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5th December 2016

Job Number: 166795-01

Coronation (28 Shepherd Street) Pty Ltd

Lvl 2, 66 Wentworth Ave Surry Hills NSW 2010

Attention: Danielle Eloss

Dear Danielle

RE: 26 and 28 Shepherd St, Liverpool – advice in relation to Riparian Zone delineation and rehabilitation

On your instruction I am providing this advice for the proposed residential development at Nos. 26 and 28 Shepherd Street. This is as a result of your proposal to rezone and develop the sites for residential development.

In undertaking my assessment, I have relied on the following information:

- Previous Report issued by Northrop titled 28 Shepherd Street Additional advice in relation to Riparian Zone Issues, dated 11th November 2016
- Results of a meeting between Coronation (proponent) and DPI Water staff held on 3rd November 2016, and in relation to 28 Shepherd Street, but also in consideration of the wider Shepherd Street Precinct
- Discussions with DPI Water (Mr Mohammed Ismail) on riparian matters at 28 Shepherd Street earlier in 2016
- Guidelines for riparian corridors on waterfront land (DPI Water 2012)
- A report written by ACS Environmental titled Flora & Fauna Survey and Riparian Zone Assessment for 26 Shepherd Street Liverpool
- A report written by ACS Environmental titled *Riparian Issues Assessment & Management at No. 28 Shepherd Street Liverpool*
- Site inspection conducted in October 2016
- Survey data, Lidar data and aerial photography of the site and the river reach
- Flood levels for this reach on the Georges River

The intention of my assessment is to delineate the 40m wide Vegetated Riparian Zone pertaining to the Georges River – a 4th order watercourse as defined by the Strahler system of waterway classification. Specifically, I delineate the inner 50% zone and the outer 50% zone which are offset from the highest bank of the river for the properties at 26 and 28 Shepherd Street.

Description of the sites

26 Shepherd Street

No. 26 Shepherd Street is a rectangular shaped lot which is largely vacant except for a 2-storey building at the rear of the property. Along the eastern perimeter and straddling the very top of the river bank is a tall walled fence (Figs 1 and 2). The eastern part of the site has been filled to create a level pad to support the development on the site.



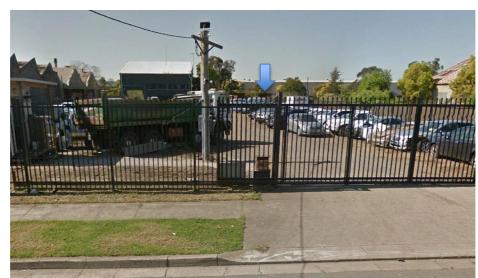


Figure 1: 26 Shepherd Street with eastern perimeter walled fence in midground shown (Google Earth).

Beyond the eastern perimeter fence is the river bank which is thickly vegetated and which falls steeply to the toe of the bank (Figs 2 & 3). The bank appears to be stable with no signs of erosion.



Figure 2: The river bank and eastern edge of 26 Shepherd Street (Google Earth)

ACS Environmental (2016a) describe the vegetation on the river bank as having patches of tall scrub and occasional trees mostly comprising woody weeds, smothered with noxious weedy vines (Fig 3). *Phragmites* spp is present in the shallow depths at the bottom of the river bank. They predicted that no impacts to threatened flora or fauna species would likely occur as a result of the proposed development.





Figure 3: Georges River bank below 26 Shepherd Street

28 Shepherd Street

No. 28 Shepherd Street is a squar(ish) shaped lot which is vacant except for a detrelict single-storey building at the rear of the property. Along the north-eastern perimeter and straddling the very top of the river bank is a retaining structure that is connected to the tall walled fence at No. 26 Shepherd Street (Fig 1). There are two concrete slabs at the rear of the property.- one behind the retaining wall, and one adjoining the building on its eastern side. The site has been filled in its eastern extent in the past.



