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Commentary and Analysis on the Whitehead & Associates 2015 NSW Sea-Level Report

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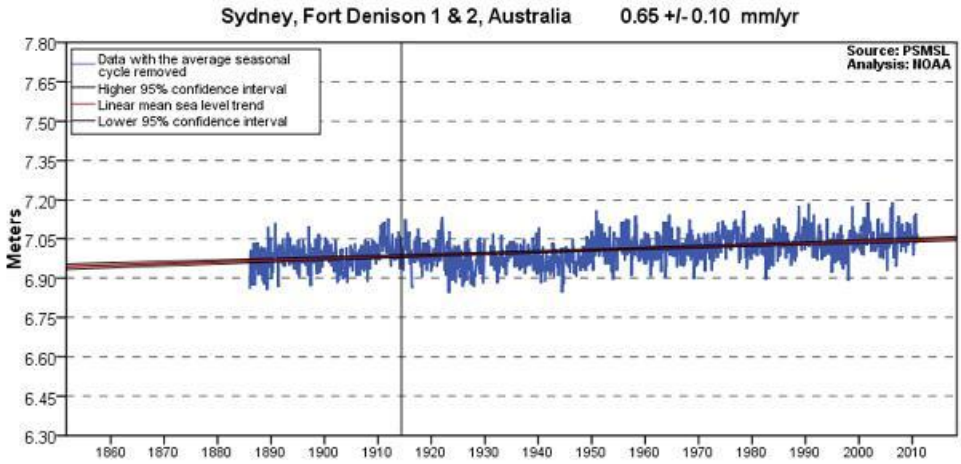

Mean sea level trend for Fort Denison, Sydney for the period 1886-2010 is 0.65 millimetres/year

Preamble

P1. At the date of writing (March 24, 2015), the Whitehead & Associates (W&A) 2015 report that is the subject of this commentary was accessible at the following web page:

http://www.gosford.nsw.gov.au/docs/default-source/Business/gov-15-tabled-item-sea-level-rise-discussion-paper.pdf

P2. In an internal council memo dated March 23, Sustainability Department Manager Dr. Alice Howe, Lake Macquarie City Council, advised interested parties that:

"Gosford City Council commissioned a report from the same consultant, and the findings and advice were basically unchanged to that provided to Eurobodalla and Shoalhaven councils."

P3. The earlier 2014 W&A Eurobodalla-Shoalhaven report that Dr. Howe refers to was subjected to substantive scientific criticism by a team of 11 experienced international sea-level scientists, whose report is available here:

https://www.heartland.org/policy-documents/commentary-and-analysis-whitehead-associates-2014-nsw-sea-level-report

P4. That the later 2015 W&A report for Gosford Council fails to acknowledge the expert NIPCC analysis of the similar but earlier Eurobodalla-Shoalhaven report, or to counter its criticisms in any way, represents a major failure of due diligence by both Council staff and by W&A.

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Summary

S1. Gosford City Council commissioned a technical report from consulting engineers Whitehead & Associates (W&A) to advise on what planning benchmark it should use for future rise in sea-level.

S2. The W&A report was received by Council in early March, 2015. The report contained discussion and recommendations regarding sea-level planning that were closely similar to those contained in an earlier (2014) report contracted by the Eurobodalla and Shoalhaven Shires.

S3. The 2014 W&A report has been subjected to deep scientific criticism by a group of 11 international sea-level scientists. The criticisms include:

- Over-reliance on the theoretical analysis of climate change provided by a single authority (the IPCC) and neglect of scientifically widespread countervailing views such as those of the NIPCC.
- Use of extreme (i.e., unrealistic) emissions scenarios suggested by the IPCC.
- Failure to distinguish clearly between global average sea-level as generated from *computer models* and measured local relative sea-level as *measured* by tide gauges.
- Failure to acknowledge that the rate of modern sea-level rise is actually decelerating at many locations, and also globally.
- Use of failed computer models, based upon homogenized "data", to project future sea-level rise.
- Use of too short a period of baseline record (last 18 years) for the purpose of making forward sea-level projections.
- Failure to use the high-quality tide gauge record of changing sea-level available from Fort Denison, Sydney Harbour.

