04 September 2013

Mr Eric Brodie
Project Director
Roads and Maritime Services
Locked Bag 5100
Camperdown NSW 1450

Dear Eric,

**Re: Shadowing Advice for Wentworth Point**

*Our Ref: Job# 16805*

Biosis Pty Ltd was engaged by Roads and Maritime Services (RMS) to provide advice regarding the shadowing effects and associated potential impacts on flora and fauna within the Newington Nature Reserve and associated wetlands as a result of the proposed development of the urban activation precinct at Wentworth Point, NSW.

This advice has been prepared based on the proposed development building footprint attributed with building height data provided by CM+ (28.06.13), which was modelled by James Shepherd (Senior GIS Officer with desktop investigations and reporting undertaken by Jane Murray, Principal Ecologist (Botanist), Josephine Dessmann (Zoologist) and Jeff Yukovic (Botanist) of Biosis.

**Site history and context**

Wentworth Point is a suburb on the foreshore of the Parramatta River, approximately 16 kilometres west of Sydney Central Business District in the Local Government Area of Auburn City Council. Wentworth Point originates from reclaimed land, created in the 1920-30s, when the site was used for a range of industrial purposes. Timber processing was the primary focus of industrial activities immediately prior to and post World War II, but has since been replaced with a mix of warehousing, light industry and 2GB's radio transmission tower located at the end of Wentworth Point. Currently residential development is replacing a large proportion of industrial activities between Homebush Bay and Hill Road, Wentworth Point (Architectus 2005).

This letter report focuses on the adjoining Newington Nature Reserve which is part of the Sydney Olympic Park, gazetted in 2000 under the *National Parks and Wildlife Act 1974* (NP&W Act) and defined by the *Sydney Olympic Park Authority Act 2001* (SOPA Act). The Nature Reserve was formerly part of the Royal Australian Navy Armament Depot Newington, and was managed by the Department of Defence up until 2000. The tight security that protected armament for over a hundred years also protected and conserved the Reserves' plant and animal inhabitants. The Reserve is fenced and public access remains restricted to ensure their continued conservation (SOPA 2011).

The Newington Nature Reserve supports a high diversity of flora and fauna (SOPA 2011) including:
- Three endangered ecological communities (Sydney Turpentine Ironbark Forest, Swamp Oak Floodplain Forest and Coastal Saltmarsh), as well as protected marine vegetation (Mangroves);
- Over 144 bird species, including migratory shorebirds protected under international treaties, hollow-nesting parrots, bush birds, an endangered population of White-fronted Chat, and a pair of White-bellied Sea Eagles;
- Ten species of microbats, recorded in and around the Nature Reserve;
- A population of the Green and Golden Bell Frog; and
- Possums, lizards, frogs and invertebrates.

**Desktop Assessment**

In order to determine the potential impacts of building shadowing the following documentation was reviewed:

1. Draft Public Domain/ Landscape Plan – Wentworth Point (Context 10.05.13);
2. RMS and CM+; design drawings, height data and footprint areas (provided 28.06.13);
3. Flora and Fauna Assessment – Wentworth Point Maritime Precinct Concept Plan (NGH 2010);
6. OEH Atlas of NSW Wildlife for NSW Threatened Species Conservation Act 1995 (TSC Act) threatened biota relevant to the study area within a 5 km buffer zone;
7. SEWPaC Protected Matters Search Tool for Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) regarding Matters of National Environmental Significance relevant to the study area within a 5 km buffer zone; and
8. Relevant aerial photography and vegetation mapping information for the area, namely the South Coast-Illawarra Vegetation Integration (SCIVI) vegetation mapping and Ocean Shores to Desert Dunes.

**Solar Radiation Modelling**

Biosis utilised spatial analysis tools to calculate the percentage of predicted solar radiation retention, post construction. The spatial analysis tools returned values across the area in total watt hours per square metre of solar gain for either an entire year or for a given period of time considering factors such as sun elevation, atmospheric conditions and shadowing. Running these tools to compare the pre construction surface to the post construction surface, with the building footprints and heights provided a value that can be modelled to give overall percentage loss of solar radiation across the vegetation communities (Figure 1) and associated fauna habitat (Figure 2).

The modelling provides a conservative calculation of radiation reduction assuming a relatively uniform surface with the supplied heights of the proposed buildings. The modelling does not take into account local topographical features such as terrain and the height of current vegetation present which will also contribute to obscuring the filtration of light and heat. Areas with a reduction in solar radiation of less than 2% were considered to be of negligible consequence and have not be considered an impact in regards to this analysis.

**Flora predicted response to shadowing**

The flora likely to be impacted by the shadowing effects of the proposed development mainly includes the area mapped as Mangroves (Grey Mangrove *Avicennia marina*, protected under the Fisheries Management
Act 1994 [FM Act]) within and outside the Newington Nature reserve (Figure 1), as well as a narrow weedy tidal channel and an area of native planted vegetation (outside the Newington Nature Reserve). The associated shadowing impact on flora has been outlined below:

- An estimated 1173 m² of native vegetation (comprising 3-9 % of the Mangroves within the Newington Nature Reserve extending up to 25 metres into the reserve) would receive between 3-9% less total solar radiation year round. This minor reduction in solar radiation will occur during the mornings only and will not occur during the middle of the day, including winter.
- Research shows that the Grey Mangrove Avicennia marina seedlings grown under natural understory shade and exposed conditions as well as in the laboratory under high and low light regimes, i.e. 100% and 6% sunlight, can survive at low light intensity although growth may be stunted (Ball and Critchley 1982). Given that the modelling for the proposed building heights has predicted a reduction in solar radiation that is much less than 94% (i.e. between 3-9%), it is expected that plants will survive the predicted shading impacts.
- There are no predicted modelled shading impacts to the two TSC Act listed ecological communities, Swamp Oak Floodplain Forest or Coastal Saltmarsh, including associated Coastal Saltmarsh threatened species, Wilsonia backhousei.

