

INQUIRY INTO CLIMATE CHANGE AND ENVIRONMENTAL IMPACTS ON COASTAL COMMUNITIES

**Submission to the House of Representatives
Standing Committee on Climate Change, Water,
Environment and the Arts**

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**ENGINEERS
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1. Introduction

Engineers Australia is the peak body for engineering practitioners in Australia, representing all disciplines and branches of engineering. Membership is now approximately 83,000 Australia wide and Engineers Australia is the largest and most diverse professional engineering association in Australia. All Engineers Australia members are bound by a common commitment to promote engineering and to facilitate its practice for the common good.

Engineers have a vital role in all manner of projects that are critical to Australia's future. This includes adaptation to climate change as much as it does the large scale minerals developments which have dominated the Australian economy in recent years. Engineers Australia is aware of the pressures generated by the movement of Australians from cities to non-metropolitan coastal regions. While the attractions of these locations are self evident, the risks associated with climate change, though recognized, are only slowly being addressed. Contemporary weather events tend to be treated as extremes on the fringes of possibility when climate change projections indicate that current extremes may become more common and surpassed by greater worst cases.

While Australia has taken steps to develop a climate change adaptation framework and a new approach to Australian climate change mitigation policy is evident, Engineers Australia is concerned about the slow progress of adaptation. Research dominates the climate change policy landscape and for good reason. There are many issues where further information is required. However, action using what is known can proceed in parallel with research and it is here that Engineers Australia believes that the issues relevant to the Committee's deliberations on the impact of climate change on coastal communities should focus.

2. Climate Change and Coastal Regions

Climate change risks for Australian coastal communities were comprehensively set out in the Report of Working Group 2 of the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment¹. Key points made in the assessment were:

- Coastal communities with on-going development and population growth are very likely to have increased risk from sea-level rises, increases in severity of storms and coastal flooding.
- On-going development is very likely to exacerbate the risk.
- Since 1950 the sea level has risen by 70mm and it is projected to rise by up to 590 mm by the end of the century, although the projections are qualified and greater rises are considered likely (see below).
- Some 711,000 addresses were within 3 km of the coast and within 6m of sea level with high concentrations of addresses in Queensland and NSW.

¹ IPCC, Fourth Assessment Report, Working Group 2 Report, "Impacts, Adaptation and Vulnerability," November 2007, www.ipcc.ch particularly Chapters 6 and 11.

- The risk is not confined to new or growing coastal communities but includes locations within major cities, for example modeling has shown that by 2050 the combined impact of a 200 mm rise in sea level and a 50 year storm event could cause coastal recession over 110m causing losses of \$US184 million at Sydney's Collaroy/Narrabeen beach.
- There are particular risks for the Great Barrier Reef (60% of the reef regularly bleached by 2020 increasing to 90% by 2050) and the communities whose economic livelihood depends on reef related activities. Reef related tourism is valued at over \$5 billion providing full time equivalent employment for 63,000 people.
- The IPCC warns that uncertainties about the melting rates of land based ice sheets and glaciers mean that the upper values of projected sea level rises should not be considered to be upper bounds and that impact analyses should take into account even higher rises.
- While individual climate impacts in themselves pose risks it is the coincidence of two or more factors (for example, sea level rise, combined with a strong storm surge at high tide) which pose the greatest risks.

The trend for Australians to live in coastal communities, particularly non-metropolitan communities has been highlighted by the National Sea Change Taskforce² which argues that there was an increase of one million people living in non-metropolitan coastal areas in the decade to 2006. Now some 5.9 million Australians live in these communities, growing by 9.8% compared to 6.1% nationally³. The Taskforce, comprised of representatives of 60 local government bodies, has proposed an integrated policy framework embracing the three spheres of government to deal with the pressures of growth. Second in the list of eight elements to be addressed is climate change risk analysis and adaptation response.

3. Engineers Australia's Expertise and Interest in Coastal Analyses

Engineers Australia is organized along geographic and technical lines. Engineers Australia's expertise in analyses of coastal issues resides with the National Committee on Coastal and Ocean Engineering (NCCOE) which represents over 3,000 Engineers Australia members with interests in ocean and coastal engineering. Members encompass private sector organizations, research institutions and government organizations.

