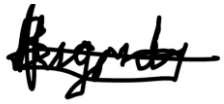
MEMO

To:	Queenbeyan-Palerang Regional Council
From:	Brett Mugridge
Date:	16 October 2024
Reference:	310853
Project name:	Sunset Estate – Stage 2
Subject:	Existing Infrastructure Review

During the Development Application for Stage 1 of the Sunset Estate; a network analysis was undertaken for the sewer and water infrastructure in the vicinity to establish the constraints of development on the site (Sunset Civil Report, WSP 2018). This assessment was conducted with consideration of a 2 stage development; 1 of which has been completed to date.

The infrastructure installed within the first stage has the residual capacity to readily extend for the future subdivision as provided within the planning proposal (refer APPENDIX A).

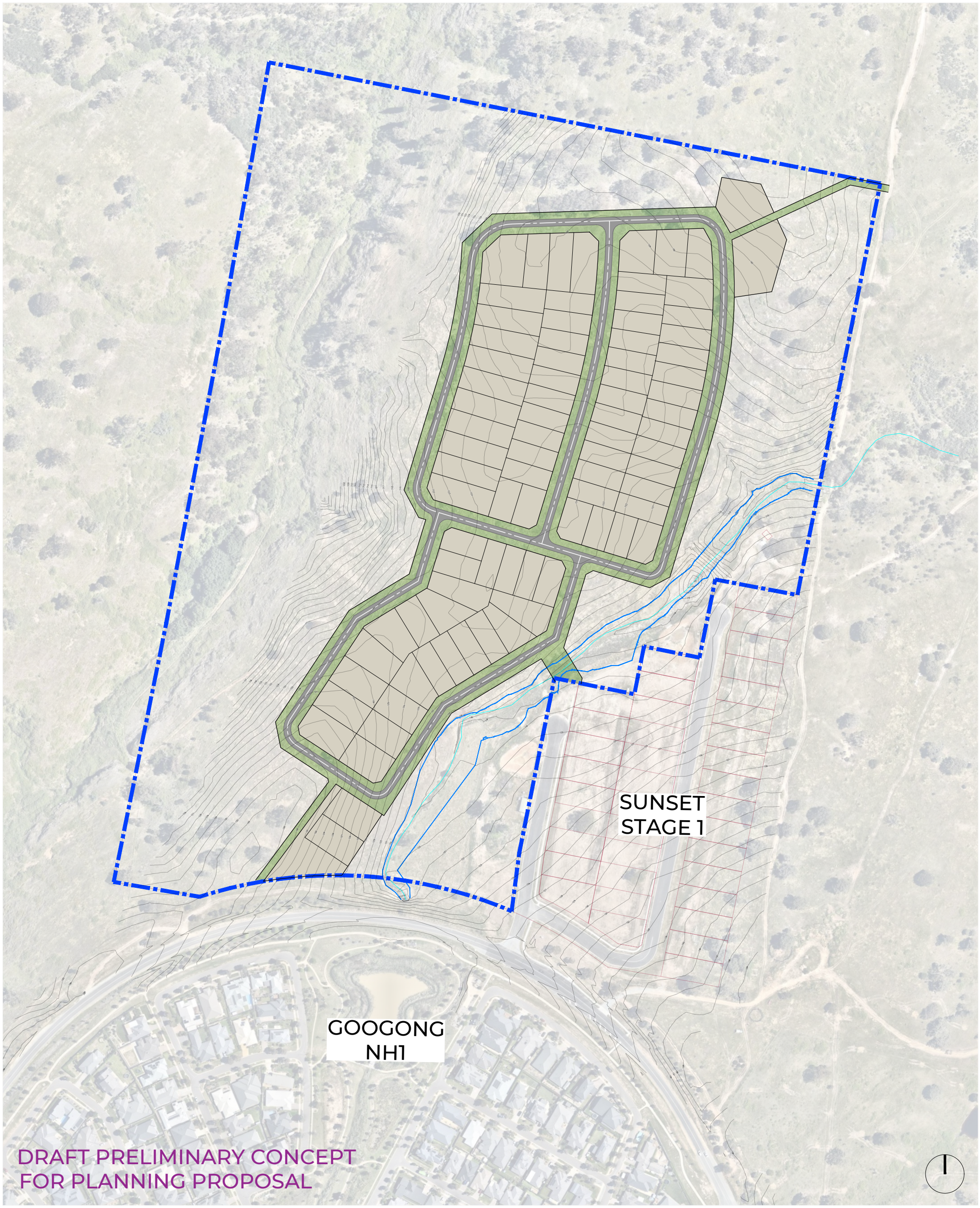


Brett Mugridge

Chartered Civil Engineer

Included:

- APPENDIX A: Concept Masterplan
- APPENDIX B - Sunset Civil Report, WSP 2018



LEGEND

- Site Boundary | Stage 2
- Q100 (1% AEP) + 500 mm Flood Line

Project	**SUNSET STAGE 2** 141 Googong Road, Googong | LOT 39 DP 1257837
Drawing Name	Concept Master Plan
Client	sunset Googong

Date	Scale	Sheet Size
2024.09.25	1:3000	A3
Drawn	Chk.	Job No.
AN	GR	21-192
Drawing No.	Issue	
CMP.M	PLANNING PROPOSAL	

URBANE STUDIO
URBAN DESIGN | STATUTORY PLANNING | ADVISORY
33 Allara St, Canberra ACT 2601
www.urbanestudio.com.au

SUNSET RESIDENTIAL DEVELOPMENT STAGE 1

CIVIL ENGINEERING REPORT

JUNE 2018

Question today
Imagine tomorrow
Create for the future

WSP
Level 2, 433 Boundary Street
Spring Hill QLD 4000
Tel: +61 7 3838 2400
wsp.com

REV	DATE	DETAILS
A	05.06.2018	Response to Council Information request

	NAME	DATE	SIGNATURE
Prepared by:	Tanel Djemil	05/06/2018	
Reviewed by:	John Condon	05/06/2018	
Approved by:	John Condon	05/06/2018	

TABLE OF CONTENTS

1 PROJECT BACKGROUND

1.1 INTRODUCTION

This engineering report has been prepared to respond to the Development Application (DA) Request For Information (RFI) to Queanbeyan Regional Council for Stage 1 of the proposed subdivision "Sunset". WSP has been engaged by Genium Civil Engineering to respond to the RFI. Stage 1 of the development consists of approximately 21 lots and is situated at 141 Googong Road, Googong, New South Wales.

This report investigates the civil engineering elements for Stage 1 and responds to the Council RFI.

The overall size of stage 1 measures 3.6 ha.

1.1.1 LOCATION AND USAGE

The site is currently largely undeveloped. The site is bounded by Googong Road to the south, a stream to the north and undeveloped land to the east and west.

The development is situated within the bounds of Lot 2 DP255492, Lot 17 DP 754881 and Lot 18 DP754881. Refer to figure 1 for a locality plan of the site and Stage 1 boundaries.

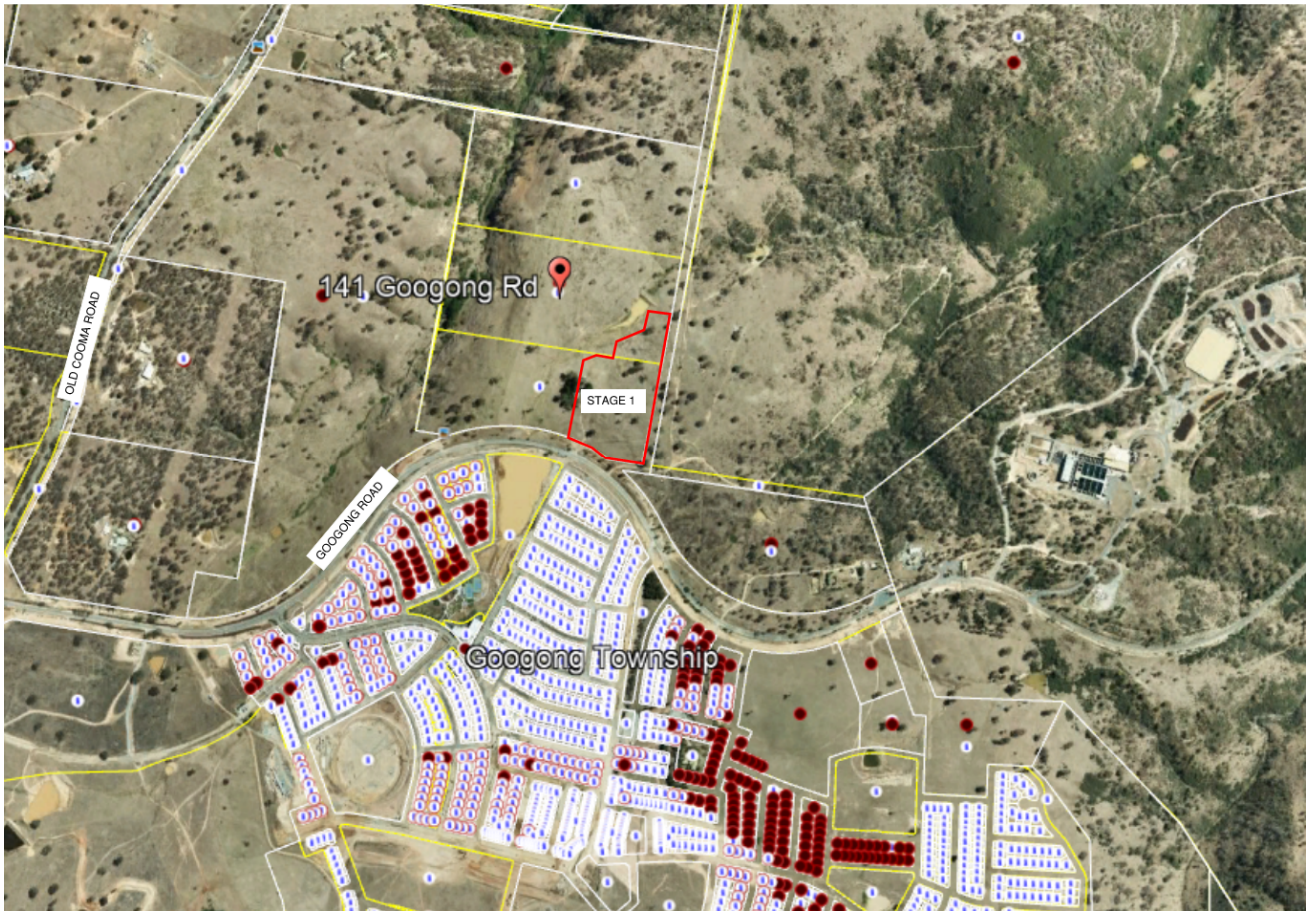


Figure 1: Location of Stage 1

1.1.2 EXISTING SITE CONDITIONS, TOPOGRAPHY AND DRAINAGE

The development site is largely undeveloped grassland. Refer to the survey plan attached in Appendix A.

The proposed Stage 1 of the subdivision has a total approximate area of approximately 3.6ha.

Review of the site survey shows that the site falls north-westerly directions towards a stream. The highest point of the site is to the south east corner at approximately 728mAHD which then slopes down to the stream at approximately 718mAHD. The general slope of the land is

1.1.3 LOCAL AUTHORITY AREA

The site is located within the limits of Queanbeyan Palerang Regional Council municipality.

1.1.4 LAWFUL POINT OF DISCHARGE

The site discharges to the stream to the north west corner of the site via an existing dam.

1.1.5 FLOODING

No flood mapping is available for the site. A catchment analysis was undertaken for the stream, a time of concentration was calculated and a node input into DRAINS to ascertain the peak Q_{100} flow rate. This flow rate was then input into a HEC-RAS model to ascertain the Q_{100} flood level. The catchment plan for the stream as well as the HEC-RAS results are provided in Appendix A3 of this report.

Some sensitivity analysis was undertaken to ascertain whether the dam had a detrimental impact on flood levels. The dam was removed in HEC-RAS and culverts were provided at road crossings.

The resulting impact was a decrease in the Q_{100} flood level within the proposed new residential lots. For this reason, the dam will be removed.