Figure 4: 28 Shepherd Street showing the site(eastern portion) & adjoining river bank (Google Earth)



ACS Environemtal (2016b) describe the river bank vegetation at 28 Shepherd Street as weed infested, and presumably similar to the description they provided for No 26 Shepherd Street (they are connected and look very similar). The bank at No. 28 has less taller vegetation and is dominated by groundcovers. The banks of No. 28 are also not as steep as those at No. 26. The river bank at No. 28 appears to be stable with no apparent signs of erosion.

Determination of Vegetated Riparian Zone

In our previous advice for 28 Shepherd Street, we adopted RL 9.0m as the level at which the VRZ commences. We also considered other factors in relation to adopting the VRZ extents, including:

- Highest Bank The highest bank at 26 Shepherd Street is the point at which the high walled fence is sited along the site's eastern perimeter. The level of the highest bank is approximately RL10.4m. Note that the site has had fill placed on its eastern extent in order to create a flat pad for development. Therefore the actual highest bank is not clearly delineated, and sits below the RL 10.4m level.
- Flood levels There are varying flood levels on the Georges River relating to different recurrence intervals of storm events. Flood levels range from the adopted river level in "normal" or base flows of RL2.79m up to RL 9.7m in the 1% AEP storm.
- Levels on opposite river bank In relation to Item 3, we have used Lidar data to show levels
 on the opposite (eastern) bank of the Georges River. This shows that the bank levels
 fluctuate between RL 8.1-8.5m and applying a 0.5m freeboard translates to RL 8.6-9.0m.
 Again, this is consistent with the adopted VRZ line of RL 9.0m.



Figure 5: Section of Georges River showing site (26 & 28 Shepherd Street and opposing bank

 Condition of opposite banks - The eastern river bank is shown to be stable (no erosion evident) with vegetation dominated by weeds (Figure 6).





Figure 6: Eastern (opposite) river bank

From this information, we conclude that the VRZ should commence at RL 9.0m. The 20m wide Inner 50% VRZ and adjoining 20m wide Outer 50% VRZ shall be offset from this line.

Impact of the newly determined VRZ

As a result, the proposed buildings at 26 & 28 Shepherd Street will be set back behind the Inner 50% VRZ at ground level. This will allow for a the creation of a fully protected and structured riparian zone with endemic native vegetation to be established up to the easternmost extent of the building footprint.

Landscaping features, walking paths and stormwater outlets are permitted in this Inner Zone. The Outer 50% VRZ may accommodate the development's built form, with offsetting occurring for native landscaping elsewhere (see Justification in next section). The river bank below the highest bank should be rehabilitated and revegetated.

The development is shown in relation to the riparian zone in Figure 7.





Figure 7: The proposed development in relation to the riparian zone



Council advise that the renewal of the precinct and the riverbank is in line with Council's strategy of becoming a river city and that they are working closely with Coronation to determine how to deliver a boardwalk and bank stabilisation works. Thus, an integrated outcome will result where waterfront land provides significantly enhanced riparian zone functions, including:

- Stabilization of banks
- Habitat improvement and connectivity
- Provision of an interface/buffer between development and the waterway
- Passive recreation shared path/boardwalk and river access

Averaging rule and offsetting

The 26 & 28 Shepherd Street developments form a part of the developments proposed in the Shepherd Street precinct by Coronation Property. The northernmost development is No. 20 Shepherd Street and is already approved and under construction. Other developments will be proposed to complete the development of the precinct, up to and including 33 Shepherd Street. Therefore, we expand out the assessment of riparian zones so that a precinct-wide strategy can be devised, and used as the basis of ongoing assessment of developments proposed (Attachment 1).

Non-riparian corridor works and activities can be authorized within the Outer 50% VRZ. The proposed development would result in the construction of buildings and ancillary infrastructure in this outer zone. In creating a reclaimed riparian zone in the Inner 50% VRZ, lands that are currently built-upon with car parks, harstands and buildings will be fully revegetated. This counts as offsetting against development incursions into the outer 50% VRZ. This was advised by Mr Frank Garofalow in our meeting on 3rd November 2016.

