Department for Planning and Infrastructure
Government of Western Australia

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The Secretary
Standing Committee on Climate Change, Water, Environment and the Arts
House of Representatives
Parliament House
PO Box 6021
CANBERRA ACT 2006

Dear Secretary

INQUIRY INTO CLIMATE CHANGE AND ENVIRONMENTAL IMPACTS ON COASTAL COMMUNITIES

Committee Chair, Ms Jennie George MP, wrote to the Premier of Western Australia, Hon Alan Carpenter MLA, on 2 April 2008 advising of the above inquiry and inviting a submission. This was in turn forwarded to the Minister for the Environment; Climate Change and subsequently to the Minister for Planning and Infrastructure, Hon Alannah MacTiernan MLA on 18 May 2008. Minister MacTiernan has asked me to thank you for this opportunity and to respond on her behalf. Please note that Dr Kate Sullivan, Inquiry Secretary, approved an extension to 17 June.

Please find enclosed the Department for Planning and Infrastructure's (DPI) submission. It has been prepared by DPI's Environment and Sustainability and New Coastal Assets areas in partnership with the Department of Environment and Conservation's (DEC) Office of Climate Change and with input from DEC's Marine Policy and Planning Branch, and the Department of Industry and Resources, Strategic Policy Division.

The need to prepare ourselves for, mitigate and adapt to the impacts of climate change on coastal environments and communities is a critical challenge for all three levels of government that must be faced immediately, cooperatively and in partnership. This inquiry and a clear framework in which to move forward are vital. Hence, our submission provides information on what is being done in Western Australia and calls for national leadership through an arrangement that respects and enhances individual jurisdictional roles and responsibilities empowered and guided by a cooperatively designed strategic framework for policy and action.

The Department for Planning and Infrastructure looks forward to being informed of the inquiry's progress and encourages the Standing Committee to utilise an intergovernmental process to assist and enhance the implementation of its findings.

Yours sincerely

Eric Lumsden PSM
Director General
20 / 6 / 2008

Department for Planning and Infrastructure (Western Australia)

Submission to

Parliament of Australia
House of Representatives
Standing Committee on Climate Change, Water, Environment and the Arts

Inquiry into climate change and environmental impacts on coastal communities

19 June 2008

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1 Introduction

On Thursday 20 March 2008 the Commonwealth Minister for the Environment, Heritage and the Arts, The Hon Peter Garrett MP and the Minister for Climate Change and Water, Senator the Hon Penny Wong, asked the House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts Committee to inquire into and report on climate change and environmental impacts on coastal communities.

The terms of reference provide for the Committee to inquire into climate change and environmental pressures experienced by Australian coastal areas, with particular regard to:

1. Existing policies and programs related to coastal zone management, taking in the catchment-coast-ocean continuum.
2. The environmental impacts of coastal population growth and mechanisms to promote sustainable use of coastal resources.
3. The impact of climate change on coastal areas and strategies to deal with climate change adaptation, particularly in response to projected sea level rise.
4. Mechanisms to promote sustainable coastal communities.
5. Governance and institutional arrangements for the coastal zone.

The Committee has invited submissions addressing the terms of reference.

The Western Australian Department for Planning and Infrastructure (DPI) has prepared this submission in partnership with the Office of Climate Change (OCC), Department of Environment and Conservation (DEC). Content has also been provided by DEC's Marine Policy and Planning Branch, and the Department of Industry and Resources, Strategic Policy Division. Coastal Zone Management Pty Ltd, including specialist input from Damara WA, was contracted to provide support in the development of response to the third term of reference.

The issues covered by the Committee's terms of reference are important and complicated. They are relevant to a number of stakeholders and Ministerial portfolio areas. This submission is specifically from the perspective of coastal land use and infrastructure policy and planning.

2 Summary

The potential impacts of climate change on coastal communities are of particular importance to Western Australia because of the length of our coastline and the concentration of development in coastal towns and cities.

This submission outlines a number of Western Australian State policies, strategies and other initiatives that seek to guide and manage coastal development both to protect the fragile coastal environment and to ensure that development is not subject to unacceptable risk through coastal processes, including those associated with climate change.

We wish to draw particular attention to the following issues on which national leadership is needed:

1. *Data required for assessment and management of climate-change-related risk to coastal development* – Data collection and coastal vulnerability assessment has to date been somewhat piecemeal and inconsistent, such that an integrated picture is not available. Studies at a global scale may have limited application at a local scale. A well-resourced, nationally coordinated, rigorous approach to the collection and analysis of data, particularly spatial data, to underpin decision-making is essential. This is unlikely to be achieved effectively through fragmented, uncoordinated small-scale projects undertaken by diverse local governments, and the Commonwealth is urged to enter into partnership with State governments to undertake this work on a regional basis, with agreed priorities and areas of focus. While a distributed approach can work well, some central coordination is necessary.

2. *Long-term risk-based approach to coastal development decision-making* – There is still some uncertainty about the likely impacts of climate change on coastal areas. Methodologies developed overseas and even in eastern Australia are not necessarily appropriate for assessing risk in Western Australia. There is considerable existing coastal development, and ongoing developmental pressure on the coast, especially in metropolitan areas. Without downplaying the likely long-term risks of climate change, some guidance is needed from planning bodies on balancing the risk of climate change impacts against the community and economic costs of restricting coastal development. A temporal approach to risk management may be feasible, with development approval given on the basis of a finite timeframe, beyond which the risk of climate change related impacts will escalate. Commonwealth leadership in developing a risk management framework that deals with both short- and long-term impacts would be valuable.