The road in Stage 1 will cross the stream as part of the future stages and therefore requires flood immunity in accordance with QPRC requirements. QPRC require roads to be designed to Q_{100} + 500mm freeboard. Therefore the lot and road levels have been designed to allow extension of the roads across the stream without impact.

1.1.6 STREAM AND DAM

The existing site currently discharges to a stream via a dam to the north of the site. The stream has been classified as a 2nd order watercourse with a 20m riparian corridor in accordance with the NSW Department of Primary Industries, Office of Water – controlled activities on waterfront land – guidelines for riparian corridors on waterfront land. Council confirmed this via correspondence (provided within appendices).

The stream currently discharges through an existing dam with a weir wall. As discussed above, the dam is not considered to be required and the weir wall has a detrimental impact on the local flood level. The Stage 1 works include removal of the dam and reinstatement of the stream.

2 GEOTECHNICAL

2.1 GENERAL

A geotechnical report is yet to be undertaken on the proposed development site. This will be undertaken at detailed design stage.

From review of previous field visits undertaken by WSP, it has been reported that the site comprises shallow very hard rock. It is therefore anticipated that road profile will be designed to a minimum pavement depth, however, this will be confirmed following receipt of a geotechnical report and at construction stage in-situ CBR tests will be conducted to inform the pavement design to be submitted to Council for approval.

In some places retaining walls may be able to be substituted for steep batters. The geotechnical report will confirm what the batters can be.

3 ENGINEERING

3.1 EARTHWORKS

To cater for the proposed subdivision development, bulk earthworks operations will be required to be undertaken. This chapter is dedicated to the bulk earthworks in stage 1 only. To minimise the impact on waste disposal facilities and to save on construction costs, it is proposed to use as much material as possible of the available material on site.

It is proposed to keep the lots as 'natural' as possible to minimise excavation into the hard rock. Design was in accordance with Council's maximum grade requirement of 15% within lots in accordance with QPRC development design specification D6 – Site regrading. Gradients of driveways shall not exceed 16% as per QPRC development design specification D13 – vehicular access design. A slope analysis plan is provided in Appendix A2.

As discussed within section 2 of this report, it is anticipated that road profile will be a minimum pavement depth due to the likely underlying hard rock on site.

3.2 CONSTRAINTS

There are a number of constraints which will impact the earthworks, which are listed below:

- Protected trees – these are shown on the attached engineering plans within Appendix A2. There are four trees located within Stage 1, three of these are located within lots and the fourth is located within the verge. The tree within the verge will dictate the road level as cut should be minimised in this location to ensure that tree roots are not damaged. Services will also need to be laid to avoid tree roots and should also be concrete encased to ensure they are not damaged by tree roots;

- Cultural Heritage – there is a cultural heritage listed item on the western boundary. To ensure that this is maintained and not damaged as part of the works, the road has been graded to ensure that no retaining walls or excessive batters will be required at this point. There is a small batter which is considered less intrusive;
- Riparian zone – The existing stream is a second order stream with a 20m riparian zone. The riparian zone needs to be preserved;
- Flood level – The existing stream conveys approximately 25m^3/sec of run-off and has an associated flood level. In accordance with Council's policy, the flood planning level will be Q_{100} + 500mm freeboard. This has had an impact on the earthworks and road design; and
- Existing Googong Road and future Stage 2 Road – The road alignment will need to tie into the existing Googong Road and will also need to tie into the future Stage 2 road.

3.3 RETAINING WALLS

Some retaining walls may be required between the site boundary and adjacent property boundaries as a result of the proposed road levels. These are shown on the design plans.

3.4 GRADING

The maximum grade for the site is 9.3% which meets the QPRC development design specification D1 – Geometric road design which states that the desirable maximum grade for a Collector Street is 10% and the maximum permissible grade is to be 12%.

The typical road section has 3% crossfall towards both sides of the road. Maximum batters into lots are 15% in accordance with Council standards and lots will be natural and below 20%.

The actual road verge grades at 2% towards the kerb as per ACT Government Design Standards.

Council have requested that each of the lots have the ability to provide POS (Private Open Space). The earthworks plan shows how this would be achieveable on one of the lots. Establishment of the building pads will form part of the building works after each lot is sold. It will be at the discretion of the owner to 'cut in' a building pad with inclusion of private open space.

3.5 ROADWORKS

Following consultation with QPRC, it has been established that the fully developed sub-division will serve as a bus route.

Table D1.8 of QPRC development design specification D1 – Geometric road design note 3 requires that the minimum road classification required for a bus route is to be a collector street. Table D1.8 also requires a "Collector Street 1" to have a minimum road reserve width of 21.2m, minimum verge widths of 5m and a minimum carriageway width of 11.2m with barrier kerb either side.

In accordance with QPRC development design specification D1 – Geometric road design, table D.1.5, a collector street 1 requires a minimum 1.5m wide footpath either side of the road.

Stage 1 comprises a single access point from Googong Road. The existing intersection is to be upgraded as an RAL intersection in accordance with Austroads – Guide to Road Design Part 4A.

3.6 PEDESTRIAN AND CYCLE LINK

QPRC requires a pedestrian and cycle link from the existing sub-division located to the south and the subject development.

A 1.8m wide footpath will be required within the development site to allow pedestrian and cycle access in accordance with ACT Government Design Standard Urban Infrastructure Drawing drawing DS4-04.

3.7 ALIGNMENT OF SERVICES

The alignment of utilities will be based off the following clearance requirements discussed with Council (approval of requirements received via email on 25th May 2018). The section provided to Council is shown on drawing C0202.

3.8 DRIVEWAYS

Driveways are shown on engineering plans and are in accordance with ACT Government Design Standard urban infrastructure drawing DS5-01.

3.9 PARKING

All parking will be done within the individual lots and as on-street parking. There are no specially designated/line marked carparking spaces within the road reserve.

3.10 TRANSPORT

There is one entrance (from Googong Road) to the development. The intersection has been design as an RAL in accordance with Austroads – Guide to Road Design Part 4A.

3.10.1 GOOGONG ROAD INTERSECTION

3.10.1.1 DESIGN STANDARDS

- Austroads Guide to Road Design – Part 4A

3.10.1.2 DESIGN VEHICLES

- The design vehicle for the intersection is a 12.5m rigid vehicle

3.11 STORMWATER QUANTITY

3.11.1 EXISTING DRAINAGE REGIME AND EXTERNAL CATCHMENTS

The site currently has no stormwater infrastructure in place and drains via overland flow into the stream.

Due to undulating terrain within the Googong township, there is some overland flow which enters the site from the east. A berm will be provided within lots along the eastern boundary to ensure this overland flow is diverted around the lots and ultimately still discharges to the dam/stream.

3.11.2 PROPOSED DRAINAGE REGIME

The stormwater network must be designed to safely convey minor storm events via a pit and pipe stormwater system with provision for larger, more infrequent storm events overland via the road network.

The proposed stormwater network will comprise of a pit and pipe network. All stormwater pits to be as per ACT Government Design Standard urban infrastructure drawing ST0011.

QPRC development design specification D5 – Stormwater drainage design requires the stormwater pit and pipe network to be sized for a minor 1 in 5 year ARI rainfall event for general residential. The road profile will convey the major storm event (1 in 100 year ARI (1% AEP)).

The residential catchment impervious areas were derived from the Googong Handbook of Drainage Design Criteria (Version 1), table 1.1. This is provided in figure 2 below:

Area/Zoning Type	% Impervious
Large Lot Residential	20 %
Residential	
450 - 600 m^2	60 %
600 - 800 m^2	45 %
800 - 1000 m^2	35 %
> 1000 m^2	30 %
Multi-dwelling	70 %
Commercial	85 %
Playing fields/Parks	10 %
Rural/Open country < 10 % slope	40 %
Steep rocky country > 10 % slope	70 %

Table 1.1
Percentage of Impervious Area

Figure 2: Impervious Areas Adopted for Lots

The relevant criteria has been highlighted within the extract above and therefore an impervious area of 35% was adopted on the residential lots within the development.

3.11.3 EXTERNAL CATCHMENTS

One of the external catchments has been discussed within section 3.8.1 of this report. An additional external catchment discharges to the dam/stream, an extract of this catchment is provided in figure 3 below and provided in Appendix A3 of this report.

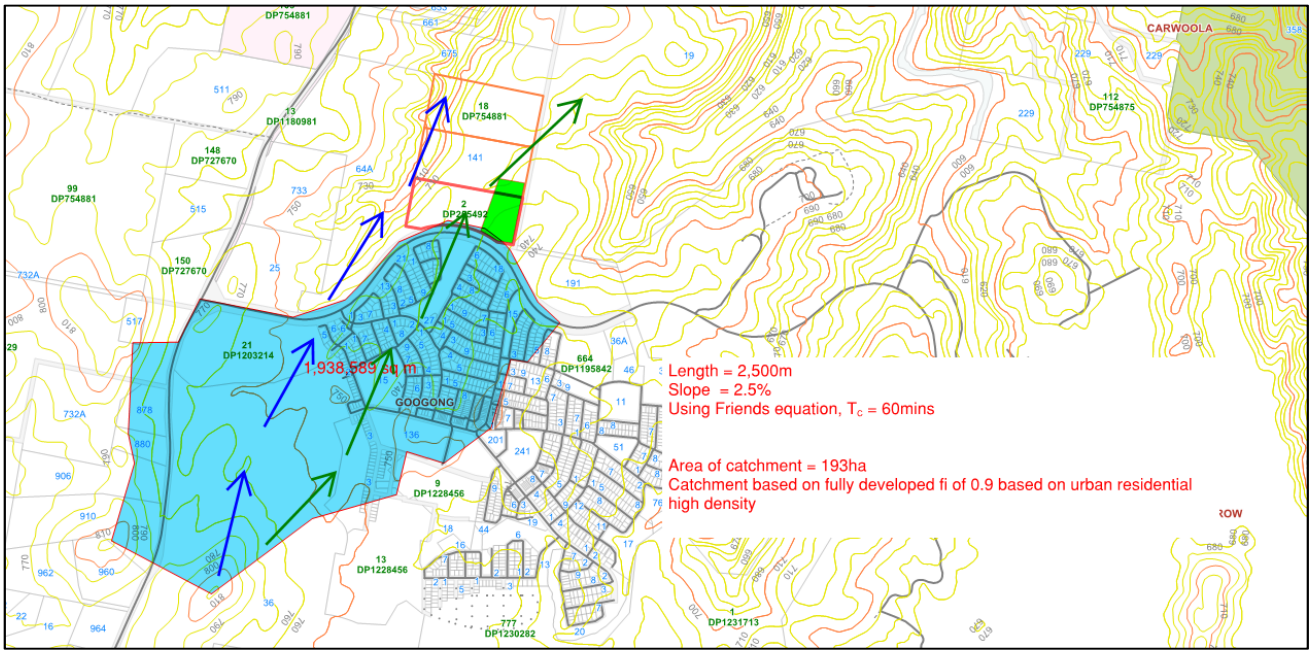


Figure 4: External Catchment

There are a series of ridges and gullies within the Googong township and it has been estimated that approximately 193ha discharges into the existing stream. A Tc of 60minutes was calculated using Friend's equation and a conservative impervious area of 90% was adopted for this catchment , although it is understood that this is likely to be significantly less as a result of the upstream sub-division attenuating much of the catchment.

A node was input in DRAINS modelling software and run for a Q_{100} event to ascertain the peak flow in the stream at the subject site. The peak flow was calculated to be $25m^3$/second.

As QPRC have no information regarding the flood level for the stream, a model was created using HEC-RAS software. Sections from 12D software were cut every 20m along approximately 500m of the stream.

Figure 4 overleaf shows a 3 dimensional plan of the dam/stream in a Q_{100} event.

