

Q&A Report: Climate Change updates to ARR Guidelines			
#	Question	Answer	Answer Name
1	am inquiring whether there would be award of certificates after the webinar	You will receive a Certificate of Participation along with the recording and resources from today's event within the next 2 business days.	Anushree Mistry AWS support
2	Given the current PMP estimates were derived in the 90s, how can the new guidance be used to derive the PMF?	The guidance includes information on "uplift factors" that should be used to adjust the PMP estimates to both current and future climate conditions	Rory Nathan
		Thanks. Does this mean the old estimation procedures are still valid, and the factors are to applied to uplift from 1990 to now; and then from now into the future?	
		Yes, the "old" procedures are still current with WMO recommendations, but the estimates need to be adjusted to higher current (and future) global temperatures. (noting that GTSM (log duration tropical) and GSDM (short duration Aus-wide) were updated ten or more years later than the GSAM estimates which were provided in early 1990s.	Rory Nathan
3	Could you please include some advice on selecting SSP and reference year based on significance of the developments?	We would suggest selecting 2 SSPs for analysis - SSP2-4.5 and SSP3-7.0. Depending on your risk appetite, you'd use these two scenarios to inform your design or decisions. As Conrad mentioned, you could design adaptatively so that you build to account for the likely rainfall associated with the smaller climate change scenario, but allow for the design to be upgraded should this be surpassed.	Leanne Haupt
		Some mission critical infrastructure and facilities may consider higher SSPs. However, the design and construction should be undertaken to accommodate changes in the future based on the trends and observations.	
4	A couple of weeks ago at an FMA meeting Mark Babister suggested that instead of selecting an SSP and reference year an alternative would be to use "x" degrees of warming as a methodology for incorporating climate change. What is the rest of the panel's view on this approach?	The guidance suggests using SSPs because they are typically used in scientific literature (e.g. by the International Panel on Climate Change. Global warming levels tend to be used in the policy space, and are used in the National Climate Risk Assessment. The National Environmental Science Program has produced an explainer that shows how SSPs compare to Global Warming levels (https://nesp2climate.com.au/wp-content/uploads/2024/01/Understanding-SSPs-1.pdf). Either can be used.	Leanne Haupt
5	Just an admin question - will we be able to share the recording? I have colleagues who wanted to attend but couldn't make the webinar and I'd love to share the recording with them	Yes the recording will be posted on the Australian Water School YouTube Channel within 48 hours: https://www.youtube.com/c/AustralianWaterSchool	Joel Voortman AWS
6	Many local governments will have flood studies which pre-date this new guidance (and aren't likely to be refreshed for another 5-10 years). What would the panel recommend for these instances, so decision makers are not basing decisions on out-dated assumptions about future flood behaviour?	live answered	Monique Retallick
7	when are the draft guidelines be officially published?	live answered	Monique Retallick
8	Is it debatable whether climate change is the primary cause of increased flood risk in urban areas where increased imperviousness and connected drainage systems could be the most significant impact?	No, its not debatable: increased flood risk in urban areas will be due to increased rainfall intensities (where role of impervious surfaces means that there is little or no offset from drier soils)	Rory Nathan
		Surely they are additive impacts Patrick, and whether one is greater than the other will presumably be dependent on the site/location?	
9	Losses would be dependent on interevent duration (and also dry spells) and how it changes from baseline conditions to future scenarios. Could guidance be provided on this?	The influence of changes in inter-event duration and dry spells is implicitly accounted for in the way the loss factors were derived - see Ho et al (2023) J of Hydrol paper cited in the guidelines	Rory Nathan

10	Baseline data-does that mean if the IFD baseline is 1961-1990, THEN the same should be applied to the baseline for sea level rise (in case we have say, a coastal boundary condition for tuflow)?	One needs to look carefully at what baseline any published projections use and what the centre point of the data is that is currently being used in the design. You would apply any additional change relative to the data you have used previously, in case of IFDs 1961-1990 is a reasonable approximation.	Conrad Wasko
11	Given that the 2016 IFD was created with data between 1961-1990, should IFDs be factored up to account for warming that occurred between 1990 and 2024? Would this mean there is a new IFD value for 2024? to account for the warming that has occurred post-1990?	Yes that is correct.	Monique Retallick
		Thank you, though how would one estimate that new 2024 IFD? The Climate Change tool does not allow you factor ARR16 IFDs (1961-1990) to 2024, instead it only allows factoring from 2021 and beyond, up to 2100.	