The Western Australian State Government is committed to supporting a national approach to identifying climate change vulnerability and initiating measures to manage the risks to coastal communities, and looks forward to working with all Australian governments to this end.

3 Existing policies and programs related to coastal zone management, taking in the catchment-coast-ocean continuum

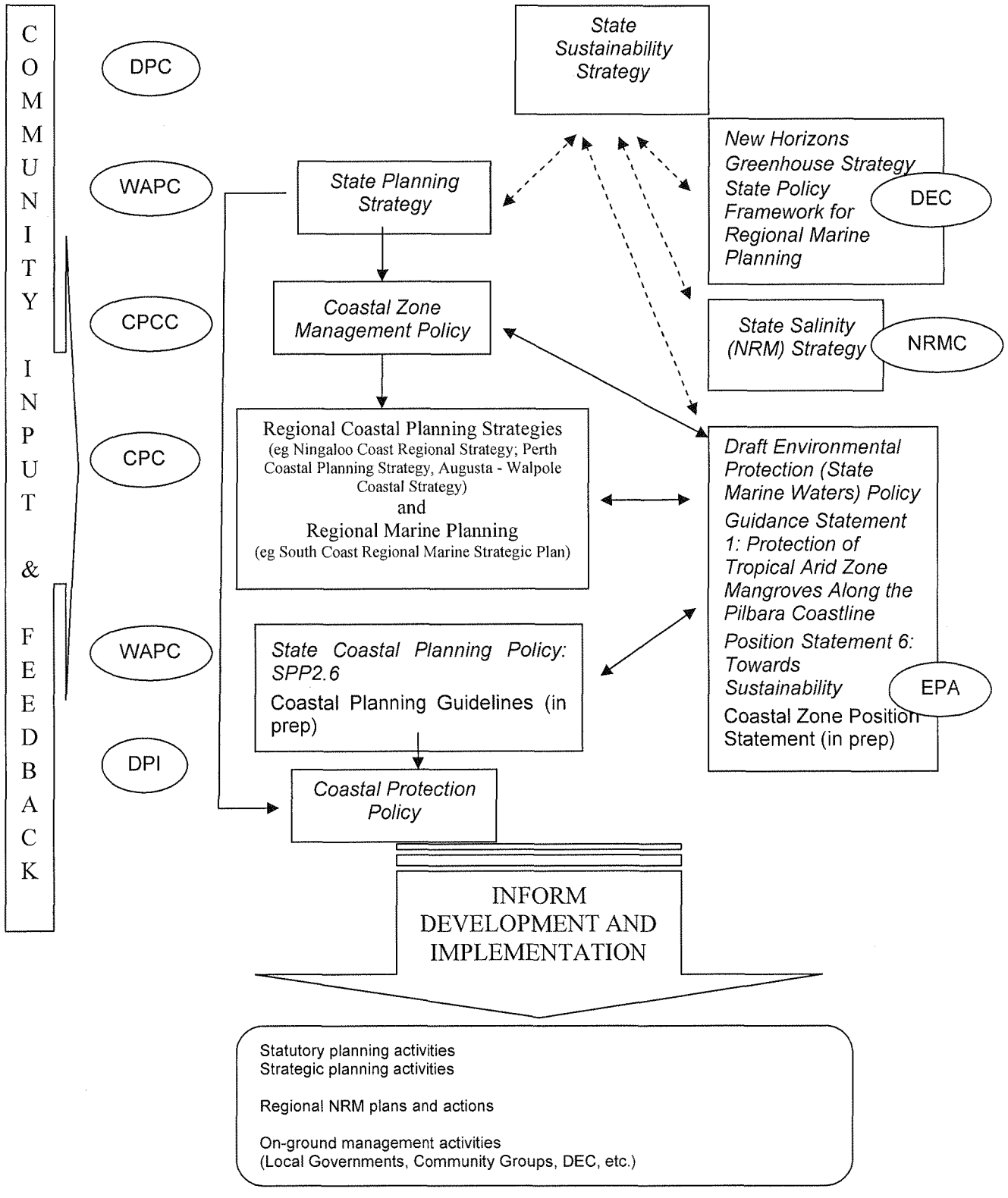
The integrated framework for coastal planning and management policy and programs in Western Australia is described in *Coasts WA: Better integration* (DPI April 2003). This program of action was developed by the Western Australian Government in response to a Ministerial Taskforce review of the structural arrangements for coastal planning and management (DPI June 2002). Copies of these two key documents are provided with this submission for consideration (see Attachments A and B). In reading these documents, a number of key changes since 2003 must be taken into account:

- organisation of government agencies in WA (creation of Department of Environment and Conservation [a merger of the former Department of Environmental Protection, the former Department of Conservation and Land Management, and sections of the former Water and Rivers Commission and the Department of the Premier and Cabinet]; the Department of Water; and the Department of Industry and Resources [a merger of the former Department of Mineral and Petroleum Resources and the Department of Industry and Technology and sections of the Department of the Premier and Cabinet]);
- streamlining of planning legislation into the *Planning and Development Act 2005*;
- gazettal of the State Planning Policy No.2.6: State Coastal Planning Policy (June 2003) and Amendment No. 1 (December 2006);
- establishment of the Coastal Planning and Coordination Council (*Western Australian Planning Commission Amendment Act 2003*).

Figure 1 on page 4 summarises the key elements of WA's policy specifically relating to the coastal zone.

