Medowie Christian School Proposed Science and Technology Building (ISTEM)

6A Waropara Road, Medowie, NSW

Stormwater Management Plan

for

Medowie Christian School

August 2019

MPC Project Ref: 180802 [Rev. E]

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Appendices

1. Background Information

1.1 Preamble

The proposed development contains of demolition of an existing structure to cater for a new building for science and technology teaching spaces (ISTEM). The refurbished building zone is contained within the Medowie Christian School Site located at Waropara Rd, Medowie NSW 2318 (refer to **Appendix A** for site plans). The proposed redevelopment includes the following:

- Demolition of existing structure with a roof area of approximately 630 m^2
- Construction of ISTEM Building with roof area of approximately 580 m^2

MPC addressed the following issues in devising this Stormwater Management Plan.

- Review of the existing stormwater drainage infrastructure on the site;
- Design of Stormwater Management for the proposed new ISTEM Building (refer **Appendix B**) in accordance with the Port Stephens Council Development Control Plan, incorporating:
    - Stormwater quantity (detention);
    - Stormwater quality (treatment);
- Review of requirements for Stormwater Harvesting (Rainwater re-use)

The stormwater and environmental management philosophy employed in the Stormwater Management Plan is discussed in Section 3.0. Construction phase controls are discussed in section 5.0 of this report.

In preparing this Stormwater Management Plan a review has been undertaken with Port Stephens Council DCP 2014 'DCP Section B – General Provisions', with the aim to maintain previous Water Sensitive Urban Design measures.

1.2 Background Information

Based on our review of the DCP and previous site design and documentation we understand the following:

- An upgrade of the on-site stormwater management system occurred in 2016 – 2017. Previous civil engineering documentation by BG&E Consulting Engineers (refer **Appendix D** for documents and report), indicates that a full catchment analysis was completed for master planning purposes and redevelopment of the recently constructed Administration Building;
- MUSIC modelling had been complete as part of BG&E's overall site analysis (refer **Appendix D** – Report S15074 dated 5th April 2016), and treatment systems including a "Humeceptor" Gross Pollutant Trap (GPT) were installed as part of the previous construction works;
- The previous water quality design did not meet the "stripping targets" set out by the DCP, and as such Port Stephens Council have requested that a new

MUSIC model be ndertaken that ensures the porposed development complies with the water quality targets of the DCP;

- Site survey data for the existing property has been supplied by Parker Scanlon (Ref: B1828DET-I-B issued 18 July 2018, Rev B). A copy of this survey is included in **Appendix E** of this report.

2. Catchment Description

2.1 The Existing Catchment

The existing school catchment comprises an area of approximately 2.56ha. The site has school buildings, pavements and landscaped areas with approximately 1.2ha of impervious area (48% impervious).

The contours on the site survey (included in **Appendix E** of this report) indicate that the school site (Lot 22 DP 1036306) slopes downward from Waropara Road to the north-east, at a grade of approximately 6%.

Stormwater runoff on the existing site is conveyed through an in-ground pit and pipe drainage system, to a detention basin in the northeast corner of the developed portion of the property. A pipe culvert exits the basin to the east, for drainage of the minor storm event. A weir exists in the top of a block wall forming the eastern edge of the basin, for controlling the major storm events.

Outflows from the basin are directed to a “diversion bank” which runs to the east through Lots 1 and 2 in DP407773, Lot 191 in DP664436 and Lot A in DP 393174, into an existing open swale drain / creek in Lot 1 DP 593462, as illustrated in Figure 1 below.

The surface contours on the neighbouring property to the north (Lot 10 in DP 1051742) indicated a slope towards the southeast, thereby creating a natural valley along the common boundary with the school property. This natural valley would naturally concentrate stormwater flows and direct them towards the pre-existing open swale in the north-east corner of the school property;

The stormwater design intent of the previous improvements to the school were to replicate the pre-existing drainage arrangement, however to upgrade the detention basin with increased capacity to control outflows to not exceed the pre-developed condition.

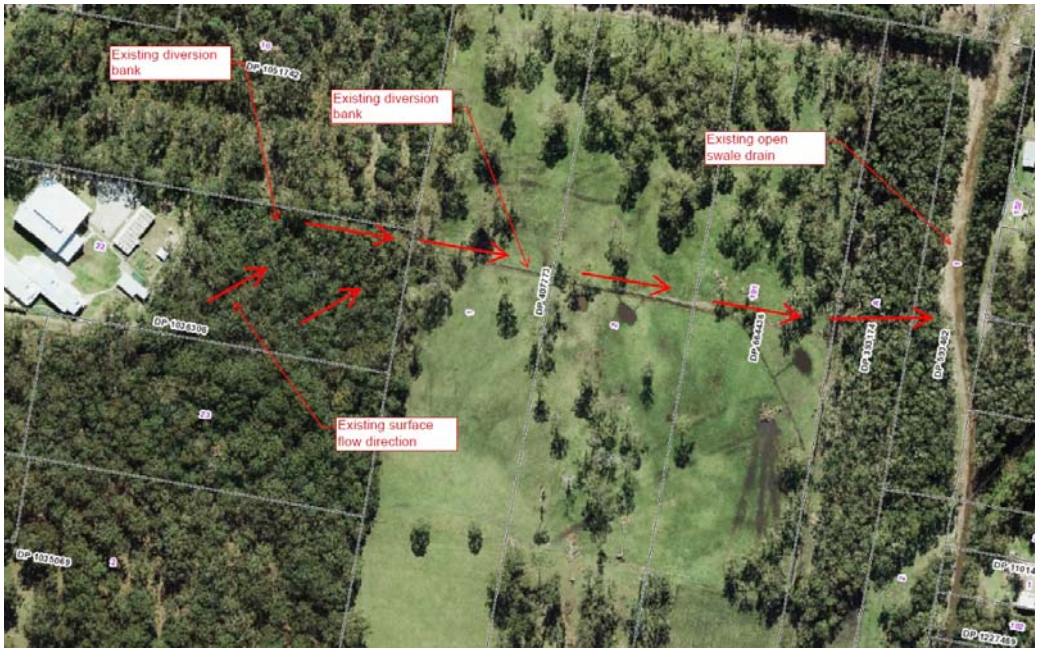


Figure 1: Pre-existing drainage flow path

Stormwater runoff onto the school property from neighbouring sites is unlikely during rainfall events based on current survey data.

2.2 The Proposed Catchment

The drawings in **Appendix A** show the site layout for the proposed development.

The proposed redevelopment includes the following:

- Existing Building Roof Area (to be demolished) = - 630 m^2
- Proposed new ISTEM Building roof area approximately = + 580 m^2
- Net increase in impervious pavement approximately = + 234m^2

There is a very small net increase (184m^2) in impermeable area as part of this proposed development, as illustrated in Table 1 below.

Table 1: Catchment Area Summary

Parameter	Pre-Development	Post-Development
Pervious Areas (m^2)	13,198	13,014
Impervious Areas (m^2)	12,402	12,586
Total Catchment (m^2)	25,600	25,600
% Impervious	48%	49%

3. Stormwater and Environmental Management Philosophy

In preparing this Stormwater Management Plan we have consulted with Council's Development Control plan in relation to stormwater. The requirements to be addressed are as follows:

- Ensure that the rate of rainwater runoff from roofs and paved areas from the pre-developed site is not increased for the developed condition for all storms up to and including the 1 in 100 years ARI event;
- Provide allowances for future rainwater re-use where appropriate. Proprietary first flush devices would be proposed prior to rainwater entering the harvesting tank;
- To ensure Water Quality outcomes are achieved, the site drainage system will incorporate pollution control measures designed to remove site generated pollutants in accordance with DCP water quality "stripping targets";
- Ensure that overland flow in the event of a choked or blocked piped system does not impact on neighbouring properties or other buildings on the site and that overflows are directed towards the stormwater detention basin.
- Institute appropriate erosion protection and soil stabilisation measures in association with the proposed site works. Such measures are to be designed in accordance with the requirements of the Managing Urban Stormwater: Soils and Construction 4th Edition – Vol.1 (the "Blue Book") published by Landcom, 2004

4. Proposed Stormwater Management Facilities

4.1 Nature and Function of Stormwater Management Facilities

The proposed stormwater management plan is shown in **Appendix B**. The principal stormwater management components and their function are listed below:

a). Minor improvements to the block walls of the existing detention basin;

b). Construction of a new bio-retention system within the existing detention basin, to address water quality requirements of the DCP,

c). Stormwater from new roof and pavement areas will be directed through a new pipe/pit system connected into the existing site drainage network;

d). Drainage from new roof areas (i.e. the ISTEM building) will include provision for future connection to rainwater tank systems for harvesting purposes;

4.2 Design Storm Events

4.2.1 Minor Storm

The minor storm Annual Probability of Exceedance adopted for this design was 10% (consistent with a 10 year ARI).

Site stormwater drainage pipes and pits were designed for minor storm events catering for 2016 Rainfall IFD data. MPC has recommended upgrading several areas of the existing site stormwater drainage network to cater for increased stormwater flows due to the new (higher rainfall intensity) IFD data.

The results of MPC's Development Application design indicate that, once the pipe upgrades and minor improvements to the existing drainage system are completed, the drainage network will have sufficient hydraulic capacity to perform in accordance with AS3500.3, Council's DCP and Australian Rainfall and Runoff (2016).

4.2.2 Major Storm

The major storm Annual Probability of Exceedance adopted for this design is 1% (consistent with a 100 year ARI).

A pit blockage factor of 0.5 was adopted for the major storm drainage analysis for the proposed development.

Surface flow paths were assessed and found to be within safe velocity-depth limits of 0.40m/s^2, including immediately downstream of the on-site detention basin's overflow weir.

4.3 On-Site Detention

The existing basin was surveyed recently in order to enable the geometry of the existing basin to be assessed as part of these proposed works.

MPC included the existing basin in the DRAINS model of the existing and proposed drainage systems. The existing basin requires some minor improvements in order to adequately cater for design flows using AR&R 2016 rainfall data (IFD).

Whilst only minor earthworks are needed for the basin, an increase to the length of the weir along the top of the block wall (the eastern wall) is recommended in order to prevent stored water in the basin from spilling over the northern wall of the basin and towards the neighbouring property. The existing basin is capable of detain maximum of 540 m^3 volume of water in a storm event. MPC proposes to cut down 0.200 m deep section from the top of the existing eastern wall (RL 10.20) for a 20 m length of the wall so as to ensure flows in a major storm are directed to the waterlogged ground on the subject property and not over the northern boundary. The ground surface directly to the east of the basin will be provided with scour protection to prevent scouring and subsequent undermining of the perimeter block walls of the basin. Table 2 summarises post-developed outgoing flows from the site in minor and major events.

Table 2: Outgoing Flow Summary (post-developed)

Storm Event	Outgoing Flows (m^3/s)			Maximum water level in the basin
	Pipe discharge	Weir discharge	Total	
Minor storm	0.27	0	0.27	RL 9.93
Major storm	1.22	0.28	1.50	RL 10.11

The controlled flows in Table 2 are consistent with (for the major storm) and less than (for the minor storm) the pre-developed flows for the existing school property.

4.4 Stormwater Harvesting

4.4.1 Future Roof Rainwater Tank

Rainwater harvesting systems are not proposed for this stage of the development, however the proposed stormwater system for this development includes allowances to connect roof rainwater pipes into a location where future harvesting tanks can be installed. Proprietary first flush devices will be installed in the future to allow connection to harvesting tank locations.

4.5 Site Flood Storage Analysis

The proposed building site is not affected by flood levels.

4.6 Water Quality

MPC created a water quality model of the existing school catchment using MUSIC software, the data previously available (previous drawings and reports) in addition to observations made during MPC's inspections.

The existing ("pre-developed") MUSIC schematic is illustrated in Figure 2.

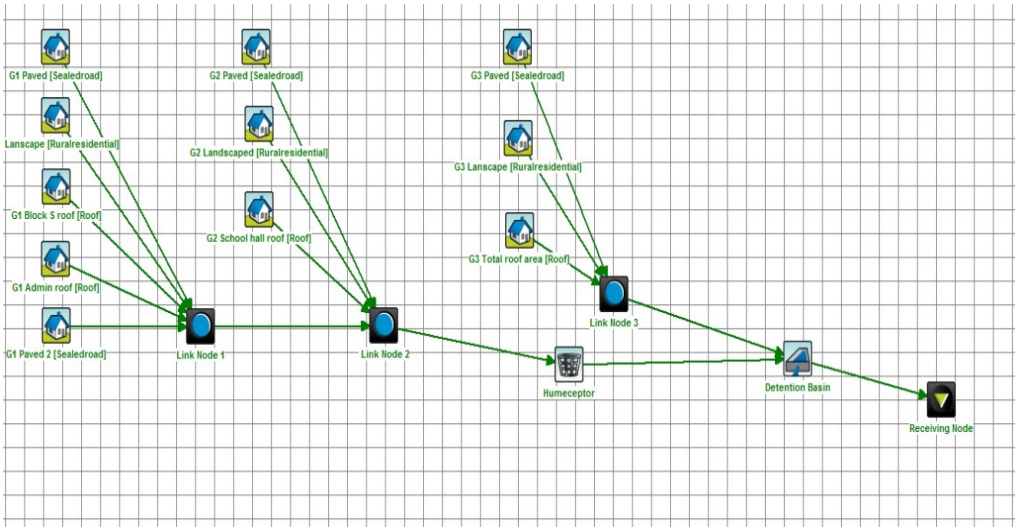


Figure 2: Pre-Developed MUSIC Model Schematic

MPC consulted Hunter Water Corporation's Water Resources Team to determine the most appropriate soil classification applicable to the Medowie Christian School property. MPC received an email from Mr. Matthew Russell of Hunter Water Corporation on 6 August 2019 which stated:

> *Other developments in Medowie located close to this one have used the Raymond Terrace Sensitive Catchment – Clay soils MUSIC-link profile, which we do not object to, and this classification appears to be consistent with the hydrologic soil group mapping for the area.*

The results of the pre-developed MUSIC model, using the Raymond Terrace Sensitive Catchment – Clay soils MUSIC-link profile as described above, indicated that the existing site does not currently comply with the "water stripping targets" (i.e. the water quality objectives specified in Council's DCP) required by Port Stephens Council. This result is consistent with the previous BG&E report (which was previously accepted by Port Stephens Council).

MPC subsequently created a MUSIC water quality model of the proposed school catchment using the "pre-developed" model but with the following differences:

- Additional 184m^2 of impervious area (net increase) due to the proposed ISTEM building and demolition of an existing building;
- A small bio-retention basin located downstream of the OSD Basin, for tertiary treatment of the school's stormwater runoff;

The proposed ("post-developed") MUSIC schematic is illustrated in Figure 3.