The NCCOE contributes to matters relating to the Committee's review in several ways. First, through the work of individual members engaged on specific coastal and ocean engineering projects. Second, through participation on government expert advisory groups. The current Chair of the NCCOE is a member of the Department of Climate Change's Expert Advisory Group on Australia's Coastal Vulnerability. The NCCOE is also represented on high level users meetings to develop a nationally co-coordinated digital elevation model (DEM) and a national elevation data framework. Third, through the production of technical material, notably the "Guidelines for

² www.seachangetaskforce.org.au

³ National Sea Change Taskforce, A Policy Framework for Coastal Australia, July 2007, Foreword, www.seachangetaskforce.org.au

responding to the effects of climate change on coastal and ocean engineering". Current guidelines were produced in 2004 and are presently under revision in the light of the IPCC's Fourth Assessment Report.

Engineers Australia is disappointed to note that the Advisory Group on Australia's Coastal Vulnerability to Climate Change has only met once as has its specialist sub-group on inundation. Remarks which follow highlight the importance of this work and why it should be accorded much higher priority.

4. What Should Coastal Development Policies be based on?

Engineers Australia strongly supports evidence based policies. Accordingly, Engineers Australia is very supportive of the research efforts underway to narrow down the range of climate change projections and to produce improved regional estimates for such projections. However, Engineers Australia is concerned that the time required for the completion of research is delaying the commencement of adaptation work unnecessarily. There is no reason why preparatory work, not dependent on this research, cannot be expedited now. Engineers Australia believes that greater priority should be given to an approach involving parallel work streams to avoid unnecessary delay.

Central to this approach is more rapid development of a tool to quantify the impacts of sea level rises on coastal foreshores using a high resolution coastal digital elevation model, including bathymetry. (A bathymetric chart shows the ocean and coastal floor relief or terrain as contour lines). This basic information is essential to estimating a range of parameters relating to the assessment of climate change impacts to ensure that local development planning has a defensible and credible scientific and engineering basis, for example, information on the inland penetration of storm surges at different stages of the tidal cycle. While individual climate related events will have consequences for planning, the greatest consequences arise from coincident impacts of two or more climate related events. Without useful data vulnerability assessments are problematic.

The NCCOE has participated in a number of workshops on the National Elevation Data Framework co-coordinated by the Spatial Information Council of Australia and New Zealand (known as ANZLIC from its former name of the Australian and New Zealand Land Information Council). The objective of this Framework is to establish the necessary data sets to quantify climate change sea level impacts.

There are two reasons why this work is important. First, the IPCC now believes that sea level rises are likely to be towards the upper values of its previous estimates because of uncertainty about the impact of melting land and sea ice on sea levels. If sea level rises are likely to be higher than previously thought, there is greater urgency to taking practical adaptation steps. Second, there are already practical concerns emanating from pressures on authorities, concerned about possible climate change related damage, from the pace of coastal development. For example, the South Australian Coast Protection Board has convened a Sea Level Rise Advisory Committee including climate change and sea level scientists, coastal engineers and managers to review its long standing sea level rise policy and adaptation measures. Ad hoc reactions of this nature are becoming more common and risk inconsistent and inappropriate responses unless anchored by consistent information and approaches.

Engineers Australia has supported and continues to support the broad direction of the framework and has provided technical comments to ANZLIC to assist its development. While this contribution will continue there are several more general views that are relevant to the Committee's Inquiry.

