SYDNEY COASTAL COUNCILS GROUP Inc.
C/- City of Sydney Council
Town Hall House, 456 Kent Street
GPO Box 1591, SYDNEY NSW 2001
Phone: (02) 9246 7791
Facsimile: (02) 9265 9660
Email: info@sydneycoastalcouncils.com.au
Internet: www.sydneycoastalcouncils.com.au
ABN: 39 638 876 538

Reference: 116-16GW

19 December 2016

Ms Carolyn McNally
Secretary
Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Santina Camroux

Dear Ms McNally,

**Re: Provision of Coastal inundation information for incorporation into the Coastal Management SEPP.**

I write on behalf of the Sydney Coastal Councils Group (SCCG) to provide coastal inundation information for incorporation into the Coastal Management SEPP. This information was prepared for SCCG Member Councils by the CSIRO as part of the SCCG project "Mapping and Responding to Coastal Inundation Project", This project was undertaken with the financial assistance from the State and Commonwealth Natural Disaster Mitigation Program.

At the SCCG Ordinary Meeting held on 3 December 2016, it was unanimously resolved:

**R5.4**

That the Sydney regional coastal inundation information, prepared by the CSIRO on behalf of the SCCG:

a) be provided to the Department of Planning and Environment for inclusion in the Coastal Management SEPP, subject to the provision of more detailed inundation information provided to the Department by Member Councils.

Please find attached to this correspondence:

- A licence agreement to use this inundation information within the Coastal Management SEPP
- An email invitation to download (from Dropbox) a zipped folder containing 6 shapefiles (24MB: 1 year and 100 year storm surge events at current SL, +40cm & +90cm).

This information is provided for the SCCG Member Councils and extends to the tidal limits of all Sydney esturaries under current and future sea level rise conditions. This includes:

1) Existing Sea levels with 1:1 ARI 'design storm'
2) Existing Sea levels with 1:100 ARI 'design storm'
3) 40 cm sea Level rise 1:1 ARI 'design storm'
4) 40 cm sea Level rise 1:100 ARI 'design storm'
5) 90cm sea level rise 1:1 ARI 'design storm'
6) 90cm sea level rise 1:100 ARI 'design storm'

Dynamical models of the coastal ocean were used to represent the physical contributions to extreme sea levels as well as capture the spatial variations in extreme sea levels that arise along the coast, due to the varying influences of different physical processes. In addition to the commonly considered contributions to extreme sea level from tides and storm surge, this information also considers the contribution of wave setup to elevated sea levels during storm events. The evaluation of inundation layers is achieved using the 'bathtub fill' method to take advantage of the greater accuracy of high resolution terrestrial LiDAR data across the Sydney Coastal Councils Group region.

For more information in relation to the modelling methodology please see **Attachment 1 Background to the Inundation Modelling.**

The final technical report supporting the modelling can be found on the SCCG website or can be accessed here McInnes et al. (2012), Mapping and Responding to Coastal Inundation - Modelling and Mapping of Coastal Inundation Under Future Sea Level Rise.

If you have any queries or concerns please contact the Group's Executive Officer, Geoff Withycombe on 9246 7791 or geoff@sydneycoastalcouncils.com.au

Yours sincerely,

Cr. Lynne Saville
**Chairperson**

**cc.**

- The Hon Dr Rob Stokes MP, NSW Minister for Planning

**ATTACHMENT 1 - Background to the Inundation Modelling:**

**The below summary text taken from:** Office of Environment and Heritage, 2014, *Mapping and Responding to Coastal Inundation – Exposure Assessment for the Sydney Coastal Councils Group.* (A report compiled by Michael Kinsela and David Hanslow (Science Branch OEH) for the SCCG.

**General Approach**

McInnes et al. (2012) used a dynamic modelling approach to estimate the extent of oceanic inundation in the Sydney region for six scenarios that were based on design elevated water levels (EWLs) and potential future sea level rise (See below summary regarding EWLs). Dynamic modelling approaches attempt to simulate both the generation and propagation of EWLs within coastal environments. They differ from simple 'bath tub' approaches, in which fixed water level anomalies derived from design EWLs and/or sea level rise are applied to static water levels uniformly throughout coastal environments.

The modelling approach has been described in detail by McInnes et al. (2012), and the main points are briefly documented below. The resulting inundation hazard mapping that has been applied in this study should be considered within the context of the limitations described in Section 2.1.3.

- A two-dimensional hydrodynamic model (GCOM2D) was used to simulate the propagation of combined tidal and storm-surge water level anomalies into estuaries. Specifically, simulated water level anomalies that were consistent with design EWLs at Fort Denison were generated from astronomical (tidal), atmospheric (pressure and wind) and ocean-wave forcing that was applied to each model. The effects of coarse-resolution forcing on coastal and estuarine water levels were downscaled using a series of high (20-m) resolution computational grids, which were nested within a 200-m resolution Sydney-wide domain, and finally a 2-km regional grid (Fig. 2.1). Where the planform area of coastal water bodies decreased to below the resolution of the hydrodynamic model (i.e. 20 m), tidal plane analysis was used to predict the behaviour of EWLs.

- A nearshore spectral wave model (SWAN) was used simulate the contribution of wave setup to EWLs along exposed parts of the Sydney coastline. An unstructured grid was used to allow for increased resolution closer to the coast, where wave setup is experienced (Fig. 2.1). The SWAN wave model was forced by nearby wave measurement records from the Sydney wave-rider buoy, which were captured during the storm events examined.

- Inundation extents were calculated using a modified bath-tub mapping approach and 2-m resolution bare-earth Lidar-derived topography. That is, modelled EWLs were used to query low-lying terrain adjacent to coastal water bodies, to estimate the potential extent of inundation for each scenario.

