

The existing site is split into three distinct stormwater catchments. The first, located on the northern part of the site, drains toward an existing dam (Dam 1 – see C02.DA) located in the north-west corner of the site, directly south of the railway line. The second, located in the central portion of the site, drains toward the south-west, toward two existing dams which are connected by a first-order creek. Dam 2, located on the eastern side of the site, spills into Dam 3, located in the south-west corner of the site. The southern part of the site also drains into a first order creek, into Dam 4, located directly adjacent to the culvert crossing beneath the existing driveway. Overflow from Dam 3 and 4 combine into a second order creek which discharges the site in the south-western corner. The catchment to the existing dams extends outside the site boundary, with runoff from the adjacent properties draining the subject site.

The site is subject only to local catchment flows, not regional flooding. This was confirmed by Council on 11/10/2018.

The proposed development consists primarily of the construction of a crematorium complex, including numerous chapels, a crematorium for two cremators, mortuary facilities, offices, car parking, modification of the existing residence for administration and back-of-house facilities, cemetery plots and gardens and landscaping. Access to the facility is proposed via utilising the existing road as well as an additional proposed access road from Old North Road.

Stormwater Management Summary

It is proposed to provide cut-off swales around the eastern side of the site (upstream) to divert the runoff from the upstream catchment around the proposed development footprint. A network of shallow landscape swales and surface profiling will be the primary stormwater conveyance through the site, with shallow culvert structures provided where required to convey runoff beneath proposed access roads or paths. Minimal pit and pipe networks are proposed on the site in order to maximise the passive irrigation.

The northern part of the development will runoff into the existing creek into Dam 3. The western part of the development will be collected by a swale and conveyed to a proposed biofiltration basin/ berm with minimum 10m² filter area, which discharges into Dam 3. The southern portion of the development, consisting only of the new access road, will runoff into the existing creek and into Dam 4.

The central portion of the development will drain to the south, where low-flows will be directed towards a bio-filtration basin/ berm with minimum 90m² filter area, which will discharge into the existing Dam 4 to the south. High-flows will bypass the bio-filtration basin and be conveyed directly to the existing dam. Dam 4 is also proposed to be modified in order to provide on site detention storage. The overall size of the dam will remain similar, however an outlet structure is proposed to be provided (i.e. pit and pipe with orifice and overflow weir) in order to reduce the overall peak flow of stormwater discharging the site.

Runoff from the two main buildings on-site, the chapel and crematorium, will be collected and conveyed to above ground re-use tanks (dual tanks minimum 5kL each). The water shall be re-used for internal toilet flushing, washing and for external uses. Note runoff from all other building roofs will discharge onto the ground.

Site Analysis

The proposed development areas consist of:

- 41.79Ha total site area;
- Existing Impervious Area 3,300m²;
- Proposed roof area 2,251 m²;
- Proposed other impervious area 18,360m²;
- Existing Impervious Fraction 0.8%;
- Proposed Impervious Fraction 5.2%; and
- Post Developed Increase Impervious Fraction 4.4%.

Stormwater Quantity

A schematic of the model can be seen below in Figure 2. Refer to catchment plan attached to the rear of this document;

