explain how the performance methodology works and how to apply the standard including a workflow. In addition we will replace complex presentation with plain English and adopt more of the NIGL terminology.		
15(3)	Explains in the forward about the Standard being non-mandatory industry recommended performance requirements. (However) Sections of the text are written as if it was mandatory.	General comment	presentation	Accept: in full	ref response to comment 1		
15(4)	"fit for purpose" – why not use appropriate infrastructure for or designed infrastructure in accordance with the requirements for flood-warning.	1. Introduction	presentation	Accept: in part	longer version suggested - Does fit for purpose imply variable performance levels?

Agree that we should add a qualifier - 'to meet flood warning requirements' | | |
15(5)	Footnotes should be used to explain terms used for example "Anticompetitive policy"	1. Introduction	presentation	Accept: in full	Agree		
15(6)	In the introduction the key words used should be better explained like functional and performance requirements to prepare the reader to think about the language used in document.	1. Introduction	presentation	Accept: in full	Agree		
15(7)	"….storing rainfall and river level and flow data (add) that meets the monitoring ….."	2.1 Purpose	presentation	Accept: in full	Agree		
15(8)	These are confusing because the standards are industry recommendations and not mandatory	2.5 Definitions	presentation	Accept: in full	We are thinking of a work around with more explanations		
15(9)	In the first paragraph an example of this objective may be useful. A suitable installation will need to produce a high level of reliable and repeatable data for communities at high risk	3 Performance standards	presentation	Accept: in part	We have refrained from introducing infrastructure benefits/management goals into the Standards. Is there a place for fit-for-purpose, goals, etc to be discussed in the introduction?

A simple statement would be ok leaving out the communities at high risk part of it. | | |
| 15(10) | The second paragraph relates to Figure ?
The figure's attributes are better shown in bold text and the empty cells in the matrix greyed. | 3.1 Performance matrix | presentation | Accept: in full | we'll try that | | |
| 15(11) | ……suggest Infrastructure components | 3.1.1 Components | presentation | Accept: in part | That is probably ok but keep in mind that the term Infrastructure is also used as a sub component of Site to distinguish from instruments. Ref to response 14(62). | | |

Consultation Feedback Log and Response

	Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)		Scope (in/out)
15(12)	.. suggest Infrastructure attributes Each attribute group should include a brief description such as . Collectability - timeliness of collection Interpretability - data definition Reliability - perhaps the point should be availability which includes reliability Assuability - confidence in the data collected	3.1.2 Attributes	presentation	Accept: in full	Yes, we need a better introduction to attributes at the start		
15(13)	Shouldn't the term 'measures' be defined? Not sure about the use of the term 'environmental conditions' •Reporting and latency………what cant the language be reporting and the time take to receive the information	3.1.2.1 Collectability	presentation	Accept: in part	We were attempting to use the same language/terminology as is used by World Meteorological Org. That way we don't have to define a new term. Its already done for us. Will consider using plain English as there has been numerous comment to this effect. Yes environmental conditions could be deleted here.		
15(14)	'Interpretability measures' ………Interpretability defines how adequately the data……..'environmental conditions'………?	3.1.2.2	presentation	Accept: in full	Replacing with the terms "current status" may not work here. Something more like . . . the environmental parameters being measured.		
15(15)	'A measure of the percentage of time the infrastructure' ……..defines?' these attributes capture….' Defines? Don't understand the subsections (b) and (c) The description is not clear in explaining the differences in timeline, reliability and availability	3.1.2.3 Availability	presentation	Accept: in full	Agree with changing measure and capture to define. Clearer explanation required around reliability, availability, uptime and downtime.		
15(16)	'Assurability measures………..' shouldn't it be defines? The attribute compliance………what does this mean? Is it about instrument set up, operation checking procedures and processes? Figure is titled but not referenced in text? What's a lumped requirement??	3.1.2.4 Assurability	content	Accept: in full	Agree with changing measures to defines. Need to define compliance and within the requirement we need to be specific/less vague about what has to be complied with. perhaps just refer to legal consent, manufacturers manuals, requirements, specs), licences and approvals, industry best practice (adopting NIGL's into SOP's), competency		
15(17)	Context - Isn't this simply the time taken to report the information and made available to the user? Functional requirement Datum? Is the correct term? Performance requirement Terms are so confusing Reporting time to be less or equal to the allowable sampling interval. It the sampling time is to be hourly then the reporting time is to be less than or equal to the hour?	3.2.1.1 Latency of reporting	presentation	Accept: in full	Yes replace latency with plain English Datum can become data point Ref response 12(4) re evaluating reporting time and latency.		
15(18)	Context – Ingest operability? Isn't it simply the systems' ability to exchange data between sites, data provider and user.	3.2.1.2 Interoperability	presentation	Accept: no action	Agree but don't think it sounds much different.		

