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Sia Lagos

Registrar

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No. VID622/2021

Federal Court of Australia

District Registry: Victoria

Division: General

Pabai Pabai

First Applicant

Guy Paul Kabai

Second Applicant

Commonwealth of Australia

Respondent

Report of the Conference of Experts

3 November 2023

Introduction

1. Pursuant to the orders of Justice Wigney dated 26 October 2023, Registrar Colbran convened an experts' conference commencing on 30 October 2023 by MS Teams.
2. The conference was attended by:
 - (a) Mr Stuart Bettington, expert for the Applicants; and
 - (b) Dr Bruce Harper and Dr Matthew Barnes, experts for the Respondent.
3. Prior to the conference, the parties provided a series of propositions to the Court. These propositions are set out in this report.
4. Prior to the conference, each expert was provided with Expert Evidence Practice Note (GPN-EXPT) and at the conference, each expert was reminded of their role as an expert witness, including their duty to the Court.
5. At the conference, each expert was reminded of the purpose of the conference, namely to discuss the propositions posed by the parties and to identify if, following this discussion, their opinions changed or remained the same.
6. Dr Barnes noted that a key issue in his preparation of the mapping was the AHD AUSGeoid differences and the absence of information provided to him to support development of the "Alternative" maps. In particular, he was not provided with the Harper report in advance of preparing the maps. This is further elaborated in the commentary below.
7. During the conference, Dr Barnes expressed the view that the "Alternative" maps in his report needed to be updated. This was because the DEM development and mapping presented in his report adopted AHD AUSGeoid98. This datum is consistent with the Bettington water levels but inconsistent with the more recent AUSGeoid09 Harper water level datum. The "Alternative" maps prepared by Dr Barnes are based on the Harper water levels and in Dr Barnes view needed to be recreated to be consistent with the Bettington datum. Registrar Colbran communicated this to the legal representatives, who agreed it was appropriate for Dr Barnes to recreate the maps. Due to the size of the maps, the recreated maps are set out in a Supplementary Report of the Conference of Experts dated 3 November 2023. Neither Mr Bettington nor Dr Harper wish to comment on the maps produced by Dr Barnes (and the time does not allow it in any event).
8. At the conclusion of the discussion, the experts were asked to confirm the substance of their discussion and the opinions expressed as set out in this report.
9. Each expert expressed the opinions set out in this report. The experts were asked to indicate this by signing the declaration at the end of the report.
10. At the conclusion of the conference, Mr Bettington recommended that his report be re-issued to reflect the agreed small changes set out in this experts report. These changes will for example, affect the figures in his Table 9 and Table 14.

REGIONAL UPLIFT

Proposition 1 – Please identify and explain your position in respect of the current storm tide levels as identified in Bettington report table 3 and Harper report modified table 3. Please explain the source for the identified figures. To the extent your answer results in any changes to table 3 in the Bettington or Harper reports please provide updated agreed or competing versions of those tables.

Mr Bettington	Dr Harper	Dr Barnes
<p>Table 3 is from Dr Harper’s 2011 report, with an updated Highest Astronomical Tide (HAT).</p> <p>The HAT has been updated because more data has been collated resulting in a better record of the tides.</p> <p>There is a transcription error in my Table meaning the Table requires further update.</p>	<p>There is an oversight in my modified Table 3, whereby the modelled Average Recurrence Interval (ARI)-related water levels from the Systems Engineering Australia (SEA) (2011) study Table 11-1 should have remained verbatim and not been adjusted for the estimated change in sea level rise (SLR) between 2010 and 2023. This results in a minor reduction of 0.04 m of all ARI-related Mean Sea Level (MSL) referenced water levels in that table but has had no effect on any of the other tables.</p> <p>The later updated Table 3 also reflects a change to using the HAT value for the Boigu Barge Ramp due to an agreement made herein to change the adopted Australian Height Datum (AHD) reference for the benefit of the present schedule.</p>	<p>I was not provided with a copy of the Harper report and the above was not within the instructions provided to me. I therefore offer no comment.</p>

Proposition 2 – Please explain whether a “regional lift” is appropriate to add to the storm tide levels set out in your answer to question 1, as included in table 5 in the Bettington report. To the extent your answer results in any changes to table 5 in the Bettington or Harper reports please provide updated, agreed or competing versions of those tables.