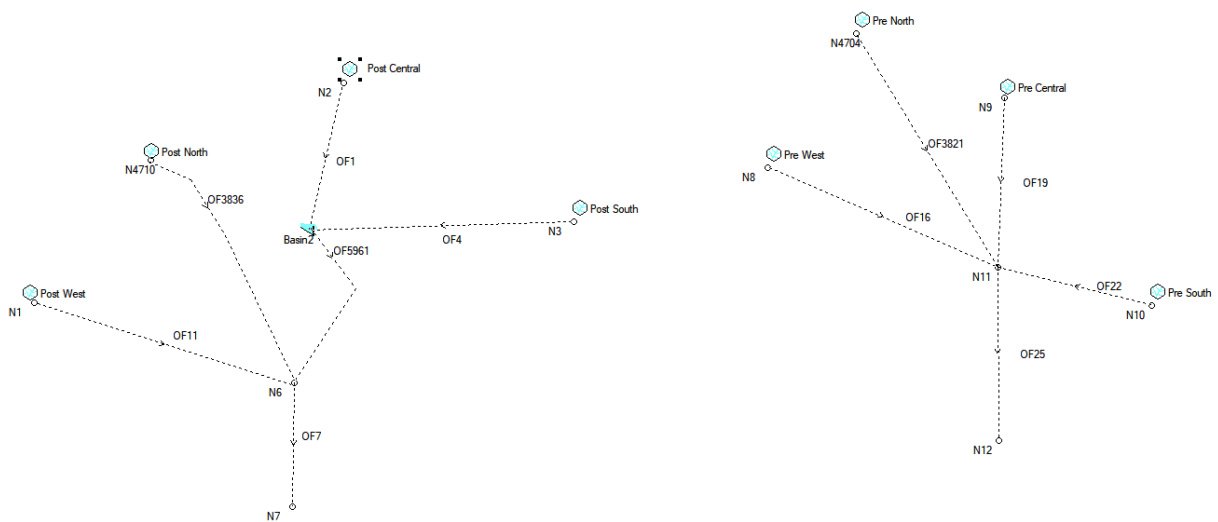


Figure 2 - DRAINS model schematic

Council's Manual of Engineering Standards indicates that post-developed flow from the site must be less than or equal to the pre-developed flow for the 1EY, 10% AEP and 1% AEP storm events.

To achieve this it is proposed to augment Dam 4 by providing a pit and pipe outlet (with orifice control) and overflow weir, to provide the required on-site detention (OSD) storage. The preliminary modelling indicates that a minimum storage volume of 300m³ is required.

Table 1 - DRAINS model results

	Pre Q (m ³ /s)	Post Q (m ³ /s)
10% AEP	0.85	0.84
1% AEP	1.88	1.77

As shown above, the proposed detention system reduces the post developed peak flow from the site to below the pre-developed, for the 10% AEP and 1% AEP storm events. The OSD system does not satisfy this requirement for 1EY storm, however due to the significant dam storage available on-site this is not likely to have adverse effects downstream. In addition, and which will further retard minor flow events, the onsite roof water tanks have not been included in the modelling and nor have any retention/retardation affects from the significant network of vegetated swale that are proposed to convey runoff around the site.

DRAINS model can be provided upon request.

Stormwater Quality

To negate any adverse impacts upon the ecology of the downstream watercourses; stormwater treatment devices have been incorporated into the design of the development. Council's DCP identifies the level of stormwater quality treatment to be provided for the proposed development (refer to Treatment Targets in Table 1).

The performance of the proposed stormwater management strategy was assessed against these targets using the conceptual software MUSIC (Version 6.3.0). The MUSIC model was developed using recommended parameters presented in the document "Draft NSW MUSIC Modelling Guidelines" (WBM, 2015). A schematic of the proposed treatment train can be seen below in Figure 3.