Comment		Reference		Response		
Comment No.	**Detail of comment received**	**ref1 (Section /Attribute)**	**Themes**	**Type (Accept: in full, in part or no action/Noted)**	**Detail (work needed)**	**Scope (in/out)**
15(19)	Functional requirement The term 'known' should be defined in the sentence under functional requirement. The term known is identified on the staff gauge diagram, however not in the sentence. Is known related to a statistical figure of level or flow such as 1% AEP or is it about the range of threshold levels and flows at the gauge in relation to threat to public and private infrastructure.	3.2.2.1 Range level range	presentation	Accept: in part	Should we use "specific" rather than "known"? The intent is to ensure that the upper limit is above the highest of • the highest recorded water level including ungauged high water marks • any required levels such as determined though a flood study • 1% AEP Needs better explanation. Known refers to the highest level/flow that has been experienced as the site	
15(20)	Shouldn't dot point 3 under context read 'how representative is the recorder (measured) level to the river cross section and measured flow.' Design or service level requirement is not defined and how it is related to the accuracy level in context and functional requirement.	3.2.2.2 Accuracy level accuracy	presentation	Accept: in part	Is there anything from the NIGL that could be useful here? There are some research reports covering aspects of flow accuracy as related to section properties, etc? Needs re wording.	
15(21)	Context 'Flow accuracy (uncertainty in the flow data) refers to how closely the flow data represent the true values. It depends on….' Suggest to change…….Accurate flow measurement depends on: Sites hydraulics and channel conditions including flow rating definition and flow sensitivity to a change in streamflow head. Infrastructure; and Monitoring program.	Flow accuracy	presentation	Accept: in part	Looks sensible to change to suggested wording Adds detail and complexity that i would rather see in the NIGL's. However could add it as its Not sure what flow rating definition is but it sounds like its related to the gauging/rating methodology	
16(1)	Email received with letter signed by CEO: on 3/09/18Hydro Tasmania submits that the 'Standard' should be renamed as a 'Guideline'. Renaming the 'Standard' as a 'Guideline' would avoid any confusion regarding possible future compliance obligations and would be consistent with the collaborative approach adopted with the development and roll-out of the ten National Industry Guidelines for hydrometric monitoring.	General comments	presentation	Noted	However: Communication required on the use of Standard as against Guidance. Communication required on compliance issues Communication required on responsibilities of owners	
16(2)	Email received with letter signed by CEO: Many of the performance requirements potentially exceed Hydro Tasmania's existing operational requirements and/or it is unclear how we would be able to implement them as they are linked to the data users requirements (so could change without notice). It is unclear who would be responsible for any additional costs associated with either additional capital works to upgrade a site or additional operations and maintenance costs that may be incurred to meet the Standard (Guideline). We submit that any additional costs should be met by the beneficiaries.	General comments	application	Noted	Communication required on the use of Standard as against Guidance. Communication required on compliance issues Communication required on responsibilities of owners	out