Mr Bettington	Dr Harper	Dr Barnes
<p>Due to geographic features on island and observed marine flooding events, it is hard to reconcile the low levels for storm tides during extreme events as presented in the SEA report. Therefore a lift is required.</p> <p>In my report, I have stated that the likely reason for this apparently low forecast of storm tides was due to poorly resolved regional water level lift. On review I have formed the opinion that the low values are likely due to general uncertainties (errors) that occur in modelling. These will include issues with resolving the complex influence of waves and local (near shore) issues and scale of regional lift impacting different islands. Due to these uncertainties in the model used by Dr Harper, I have added a lift to account.</p> <p>Amount of lift used is to explain what I have observed both from the recent floods and geographic features (dune crest levels) seen on coral cays. I acknowledge that it is arbitrary (but when building structures, it is important to include a lift to cover for extreme events). These events have not been captured in recorded data and therefore the assessment is interpretative, derived from back calculating runup levels during a very rare event (500 year ARI).</p> <p>The difference by including the regional lift is approximately 0.3m in the 100 years ARI event.</p> <p>No change to tables for this issue.</p>	<p>My position is unchanged on this issue, whereby I did not provide a modified Table 5.</p> <p>When proposing a regional lift, Mr Bettington stated that the SEA (2011) study only included tropical cyclone impacts, which would have been an appropriate and rational reason for doing so.</p> <p>Although I respect Mr Bettington’s regional knowledge and his concerns relative to the design of coastal defences, I now understand that the uplift is mainly quantified on the basis of historical dune heights on the coral cays and the natural processes of wave runup and overtopping that maintain them.</p> <p>Meanwhile, I understand that the above concerns do not logically extend to Boigu and Saibai due to their much-reduced wave exposures, but the regional lift has been applied across all the sites being considered here.</p> <p>No change to tables.</p>	<p>I was not provided with a copy of the Harper report and the above was not within the instructions provided to me. I therefore offer no comment.</p>

AHD ADJUSTMENT

Proposition 3 – Please explain your positions on the conversion from MSL to AHD of the storm tide levels as identified in table 6 of the Bettington report. To the extent your answer results in any changes to table 6 in the Bettington or Harper reports please provide updated, agreed or competing versions of those tables.

Mr Bettington	Dr Harper	Dr Barnes
<p>The conversion has used two different AHD datums figures (AHD AUSGeoid09 v AHD AUSGeoid98) which has resulted in a different baseline being used between the experts.</p> <p>If the experts agree on Geoid differences (see Table below), this will provide a reason for the existing difference in numbers.</p> <p>I would prefer to use AUSGeoid98 as all survey data is in AUSGeoid98 data, although both AUSGeoid98 and AUSGeoid09 are accurate.</p> <p>I have prepared my datasets based on AHD AUSGeoid98.</p>	<p>I am not qualified to comment on the specifics of how to best tie the community ground levels to the AHD surface.</p> <p>I relied on the updated Queensland Department of Environment and Science (DES) (2023) tidal plane data (where available) to express the modelled water levels relative to “present” AHD. This provided levels referenced to AUSGeoid09, which corrects the many erroneous aspects of the outdated AUSGeoid98 across the Torres Strait.</p> <p>However, our discussions identified that due to remaining complexities with the available survey data, that the use of the earlier AUSGeoid98 reference would be more expeditious in enabling equivalent mapping comparisons. That is regrettable going forward, because it may well cause confusion in the community that uses published DES AHD elevations for warnings.</p> <p>This change of datums has the effect of all my previous water levels appearing to increase because the earlier AUSGeoid98 datums are all set lower than the later corrected datums.</p> <p>This also involved changing the Boigu AHD reference from the nearshore Storm Tide Gauge, which was my original recommendation, to that of the community-adjacent Barge Ramp AHD reference. Accordingly, the HAT values for Boigu have also been changed to suit.</p>	<p>The Digital Elevation Models (DEM) development and mapping presented in my report adopted AHD AUSGeoid98. This datum is consistent with the Bettington water level datum but inconsistent with the more recent AUSGeoid09 Harper water level datum.</p> <p>Considering the above, the “Alternative” maps I prepared based on the Harper water levels will need to be recreated to be consistent with the Bettington datum.</p> <p>The updated set of mapping using the agreed common AUSGeoid98 datum, and addressing other minor changes to the Bettington and Harper water levels, are included in the Supplementary Report.</p>