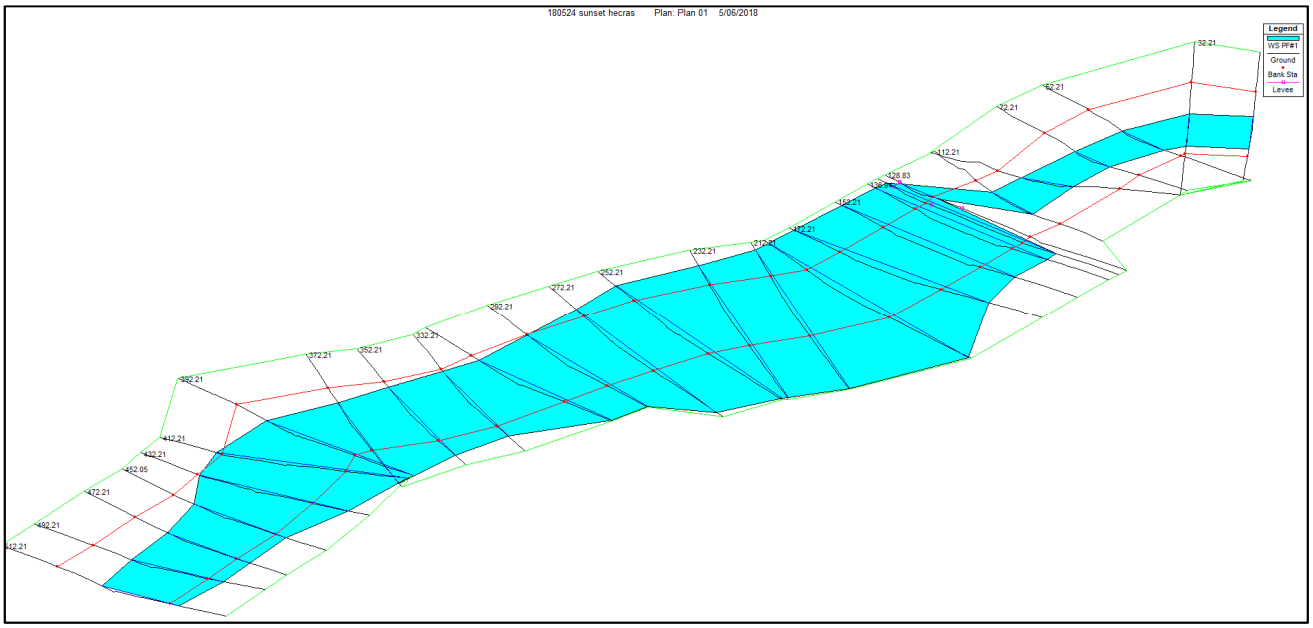


Figure 4: HEC-RAS Flood Modelling Results with Dam

Figure 5 below shows a 3 Dimensional plan of the stream with culvert crossings and without the dam:

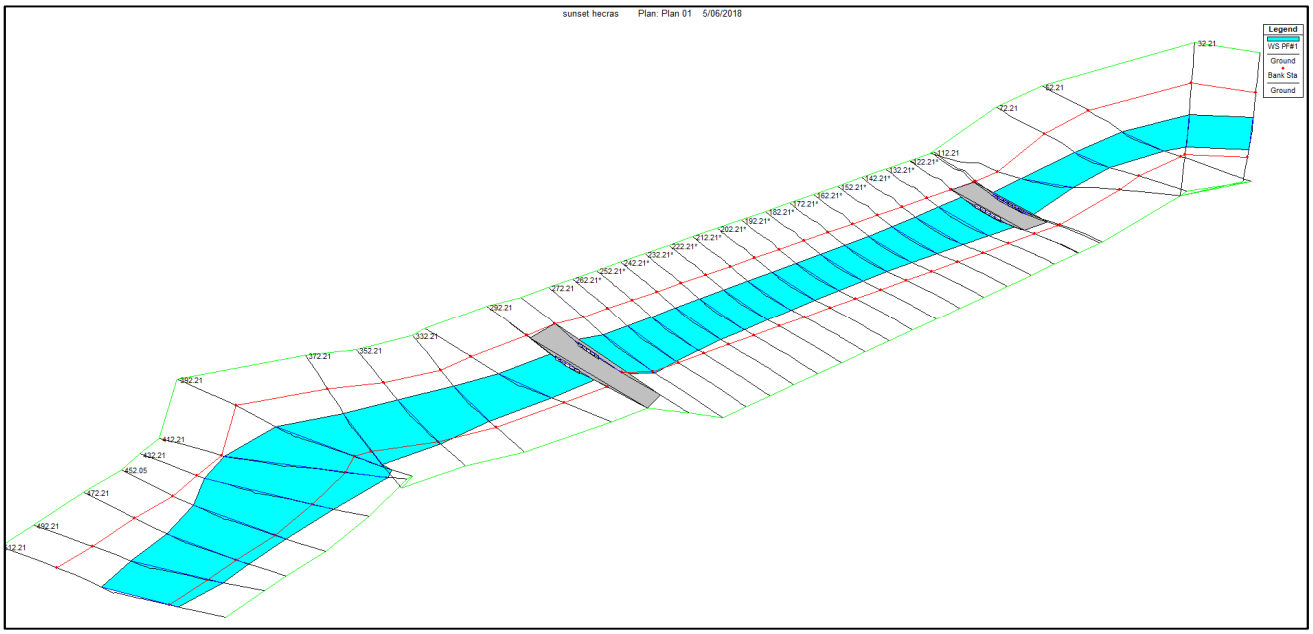


Figure 5: HEC-RAS Flood Modelling Results without Dam and with Culverts

3.11.4 STREAM AND DAM WORKS

The dam is a private asset and based on topographical information the weir wall is 119.250mAHD. Analysis was undertaken in HEC-RAS to ascertain impacts should the dam be removed. Further analysis was then undertaken to assess the impacts of the provision of two culvert crossings resulting in the future road crossings over the stream.

Removing the dam significantly reduced the flood level locally. Provision of the culvert crossings slightly altered the afflux (increase) but the flood level was still less than when modelled with the dam. Following the HEC-RAS analysis the road levels could be established and none of the proposed lots were located within the Q_{100} flood plain.

3.11.5 MINOR AND MAJOR FLOWS

A DRAINS model has been used to determine the peak flow rates corresponding to minor and major storm events for this development. Developed stormwater peak flows from the proposed developable areas have been calculated and analysed. These have been modelled using the hydraulic software DRAINS.

The table below shows the minor and major flows for the development site and for the stream:

OUTLET	MINOR FLOW (M^3/S)	MAJOR FLOW (M^3/S)
Development Site	0.786	1.54
Upstream catchment (to stream)	14.6	24.7

Table 1: Major and minor storm flows at Stage 1 outlet

3.11.6 DETENTION

In accordance with QPRC development design specification D5 – Stormwater drainage design, table D5.3 the predevelopment peak discharge rates for ARI's of 5 years and 100 years must not be exceeded.

DRAINS modelling was undertaken to ascertain pre and post development flows for these events and three detention basins were sized based on associated catchments.

The catchments plan is provided in Appendix A3 of this report.

The basins will each have a low flow (Q5) and high flow (Q100) outlet. It is anticipated that the low flow outlet will comprise a pipe with a screen which will connect into the site of a 900 x900 field inlet pit with a domed grate. The walls of the 900 x 900 field inlet pit will act as a 2.7m wide weir.

Existing and proposed flow rates are provided in the table below for each of the detention basin catchments:

Storm Event (ARI)	Predeveloped Flow Rate m^3/sec	Post developed Flow Rate m^3/sec	Post developed attenuated Flow Rate m^3/sec
5	0.157	0.365	0.140
100	0.503	0.720	0.502

Table 2: Catchment 1, Basin 1

Storm Event (ARI)	Predeveloped Flow Rate m^3/sec	Post developed Flow Rate m^3/sec	Post developed attenuated Flow Rate m^3/sec
5	0.040	0.072	0.032
100	0.128	0.160	0.125

Table 3: Catchment 2, Basin 2

Storm Event (ARI)	Predeveloped Flow Rate m^3/sec	Post developed Flow Rate m^3/sec	Post developed attenuated Flow Rate m^3/sec
5	0.134	0.323	0.122
100	0.429	0.635	0.423

Table 4: Catchment 3, Basin 3

From the tables above, it can be seen that the development will result in an increased peak flow rate. However, the attenuated peak flow rates provide a slight improvement on the pre-developed case. The basin sizes are provided in the table below:

Basin	Storage Volume (m^3)
1	290
2	60
3	270

Table 5: Basin Volumes

3.11.7 OVERLAND FLOW

The minor stormwater system (piped) was sized for the 5 year ARI storm event. Larger storm events cannot enter the minor system and are discharged conveyed within the road reserve or via overland flow. The relevant storm event for the overland flow is the 100 year ARI (1% AEP). The whole site is graded so that all overland flow is directed towards the streets where possible, some lots will have inter-allotment drainage. The overland flow runs down the roads and discharges to the stream via the detention basins.

The 100 year ARI flows have been input into a Manning's spreadsheet to ascertain whether the road profile can convey run-off in this event.

Based on a minimum road grade of 3.2% (obtained from road long-sections), the road profile can convey each of the respective catchments in a Q_{100} event.

3.12 STORMWATER QUALITY

It is proposed to put a Gross pollutant traps (GPT) at each of the three outlets from the site.

It is proposed to utilise a Rocla CDS1009 Unit or similar for each of the outlets. A single unit can treat between 2-8 ha per unit.

In many GPT's the Q_{3month} is the governing amount of flow that needs to be treated. This needs to be further detailed once the final design is specified.

3.13 SEWER RETICULATION

No existing services were located within the existing site therefore the proposed development will require a sewer connection to the municipal sewer network. An existing DN300 sewer main is located at Googong Road approximately 550m from the site. It is proposed that the development will connect to the existing main on Googong Road via a rising main from the on-site pump station.

To determine the anticipated sewer demand for this site, the Water Services Association of Australia (WSAA) Sewerage Reticulation Code of Australia was adopted. For the demand calculations, WSAA was referred to for development densities and Queanbeyan Council design requirements were adhered to. The sewer flow calculations and preliminary design were based off the following parameters set out in Table 6. Refer to Appendix A3 for an overview of the sewer design calculations.

PARAMETER	LOW DENSITY RESIDENTIAL

Development Density	3 EP/Lot
ADD - Average Day Demand	180 L/EP/day
ADWF – Average Dry Weather Flow	ADWF = ADD x EP
PDWF – Peak Dry Weather Flow	PDWF = d x ADWF
D – Peaking factor	$D = 0.01(\log A)^4 – 0.19(\log A)^3 +1.4(\log A)^2 – 4.66\log A + 7.57$
A – Gross Plan Area	5 ha
GWI – Groundwater Infiltration	$GWI = 0.025 \times A \times Portion_{wet}$
$Portion_{wet}$ = Portion of pipe network impacted by groundwater	Comprehensive Geotech not available, assume worst-case = 100% impacted, $Potion_{wet} = 1$
IIF – Inflow and Infiltration	$IIF = 0.028 \times A_{eff} \times C \times I$
A_{eff} - Effective Area	$A_{eff} = A \times (Density/150)^{0.5}$
Density	Density = 38lots (worst case)/5ha
C – Leakage Severity Coefficient	S_{aspect} = Soil aspect = low impact (shallow rock) = 0.2 N_{aspect} = Network Defects and inflow aspect = low impact (new sewer) = 0.2 $C = S_{aspect} + N_{aspect} = 0.4$
I – Function of Rainfall Intensity	$I = I_{1,2} \times Factor_{size} \times Factor_{containment}$
$I_{1,2}$ – 1 hr rainfall	22mm/hr – Canberra
$Factor_{size}$ – Flow concentration time factor	$Factor_{size} = (40/A)^{0.12}$
$Factor_{containment}$ – Sewage Spill Frequency Permitted	Assume worst case 10yr ARI = 1.5 (Table B3 WSA)
Design Flow	Design Flow = PDWF + GWI + IIF
Maximum Grade	7% As per section clause 4.6.6.5 in WSA02 - 2014-3.1
Minimum Grade	0.55 % (DN150) & 0.33 % (DN225)
Minimum Cover over Sewers	900mm
Manhole Maximum Spacing	180m
Sewer Material	PVC-U , Class SN8
Sewer Pump Station Emergency Storage	8 hrs emergency storage of dry weather flows – QPRC
Sewer Pump Station Flood Immunity	Top of pump well to be 1m above Q100 flood level - QPRC

Table 6: Sewer Design Parameters

3.13.1 PROPOSED SEWER DESIGN REGIME

A single reticulation system will be used and consist of a single sewer main on one side of the road within the verge or within the lot. This will allow for property connections directly onto the main. Sewer line 2 will be located within an easement at the back of lots 10-21 so as to match the natural fall of the site. All other lots will be serviced via a sewer main within the verge.

