ADAPTATION TO CLIMATE CHANGE AND SEA LEVEL RISE — AN UPDATE ON THE CHALLENGES FACING LOCAL GOVERNMENT

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ABSTRACT

The Intergovernmental Panel on Climate Change Fourth Assessment Report of 2007 concludes that climate change and sea level rise are inevitable.

Local councils have ‘good guidance’ on the potential increases in ocean levels and rainfall intensities from international and Australian climate change scientists and the New South Wales State Government, but it was not until late 2009, at the time of the preparation of this paper, that methodologies were just starting to emerge as to how to incorporate this ‘guidance’ into long-term adaptive strategies for Council. Many council floodplain and stormwater managers are still grappling with the fundamental question … “What do I do next?”

With about 1 in 5 properties in the Pittwater Local Government Area having been identified as having some form of flood affectation, the impacts of increasing ocean levels and rainfall intensities associated with climate change pose a great challenge to the Pittwater community.

Pittwater is using its Floodplain Risk Management Strategy and the framework of the NSW Government Floodplain Management Process to determine the potential impacts of increasing ocean levels and rainfall intensities in its floodplain, tidal and coastal areas. This paper examines some of the challenges facing local government now that these potential impacts are becoming more pressing …

- How should the local community be informed and engaged particularly with regard to the release of the mapping of impacts of climate change and sea level rise?
- How does Council incorporate climate change and sea level rise into its Development Control Plan?
- What does Council need to include in its Climate Change Policy to provide for long-term strategic direction to adapt to climate change and sea level rise?
- How does Council risk manage the long-term risks of climate change and sea level rise on local development (whose life is generally taken as 100 years) together with infrastructure, the environment and other assets?
INTRODUCTION

The Existing Flood Problem

The Pittwater Local Government Area (LGA) is located in Sydney’s Northern Beaches, about 30 kilometres north of the Sydney Central Business District. Pittwater LGA has a population of about 57,000 people and about 25,000 properties.

Pittwater LGA is characterised by many small, steep urbanised catchments, and so is highly susceptible to flash flooding. There are also many low-lying properties close to the ocean, lagoons and estuaries that are also affected by flooding from catchment rainfall as well as from tidal and ocean influences. Nearly 2,500 properties have been identified as being affected by ‘mainstream flooding’, with 1,500 properties affected by tidal inundation. In addition, about 100 properties are affected by coastal inundation and 3,000–4,000 affected by overland flow.

Challenges facing Local Government

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This paper presents an overview of Pittwater Council’s achievements to date (and planned in the short-term); as this Council has been grappling with rapidly evolving challenges facing local government in the formulation of strategies to adapt to climate change now and into the future.

ADAPTATION STRATEGIES UNDERTAKEN TO DATE

Getting “Good Guidance”

It became apparent early in the consideration of adaptation to climate change, that it was unreasonable to expect Council’s Floodplain and Stormwater Managers to be the ‘Climate Change Scientists’ for their Local Government Area. Therefore, the important first step in addressing the impacts of climate change was to identify where to look for the ‘good guidance’ that Council could rely upon in its adaptation strategies. ‘Good Guidance’ has been found from the following sources:

- international scientific opinion, through the Intergovernmental Panel on Climate Change (IPCC) and the latest Fourth Assessment Report in 2007;
- Australia’s CSIRO, who have provided a more local perspective to the work done by the IPCC through documents such as Climate Change in Australia Technical Report (2007) and more recently, Science Update (November 2009);
- the NSW Department of Environment, Climate Change and Water (DECCW), who have been able to provide:
practical guidance on how to consider the impacts and ramifications of climate change in light of the NSW Government’s Flood Prone Land Policy, through the 2007 Floodplain Risk Management Guideline (NSW Department of Environment and Climate Change, 2007) and the recently released Draft Flood Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Assessments (DECCW, October 2009);

- policy guidance for New South Wales councils for the ‘numbers to use’ through the adoption of benchmarks for sea level rise up until 2100 in October 2009 (NSW Government, 2009);

- the Sydney Coastal Councils Group, a regional group of 15 councils, who have been able to provide a regional perspective to some of the challenges that face all member councils.