Mr Bettington’s table: AHD relative to AUSGeoid98 vs AUSGeoid09

Datum	Boigu (PSM 1404483)	Saibai (PSM 173501)	Poruma (PSM 156561)	Warraber (PSM 146550)
AUSGeoid98	2.706 m AHD	2.793 m AHD	2.306 m AHD	3.204 m AHD
AUSGeoid09	2.131 m AHD	2.099 m AHD	1.951 m AHD	2.709 m AHD
Diff (Geoid 98 to 09)	-0.575 m	-0.694 m	-0.355 m	-0.495 m
MSL2023 to AHD 09	-0.23 m	N/A	0.00 m	0.00 m
MSL2023 to AHD 98	-0.805 m	-0.694 m	-0.355 m	-0.495 m

Dr Barnes agrees with the calculations in Mr Bettington’s table above.

A change to the Geoid will impact on all tables with AHDs.

All experts agree that:

The water levels presented in the Bettington and Harper reports adopt different AHD datums:

- Bettington adopted AHD AUSGeoid98 which is consistent with the ground survey datasets and survey control mark reports published by the Queensland Department of Resources
- Harper adopted AHD AUSGeoid09 which is consistent with the recent DES publications regarding storm tide reference landmarks (DES 2018) and Torres Strait tidal datum reviews (DES 2021; 2023)

Both approaches are valid; however, the datum inconsistency means the water levels between the Bettington and Harper reports cannot be directly compared. Furthermore, the mapping presented in the Barnes report comparing the “Bettington” and “Alternative” scenarios cannot be directly compared. The DEMs and mapping presented in the Barnes report adopted AHD AUSGeoid98 and therefore the “Alternative” maps by Dr Barnes based on the Harper water levels that adopted AHD AUSGeoid09 are inconsistent with that datum.

To address the inconsistent datum issue, the experts agreed to use AHD AUSGeoid98 as the common datum and convert the Harper water levels to AHD AUSGeoid98. The converted Harper water levels could then be used as the basis for updating the “Alternative” maps presented in the Barnes report.

Mr Bettington completed an initial comparative analysis of AHD AUSGeoid98 and AHD AUSGeoid09 at a survey control mark location on each island. Dr Barnes completed an independent comparative analysis at the same survey control mark locations and the results agreed with Mr

Bettington, as summarised in Table 1¹. The ‘difference’ for each island provided the basis for converting the Harper water levels from AHD AUSGeoid09 to AHD AUSGeoid98.