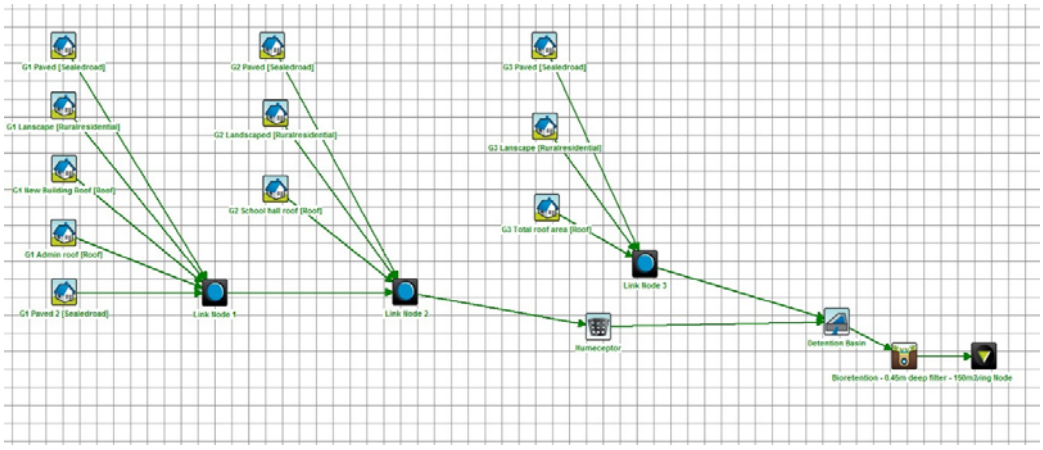


Figure 3: Post-Developed MUSIC Model Schematic

The results of the post-developed MUSIC model indicated that the proposed development can comply with the water stripping targets of the DCP provided that a Bio-Retention basin in the order of 150m^2 and 0.45m deep was constructed at the downstream end of the existing On Site Detention Basin.

The post-developed MUSIC model results are summarised in Table 3.

Table 3: Post-developed MUSIC Model Results

Pollutant Description	PSC's Water Quality Stripping Targets	Post-Developed (proposed) MUSIC Model Results
Total Nitrogen (TN) Retention Post-Developed Load	45%	47.6% (Pass)
Total Phosphorus (TP) Retention Post-Developed Load	60%	71% (Pass)
Total Suspended Solids (TSS) Post-Developed Load	90%	92.4% (Pass)
Gross Pollutants Post-Developed Load	90%	100% (Pass)

A copy of the MUSIC-Link report generated by the MUSIC software is enclosed in **Appendix F** to this report.

The Bio-Retention basin will require detailed civil engineering design and documentation so that the plan layout, pit and pipe infrastructure, and filter media (soil) profile, will meet the specifications adopted in the post-developed MUSIC model.

The results of the MUSIC assessment therefore indicate that the proposed development including the new bio-retention basin will have a beneficial impact on the Hunter Water Drinking catchment.

4.7 Maintenance of Stormwater Management Facilities

Recommendations for periodic maintenance of stormwater pits and pipes are included on MPC's Stormwater Management Plans.

Maintenance requirements for paved flow paths will be minimal as they are generally self-cleansing, and hence only involve very occasional cleaning.

The existing Gross Pollutant Trap will be part of the schools ongoing maintenance program. Maintenance of the Bio-retention basin will be added to the school's maintenance program. Further requirements for maintenance of the system will be provided at Construction certificate stage.

Regular inspections of control systems should be carried out to ensure satisfactory performance of the drainage systems proposed. Sediment/pollution control pits and proprietary pollution control devices will be provided before entering any future harvesting tank systems.

Proprietary stormwater pit inserts will also be accessible for cleaning and maintenance. Maintenance should occur on a 3 month basis or after major storm events.

5. Construction Phase Erosion and Sediment Controls

The construction phase approach adopted for this site will incorporate principles recommended by the NSW Department of Housing, namely:

- Plan for erosion and sediment control concurrently with engineering design and in advance of earthworks proper assessment of site constraints and integration of the various needs;
- Minimise the area of soil exposure;
- Conserve the topsoil where possible:
- Control water flow from the top of the development area, through the works and out the bottom of the site, for example,
    - divert clean runoff above denuded areas
    - minimize slope gradient and length
    - keep runoff at non-erodible velocities
    - trap soil and water pollutants
- Rehabilitate disturbed lands quickly.

A preliminary design of erosion and sediment controls for the overall site development is shown in **Appendix C**. Controls will be provided on the site prior to and during all earthworks in accordance with EPA Site Work Practices. Features of the construction phase erosion and sediment controls adopted for this site include:

- Prevention of sediment and polluted runoff water from entering the existing adjacent watercourse. This procedure involves the provision of silt fences, catch drains and sediment traps.
- Control of actual and potential soil erosion – grassing and stabilization of embankments and drainage outlets where required.
- Stabilised stockpile areas to prevent wind and water erosion.
- Scour protection at discharge locations.
- Stabilised site access to provide a firm base for vehicle entry/exit and to prevent the main access from becoming a source of sediment.

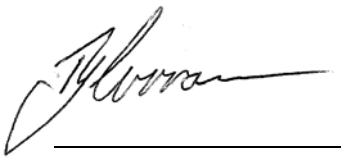
6. Summary

This stormwater management plan has been prepared by MPC Consulting Engineers for Medowie Christian School, and the systems outlined in this report address the requirements of Port Stephens Council DCP.

For further information in relation to this stormwater management plan, please contact the undersigned.

Signed:

Prepared by



Benjamin Curran
BE (Civil) (Hons), MieAust, CPEng, NER, RPEQ
Structural/Civil Engineer

Date: 23 August 2019

Reviewed by

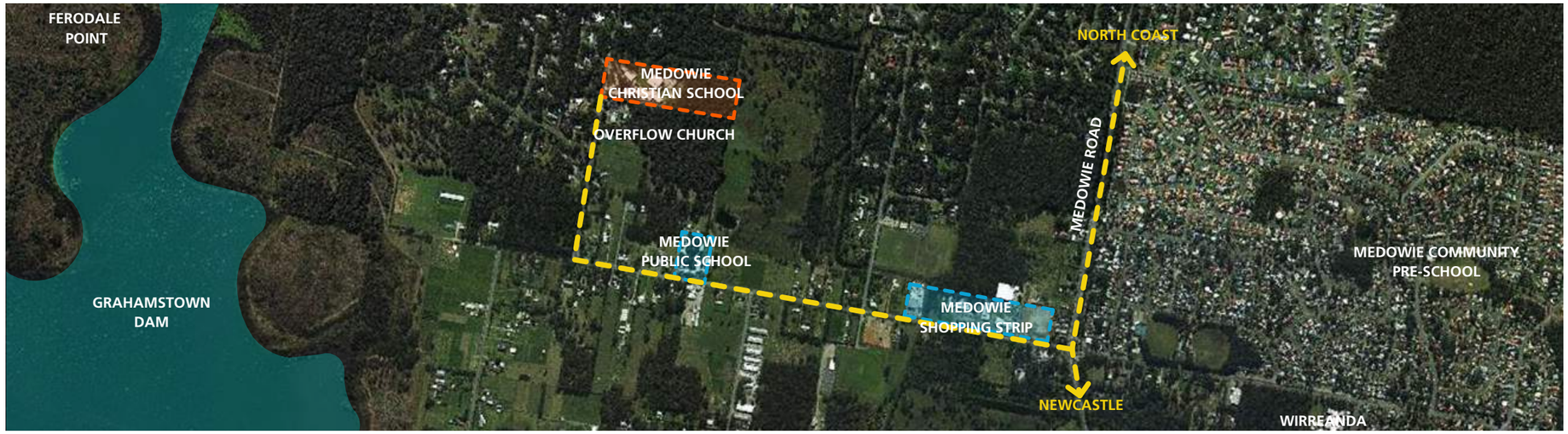
DEREK PRENTICE

BE (Civil)(Hons), MIEAust, CPEng NER APEC Engineer IntPE(Aus)
Director

Date: 23 August 2019

Appendix A

Proposed Site Plan



3846
DA1007
RevC 15.11.18

Existing Site Plan

Medowie Christian School
Waropara Road, Medowie

0m 20 40 60 80 100 1:2000 @A3

Medowie Christian School

DA SUBMISSION

1. Dimensions are in millimeters unless otherwise shown.
2. Work to given dimensions. Do not scale from drawing.
3. Check all dimensions on site prior to construction and fabrication.
4. Bring any discrepancies to the attention of the proprietor & architect.

SCHOOL DETAILS

Site Address:	6B Waropara Road, Medowie, 2318
Lot / DP Address:	Lot 2 DP1036306
Site Area:	**Total - 40,500m² (4.05 h.a.)**
	Developable - 24,000m² (2.4 h.a.)
Council:	Port Stephens LGA
Zoning:	R5 - Large Lot Residential

ANALYTICAL SUMMARY

Student Numbers:	Primary 260
	Secondary 200
Staff Number:	59
Existing Carparks:	50
Carparks on Church site:	47

LEGEND

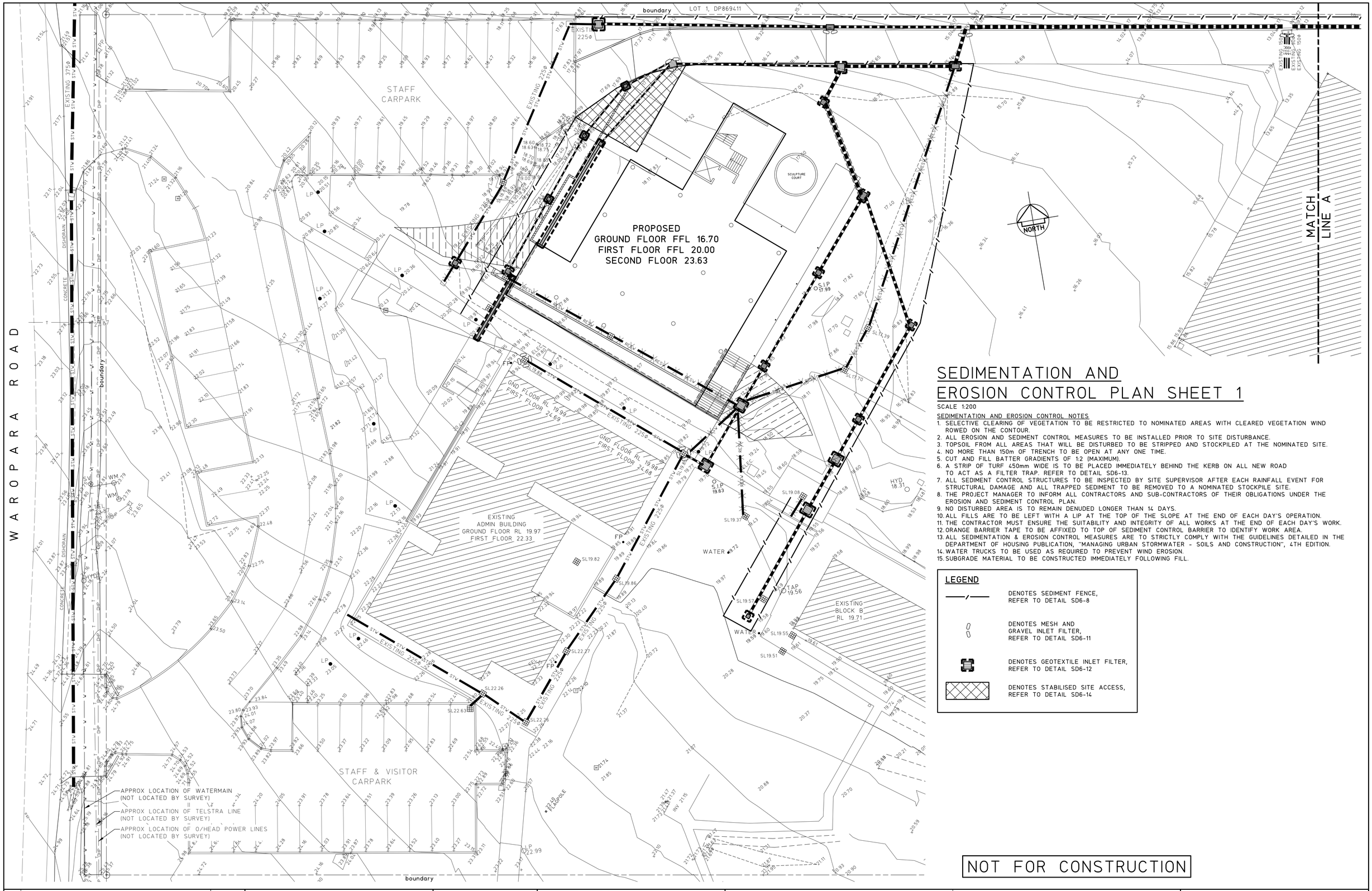
- SUBJECT SITE
- MAJOR MEDOWIE AREAS
- ROAD ACCESS
- UNUSABLE SITE AREA
- EXISTING BUILDING

SHAC

Nominated Architect Justin Hamilton (6160) | ABN 32 131 584 846

Appendix B

Stormwater Management Plan



SEDIMENTATION AND EROSION CONTROL PLAN SHEET 1

SCALE 1:200

SEDIMENTATION AND EROSION CONTROL NOTES

1. SELECTIVE CLEARING OF VEGETATION TO BE RESTRICTED TO NOMINATED AREAS WITH CLEARED VEGETATION WIND ROWED ON THE CONTOUR.
2. ALL EROSION AND SEDIMENT CONTROL MEASURES TO BE INSTALLED PRIOR TO SITE DISTURBANCE.
3. TOPSOIL FROM ALL AREAS THAT WILL BE DISTURBED TO BE STRIPPED AND STOCKPILED AT THE NOMINATED SITE.
4. NO MORE THAN 150m OF TRENCH TO BE OPEN AT ANY ONE TIME.
5. CUT AND FILL BATTER GRADIENTS OF 1:2 (MAXIMUM).
6. A STRIP OF TURF 450mm WIDE IS TO BE PLACED IMMEDIATELY BEHIND THE KERB ON ALL NEW ROAD TO ACT AS A FILTER TRAP. REFER TO DETAIL SD6-13.
7. ALL SEDIMENT CONTROL STRUCTURES TO BE INSPECTED BY SITE SUPERVISOR AFTER EACH RAINFALL EVENT FOR STRUCTURAL DAMAGE AND ALL TRAPPED SEDIMENT TO BE REMOVED TO A NOMINATED STOCKPILE SITE.
8. THE PROJECT MANAGER TO INFORM ALL CONTRACTORS AND SUB-CONTRACTORS OF THEIR OBLIGATIONS UNDER THE EROSION AND SEDIMENT CONTROL PLAN.
9. NO DISTURBED AREA IS TO REMAIN DENUDED LONGER THAN 14 DAYS.
10. ALL FILLS ARE TO BE LEFT WITH A LIP AT THE TOP OF THE SLOPE AT THE END OF EACH DAY'S OPERATION.
11. THE CONTRACTOR MUST ENSURE THE SUITABILITY AND INTEGRITY OF ALL WORKS AT THE END OF EACH DAY'S WORK.
12. ORANGE BARRIER TAPE TO BE AFFIXED TO TOP OF SEDIMENT CONTROL BARRIER TO IDENTIFY WORK AREA.
13. ALL SEDIMENTATION & EROSION CONTROL MEASURES ARE TO STRICTLY COMPLY WITH THE GUIDELINES DETAILED IN THE DEPARTMENT OF HOUSING PUBLICATION, "MANAGING URBAN STORMWATER - SOILS AND CONSTRUCTION", 4TH EDITION.
14. WATER TRUCKS TO BE USED AS REQUIRED TO PREVENT WIND EROSION.
15. SUBGRADE MATERIAL TO BE CONSTRUCTED IMMEDIATELY FOLLOWING FILL.