Who is responsible for what in coastal management and planning in WA is described in detail in Chapter 2 of the *Report of the Ministerial Taskforce* (June 2002) (Attachment B). The improved integrated framework is described in *Coasts WA: Better integration* (Attachment A pages 5-9 and 15-20). Generally, the key WA programs related to coastal zone planning and management are contained within the functions for the Department for Planning and Infrastructure (DPI), the Department of Conservation and Environment (DEC) and the Department of Fisheries.

Figure 1: WA STATE COASTAL ZONE KEY POLICY ELEMENTS



CPCC = Coastal Planning and Coordination Council

DEC = Dept of Environment and Conservation (includes the Office of Climate Change)

DPC = Dept of the Premier and Cabinet

NRMC = Natural Resource Management Council

EPA = Environmental Protection Authority

DPI = Dept for Planning and Infrastructure

WAPC = WA Planning Commission

The DPI provides a very wide range of programs relating to the coastal zone from maritime transport to land use planning, information and research, and urban policy and innovation. Listed below are programs dealing specifically with the coastal zone.

- Environment and Sustainability programs include:

  Coastal planning – biannual audit; regional coastal planning strategies; coastal management plan assistance program; coastal planning policy development and implementation.

- Coastal Infrastructure programs include:

  Coastal engineering services including setback assessments for protection from coastal processes; planning for and development of new coastal assets; management of coastal facilities; cyclone contingency plans; collection of maritime data and cartography.

- Marine Safety programs include:

  Tide and wave information; marine environmental protection.

- Ningaloo Sustainable Development Office.

The DEC coastal zone programs range from conservation estate (terrestrial and marine) planning and management to the establishment of environmental protection policies, and environmental impact assessment of development, subdivision and scheme amendment proposals. DEC programs dealing specifically with the coastal zone are:

- Marine Policy and Planning (marine reserves and regional marine planning)
- Marine Ecosystems (EIA advice to the EPA)
- Marine Science

The DEC also hosts the WA Office of Climate Change.

4 The environmental impacts of coastal population growth and mechanisms to promote sustainable use of coastal resources

Western Australia's Environmental Protection Authority released its latest *State of the Environment* report in 2007. The report recognises two fundamental pressures on WA's environment: population and consumption, and climate change. One of the key themes examined is the impact of human settlements. The *State of the Environment* report concludes that "some WA settlements are growing at an unsustainable pace".

State of the Environment 2007 includes suggested responses to each of the pressures and themes examined. A fundamental component in these responses is the need to continue to implement the *State Sustainability Strategy* (2003) and undertake a review of progress after five years. Suggested responses (directly pertinent to promoting sustainable use of coastal resources) that are being progressed include:

- building on the Indian Ocean Climate Initiative;
- developing a risk based policy framework for planning and development decisions;
- updating of the WA Greenhouse Strategy;
- implementing the Network City Strategy for Perth and Peel;
- undertaking of comprehensive environmental planning and assessment at all levels in the planning process;
- ensuring that all new sub-divisions and redevelopment areas are designed and developed according to sustainability principles for resource efficiency and minimal environmental impact according to best practice;
- implementing State Planning Policy No.3: Urban Growth Settlement; and
- developing strategies to assist local governments in implementing sustainable tourism planning through their local plans.

In *Hope for the future: The Western Australian State Sustainability Strategy* (September 2003), sustainability is defined as meeting the needs of current and future generations through an integration of environmental protection, social advancement, and economic prosperity. The foundation principles include four that are of particular importance to promoting the sustainable use of coastal resources, and these are the need for biodiversity and ecological integrity, settlement efficiency and quality of life, common good from planning, and net benefit from development. Accompanying these are process principles including integration of the triple bottom line and precaution.

The State Sustainability Strategy proposes six sustainability goals as priority areas for action, which comprise the State's mechanism to promote and achieve sustainability. The use of regional planning and State Planning Policies are key processes for implementing the Sustainability Strategy.

The Western Australian State Government commissioned Michael Keating to review approvals processes in 2002 (Keating Review). This review recommended a sustainability assessment that addresses industrial sites and associated infrastructure

corridors. It was recommended that this be undertaken by project proponents and submitted with development applications. The addition of climate change risk considerations fits well with sustainability assessment and provides a more holistic mechanism to ensure best practice and an ongoing review cycle for coastal zone management.

As climate change impacts and resource use can have cumulative impacts, the sustainable use of coastal resources should also include not just industry and infrastructure, but also subdivisions. This should ensure that government policies are being addressed in terms of climate change adaptation and mitigation and that private and government capital are spent wisely in terms of return on investment for proponents and future land holders.

Sustainability assessment and/or planning should question the location of development in the first place, and determine if private or government infrastructure is best placed within a particular coastal location, and the type or form of development best suited to a particular site.

5 Impact of climate change on coastal areas and strategies to deal with climate change adaptation, particularly in response to sea level rise

Western Australia has a long history of recognising the effects of climate variability, with recognition of extreme events, including floods and droughts, storms and cyclones, extending well before European settlement. Since 1829, considerable effort has been made to monitor the coastal and atmospheric climate to provide long records suitable for identifying climate trends and cycles. Evaluations of Western Australian stratigraphic records and geomorphic features were seminal in the identification of sea level cycles and trends worldwide.

Western Australia has provided ongoing contributions to the science of climate change at local, State, Federal and international levels through local governments, the WA State Government, tertiary research institutions and private industry groups, particularly those associated with the energy industry. The WA State Government has actively partnered the majority of assessments.

Vulnerability assessment for climate change impacts requires an understanding of:

- climate change science;
- processes by which change will occur on the coast;
- local climate variability and ongoing dynamics, including those unrelated to climate change;
- habitats, flora, fauna and human activities affected by change;
- sensitivity of these biophysical components to change; and
- capacity for adaptation, including active management.