- ANZLIC documents provide a comprehensive overview of the National Elevation Data Framework with suitable prioritization of the coastal components. The documents outline (in Section 5.7.3 of the Business Case) a 'collect once, use many times' principle which warrants qualification in the context of climate impacts on the coast. The reason is that a single data collection will not capture significant changes to coasts caused by sea level rises. These changes will accelerate with the extent of the rise and active areas will need to be resurveyed periodically with the first survey treated as a baseline data collection.
- Engineers Australia is concerned about the rate of progress on the National Elevation Data Framework. There is a pressing need for detailed digital modeling of the near-shore marine areas and the on-shore areas to facilitate modeling of climate change impacts. Besides the South Australia example other government agencies, at all levels, are being pressured for information about sea levels and the digital elevation model from the framework is an essential ingredient. Slow progress means this information is not available and creates the risk that State and local governments go their own way to satisfy community expectations. Not only will this increase the difficulty in achieving a consistent national approach, but there will be a loss of economies of scale resulting in higher costs to the community. As previously mentioned there are already signs of independent and inconsistent approaches responding to the pressures of coastal development.
- Engineers Australia has concerns about data quality. On-shore data is from Spot5 satellite sources purchased by the Commonwealth Government. This data has low resolution and is of limited value for coastal management. Near-shore bathymetry (contour lines out to 30m depth from the shore) has not been addressed. In most areas sparse naval survey data is used. NSW and Victoria are endeavoring to address the lack of data through opportunistic and fragmented Laser Airborne Depth Sounders (LADS) surveys. LADS surveys are undertaken by a single modified Fokker F27 aircraft operated by the Australian Navy primarily to prepare hydrographic maps. The absence of national data co-ordination poses risks for the aims of the COAG National Climate Change Adaptation Framework by undermining its objective of coordinated national action.
- The Science Case for the National Elevations Data Framework argued that "Implementation of a National Digital Elevation Model constitutes a major engineering challenge rather than an initiative possessing significant scientific risk"⁴. This, however, is not reflected in governance arrangements which need to be enhanced to provide for greater scope for regular participation by technical users. At a time of severe engineering skills shortage Engineers Australia believes that targeted action, as well as more research is needed in this case and is willing to facilitate participation of its members possessing the necessary technical expertise in governance arrangements with the aim of expediting progress.

⁴ ANZLIC, National Elevation Data Framework, Science Case, 20 February 2008, www.anzlic.org.au ,p7

Projections for future climate changes depend on benchmark assumptions made by those undertaking the projections. Although there has been a profound change in attitude towards climate change policies in government, there continues to be uncertainty about the most appropriate benchmark assumptions to use when making projections. At present, State governments and some local governments are preparing their own best estimates for planning purposes. The variations between them leads to inconsistent outcomes and results in different development and building constraints across jurisdictions. This unstable basis for planning needs to change. Engineers Australia recognizes that the requirements of an international agreement on climate change mitigation may take some time and may require the Commonwealth government to adopt a negotiating approach to emission reduction targets and the assumptions that underpin future projections. However, climate change adaptation can only proceed on a nationally consistent basis if nationally consistent, practical benchmark assumptions and projections are made available by the Commonwealth, adequately accounting for regional variations, even if on an interim basis.

5. Mechanisms to Promote Sustainable Coastal Communities

Much of the focus of climate change continues to be on research. However, Engineers Australia believes that more progress on climate change adaptation, particularly in regard to coastal matters, could be achieved by adding pressing ahead with parallel action and research programs as described above.

Several jurisdictions already have policies which allow for the impact of sea level rise on coastal development and infrastructure. Engineers Australia believes these policies need to be informed and updated by quantitative engineering assessments in the light of climate change projections and if necessary, planning and development policies need to be revised. Where such policies are not in place jurisdictions will need to address this omission with some urgency.

Clearly the benefit of this approach will be to minimize new developments that would be subject to coastal climate hazards in the foreseeable future. However, it will also provide benchmarks for evaluating climate change consequences for established settlements. Considerable capital investment resides in many of these communities and considerable more investment will be needed in the future. In many cases it will be cost effective to protect existing settlements against flooding, erosion and other hazards caused by rising groundwater and storm water disposal problems created by rising sea levels. Action necessary will include revision of building codes and design parameter, as well as physical works.

Climate change is predicted to result in heavier rainfall events which will result in significantly higher storm water run off than in the past. Coincidence of these with higher sea levels with inevitable tidal complications illustrates one of the less complicated climate change impacts that may occur. Engineers Australia is already in the process of updating the publication "Australian Rainfall and Runoff" which is produced by the National Committee on Water Engineering. "Rainfall and Runoff provides practicing engineers with methodologies to calculate the extent of runoff in different geographic circumstances under different rainfall conditions. Negotiations are in train with the Department of Climate Change and the Bureau of Meteorology in respect of financial assistance to expedite this work.