LEGEND

- DENOTES SEDIMENT FENCE, REFER TO DETAIL SD6-8
- DENOTES MESH AND GRAVEL INLET FILTER, REFER TO DETAIL SD6-11
- DENOTES GEOTEXTILE INLET FILTER, REFER TO DETAIL SD6-12
- DENOTES STABILISED SITE ACCESS, REFER TO DETAIL SD6-14

NOT FOR CONSTRUCTION

ISSUE	REASON FOR ISSUE	DATE
5	REVISED DEVELOPMENT APPLICATION	23.8.19
4	FOR COORDINATION	19.3.19
3	REVISED DEVELOPMENT APPLICATION	19.10.18
2	REVISED DEVELOPMENT APPLICATION	4.10.18
1	DEVELOPMENT APPLICATION	7.8.18
0	PRELIMINARY	6.7.18

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CLIENT: MEDOWIE CHRISTIAN SCHOOL

TITLE: SEDIMENTATION AND EROSION CONTROL PLAN SHEET 1

PROJECT: PROPOSED ADDITION AT; MEDOWIE CHRISTIAN SCHOOL, WAROPARA ROAD, MEDOWIE

DO NOT SCALE DRAWING

DRAWN	ENGINEER	No in SET	SHEET
R.G.	D.P.	-	A1
SCALES	JOB No	DRAWING No	ISSUE
1:200	18-802	C01.00	5

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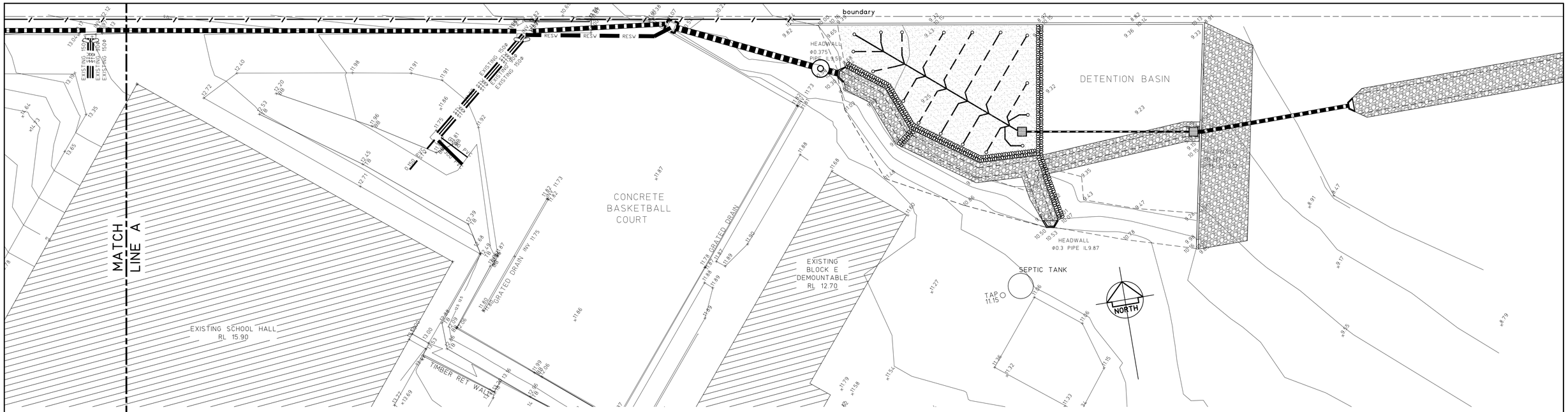

SEDIMENTATION AND EROSION CONTROL PLAN SHEET 2

SCALE 1:200

SEDIMENTATION AND EROSION CONTROL NOTES

1. REFER TO DRAWING C01.00 FOR SEDIMENTATION AND EROSION CONTROL NOTES.

LEGEND

——/—— DENOTES SEDIMENT FENCE, REFER TO DETAIL SD6-8

DENOTES MESH AND GRAVEL INLET FILTER, REFER TO DETAIL SD6-11

DENOTES GEOTEXTILE INLET FILTER, REFER TO DETAIL SD6-12

NOT FOR CONSTRUCTION

ISSUE	REASON FOR ISSUE	DATE
3	REVISED DEVELOPMENT APPLICATION	28.8.19
2	FOR COORDINATION	19.3.19
1	REVISED DEVELOPMENT APPLICATION	4.10.18
0	DEVELOPMENT APPLICATION	7.8.18

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A.C.N. 098 542 575

CLIENT: MEDOWIE CHRISTIAN SCHOOL

TITLE: SEDIMENTATION AND EROSION CONTROL PLAN SHEET 2

PROJECT: PROPOSED ADDITION AT; MEDOWIE CHRISTIAN SCHOOL, WAROPARA ROAD, MEDOWIE

DO NOT SCALE DRAWING

DRAWN	ENGINEER	No in SET	SHEET
R.G.	D.P.	-	A1
SCALES	JOB No	DRAWING No	ISSUE
1:200	18-802	C01.01	3

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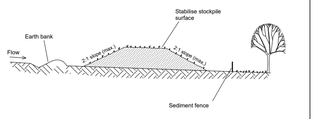
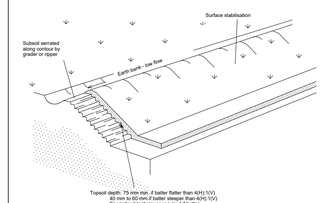


Construction Notes

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

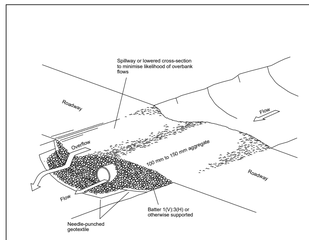
STOCKPILES SD 4-1



Construction Notes

1. Scarify the ground surface along the line of the contour to a depth of 50 mm to 100 mm to break up any hardsetting surfaces and to provide a good bond between the respread material and subsoil.
2. Add soil ameliorants as required by the ESCP or SWMP.
3. Rip to a depth of 300 mm if compacted layers occur.
4. Where possible, replace topsoil to a depth of 40 to 60 mm on lands where the slope exceeds 4(H):1(V) and to at least 75 mm on lower gradients.

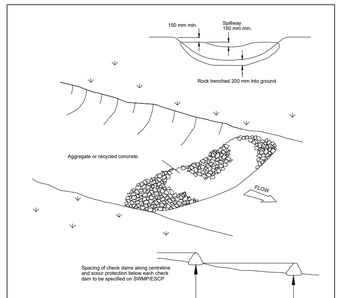
REPLACING TOPSOIL SD 4-2



Construction Notes

1. Prohibit all traffic until the access way is constructed.
2. Strip any topsoil and place a needle-punched textile over the base of the crossing.
3. Place clean, rigid, non polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm.
4. Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3(H): 1 (V) slope on side batters.
5. Install a lower section to act as an emergency spillway in greater than
6. Ensure that culvert outlets extend beyond the toe of fill embankments.

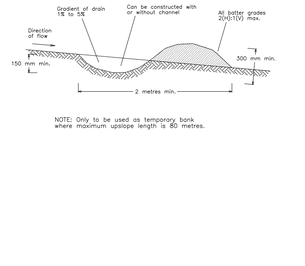
TEMPORARY WATERWAY CROSSING SD 5-1



Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.
3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.
4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM SD 5-4

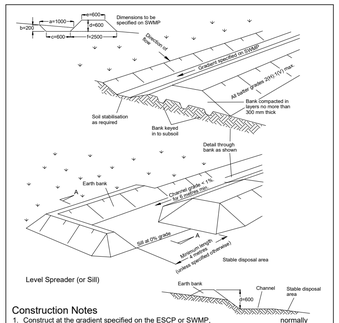


NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

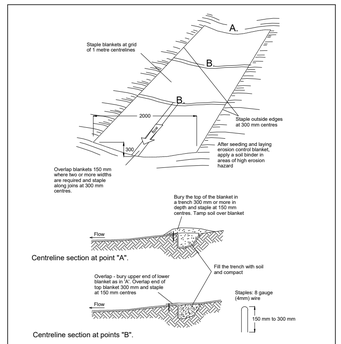
EARTH BANK (LOW FLOW) SD 5-5



Construction Notes

1. Construct at the gradient specified on the ESCP or SWMP, between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

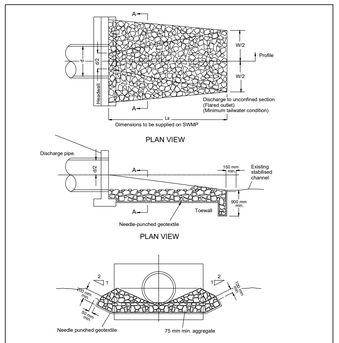
EARTH BANK (HIGH FLOWS) SD 5-6



Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end.
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

RECP : CONCENTRATED FLOW SD 5-7

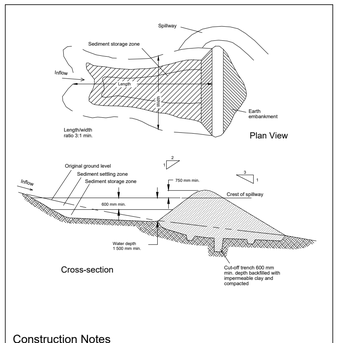


CROSS SECTION AA

Construction Notes

1. Compact the subgrade fill to the density of the surrounding undisturbed material.
2. Prepare a smooth, even foundation for the structure that will ensure that the needle-punched geotextile does not sustain serious damage when covered with rock.
3. Should any minor damage to the geotextile occur, repair it before spreading any aggregate. For repairs, patch one piece of fabric over the damage, making sure that all joints and patches overlap more than 300 mm.
4. Lay rock following the drawing, according to Table 5.2 of Landcom (2004) and with a minimum diameter of 75 mm.
5. Ensure that any concrete or riprap used for the energy dissipater or the outlet protection conforms to the grading limits specified on the SWMP.

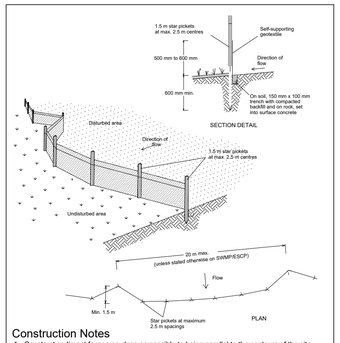
ENERGY DISSIPATER SD 5-8



Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

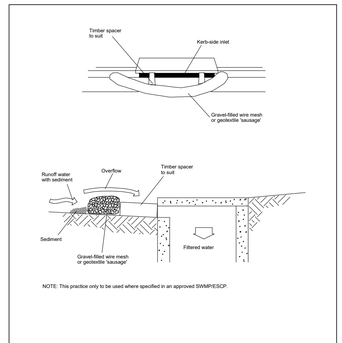
EARTH BASIN - WET
(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY) SD 6-4



Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE SD 6-8

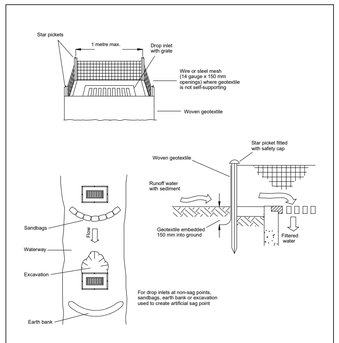


NOTE: This practice only to be used where specified in an approved SWMP/ESCP.

Construction Notes

1. Install filters to kerb inlets only at sag points.
2. Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 25 mm to 50 mm gravel.
3. Form an elliptical cross-section about 150 mm high x 400 mm wide.
4. Place the filter at the opening leaving at least a 100-mm space between it and the kerb inlet. Maintain the opening with spacer blocks.
5. Form a seal with the kerb to prevent sediment bypassing the filter.
6. Sandbags filled with gravel can substitute for the mesh or geotextile providing they are placed so that they firmly abut each other and sediment-laden waters cannot pass between.

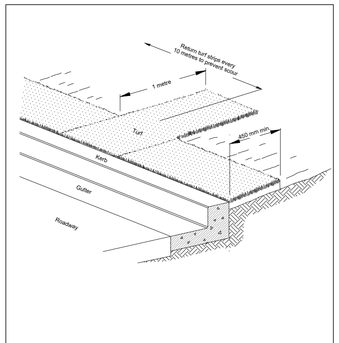
MESH AND GRAVEL INLET FILTER SD 6-11



Construction Notes

1. Fabricate a sediment barrier made from geotextile or straw bales.
2. Follow Standard Drawing 6-8 for installation procedures for the straw bales or geofabric. Reduce the picket spacing to 1 metre centres.
3. In waterways, artificial sag points can be created with sandbags or earth banks as shown in the drawing.
4. Do not cover the inlet with geotextile unless the design is adequate to allow for all waters to bypass it.

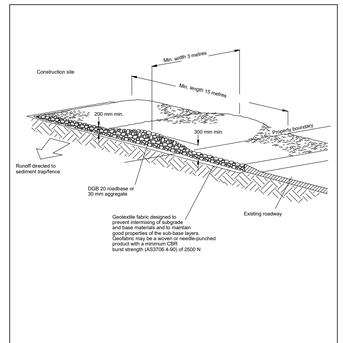
GEOTEXTILE INLET FILTER SD 6-12



Construction Notes

1. Install a 450 mm minimum wide roll of turf on the footpath next to the kerb and at the same level as the top of the kerb.
2. Lay 1.4 metre long turf strips normal to the kerb every 10 metres.
3. Rehabilitate disturbed soil behind the turf strip following the ESCP/SWMP.

KERBSIDE TURF STRIP SD 6-13



Construction Notes

1. Strip the topsoil, level the site and compact the subgrade.
2. Cover the area with needle-punched geotextile.
3. Construct a 200 mm thick pad over the geotextile using road base or 30 mm aggregate.
4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide.
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence

STABILISED SITE ACCESS SD 6-14

SEDIMENTATION AND EROSION CONTROL DETAILS

NOT FOR CONSTRUCTION

ISSUE	REASON FOR ISSUE	DATE
4	REVISED DEVELOPMENT APPLICATION	23.8.19
3	FOR COORDINATION	19.3.19
2	REVISED DEVELOPMENT APPLICATION	4.10.18
1	DEVELOPMENT APPLICATION	7.8.18
0	PRELIMINARY	6.7.18

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CLIENT: MEDOWIE CHRISTIAN SCHOOL