Therefore, the knowledge base for an understanding of coastal climate change impacts is not limited to those studies specifically targeted at climate change vulnerability assessment.

5.1 Current state of knowledge of the impacts of climate change on the Western Australian coast

The State Government performs a number of roles related to coastal and marine management, primarily involving the Department of Environment and Conservation, the Department for Planning and Infrastructure, the Department of Industry and Resources and the Department of Fisheries. These agencies provide data collection and collation, management of State government facilities, including Crown Land and Marine Reserves, funding of coastal management grant schemes and regulatory review of coastal development.

The State Government's knowledge of the potential impacts of climate change particular to the Western Australian coast is made up of:

- a number of local-scale coastal vulnerability assessments;
- detailed scientific and technical assessments developed through collaboration with research agencies, generally for regional sections of the coast, or specific impacts;
- overall climate risk assessments, not necessarily focused on climate change or coastal impacts;
- regional assessments of coastal habitats, marine biodiversity and faunal stocks;
- individual scientific studies and assessments made as a result of the State's requirement for climate change and sea-level rise to be factored into coastal development approval decisions, recognising that the majority of these assessments are determined using simplified criteria; and
- information gained through technical investigations for coastal engineering works and coastal planning strategies and plans.

Focus is required on physical impacts on the coastline, particularly related to sea level rise. However, there is a range of impacts brought about through biological sources or human activities. These include potential changes to shell sand production and distribution, or construction of coastal defences.

No comprehensive statewide assessment of the impacts of climate change on the coast has been undertaken or is presently planned by the State Government. What is known from the coastal vulnerability assessments undertaken to date is that there is the potential for significant coastal impacts in parts of Western Australia, although the magnitude, timing and relative impacts between sections of coast remains far from clear.

Western Australia recognised from a very early stage the potential implications of climate change-induced sea level rise for the management of its diverse and valuable coast. Initial assessment focused on evaluation of local dynamics, such as vertical land motions, to provide regional and local application of projected changes. Regional climate impacts were generally examined at a national level, following on from previous weather risk studies.

The first climate change coastal vulnerability assessment of the Australian mainland was undertaken in Geographe Bay in 1992. Aimed at testing a method proposed by the International Panel Climate Change (IPCC), it found that the method was not appropriate for Australian circumstances and contributed to framing the international debate on the issues. The project was supported by State and Federal governments.

Western Australia's interest in this important issue continued with Western Australia's active participation in the Australian Coastal Vulnerability Assessment Project (1996) undertaken during the mid 1990s. The Western Australian case study analysed the Perth metropolitan coastline, strongly linked to urban planning requirements. Further impact assessment was part of the Perth Coastal Planning Strategy (2007), using the framework of State planning guidelines.

Investigations of possible impacts of sea level rise through the Perth Cities Project (2005) have had limited use by the State Government, as the modelling used was not validated.

Several significant environmental studies in Western Australia have considered the impacts of climate change on a regional scale, including the Indian Ocean Climate Initiative (2002), *North West Shelf Joint Environmental Management Study* (2007), Marine Futures Project (from 2006) and Ningaloo Research Program (from 2006). However, these projects have not examined specifically the aspect of sea level rise or corresponding potential future coastal change.

Woodside and the University of Oklahoma have undertaken a significant climate modelling exercise to identify the impacts of climate change on weather systems through the North Australian Climate Change Study (2007). Discussion is presently underway between Woodside and the Western Australian Government to determine the relevance and value of this extensive model data set for application to ongoing coastal management.

The Australian Coastal Vulnerability Assessment (2008) is presently underway, which is intended to provide a first-pass national coastal vulnerability assessment. The Western Australian Government, through DEC, has been providing technical support with the derivation of 'smart-line' classification of the Western Australian coast. Data for a national Digital Elevation Model are being provided from a range of State government agencies through the WALIS Marine Community. A case study for the Northwest Shelf has recently been tendered for quotations by the Department of Climate Change, with support from DPI and DOIR.

Local scale studies of climate risk assessment, including the effects of sea level rise, have recently been conducted at various strategic levels for the City of Rockingham, Shire of Roebourne, Swan River, Town of Cottesloe and Shire of Busselton. It is recognised that many local studies were commissioned by local governments and NRM agencies and this list is far from exhaustive. The standard of assessment and focus of reporting is highly variable given that there are currently no specific guidelines, standards or manuals to assist local governments to undertake such analyses.

Studies of coastal impacts at an Australian regional level have been strongly linked to the Intergovernmental Panel on Climate Change, with significant contributions from CSIRO. The National Climate Change Adaptation Research Facility has included Western Australian representation.

5.2 Existing Western Australian research activities, programs and policies directly addressing the impact of climate change on the coast

5.2.1 Overarching Climate Change Policy and Research Context

The overall policy approach of the State Government is contained in the Premier's Climate Change Statement released in May 2007. The Premier's Statement contains a number of policy, legislative and governance initiatives covering all aspects of climate change from Greenhouse Gas emission reduction through to adaptation initiatives.

Two of the major initiatives address climate change adaptation generally, namely:

- Major Initiative 8: Adapting to the impacts of climate change
- Major Initiative 28: Understanding future climate-related risks and opportunities

Each is discussed in turn below.