Due to the natural fall away from the site entrance, the sewer will require the use of a sewer pump stations and rising mains to service the site.

The ultimate/stage 2 site will be serviced by the same pump station (pump station 1) as stage 1. The pump station will then connect to the existing sewer main on Googong Road via rising main, refer to figure 6 overleaf. Initial wet well storage

calculations have been completed for the master planned development. Detailed analysis will be completed in the next design phase.

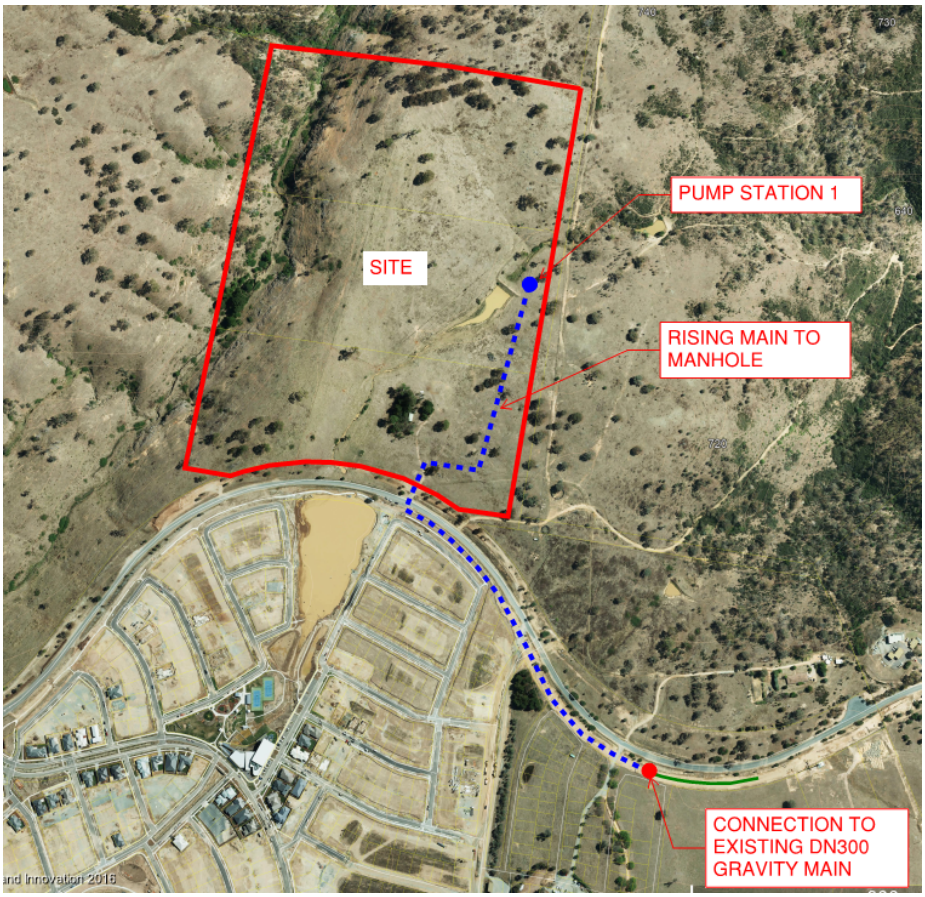


Figure 6: Sewer Connection to Municipal Network

3.13.2 DESIGN CONSIDERATIONS

It was found that due to the low equivalent population being serviced on certain lines, minimum velocity requirements could not be met. In these cases, WSA allows for the consideration of self-cleansing velocity. This specifies that low demand lines are required to have a specified grade to ensure self-cleansing. The Hunter Water Corporation – gravity sewer capacity table, see Appendix A3, was used as a guide.

The proposed pump station (Pump station 1) is located in close proximity to the creek outlet on the eastern side of the site, refer to figure 8. From initial analysis, it was found that this site would be able to provide service to all of the subdivision and only require a single pump station for the entire site. To ensure the pump station wet well capacity satisfies QPRC's emergency storage requirements, calculations were completed – refer to Appendix A3. QPRC require 8-hour emergency storage for the 100% lot yield scenario, WSA Pump Station Code 04-2005 2.1 stipulates in Cl5.6.2.2 that the, "*emergency storage shall contain all dry weather flows".* Based on this requirement, the ADWF was used to size the emergency storage. It was found that over 8 hours in ADWF conditions, the site produces 21,600L (21.6m^3) of sewage. A wet well 2.3m in diameter and 5.2m deep has a volume of 21.6m^3. To allow for 300mm freeboard, the overall wet well depth is 5.5m.

High level calculations have been completed for the sewer pump sizing. It was found that at the ultimate worst-case scenario of 120 lots, a design flow of 4.65L/s is anticipated. Assuming 8 pump cycles an hour – maximum set by WSAA Pump

Station Code 04-2005 2.1 in Cl 5.4.3, it was calculated that the pump would be required to pump 19.5L/s/cycle at 36m head.

To ensure minimal interruption to pump station operations, it is proposed to service stages 1 and stage 2/ultimate subdivision with the same pump system. To ensure the system is run efficiently and rising main operational pressures are maintained, it is suggested to set pump operation levels specific for each stage i.e. during stage 1 the pump start level will be higher than the stage2/ultimate pump start level. By changing the operational pump levels, this will maintain a steady pump operation and remove the need to upgrade the pumps at the ultimate stage.

3.14 WATER RETICULATION

This report and its hydraulic assessment focuses on the requirements for water reticulation within the total development (Stages 1 and 2). The QPRC water network model was not made available, therefore impacts on the existing upstream water demand area have not been included in this assessment. Council will have to determine these impacts on the upstream water network. Council has not provided upstream boundary conditions for potential connection points from the development site. A realistic value of 30m was chosen for this assessment.

The boundary condition for the model was set at the temporary end cap of the existing DN250 trunk main on the corner of Googong Road and Beltana Avenue. From existing construction drawings it is known that the trunk main was set at an elevation of 738.4m, this elevation was used as the set boundary condition. As available pressures are not yet known for this area, sensitivity analysis was completed using WaterGEMS V8i modelling software and multiple scenarios were tested, these include:

- Average Demand Flows;
- Instantaneous Demand Flows; and
- Residential Fireflow.

The model layout is shown in figure 7 below:

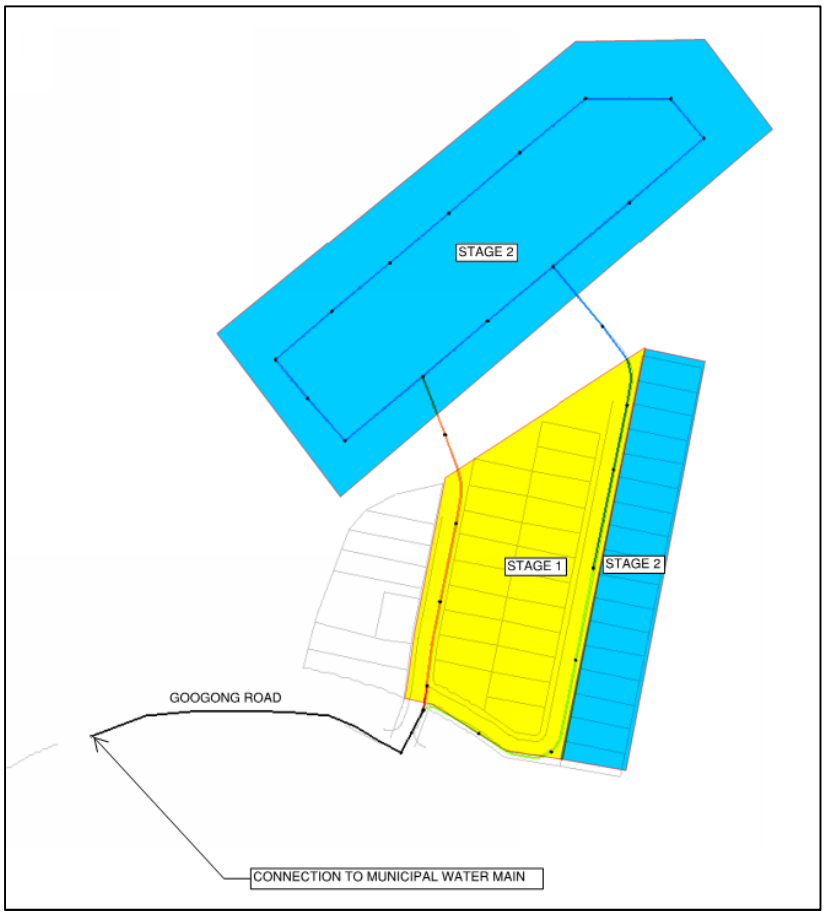


Figure 7: WaterGEMS V8i Model Layout

The modelling was set in a masterplan scenario which includes Stage 1 (40 Lots) and Stage 2 (80 Lots) for a total of maximum case of 120 lots. The masterplan was modelled to analyse the impact of the undulating topography on service pressures.

To test the viability of the network the following design criteria in Table 7 were followed:

PARAMETER	LOW DENSITY RESIDENTIAL	SOURCE
Peak Instantaneous Demand	0.15L/s/Tenement	QPRC Googong Water Reticulation
Average Day Demand	230 L/EP/day	SEQ D&C WS&S Code
EP/Tenement	3	WSA 02-2014 Gravity Sewerage Code
Maximum Service Pressure	80m	QPRC Googong Water Reticulation
Minimum Service Pressure	20m	WSA 03 - 2011 Water Supply Code T2.3
Firefighting	15L/s	AS2419.1
Firefighting Pressure Requirements	15m min at the flowing hydrant	AS2419.1
Firefighting Background Demand	2/3 Peak Hour Residential Demand and 1 x Non-Residential Peak Hour Demand	SEQ D&C WS&S Code

Maximum Velocity	≤ 2m/s under general operational conditions	WSA 03 - 2011 Water Supply Code Cl3.1.6.4
	≤ 4m/s under fire flow conditions	
Maximum Headloss	5m head/km for ≤ DN150	WSA 03 - 2011 Water Supply Code Cl3.1.6.2
	3m head/km for ≥ DN200	
Material	Series 2 PVC-M PN16	QPRC Googong Water Reticulation
Hydrant Spacing	60m	QPRC Googong Water Reticulation

Table 7: Water Design Parameters

The modelling provided the following results in Table 8:

	INSTANTANEOUS DEMAND - 0.15L/S		ADD - 230L/EP/DAY		FF - 10L/S + 2/3 INSTANT DEMAND	
Reservoir Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Pressure at Hydrant	Minimum Pressure Elsewhere
0	-11	9	-10	11	-8	10
10	-1	19	0	21	2	20
20	9	29	10	31	12	30
30	19	39	20	41	22	40
40	29	49	30	51	32	50
50	39	59	40	61	42	60
60	49	69	50	71	52	70
70	59	79	60	81	62	80

Table 8: Water Modelling Results – Minimum Pressures

From the results it can be seen that for the system to meet the minimum service requirement of 20m pressure, a pressure of ≈30m is required as the worst case scenario occurs during the instantaneous demand scenario. A boundary condition pressure of >70m would require pressure reduction measures as the maximum pressure requirement of 80m is exceeded during average day demands.

During reticulation sizing, it was found that the controlling parameter was the allowable headlosses. This caused the minimum allowable mains to vary between DN150, DN200 and DN300, refer to Appendix A3. The extension of the existing trunk main along Googong Road will need to be a minimum DN300 as smaller sizes cause headlosses greater than what is stipulated in WSA 03 – 2011.

