Job No: 2017-01

24 September 2019

Claron Consulting Pty Ltd
PO Box 115 Castle Hill
SUBURB NSW 1765

Attention: Brent Winning

RE: 55 MARTIN ROAD BADGERYS CREEK – REVISED STORMWATER MANAGEMENT

I refer to the revised site layout for this property. The new site layout increases the size of the shed, bin and hardstand area from 1.116 Ha to 1.293 Ha, an increase in 0.177 Ha. We have investigated the impact of the increased impervious area has on the approved stormwater management design.

As part of the revised design the location of the underground stormwater management tank need to be moved clear of the proposed shed. The shape of the tank changed; however, the area and volume remained the same.

The *DRAINS* model was updated with the new catchment areas and all other information was left unchanged. And run for the range of storms. The table below summarises the peak flow from the developed site compared to the PSD:

ARI	Pre Development Q (m^3/s)	Post Development Approved Q (m^3/s)	Post Development Mod Q (m^3/s)
100	0.658	0.342	0.312
50	0.543	0.306	0.238
20	0.418	0.270	0.256
10	0.322	0.224	0.226
5	0.244	0.173	0.200
2	0.121	0.121	0.125

Generally, the flows from the site are reduced with the larger hardstand area, as there is less area of the site bypassing the OSD tank.

The other impact hat the increased hard stand has on the approved design is the reduction in width on the swale running along the eastern boundary of the site. The width available for the swale has been reduced to 2.5m. A swale 2.2m wide with vertical sides 600mm deep has enough capacity to safely convey upstream flow of 1.45m^3/s. The swale is proposed to run to just past the end of the building and from there it will tailout to allow the runoff to find its own path across the bottom part of the site, as it does currently.

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The information of the swale is listed below:

mannings n=	0.040	Top width (m)=	2.20
channel slope (%) =	1.10	Flow area (m^2) =	1.32
base width (m) =	2.20	Perimeter (m) =	3.40
depth (m)=	0.60	Hyd radius (m) =	0.39
side slope (1 in x) =	0.00	Velocity (m/s) =	1.40
Bed Shear Stress (N/m^2)	58.30	Capacity (m^3/s) =	1.843
Bank Shear Stress (N/m^2)	48.60	Froude No	0.58
Stream Power (W/m^2)	150.60	VxD ratio =	0.84

There are no changes required for the proposed stormwater quality treatment system, an Ocean Protect Stormfilter.

This report is submitted for Council's review and approval and should be read in conjunction with the engineering drawings submitted for the development application modification and the previous stormwater management report.

Based on the proposed stormwater drainage concept the key features are:

- Post development flows will be attenuated to at least predevelopment rates for the range of events up to the 100 Year ARI event.
- The amended swale design along the southern boundary can safely convey the 100 Year ARI flow.

It is therefore concluded that the drainage design for the site addresses Council's watercycle management requirements for the development.

Yours faithfully,

ULTRAMARK PTY LTD

ROBERT PETERSON
Director