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General Manager
Northern Beaches Council
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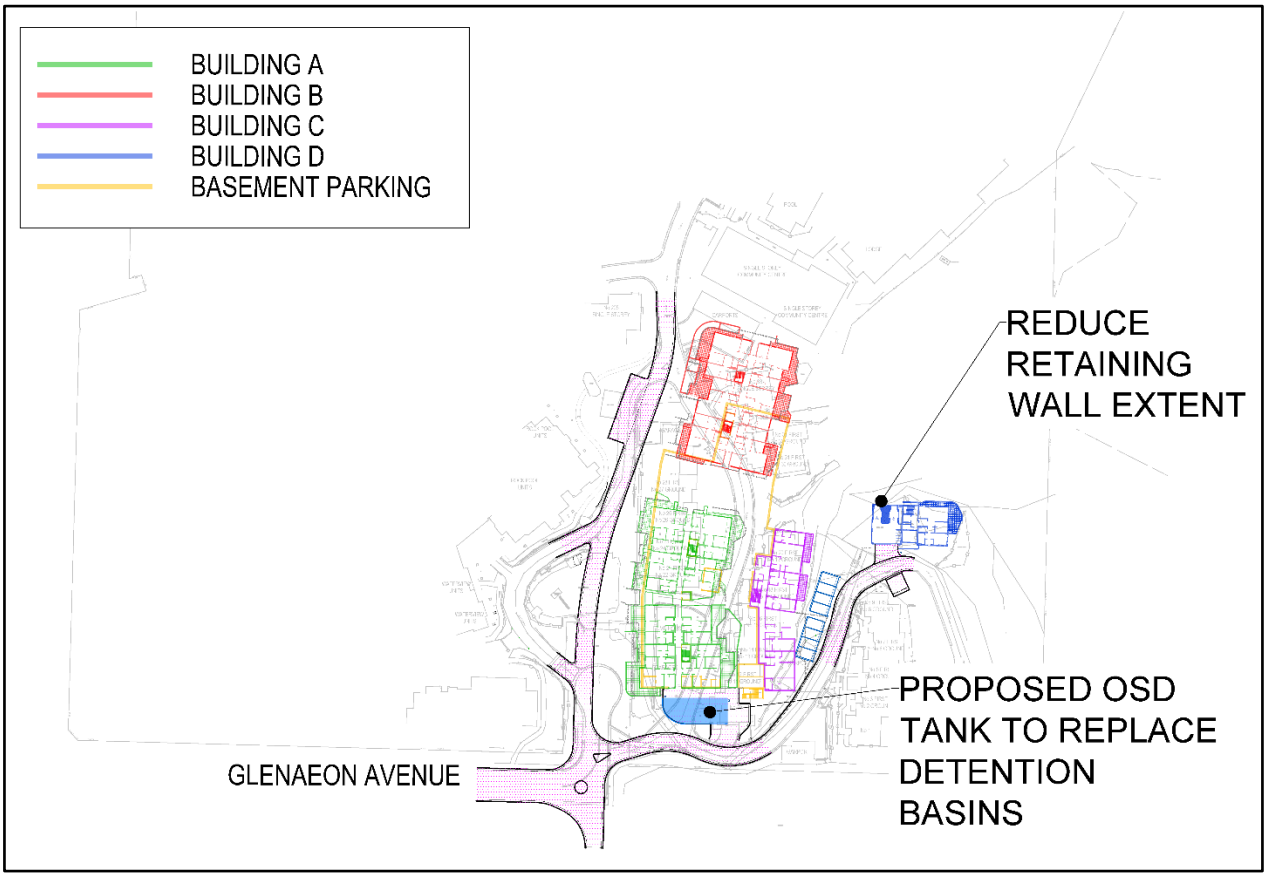
Attention: Louise Kerr

207 FOREST WAY, BELROSE
DA NO 2018/1332 SECTION 4.55 MODIFICATION – ADDENDUM A TO THE CIVIL INFRASTRUCTURE REPORT

Further to the Development Application (DA) submission for the proposed Glenaeon Retirement Village development, Cardno (NSW/ACT) was engaged by Lendlease to modify the proposed DA design to reduce impacts on existing vegetation at the south-eastern end of the site. These modifications include replacement of the detention basins originally proposed with an OSD tank within the Building A driveway footprint and amendment to the retaining wall around Building D to reduce impact on the existing surrounds.