Unfortunately, in some situations policies to protect existing settlements are unlikely to be successful and/or cost effective. Adjustment will be difficult and costly for all concerned. Revised development policies which adequately take climate change impacts into account can inform the adjustment process and help minimize capital losses and misdirecting new investment to lost causes.

6. Governance and Institutional Arrangements

One of the key objectives of the Sea Change Taskforce is to press for the establishment of an integrated planning model covering coastal management and protection, land use planning and development other facets of coastal economic and social importance. The case is being made for arrangements that bring together the interests of Commonwealth, State and Territory and local governments. The present model for coastal planning and development has key responsibilities residing at State and Territory government with a range of responsibilities undertaken at local government level. The success of these arrangements varies across jurisdictions.

Engineers Australia does not wish to express a view on which approach is preferable. However, Engineers Australia does wish to draw attention to the implications of the severe engineering skills shortage for the two alternatives and to suggest a way forward.

Over the past two decades Government agencies at all levels have experienced organizational stream-lining processes motivated by corporatisation, in line with competition policies, or by the need for budget stringency. A consequence has been the depletion of engineering resources, particularly coastal engineers. These skills are now found predominantly in the private sector and in universities, although some skilled engineers have been retained in government agencies. This issue is critically important because many climate change adaptations necessary in coastal communities are highly dependent on engineering skills.

Engineers Australia has strenuously argued in other forums that Australia must address its engineering skills shortage through policies directed at Australian students. Skilled migration is an acceptable short term answer because of the gestation period needed for education sector responses. However, in the medium to long term, there are severe risks associated with skilled migration because many countries are also experiencing engineering shortages and Australia's current success in attracting skilled migrants may not continue.

Engineers Australia believes that these circumstances indicate the importance of ensuring that planning and development mechanism which are to address climate change adaptation maximise the scope for engineering input from the outset. By including engineering representatives in governance arrangements, either for existing or new planning and development models, necessary higher level input can work to ensure necessary data are produced and that actions to develop adaptation strategies proceed in parallel with continuing and essential research.

7. Infrastructure Issues

The central thrust of the Sea Change Taskforce is addressing a perceived infrastructure shortfall in non-metropolitan coastal settlements. The issues addressed in this submission are vitally important for infrastructure development. A recent assessment of climate change risks for Victorian

infrastructure⁵ pointed out that most common infrastructure forms such as buildings and structures, urban facilities, sewer, storm water, electricity, communications and roads would experience a definite risk due to climatic events such as increased rainfall intensity, increased intensity and frequency of storms, increases in wind speed and sea level rises. It is vital that government responses to demands for new infrastructure development be founded on modern sustainable methodologies which take into account climate adaptation and climate mitigation issues.

Infrastructure climate related risks will need to be dealt with in respect of existing infrastructure assets and in respect of assets yet to be built. The Victorian Report says “the modeling underpinning this report makes it clear that climate change presents a number of risks that courts would consider to be reasonably foreseeable. As a consequence, all involved in the development, ownership and management of infrastructure face the prospect of liability for negligence in the event losses are suffered because of a failure to properly address these risks.”⁶ In other words, risks are relatively well known and action is necessary to deal with them. These actions begin with the matters addressed in this submission.

Adaptation responses will, of course, vary and will depend on the risk exposure for the infrastructure asset concerned. Furthermore, adaptation responses will need to be prospective rather than reactive. Responses will need to consider:

- Changes in materials selected for infrastructure assets
- Changes in design standards to accommodate more extreme weather events
- Changes in maintenance regimes to ensure that asset integrity is not degraded by climatic conditions
- Changes in technology
- Changes in culture across a range of stakeholders
- Changes in planning arrangements

Engineers have a central role to play in the majority of these factors. The change agenda ahead is extensive and involves many fundamental changes to how commonplace issues are now dealt with. Engineers Australia urges the Committee to inject a sense of urgency and the importance of complementing much needed research with action on those issues where this is possible.

⁵ CSIRO, Maunsell Australia Pty Ltd and Phillips Fox, Infrastructure and Climate Change Risk Assessment for Victoria, Report to the Victorian Government, March 2007, www.greenhouse.vic.gov.au

⁶ CSIRO et al, op cit, p2