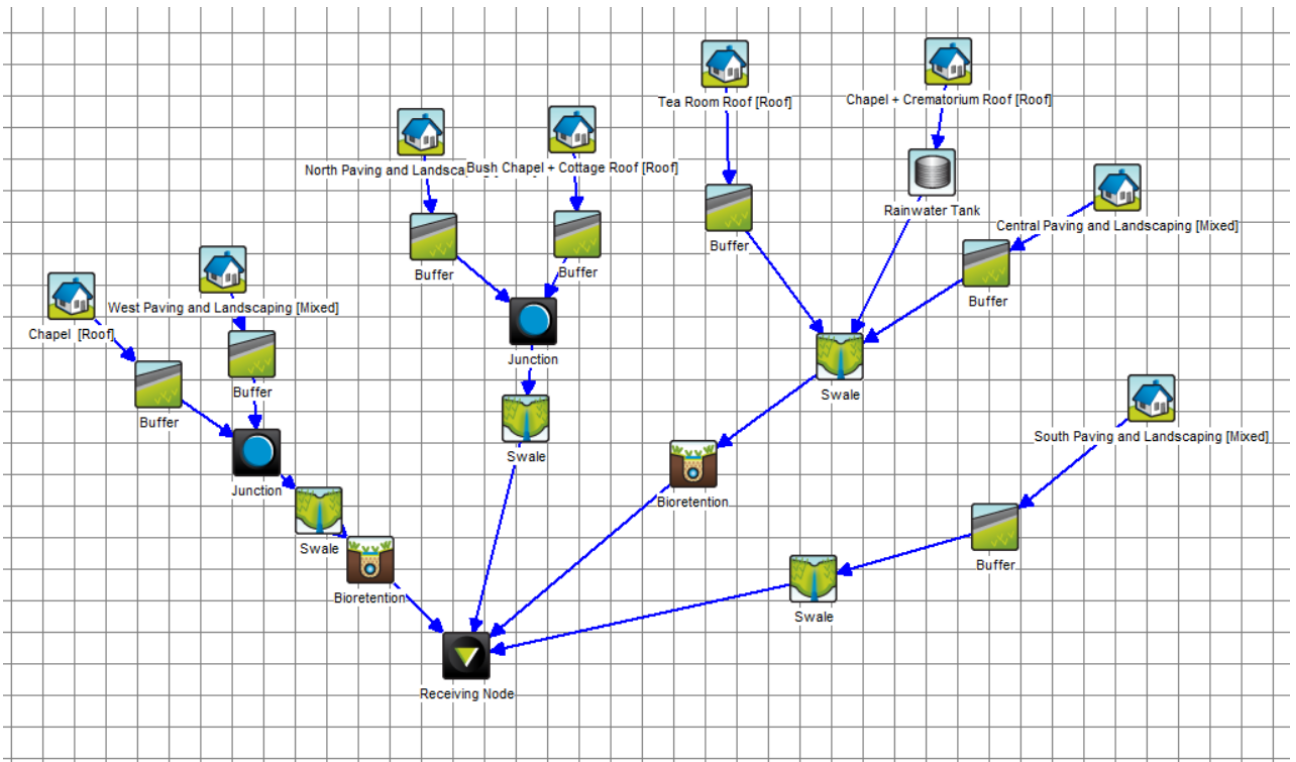


Figure 3 - MUSIC Model schematic

The results of the proposed treatment train can be seen below in Table 2.

Treatment train node summary:

- Pre-treatment via landscape buffers and swales for all catchments;
- Dual 5kL rainwater tanks to treat runoff from the chapel and crematorium buildings; and
- The western catchment shall receive additional treatment via a biofiltration basin (min 10m²). Similarly, the central development shall be treated via 90m² biofiltration basin.

Table 2 - MUSIC model results

	Source Load (kg/yr)	Residual Loads (kg/yr)	Percentage Reduction	Target Objectives
Total Suspended Solids (TSS)	4380	537	87.8	80%
Total Phosphorous (TP)	9.41	3.1	67	45%
Total Nitrogen (TN)	70.3	38.2	45.7	45%
Gross Pollutants	721	0	100	70%

Table 2 shows that the proposed stormwater management strategy is predicted to achieve the load reduction targets set out in the MCC DCP 2011, as estimated by MUSIC.

MUSIC model can be provided upon request.

Conclusions

Given the results of the above investigations, it is reasoned that the development meets MCC's requirements. In particular:

- Post developed peak flow is reduced to the pre-developed flow regime for the 10% and 1% AEP storm events; and
- The treatment of stormwater runoff for waterborne pollutants is achieved through the proposed treatment train.

We trust this meets your requirements, however should you require anything further, please do not hesitate to contact the undersigned.