The proposed water main route from the development site to the existing municipal infrastructure is shown in figure 8 below:

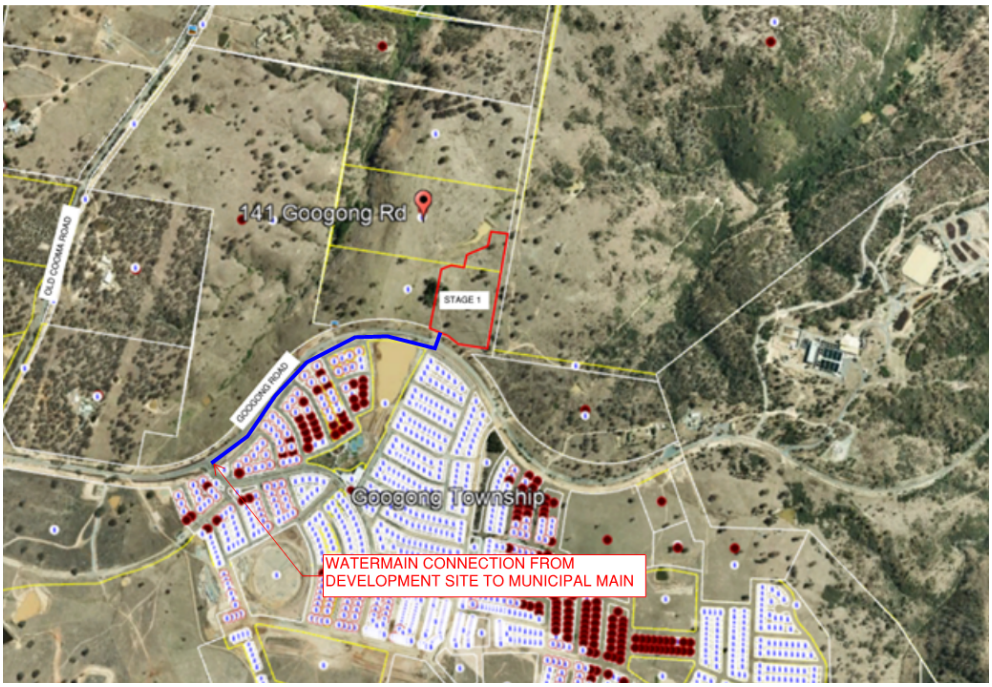


Figure 8: Water Connection to Municipal Network

3.15 RECYCLED WATER RETICULATION

QPRC subdivisions require dual water reticulation which requires all residential households to be connected to recycled water reticulation.

The QPRC recycled water network model was not made available, therefore impacts on the existing upstream recycled water demand area have not been included in this assessment. Council will have to determine these impacts on the upstream recycled water network. Council has not provided upstream boundary conditions for potential connection points from the development site.

3.15.1 DESIGN CONSIDERATIONS

QPRC requires all recycled water mains to be sized for firefighting flows. As such, the recycled water reticulation and potable water reticulation are expected to be similar in design demand requirements. It is expected for both water and recycled water reticulation to be the same size. It is unknown where the closest existing recycled water main is, however, there is indication that an existing main is located within Googong Road. This will be confirmed at detailed design.

3.16 POWER AND TELECOMMUNICATION

Essential Energy owns underground High Voltage cables within Googong Road and these assets cross the site boundary, refer extract (Figure 9) below:

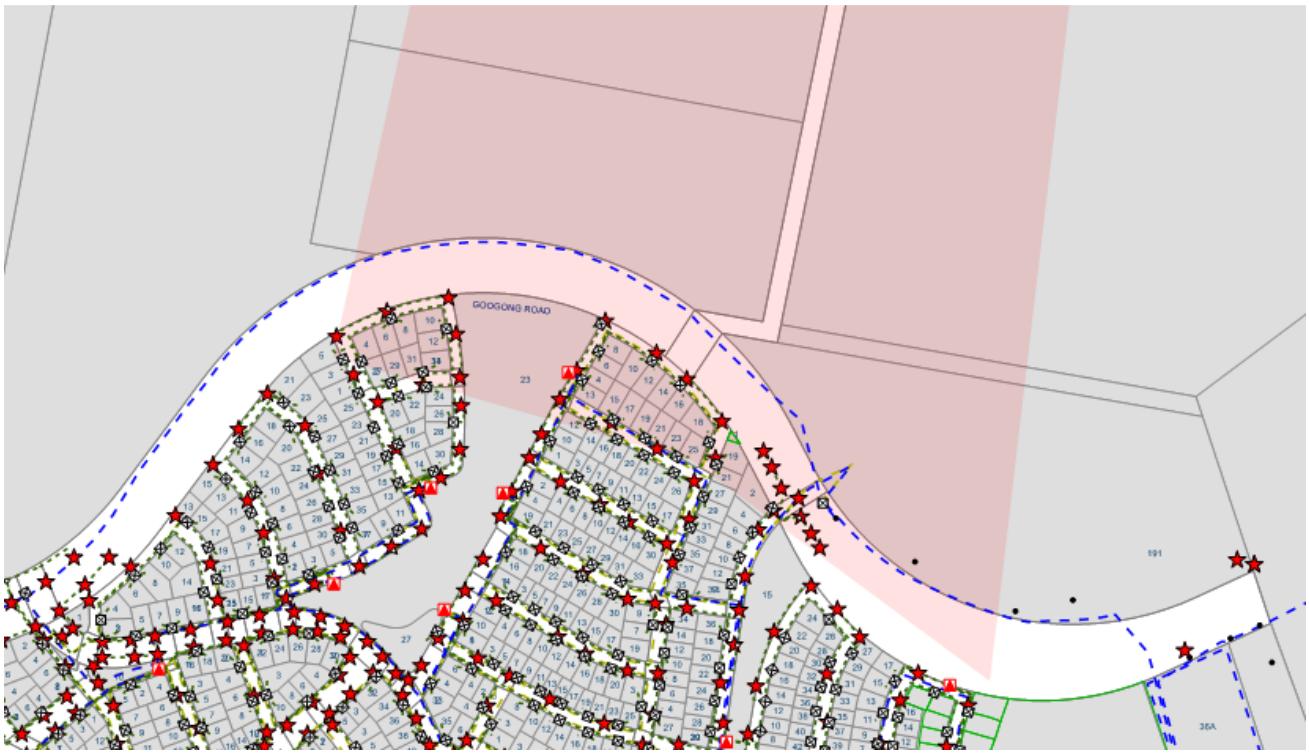


Figure 9: Essential Energy Asset Map Extract

Telstra assets are located along Googong Road.

4 EROSION AND SEDIMENT MANAGEMENT (SOIL AND WATER MANAGEMENT)

Erosion and sediment control plans indicating the layout and type of proposed Erosion and Sediment Control measures are stipulated in the civil engineering plans and are in accordance with QPRC Development Design Specification D7 – Erosion Control and Stormwater Management.

Once the site is stripped, the contractor will need to ensure that sediment is not washed into drains and that the loose dense silty sand and clays are not eroded away. Sediment fencing around the area of works, three Sedimentation basins and filter socks to stormwater pits will provide an effective means of erosion and sediment control for the proposed development site.

Due to the close proximity to the stream, it will be imperative that appropriate measures are adopted to ensure that sediment does not wash into the stream.

Seeding the stockpile area of providing sediment fencing around it will ensure that sediment is controlled/contained in rainfall events.

4.1 GENERAL

All erosion and sediment control measures are required to be installed and functional prior to works commencing. The following implementation sequence shall be adopted where practicable with the construction program. Plans shall be updated, and measures moved and reinstated to reflect the progression of the works. An assessment of the Erosion Hazard has been conducted and the site is a high-risk site.

Indicative ESC measures will be required on the detailed design drawings and a final Erosion and Sediment Control Management Plan (ESCMP) shall be prepared by the Contractor as part of the Construction Management Plan for the information of the relevant parties prior to the Pre-start Meeting. The ESCMP to be generally in accordance with Best Practice Erosion & Sediment Control Document published by International Erosion Control Association (Australasia) 2008.

In addition to the general environmental duty which applies to all persons, it is the contractor's responsibility to implement and maintain all erosion and sediment control measures on site, until all disturbed areas are reinstated.

The contractor is, at all times, responsible for the establishment, management and maintenance of the erosion and sediment control measures, to ensure minimal environmental harm and to comply with Council's standards.

4.2 IMPLEMENTATION SEQUENCE

It is proposed to construct a sediment fence along the boundaries. Straw bales, rock check dams and water diversion mounds can direct the water into the sediment basins.

It is noted that during the construction of the works, it is the Contractor's responsibility to implement the ESCMP to comply with the requirements of the Environmental Protection Act and Regulations and to provide written evidence of audit inspections on an as needed basis (minimum monthly basis) until all disturbed areas are reinstated / stabilised.

4.2.1 PHASE 1 - PRIOR TO WORKS COMMENCING – STRIPPING AND BULK EARTHWORKS

Prior to any stripping or bulk earthworks on site, all erosion and sediment control measures should be installed and operational.

Provide a stabilised site access, either wash down area or shake down the device at the construction site entrance to minimise the amount of sediment being tracked off site. Only a single site access point is to be provided unless specific circumstances warrant an additional access point, which is to be approved by local authority.

Sediment fences (or appropriate barrier fencing) are to be installed adjacent to the access point to confine ingress to and egress from the site to the established stabilised point.

The wash down area/shake down device is to be drained to a suitable sediment capture device such as a sediment fence installed downstream of the construction entry.

Inlet protection is to be provided to all gully pits, field or kerb inlets on all adjoining roads.

All 'clean' upstream water is to be diverted from disturbed areas and stockpiles to minimise the amount of water flowing through the site, the amount of sediment mobilised and the amount of water requiring treatment.

'No-go' (restricted access) zones are to be established around areas of native vegetation to be retained and any areas which do not require disturbance, to limit the area of exposed soil.

Earth banks are to be installed at intervals < 80 metres along slope contours to limit slope lengths.

Sediment fences are to be installed 2-5 metres downstream of all works areas, including along the downstream property boundaries, downstream of batters and stockpiles, prior to stripping and throughout earthworks operations. All sediment fences are to be monitored and maintained throughout the duration of works.

All nominated sediment basins and sediment traps are to be constructed with appropriately stabilised diversion structures and emergency spillways.

4.2.2 PHASE 2 – DURATION OF WORKS

Works are to be staged to keep disturbed areas to workable sizes and are exposed for a short a period as practicable.

All disturbed areas and clearings are to extend no more than 5 metres (preferable 2 metres) from essential works areas to minimise amount of exposed surface. Land outside the essential works areas should remain undisturbed and in its natural condition, ensuring topsoil remains in place. These areas are to be protected by barrier fencing.

Topsoil is to be stripped and stockpiled for later use on site. Sediment fences should be established downstream of all topsoil stockpiles.

Native vegetation required and approved for clearing should be mulched and stockpiled for later use in landscaping, stabilisation and/or site rehabilitation works.

Any stockpiles remaining on site for more than 10 days must be stabilised. Additionally, all disturbed areas are to be progressively grass seeded and stabilised using mulch, hydroseeding or hardstand to achieve 70% ground coverage within 20 days of inactivity or completion of works (even if works may continue later) for protection against both wind and water erosion.

During windy and dry weather any unprotected areas are to have sufficient dust control measures implemented including watering, roughening or wind barrier fencing.

Acceptable receptors and appropriate waste disposal practices should be used for concrete and mortar slurries, paints, acid washers, litter and general waste materials.

All vehicles departing site shall ensure no sediment is carried or transported off site. Regular inspection of public roads adjacent to the site are to be conducted and any sediment deposits are to be manually removed (not washed down).

Any vehicle or equipment washing and/or refueling conducted on site should be conducted in specific bunded areas, away from concentrated flow paths and the stormwater system.

4.2.3 PHASE 3 – FINISHING WORKS & DEFECTS LIABILITY PERIOD

All erosion and sediment control measures, including sediment fences and inlet traps, are to be maintained until completion of surface finishes including landscaping and turfing and only removed once the site is stabilised.