Table 1 Difference between AHD AUSGeoid98 and AHD AUSGeoid09

Survey Control Marks GDA 94	Boigu	Saibai	Poruma	Warraber
	PSM 140483	PSM 173501	PSM 156561	PSM 146550
Latitude (S)	9.22950151	9.38028693	10.0494171	10.2046774
Longitude (E)	142.2209517	142.6135658	143.0636626	142.8222355
AHD (m), AUSGeoid98	2.706	2.793	2.306	3.204
AHD (m), AUSGeoid09	2.131	2.100	1.951	2.709
Difference (m)	0.575	0.693	0.355	0.495

For the Torres Strait Island communities considered here, the difference between AHD AUSGeoid98 and AHD AUSGeoid09 is large, and this contributes to the challenges and uncertainty regarding coastal hazard assessment and the design of hazard mitigation strategies. These datum differences need to be addressed by the State and Commonwealth authorities and brought up to date with current standards. Future coastal hazard planning, design and construction projects can then be delivered with greater certainty.

¹ Dr Barnes also checked an additional survey mark on each island (not shown in Table 1) and obtained a consistent difference between AHD AUSGeoid98 and AHD AUSGeoid09

EXTREME SEA LEVELS FOR 1900, 2050 AND 2100

Proposition 4 – To the extent that your answers to questions 1-3 result in any changes to tables 7, 8, 11, 12, 13, 15, 16 and 17 of the Bettington or Harper reports, please provide updated, agreed or competing versions of those tables.

Mr Bettington	Dr Harper	Dr Barnes
<p>Will change Table 3 to account for updated HAT.</p>	<p>Will change Table 3 to remove the allowance for sea level rise in the ARI-related water levels.</p> <p>Will change the Boigu AHD reference from the Storm Tide Gauge to the Barge Ramp gauge, with commensurate changes to HAT and other tidal plane levels.</p> <p>Will change all other Tables to provide an equivalent baseline to Mr Bettington’s modified tables of AUSGeoid98 water levels.</p>	<p>The changes to ARI-related water levels and conversion of the Harper water levels to AHD AUSGeoid98 are included in the recreated maps set out in the Supplementary Report.</p>

MAPPING PROCESS

Proposition 5 – Please explain any similarities or differences between the digital elevation models (DEMs) for the Mapped Islands used in the Bettington Report and the Barnes Report, including any difference in datasets used to create the DEMs (identifying the datasets used and any available information about the date the dataset was compiled), and any adjustment made to those datasets.

Mr Bettington	Dr Harper	Dr Barnes
<p>I used the bathtub model (the model used is slightly less sophisticated than that used by the Barnes report, which was a bathtub method but excluded flooding where no flow path existed).</p> <p>The ground data used in the two reports is sourced from the same origin.</p>	<p>No comment as I had no role in either process.</p>	<p>There is limited detail in the Bettington report about the DEM development.</p> <p>Through discussion, it was established that the sourced underlying land datasets used in the Bettington report and in my report are sourced from the same origin. There will be some minor differences related to data processing and DEM development.</p> <p>I agree bathtub mapping is the correct approach for these localities and level of data certainty, however the Bettington mapping shows flooding where there are no obvious connections to sea. This overstates the hazard extent for some scenarios but is a relatively minor issue.</p>

Dr Barnes further states that:

The underlying datasets used to create the DEMs are of the same origin, as listed in the Barnes report. Despite the lack of detail regarding DEM development in the Bettington report, it was agreed that differences in data processing and adjustment of the datasets to a common datum to create the DEM are likely minor and insignificant in terms of the mapped flood extents.

It was agreed that the differences between the “Bettington” and “Alternative” mapped flood extent is primarily due to the difference in water level, and this was amplified by the inconsistent AHD AUSGeoid issue discussed in the response to Proposition 3.

An additional but likely secondary cause of difference in the mapped flood extents is due to the bathtub mapping methodology. Both the Bettington report and my report use a bathtub mapping approach, however the Barnes report only shows flooding in areas with a hydraulic connection to the sea.

UPDATED VERSIONS OF TABLES

In the modified Table 3 Bettington has included a revised HAT to the agreed more recent values and has revised the levels for Boigu, where he made an error in the original. Note that these changes are reflected in all subsequent tables.