We have conducted a comparative spatial assessment of offsets vs incursions across the Shepherd Street precinct, and this is shown in **Attachment 1**. In summary, the amount of land that counts as offset is greater than the land area that requires offsetting. This results in a 901m² suplus of land that will be offset.

While this demonstrates that no further offsetting is required outside of the Shepherd Street Precinct, Coronation is committing to provide offsets as a commitment to the redevelopment of the precinct, and the deilivery of a catalyst project consistent with Council's strategy of becoming a river city.

River Reach Context

The Shepherd Street precinct forms part of the reach of the Georges River bounded by the weir to the north, and the Casulal Powerhouse to the south.

For the purposes of this assessment, we ignore the eastern bank of the river which will be the subject of future development proposals over much of its extent, and riparian matters will be dealt with separately by other development proponents.

The western bank is of more relevance to this assessment. To the immediate north of Shepherd Street is a spread-out development that was constructed in the 1980-90s comprising apartment blocks. This and the Shepherd Street precinct will be the only developments along the entire reach. The remainder of the land on the reach is dedicated open space land in Council ownership (Figure 8). Council has plans to upgrade all this riverfront open space into recreational and



environmental land use for the people of Liverpool. Developer contributions will be used to fund much of this work to improve the environmental features of these lands.

When seen in the context of the entire river reach, a clear indication of offsets can be ascertained. It shows that there is good potential to enhance the waterway and environmental outcomes for the reach, in balance with development outcomes.

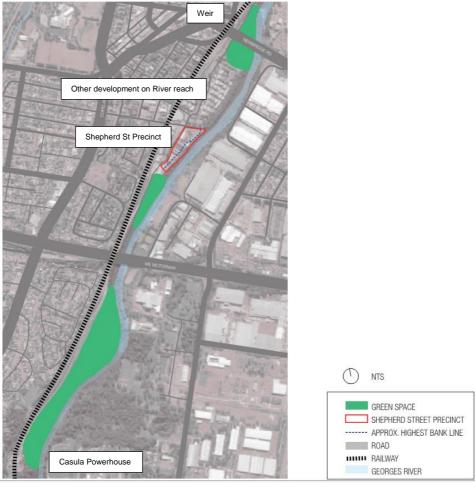


Figure 8: Georges River reach context for riparian offsetting

Requirements to inform future assessments

It is important to define the types of works that are required, the documentation of them, and the subsequent maintenance requirements to ensure the success of riparian stabilization and revegetation. At the meeting with DPI Water on 3 November, it was discussed that the offsetting/rehabilitation works could be defined by either a monetary amount or by an outcome. It is proposed to define these works by outcomes, which are detailed below. We envisage this would be managed through a Vegetation Management Plan, which can be required to be submitted as part of the Controilled Activity Approval (CAA) as a condition of approval in the General Terms of Approval (GTAs) issued by DPI Water for the current DA.

Once the built-upon lands in the Inner 50% VRZ are reclaimed, they will be stabilised and revegetated as follows:



- Bank stabilization structures Coronation are currently undertaking a fluvial geomorphic assessment of the entire Georges River reach both upstream and downstream of the Shepherd Street precinct. The results of this assessment will be used to determine if any stabilization measures are required at the toe of banks, or in other situations. If so, they will be incorporated into a Rehabilitation Plan for the Precinct. The preference is to include hard measures such as revetment only where they are required, and to seek to maximize vegetative responses. This work is being undertaken in conjunction with Council as they seek to design a boardwalk along the reach. It will be important to install any protective works initially, followed by other works, as follows;
 - Soil amelioration/amendment existing site soils will be assessed for their properties to support vigorous plant growth. Should they be found to be deficient in any characteristic, they will be ameliorated as required, e.g. lime, fertilizer, gypsum, etc. This would be spelled out in a Vegetation Management Plan for the Precinct.
 - Revegetation of the Inner and Outer 50% VRZs. Species should be selected based on those recommended by ACS Environmental (2015) (Table 1), and a full revegetation design showing these plants and where they are to be planted in zones and with planting densities will be provided. This would form part of the Vegetation Management Plan for the Precinct.