12	Adopting these guidelines is going to make all kinds of new infrastructure very expensive. What happens if you're wrong about the link between future temperature and rainfall? Or if the temperature projections themselves do not come to pass?	There is unequivocal evidence in support of these projected impacts - both in the historical record and in modelling studies. See the paper by Wasko et al (2023) published in HESS (cited in the guidelines) for some of the published evidence for this.	Rory Nathan
		One could equally ask what if you ignore the process?? If you are 'wrong', then infrastructure may be bigger than required and people and places may not flood in the future for larger events than would be the case otherwise.....	
		Some mission critical infrastructure and facilities may consider higher SSPs. The design and construction elements should be undertaken to accommodate the changes in the future based on the trends and observations (and the pathway for evolving the climate change conditions).	
13	I missed the climate. science@???? email Conrad mentioned. can i pleas eget that again.	Contact email: climate.science@dceew.gov.au	Joel Voortman AWS
14	can WBNM parameters be made available for various sample catchments?	Not at this stage as this work is currently not part of the ARR project and was undertaken privately	Monique Retallick
15	Short of any statutory guidance or requirements, how would you recommend approaching projects that expect to use hydrology and/or erosion models to simulate scenarios out to the year 2300? Whilst some CMIP experiments have extended simulation periods, most easily available temperature change statistics which may be used for rainfall scaling are limited to the 2090/2100 horizon.	As we move further away from the present time the uncertainty over future climate increases. The world is working hard to meet the obligations of the Paris Agreement - well under 2 degrees global warming and using best efforts to limit to 1.5 degrees. If Paris Agreement goals are achieved, the world will settle at 1.5 or 2 degrees. If we continue as we are going, we are on-track for more of a 3 degree of warming. For projects beyond 2100, I'd suggest investigating 2 and 3 degree global warming levels and testing a higher warming scenario in case impacts that we think will be associated with a 3 degree warming scenario will actually be greater than currently projected. Then make a decision on design, based on risk appetite.	Leanne Haupt
16	Are there proposed to be rates of change (%/C) for IL/CL empirical losses for the Rangelands NRM cluster included in the final document/datahub update? It is currently missing in Table 4 of the draft document. Or does the paucity of data in this region influence the ability to provide reliable estimates?	The data for this region is very sparse, but the updated guidance does provide guidance for the Rangelands	Rory Nathan

17	The new guidance includes information regarding uncertainties in the inputs for the new guidance (e.g. the rainfall depth scaling factors per degree of warming), expressed in terms of confidence intervals. The guidance also includes a note on the higher “epistemic” uncertainties associated with future climate projections. As dam owners in particular move to using more rigorous risk assessment tools (e.g USACE TotalRisk) which can use more than just a “best estimate” flood frequency curve, it would be beneficial to be able to include these components of uncertainty in Monte Carlo sampling and derived frequency curves. Are there empirical distributions available for these inputs to allow sampling of (say) the percentage increase in rainfall depth per degree of warming?	live answered	Seth Westra
18	Monique, does your research in change in peak flow take into account change in critical duration?	we did consider critical duration. It sometimes gets shorter	Monique Retallick
19	Will you be developing guidance on applying climate change factors to historic long term rainfall timeseries (say 10yr timeseries) i.e., more extreme larger events and smaller/ no rainfall for smaller events	Long-term and time series simulations in some cases have been undertaken by scaling the baseline rainfall changes under future scenarios based on climate change data.	
20	Will there be guidance on how to apply climate change factors to pre-burst depths?	More importantly, are there any proposed changes to pre-burst ratios (as pre-burst depths may simply scale with changes in the IFD depths)?	
21	Why was the impact of the guidelines only tested in a few states. WA seems to get forgotten a lot in these things.	live answered	Monique Retallick
22	is this mean a 14% increase in 1%AEP flood events then?	yes, and 14% is the average for 1% AEP events but this really only applicable for catchments from 50-500km ²	Monique Retallick
23	is this mean a 14% increase in 1%AEP flood events then?	Will the peak flow increase estimates presented by Monique change as the temperature increase projections were updated recently?	Monique
24	Does the next version of the Chapter provide any guidance on pre-burst rainfall? Should it be upscaled with temperature increase? If so, what %/°C sensitivity factor should be applied for pre-burst (i.e. is it the same as for the burst duration, or say a constant 8%/°C)?	Hello, with your feedback the final document does explicitly state to apply the factors to pre-burst also. Really appreciate your question and feedback.	Conrad Wasko
24	Thanks Monique, what was the reason to revise the temperature from the draft guideline?	Also - what are the revised temps?	