This letter is written in support of a Section 4.55 modification and discusses the above changes as an addendum to the report "Civil Infrastructure Report – Glenaeon Retirement Village" dated 27th July 2018. The changes discussed in **Section 2** are based on the "Stormwater/Water Quality Analysis Statement" letter dated 8th August 2019. The modifications from the original DA have been documented in the drawing set 256773_CDA_DA2_000 and are shown on **Figure 1-1**.

Figure 1-1 Proposed DA Design Modifications



2 Civil Works

2.1 Retaining Walls

Retaining wall RW03 is located around the proposed Building D in the original DA submission. It is proposed to reduce the footprint of Building D by amending this wall around half of the northern side and along the western side of Building D. This will eliminate the offset from the building and reduce impacts on the surrounding bushland. Site Section 04 on drawing 256773_CDA_DA2_000_1152 and the siteworks plan on drawing 256773_CDA_DA2_000_1301 shows this modification.

3 Stormwater Management

3.1 Stormwater Quantity

Stormwater quantity management has been assessed and designed in accordance with the following:

1. Northern Beaches PL 850 Council Water Management Policy;
2. Warringah Council On-site Stormwater Detention Technical Specification; and
3. Australian Rainfall and Runoff A Guide to Flood Estimation, Commonwealth of Australia (Geoscience Australia), 2016.

3.1.1 Pre Development Scenario

Pre development catchments are illustrated in **Figure 3-1** with a summary of catchment properties and pre development modelling assumptions provided in **Table 3-1**.

