Hyder Consulting Pty Ltd
Level 5, 141 Walker Street
Locked Bag 6503
North Sydney NSW 2060
Australia
Tel: +61 2 8907 9000
Fax: +61 2 8907 9001
www.hyderconsulting.com

18 June 2013

Mr Ron Meyer
Lend Lease
30 The Bond,
30 Hickson Road,
Millers Point,
NSW 2000

Our Ref: 130618PPP-DoPI

SICEEP – PPP – Hyder storm water response to Department of Planning & Infrastructure comments on redevelopment of the convention, exhibition and entertainment facilities and associated public domain works at Darling Harbour (SSD 5752-2012)

Dear Ron,

Hyder Consulting has reviewed the comments provided by the DoPI in their response to the SICEEP State Significant Development Application SSD 5752-2012, dated 29th May 2013 and provide the following response.

We trust that these responses are helpful. Should there be any further questions please do not hesitate to contact Joe Heydon.

Yours sincerely

Joe Heydon

02 8907 9149

Hyder Consulting Pty Ltd
Level 5, 141 Walker Street
Locked Bag 6503
North Sydney NSW 2060
Australia
Tel: +61 2 8907 9000
Fax: +61 2 8907 9001
www.hyderconsulting.com

DoPI Comment	Hyder Response
Comment 52 Based on the rainfall and tide events data provided in Appendix F of the Stormwater and Flooding report there is a risk that peak runoff for a significant rainfall event will coincide with tide levels equal to or above 0.7m AHD once every 20 to 30 years. Therefore adopting the design still water levels of 0.9m AHD for the 100 year ARI rainfall event may not define the worst case 1% Annual Exceedance Probability event that takes into account the joint probability of rainfall and high tide. In order to support the argument for adopting the lower design still water levels it is recommended that further comment is provided on the approximate probability of occurrence of a tide level of 0.9m AHD and the risk of tide levels of this magnitude coinciding with peak runoff.	The coincident catchment runoff and tide level is a function of probability. As stated by Hyder in report section 'Coincidence of Cockle Bay and Catchment Runoff' (p18), this probability has been investigated by Australian Rainfall & Runoff Revision Project 18 'Interaction of Coastal Processes And Severe Weather Events' (June 2012, ARR) using Sydney Harbour and Sydney metropolitan catchments, with the conclusion that storm surge and rainfall runoff is independent. Further investigation of the SICEEP catchment (having a rapid response time of only 25 minutes) and examination of 99 years of continuously recorded Sydney Harbour water levels, and 155 years of rainfall data affirms the ARR (June, 2012) findings. While it is noted that there is a possibility of any and all catchment runoff events coinciding with Cockle Bay water levels greater than 0.9mAHD, there is also the need when determining flood frequency, to understand that such possibility sits alongside all the other the possibilities of any and all catchment runoff coinciding with Cockle Bay water levels of less than 0.9mAHD and in fact as low as -0.8mAHD (or lower). As noted in the report (p18), the highest recorded Harbour level (in 155 years of records) is 1.475mAHD (on 25 May 1974) – and that event had a maximum recorded surge component of 0.6m yet was not associated with major event rainfall. In fact none of the fifteen worst Sydney Harbour water levels are associated major event rainfall. Based on the independence between rainfall and storm surge found by ARR Project 18 (June 2012) for small urban stormwater catchments with rapid response times, and the review of historic events carried out by Hyder, it may be reasonable to adopt a coincident Sydney Harbour water level of 0.2mAHD (being the average coincident water level for the twenty maximum recorded rainfall events).

DoPI Comment	Hyder Response
Comment 52 (continued)	However, Hyder has adopted a more conservative fixed coincident water level of 0.9mAHD with all catchment rainfall runoff conditions, which allows for an additional 0.7m surge component. As such, the ARR (June 2012) and Hyder assessments indicate that the probability of a >0.9mAHD Cockle Bay water level coinciding with a 100 year ARI peak catchment flow would be a >100 ARI flood. Further, based on a desktop review of the tidal data, the probability of the still water level being at or above 0.9mAHD is approximately 1% for any given hour.
Comment 53 Confirm whether Sydney Water has agreed in principle to the amplification of the underground box culvert system and whether it is technically feasible and desirable for them to take ownership of the amplified assets.	The amplification of the culvert system is wholly located and related to the Haymarket development. While the flooding implications from the amplifications would affect flood levels within the PPP site area it will be assessed alongside the Haymarket development approvals.
Comment 54 The existing large inlet pit under Pier Street has been identified as a hydraulic hazard. Clarification is sought as to whether it will be accessible by the public or workers on the site, or fenced off to prevent exposure.	The existing large inlet pit is located within the SHFA compound. It is not expected to be exposed to the public. The issue will be addressed by negotiation with SHFA.