		The ones in the draft were a multi-model mean whereas the final temperatures use a temperature using a multiple lines of evidence approach - in layman terms some of the "hot" climate models are removed from the those projections.	Conrad Wasko
26	if net zero policy to be relatively successful in Australia by 2050, what will be the impact of these factors?	If the entire globe reaches net zero by 2050, we may limit global warming to somewhere between 1.5 and 2 degrees, but there is a lot of uncertainty around the likely temperature increases. Given this uncertainty, we suggest considering a range of plausible futures (i.e. still apply the guidance over your design lifetime, or develop an adaptive design that takes into account plausible futures to 2050, but allows for upgrades if temperatures or impacts increase)	Leanne Haupt
		Our view is that until such time as the United nations Emissions Gap report, and/or the IPCC tell us that we've succeeded in flattening the emissions trajectory - that we must plan for SSP5-8.5 The Australian Government is not currently assessing risks or developing adaptation for SSP5-8.5 because it is considered an unrealistic trajectory. Our current emissions trajectory has us on a 3 degree pathway which is closer to SSP3-7.0. We would recommend using and adaptive approach to design which includes a likely emissions outcome (e.g. 2 degrees by 2050), but allows for expansion / upgrade should we surpass this.	Leanne Haupt

27	Will there be means to obtain climate change-factored IFDs (via ARR Data Hub or BOM) rather than relying post-processing via third party software?	At this stage no unfortunately.	Monique Retallick
28	How would we apply the factors to the PMP calcs The BOM PMP calcs methodology was from around 2004. Do we need to factor the PMP to current climate and again to future climate?	Refer to an earlier answered question	Monique Retallick
29	Will the Climate Change guidelines continue to be revised as the science updates and is there a commitment / funding to undertake reviews periodically?	The guidelines recommend that the most up to date science is used. We would hope to be able to update the guidance periodically when new information becomes available.	Leanne Haupt
30	There is no doubt that incorporating climate change allowances in design will result in larger drainage infrastructure, which requires more consumption of natural resources and energy. Does this mean that applying climate change allowances in design contributes to pushing the Earth towards an undesired scenario?	The Australian Government is working with industry and other stakeholders to develop a net zero 2050 plan and six sectoral plans. These plans will consider current and future infrastructure requirements.	Leanne Haupt
31	There is no doubt that incorporating climate change allowances in design will result in larger drainage infrastructure, which requires more consumption of natural resources and energy. Does this mean that applying climate change allowances in design contributes to pushing the Earth towards an undesired scenario?	No, it means that we will have a better understanding of the risks CC pose to extreme rainfall and runoff. How we choose to address those risks is another matter beyond the guidelines scope.	Chris Nielsen
32	Thanks, everyone. I'm wondering if this is going to supersede the NSW OEH guidelines?	I believe NSW DCCEEW is working on a response to the guidelines. They presented at the FMA quarterly meeting recently.	Monique Retallick
33	Can the WMA tool be used to determine proxy events? E.g., if the tool indicates "A future 1 in 100 AEP event is equivalent to a 1 in 500 AEP historical event", can the latter be used as a proxy?	Yes that is correct	Monique Retallick