BETTINGTON REPORT MODIFIED TABLE 3

Average recurrence interval (ARI years)	Boigu Storm tide (m MSL)	Saibai Storm tide (m MSL)	Poruma Storm tide (m MSL)	Warraber Storm tide (m MSL)
HAT	2.29	2.06	2.27	2.23
10 years	2.49	2.14	2.47	2.53
25 years	2.55	2.19	2.51	2.61
50 years	2.59	2.22	2.55	2.65
100 years	2.62	2.26	2.56	2.67
500 years	2.72	2.35	2.60	2.72

HARPER REPORT MODIFIED TABLE 3

	Boigu (m MSL)	Saibai (m MSL)	Poruma (m MSL)	Warraber (m MSL)
HAT	2.31	2.06	2.27	2.23
Average Recurrence Interval				
ARI (y)	Storm Tide	Storm Tide	Storm Tide	Storm Tide
10	2.49	2.14	2.47	2.53
25	2.55	2.19	2.51	2.61
50	2.59	2.22	2.55	2.65
100	2.62	2.26	2.56	2.67
500	2.72	2.35	2.6	2.72

BETTINGTON REPORT MODIFIED TABLE 5

Average recurrence interval (ARI years)	Boigu Storm tide (m MSL)	Saibai Storm tide (m MSL)	Poruma Storm tide (m MSL)	Warraber Storm tide (m MSL)
HAT	2.29	2.06	2.27	2.23
10 years	2.49	2.14	2.47	2.53
25 years	2.65	2.29	2.61	2.71
50 years	2.79	2.42	2.75	2.85
100 years	2.92	2.56	2.86	2.97
500 years	3.22	2.85	3.10	3.22

There is no modified table 5 in the Harper report due to the absence of a ‘regional lift’.

BETTINGTON REPORT TABLE 6

Horizon	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MSL in 1900 (Base Line)	0.66	0.55	0.19	0.30
MSL in 2010	0.83	0.72	0.36	0.47
MSL 2023 (Present Day)	0.87	0.76	0.40	0.51

The relationship adopted by Bettington is retained for his work, though it is recognised that it differs slightly from the revised values adopted following the meeting of experts. These differences are small (<1 cm) and have been ignored in the interest of expedience. This should not be taken as a difference of opinion regarding the relationship between AHD to the AUSGeoid98 and MSL. Rather it reflects scale of errors that can be expected to occur in different data sets.

HARPER REPORT MODIFIED TABLE 6

Horizon	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MSL in 1900 (Base Line)	0.60	0.48	0.15	0.29
MSL in 2010	0.77	0.65	0.32	0.46
MSL 2023 (Present Day)	0.805	0.693	0.355	0.495

BETTINGTON REPORT MODIFIED TABLE 7

Average recurrence interval (ARI years)	Boigu Storm tide (m AHD)	Saibai Storm tide (m AHD)	Poruma Storm tide (m AHD)	Warraber Storm tide (m AHD)
HAT	2.95	2.61	2.46	2.53
10 years	3.15	2.69	2.66	2.83
25 years	3.31	2.84	2.80	3.01
50 years	3.45	2.97	2.94	3.15
100 years	3.58	3.11	3.05	3.27
500 years	3.88	3.40	3.29	3.52

HARPER REPORT MODIFIED TABLE 7

	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
HAT	2.92	2.54	2.42	2.52
Average Recurrence Interval				
ARI (y)	Storm Tide	Storm Tide	Storm Tide	Storm Tide
10	3.13	2.66	2.66	2.86
25	3.19	2.71	2.70	2.94
50	3.23	2.74	2.74	2.98
100	3.26	2.78	2.75	3.00
500	3.36	2.87	2.79	3.05

BETTINGTON REPORT MODIFIED TABLE 8

Average recurrence interval (ARI years)	Boigu Storm tide (m AHD)	Saibai Storm tide (m AHD)	Poruma Storm tide (m AHD)	Warraber Storm tide (m AHD)
HAT	3.16	2.82	2.67	2.74
10 years	3.36	2.90	2.87	3.04
25 years	3.52	3.05	3.01	3.22
50 years	3.66	3.18	3.15	3.36
100 years	3.79	3.32	3.26	3.48
500 years	4.09	3.61	3.50	3.73