Figure 3-1 Pre Development Catchment Plan

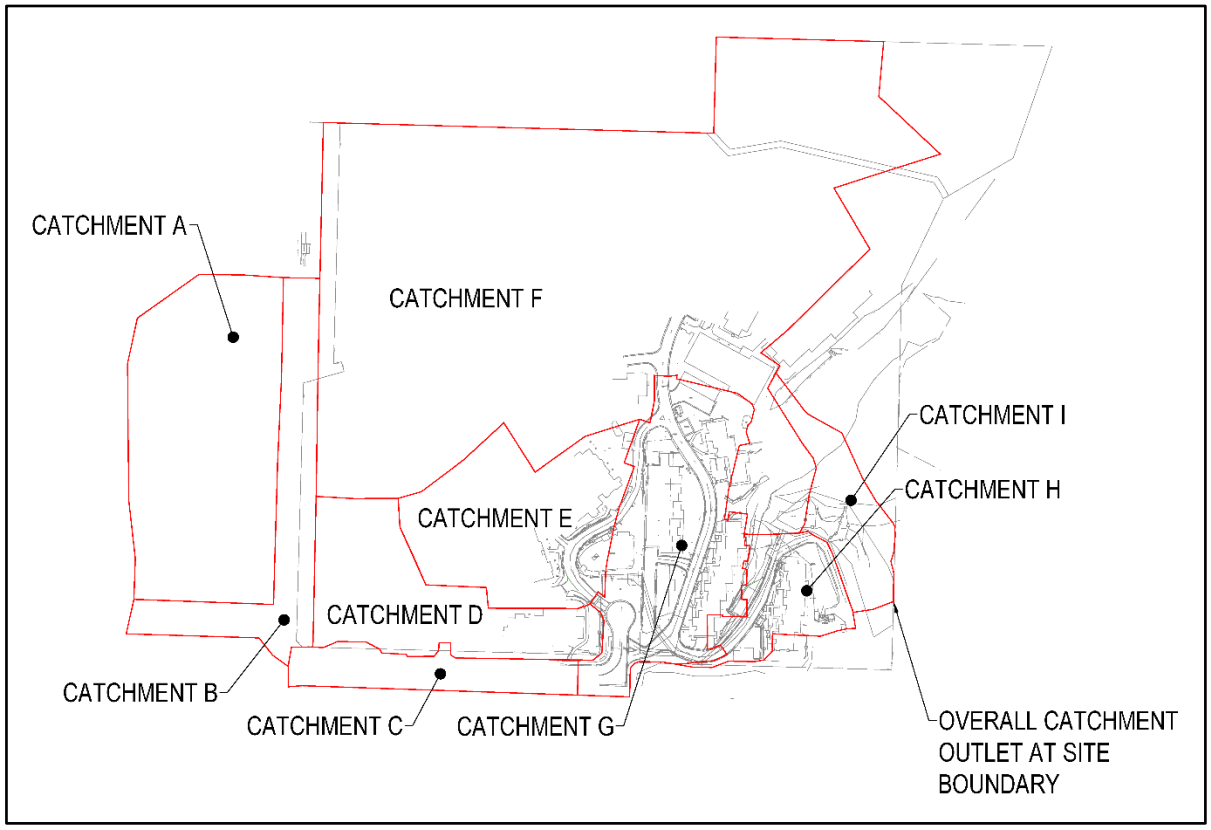


Table 3-1 Pre Development Catchment Summary

ID	Area	Description	Modelling Notes
A	1.17 ha	West of Forest Way	Connects via Forest Way into the development site.
B	0.48 ha	Existing Forest Way and Linden Ave road catchment	Pit and pipe modelled along Forest Way with bypass overflow along Glenaeon Avenue.
C	0.28 ha	Existing Glenaeon Avenue road catchment	Modelled as a typical road catchment.
D	0.63 ha	Existing South West Village catchment	Contributes to an existing OSD tank prior to discharge into Council's drainage network. Catchment modelled as pervious to account for OSD outflows in the absence of existing model.
E	0.75 ha	Existing ornamental pond catchment (West Village Catchment)	Contributes to existing OSD tanks prior to discharge into Council's drainage network. Catchment modelled as pervious to account for OSD outflows in the absence of existing model. Existing ornamental pond assumed to provide no detention storage.
F	4.56 ha	Existing North Village Catchment	Bypasses existing underground storage tanks and discharges directly to sediment basins. Catchment modelled as developed with fraction impervious based on a sample area. Sediment basins modelled with permeable walls and base to factor in existing gabion wall outlet control.
G	0.86 ha	Existing Central Village Catchment	Bypasses existing underground storage tanks and discharges directly to sediment basins. Catchment modelled as developed with fraction impervious based on a sample area. Encompasses the majority of the renewal development extent.
H	0.30 ha	Existing escarpment catchment	Bypasses existing underground storage tanks and partially discharges directly to sediment basins. Encompasses all areas from the base of the escarpment to the eastern boundary.
I	0.29 ha	Existing bushland catchment	Bushland at the base of the escarpment drains south-east to the eastern boundary.

3.1.2 Post Development Scenario

Post development catchments are illustrated in **Figure 3-2** with a summary of catchment properties and post development modelling assumptions provided in **Table 3-2**.