With discussion and information relating to climate change being generated and evolving rapidly over the past few years, another important aspect of getting ‘good guidance’ is the challenge of keeping up-to-date with the ‘good guidance’. Although the myriad of seminars, workshops and reports seems to be overwhelming, Pittwater Council has been supportive in keeping Council officers ‘up-to-date’.

**What to Focus On — Sea Level Rise and Increased Rainfall Volume**

The term ‘Climate Change’ encompasses a broad range of issues. The Pittwater Draft Climate Action Plan (see below) breaks ‘climate change’ into a number of fundamental and more manageable components as follows:

- **mitigation** — which includes the following components:
  - community greenhouse gas emissions;
  - business greenhouse gas emissions;
  - Council greenhouse gas emissions;
  - transportation strategy;
  - urban forest and carbon sequestration;

- **adaptation** — which includes the following components:
  - adaptation to increased flooding and tidal inundation;
  - adaptation to increased risks from coastline hazards;
  - adaptation to more extreme weather events;
  - adaptation to increased bushfire risk;
  - asset vulnerability assessment and management;
  - community vulnerability assessment;
  - adaptation issues for the natural environment.

To try to address all ‘climate change’ issues all at once was found to be impractical and overwhelming. Therefore, a decision was made to initially focus on those issues with the most information available, namely potential increases in ocean levels and rainfall volumes. Hence work began on investigating the impacts of increased flooding, tidal inundation and coastline hazards and adaptation strategies that try to manage these issues.

**Framework and Methodology — The NSW Floodplain Risk Management Process**
The first step in the consideration of adaptation strategies for flooding and tidal inundation for Pittwater was to identify a logical framework by which strategies could be developed, assessed, recommended, implemented and progressively reviewed.

Unlike many other aspects of climate change adaptation, floodplain and stormwater managers already have an existing framework and methodology to address the impacts of sea level rise and increased rainfall volumes due to climate change. This framework is the ‘Floodplain Risk Management Process’ as described in the NSW Government’s Floodplain Development Manual (NSW Government, 2005) and as required by the NSW Government Flood Prone Land Policy. The Floodplain Risk Management Process forms the basis of Pittwater Council’s Flood Risk Management Strategy. Figure 1 shows the key elements of the Floodplain Risk Management Process.

The NSW Government Flood Prone Land Policy, through the 2005 Floodplain Development Manual requires that the impacts and ramifications of climate change and sea level rise be considered as part of the Floodplain Risk Management Process.

An added incentive for utilising the framework provided by the Floodplain Risk Management Process is the definition of ‘flood’ in the 2005 Floodplain Development Manual covers all types of inundation as follows:

“flood is a relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam and/or local overland flooding associated with major drainage before entering a water course and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences, excluding tsunami”.

Even further incentive for utilising the framework provided by the Floodplain Risk Management Process is Section 733 of the NSW Local Government Act, 1993, which:

“provides Councils, statutory authorities and their staff with indemnity for decisions made and information provided in good faith from the outcome of the floodplain management process (NSW Government, 2005)”.

**Formal Recognition of Climate Change by Councillors and Senior Management**

Generally Council’s Floodplain and Stormwater Managers do not have the technical expertise to prove or disprove the current scientific opinion of the ‘Climate Change Scientists’. Therefore, it was important that one of the first steps in dealing with climate change was for elected councillors and senior council management to formally acknowledge that sea level rise and climate change is worth worrying about and that they support the current scientific opinion, through the adoption of a range of policies and action plans.
The following policy and action plans, which relate to the adaptation to flooding and tidal inundation due to climate change, have been adopted by Pittwater Council during the past few years:

- **2004** — design flood levels that included 0.2m for sea level rise were adopted by Council for Newport Beach and tidal areas of the Pittwater Estuary;
- **September 2007** — there was a resolution by Council that:
  - all future Flood Studies and Floodplain Risk Management Studies include a consideration of climate change;
  - Flood Risk, Estuarine (Tidal) Risk and Coastline Risk Policy be amended to incorporate provisions for climate change and sea level rise;
- **February 2008** — public exhibition of first Draft Climate Change Policy;
- **April 2008** — adoption of Pittwater 2020 Strategic Plan that included a number strategic initiatives relating to climate change;
- **April 2009** — adoption of Pittwater Climate Change Policy and Draft Climate Action Plan (see above);
- **July 2009** — adoption of the Pittwater 21 Development Control Plan (Amendment 5), which included the first development controls relating to climate change (sea level rise and increased rainfall volumes only). This control is viewed as an interim control in order for Council to satisfy its responsibilities under Section 79C of the Environmental Planning and Assessment Act, 1979. At this stage, the new control only applies to development applications where intensification of development (residential and commercial) is proposed on properties already affected by flood risk, estuarine (tidal) risk and coastline hazards. Also as an interim measure, applicants are advised to contact Council to determine the source of the information to use to determine the likely increases in design flood and tidal levels.