At construction completion, all temporary earth structures, including soil stockpiles, are to be track rolled and seeded to achieve 70% strike rate within 20 days.

Final site landscaping is to be conducted as soon as possible.

4.3 SEDIMENT BASINS

It is proposed to provide sediment basins where the detention basins will be located.

The following formulae have been adopted to calculated the Sediment Basin sizes:

- Settling Zone – 10 x C_v x A x $R_{(y\ \%ile,\ 5\ day)}$
- Sediment Storage Zone - 50% of settling zone

Sediment basin sizes are as follows:

Catchment ID	Disturbed Area (ha)	80th Percentile 5 day rainfall depth (mm)	Sediment Basin Volume (m^3)
1	0.9413	21.3	Settling Zone = 100m^3 Sediment Storage Zone = 50m^3
2	0.3	21.3	Settling Zone = 32m^3 Sediment Storage Zone = 16m^3
3	0.663	21.3	Settling Zone = 71m^3 Sediment Storage Zone = 35.5m^3

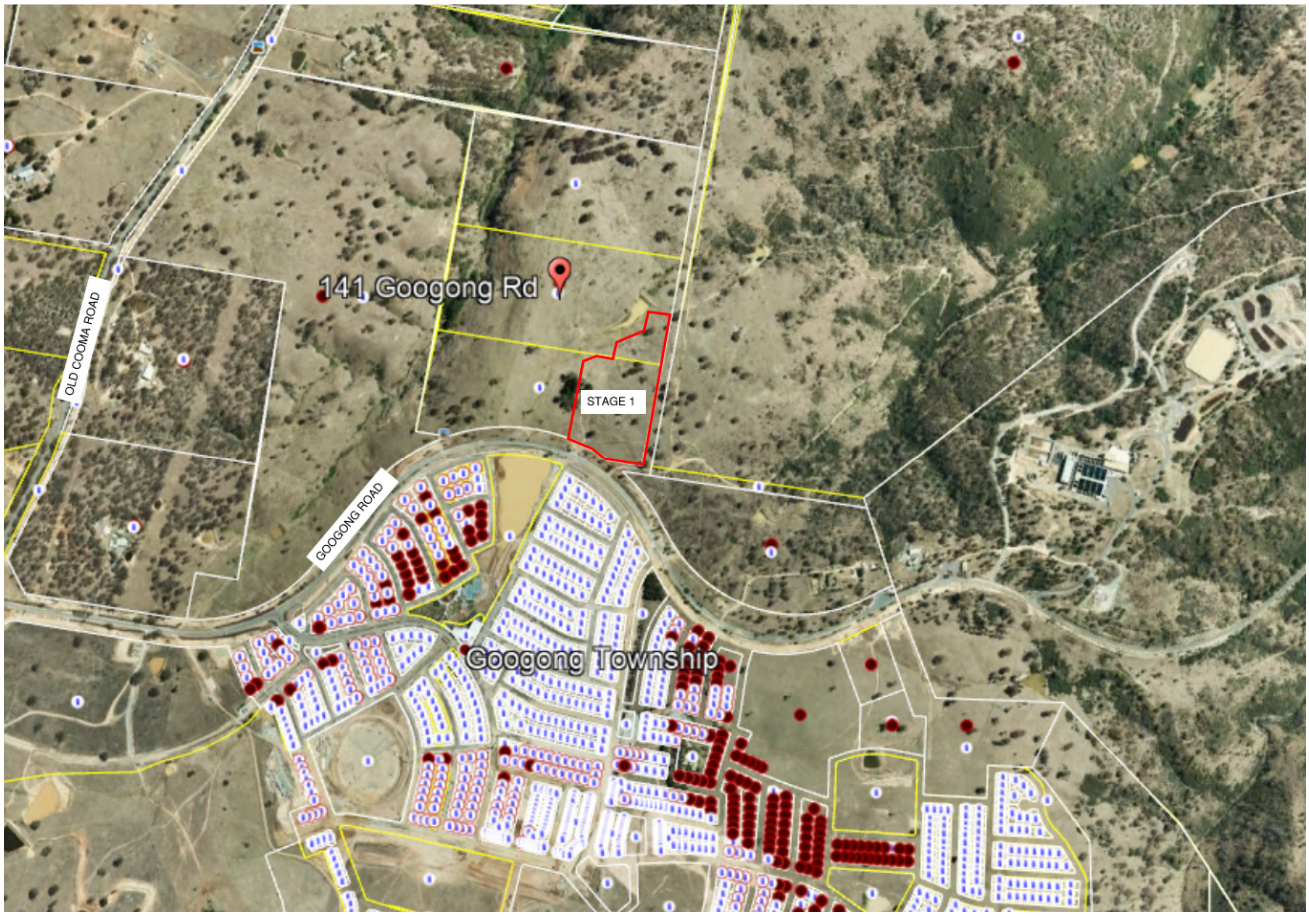
BIBLIOGRAPHY

- Googong Engineering Design Standards
- AustRoads
- WSA Code
- ACT Government Design Standards

APPENDIX A

SITE LOCATION PLAN

A1 LOCALITY PLAN



A2 ENGINEERING DRAWINGS

SUNSET
RESIDENTIAL DEVELOPMENT
STAGE 1

LOCALITY PLAN
NTS

DRAWING SCHEDULE	
DWG No.	DRAWING TITLE
0001	COVER SHEET, LOCALITY PLAN AND DRAWING SCHEDULE
0002	ESTATE LAYOUT PLAN
0101	BULK EARTHWORKS PLAN
0102	EROSION AND SEDIMENT CONTROL PLAN - PART A
0103	EROSION AND SEDIMENT CONTROL PLAN - PART B
0104	EROSION AND SEDIMENT CONTROL DETAILS - SHEET 1 OF 2
0105	EROSION AND SEDIMENT CONTROL DETAILS - SHEET 2 OF 2
0201	ROADWORKS LAYOUT PLAN
0202	ROADWORK TYPICAL SECTION AND ROAD 1 LONG SECTION
0203	ROAD 2 LONG SECTION
0204	SLOPE ANALYSIS PLAN
0205	LOT CONSTRAINTS PLAN
0301	STORMWATER LAYOUT PLAN
0302	STORMWATER CATCHMENT PLAN
0501	SEWER LAYOUT PLAN - SHEET 1 OF 2
0502	SEWER LAYOUT PLAN - SHEET 2 OF 2
0503	SEWER CONNECTION PLAN
0601	WATER LAYOUT PLAN
0602	WATER CONNECTION PLAN
0701	EXTERNAL WORKS PLAN

NOT FOR CONSTRUCTION

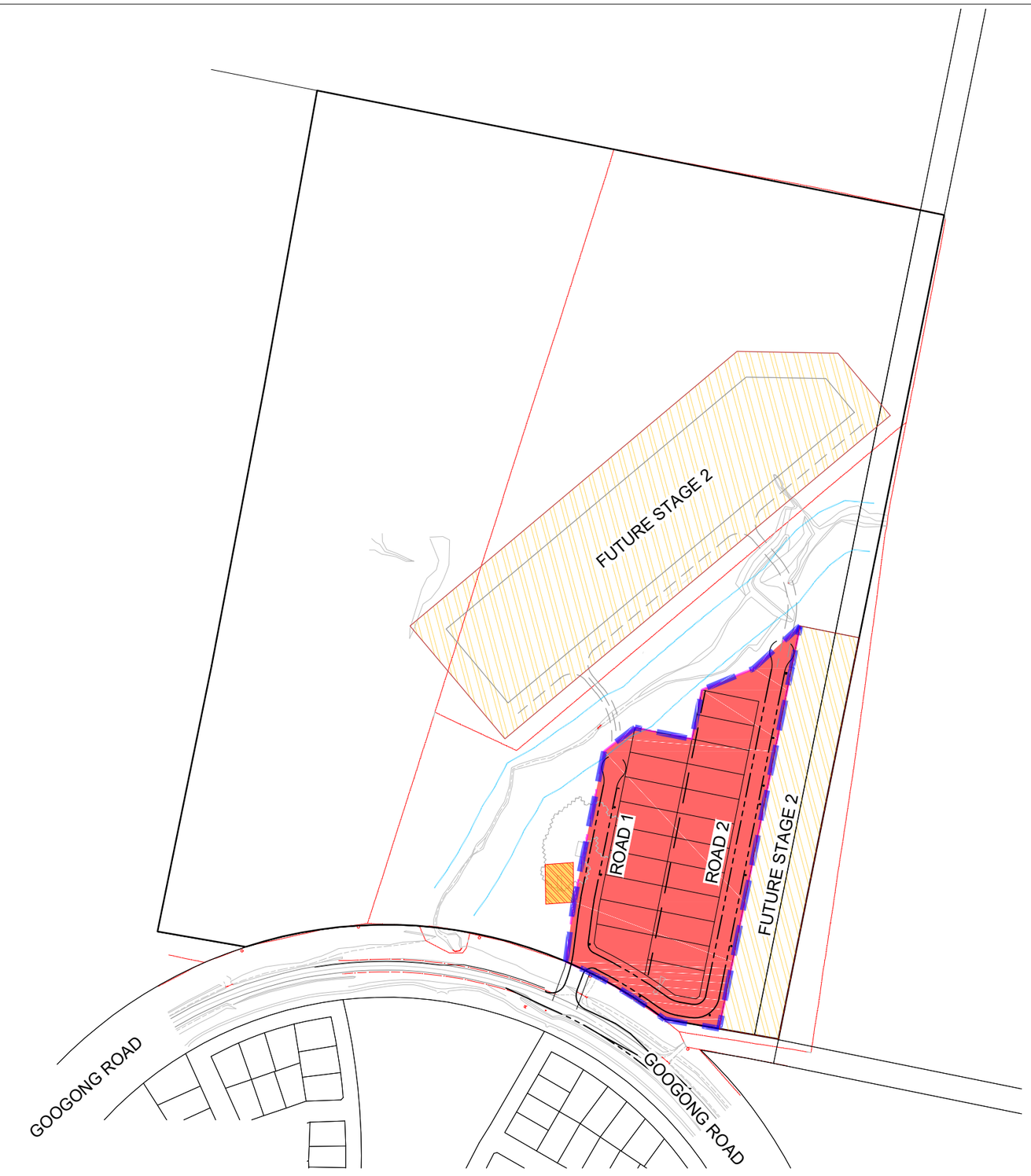
Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	**Scales**	
DPP	-	

Project
SUNSET RESIDENTIAL DEVELOPMENT STAGE 1 NSW
Sheet
COVER SHEET AND LOCALITY PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C.0001	P2



LEGEND

- STAGE 1 BOUNDARY
- STAGE 1
- FUTURE STAGE 2
- EXISTING SITE BOUNDARY

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018

Drawn	Scales
DPP	-

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
ESTATE LAYOUT PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0002	P2

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0001-2 - COVER SHEET LAYOUT.dwg C0001

250mm HIGH EARTH BERM WITH LONGITUDINAL GRADE TO DIRECT UPSTREAM OVERLAND FLOW.

250mm HIGH EARTH BERM WITH LONGITUDINAL GRADE TO DIRECT UPSTREAM OVERLAND FLOW.

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

EXAMPLE HOUSE PAD, APPROX 300m²

ROAD 2

ROAD 1

21 20 19 18 17 16 15 14 13 12 11 10

9 8 7 6 5 4 3 2 1

720 721 722 723 724 725 726 727 728 729 730 731 732 733 734

729 728 727 726 725 724 723 722 721 720

SW RW

1:100

BULK EARTHWORKS LEGEND

	BULK EARTHWORKS CUT AREA
	BULK EARTHWORKS FILL AREA
● BE12.50	PROPOSED BULK EARTHWORKS LEVEL
12.50	PROPOSED DESIGN CONTOURS
12.5	EXISTING CONTOUR
W	EXISTING WATER MAIN
S	EXISTING SEWER RETICULATION
SW	EXISTING STORMWATER PIPE
	EXISTING ELECTRICAL CABLE OVERHEAD
	EXISTING ELECTRICAL CABLE UNDERGROUND
	EXISTING TELECOMMUNICATIONS CABLE
	Q100 (1% AEP) + 500MM FLOOD LINE
	STAGE BOUNDARY
	HERITAGE RUINS SITE

BULK EARTHWORKS VALUES
CUT = 94049m³
FILL = 97050m³
EXCESS = 3001m³

VALUES DO NOT ACCOUNT FOR ROAD BOXING, EXISTING SURFACE STRIPPING OR TOP SOIL REMOVAL, OR BULKING FACTORS.