Yours sincerely



Kane Sinclair

Civil Engineer

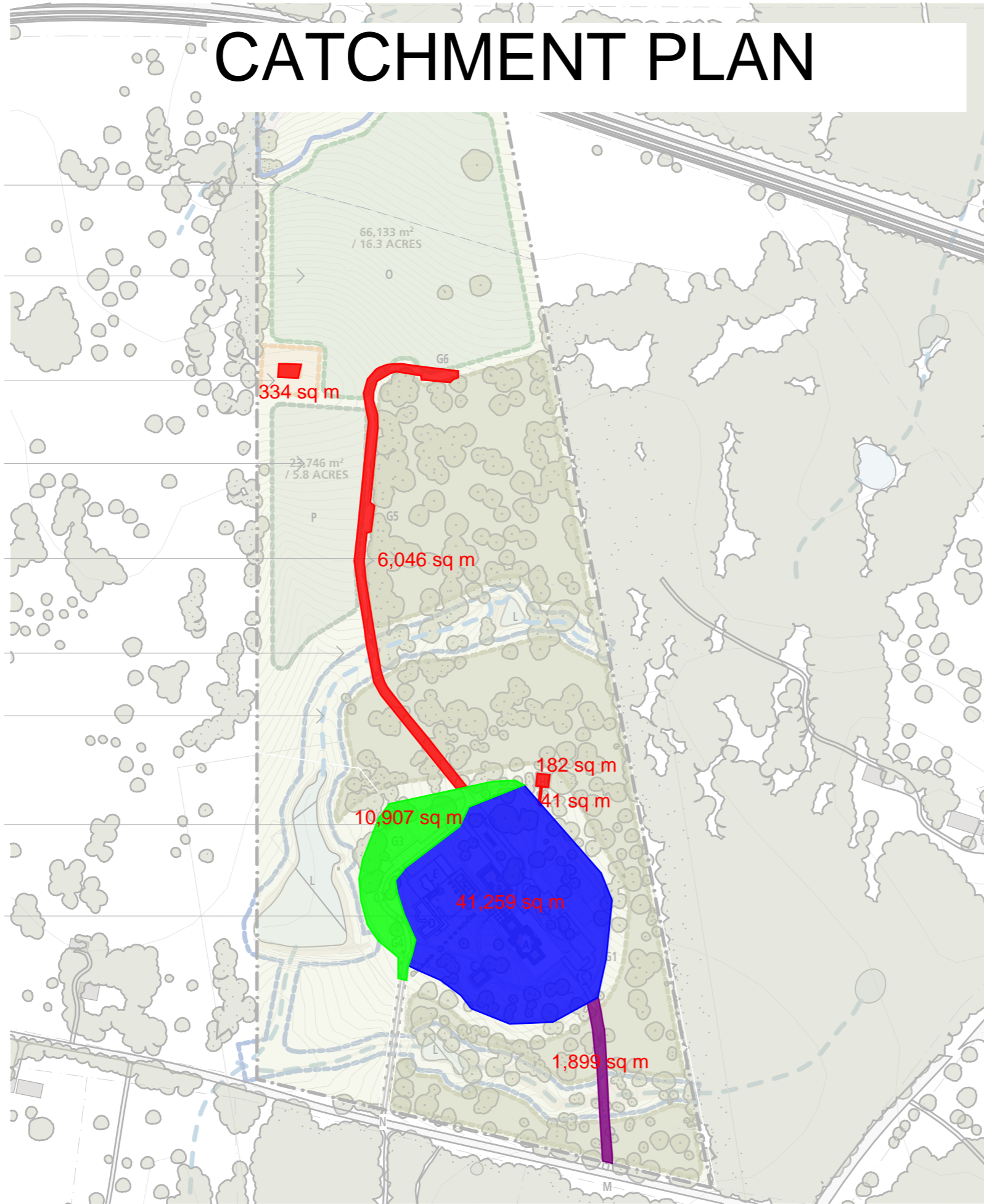
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Attachment 1 – Catchment Plan

Attachment 2 – C01.DA- C03.DA Drawing Set

CATCHMENT PLAN



LEGEND

- NORTH CATCHMENT
- WEST CATCHMENT
- CENTRAL CATCHMENT
- SOUTH CATCHMENT

NOTE THE CATCHMENTS SHOWN ARE CONSISTENT WITH THE DRAINS MODEL. HOWEVER FOR THE MUSIC MODEL ONLY 1/3 OF THE LANDSCAPED AREA IN THE WEST AND CENTRAL CATCHMENT WERE MODELLED (i.e. THE APPROXIMATE DISTURBED EXTENT).