This decision to move forward with adaptation to climate change has now been made somewhat easier with the release of a range of documents around the time of preparation of this paper including the following that relate specifically to flooding:

- adoption of the NSW Sea Level Rise Policy Statement (DECCW, October 2009a);
- draft NSW Coastal Planning Guideline: Adapting to Sea Level Rise (NSW Department of Planning, October 2009);
- Draft Coastal Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Coastal Risk Assessments (DECCW, October 2009b);
- Draft Flood Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments (DECCW, October 2009c);
- Climate Change in Australia. Science Update 2009 (CSIRO and Bureau of Meteorology, November 2009);
- Climate Change Risks to Australia’s Coast. A First Pass National Assessment (Australian Department of Climate Change, November 2009).

With even more ‘good guidance’ and some ‘numbers to use’ for sea level rise up until 2100, there is still not a definitive methodology of how to incorporate this ‘guidance’ into long-term adaptation strategies for Council.

**Getting an Idea of the Impacts — Using Available Information**
With ‘good guidance’, a ‘focus’, some ‘numbers’ to use, a ‘framework’ and official Council support, the next step in the process was to get a preliminary indication of those areas that would be most vulnerable to increases in ocean levels and increased rainfall intensities, using existing and readily available information. This information was required with a very limited timeframe and very limited budget. Two principal sources of information were used for this analysis:

- **completed Flood Studies** — where the results of sensitivity analyses from varying downstream water levels and increases in flows and/or rainfall were used to get an idea of the impacts of climate change;
- **best available ground level data** — where Council’s Airborne Laser Scanning (ALS) or LiDAR data provided digital ground level information for the entire Local Government Area to compare to different predicted tidal levels.

Using this available data, the following conclusions were made about the overall vulnerability of the Pittwater LGA to climate change and sea level rise:

- **‘everyday high tide’** — is likely to rise from about 0.6 mAH to up to 1.5 mAH by 2100. The impacts of this daily occurrence will be generally limited to only parkland and foreshore areas, which primarily consists of Council land and infrastructure. It is likely these areas will not be able to maintain their current use without some form of adaptation works;
- **‘once a year king tide’** — is likely to rise from about 1.3 mAH to up to 2.2 mAH by 2100. It is these ‘king tides’ that will start to impact ‘developed’ areas including private property, roads and other infrastructure. These king tides will impact the lowest areas of all Pittwater’s already developed floodplain and estuarine areas;
- **sea level rise combined with large rainfall events** — the most vulnerable areas of the Pittwater LGA to climate change and sea level rise are those areas already affected by flooding and tidal inundation. Climate change and sea level rise will cause flooding to be worse in all flood-prone areas.

**Incorporation of Climate Change and Sea Level Rise into current Floodplain Risk Management Studies and Plans.**

Pittwater is currently close to placing three Floodplain Risk Management Studies on public exhibition that have incorporated a detailed consideration of sea level rise and increased rainfall intensity due to climate change. This has involved the following key components:

- **use of DECC Guideline** — ‘Practical Consideration of Climate Change’ (DECC, 2007) has been used to determine a wide range of impacts using the low, medium and high level scenarios of sea level rise and increased rainfall volumes (the analyses were undertaken prior to the release of the documents listed above in October and November 2009);
- **use of existing flood models** — existing computer models of the flood behaviour were used to assess a range of combinations of increases in sea level and increases in rainfall volumes for a range of flood sizes. The results include:
  - maps that show changes in flood depths, flood extents and flood velocities;
  - changes in the number of properties affected;
  - an indication of the range of private property and public infrastructure that will be affected.
• **long-term viability of communities** — a preliminary investigation was undertaken to examine the long-term viability of the communities impacted by climate change and sea level rise;