Major Initiative 8: Adapting to the impacts of climate change

The State Government will invest $8.625 million over five years to help Western Australia's industries, people and environment adapt to the unavoidable impacts of climate change. As part of this initiative, research on the impacts of climate change will be boosted with a $4 million investment into the successful Indian Ocean Climate Initiative (IOCI), an innovative partnership between the State Government, the CSIRO and the Australian Bureau of Meteorology. This investment will provide better projections of regional weather into the future to allow people and businesses, as well as State government agencies, to plan and adapt to a changing climate.

The finalisation of the State Government's investment in IOCI Stage 3 is imminent. Stage 3 is to examine climate variability, climate change and inter-seasonal forecasting in Western Australia, particularly focussing on the north-west region of the State. Climate change scenarios for the north-west and south-west will be provided at a range of spatial and temporal resolutions for 2030 and beyond. IOCI Stage 3 will investigate factors affecting climate conditions in north-west WA, including the potential for particulates from climate change induced vegetation burning to contribute to changes to rainfall patterns, tropical cyclone formation, sea surface temperature and air quality. The funding of Stage 3 demonstrates the ongoing success of a collaborative research approach initiated under IOCI Stage 1 in January 1998.

Building on the collaborative research model developed by IOCI, the Western Australian Marine Science Institution (WAMSI) aims to provide a better scientific understanding of the marine environment for the people of the State of Western Australia. The thirteen WAMSI core parties include Commonwealth and Western Australian State government research organisations, including the Bureau of Meteorology, CSIRO and AIMS, Western Australian universities and the private sector. Two of the six WAMSI Research Nodes have important climate change components:

- Climate Processes, Predictability and Impacts in a warming Indian Ocean (Node 2)
- Ocean Science for Offshore and Coastal Engineering (Node 6)

For example, WAMSI Node 6.1 is entitled *Climate Change and the Coastal Environment* and aims to assess the effects of climate change on wave climate, storm surge and sea level, and hence quantify impact and stability along the WA coast. The WA Government actively provides support for WAMSI Node 6.1, including provision of historical data sets and ongoing monitoring.

WAMSI has recently initiated the development of the Western Australian Integrated Marine Observation System, which will provide regional coverage of coastal conditions from Fremantle to Jurien.

Ongoing monitoring of shoreline change at selected locations is regularly undertaken by DPI as part of the coastal protection program. Collection of baseline coastal data, including waves and water levels, is undertaken to support the coastal protection program. Some of this data is shared with national research programs through the Bureau of Meteorology.

Major Initiative 28: Understanding future climate-related risks and opportunities

The State Government plans to develop a risk management strategy to manage the effects of climate change on State government services and the Western Australian economy. To meet this initiative, the State is finalising a tender to undertake the required risk assessment with a view to identifying priority areas followed by high resolution risk assessments and the development of management plans.

In addition, Western Australia is pleased that Murdoch University will become an active partner in the National Climate Change Adaptation Research Facility (NCCARF). It is hoped that the involvement of a Western Australian institution in the NCCARF will ensure that a national approach is taken that includes a significant component of research relevant to this State. The NCCARF, in collaboration with the jurisdictions, has an important role to play in identifying adaptation action priorities and conducting required research as identified through the COAG adaptation sub group.

5.2.2 Coastal Policy Context

The State Planning Policy No. 2.6: State Coastal Planning Policy (2003) (SPP 2.6) is the primary policy mechanism for the consideration of potential climate change impacts for new land developments. The key objective of the policy is to ensure that the location of coastal facilities and development takes into account coastal processes including erosion, accretion, storm surge, tides, wave conditions, sea level change and biophysical criteria. To achieve this objective, SPP 2.6 relies on the use of:

- measures to guide regional and local coastal planning;
- encouragement of development of strategic coastal plans prior to development of an area; and
- development setback guidelines.

SPP 2.6 includes specific physical processes setback factors, for new developments, one of which includes the sea level change factor drawn from the IPCC Third Assessment Report (2001) 'median' assessment of 0.38 m mean sea-level rise by 2100. The pro-active policy has been actively implemented by State planning authorities with the support of local governments.

Importantly, strategic assessments of the application of the physical processes setback factors to the Perth metropolitan area were undertaken by the Department for Planning and Infrastructure as part of preparing the Perth Coastal Planning Strategy in 2006. This work was undertaken to provide a framework for assessment and to highlight areas of the coast where current development may be in need of additional study or management actions due to possible climate change impacts on coastal process trends in the future. Although deliberately constructed to be more conservative than a high-resolution application of SPP 2.6, the studies suggested that some of the Perth foreshore may be vulnerable to future climate change and sea-level rise.

The Coastal Protection Policy is an operational policy of the Department of Planning and Infrastructure that articulates the roles and responsibilities of the State Government in providing engineering works and associated support services — in essence, how, when and where areas of the coast are to be protected from ocean forces. This policy also clarifies the role of coastal protection in the State Government's broader approach to coastal management and is complementary to the State Coastal Planning Policy in that it focuses on particular coastal management situations. The Coastal Protection Policy is likely to be a key tool in managing future climate change impacts in currently developed areas where existing development setbacks may not be sufficient, as in the case of many coastal locations in Perth outlined above.

Western Australia is an active member of national initiatives established through inter-governmental cooperative mechanisms including:

- the 'Managing Climate Change' component of the Framework for a National Cooperative Approach to Integrated Coastal Zone Management;
- the development of a Climate Change and Fisheries Action Plan, to be considered through the Natural Resource Management Ministerial Council and Primary Industries Ministerial Council October 2008; and
- assessing Australia's Coastal Vulnerability to Climate Change - Key Elements of a First-Pass National Assessment (2006-2008), through the Coalition of Australian Governments.