TITLE: SEDIMENTATION AND EROSION CONTROL DETAILS

PROJECT: PROPOSED ADDITION AT; MEDOWIE CHRISTIAN SCHOOL, WAROPARA ROAD, MEDOWIE

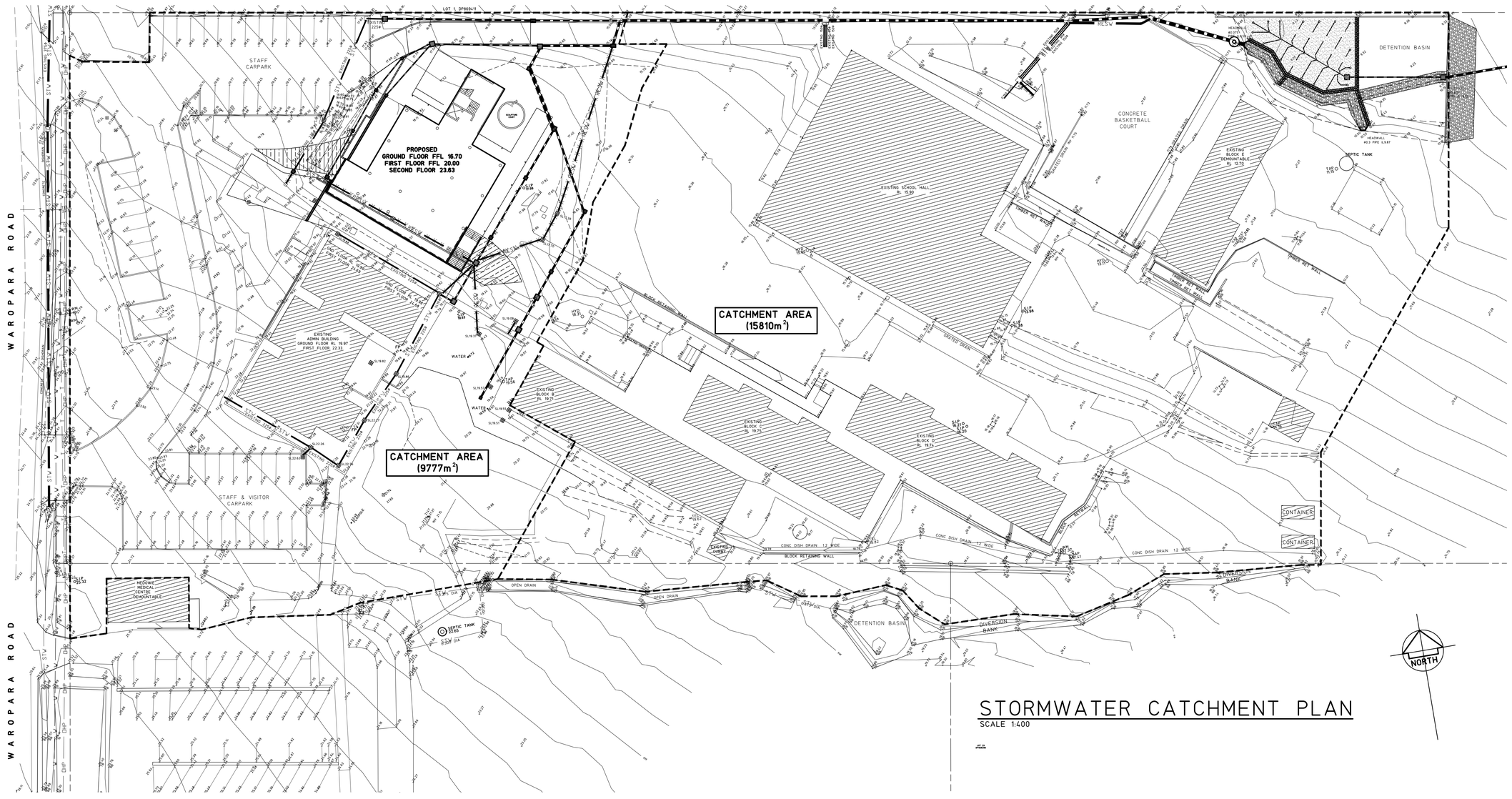
DO NOT SCALE DRAWING

DRAWN	ENGINEER	No in SET	SHEET
R.G.	D.P.	-	A1
SCALES	JOB No	DRAWING No	ISSUE
N.T.S	18-802	C02.00	4

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm

Appendix C

Sediment and Erosion Control Plan and Details



STORMWATER CATCHMENT PLAN

SCALE 1:400

NOT FOR CONSTRUCTION

ISSUE	REASON FOR ISSUE	DATE
5	REVISED DEVELOPMENT APPLICATION	23.8.19
4	FOR COORDINATION	19.3.19
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CLIENT
MEDOWIE CHRISTIAN SCHOOL

TITLE
STORMWATER CATCHMENT PLAN

PROJECT
PROPOSED ADDITION AT;
MEDOWIE CHRISTIAN SCHOOL,
WAROPARA ROAD,
MEDOWIE

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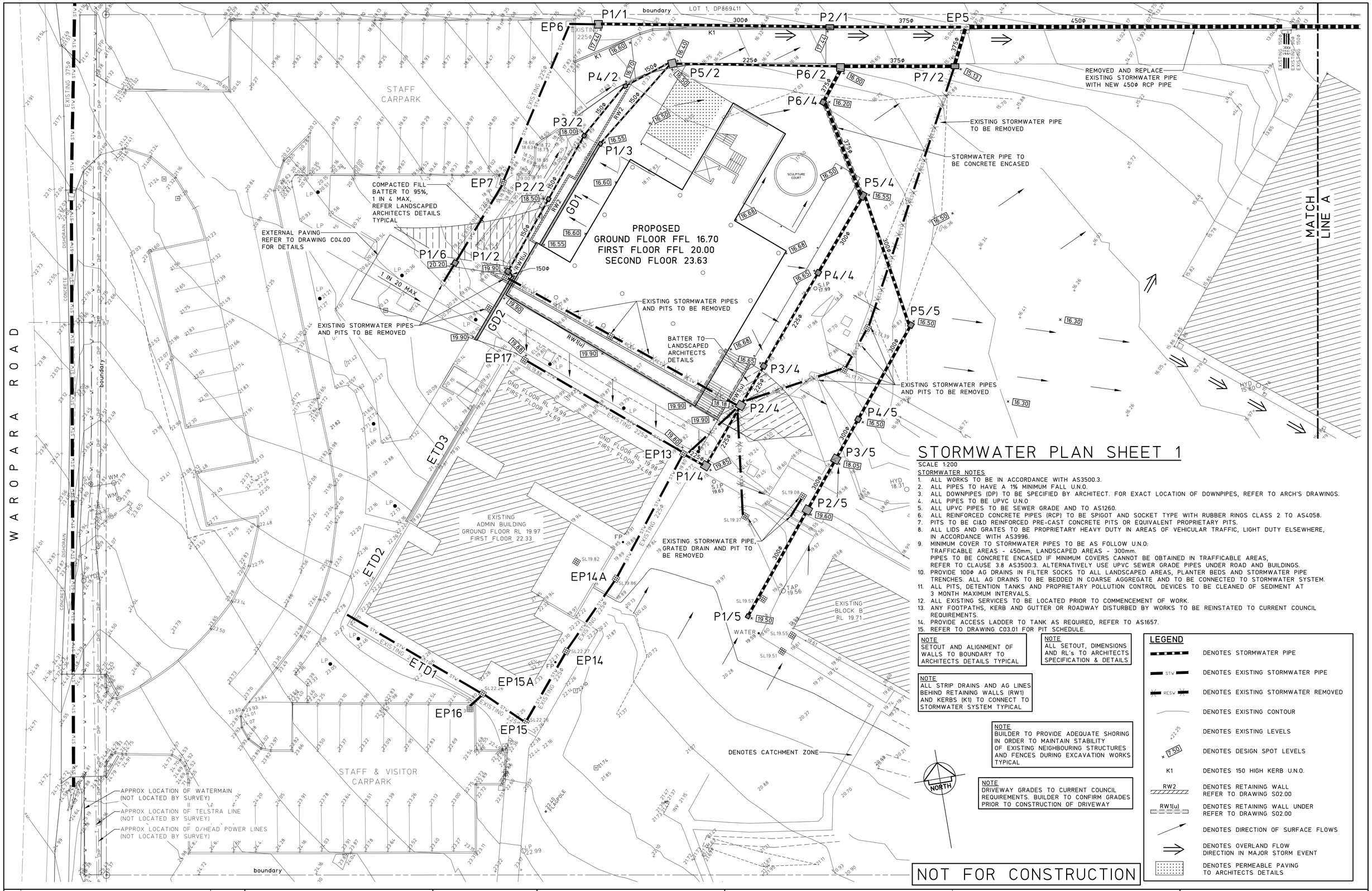
SCALES	JOB No	DRAWING No	ISSUE
1:400	18-802	C03.00	5

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



STORMWATER PLAN SHEET 1

SCALE 1:200

STORMWATER NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH AS3500.3.
2. ALL PIPES TO HAVE A 1% MINIMUM FALL U.N.O.
3. ALL DOWNPIPES (DP) TO BE SPECIFIED BY ARCHITECT. FOR EXACT LOCATION OF DOWNPIPES, REFER TO ARCH'S DRAWINGS.
4. ALL PIPES TO BE UPVC U.N.O
5. ALL UPVC PIPES TO BE SEWER GRADE AND TO AS1260.
6. ALL REINFORCED CONCRETE PIPES (RCP) TO BE SPIGOT AND SOCKET TYPE WITH RUBBER RINGS CLASS 2 TO AS4058.
7. PITS TO BE CI&D REINFORCED PRE-CAST CONCRETE PITS OR EQUIVALENT PROPRIETARY PITS.
8. ALL LIDS AND GRATES TO BE PROPRIETARY HEAVY DUTY IN AREAS OF VEHICULAR TRAFFIC, LIGHT DUTY ELSEWHERE, IN ACCORDANCE WITH AS3996.
9. MINIMUM COVER TO STORMWATER PIPES TO BE AS FOLLOW U.N.O:
   TRAFFICABLE AREAS - 450mm, LANDSCAPED AREAS - 300mm.
   PIPES TO BE CONCRETE ENCASED IF MINIMUM COVERS CANNOT BE OBTAINED IN TRAFFICABLE AREAS, REFER TO CLAUSE 3.8 AS3500.3. ALTERNATIVELY USE UPVC SEWER GRADE PIPES UNDER ROAD AND BUILDINGS.
10. PROVIDE 100Φ AG DRAINS IN FILTER SOCKS TO ALL LANDSCAPED AREAS, PLANTER BEDS AND STORMWATER PIPE TRENCHES. ALL AG DRAINS TO BE BEDDED IN COARSE AGGREGATE AND TO BE CONNECTED TO STORMWATER SYSTEM.
11. ALL PITS, DETENTION TANKS AND PROPRIETARY POLLUTION CONTROL DEVICES TO BE CLEANED OF SEDIMENT AT 3 MONTH MAXIMUM INTERVALS.
12. ALL EXISTING SERVICES TO BE LOCATED PRIOR TO COMMENCEMENT OF WORK.
13. ANY FOOTPATHS, KERB AND GUTTER OR ROADWAY DISTURBED BY WORKS TO BE REINSTATED TO CURRENT COUNCIL REQUIREMENTS.
14. PROVIDE ACCESS LADDER TO TANK AS REQUIRED, REFER TO AS1657.
15. REFER TO DRAWING C03.01 FOR PIT SCHEDULE.

NOTE
SETOUT AND ALIGNMENT OF WALLS TO BOUNDARY TO ARCHITECTS DETAILS TYPICAL

NOTE
ALL SETOUT, DIMENSIONS AND RL's TO ARCHITECTS SPECIFICATION & DETAILS

NOTE
ALL STRIP DRAINS AND AG LINES BEHIND RETAINING WALLS (RW1) AND KERBS (K1) TO CONNECT TO STORMWATER SYSTEM TYPICAL

NOTE
BUILDER TO PROVIDE ADEQUATE SHORING IN ORDER TO MAINTAIN STABILITY OF EXISTING NEIGHBOURING STRUCTURES AND FENCES DURING EXCAVATION WORKS TYPICAL

NOTE
DRIVEWAY GRADES TO CURRENT COUNCIL REQUIREMENTS. BUILDER TO CONFIRM GRADES PRIOR TO CONSTRUCTION OF DRIVEWAY

LEGEND

- DENOTES STORMWATER PIPE
- STW — DENOTES EXISTING STORMWATER PIPE
- RESW — DENOTES EXISTING STORMWATER REMOVED
- DENOTES EXISTING CONTOUR
- 22.25 — DENOTES EXISTING LEVELS
- 7.50 — DENOTES DESIGN SPOT LEVELS
- K1 — DENOTES 150 HIGH KERB U.N.O.
- RW2 — DENOTES RETAINING WALL REFER TO DRAWING S02.00
- RW1(u) — DENOTES RETAINING WALL UNDER REFER TO DRAWING S02.00
- DENOTES DIRECTION OF SURFACE FLOWS
- DENOTES OVERLAND FLOW DIRECTION IN MAJOR STORM EVENT
- DENOTES PERMEABLE PAVING TO ARCHITECTS DETAILS

NOT FOR CONSTRUCTION

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CLIENT
MEDOWIE CHRISTIAN SCHOOL

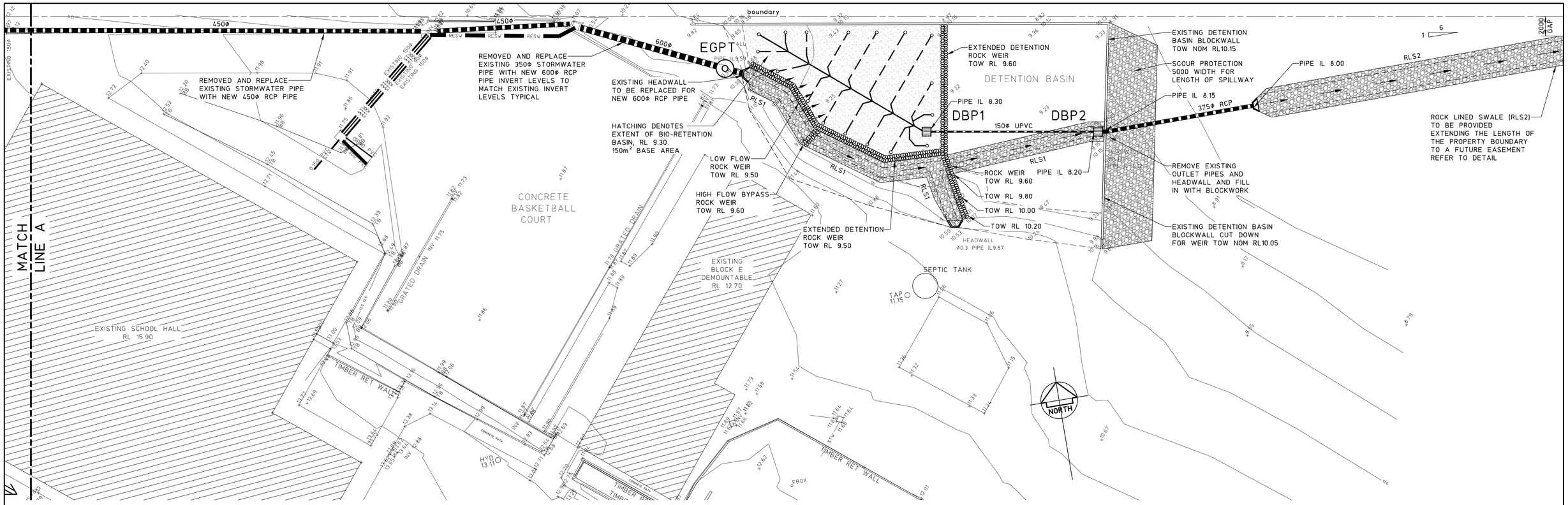
TITLE
STORMWATER PLAN
SHEET 1

PROJECT
PROPOSED ADDITION AT;
MEDOWIE CHRISTIAN SCHOOL,
WAROPARA ROAD,
MEDOWIE

DO NOT SCALE DRAWING

DRAWN	ENGINEER	No in SET	SHEET
R.G.	D.P.	-	A1
SCALES	JOB No	DRAWING No	ISSUE
1:200	18-802	C03.01	4

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



STORMWATER PLAN SHEET 2

SCALE 1:200

STORMWATER NOTES

1. REFER TO DRAWING C03.00 FOR STORMWATER NOTES

STORMWATER PLAN - PIT SCHEDULE

LINE No.	PIT No.	SIZE	TYPE	SURFACE LEVEL S.L.	INVERT LEVEL I.L.
LINE 1	P1/1	900x900	GRATED PIT	17.44	16.00
	P2/1	600x900	KERB INLET PIT	15.80	15.04
LINE 2	GD2	200 WIDE	GRATED DRAIN	19.90	MIN 200 DEEP
	P1/2	600x600	GRATED PIT	19.90	19.24
	P2/2	450x450	GRATED PIT	18.50	18.04
	P3/2	450x450	GRATED PIT	18.00	17.52
	P4/2	450x450	GRATED PIT	16.70	16.15
	P5/2	900x900	GRATED PIT	16.40	15.85
	P6/2	900x900	GRATED PIT	16.00	14.74
	P7/2	600x900	GRATED PIT	15.13	14.20
LINE 3	GD1	200 WIDE	GRATED DRAIN	16.55	MIN 200 DEEP
	P1/3	450x450	GRATED PIT	16.55	16.09
LINE 4	P1/4	900x900	GRATED PIT	19.85	18.52
	P2/4	900x900	GRATED PIT	18.18	16.03
	P3/4	600x600	GRATED PIT	16.65	15.93
	P4/4	600x600	GRATED PIT	16.65	15.79
	P5/4	600x900	GRATED PIT	16.55	15.59
	P6/4	600x600	GRATED PIT	16.20	15.44
LINE 5	P1/5	450x450	GRATED PIT	19.50	18.90
	P2/5	900x900	GRATED PIT	19.60	17.17
	P3/5	900x900	GRATED PIT	18.05	16.05
	P4/5	600x600	GRATED PIT	16.50	15.89
	P5/5	600x600	GRATED PIT	16.50	15.66
LINE 6	P1/6	600x600	GRATED PIT	±20.20	T.M.E