**Fauna predicted response to shadowing**

A population of TSC Act and EPBC Act listed Green and Golden Bell Frog Litoria aurea is known to occur within Sydney Olympic Park and potentially Newington Nature Reserve to the south west of the proposed development. Modelling of the global and reflected (total) solar radiation during the peak breeding season (October through to March) pre and post development was undertaken to quantify the decrease of solar energy to inform how the buildings shading may affect the Green and Golden Bell Frog population.

The modelling shows that the total radiation reduction extending into the Newington Nature Reserve is between 3-9% and occurs exclusively over the mangrove vegetation community (Figure 1). This area is unlikely to provide breeding habitat for the Green and Golden Bell Frog as no suitable breeding pools have been recorded at this location (NGH 2010). An artificial tidal channel (Plate 1 and Figure 2) connected to the Parramatta River extends north-south along the boundary of the Newington Nature Reserve and is inundated with weeds. This brackish waterway may be shaded up to 29% in two sections as a result of the proposed buildings (Figure 2). Although this channel does not form suitable breeding habitat, it has been identified as a potential dispersal avenue for Green and Golden Bell Frog (NGH 2010), however frog movement can also occur through the Newington Nature Reserve. The closest Green and Golden Bell Frog record occurs within the study area approximately 150m from the channel dating from 1993 (Figure 2).

**Plate 1: Dense vegetation along the tidal channel adjacent to Newington Nature Reserve**

During the inspection of vegetation within the development footprint adjacent to Newington Nature Reserve (27.05.2013), the banks of the channel were observed to be heavily vegetated which is likely to overshadow any
water present within the drainage line (Plate 1). The proposed buildings do not inhibit the northern sunlight received along the channel, which is the most consistent aspect of sunlight received throughout the year.

The mangrove vegetation within Newington Nature Reserve where the shading has been predicted to occur has not been identified as either a primary or supplementary habitat management zone for the Green and Golden Bell Frog as mapped within the Sydney Olympic Park Biodiversity Management Plan (SOPA 2008). This would suggest that the mangroves and drainage channel are not likely to provide important habitat for the local Green and Golden Bell Frog populations. Further, based on the location and relatively minor intensity of shading expected to occur over a small area of mangroves and tidal channel, the behaviour of Green and Golden Bell Frogs within the Newington Nature Reserve are unlikely to be altered as a result of the construction of the proposed buildings.

In addition to the Green and Golden Bell Frog, seventeen migratory shorebirds are known to utilise the habitat resources along the Parramatta River estuary and may visit the Newington Nature Reserve seasonally. These birds are typically present from September through to April (SOPA website accessed July 2013) foraging within the intertidal zone of the saltmarsh and mudflats, and roosting during the evening within the wetlands. A small area of mangroves will be shaded by up to 3-9% during October through to April when these shorebirds are present within the wetlands. The primary shorebird foraging resources within the saltmarsh and mudflats will not be shaded (Figure 1). The foraging and roosting behaviour of shorebirds utilising the mangroves is not likely to be influenced given the productivity and shelter provided by these forests will not be significantly altered by the 3-9% reduction in solar radiation received. Similarly, microbats foraging throughout the mangroves are not likely to be affected by the increased shading of this community given the marginal reduction of solar radiation is unlikely to affect the growth and productivity of the mangrove community and the biodiversity they support.

**Concluding Advice**

Based on the spatial analysis and modelling information the following impacts to flora and fauna have been provided below regarding items of ecological significance:

- There are no predicted shading impacts to areas of TSC Act listed ecological communities, Swamp Oak Floodplain Forest and Coastal Saltmarsh, including associated Coastal Saltmarsh threatened species, *Wilsonia backhousei*.

- Predicted shade effects on mangroves are minor and are not expected to significantly affect the values and functions of this vegetation.

- As there is no predicted shading of breeding habitat, and only partial shading (3-9%) of marginal dispersal habitat is expected, therefore the TSC Act and EPBC Act listed, Green and Golden Bell Frog should not be significantly impacted by the proposed development and associated shading effects.

- As there will be no shading of primary foraging saltmarsh habitat, floodplain forest and/or mudflat habitat suitable for migratory shorebirds, microbats and birds of prey, the behaviour of these species should not be impacted by the proposed development and associated shading effects.

- This report concludes that there is no likely impacts to TSC Act or EPBC Act listed species or ecological communities, therefore no further assessments are required.

*Note: Guidance provided in this letter does not constitute legal advice.*
Bibliography

- Biosis, 2012, *Vegetation Advice for Wentworth Point*.
- Bower et al., 2012, Monitoring and research outcomes for the Green and Golden Bell Frog at Sydney Olympic Park 2011/2012.
- Tozer et. al., 2006, *South Coast-Illawarra Vegetation Integration (SCIVI)*, vegetation mapping.

Please contact me on 0421 013 061 if you would like to discuss further.

Yours sincerely

Jane Murray
Principal Ecologist
Figure 1: Percentage retained annual direct solar radiation following proposed development.
Figure 2: Percentage retained global solar radiation during the Green and Gold Bell Frog breeding season (October - March) following proposed development.