Figure 3-2 Post Development Catchment Plan

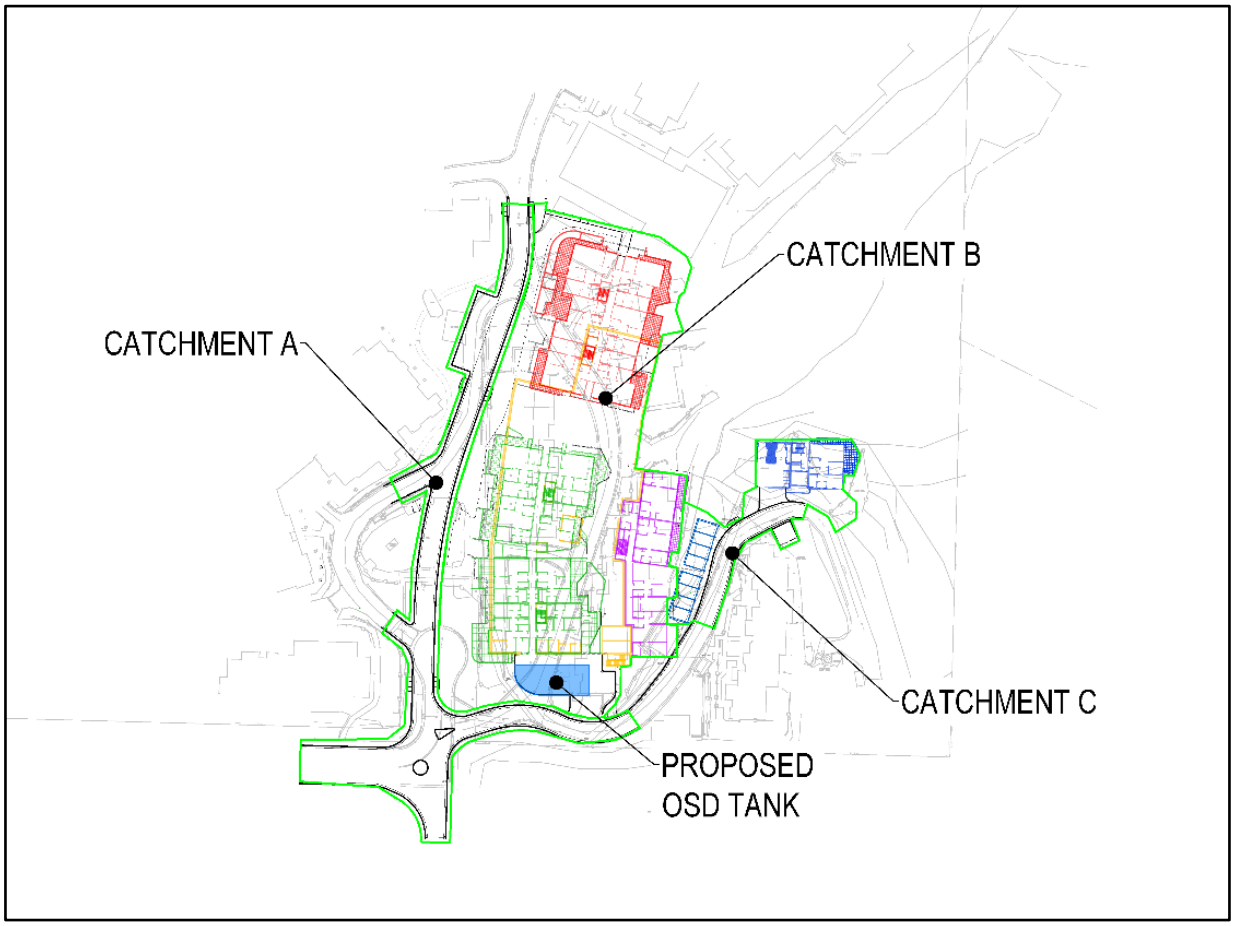


Table 3-2 Post Development Catchment Summary

ID	Area	Description	Modelling Notes
A	0.24 ha	New road catchment. Forms part of Existing Catchment G.	Modelled based on measured fraction imperviousness.
B	0.64 ha	New building catchment. Forms part of Existing Catchment G.	Modelled based on measured fraction imperviousness. Building area has been modelled as 100% impervious
C	0.10 ha	New road and building catchment. Forms part of Existing Catchments F, H and I.	Modelled based on measured fraction imperviousness.

Note: Existing external catchments A through to E have remained unchanged in the post development case. Existing catchments F through to I have been modified in the post development case to incorporate the changes provided in the table.