Table 1: Species suitable for planting in a reconstructed riparian forest/woodland landscaped VRZ for 26 and 28 Shepherd Street Liverpool

Trees	Small trees	Shrubs	Ground cover plants
Rough-barked Apple	Acacia decurrens	Ozothamnus	Dianella longifolia
(Angophora floribuna)		diosmifolius	
Broad-leaved Apple	Acacia	Hibbertia diffusa	Brunoniella australis
(Angophora subvelutina)	parramattensis		
Cabbage Gum	Exocarpus	Acacia longifolia	Pratia purpurascens
(Eucalyptus amplifolia)	cupressiformis		
Blue Box	Melaleuca decora	Callistemon citrinus	Microlaena stipoides
(Eucalyptus baueriana)			
Forest Red Gum	Melaleuca	Kunzea ambigua	Dichondra repens
(Eucalyptus tereticornis)	styphelioides		
Blue Gum	Melaleuca	Bursaria spinosa	Oplismenus aemulus
(Eucalyptus saligna)	linariifolia		
Swamp Mahogany			Pteridium
(Eucalyptus robusta)			esculentum
Grey Box			Viola hederacea
(Eucalyptus moluccana)			
			Einadia hastata
			Cheilanthes sieberi
			Clematis glycinoides

 A full maintenance plan will be devised to ensure that the revegetated riparian zones are stable and fully self-sustaining with no erosion, no noxious weeds and only 5% cover of environmental weeds at the end of the maintenance period. Of the total number of plants to be planted, 90% survival must be recorded at the end of the 5 year period. The details of this would be included in a *Vegetation Management Plan* for the precinct.



Conclusion

We have adopted RL 9.0m as the highest bank and offset this line by 20m and 40m to eastblish and formalise the Inner and Outer 50% VRZs for Nos. 26 & 28 Shepherd Street.

We have assessed the broader Shepherd Street precinct to define an offsetting strategy to offset the incursions into the outer 50% VRZ (**Attachment 1**). We calculate that the area requires offsetting is less than the offsetting that will be provided in the precinct. Despite being in surplus, Coronation Property will provide further riparian revegetation and improvement in an area to the north of Shepherd Street precinct.

All riparian works and subsequent maintenance will be the subject of a *Vegetation Management Plan* for the precinct. The measurable outcomes for works under the VMP are as follows:

- Banks stable with no visible signs of erosion
- 90% survival of all plants after 5 years
- 0% cover of Noxious weeds after 5 years
- Less than 5% cover of Environmental Weeds after 5 years.

The strategy proposed for the precinct above demonstrates that sufficient offsets are available within the precinct itself following the carrying out of improvement works in relation to removal of existing structure within the inner and outer VRZs, then rehabilitation and revegetation work undertaken as part of the redevelopment of the site. Outcomes have been identified to ensure that the work is delivered satisfactorily and in line with the objectives of DPI Water. We believe this to be consistent with the agreed approach in the meeting with DPI Water on 3 November 2016, though we would be happy to discuss any aspect of this strategy further if required.

We invite conditions which reflect these riparian proposals as part of GTAs. Further details which expand upon these concepts would be provided to DPI Water as part of the assessment of a Controlled Activity Approval for DAs for 26 & 28 Shepherd Street.

If you would like to discuss the contents of this letter, please do not hesitate to contact me.