S4. Closely similar criticisms apply to the recommendations made in the W&A 2015 Gosford report, whose authors have however failed to consider the earlier criticisms made, or even to reference the conflicting NIPCC view.

S5. Based on material contained in the W&A 2015 report, at a meeting on March 10 Gosford Council adopted the planning benchmarks of 0.20 m sea-level rise by 2050 and 0.74 m sea-level rise by 2100 compared to the base-year 2015.

S6. Because the decisions were based on inadequate advice, regarding which due diligence had been completely neglected, Council's future sea-level benchmark rulings need to be reconsidered. The reconsideration should include a period of public commentary and submissions regarding (i) the recommendations in the W&A 2015 report, and (ii) the Council's rulings of March 10. In making the final decision, all available expert advice should be considered **and should be seen to be considered.**

Commentary on W&A 2015 Gosford sea-level report

INTRODUCTION

1. The Whitehead & Associates Gosford Sea Level Paper (W&A, 2015) was labelled as a "Discussion Paper". Yet the paper was not made available for public comment prior to the council meeting at which its recommendations were considered.

2. The report does not include a copy of the instruction brief that Gosford City Council gave to W&A. In its absence, one can assume that the four dot points listed in "Section I. Scope of the Assessment" as "the agreed purpose of this discussion paper" fairly reflect the agreed brief.

These points are:

- To review the development and adoption of the existing Gosford City Council sea level rise benchmarks.

- To comment on more recent information relating to the future sea level rise projections including the most recent published IPCC reports, the Whitehead & Associates report on the NSW south coast sea level rise framework, recent publications by the Climate Change Council and the Australian Academy of Science, and other relevant issues relating to the current sea level rise allowances as raised by Council.

- To advise Gosford City Council of the suitability or otherwise of their current sea level rise allowances.

- To advise an appropriate framework for ongoing review of the adopted benchmarks.

ITEMISED DISCUSSION

3. The second paragraph of Section I indicates that the Gosford assessment:

> *"draws on a recent comprehensive review of sea level rise allowances suitable for coastal planning undertaken for Shoalhaven City Council and Eurobodalla Council in 2014 (Whitehead & Associates and Coastal Environment, 2014) …"*

The W&A (2014) report is irredeemably flawed, as established by an *amicus brief* provided to the Shoalhaven and Eurobodalla Shire Councils by a group of 11 established international sea-level experts (NIPCC, 2014).

It is little short of astonishing that the NIPCC (2014) report does not appear in the reference list of the Gosford report, and nor does any account appear to have been taken of the many and fundamental criticisms levied against the earlier W&A (2014) by NIPCC's group of independent international sea-level experts.

4. The last paragraph of Section 1 reads:

> *In undertaking this review, it should be understood that consideration of sea level rise is limited to deep water sea levels and does not account for shoreline changes in morphology or localised storm effects which considerably impact the level of inundation and wave activity at the coast and within estuaries. The offshore sea*

> *level is the primary input to more detailed coastal process and hazard definition studies which then define the water levels and extent of hazard at a particular location. These detailed local studies remain essential for coastal management, planning and development assessment. This process, including allowance for future sea level rise, has been applied in NSW for the past 25 years.*

As applied to the deterministic computer models that W&A and others have applied to sea-level hazards this statement is likely true. It effectively says that the offshore sea level forms a boundary condition for application to more detailed coastal process and response models.

Given that the offshore sea-level is not actually measured, but rather computer model generated, the deficiencies of this approach are obvious. Such modelled projections are not descriptive of the real world but of an assumed future virtual reality. Back in the real world, for more than 100 years coastal engineers have designed management plans and structures based, *inter alia,* on MEASURED sea-level change as recorded by coastal tide gauges.

As noted by the Chief Scientist of NSW in her report on the sea-level issue (O'Kane, 2013), coastal management policy is best based upon nearby tide gauge data, rather than on experimental satellite measurement results or speculative computer projections.