LINE No.	PIT No.	SIZE	TYPE	SURFACE LEVEL S.L.	INVERT LEVEL I.L.
EXISTING	EP5	T.B.C	EXISTING KERB PIT	14.97	14.03
	EP6	600x600	EXISTING GRATED PIT	17.63	17.10
	EP7	600x600	EXISTING GRATED PIT	18.88	17.63
	EP13	600x900	EXISTING GRATED PIT	19.80	18.52
	EP14	900x900	EXISTING GRATED PIT	22.27	21.02
	EP14A	900x900	EXISTING GRATED PIT	19.86	18.75
	EP15	600x600	EXISTING GRATED PIT	22.26	21.22 ✳
	EP15A	600x600	EXISTING GRATED PIT	22.26	21.26
	EP16	1050x540	EXISTING GRATED PIT	22.63	21.60 ✳
	EP17	600x600	EXISTING GRATED PIT	19.88	18.93
	ETD1	200 WIDE	EXISTING GRATED DRAIN	✡22.25	T.B.C
	ETD2	200 WIDE	EXISTING GRATED DRAIN	✡22.25	T.B.C
	ETD3	200 WIDE	EXISTING GRATED DRAIN	✡19.85	T.B.C
DETENTION BASIN	DBP1	900x900	GRATED PIT	9.50	8.40
	DBP2	900x900	GRATED PIT	9.15	8.15

✡ DENOTES DESIGN SURFACE LEVEL FROM BG&E DRAWING C-0200 (TO BE CONFIRMED)

✳ DENOTES DESIGN INVERT LEVEL FROM BG&E DRAWING C-0200 (TO BE CONFIRMED)

T.M.E DENOTES DESIGN INVERT LEVEL TO MATCH EXISTING

NOTE
SETOUT AND ALIGNMENT OF WALLS TO BOUNDARY TO ARCHITECTS DETAILS TYPICAL

NOTE
DRIVEWAY GRADES TO CURRENT COUNCIL REQUIREMENTS. BUILDER TO CONFIRM GRADES PRIOR TO CONSTRUCTION OF DRIVEWAY

NOTE
ALL STRIP DRAINS AND AG LINES BEHIND RETAINING WALLS (RW1) AND KERBS (K1) TO CONNECT TO STORMWATER SYSTEM TYPICAL

NOTE
ALL SETOUT, DIMENSIONS AND RL's TO ARCHITECTS SPECIFICATION & DETAILS

LEGEND

- DENOTES STORMWATER PIPE
- STV — DENOTES EXISTING STORMWATER PIPE
- RESV — DENOTES EXISTING STORMWATER REMOVED
- DENOTES EXISTING CONTOUR
- ×22.25 — DENOTES EXISTING LEVELS
- ✳ 7.50 — DENOTES DESIGN SPOT LEVELS
- K1 — DENOTES 150 HIGH KERB U.N.O.
- RW1 — DENOTES RETAINING WALL
- RW1(u) — DENOTES RETAINING WALL UNDER
- DENOTES DIRECTION OF SURFACE FLOWS
- DENOTES OVERLAND FLOW DIRECTION IN MAJOR STORM EVENT

LEGEND FOR STORMWATER DETENTION BASIN

- FLUSH POINT — DENOTES 100Φ SLOTTED UPVC PIPE TO AS2439.1 "TYPE 2" (8mmx1.5mm PERFORATIONS) AT 2.5m MAX SPACING WITH UNSLOTTED INSPECTION RISER AND SCREW CAP
- FLUSH POINT — DENOTES 100Φ UPVC PIPE WITH 45° ANGLE CONNECTIONS FOR EACH SLOTTED PIPE. PROVIDE UNSLOTTED INSPECTION RISER AND SCREW CAP. ALL PIPE JUNCTIONS TO BE SEALED.

NOT FOR CONSTRUCTION

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A.C.N. 098 542 575

CLIENT: MEDOWIE CHRISTIAN SCHOOL

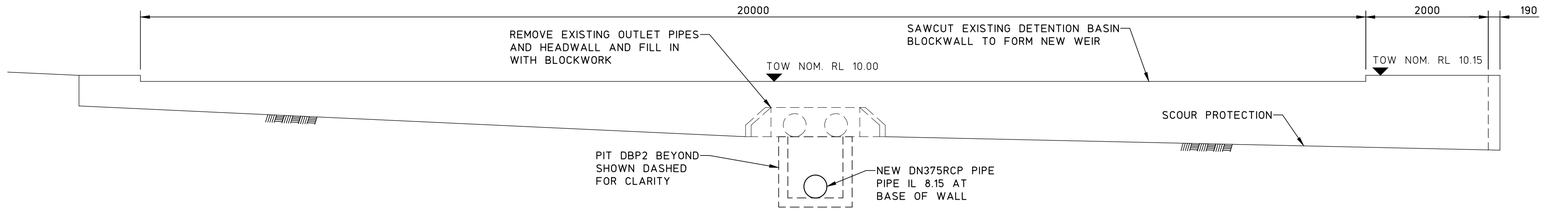
TITLE: STORMWATER PLAN SHEET 2

PROJECT: PROPOSED ADDITION AT; MEDOWIE CHRISTIAN SCHOOL, WAROPARA ROAD, MEDOWIE

DO NOT SCALE DRAWING

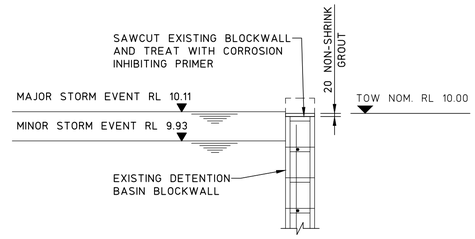
DRAWN	ENGINEER	No in SET	SHEET
R.G.	D.P.	-	A1
SCALES	JOB No	DRAWING No	ISSUE
1:200	18-802	C03.02	3

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm



DETENTION BASIN WEIR ELEVATION

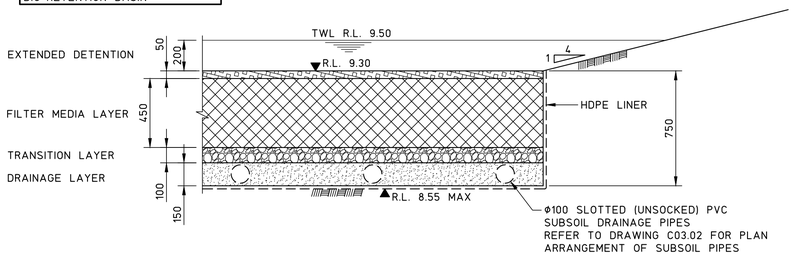
SCALE 1:50



NEW WEIR FOR EXISTING DETENTION BASIN DETAIL

SCALE 1:20

NOTE
PROVIDE COMPACTED FILL WHERE REQUIRED TO UNDERSIDE OF BIO-RETENTION BASIN



TYPICAL BIO-RETENTION CROSS-SECTION

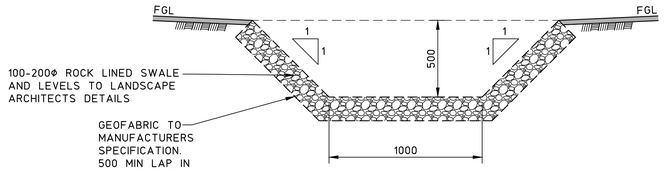
NOT TO SCALE

MULCH LAYER:
- WASHED AGGREGATE 10-20 mm
- MIN 50mm THICK.

FILTER MEDIA LAYER:
- MIN 450mm THICK
- BENEDICTS 'BIO-RETENTION FILTER MEDIA (M165)' OR APPROVED EQUIVALENT WITH MINIUMUM REQUIREMENTS
  - -- SANDY LOAM MIX
  - -- SATURATED HYDRAULIC CONDUCTIVITY 100mm/HR - 300mm/HR
  - -- TOTAL CLAYAND SILT CONTENT <3%
  - -- ORGANIC CONTENT <5%

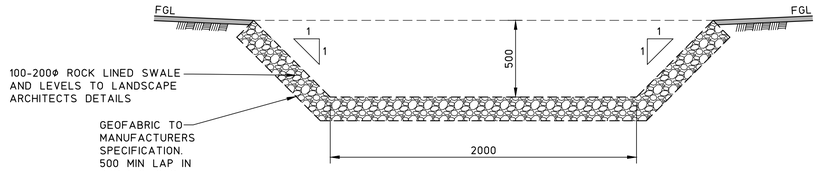
TRANSITION LAYER SPECIFICATIONS:
- MIN 100mm THICK.
- BENEDICTS 'WASHED GLASS-SAND (GSMEDIUM)' OR APPROVED EQUIVALENT WITH MINIMUM REQUIREMENTS AS FOLLOWS:
  - -- COARSE WASHED RIVER SAND CONTAINING LITTLE OR NO FINES OR RECYCLED CRUSHED GLASS EQUIVALENT

DRAINAGE LAYER SPECIFICATIONS:
- MIN 150mm THICK
- BENEDICTS 'NO FINES DRAINAGE GRAVEL (5mm GRADE)' OR APPROVED EQUIVALENT WITH MINIMUM PRODUCT REQUIREMENTS AS FOLLOWS:
  - -- CLEAN GRAVEL 5mm



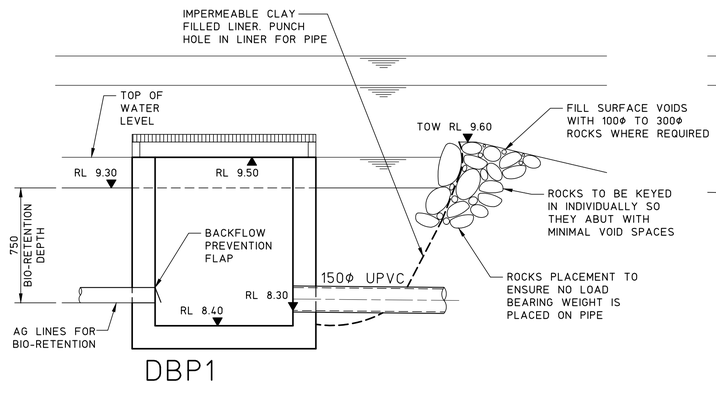
ROCK LINED SWALE - RLS1

SCALE 1:20



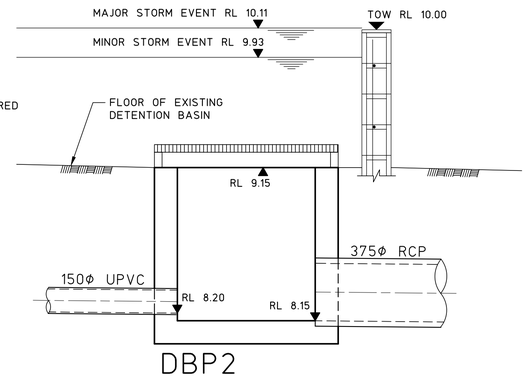
ROCK LINED SWALE - RLS2

SCALE 1:20



PIT - DBP1 DETAIL

SCALE 1:20



PIT - DBP2 DETAIL

SCALE 1:20

NOT FOR CONSTRUCTION

ISSUE	REASON FOR ISSUE	DATE
0	REVISED DEVELOPMENT APPLICATION	23.8.19

mpc CONSULTING ENGINEERS
Suite 3, Level 1,
16 Telford Street,
NEWCASTLE EAST, NSW 2300
PO BOX 553
THE JUNCTION, NSW 2291
Tel: (02) 4927 5566
Fax: (02) 4927 5577
Email: admin@mpceng.com.au
Web: www.mpcconsultingengineers.com.au
A.C.N. 098 542 575

CLIENT
MEDOWIE CHRISTIAN SCHOOL

TITLE
STORMWATER DETAILS

PROJECT
PROPOSED ADDITION AT;
MEDOWIE CHRISTIAN SCHOOL,
WAROPARA ROAD,
MEDOWIE

DO NOT SCALE DRAWING

DRAWN	ENGINEER	No in SET	SHEET
R.G.	D.P.	-	A1
SCALES	JOB No	DRAWING No	ISSUE
1:50, 20	18-802	C03.03	0

FULL SIZE ON ORIGINAL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 cm

Appendix D

Previous Engineering Documentation by BG&E

Project No: S15074

5 April 2016

Medowie Christian School
c/- epm Projects Pty Ltd
Suite 2, Level 5
655 Pacific Highway
ST LEONARDS NSW 2065

Attention: Todd Ewart

Dear Todd

MEDOWIE CHRISTIAN SCHOOL CONCEPT PROPOSAL & STAGE 1 ADMINISTRATION BUILDING STORMATER MANAGEMENT STRATEGY

This letter outlines the stormwater management strategy associated with the concept proposal and Stage 1 Administration Building at Medowie Christian School. The letter should be read in conjunction with BG&E Civil Works drawings and architectural plans prepared by Smith and Tracey Architects.

1 EXISTING SITE

The site contains an area of 8.1 hectares (ha) and is located within the Port Stephens Local Government Area (LGA) on land that is described as Lot 1 DP 868525, Lot 22 and Lot 23 DP 1036306 Nos. 6, 6A, and 6B Waropara Road, Medowie (Figure 1). The site is regular in shape and has a 201 metre (m) frontage to Waropara Road as noted on the site survey prepared by Carman Surveyors.

An existing educational establishment (MCS) currently operates on the site together with a place of worship known as Medowie Baptist Community Church and other medical centre/community facility uses with associated car parking and access from Waropara Road.

1.1 Area of Interest

The stormwater management strategy is limited to the area of interest shown in Figure 1 which has been developed as MCS. Key features of this area include:

- The site area is approximately 2.5 hectares.
- Topography ranges from approximately 25 mAHD in the south western corner to 9 mAHD in the north-eastern corner.
- The impervious area of the site (pavements, buildings etc.) is approximately 60% of the site area.

- Paved areas and roof areas are serviced via an underground pipe and pit system for frequent storm events. The pipe system discharges to an existing stormwater basin on the north-western corner of the site. The outlet of the basin does not appear functional.
- Once the capacity of the pipe system is exceeded stormwater will flow overland towards the stormwater basin.
- Stormwater from external properties does not appear to enter the site. Stormwater within the site is restricted to rainfall falling directly over the site.