3.1.3 Stormwater Quantity Management Summary

A summary of pre and post development flows is provided in **Table 3-3** based on the parameters established in **Section 3.1.1** and **Section 3.1.2**. It is proposed to replace the proposed detention basins documented in the original DA with an underground concrete OSD tank located beneath the driveway to Building A. This OSD tank will be designed to detain a majority of the redevelopment site and will bypass the external public road catchment, providing source control as opposed to end-of-line treatment. The proposed OSD tank solution reduces impacts to the existing vegetation at the south-eastern end of the site, providing a low visual impact option.

It is intended that the proposed OSD tank arrangement will be refined as part of a Construction Certificate in accordance with the concept provided in the drawings accompanying this Section 4.55 modification.

Table 3-3 Pre and Post Stormwater Discharge Summary

AEP	Pre Development Flow (m^3/s)	Post Development Flow (m^3/s)	OSD Tank Storage (m^3)
20%	1.51	1.30	235
5%	2.39	1.90	370
1%	3.31	2.53	370*

*The OSD tank is full and the flow rate will be controlled by the access grates at the low point of the tank, which would operate as a weir.

3.2 Stormwater Quality

Stormwater quality management has been generally assessed and designed in accordance with the following:

1. Northern Beaches PL 850 Council Water Management Policy; and
2. NSW MUSIC Modelling Guidelines, BMT WBM Pty Ltd, August 2015.

Water quality treatment effectiveness has been modelled using the MUSIC software package to achieve the stormwater quality treatment objectives at the downstream end of the site as outlined in Table 4 of PL 850 Council Water Management Policy.

- 90% Total Gross Pollutants;
- 85% Total Suspended Solids;
- 65% Total Phosphorus; and
- 45% Total Nitrogen removal.

Figure 3-3 provides a summary plan of the proposed stormwater quality management network which incorporates:

- Modification to the existing ornamental pond – note that pre-development and post development modelling has assumed that the pond offers no tangible water quality performance.
- Installation of a proprietary Gross Pollutant Trap at Building D for the capture of gross pollutants; and
- Installation of proprietary nutrient treatment cartridges (e.g. 15 x Stormfilter) in the proposed OSD tank for the capture of Total Suspended Solids, Total Phosphorous and Total Nitrogen from the majority of the proposed buildings and re-aligned road.