34	What provision has been made for feedback loops/ tipping points and/or the Precautionary Principle??		
35	Monique, where are the updated temperatures published?	They will be published in ARR version 4.2 which will go live imminently	Monique Retallick
36	Has there been any testing of the implications of this changed approach for large infrastructure projects especially in terms of costs for providing increased flood immunity or increased transverse structures to minimise impacts? I realise it is required but wondering what the potential cost implications for construction are - though might obviously reduce future restoration works too.	Not that i am aware. The testing on the 400 catchments and impacts on flood planning level is the first broad testing I am aware of.	Monique Retallick
37	Hi, ARR2019 v4.2 doesnt have a release date on it (or the website). This should be added for when lawyers get involved. I also note that web based viewer (https://arr.ga.gov.au/arr-guideline) is still the old climate chapter.	The release is still being loaded	Monique Retallick
38	So does the imply that we are now factoring the PMP by various climate change factors?	Yes PMP should also be scaled.	Monique Retallick
39	It seems that long duration rainfalls (not necessarily with highest intensities) were the cause of major flooding in Australia. I would to hear your thoughts on this challenge to be considered/recognized in the guidelines?	This is a good question. There have been fewer studies on longer-duration events - while there is some evidence these may be increasing at a slower rate than for daily extremes, there is also a lot of uncertainty in some of the key processes and whether they are well represented in models. For this reason, in the guidelines we recommend the same adjustment factor of ~8% per degree of warming for daily to multi-day totals.	Acacia Pepler
40	Hi 1. Do you recommend any particular GCM to be used for Australia? Usage of different GCMs may bring large uncertainty to the analysis 2. Is there any guidelines from regulators provided to insurance and bank industry to adapt climate change?	Generally climate scientists would recommend against using a single GCM - the future is intrinsically uncertain, and using a single model may give you a false sense of certainty. At minimum, a few models should be used to test sensitivity to a range of different possible futures. One resource for identifying models that may be useful to focus on for Australia is https://doi.org/10.1029/2019EF001469	Acacia Pepler
41	Does the climate change methods apply for AEPs higher than 1:500?	They apply for all AEP	Monique Retallick

42	By what year will we know if these predictions are correct?	2200	
43	are we going to receive updated temporal patterns? Or we will just need to weed out the 'front loaded' temporal patterns and only run them?	The TP changes are very small so in most cases you can ignore the scalling advice. The advice suggest slight rescaling TP not "weeding out"	Mark Babister
44	Are there any proposed changes to the pre-burst rainfall ratios due to climate change?	No	Monique Retallick
45	This guidance appears very focused around flood risk and flood management. Is there any guidance surrounding potential changes to long-term flow sequences that would be used for water supply studies or environmental flows?	ARR is a guide to flood estimation.	Monique Retallick
46	How do we get competing consultants to stop arguing that their approach is wrong and "ours" is right when it comes to flood model outputs, both of which use the hierachy provided in ARR 2019?!! It's driving me crazy a a Floodplain Manager!!! Clearly there's enough 'scope' on the guidelines that lends inself to this issue!	Would be interested to see how climate change is practically and consistently applied across different authorities and geographical locations too.	
47	What factors should we adopt post 2090? We are involved in projects that have a life beyond 2090.....	Draft guidance has temperature projections up to 2300, but it looks like that table got dropped for the final report although they do reference the IPCC AR6 Report (which is where the table was taken from).	
48	What factors should we adopt post 2090? We are involved in projects that have a life beyond 2090.....	Would you then update the scale factors at a later date beyond 2090?	
49	Is it possible to compile the Q and A herein into a document for sharing after this webinar? Thanks.	The Q&A will be shared along with the recording of this event.	Anushree Mistry AWS support
50	Have the insurance industry had any involvement or given feedback on this project? Given that we are upscaling the 'now' risk, this is likely to impact insurance affordability, which is already under significant pressure.	Yes the chapter was open for industry comment earlier in the year as mentioned by Leanne. Post the release there will also be a pilot program and workshops. There was also a representative from the Insurance Council of Australia on the Program Control Group that guided the project.	Monique Retallick
51	Hi Acacia, you said the modelling is relevant to most of WA except for south west WA. How is rainfall modelling in south west WA expected to be different?	Southwest WA has some of the most robust observed and projected decreases in total rainfall, partivularly in the cool half of the year. However, decreases in total rainfall do not necessarily mean that extreme rainfall will decrease, particularly where extreme rainfall is driven by different processes e.g. thunderstorms. This means potentially larger uncertainty in future extreme rainfall in this region, and there is active research on high resolution modelling in SWWA ongoing at e.g. Murdoch university	Acacia Pepler