Consultation Feedback Log and Response

Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
16(3)	Email received with letter signed by CEO: Determining compliance requirements with the draft performance requirements will be difficult as many of the documents verification guidelines are both difficult to assess against and/or impractical to comply with. Many of the functional, performance, or verification requirements assume hydrological analysis has been undertaken at these sites which may not be the case. Additionally, there does not appear to have been any consideration of practical instrument limitation because of the local site conditions. A number of examples are provided in Attachment A.	General comments	content	Accept: in part	Communication required on the use of Standard as against Guidance. Communication required on compliance issues Communication required on responsibilities of owners One of the aims of the standard is to ensure that there is no mismatch between infrastructure capability and the level of the flood warning service agreed to be provided. Where the site conditions limit achievement of the standard this info should inform the flood warning service so it can be set at a level that can be achieved.	
16(4)	Email received with letter signed by CEO: There was a proposal during the development of the Standard (Guidelines) that a tiered structure be introduced with different infrastructure requirements for different classes of flood warning sites. We submit that this proposal be reinvestigated as it is unlikely that many existing monitoring sites would meet the proposed Standard (Guideline) without significant costs being incurred.	General comments	application	Noted	However: Improved communication on fit-for-purpose concepts Communication required on the use of Standard as against Guidance. Communication required on compliance issues Communication required on responsibilities of owners	
16(5)	Email received with letter signed by CEO: In addition to the above comments and examples we have a range of other concerns about the draft Standard (Guideline). Should you wish to discuss these please contact Ray Clark in the first instance.	General comments	application	Accept: in full	Communication required on the use of Standard as against Guidance. Communication required on compliance issues Communication required on responsibilities of owners	
16(6)	Hydro Tasmania has not completed an assessment to determine if the upper range of our monitoring sites is equal to or greater than the 1% AEP design level or flow (plus freeboard) as this is not required for our operations. This would be a significant task to complete across all the sites we operate.	Page 14 - Level - Range	application	Accept: no action	This could be an important requirement to check given the recent failures of sites at key times during flooding.	
16(7)	The design or service level requirements are determined by factors independent of and outside the control of the entity that operates the monitoring site. These may change without notice. It is unreasonable to expect a site operator to potentially have to upgrade their site to meet a requirement set by others.	Page 20 - Flow accuracy	application	Accept: no action	If the performance requirements are beyond what is expected for its intended use (such as positioning a site beyond the maximum flood height), then it is reasonable for the beneficiaries to pay for the difference.	out

Consultation Feedback Log and Response

Comment		Reference		Response		
Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
16(8)	Where Hydro Tasmania is aware that data is incorrect (eg. it is flat lining) we classify it internally as bad data and do not forward it to other data users. This means we do not provide the Bureau with information that is false or misleading in a material manner (Water Act 2007 sect 126(5)).	Data transfer - site accuracy Page 22	content	Noted	Is that true for real time data also? What is the best way to convey to the data recipient if there is something like flat lining happening? The fact that the data is being received but it is incorrect is often a useful piece of information.	
16(9)	Hydro Tasmania has standard internal operating practices for its sites based on our operational requirements. Adoption of the proposed performance and/or verification requirements would mean moving away from our existing standard operating model.	Rain sampling page 24	application	Accept: no action	Good point f how to reconcile with existing "standards" if there are any. Potentially the FWIS could remain fairly high level and the agency SOPs or other instructions could be the detail. Especially if the standards in place are for other applications e.g. low flow water monitoring.	out
16(10)	It is not clear how this would be determined, or if the standard was not met, what the options to meet it may be	Network reliability page 40	application	Accept: no action	(In general) How to address gaps when performance requirements are not met could be in the set of guidelines to be developed?	out
16(11)	It is unclear what the definition of availability is, or how it would be measured. We are aware that different organisations have different definitions and hence use different measures of availability. A 99.9% requirement exceeds our existing operational target network availability.	Infrastructure maintenance	content	Accept: in full	Is there a need to consider factors such as return to service, priority of sites (used in SLS), etc? Ref to comments 10(33) and 10(34)	
17	Thanks for the opportunity to provide feedback on the draft Flood Warning Infrastructure Standard. On behalf of Ian Gordon (our FWCC member) who is currently on leave, I'd like to advise that we have no specific feedback on the draft Standard. Generally, it may prove too high-level and difficult to implement by local bodies managing flood warning infrastructure, without development of supporting work practices. I note this was a common theme during working group discussions. Email: 23/08/18	General comment	application	Accept: in full	Supporting guidelines are being developed	

Consultation Feedback Log and Response

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Comment No.	Detail of comment received	ref1 (Section /Attribute)	Themes	Type (Accept: in full, in part or no action/Noted)	Detail (work needed)	Scope (in/out)
18	I've just had an extremely cursory look at the Flood Warning Infrastructure Standard of 1 June 2018, and suspect that two major issues with the accuracy of data used for flood warning purposes might not have been covered? (I confess I might have quickly passed over something though, as the Standard is far too long in my opinion!) I suggest that your standard should prominently mention the following two error sources: 1. Drawdown of logged sensor heights during large floods 2. Raingauges significantly under-register in strong winds (e.g. in tropical cyclones) Some details provided including a paper by David Curtis, US on effect of wind on under reading of rain gauge Email 2/10/18	General comment	content	Noted	However: Detailed descriptions of potential sources of errors or causes that reduce accuracy are not part of the Standard. These comments are to be referred to NIGL who deal with such issues. However:	out