Figure 1 – Site area

2 PROPOSED DEVELOPMENT

The concept proposal involves alterations and additions to an existing education establishment. This strategy and associated civil works drawings have been prepared to support the development application for Stage 1. The Stage 1 DA involves components A, G, H and R from the concept proposal as summarised below:

- Construction of a new 2-storey administration building with a height of 7.8m comprising meeting rooms, amenities, reception, executive offices, sick bay and staff common room; and
- Ancillary site works including:
    - i) Demolition of the existing demountable buildings/reception and excavation;
    - ii) Removal of 32 x trees including Tree Nos. 29-48 (inclusive), 62-64 (inclusive) and 107-115 (inclusive);
    - iii) Landscaping including new pedestrian pathways and replacement planting of local endemic species;

iv) 10 additional car parking spaces located adjacent to the existing bus manoeuvring bay at the front of the site and conversion of existing parking spaces to provide 2 accessible parking spaces; and

v) Drainage to the rear of the site including enlargement of an existing detention basin adjacent to the northern side boundary; and

vi) Building identification signage.

3 STORMWATER MANAGEMENT STRATEGY

The proposed stormwater management strategy is documented in the BG&E Civil Works drawings and summarised as follows:

- New stormwater pits and pipes to collect and convey stormwater flows from the new car parking areas and administration building.
- Upgrade of the existing OSD basin.
- Construction of water quality treatment measures.

4 STORMWATER QUANTITY

4.1 Pre-development

The existing stormwater network was modelled using the DRAINS software package. The following model parameters were adopted:

- Catchment areas to each inlet pit estimated based on field survey topography data (refer catchment plan in civil drawings).
- Catchment impervious fraction estimated based on aerial photography.
- 5 minute and 10 minute time of concentration to inlets adopted for impervious and pervious areas respectively.
- Pipe and pit details based on field survey data where available.

The existing basin has minimal storage volume and the outlet does not appear to currently be functioning and as such no allowance for stormwater detention was included in the pre-development model.

4.2 Post-development

The DRAINS model was updated to reflect the proposed upgrade works for Stage 1 and the concept proposal. The upgrade works represent an increase in impervious area of less than 10% of the site area. The following changes were made to the model;

- Proposed inlets pits and pipes incorporated into the model for Stage 1 works.
- Catchment nodes updated to reflect Stage 1 and concept proposal works.
- OSD basin incorporated at the downstream end of the model.

It was agreed with Council that the OSD basin should been sized to ensure post-development peak flows from the developed site (including Stage 1 and the concept proposal) are equal to or less than pre-development (current scenario) peak flows for all storm events up to and including the 100 year ARI event. Design peak flows are summarised in Table 1.

	2yr ARI	5yr ARI	10yr ARI	20yr ARI	50yr ARI	100yr ARI
Pre-dev	0.58	0.71	0.83	0.93	0.10	1.11
Post-dev	0.34	0.37	0.40	0.43	0.46	0.49

Table 1 – OSD Peak flows (m3/s)

The volume and outlet configuration for the basin has been selected to contain the 50 year ARI flood event without overtopping the high level weir. The DRAINS model shows a significant reduction in peak flows. A review of the basin will be carried out during detailed design to investigate whether a smaller basin which overtops during more frequent storm events (say the 20 year ARI event) would be acceptable.

5 STORMWATER QUALITY

It was agreed with Council that the site should only be required to maintain or improve the existing stormwater quality, ie. post-development stormwater quality should be equal to or better than pre-development. This decision was made on the following basis:

- Upgrades to the school are minimal and limited to the demolition and construction of 1 new building and small extension of the existing concrete carpark;
- Existing stormwater quality infrastructure is non-existent, the introduction of infrastructure to comply with original requirements would be financial unfeasible and would likely affect the potential development of the school.

5.1 Pre-development

Water quality modelling for the site was undertaken using the MUSIC software. The site was divided into 4 types of catchments. Catchment parameters were adopted in accordance with the NSW Draft Music Modelling Guideline:

- Roof - 100% Impervious
- Road - 100% Impervious
- Permeable (soft landscaping and grass areas) - 100% Pervious
- Landscape (hardstand landscaping such as concrete and paved footpaths) - 100% Impervious

5.2 Post-development

The MUSIC model was updated to reflect the proposed upgrade works for Stage 1 only. The following changes were made to the model:

- Catchment areas updated to reflect proposed pavement and building works.

- Additional node to represent primary treatment via Enviropod pit inserts to existing and proposed stormwater pits. Node data was provided by the supplier Stormwater360.
- Additional node to represent treatment via Humeceptor installed on-line to existing stormwater pipe prior to discharge to OSD basin. Node data was provided by supplier Humes.

The MUSIC model demonstrates the development would have a neutral or beneficial effect to water quality. Results are summarised in Table 2.

	Pre-development	Post-development
Flow (ML/yr)	12.7	14.9
Total Suspended Solids (kg/yr)	1740	723
Total Phosphorus (kg/yr)	3.65	3.14
Total Nitrogen (kg/yr)	27.2	27.1
Gross Pollutants (kg/yr)	293	266

Table 2 – Water quality results

6 CLOSING

The stormwater strategy has been prepared to address the following:

- Inclusion of additional stormwater pits and pipes to collect runoff from new paved and building areas associated with the Stage 1 development during frequent storm events;
- The proposed OSD basin ensures post-development peak flows from the developed site (including Stage 1 and the concept proposal) are equal to or less than pre-development peak flows for all storm events up to and including the 100 year ARI event.
- Inclusion of water quality treatment measures to ensure the development (Stage 1) would have a neutral or beneficial effect to water quality. Further treatment measures may be required for subsequent stages comprising the concept proposal.

Yours faithfully
for BG&E Pty Limited

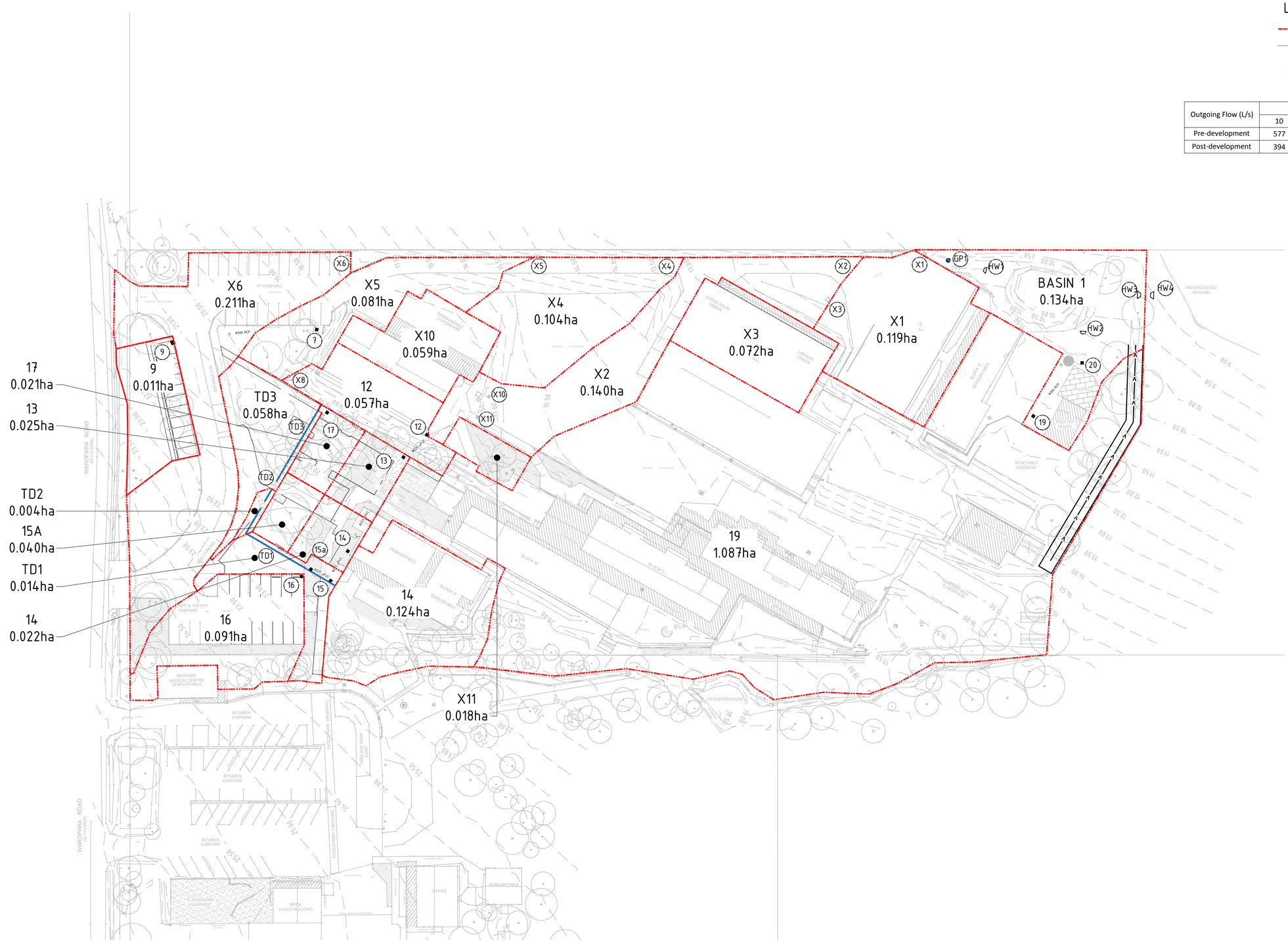
BRETT STINTON
Principal Water Engineer

N

LEGEND

- CATCHMENT BOUNDARY
- 52 — — EXISTING SURFACE
- 10 / 0.1236Ha — CATCHMENT NAME / CATCHMENT AREA

Outgoing Flow (L/s)	ARI (years)			
	10	20	50	100
Pre-development	577	688	779	878
Post-development	394	434	456	498



0 5 10 15 20 25 30m
SCALE 1:500 AT A1 SIZE

REV	DATE	DESCRIPTION	RVD
B	24.06.16	REISSUED FOR TENDER	BS
A	01.03.16	REISSUED FOR TENDER	AB

REVISIONS

REVISIONS

CLIENT: MEDOWIE Christian School

Sydney Office
L2 8 Windmill St Sydney NSW 2000
P:/+61 2 9770 3300
E:/info@bgeeng.com
bgeeng.com

PROJECT: MEDOWIE CHRISTIAN SCHOOL
6A WAROPARA RD, MEDOWIE NSW 2318

STATUS: ISSUED FOR TENDER
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
LM	LM	AB	

DATUM	GRID	SCALE	
AHD	MGA	1:500	AT A1 SIZE

TITLE: DRAINAGE CATCHMENT PLAN

PROJECT No. S15074 | DRAWING No. C-0300 | REV. B

P:\BGE\SYD\S15074\300 DRAW\300.2 CIVIL\AUTOCAD\S15074-DRG-C-0300.DWG
28/06/2016 12:40:16 PM

PIT / NODE DETAILS

Name	Max HGL	Max Pond	Max Surface	Max Pond	Min	Overflow	Constraint
		HGL	Flow Arriving	Volume	Freeboard	(cu.m/s)	
			(cu.m/s)	(cu.m)	(m)		
7	17.860		0.000		1.040	0.000	None
9	19.480		0.017		1.700	0.004	Inlet Capacity
12	17.840	17.840	0.033	0.900	-0.100	0.059	Outlet System
13	19.260		0.000		0.590	0.000	None
14	21.450		0.000		0.800	0.000	None
15	21.740	22.250	0.000	0.000	0.510	0.000	None
16	22.070		0.035		0.480	0.015	Inlet Capacity
17	19.290		0.000		0.560	0.000	None
19	10.990		0.324		0.660	0.324	Inlet Capacity
20	10.370		0.324		0.590	0.324	Inlet Capacity
X2	11.810		0.064		0.020	0.016	Inlet Capacity
X4	12.710		0.067		0.270	0.015	Inlet Capacity
X5	15.000		0.029		-0.010	0.035	Outlet System
X6	17.660	17.780	0.083	0.900	-0.030	0.015	Outlet System
X8	18.060	19.530	0.000	0.000	1.470	0.000	None
13 IN	19.320		0.011		0.530	0.000	None
14 INA	21.640		0.033		0.610		None
15a	22.020		0.031		0.230		None
15b	22.030		0.002		0.220		None
15b in	22.060		0.009		0.190		None
17 IN	19.410		0.015		0.440	0.000	None
17 INA	19.340		0.009		0.510	0.000	None
19 INA	11.340		0.041				
7 IN	18.020		0.013		0.980		None
B1 OUT	9.100		0.000				
C 15a IN	22.050		0.009		0.200		None
X1	11.080		0.016		0.000	0.060	Outlet System
X10	16.760		0.028		0.360	0.010	Inlet Capacity
X10 INA	16.970		0.013		0.230		None
X11	17.420		0.059		0.340	0.028	Inlet Capacity
X11 IN	17.420		0.008		0.380		None
X12 IN	17.750		0.010		0.000	0.019	Outlet System
X19 IN	14.400		0.323		-0.270	0.324	Outlet System
X3	11.850	11.860	0.013	0.900	-0.100	0.019	Outlet System
X3 IN	11.990		0.031		0.010	0.013	Inlet Capacity

PIPE DETAILS

Name	Max Q	Max V	Max U/S	Max D/S	Due to Storm
	(cu.m/s)	(m/s)	HGL (m)	HGL (m)	
p 12	0.101	2.190	17.640	17.420	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P 13	0.131	3.150	18.765	17.839	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P 13 IN	0.011	0.570	19.258	19.259	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
p 14	0.103	2.230	21.221	19.259	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P 14 INA	0.033	0.750	21.550	21.452	AR&R 10 year, 2 hours storm, average 30.4 mm/h, Zone 1
P 15	0.065	1.420	21.533	21.452	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P 15a	0.065	1.420	21.794	21.736	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P 15b	0.010	0.230	22.028	22.023	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P 15b IN	0.009	0.460	22.033	22.031	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P 16	0.020	0.430	22.029	22.023	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
p 17	0.024	0.520	19.287	19.259	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P 17 IN	0.015	0.820	19.301	19.295	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P 17INA	0.009	0.460	19.297	19.295	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P 19	0.119	3.100	10.909	10.371	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P 19 INA	0.041	2.290	11.342	10.987	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P 20	0.122	3.410	10.222	9.872	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P 7	0.025	1.860	17.791	17.656	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P 7 IN	0.013	0.720	17.910	17.861	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P 9	0.013	1.630	19.401	17.861	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P B1	0.395	4.590	9.455	9.105	AR&R 10 year, 2 hours storm, average 30.4 mm/h, Zone 1
P C 15a IN	0.009	0.460	22.025	22.023	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P X1	0.242	2.270	10.329	10.035	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P X10	0.126	2.730	16.492	15.001	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P X10 IN	0.013	0.970	16.890	16.795	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P X11	0.113	2.460	16.949	16.756	AR&R 10 year, 1.5 hours storm, average 36.5 mm/h, Zone 1
P X11 IN	0.008	0.430	17.420	17.420	AR&R 10 year, 15 minutes storm, average 98.0 mm/h, Zone 1
P X12 IN	0.005	0.260	17.750	17.839	AR&R 10 year, 1.5 hours storm, average 36.5 mm/h, Zone 1
P X19	0.079	3.540	13.604	10.987	AR&R 10 year, 30 minutes storm, average 69.0 mm/h, Zone 1
P X2	0.286	2.590	11.495	11.082	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P X3	0.027	1.470	11.832	11.806	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P X3 IN	0.027	1.470	11.902	11.855	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
P X4	0.241	2.180	12.653	11.806	AR&R 10 year, 20 minutes storm, average 85.0 mm/h, Zone 1
P X5	0.200	3.490	14.277	12.715	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P X6	0.090	3.230	17.226	15.001	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
P X8	0.000	0.000	18.060	17.861	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1