52	Early in the chat I asked the following question, and currently 40 people have given it a thumbs up to be answered. Are you able to re-visit this question as so far the panel hasn't really answered the question. What should a local council do in practical terms (apart from not re-doing the flood study). How do we convert the information in existing flood studies to reflect the change in magniture/frequency: Many local governments will have flood studies which pre-date this new guidance (and aren't likely to be refreshed for another 5-10 years). What would the panel recommend for these instances, so decision makers are not basing decisions on out-dated assumptions about future flood behaviour?	This was covered in the earlier discussions live. There is no need to rush out and update all your studies now. Look at what events you have and consider using events as proxy for climate change increases. Also you can use tool such as the climate change calculator to see how your risk will change.	Monique Retallick

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54	<p>Early in the chat I asked the following question, and currently 40 people have given it a thumbs up to be answered. Are you able to re-visit this question as so far the panel hasn't really answered the question. What should a local council do in practical terms (apart from not re-doing the flood study). How do we convert the information in existing flood studies to reflect the change in magnitude/frequency:</p> <p>Many local governments will have flood studies which pre-date this new guidance (and aren't likely to be refreshed for another 5-10 years). What would the panel recommend for these instances, so decision makers are not basing decisions on out-dated assumptions about future flood behaviour?</p>	<p>ccc.wmawater.com.au</p>	<p>Monique Retallick</p>
55	<p>Your presumably also considered different AEPs, but can't see enough distinction for higher scaling factors for rarer events? Should we say that these factors apply for AEPs rarer than 1 in 1 year, or 1 in 2-5 years, etc...?</p>	<p>We did look at this, and while there is some evidence favouring stronger rates of intensification for rarer events, we did not find a sufficiently large number of studies to support different scaling factors for different AEPs at this point.</p>	<p>Acacia Pepler</p>
56	<p>Many local governments will have flood studies which pre-date this new guidance (and aren't likely to be refreshed for another 5-10 years). What would the panel recommend for these instances, so decision makers are not basing decisions on out-dated assumptions about future flood behaviors?</p>	<p>this qn was answered above</p>	
		<p>If you have a 1 in 200 and/or 1 in 500 estimate you can work out how close a future senario is these estimates. The climate change calculator will also do this calculation for you.</p>	<p>Mark Babister</p>
57	<p>1% AEP + Climate changes doesn't it practically come upto 0.5% AEP ?</p>	<p>depends on the SSP and the reference year</p>	
		<p>it would look more like 0.5% under today's rainfall distribution, but today's 1% AEP would look closer to the 2% AEP by the end of the century as the distribution of rainfall changes.</p>	
58	<p>Whats the best SSP to be adopted for the South-East Queensland?</p>	<p>We would suggest selecting 2 SSPs for analysis - SSP2-4.5 and SSP3-7.0. Depending on your risk appetite, you'd use these two scenarios to inform your design or decisions. As Conrad mentioned, you could design adaptatively so that you build smaller now (e.g. SSP2-4.5), but allow for increases / upgrades to account for later changes. The location does not determine the SSP that you would look at.</p>	<p>Leanne Haupt</p>
59	<p>Apologies if i have misunderstood some of the discussion on how to estimate rainfall intensity in areas (i believe some were mentioned in WA/SA) that are likely to or already experience drier conditions. If we are using global temperature rise for rainfall intensity, would you adopt something different in these locations that may actually experience less rainfall?</p>	<p>While extreme rainfalls are still likely to increase, the mean rainfalls are declining. Using global temperature is still valid in the sense of applying to extremes.</p>	<p>Conrad Wasko</p>
60	<p>Are there any recommendations on future research around current ARR practice?</p>	<p>live answered</p>	<p>Monique Retallick</p>

61	Localised problem. Live in a 1970's unit block, guttering overflows with current rainfall.... not made to cope, updates expensive, insurance etc. Roofing plumber looking for guidance on guttering capacity for future life of the structure. Must be common on structures across the world. Guidance well timed. Might need extension to wider trades who are not engineers.		
62	Can we please clarify whether or not the temp increase recs. have changed in the final version?	yes they have	Monique Retallick
63	It was mentioned that adaptive approach may be better. So would it be better to use 2100 and SSP4.5 as design case and 2150 and SSP7 as sensitivity for significant developments/critical infrastructures?	Given that temperature projections beyond 2100 have a high degree of uncertainty, we'd suggest testing different SSPs for the same time horizon (e.g. SSP2-4.5 and SSP3-7.0) at 2100. The adaptive component would mean designing for the lower scenario, but designing in such a way that the structure could be increased / upgraded if / when it looks like temperatures may be higher.	Leanne Haupt