Western Australia supports the proposed case study entitled *Vulnerability Assessment of Climate Change on Pilbara Oil and Gas Infrastructure: A Case Study to Support the First Pass National Coastal Vulnerability Assessment.* It should be stressed that the implementation of this proposed case study will require close coordination with the State Government to ensure there is no duplication or overlap with the proposed statewide climate change infrastructure risk assessment, outlined above.

Also, Western Australia is actively developing a proposal to undertake a high-resolution coastal bathymetry and land-height survey of the State's south-west coast (Perth-Cape Leeuwin) using LIDAR technology. The proposal is to support operational coastal planning and assist in planning for future climate change impacts on the coast.

Finally, it is important to recognise the critical role of Western Australian local governments in this issue. Local governments are actively supported by the State in this regard and have also shown considerable initiative in seeking to increase their understanding of potential policy implications. For example:

- The City of Rockingham undertook a preliminary application of the State Coastal Planning Policy to establish setback requirements due to sea level rise, completed in 2004.
- The Shire of Roebourne coordinated the West Pilbara Disaster Mitigation Study.
- The City of Mandurah organised the Climate Change and the Coast: Think Global Act Local conference in August 2007.
- The Town of Cottesloe is near to completing a climate risk assessment of its coastal zone supported by a grant from Emergency Management Australia.
- The Shire of Busselton has commenced the Busselton Local Environmental Planning Study.

It is recognised that the State's approach has emerged and grown organically over the last five years, and has achieved significant successes. However, there remain significant challenges to building on the initial successes of the State's policy and research initiatives outlined in the next section.

5.3 Major Western Australian and national research, information, policy and program gaps and barriers to be overcome

This section is divided into two-subsections. First, the major gaps are outlined. Second, the major barriers to addressing these gaps are discussed.

5.3.1 Major Gaps

Fundamental to understanding the impacts of climate change at the coast are the models that connect the climate change process-drivers to predicting how the various coastal systems in Western Australia will respond to those changes. At present, models imported from other parts of the world, including eastern Australia, have to be used in the absence of more appropriate localised models. This is unsatisfactory from both scientific and policy development perspectives, and remains the most fundamental gap in moving forward with addressing climate change impacts on the Western Australian coast.

The impacts of climate change will be superimposed upon the existing patterns of coastal change. Knowledge of these patterns of change is uneven. Some areas of the coast are extensively monitored and well understood, such as between Cape Naturaliste and Yanchep, while other areas are poorly identified, with only historic aerial photography runs available, but not supported by an in-depth understanding of coastal geology, sedimentology or active coastal processes that would lead to the required level of impact assessment for policy considerations.

An important outcome of the recent Cottesloe Foreshore Vulnerability assessment has highlighted the critical gap in knowledge of a detailed understanding of local coastal geology. The project, when completed in June 2008, will call for very detailed localised assessments of coastal geology to be undertaken as an immediate priority to enhance the long-term adaptation planning options developed.

The role of estuarine systems to variously act as sediment sinks or sources has been identified as an important research gap, particularly given their importance in Western Australia as both population centres and areas with rich biodiversity. As estuarine systems provide tidal damping, they also represent a large part of the micro-tidal coast, for which the impacts of sea level rise are expected to be enhanced relative to coast with a larger tide range. The Swan River Trust coordinated a high level assessment of climate change impacts for the Swan and Canning Rivers during 2007 and reinforced the need for significant and well-coordinated research programs.

There is a need to collate the large quantity of valuable baseline information contained in environmental and planning studies that is not specifically identified as being related to climate change – but is critically important to any climate change impact and adaptation assessments.

Finally, a current gap is the lack of process to coordinate and guide the assessment of coastal impacts due to climate change in Western Australia. There is currently no dedicated central repository of the various coastal assessments and hence there has been limited comparative analysis to date, including lessons learned.

5.3.2 Major Barriers to Addressing these Gaps

The sheer scale of Western Australia, with its diversity of coast and climate types, creates significant difficulty with the development of a meaningful interpretation of the coastal risks associated with climate change.

The absence of population centres along much of the coast reduces the impetus for coastal monitoring and consequently has resulted in the present fragmented approach to vulnerability assessment.

The time, cost and effort required to develop and validate coastal models are high. This provides an uncritical acceptance of inappropriate or unvalidated models on the basis that there is no alternative. In addition, the more complex these models, the less suited they are to planning applications.

Although there is significant capacity throughout WA, it is distributed through different government agencies, NRM bodies, academic institutions and the private sector. It takes a significant investment of time and money to develop distributed systems (like WAMSI and IOCI) given that important issues of legal liability, intellectual property and the like have to be addressed. However, experience to date with IOCI suggests that such approaches can be highly effective and potentially more effective than single-institution, large, centralised research teams.

Importantly, studies at a global, or even regional scale, may have limited relevance to the application at a local scale. This again stresses the need for models and approaches applicable to Western Australia. For example, the developers of a global model of coastal impacts developed in Europe – the Dynamic Interactive Vulnerability Analysis System (DIVA) state: "Nevertheless, due to its resolution, the information contained in the database is not designed for use at local scales and should be evaluated considering all the limitations that are associated with global datasets."

5.4 Potential strategies to address gaps or enhance climate change impact management and planning in Western Australia and nationally

5.4.1 Existing Strategies

Western Australia plans to continue to take a coordinated, proactive approach to integrating climate change impacts and adaptation requirements into policies, plans and programs that support the long-term sustainable management of the State's coastal zone. This approach will build on the long history of success in addressing existing oceanographic and climatic variability and more recent approaches developed over the past five years to specifically address the climate change issue in State coastal planning policy.