• **adoption of Floodplain Risk Management Plan** — although not finalised prior to the completion of this paper, it is anticipated that a number of climate change adaptation strategies will form part of the Floodplain Risk Management Plan, including:
  
  o recommendation that design flood levels (and hence Flood Planning Levels, flood hazards, hydraulic categories, etc) be updated to include a high level climate change scenario that is equivalent to the benchmarks outlined in the latest NSW Sea Level Rise Policy Statement;
  
  o recommendation that flood-related development controls be amended to take into account the long-term impacts of climate change;
  
  o recommendation that a review of climate change impacts and adaptation strategies be undertaken every 5–10 years as required by the Floodplain Development Manual.

**ADAPTATION STRATEGIES PROPOSED IN THE SHORT TERM**

With momentum on adaptation strategies for climate change growing, Pittwater has a number of projects planned to be commenced in the short-term, including:

• public exhibition of current Floodplain Risk Management Studies and Plans that will provide the first recommendations for adaptation to climate change in a Floodplain Risk Management Plan;

• preparation and public exhibition of mapping of sea level rise impacts (only) for the Pittwater Estuary and Narrabeen Lagoon together with the commencement of an associated community engagement strategy;

• commencement of the review of three existing Flood Studies, plus an overland flow mapping project, to incorporate sea level rise and increased rainfall intensity;

• preparation of a Climate Change Strategic Planning Policy that will include:
  
  o adoption of the NSW Government’s ‘benchmarks’ for sea level rise (and the best guidance for increased rainfall intensity), including an associated planning period, for consideration of all Council’s future land use planning, asset management, infrastructure and operational responsibilities;
  
  o progressive adoption of design flood levels (and hence Flood Planning Levels, flood hazards, hydraulic categories, etc) that include the NSW Government ‘benchmark’ for sea level rise (and the best guidance for increased rainfall intensity) as they become available;
  
  o adoption of notifications to be included on Section 149 Planning Certificates for properties potentially affected by sea level rise and increased rainfall intensities;
  
  o acknowledgement that there will need to be an on-going review of the policy and its associated actions as future ‘good guidance’ is provided.

**CONCLUSIONS AND TAKE HOME MESSAGES**

With about 1 in 5 properties in the Pittwater Local Government Area having been identified as having some form of flood affectation, the impacts of increasing ocean levels and rainfall intensities associated with climate change pose a great challenge to the Pittwater community.
Although Local Government has some ‘good guidance’ on the potential increases in ocean levels and rainfall intensities, it was not until late 2009, at the time of preparation of this paper, that the first guidelines emerged that provided a proposed approach to assist Councils to address sea level rise (but not increased rainfall volume) in land use planning and development assessment.

Local Council are reliant upon ongoing ‘good guidance’ to move forward with addressing the impacts of climate change. It is unreasonable to expect Council’s Floodplain and Stormwater Managers to be the ‘Climate Change Scientists’ for their Local Government Area, as they generally do not have the technical expertise to prove or disprove the current scientific opinion.

Similarly, it is important for elected councillors and senior council management to formally acknowledge that sea level rise and climate change are worth worrying about and that they support the current scientific opinion, through the adoption of a range of Council policies and action plans.

This paper has summarised the rapidly paced journey at Pittwater so far, an overview of the achievements to date and what is planned in the near future. It highlights just some of the issues Pittwater Council has been grappling with rapidly evolving challenges facing local government in the formulation of strategies to adapt to climate change now and into the future.

This journey is just beginning. There are still many still issues to be addressed, investigate, and mull over, let alone resolve, including the long-term viability of certain locations within the floodplain community. Some of these issues include:

- roles and responsibilities of each level of Government and how this is to be resourced;
- the level of support to be provided by the State and Federal Governments;
- exposure, liabilities, compensation and insurance for Local Government;
- statutory and legislative underpinning of all the ‘good guidance’, policies and Action Plans.

REFERENCES

- Australian Department of Climate Change. Climate Change Risks to Australia’s Coast. A First Pass National Assessment. (November 2009).
- New South Wales Department of Environment, Climate Change and Water, 2009a. NSW Sea Level Rise Policy Statement. (DECCW 2009/708, October 2009);