DoPI Comment	Hyder Response
Comment 55 Clarification is sought in regard to the duration of flooding for the site under the PMF event including extreme Cockle Bay water levels (e.9. the 2Jm AHD design still water level for the PMF at 2100) noting that flood dispersal times still relatively short under extreme events.	Hyder do not consider this question is relevant since 2.7mAHD (ponded still water) would not incur preliminary hydraulic high hazard conditions. That said, tidal fluctuation indicates that the Hyder have investigated the modelling completed and determined that the duration of flooding for; • The 'Maximum Tide' of 2.7mAHD would have a duration of flooding of less than 1 hour. • The 'Maximum Tide' of 1.8mAHD (coincident with PMP rainfall) would have a duration of less than 1 hour.
Comment 56 Clarify whether the existing and proposed stormwater systems have 2Q year ARI capacity for runoff from the site only and if the modelling includes overland flow from adjacent areas.	Not all existing trunk drainage systems have 20 year ARI capacity for runoff (when considering the entire catchment flow). The modelling of underground systems extends beyond the site boundary. In the TUFLOW model, all upstream catchment flows have been applied to the culvert. Once the culvert has reached capacity, the excess is applied to the surface. Therefore modelling includes overland flow from adjacent areas. Hyder do not consider it useful to complete modelling for the unrealistic condition of runoff from site only. For design purposes, at detail design stage, systems will provide 20 year ARI capacity except when limited by downstream system capacities.

DoPI Comment	Hyder Response
Comment 57 Clarify whether any preliminary concept work been undertaken to confirm whether the opportunities to improve the drainage of surface water conditions along Darling Drive are feasible.	Hyder have completed a concept road design and stormwater design. The improved surface drainage conditions will be assessed during detail design.
Comment 58 The Flooding and Stormwater Report submitted with the EIS states that when adopting a 30% and 50% blockage assumption there are sufficient inlet pits so that the underground system will not be limited by surface inlet capacities. Clarification is sought as to whether the modelling assumes all upstream catchment flows entering the project site are contained within the underground pipe systems with no overland flow component.	Please refer to the response to (56). Catchment flows are not contained within the underground system. The underground systems have limited capacity and the modelling includes overland flows in excess of the underground capacity. The flood mapping provided is considered adequate to address this comment.
Comment 59 In terms of the potential flood impacts in Section 3.4 further explanation is sought as to the key differences in hydrological and hydraulic representations between the existing and proposed case DRAINS and TUFLOW models.	The key differences between the existing and proposed case DRAINS and TUFLOW models are; • Inclusion of concept minor drainage system in the proposed model. • Modifications to the digital elevation model (Including the proposed building ground floor footprints). • Sub-catchment boundary delineation, noting that overall (total) existing and proposed catchment areas are the same. • Amplification option. All other parameters are consistent in existing and proposed models.

DoPI Comment	Hyder Response
Comment 60 Section 5.7 MUSIC Models and assumptions does not explain how the runoff from flyover road structures are drained and whether they have any interaction with the existing or proposed site drainage systems including Sydney water trunk drainage systems. Provide a brief explanation in that regard.	The flyover road structures have been included in the MUSIC model as a 'bypass' catchment in both the existing and proposed modelling. Runoff from the flyover drains into existing stormwater system below or in the case of the proposed development into the new drainage system within the PPP site. Hyder have assumed that drainage from the flyover structures will be independent of the proposed stormwater quality treatment strategy for SICEEP. The runoff from the flyover is not considered in the determination of the percentage pollutant reductions achieved by the treatment strategy proposed for the PPP site hence being called a 'bypass' catchment.
Comment 61 Provide an explanation as to slight increase of SS pollutant load given that there will be a slight decrease in the TP and TN pollutant loads.	The slight increase in TSS can be attributed to an increase in areas allocated for roads (i.e. Darling Drive, shared zones and taxi ranks) within the proposed PPP site relative to the existing scenario (see table below). Runoff from roads bears far more TSS than roofs and general impervious areas (see Table 5-7 of Hyder PPP report) and so even with a slight decrease in the overall imperviousness of the proposed site, the addition of areas trafficable by vehicles will result in the generation of more TSS pollutants. COMPARISON OF LAND USE AREAS EXISTING versus PROPOSED DEVELOPMENT - SICEEP PPP **Land Use Type** / **'Existing' Area (ha)** / **'Proposed Development' Area (ha)** Pervious Areas: 1.439 / 1.836 Roads: 2.789 / 2.991 Roofs: 4.587 / 4.337 Impervious Areas: 4.157 / 3.808 **Total**: **12.972** / **12.972** **% Imperviousness**: **89%** / **86%**

DoPI Comment	Hyder Response
Comment 62 |n terms of the TUFLOW Model clarify the following: • how potential climate change applied to the PMF event and whether this involved applying sea level rise only • It is not clear from the colour coding for localised flood impacts what are the maximum impact is at the northern end of the Boulevard. Identify the cause of the aflux and provide details as to whether is it possible to eliminate/mitigate at a later stage of the design. • Clarify the technique used to map the provisional hydraulic hazard and provide an explanation of how the hazard categories defined in Figure L2 of the Floodplain Development Manual are translated to the maps.	Hyder have applied sea-level rise only to the PMF modelling. The afflux in this area has been investigated in the modelling. It seems to be due to a change in the local drainage systems and catchment break-up. It is expected that with further detail this afflux can be mitigated/eliminated. The provisional hydraulic hazard mapping has been output from TUFLOW (similar to flood depths and velocities) with the _Z1.dat function. The results (based on the maximum DxV) output a number of 1, 2 or 3 as Low Hazard, Intermediate Hazard and High Hazard respectively. These numbers have then been mapped based on the grid output.