It is important to note that the potential influence of coincident catchment flooding on coastal inundation was beyond the scope of the hydrodynamic modelling approach. Catchment flooding would be expected to contribute to higher EWLs and thus enhanced inundation during severe coastal storms that also feature high rainfall over coastal land areas.

**Elevated Water Level (EWL) scenarios**

Simulated water levels consistent with the 1-year and 100-year Average Recurrence Interval (ARI) levels at Fort Denison (Watson and Lord, 2008) were simulated by CSIRO for the Sydney region using the GCOM2D hydrodynamic model (Fig. 2.1). Water level anomalies due to tides, storm surge (barometric and wind setup) and wave setup were considered in the modelling (McInnes et al., 2012). A significant East Coast Low (ECL) storm that was experienced during May 1997 was identified as a suitable basis for the design storm scenarios. The simulated 1-year ARI scenario was consistent with conditions experienced during the May 1997 ECL, whilst coincident spring high tides were added to achieve the 100-year ARI Fort Denison water level using the same simulated storm conditions.

Future sea level rise scenarios were constructed by subtracting sea level rise magnitudes of 0.4 m and 0.9 m from the terrain data and repeating the 1-year and 100-year ARI storm model runs (i.e. the land surface was lowered by 0.4 and 0.9 m to simulate raised mean sea level conditions). The sea level rise scenarios considered are consistent with former NSW sea level rise planning benchmarks (NSW Government, 2009) and the recent upper range international projections (IPCC, 2013). The simulated EWLs (at Fort Denison) associated with the design storm and sea-level rise scenarios are provided for each model scenario in Table 2.1.

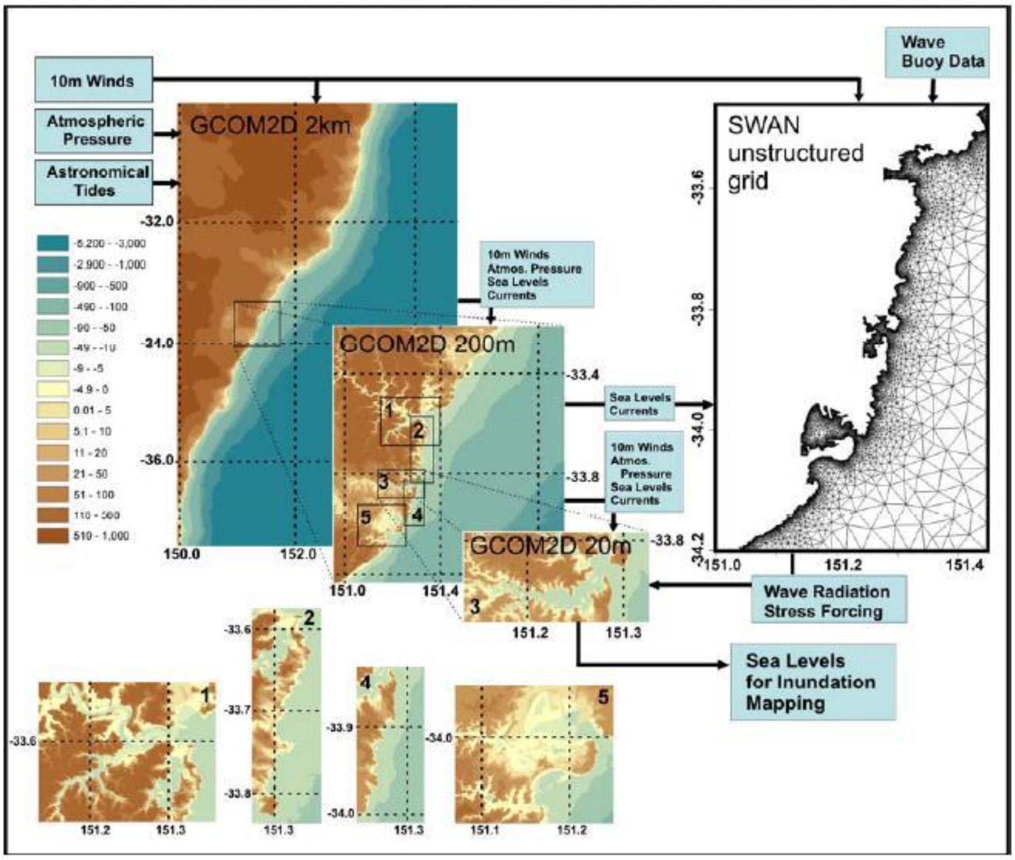


**Figure 2.1 – Hierarchy of model domains used to predict water level anomalies due to astronomical, atmospheric and wave forcing. A hydrodynamic model (GCOM2D) and a nearshore spectral wave model (SWAN) were collectively used to simulate design elevated water levels. From McInnes et al. (2012).**

**Table 2.1 – Model inundation scenarios showing the contributions from dynamically simulated 1-year and 100-year average recurrence interval (ARI) storm surge scenarios and sea level rise (SLR), and the resulting simulated elevated water levels (EWL) measured at Fort Denison for each scenario.**

| Model scenario | 1-year ARI design storm | 100-year ARI design storm | 40 cm sea level rise | 90 cm sea level rise | EWL (m AHD) at Fort Denison |
|---|---|---|---|---|---|
| 1yr00 | ✓ | | | | 1.24 |
| 100yr00 | | ✓ | | | 1.44 |
| 1yr40 | ✓ | | ✓ | | 1.58 |
| 100yr40 | | ✓ | ✓ | | 1.78 |
| 1yr90 | ✓ | | | ✓ | 2.08 |
| 100yr90 | | ✓ | | ✓ | 2.28 |