Figure 3-3 Stormwater Quality Management Plan

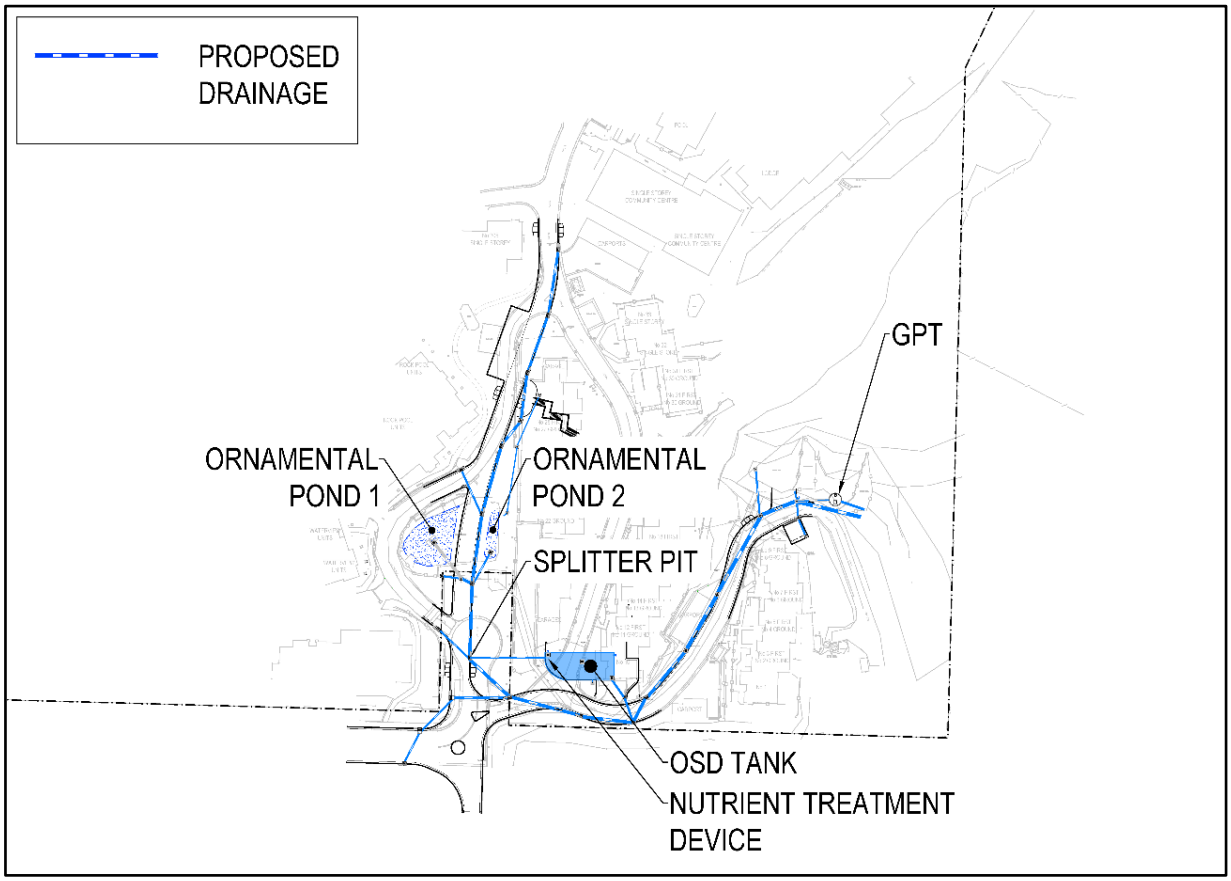


Table 3-4 Water Quality Results Summary

Pollutant	Post Development Residual Load	Post development after treatment	% Reduction
Gross Pollutants (kg/yr)	1790	13.1	99.3
Total Suspended Solids (kg/yr)	12200	1120	91
Total Phosphorus (kg/yr)	20.3	5.92	70.8
Total Nitrogen (kg/yr)	142	77.8	45.2

3.3 Road Drainage Network

Public stormwater drainage has been designed in accordance with the following standards and guidelines:

1. Australian Rainfall and Runoff A Guide to Flood Estimation, Commonwealth of Australia (Geoscience Australia), 2016; and
2. AUSPEC 1.

Private stormwater drainage is to be designed in accordance with the following standards and guidelines:

1. AS3500 – Plumbing and Drainage.

The proposed drainage network has been designed for the safe conveyance of major and minor flows towards the site outlet. Annual Exceedance Probabilities for minor and major events are:

- Minor: 10% AEP
- Major: 1% AEP

Hydraulic modelling has been completed in the DRAINS software package, and preliminary pipe sizes are provided within drawing set 256773_CDA_DA2_000.