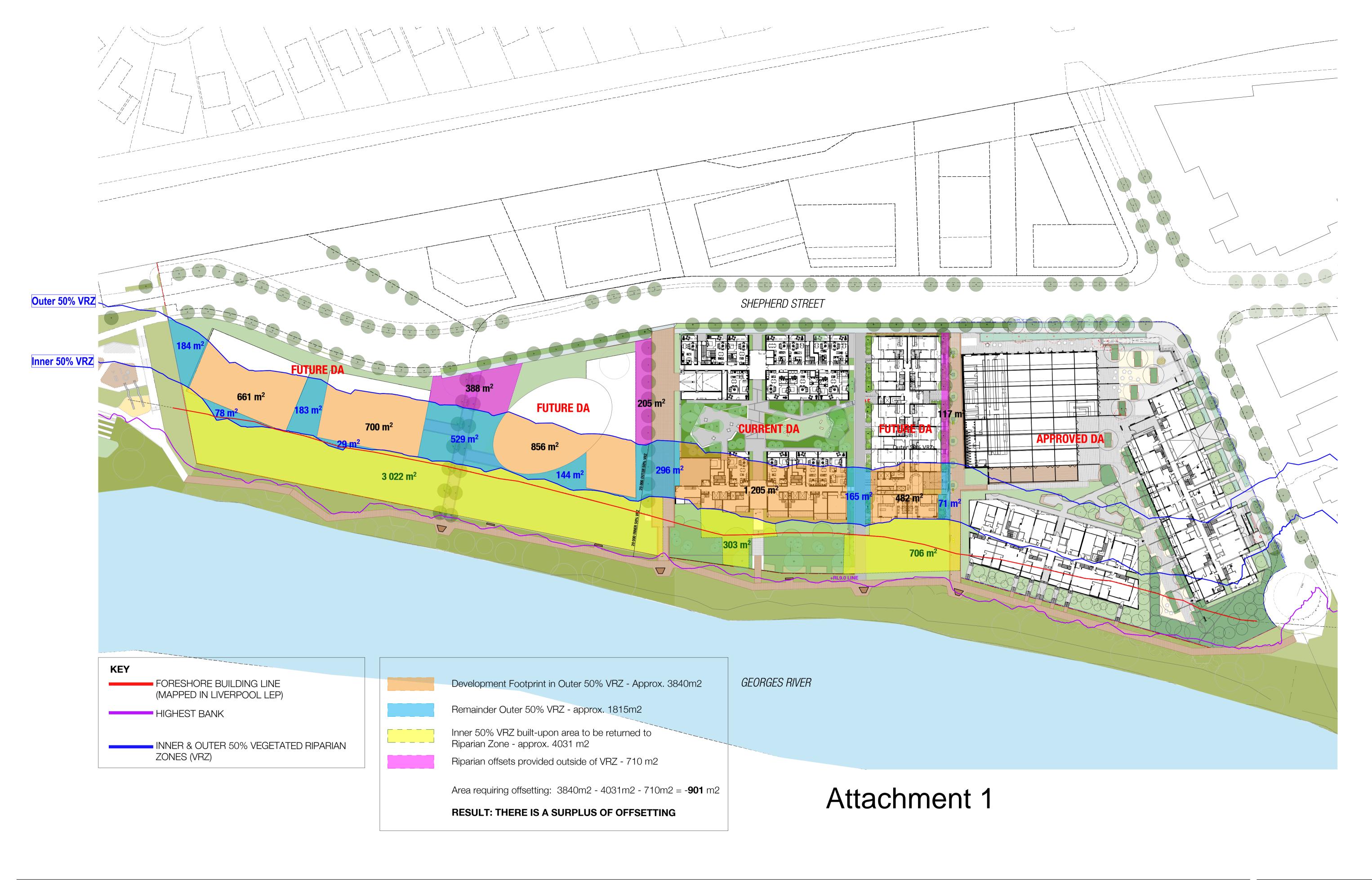
Yours faithfully,

Mal Brown

Principal | Group Manager – Water and Environment

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CORONATION PROPERTY CO

10/11/2016 02/08/2016 Coronation Property Co Pty Ltd 9-25 Commonwealth Street

B FOR INFORMATION A FOR INFORMATION

Date App'd Rev Description

Sketch
PRECINCT PLAN

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120597
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