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

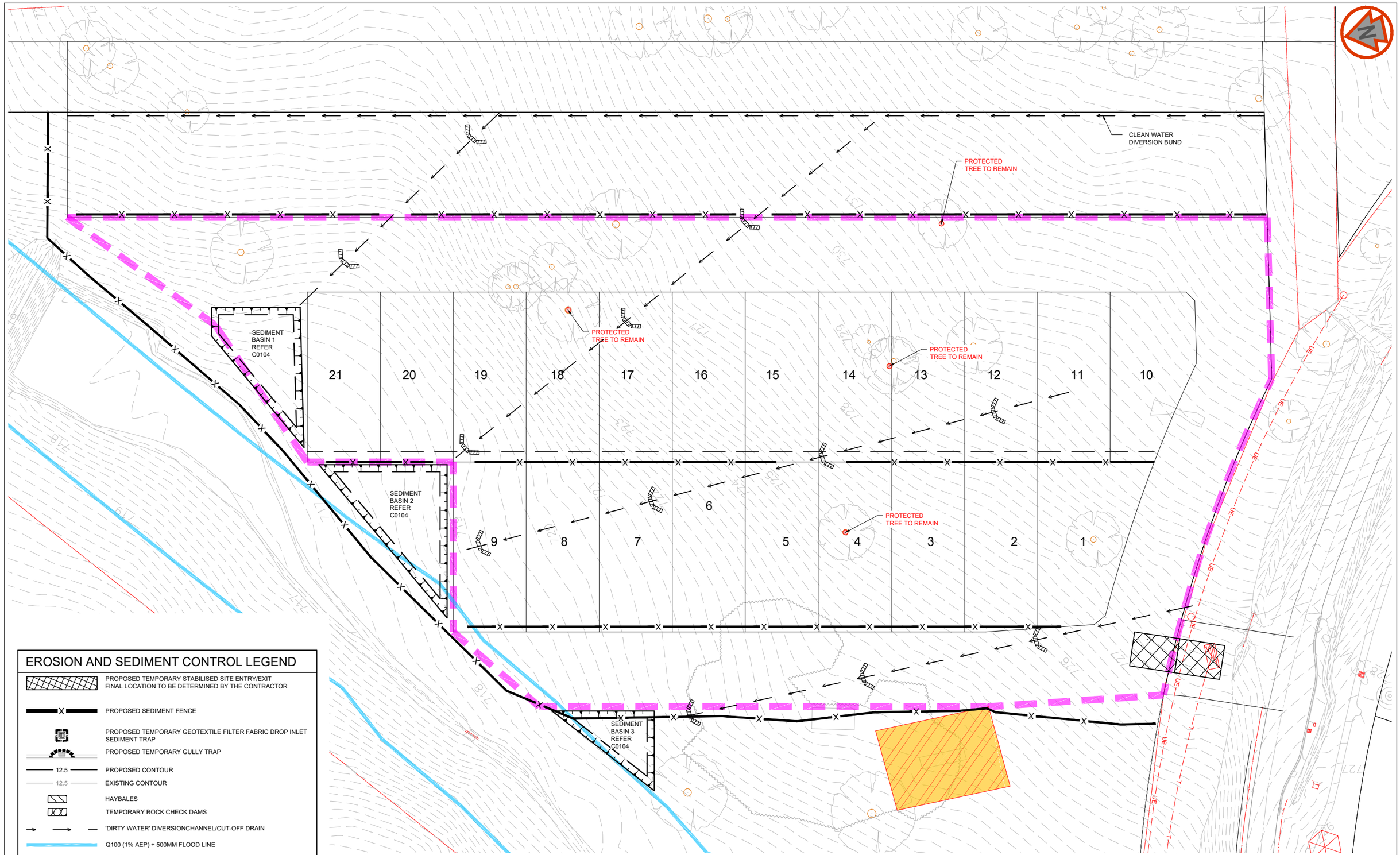
Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
BULK EARTHWORKS
PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0101	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0101 - EARTHWORKS.dwg C0101



EROSION AND SEDIMENT CONTROL LEGEND

- PROPOSED TEMPORARY STABILISED SITE ENTRY/EXIT
  FINAL LOCATION TO BE DETERMINED BY THE CONTRACTOR
- PROPOSED SEDIMENT FENCE
- PROPOSED TEMPORARY GEOTEXTILE FILTER FABRIC DROP INLET SEDIMENT TRAP
- PROPOSED TEMPORARY GULLY TRAP
- 12.5 PROPOSED CONTOUR
- 12.5 EXISTING CONTOUR
- HAYBALES
- TEMPORARY ROCK CHECK DAMS
- 'DIRTY WATER' DIVERSIONCHANNEL/CUT-OFF DRAIN
- Q100 (1% AEP) + 500MM FLOOD LINE
- STAGE BOUNDARY
- HERITAGE RUINS SITE

IMPORTANT

SEDIMENT AND CONTROL MEASURES SHOWN ON THIS PLAN ARE PREPARED AS A GUIDE FOR CONSTRUCTION APPROVAL BY COUNCIL. IT DOES NOT IN ANY WAY RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO PLAN AND IMPLEMENT ENVIRONMENTAL PROTECTION MEASURES AS REQUIRED BY LAW, THE COUNCIL AND THE CONTRACT THROUGHOUT THE WORKS.

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

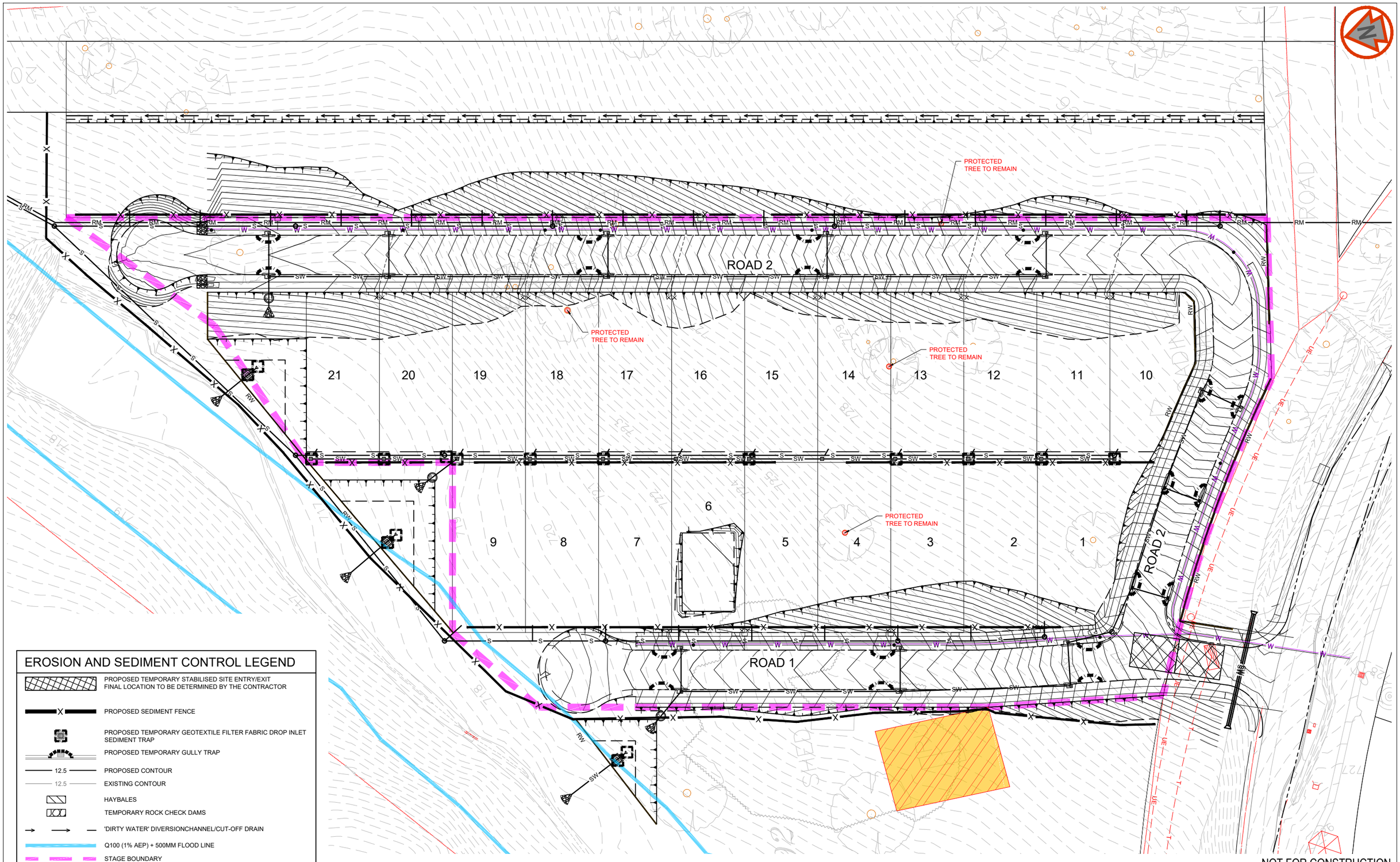
Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
EROSION AND SEDIMENT CONTROL PLAN
PART A

Project No.	Sheet. No.	Revision
T-C0293.00	C0102	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0102-5 - EROSION AND SEDIMENT.dwg C0103



EROSION AND SEDIMENT CONTROL LEGEND

- PROPOSED TEMPORARY STABILISED SITE ENTRY/EXIT — FINAL LOCATION TO BE DETERMINED BY THE CONTRACTOR
- PROPOSED SEDIMENT FENCE
- PROPOSED TEMPORARY GEOTEXTILE FILTER FABRIC DROP INLET SEDIMENT TRAP
- PROPOSED TEMPORARY GULLY TRAP
- 12.5 — PROPOSED CONTOUR
- 12.5 — EXISTING CONTOUR
- HAYBALES
- TEMPORARY ROCK CHECK DAMS
- 'DIRTY WATER' DIVERSIONCHANNEL/CUT-OFF DRAIN
- Q100 (1% AEP) + 500MM FLOOD LINE
- STAGE BOUNDARY
- HERITAGE RUINS SITE

IMPORTANT

SEDIMENT AND CONTROL MEASURES SHOWN ON THIS PLAN ARE PREPARED AS A GUIDE FOR CONSTRUCTION APPROVAL BY COUNCIL. IT DOES NOT IN ANY WAY RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO PLAN AND IMPLEMENT ENVIRONMENTAL PROTECTION MEASURES AS REQUIRED BY LAW, THE COUNCIL AND THE CONTRACT THROUGHOUT THE WORKS.