The State intends to implement its integrated approach through a coordinated program of activities, policy review and reform underpinned by rigorous scientific analysis. Each is outlined in turn below.

Program activities will include the following:

1. A review of existing coastal data collection, management and dissemination programs undertaken by the State. The intended outcome of this review is to ensure that the current data collected to support coastal planning and policy are optimised to address potential climate change impacts and adaptation strategies. An important part of the review will be an assessment of the best flows of information from data collectors, through data providers to users.
2. A process of selecting vulnerability assessment and adaptation option-choice methods and tools appropriate for Western Australian coastal settings. It is intended that this selection process will both inform and guide those implementing vulnerability assessment studies and implementing adaptation approaches at a local level.
3. Implementation of sub-regional assessments at a State planning-region scale based on strategic risk priorities for the coast developed by the State. These assessments are intended to provide a critical link between State policy reform (outlined below) and national initiatives, and assist in integrating local level assessments. The scale of the assessments will also readily allow integration into the State's strategic coastal planning program.

The policy reform strategy will focus on explicitly recognising and then addressing the challenges and potentials in implementing a State policy framework that reduces implementation uncertainty for those with coastal management decision-making and decision-support responsibilities. Specific coastal policy reforms will include the following:

1. Re-analysing the State Coastal Planning Policy with a focus on the methods used and climate change drivers in the Policy, including future mean sea-level rise factors. It is intended that this analysis process will require input from Commonwealth scientific organisations (such as CSIRO, BoM, GA) and the Federal Government to ensure national consistency of approach, while recognising regional differences in Western Australia. It will be important to ensure that this analysis process ensures that climate change risk is responsibly considered alongside all other coastal planning policies and issues in the State.
2. Review of Coastal Protection Policy to ensure that the current focus on areas of known coastal erosion sensitivity adequately addresses potential climate change risks. The review will also ensure that areas currently not known for coastal sensitivity but which may become sensitive in the future are addressed.
3. Assessment of emergency management policy responses to coastal storms and cyclones and other extreme events that impact the coast in the light of potential changes to extreme climatic events due to climate change.

In order to achieve the above initiatives, the State is currently investigating a framework for the integration of environmental assessments and risk analyses currently being undertaken by several State government agencies as part of their normal (core) responsibilities but which relate directly to the impacts of climate change and variation in the weather regime at a variety of scales. The initiative is coordinated by the Office of Climate Change (Department of Environment and Conservation) and

brings together work being done by the Department for Planning and Infrastructure (Marine Branch and Coastal Planning Branch), the Department of Environmental and Conservation (Science and Marine Policy and Planning Branches) and the Department of Industry and Resources (Geological Survey of Western Australia). It is intended that the framework approach will link with, support and build on work planned by WAMSI, IOCI, the NCCARF, local tertiary educational institutions and initiatives of the private sector.

5.4.2 Coordination and Communication

There is a need to develop a coordinated focus point for the diverse agencies with interest in the coastal impacts of climate change. It is questionable whether any of the primary State government agencies involved in coastal management have sufficient legislative mandate, or existing resources, to act as a sole focal point. Consequently, it is suggested that a distributed network be developed, linking the knowledge base of these organisations, with a central agency acting as a coordinating rather than managing body. A similar distributed network was established, for example, for the Coastal Monitoring Framework for the Alligator Rivers Region, through the Office of the Supervising Scientist.

The major difficulties of knowledge sharing from a range of sources can be reduced through the effective use of metadata systems and suitable GIS development. Considerable inter-agency cooperation already exists through the WALIS Marine Community. Immediate tasks in existing organisations include:

- collating existing coastal vulnerability assessment information associated with development approvals;
- developing a stronger knowledge base of local scale climate change impacts assessments; and
- review of existing models and development of a base model for the assessment of sea level rise impacts of climate change on local and regional coasts in WA.

Significant benefit is considered likely to be achieved by linking any State government effort to largely inter-agency forums, including WAMSI, IOCI and NCCARF.

5.4.3 Development of Coastal Response Models

The absence of validated models for the Western Australian climate and coast types limits the value of current climate change impact assessments. At present, this is incorporated into policy by defining setbacks that are generally intended to be conservative. The capacity is assumed to exist to respond with coastal protection works where required if risk levels exceed those required by the policy or existing development is threatened by erosion in the future. However, the uncertainty introduced by simplistic modelling, particularly the exclusive use of a 0.38 m setback allowance for sea level rise (as required under the Coastal Planning Policy), results in a variable risk profile across the State. It has therefore been suggested that there is a need to develop improved coastal response models.

The performance of any modelling system needs to be evaluated using a review of existing information, within the context of historic climate variability . This will also assist in improving knowledge of existing patterns of coastal change, which will interact with those induced by climate change. DPI has presently commenced review of the historic beach monitoring records in association with WAMSI node 6.1.

State government agencies, in association with WAMSI, have identified several avenues for enhanced coastal modelling:

- Definition of coastal geology, particularly for type of beaches (called 'perched') that are prevalent along much of Western Australia, where mobile sediments overlie a rock substrate
- Evaluation of the dynamics of perched beach systems
- Analysis of bio-production and its contribution to coastal sediments
- Inclusion of regional sediment budgets, which drive wider patterns of coastal change
- Review of wave observations to improve understanding of fringing reef protected coasts prevalent in South-West WA
- Improved representation of estuaries, mangroves and tidal creek responses to inundation by floods, surges and mean sea level rise

WAMSI node 6.1 has, to date, provided a catalyst for identification of these needs and pathways. As an inter-agency forum including several tertiary institutions, WAMSI retains the capability to encourage the fundamental research necessary to develop coastal response modelling to a suitable level. However, this requires further State government investment for both data provision and the necessary interpretation from research outcomes to policy application.