HARPER REPORT MODIFIED TABLE 8

	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
HAT	3.13	2.75	2.63	2.73
Average Recurrence Interval				
ARI (y)	Storm Tide	Storm Tide	Storm Tide	Storm Tide
10	3.34	2.87	2.87	3.07
25	3.40	2.92	2.91	3.15
50	3.44	2.95	2.95	3.19
100	3.47	2.99	2.96	3.21
500	3.57	3.08	3.00	3.26

BETTINGTON REPORT MODIFIED TABLE 11

Recurrence Interval (ARI years)	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS/MHHW	2.31	1.99	1.69	1.70
HAT	3.29	2.95	2.80	2.87
10 years	3.49	3.03	3.00	3.17
25 years	3.65	3.18	3.14	3.35
50 years	3.79	3.31	3.28	3.49
100 years	3.92	3.45	3.39	3.61
500 years	4.22	3.74	3.63	3.86

HARPER REPORT MODIFIED TABLE 11

	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS or MHHW	2.34	1.88	1.71	1.73
HAT	3.26	2.88	2.76	2.86
Average Recurrence Interval				
ARI (y)	Storm Tide	Storm Tide	Storm Tide	Storm Tide
10	3.47	3.00	3.00	3.20
25	3.53	3.05	3.04	3.28
50	3.57	3.08	3.08	3.32
100	3.60	3.12	3.09	3.34
500	3.70	3.21	3.13	3.39

BETTINGTON REPORT MODIFIED TABLE 12

Recurrence Interval (ARI years)	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS/MHHW	2.33	2.01	1.71	1.72
HAT	3.31	2.97	2.82	2.89
10 years	3.51	3.05	3.02	3.19
25 years	3.67	3.20	3.16	3.37
50 years	3.81	3.33	3.30	3.51
100 years	3.94	3.47	3.41	3.63
500 years	4.24	3.76	3.65	3.88

HARPER REPORT MODIFIED TABLE 12

	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS or MHHW	2.36	1.90	1.73	1.75
HAT	3.28	2.90	2.78	2.88
Average Recurrence Interval				
ARI (y)	Storm Tide	Storm Tide	Storm Tide	Storm Tide
10	3.49	3.02	3.02	3.22
25	3.55	3.07	3.06	3.30
50	3.59	3.10	3.10	3.34
100	3.62	3.14	3.11	3.36
500	3.72	3.23	3.15	3.41

BETTINGTON REPORT MODIFIED TABLE 13

Recurrence Interval (ARI years)	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS/MHHW	2.35	2.03	1.73	1.74
HAT	3.33	2.99	2.84	2.91
10 years	3.53	3.07	3.04	3.21
25 years	3.69	3.22	3.18	3.39
50 years	3.83	3.35	3.32	3.53
100 years	3.96	3.49	3.43	3.65
500 years	4.26	3.78	3.67	3.90

HARPER REPORT MODIFIED TABLE 13

	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS or MHHW	2.38	1.92	1.75	1.77
HAT	3.30	2.92	2.80	2.90
Average Recurrence Interval				
ARI (y)	Storm Tide	Storm Tide	Storm Tide	Storm Tide
10	3.51	3.04	3.04	3.24
25	3.57	3.09	3.08	3.32
50	3.61	3.12	3.12	3.36
100	3.64	3.16	3.13	3.38
500	3.74	3.25	3.17	3.43

BETTINGTON REPORT MODIFIED TABLE 15

Recurrence Interval (ARI years)	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS/MHHW	2.53	2.21	1.91	1.92
HAT	3.51	3.17	3.02	3.09
10 years	3.71	3.25	3.22	3.39
25 years	3.87	3.40	3.36	3.57
50 years	4.01	3.53	3.50	3.71
100 years	4.14	3.67	3.61	3.83
500 years	4.44	3.96	3.85	4.08