5. The adoption in August 2013 of a 0.9 m sea-level rise by 2100 by Gosford City Council is summarised in Section 2 (p. 5-6) of the report. Though heavily influenced by previous IPCC reports, the particular level of 0.9 m followed recommendations in various CSIRO reports.

Two comments follow. The first is that the inadequacy of IPCC reports has been detailed by the NIPCC (2014) *amicus brief,* after NIPCC (2013a, b). And the second is that the IPCC recommendations and the closely related CSIRO recommendations, plus the other differing figures discussed in previous NSW and federal government decisions and dictates, ALL refer to global average sea-level.

As the NIPCC (2014) authors conclude:

> ***Local relative sea-level change* [measured by tide gauges] *is what counts for purposes of coastal planning, because even in a largely tectonically stable area such as eastern NSW, different rates of uplift and subsidence may apply in different locations.***

6. Section 3.1 of the report contains the following remarkable paragraph:

> *In 2014 the authors undertook a detailed review of available climate change information as part of a study into sea levels for a South Coast Sea Level Rise Policy and Planning Framework (Whitehead & Associates and Coastal Environment, 2014). Based on that review we have concluded that the broad theory of anthropogenic climate change presented by the Intergovernmental Panel on Climate Change (IPCC) represents the view held by an overwhelming majority of scientists that are suitably qualified in this area. Nevertheless, there remains a vocal minority claiming that the underlying scientific principles are flawed. We recommend Council take special care in checking the veracity of any advice they receive in contradiction of the IPCC position which are often based on negative reviews, designed to confuse and contradict.*

As noted in 5 above, the W&A (2014) review has been subject to expert review and found to be irredeemably flawed (NIPCC, 2014). Second, W&A cite no evidence, and nor is there any, that "*an overwhelming majority of (suitably qualified) scientists*" agree with the IPCC's recommendations on climate change: they are simply repeating politically correct folk "wisdom". Third, the "*vocal minority claiming that the underlying scientific principles* (of IPCC's work) *are flawed*" describes an army of straw man.

Scientific discussions proceed by analysing and discussing the relevant evidence, not by engaging in vague backhanders against imaginary opponents of whatever ideological view (here, the Gospel of the IPCC) you wish to defend.

Rather than jumping at computer manufactured sea-level ghosts, the Gosford City Council would do better to apply the following advice of NIPCC (2014):

> ***Considering the flooding and erosion risks already inherent in coastal locations, the likely 7.3 cm rise in local sea-level in NSW over the next 100 years is too small to justify a major planning response. Though other human impacts at the coast might require changes in coastal regulations, no imperative exists to change planning rules because of unproven futuristic sea-level hazard.***

7. Section 3.2 is concerned with W&A's analysis of changes and trends in offshore sea-level in NSW between 1996-2013, using a variety of computer-manipulated or modelled databases.

The unexceptional conclusions are reached (i) that the rates of offshore sea-level change from Sydney are likely the same as for Sydney, and (ii) that the Fort Denison tide gauge record is the most useful for monitoring sea-level rise.

Meanwhile, it remains the case that considering sea-level change over periods as short as 1996-2013 (as most of W&A's analysis here does) is unwise.

The key determinative statistic for purposes of coastal management in central NSW is the 100+ yr long-term average rate of sea-level rise recorded at the Fort Denison tide gauge. Various reconstructions of this high quality sea-level record yield estimates between 0.5 and 0.93 mm/yr of local relative sea-level rise, with a mean estimate of 0.63 mm/yr or 6.3 cm/century (NIPCC, 2014, Table 3).

8. Section 3.3 presents a discussion of the four main emissions scenarios recommended in the IPCC's 5th Assessment Report, and recommended that council adopts the most extreme of these, RCP8.5 high range.

This recommendation was made also by W&A to the Shoalhaven and Eurobodalla shires. The methodology has been comprehensively criticized by NIPCC (2014, Section 3), and the use of RCP 8.5 has been rejected by the Shoalhaven shire.