SUB-CATCHMENT DETAILS

Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)	
C B1	0.086	0.062	0.025	5.000	10.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C X2	0.041	0.017	0.025	5.000	10.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C X4	0.032	0.015	0.017	5.000	10.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C 12	0.014	0.014	0.000	5.000	0.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C 13 in	0.011	0.011	0.000	2.000	0.000	0.000	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
C 14 INA	0.033	0.005	0.030	5.000	10.000	0.000	AR&R 10 year, 2 hours storm, average 30.4 mm/h, Zone 1
C 15a	0.016	0.016	0.000	5.000	0.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C 15a IN	0.009	0.009	0.000	2.000	0.000	0.000	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
C 15b	0.002	0.002	0.000	2.000	0.000	0.000	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
C 15b in	0.009	0.009	0.000	2.000	0.000	0.000	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
C 17 IN	0.015	0.002	0.014	5.000	10.000	0.000	AR&R 10 year, 2 hours storm, average 30.4 mm/h, Zone 1
C 17INA	0.009	0.009	0.000	2.000	0.000	0.000	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
C 19 INA	0.041	0.041	0.000	2.000	0.000	0.000	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
C 21	0.007	0.006	0.000	5.000	10.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C 7	0.013	0.013	0.000	2.000	0.000	0.000	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
C X10 IN	0.013	0.013	0.000	2.000	10.000	0.000	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
C X11 IN	0.008	0.008	0.000	5.000	0.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C X12 IN	0.010	0.010	0.000	5.000	0.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C X-16	0.035	0.030	0.005	5.000	10.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C X19 IN	0.323	0.303	0.020	5.000	10.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C X3	0.031	0.031	0.000	2.000	0.000	0.000	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
C X5	0.029	0.024	0.006	5.000	10.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C X6	0.079	0.069	0.010	5.000	10.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
C-9	0.017	0.011	0.006	5.000	10.000	0.000	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
F 12	0.059	0.059	0.703	0.045	0.020	4.000	0.490	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F 13	0.000	0.000	1.287	0.000	0.000	0.000	0.000	
F 13 IN	0.000	0.000	0.091	0.000	0.000	0.000	0.000	
F 14	0.000	0.000	0.908	0.000	0.000	0.000	0.000	
F 15	0.000	0.000	1.075	0.000	0.000	0.000	0.000	
F 16	0.015	0.015	1.357	0.018	0.020	1.820	0.920	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F 17	0.000	0.000	0.287	0.000	0.000	0.000	0.000	
F 17 IN	0.000	0.000	0.091	0.000	0.000	0.000	0.000	
F 17 INA	0.000	0.000	0.091	0.000	0.000	0.000	0.000	
F 19	0.324	0.324	1.418	0.063	0.110	4.000	1.700	AR&R 10 year, 15 minutes storm, average 98.0 mm/h, Zone 1
F 20	0.324	0.324	1.377	0.071	0.100	4.000	1.460	AR&R 10 year, 15 minutes storm, average 98.0 mm/h, Zone 1
F 21	0.007	0.007	0.132	0.033	0.020	0.790	0.520	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F 6	0.015	0.015	1.380	0.019	0.020	1.920	0.820	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F 7	0.000	0.029	0.635	0.052	0.090	0.860	1.720	AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1
F B1 OUT	0.000	0.000	0.226	0.000	0.000	0.000	0.000	
F X 12 IN	0.019	0.019	0.497	0.033	0.010	4.000	0.260	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F X1	0.060	0.060	0.908	0.041	0.020	4.000	0.580	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F X10	0.010	0.010	1.414	0.017	0.010	1.730	0.640	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F X11	0.028	0.028	1.351	0.023	0.020	4.000	0.860	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F X19 IN	0.324	0.324	1.373	0.052	0.110	4.000	2.200	AR&R 10 year, 15 minutes storm, average 98.0 mm/h, Zone 1
F X2	0.016	0.016	0.673	0.044	0.060	0.600	1.410	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F X3	0.019	0.019	0.406	0.036	0.010	4.000	0.230	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F X3 IN	0.013	0.013	1.428	0.022	0.010	4.000	0.440	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F X4	0.015	0.041	0.495	0.066	0.080	1.330	1.280	AR&R 10 year, 20 minutes storm, average 85.0 mm/h, Zone 1
F X5	0.035	0.057	0.665	0.065	0.120	1.290	1.830	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1
F X8	0.000	0.000	1.391	0.000	0.000	0.000	0.000	
F X9	0.004	0.081	0.563	0.068	0.160	1.400	2.270	AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1

Outflow Volumes for Total Catchment (1.75 impervious + 0.62 pervious = 2.38 total ha)

Storm	Total Rainfall	Total Runoff	Impervious Runoff	Pervious Runoff
	cu.m	cu.m (Runoff %)	cu.m (Runoff %)	cu.m (Runoff %)
AR&R 10 year, 5 minutes storm, average 153 mm/h, Zone 1	302.980	226.19 (74.7%)	205.92 (92.2%)	20.27 (25.5%)
AR&R 10 year, 10 minutes storm, average 117 mm/h, Zone 1	463.380	374.39 (80.8%)	324.22 (94.9%)	50.17 (41.2%)
AR&R 10 year, 15 minutes storm, average 98.0 mm/h, Zone 1	582.190	483.59 (83.1%)	411.85 (95.9%)	71.74 (46.9%)
AR&R 10 year, 20 minutes storm, average 85.0 mm/h, Zone 1	673.280	566.91 (84.2%)	479.03 (96.5%)	87.89 (49.7%)
AR&R 10 year, 25 minutes storm, average 76.0 mm/h, Zone 1	752.490	636.40 (84.6%)	537.45 (96.8%)	98.95 (50.1%)
AR&R 10 year, 30 minutes storm, average 69.0 mm/h, Zone 1	819.820	694.81 (84.8%)	587.10 (97.1%)	107.71 (50.1%)
AR&R 10 year, 45 minutes storm, average 55.0 mm/h, Zone 1	980.220	836.22 (85.3%)	705.40 (97.6%)	130.82 (50.8%)
AR&R 10 year, 1 hour storm, average 47.0 mm/h, Zone 1	1116.860	957.04 (85.7%)	806.16 (97.9%)	150.87 (51.5%)
AR&R 10 year, 1.5 hours storm, average 36.5 mm/h, Zone 1	1301.000	1114.77 (85.7%)	941.97 (98.2%)	172.80 (50.6%)
AR&R 10 year, 2 hours storm, average 30.4 mm/h, Zone 1	1444.810	1237.41 (85.6%)	1048.05 (98.4%)	189.36 (49.9%)
AR&R 10 year, 3 hours storm, average 23.4 mm/h, Zone 1	1668.100	1428.48 (85.6%)	1212.76 (98.6%)	215.71 (49.3%)
AR&R 10 year, 4.5 hours storm, average 18.0 mm/h, Zone 1	1924.740	1636.52 (85.0%)	1402.03 (98.8%)	234.49 (46.4%)

REV	DATE	DESCRIPTION	RVD
B	24.06.16	REISSUED FOR TENDER	BS
A	01.03.16	REISSUED FOR TENDER	AB

REVISIONS

REVISIONS

CLIENT: MEDOWIE Christian School

Sydney Office
L2 8 Windmill St Sydney NSW 2000
P/ +61 2 9770 3300
E/ info@bgeeng.com
bgeeng.com

PROJECT: MEDOWIE CHRISTIAN SCHOOL
6A WAROPARA RD, MEDOWIE NSW 2318

STATUS: ISSUED FOR TENDER
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
LM	LM	AB	

DATUM	GRID	SCALE
AHD	MGA	AT A1 SIZE

TITLE: DRAINAGE CALUCATION TABLE

PROJECT No.	DRAWING No.	REV.
S15074	C-0310	B

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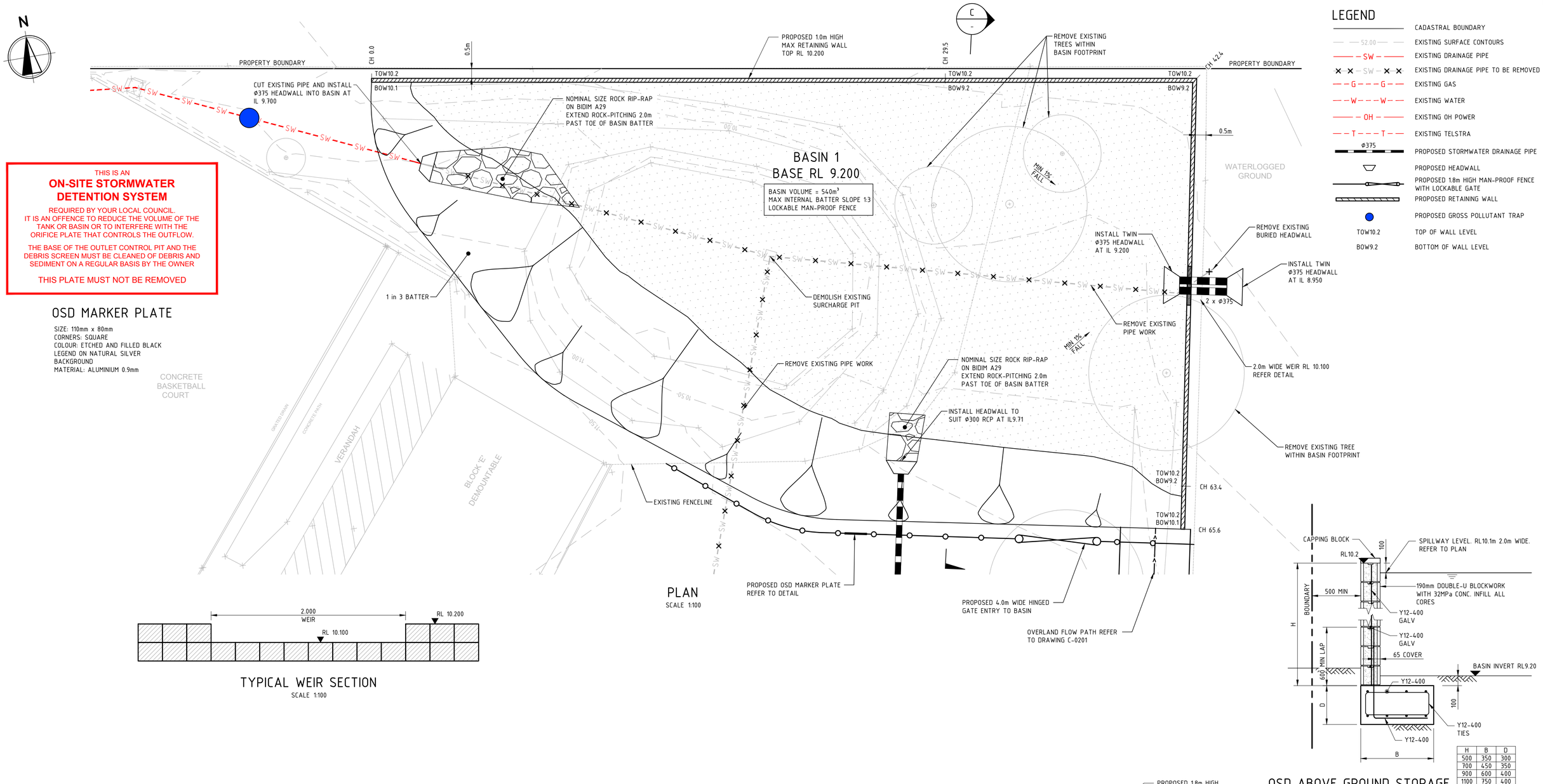
28/06/2016 12:40:19 PM



THIS IS AN
ON-SITE STORMWATER DETENTION SYSTEM

REQUIRED BY YOUR LOCAL COUNCIL.
IT IS AN OFFENCE TO REDUCE THE VOLUME OF THE TANK OR BASIN OR TO INTERFERE WITH THE ORIFICE PLATE THAT CONTROLS THE OUTFLOW.

THE BASE OF THE OUTLET CONTROL PIT AND THE DEBRIS SCREEN MUST BE CLEANED OF DEBRIS AND SEDIMENT ON A REGULAR BASIS BY THE OWNER

THIS PLATE MUST NOT BE REMOVED

OSD MARKER PLATE

SIZE: 110mm x 80mm
CORNERS: SQUARE
COLOUR: ETCHED AND FILLED BLACK
LEGEND ON NATURAL SILVER BACKGROUND
MATERIAL: ALUMINIUM 0.9mm

LEGEND

- CADASTRAL BOUNDARY
- 52.00 — EXISTING SURFACE CONTOURS
- SW — EXISTING DRAINAGE PIPE
- SW — EXISTING DRAINAGE PIPE TO BE REMOVED
- G — EXISTING GAS
- W — EXISTING WATER
- OH — EXISTING OH POWER
- T — EXISTING TELSTRA
- Ø375 — PROPOSED STORMWATER DRAINAGE PIPE
- PROPOSED HEADWALL
- PROPOSED 1.8m HIGH MAN-PROOF FENCE WITH LOCKABLE GATE
- PROPOSED RETAINING WALL
- PROPOSED GROSS POLLUTANT TRAP
- TOW10.2 — TOP OF WALL LEVEL
- BOW9.2 — BOTTOM OF WALL LEVEL

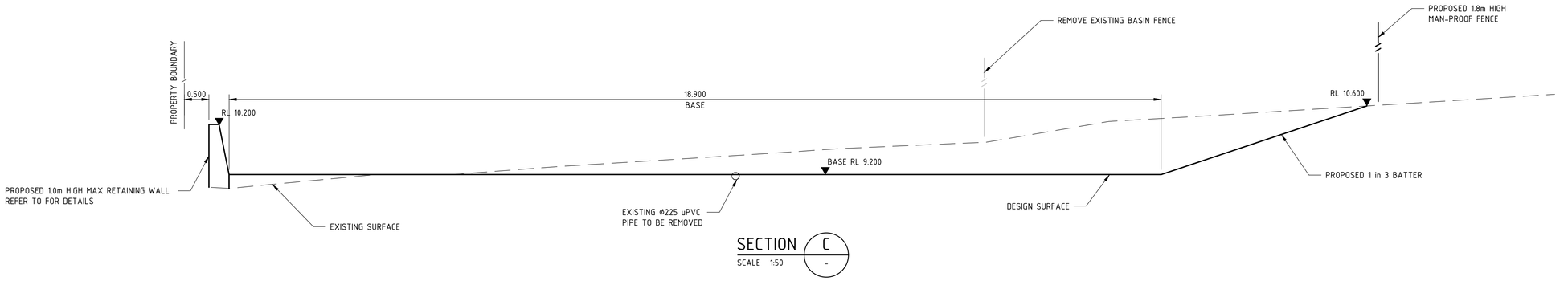
PLAN
SCALE 1:100

TYPICAL WEIR SECTION
SCALE 1:100

H	B	D
500	350	300
700	450	350
900	600	400
1100	750	400

OSD ABOVE GROUND STORAGE TYPICAL WATER RETAINING WALL BLOCK WALL UP TO 1100mm HIGH
SCALE 1:20

NOTE: CLEAN CORES BEFORE POURING
DAMPEN CORES BEFORE POURING



SECTION C
SCALE 1:50

0 0.5 1.0 1.5 2.0 2.5 3.0m
SCALE 1:50 AT A1 SIZE

0 1 2 3 4 5 6m
SCALE 1:100 AT A1 SIZE

REV	DATE	DESCRIPTION	
G	24.06.16	REISSUED FOR TENDER	BS
F	05.04.16	RETAINING WALL ADDED	TW
E	01.03.16	REISSUED FOR TENDER	AB
D	11.02.16	REISSUED FOR TENDER	AB
C	05.02.16	ISSUED FOR TENDER	AB
B	02.12.15	REISSUED FOR DA APPROVAL	AB
A	01.10.15	ISSUED FOR DA APPROVAL	AB

REVISIONS

REV	DATE	DESCRIPTION	

REVISIONS

CLIENT: MEDOWIE Christian School

Sydney Office
L2 8 Windmill St Sydney NSW 2000
P/ +61 2 9770 3300
E/ info@bgeeng.com
bgeeng.com

PROJECT: MEDOWIE CHRISTIAN SCHOOL
6A WAROPARA RD, MEDOWIE NSW 2318

STATUS: ISSUED FOR TENDER
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
LM	LM	TW	

DATUM	GRID	SCALE	
AHD	MGA	1:100, 1:50	AT A1 SIZE

TITLE: DRAINAGE BASIN PLAN AND SECTION

PROJECT No: S15074
DRAWING No: C-0350
REV: G

P:\BGE\S15\15074\100 DRAWN\100.2 CIVIL\AUTOCAD\S15074-DRG-C-0350.DWG
24/06/2016 10:50:27 AM

Appendix E

Survey Drawing by Parker Scanlon

G.N.