5.4.4 Governance

Each of the agencies responsible for coastal management has a different legislative capacity and zone of responsibility. Consequently, the majority of climate change impact assessments are described in terms of the roles and potential actions of the commissioning agency. This restricts value when applied to different sectors. The dominance of high level and strategic assessments for coastal climate change, developed through the focus at Federal and State government levels, restricts its value for application at a local scale.

It is believed that benefit may accrue from the deliberate strategic application of climate change impact assessments at a range of levels, from national to local. It is appropriate to enable flexibility of process that is outside the domain of regional or national policy or analysis, to cater for local government or NRM needs. The methodologies developed may therefore provide stronger guidelines for adaptation actions and impact management, which more directly affect local management agencies. Development of multi-level assessment requires careful coordination and inter-agency communication.

6 Mechanisms to promote sustainable coastal communities

The *Western Australian State Sustainability Strategy* (September 2003) and *State Planning Strategy* (WAPC December 1997) underpin Western Australia's activities to support the development of sustainable communities. In addition to these, the State's policies and programs as described in Section 2 of this submission are in themselves key mechanisms. SPP 2.6: State Coastal Planning Strategy is critical, as is the broader suite of planning policies in which it operates. This includes SPP1: State Planning Framework Policy (February 2006), SPP 2: Environment and Natural Resources (June 2003), SPP 3: Urban Growth and Settlement (March 2006), SPP3.4: Natural Hazards and Disasters (April 2006) and the draft Network City SPP (March 2006).

The Sustainability Checklist (WAPC, March 2005) helps ensure that sustainability is an integral element of planning, development and building in Western Australia.

The concepts and planning frameworks provided in the mechanisms above are being put into practice on the ground. Three key examples are:

- the Ningaloo Sustainable Development Office, acting through an Interim Development Order to implement the *Ningaloo Coast Regional Strategy: Carnarvon to Exmouth* (WAPC, August 2005) and Ningaloo Coast SPP 6.3;
- new development by LandCorp of a sustainability demonstration residential concept plan for the expansion of Gracetown, an iconic coastal townsite in the South West ; and
- the development of a *South West Regional Planning Framework* is currently being led by the Urban Growth Management Program team in the Department for Planning and Infrastructure.

7 Governance and institutional arrangements for the coastal zone

In the description of WA's existing policies and programs throughout this submission, particularly in section 2 (and detailed in the attachments), WA's governance and institutional arrangements have already been largely outlined. By design or by virtue of operational practicalities, programs in particular reflect the institutional arrangements in which they have developed and operate.

One of the first actions of the WA Labor Government when it came into power in 2001 was the establishment by the Minister for Planning and Infrastructure of a Ministerial Taskforce to investigate the structural arrangements for coastal planning and management in Western Australia. Particular attention was given to the roles and relationships of government agencies, focusing on the higher order processes affected by government structures, including those of local government. In doing so, the terms of reference included an examination of the strengths and weaknesses of existing arrangements, the effectiveness of earlier reviews, a review of arrangements elsewhere in Australia or internationally for applicability and relevance to WA, including benefits and costs, and identifying opportunities for best practice improvements. The Taskforce's conclusion was provided in its recommendations for an improved and more integrated framework based on leadership by a strengthened, legislatively based and independently chaired Coastal Planning and Coordination Council (CPCC). The Taskforce's recommendations were adopted by the Western Australian Government as *Coasts WA: Better integration* (DPI April 2003). The CPCC was established through legislation in 2004; its Terms of Reference are provided at Attachment C.

While WA does not have a single specific legislative instrument establishing the roles and responsibilities of government instruments for the coastal zone, or establishing a single overarching goal, set of principles or objectives to guide the use and management of the coastal zone, its integrated framework for coastal planning and management policy and programs across government agencies, local governments and community/private players provides a strong governance structure producing sustainable outcomes equal to those of other Australian States and Territories.

While recognising State (and local government) jurisdiction over coastal planning and management, a cooperative and collaborative approach across governments (all other States and Territories and the Commonwealth Government) is essential to achieve timely understanding of the high-magnitude impacts of climate change on the coastal zone and coastal communities. A cooperative approach will require leadership and an appropriate structural arrangement such as is provided through the Council of Australian Governments (COAG) with input through Ministerial Councils and sub-committees such as the long-standing Intergovernmental Coastal Advisory Group (ICAG). The *National Cooperative Approach to Integrated Coastal Zone Management* (2006), prepared by ICAG on behalf of the Natural Resource Management Ministerial Council, is a good example of what can be achieved in identifying priority actions across jurisdictions.

Such cooperation in identifying actions must be matched with an availability of funding and a transparent process by which all contributions are recognised and funds distributed. Tripartite agreements between the Commonwealth, the States and local governments are a strong means of achieving synergy in actions and an efficient use of resources. Only through a long-term inter-jurisdictional framework designed and implemented through cooperation, can effective actions, structural efficiency and accountability be achieved.

In conclusion, while there remain significant challenges to addressing the potential impacts of climate change on the diverse coastal zone of Western Australia, the State has recognised these challenges and is actively working to develop a thorough, coordinated response. Importantly, this approach recognises the State's research, policy and planning capacity and plans to build on previous successes in this regard, while learning from the barriers faced to date.