3.3.1 Time of Concentration

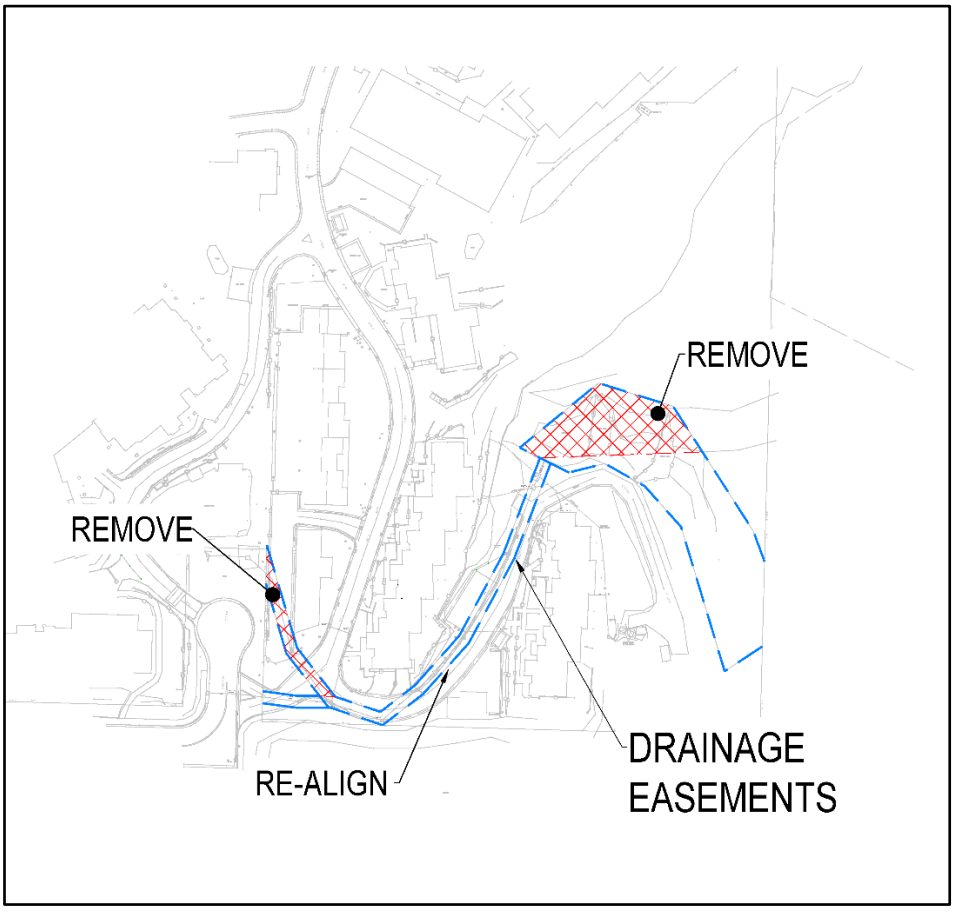
The times of concentration from the external catchments were calculated based on the flowpath length and assumed a flow velocity of 1.5 m/s. A constant time of 5 minutes was added to include the time between the roof/garden area to the nearest stormwater pits. The catchments within the development site have been delineated into small sub-catchments based on the pit locations, where the minimum 5 minutes was adopted as the time of concentration.

3.4 Existing Easements for Drainage

As part of the proposed works, adjustments to existing easements for drainage will be required to facilitate development as summarised below and on **Figure 3-4**.

- Regrading of existing low point within Council land to achieve free draining condition to the southern road facilitating part removal of easement conflicting with south west corner of proposed building;
- Realignment of southern easement to follow proposed road and drainage route; and
- Removal of easement conflicting with proposed Building D at the base of the escarpment.

Figure 3-4 Proposed Adjustments to Existing Drainage Easements



3.5 Erosion and Sediment Control

Erosion and sediment control will be installed and maintained in accordance with Northern Beaches Council's specifications and Landcom's Managing Urban Stormwater, Soils and Construction ('Blue Book'). Generally erosion and sediment control measures will include:

- Erection of temporary perimeter security fencing and sediment control fencing;
- Installation of sediment traps and barriers along existing stormwater flow paths and inlet pits;

- Appropriate treatment of construction vehicles to control and minimise sediment and debris affecting areas external to the development site;
- Establishment of dust screening scaffolds or similar appropriate measure for site conditions;
- Formation of material delivery stockpiles near areas of minimal cut or fill. Provision of appropriate covers and containment to prevent sediment runoff;
- Modification and maintenance of existing sediment basins for interim works;
- Provision of temporary sediment basin at OSD tank location during Building A - C works.

4 Conclusion

This letter has been written in support of a Section 4.55 Modification to DA 2018/1332 and describes the proposed changes to the civil works and stormwater management strategy, aimed to reduce impacts on the existing vegetation at the south-eastern end of the site.

Yours sincerely,

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for Cardno
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