M.G.A.

LEGEND

- LP — LIGHT POLE
- WATER METER
- WATER HYDRANT
- WATER TAP
- TELSTRA PIT
- STORMWATER PIT
- MISC — MISCELLANEOUS SERVICE
- FP — FLUSH POINT
- DRAINAGE PIPES
- DENOTES AREA OF SURVEY

NOTE:
DETAIL SHOWN AS GREY UNDERLAY IS FROM SURVEY BY CARMAN SURVEYORS PLAN REF: 3287DET 150814.DWG, REV B DATED 14.08.15.

RESTRICTIONS NOTED ON TITLE:
RESTRICTION(S) ON THE USE OF THE LAND (AG 238964)

0m 2.5 5.0 10 15 20 25m
SCALE 1:250 (A1) 1:500 (A3)

AMENDMENT	DATE	DESCRIPTION
B	18.07.18.	PLAN ISSUED
A	05.07.18.	DRAFT PLAN ISSUED

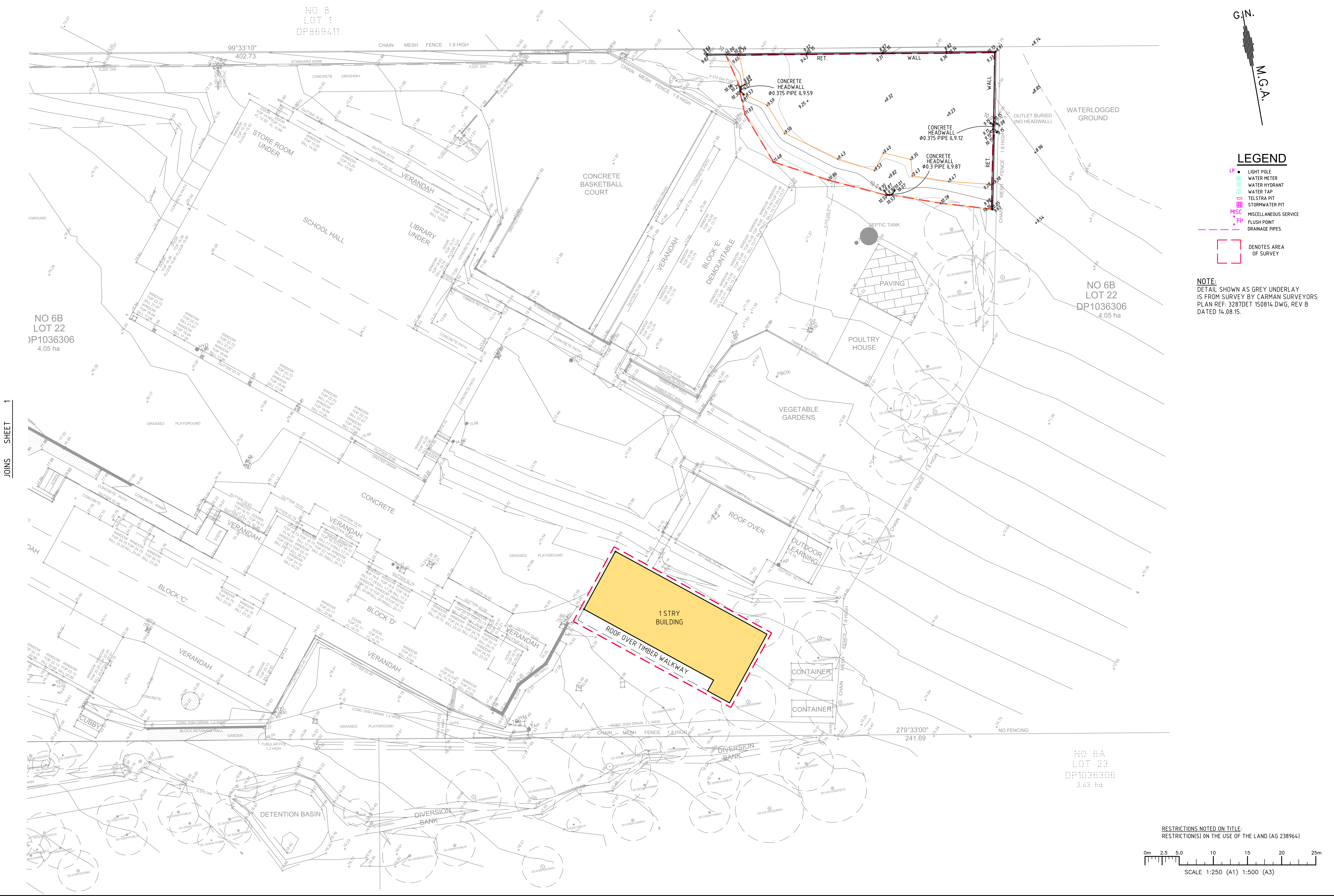
NOTES:
1. ALL UNDERGROUND SERVICES WHERE SHOWN HAVE BEEN PLOTTED FROM AUTHORITY RECORDS AND ARE APPROXIMATE ONLY. SURFACE INDICATORS WHERE SHOWN ARE TYPICALLY BY SURVEY AND SHOWN FOR PLOT ONLY.
2. THE SITE BOUNDARIES WHERE SHOWN WERE NOT MARKED AT TIME OF SURVEY AND ARE APPROXIMATE. ACCURATE BOUNDARY POSITIONS ARE TO BE DETERMINED ON SITE PRIOR TO ANY WORK.
3. ORIGIN OF LEVELS IS AUSTRALIAN HEIGHT DATUM (A.H.D.) PM71632 RL15.282.
4. CONTOUR INTERVALS ARE 0.5 METRES.
5. THIS DOCUMENT IS FOR PLANNING PURPOSES ONLY.
6. CONTOURS, WHERE SHOWN, HAVE BEEN DERIVED FROM THE SPOT LEVELS TAKEN AND PROVIDE A GENERAL INDICATION ONLY OF THE GROUND SURFACE.
7. RIDGES, GUTTERS AND WINDOWS HAVE BEEN LOCATED BY REMOTE MEANS AND ARE APPROXIMATE ONLY.

PARKER SCANLON PTY LTD
Surveying, Engineering, Town Planning and Project Management
17 Wandella Street, HAMILTON NSW 2303 ★ PO Box 188, HAMILTON NSW 2303
Ph: 4969 6866 ★ Fax: 4969 6877 ★ Email: surveys@parkerscanlon.com.au ★ ABN 39 343 824 026
www.parkerscanlon.com.au

TITLE:
DETAIL SURVEY OF PART OF MEDOWIE CHRISTIAN SCHOOL, WAROPARA ROAD, MEDOWIE

DATE:	5 JULY 2018
DRAWING:	B1828DET-1-B.DWG
DRAWN/SURVEYED/CHECKED:	WW/ NK/ MS
PARKER SCANLON CONTACT:	M.SCANLON
DATUM:	A.H.D.
REFERENCE No:	B1828
SHEET OF SHEETS	1 2

Plotted By: will wilkinson Plot Date: 19/07/2018 Cad File: L:\B1828 - Medowie\B1828 - Dwgs\B1828DET-1-B.dwg



LEGEND

- LIGHT POLE
- WATER METER
- WATER HYDRANT
- WATER TAP
- TELSTRA PIT
- STORMWATER PIT
- MISCELLANEOUS SERVICE
- FLUSH POINT
- DRAINAGE PIPES
- DENOTES AREA OF SURVEY

NOTE:
DETAIL SHOWN AS GREY UNDERLAY IS FROM SURVEY BY CARMAN SURVEYORS PLAN REF: 3287DET 150814.DWG, REV B DATED 14.08.15.

RESTRICTIONS NOTED ON TITLE:
RESTRICTION(S) ON THE USE OF THE LAND (AG 238964)

SCALE 1:250 (A1) 1:500 (A3)

AMENDMENT	DATE	DESCRIPTION
B	18.07.18.	PLAN ISSUED
A	05.07.18.	DRAFT PLAN ISSUED

NOTES:
1. ALL UNDERGROUND SERVICES WHERE SHOWN HAVE BEEN PLOTTED FROM AUTHORITY RECORDS AND ARE APPROXIMATE ONLY. SURFACE INDICATORS WHERE SHOWN ARE TYPICALLY BY SURVEY AND SHOWN FOR PLOT ONLY.
2. THE SITE BOUNDARIES WHERE SHOWN WERE NOT MARKED AT TIME OF SURVEY AND ARE APPROXIMATE. ACCURATE BOUNDARY POSITIONS ARE TO BE DETERMINED ON SITE PRIOR TO ANY WORK.
3. ORIGIN OF LEVELS IS AUSTRALIAN HEIGHT DATUM (A.H.D.) PM71632 RL15.282.
4. CONTOUR INTERVALS ARE 0.5 METRES.
5. THIS DOCUMENT IS FOR PLANNING PURPOSES ONLY.
6. CONTOURS, WHERE SHOWN, HAVE BEEN DERIVED FROM THE SPOT LEVELS TAKEN AND PROVIDE A GENERAL INDICATION ONLY OF THE GROUND SURFACE.
7. RIDGES, GUTTERS AND WINDOWS HAVE BEEN LOCATED BY REMOTE MEANS AND ARE APPROXIMATE ONLY.

PARKER SCANLON PTY LTD
Surveying, Engineering, Town Planning and Project Management

TITLE:
DETAIL SURVEY OF PART OF MEDOWIE CHRISTIAN SCHOOL, WAROPARA ROAD, MEDOWIE

DATE: 5 JULY 2018	
DRAWING: B1828DET-1-B.DWG	
DRAWN/SURVEYED/CHECKED: WW/ NK/ MS	
PARKER SCANLON CONTACT: M.SCANLON	DATUM: A.H.D.
REFERENCE No: B1828	SHEET OF SHEETS 2 2

Appendix F

MUSIC-Link Report

MUSIC-*link* Report

Project Details		Company Details	
Project:	Medowie Christian School - Proposed ISTEM Building	**Company:**	MPC Consulting Engineers
Report Export Date:	8/08/2019	**Contact:**	Benjamin Curran
Catchment Name:	180802 Medowie - Proposed system 8.8.2019	**Address:**	Suite 3, Lvl 1, 16 Telford St Newcastle NSW 2300
Catchment Area:	2.482ha	**Phone:**	+61 2 4927 5566
Impervious Area*:	50.76%	**Email:**	benjaminc@mpceng.com.au
Rainfall Station:	WILLIAMTOWN RAAF - Station 061078 - Zone C		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1998 - 31/12/2007 11:54:00 PM		
Mean Annual Rainfall:	1238mm		
Evapotranspiration:	1394mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.32		
Study Area:	Raymond Terrace		
Scenario:	Sensitive Catchment - Clay soils		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness

Node: Receiving Node	Reduction
Flow	3.49%
TSS	92.4%
TP	71%
TN	47.6%
GP	100%

Treatment Nodes

Node Type	Number
Detention Basin Node	1
Bio Retention Node	1
GPT Node	1

Source Nodes

Node Type	Number
Urban Source Node	11

Comments

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention - 0.45m deep filter - 150m2	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention - 0.45m deep filter - 150m2	PET Scaling Factor	2.1	2.1	2.1
Detention	Detention Basin	% Reuse Demand Met	None	None	0
GPT	Humeceptor	Hi-flow bypass rate (cum/sec)	None	99	99
Receiving	Receiving Node	% Load Reduction	None	None	3.49
Receiving	Receiving Node	GP % Load Reduction	90	None	100
Receiving	Receiving Node	TN % Load Reduction	45	None	47.6
Receiving	Receiving Node	TP % Load Reduction	60	None	71
Receiving	Receiving Node	TSS % Load Reduction	90	None	92.4
Urban	G1 Admin roof	Area Impervious (ha)	None	None	0.054
Urban	G1 Admin roof	Area Pervious (ha)	None	None	0
Urban	G1 Admin roof	Total Area (ha)	None	None	0.054
Urban	G1 Lanscape	Area Impervious (ha)	None	None	0
Urban	G1 Lanscape	Area Pervious (ha)	None	None	0.44
Urban	G1 Lanscape	Total Area (ha)	None	None	0.44
Urban	G1 New Building Roof	Area Impervious (ha)	None	None	0.073
Urban	G1 New Building Roof	Area Pervious (ha)	None	None	0
Urban	G1 New Building Roof	Total Area (ha)	None	None	0.073
Urban	G1 Paved	Area Impervious (ha)	None	None	0.06
Urban	G1 Paved	Area Pervious (ha)	None	None	0
Urban	G1 Paved	Total Area (ha)	None	None	0.06
Urban	G1 Paved 2	Area Impervious (ha)	None	None	0.328
Urban	G1 Paved 2	Area Pervious (ha)	None	None	0
Urban	G1 Paved 2	Total Area (ha)	None	None	0.328
Urban	G2 Landscaped	Area Impervious (ha)	None	None	0
Urban	G2 Landscaped	Area Pervious (ha)	None	None	0.194
Urban	G2 Landscaped	Total Area (ha)	None	None	0.194
Urban	G2 Paved	Area Impervious (ha)	None	None	0.126
Urban	G2 Paved	Area Pervious (ha)	None	None	0
Urban	G2 Paved	Total Area (ha)	None	None	0.126
Urban	G2 School hall roof	Area Impervious (ha)	None	None	0.151
Urban	G2 School hall roof	Area Pervious (ha)	None	None	0
Urban	G2 School hall roof	Total Area (ha)	None	None	0.151
Urban	G3 Lanscape	Area Impervious (ha)	None	None	0
Urban	G3 Lanscape	Area Pervious (ha)	None	None	0.588
Urban	G3 Lanscape	Total Area (ha)	None	None	0.588
Urban	G3 Paved	Area Impervious (ha)	None	None	0.16
Urban	G3 Paved	Area Pervious (ha)	None	None	0
Urban	G3 Paved	Total Area (ha)	None	None	0.16
Urban	G3 Total roof area	Area Impervious (ha)	None	None	0.308

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	G3 Total roof area	Area Pervious (ha)	None	None	0
Urban	G3 Total roof area	Total Area (ha)	None	None	0.308

Only certain parameters are reported when they pass validation