HARPER REPORT MODIFIED TABLE 15

	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS or MHHW	2.56	2.10	1.93	1.95
HAT	3.48	3.10	2.98	3.08
Average Recurrence Interval				
ARI (y)	Storm Tide	Storm Tide	Storm Tide	Storm Tide
10	3.69	3.22	3.22	3.42
25	3.75	3.27	3.26	3.50
50	3.79	3.30	3.30	3.54
100	3.82	3.34	3.31	3.56
500	3.92	3.43	3.35	3.61

BETTINGTON REPORT MODIFIED TABLE 16

Recurrence Interval (ARI years)	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS/MHHW	2.59	2.27	1.97	1.98
HAT	3.57	3.23	3.08	3.15
10 years	3.77	3.31	3.28	3.45
25 years	3.93	3.46	3.42	3.63
50 years	4.07	3.59	3.56	3.77
100 years	4.20	3.73	3.67	3.89
500 years	4.50	4.02	3.91	4.14

HARPER REPORT MODIFIED TABLE 16

	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS or MHHW	2.62	2.16	1.99	2.01
HAT	3.54	3.16	3.04	3.14
Average Recurrence Interval				
ARI (y)	Storm Tide	Storm Tide	Storm Tide	Storm Tide
10	3.75	3.28	3.28	3.48
25	3.81	3.33	3.32	3.56
50	3.85	3.36	3.36	3.60
100	3.88	3.40	3.37	3.62
500	3.98	3.49	3.41	3.67

BETTINGTON REPORT MODIFIED TABLE 17

Recurrence Interval (ARI years)	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS/MHHW	2.84	2.52	2.22	2.23
HAT	3.82	3.48	3.33	3.40
10 years	4.062	3.56	3.53	3.70
25 years	4.218	3.71	3.67	3.88
50 years	4.32	3.84	3.81	4.02
100 years	4.45	3.98	3.92	4.14
500 years	4.75	4.27	4.16	4.39


HARPER REPORT MODIFIED TABLE 17

	Boigu (m AHD)	Saibai (m AHD)	Poruma (m AHD)	Warraber (m AHD)
MHWS or MHHW	2.87	2.41	2.24	2.26
HAT	3.79	3.41	3.29	3.39
Average Recurrence Interval				
ARI (y)	Storm Tide	Storm Tide	Storm Tide	Storm Tide
10	4.00	3.53	3.53	3.73
25	4.06	3.58	3.57	3.81
50	4.10	3.61	3.61	3.85
100	4.13	3.65	3.62	3.87
500	4.23	3.74	3.66	3.92

Declarations of Experts

I, Stuart Bettington, in expressing the opinions attributed to me in this report have had regard to the basis material and the statements made at the conference of experts and have made all the inquiries which I believe are desirable and appropriate and that no matters of significance which I regard as relevant have, to my knowledge, been withheld.

Signed:

A handwritten signature in blue ink that reads "Stuart Bettington".

Dated: 3 November 2023

I, Bruce Harper, in expressing the opinions attributed to me in this report have had regard to the basis material and the statements made at the conference of experts and have made all the inquiries which I believe are desirable and appropriate and that no matters of significance which I regard as relevant have, to my knowledge, been withheld.

Signed:

A handwritten signature in blue ink that reads "Bruce Harper".

Dated: 03/11/2023

I, Matthew Barnes, in expressing the opinions attributed to me in this report have had regard to the basis material and the statements made at the conference of experts and have made all the inquiries which I believe are desirable and appropriate and that no matters of significance which I regard as relevant have, to my knowledge, been withheld.

Signed:

A handwritten signature in blue ink that reads "Matthew Barnes".

Dated: 03/11/2023