To meet a NSW state government guideline that *"Councils should consider adopting projections that are widely accepted by competent scientific opinion"*, W&A introduce their Section 3.3 with a discussion of how to meet that recommendation. They conclude that "***the conclusions presented by the IPCC are reasonable and represent the views most widely accepted by the international climate change science community***".

This conclusion is not substantiated (as opposed to asserted) by W&A, has been strongly criticised by NIPCC (2014, Section 2) and is unlikely to be true.

The key point is not whether IPCC recommendations represent a consensus view but whether they are accurate as applied to the NSW coast. Extensive evidence, discussed in NIPCC (2014, Sections 4, 7), establishes that the IPCC computer modelling is irredeemably flawed. It follows that IPCC advice is unsuitable as a basis for coastal management policy.

9. Section 3.4 comprises a catalogue of Australian organisations and individuals that have proffered an opinion on sea-level change (or global warming) in the 18 months since the publication of the IPCC's 5th Assessment Report. The organisations range from high-credibility scientific sources such as the Australian Academy of Science, through self-interested industry groups such as the Insurance Council and Westpac to naked political lobby groups such as the Climate Council.

Of course, all these organisations are entitled, indeed welcome, to express an opinion on matters of public interest, though it must be said that motherhood, political influence, selective reasoning and direct misinformation are widely present throughout the selected quotations.

Whilst this may be unsurprising, what is surprising is that a firm of professional consulting engineers would think that the appropriate way to discuss a complex scientific and technical issue is to seek the views of what might not unfairly be termed a lobby group community, instead of confining their discussion to the real scientific research relevant to the issue (detailed references to which can be found in NIPCC, 2014a).

The key fact is that, so far as I know, none of the organisations quoted polled their memberships before adopting a public (and often political) stance on the global warming/sea-level issue. Therefore, and even for the minority of genuine scientific organisations that are cited, the stated opinions come not from scientific experts but from management or governance representatives. Worse, where sea-level is specifically concerned, ALL the statements are concerned with changes in global average sea-level, i.e. are irrelevant as applied to the NSW coast.

Because changes in global average sea-level have nothing to do with the sensible coastal management at specific locations (at which many differing rates and directions of sea-level change apply), the opinions of the cited organizations provide no useful information to the Gosford City Council in formulating coastal management policy.

10. Section 4.1 provides an explanation of the difference between a sea-level prediction (a best estimate of what value will occur at a particular future time) and a sea-level projection (a speculative computer-generated "what if" experiment of a possible future value for sea-level assuming the accuracy of the facts and scenario that are built into the governing model).

W&A acknowledge that their own prognostications as to possible sea-level are indeed speculative projections, and not predictions. They also acknowledge that ongoing future changes in climate and sea-level are often (over short periods) neither precisely known nor likely to be linear, thereby vitiating their own modelling the projections from which HAVE to be based on a set of assumptions as to what future changes will occur in temperature, ice volume and rate of industrial emissions of greenhouse gases – none of which are known with any certainty. As W&A rightly stress, "*The benchmark levels should not be treated as accurate predictions*".

Building on their belief in the lack of usefulness of traditional long-term linear models of sea-level change, they make the remark that "*A common and often repeated misconception is that … linear extrapolation of historical records is the valid approach to setting sea level rise benchmarks … It is not*."

Strange then that over the longer periods of time appropriate for coastal planning (many decades to a century or so), the rate of sea-level change does often approximate to a linear relationship. Which is precisely why such data have been used in the past as a guide to best practice coastal management (cf. Lange & Carter, 2014).

11. Section 4.2 provides a summary of the most recent climate change projections contained in the recent (2014) 5th Assessment Report (5AR) of the IPCC.

W&A repeat their earlier recommendation to NSW councils that the most extreme emissions scenario, RCP8.5, should be applied.

NIPCC (2014, Sections 3, 5) have provided a detailed criticism of W&A's reliance on IPCC science in general and this recommendation in particular, saying:

> ***IPCC's Representative Concentration Pathway of future greenhouse gas emissions. Model projections that are based upon this scenario, as are W&A's, are therefore exercises in speculation.***

12. In Section 4.3, regarding the application of their recommended benchmarks, W&A say:

> *There is ongoing confusion in communities and promulgated by some inaccurate media reports, that sea level rise benchmarks are definitive predictions of mean sea level in 2050 and 2100. Likewise, when translated to coastal hazard lines the community may believe that these represent a best prediction of the shoreline location at those times. Neither of these are true and indicate our failure in communicating the purpose and use of these tools for coastal management planning.*
>
> *More plausibly explained, they represent a statistically acceptable worst case that may occur at some locations (not at all locations simultaneously) and for some conditions (usually coincident with an event that would occur on average, about once every 100 years.).*

Indeed, but these comments, and the extensive citation of other similar benchmark numbers from up and down the NSW coast, do nothing to allay citizens' well-founded suspicions that the IPCC's presumed emissions' scenarios, and the deterministic computer models based upon them, are demonstrably inaccurate as compared with the MEASURED sea-level change on the NSW coast (see NIPCC, 2014, Section 7).

Yes, the matter is one of risk analysis, but the risk analysis presented by W&A is neither well founded nor scientifically defensible.

13. In section 4.4, W&A address a number of issues that they believe are being subjected to misinformation or misunderstanding.

The scientific issues that W&A allege to be affected in this way include:

- *The view that local tide gauge data, and its projection, should be given priority when estimating future sea-levels.*

  W&A believe, correctly, the computer modelling can *potentially* be used to modify future sea-level estimates so that full account is taken of theoretical anthropogenic effects, such as changing temperature, ice melt or ocean expansion. In principle, yes. The severe problem that arises in practice, though, is that when compared with tide gauge reality, the models that have incorporated such factors are now well proven to be wrong. Therefore, so are any sea-level benchmarks that are based on the same modelling.

  Contrary to W&A's view, extrapolation of tide gauge data is our most reliable guide as to the future of sea-level change at specific locations; and particularly so now that a roughly 50 year period has elapsed during which industrial carbon dioxide emissions were rising persistently yet produced no measurable increase in the rate sea-level rise as measured by NSW tide gauges.

- *The view that satellite altimeter measurement of sea-level is still an experimental technique, and therefore not suited to projecting future sea-levels*.

  In fact, and despite making extensive reference to satellite data in their various reports, W&A actually support this view, saying that "*we agree that the satellite data should not be used as the primary basis for making future [sea level] projections*".

- *The view that at some locations along the coast particular beaches, or estuaries, are "special" in some way (and therefore unlikely to be impacted by projected sea level rise).*

This first half of this sentence view is undeniably true in manifold ways, for factors such as sediment supply, subsidence or uplift, storminess and coastal infrastructure are all just as important as sea-level in determining the location and stability of any shoreline.

Nonetheless, I agree with W&A that all these factors also interact with sea-level as they exercise their influence on coastal morphology.

- *That consensus opinion (i.e., that of the IPCC) has no place in science.*

  W&A concede this point, but add that "*when making decisions that are defensible on behalf of the community, a consensus is entirely relevant*" [it is not clear whether the consensus that they refer to is envisaged to be a scientific or a community one, but I have presumed the latter].

  This is a difficult point. It is obvious that in a democracy, a consensus in favour of a particular view will normally carry the day irrespective of its absolute merits, scientific or otherwise.

  But science and engineering aren't like that. Rather, advice given in these areas must be based upon the best observational data and theoretical framework that are available, quite irrespective of whether a conclusion corresponds with scientific fashion or community consensus.

CONCLUSIONS

For more than 200 years, empirical bedrock for useful coastal management has been the documented records of tides, weather, nearshore oceanography (including wave climate), sediment supply and geological setting.

Using such data (and the Fort Denison tide gauge), the most likely rate of local relative sea-level rise along the NSW coast over the next 50 or 100 years is somewhat less than 5 or 10 cm, respectively (NIPCC, 2014, Table 3). These benchmark estimates should be used to inform coastal hazard mapping and management.

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