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
EROSION AND SEDIMENT CONTROL PLAN
PART B

Project No.	Sheet. No.	Revision
T-C0293.00	C0103	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0102-5 - EROSION AND SEDIMENT.dwg C0103

EROSION AND SEDIMENT CONTROL NOTES

GENERAL INSTRUCTIONS

1. THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE ENGINEERING PLANS, LANDSCAPING PLANS AND WRITTEN INSTRUCTIONS RELATING TO THE SUBJECT DEVELOPMENT.
2. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO CONTROL EROSION AND DOWNSTREAM SEDIMENTATION DURING ALL STAGES OF CONSTRUCTION INCLUDING THE MAINTENANCE PERIOD.
3. THE EXTENT AND POSITION OF THE EROSION AND SEDIMENT CONTROL MEASURES TO BE DETERMINED ON SITE BY THE CONTRACTOR TO SUIT THE CONSTRUCTION PROGRAM.
4. THESE PLANS PRESENT CONCEPTS ONLY AND THE MEASURES SHOWN ON THIS DRAWING(S) ARE MINIMUM REQUIREMENTS ONLY.
5. THE CONTRACTOR SHALL AT ALL TIMES BE RESPONSIBLE FOR THE ESTABLISHMENT, MANAGEMENT AND MAINTENANCE OF THE EROSION AND SEDIMENT CONTROL MEASURES TO MEET COUNCIL STANDARDS.
6. LARGE OPEN AREAS OR STEEP BATTERS SHOULD NOT BE LEFT EXPOSED/UNSTABILISED FOR MORE THAN 10 DAYS OR IF WET WEATHER IS FORECAST.
7. EXPOSED AREAS INCLUDING BATTERS WHICH REMAIN UN-WORKED FOR MORE THEN 10 DAYS SHOULD BE STABILISED USING TEMPORARY HYDROMULCHING, HYDROSEEDING OR MULCHING, EVEN IF AREAS WILL BE WORKED AT A LATER TIME.
8. ALL WORKS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST VERSION OF THE INSTITUTION OF ENGINEERS AUSTRALIA, 'SOIL EROSION AND SEDIMENT CONTROL - ENGINEERING GUIDELINES FOR QUEENSLAND CONSTRUCTION SITES (IECA GUIDELINES) NOV. 2008.
9. THE CONTRACTOR SHALL BE AWARE OF ITS RESPONSIBILITIES FOR PROTECTING THE DOWNSTREAM ENVIRONMENT AND RECEIVING WATER FROM POLLUTION AND ENVIRONMENTAL HARM, UNDER THE ENVIRONMENTAL PROTECTION ACT. 1994.
10. ADDITIONALLY THE CONTRACTOR SHALL BE AWARE OF ITS DUTY TO NOTIFY THE LOCAL AUTHORITY AND THE ENVIRONMENTAL PROTECTION AGENCY (QLD) OF A POTENTIAL OR ACTUAL INCIDENT OF ENVIRONMENTAL HARM, UNDER THE ENVIRONMENTAL PROTECTION ACT. 1994.

RECOMMENDED IMPLEMENTATION SEQUENCE:

1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND FUNCTIONAL PRIOR TO WORKS COMMENCING AND IN THE FOLLOWING SEQUENCE.
   a. CONSTRUCT TEMPORARY STABILISED SITE ACCESS, ENSURING ADJACENT STORMWATER RUN OFF IS DIVERTED AWAY FROM ACCESS
   b. INSTALL SEDIMENT FENCING AND/OR BARRIER FENCING TO CONFINE INGRESS TO AND EGRESS FROM THE SITE TO STABILISED ACCESS POINT(S) ONLY.
   c. PROVIDE INLET PROTECTION TO STORMWATER INLETS AND GULLIES ON ALL ROADS ADJOINING THE SITE.
   d. CONSTRUCT BARRIER FENCING AROUND RESTRICTED 'NO-GO' ZONES OF RETAINED VEGETATION, AREAS NOT TO BE DISTURBED AND AREAS WHICH WILL REMAIN UN-WORKED.
   e. CONSTRUCT UPSTREAM DIVERSION CHANNELS TO DIVERT CLEAN WATER AROUND WORKSITE, AND INSTALL APPROPRIATE CHANNEL STABILISATION IF REQUIRED.
   f. CONSTRUCT LOW FLOW EARTH BANKS AS CATCH DRAINS PARALLEL TO CONTOURS TO LIMIT LARGE SLOPE LENGTHS (SLOPES SHOULD BE LESS THEN 80M IN LENGTH).
   g. INSTALL ALL TEMPORARY SEDIMENT FENCES.
   h. STABILISE ALL DISTURBED AREAS ASAP AND PROGRESSIVELY AS WORKS ARE COMPLETED. TEMPORARY STABILISATION TO BE DONE USING MULCHING, HYDROMULCHING, HYDROSEEDEDING OR DIRECT SEEDING TO GIVE A 70% COVERAGE OF GROUND SURFACE WITHIN 14 DAYS OF WORKS COMPLETING (EVEN IF WORKS MAY CONTINUE LATER).
2. UNDERTAKE SITE DEVELOPMENT WORKS SO THAT LAND DISTURBANCE IS CONFINED TO MINIMUM WORKABLE AREAS.
3. DISTURBED AREAS TO EXTEND NO MORE THAN 5 METRES (PREFERABLY 2 METRES) FROM ESSENTIAL WORKS AREAS.
4. WORK AREAS TO BE DELINEATED BY BARRIER FENCING AND DIVERSION CHANNEL UPSLOPE AND SEDIMENT FENCING DOWNSLOPE.
5. THE CONTRACTOR SHALL ENSURE THAT THE EXISTING VEGETATION AND GROUNDCOVER IS RETAINED AS MUCH AS POSSIBLE.
6. TOPSOIL SHALL BE STRIPPED AND STOCKPILED FOR LATER USE ONSITE.
7. NATIVE SITE VEGETATION REQUIRED AND APPROVED FOR CLEARING SHOULD BE MULCHED AND STOCKPILED FOR LATER USE IN LANDSCAPING, STABILISATION AND/OR SITE REHABILITATION WORKS.
8. AT ALL TIMES THE CONTRACTOR SHALL MONITOR THE PREVAILING WEATHER CONDITIONS AND PROTECT ANY DOWNSTREAM CONSTRUCTION AND RECEIVING ENVIRONMENTS.
9. EROSION AND SEDIMENT CONTROL PROTECTION MEASURES SHALL BE MAINTAINED BY THE CONTRACTOR THROUGHOUT CONTRACT.
10. PLANS AND CONTROL MEASURES FOR LARGE SITES WILL NEED TO BE REVISED AND UPDATED TO REFLECT THE SITE STAGES AND PROGRESSION OF WORKS.
11. MEASURES INCLUDING SEDIMENT FENCES SHOULD BE MOVED AND REINSTATED AS WORKS PROGRESS.
12. FOOT AND VEHICULAR TRAFFIC TO BE RESTRICTED IN RECENTLY STABILISED AREAS INCLUDING THOSE HYDROSEEDED, TURFED OR SEEDED.

CONTROL MEASURES

1. FINAL SITE LANDSCAPING SHALL BE UNDERTAKEN AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS OF CONSTRUCTION COMPLETION
2. SEDIMENT LADEN WATER SHALL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM BY USING INLET PROTECTION.
3. ALL PERIMETER BANKS AND CHANNEL DRAINS SHALL HAVE UNINTERRUPTED POSITIVE GRADE TO AN OUTLET.
4. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL ONLY BE REMOVED ONCE SITE IS STABILISED AND UPSTREAM WORKS HAVE BEEN COMPLETED.
5. AT CONSTRUCTION COMPLETION ALL TEMPORARY EARTH STRUCTURES, INCLUDING SOIL STOCKPILES ARE TO BE TRACK ROLLED AND SEEDED. THE CONTRACTOR IS TO ENSURE A 70% COVERAGE WITHIN 14 DAYS.

DUST CONTROL

1. DURING WINDY AND DRY WEATHER ANY UNPROTECTED AREAS SHALL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL. WHERE WATER IS NOT AVAILABLE IN SUFFICIENT QUANTITIES, SOIL BINDERS OR DUST RETARDANTS TO BE USED FOR DUST SUPPRESSION.
2. EXPOSED SURFACES INCLUDING BATTERS SHOULD BE LEFT ROUGH TO REDUCE WIND SPEEDS AND POTENTIAL FOR WIND EROSION.
3. USE OPEN WEAVE BARRIER FENCING ON WINDWARD SIDE OF SITE IF REQUIRED (REFER DETAIL). FENCING IS GENERALLY REQUIRED WHERE AREA OF DISTURBANCE IS >5000m^2.

OTHER MATTERS

1. ACCEPTABLE RECEPTORS AND DISPOSAL PRACTICES WILL BE USED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHERS, LITTER AND GENERAL WASTE MATERIALS.
2. ANY EXISTING TREES WHICH ARE NOT REQUIRED OR APPROVED TO BE CLEARED FOR THE WORKS AND/OR FORM PART OF THE FINAL LANDSCAPING PLAN SHOULD BE PROTECTED FROM CONSTRUCTION ACTIVITIES BY:
   a. PROTECTING THEM WITH BARRIER FENCING OR MARKERS.
   b. ENSURING NOTHING IS NAILED TO THEM
   c. PROHIBITING PAVING, GRADING OR PLACING OF STOCKPILES WITHIN DRIP LINE.
3. ALL VEHICLE AND EQUIPMENT WASHING SHOULD BE CONTAINED IN SPECIFIC BUNDED AREAS, DISCONNECTED FROM CONCENTRATED FLOW PATHS AND THE STORMWATER SYSTEM.
4. ANY NECESSARY VEHICLE OR EQUIPMENT REFUELING SHOULD BE UNDERTAKEN AWAY FROM CONCENTRATED FLOW PATHS AND PREFERABLY WITHIN A BUNDED AREA.
5. ANY ONSITE FUEL STORAGE AREAS SHOULD BE COVERED AND BUNDED.

MAINTENANCE OF PUBLIC ROADS

1. ALL CONSTRUCTION VEHICLES DEPARTING FROM THE SITE SHALL HAVE THEIR TYRES WASHED DOWN OR SEDIMENT REMOVED BY A STABILISED SITE ACCESS DEVICE.
2. THE STABILISED SITE ACCESS AREAS SHALL BE LOCATED SUCH THAT SILTED WATER IS FILTERED THROUGH A SUITABLE SEDIMENT TRAP (SUCH AS A SEDIMENT FENCE) INSTALLED DOWNSTREAM OF ACCESS.
3. THE CONTRACTOR SHALL INSPECT THE PUBLIC ROADS ADJACENT TO THE SITE DAILY AND MANUALLY REMOVE ANY SEDIMENT DEPOSITS (BY SWEEPING NOT WASH DOWN).

SITE INSPECTION AND MAINTENANCE

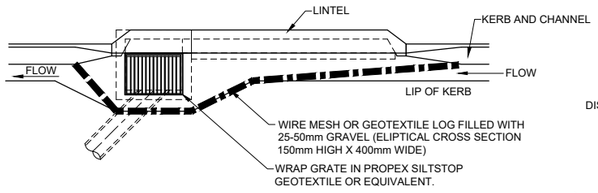
1. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED REGULARLY, IMMEDIATELY BEFORE SITE CLOSURE, PRIOR TO PREDICTED LARGE STORM EVENTS AND AFTER EVERY SIGNIFICANT (> 5MM) RAINFALL EVENT OR AT LEAST ON A WEEKLY BASIS.
2. THE CONTRACTOR WILL AS A MINIMUM CONDUCT EACH INSPECTION IN LINE WITH THE FOLLOWING
   a. RECORD TYPE OF DEVICE/CONTROL MEASURE BEING INSPECTED AND ITS LOCATION;
   b. RECORD THE CONDITION OF EVERY CONTROL MEASURE;
   c. RECORD MAINTENANCE REQUIREMENTS FOR EVERY CONTROL DEVICE;
   d. RECORD SEDIMENT VOLUMES REMOVED FROM SEDIMENT TRAPPING DEVICES;
   e. RECORD DETAILS OF SEDIMENT BASIN TREATMENT, FLOCCULANT DOSAGE AND CLEANOUT;
   f. RECORD SEDIMENT DISPOSAL PROCEDURES AND LOCATION.
3. REPAIRS AND MAINTENANCE OF ALL DEVICES AND MEASURES INCLUDING DIVERSION CHANNELS SHALL BE UNDERTAKEN AS REQUIRED, ENSURING ALL MEASURES ARE FULLY FUNCTIONAL AT ALL TIMES.
4. ENSURE SEDIMENT LADEN WATER HAS NOT BEEN DIVERTED AROUND DEVICES.
5. REPAIR SCOUR DAMAGE TO SEDIMENT CONTROL MEASURES AFTER RAINFALL EVENTS AND REINSTATE DEVICES AS NECESSARY.
6. SEDIMENT FENCES WILL REQUIRE CLEANING WHEN SEDIMENT REACHES 300MM DEPTH OR ONE-HALF THE HEIGHT OF THE FILTER FABRIC AND ALL OTHER SEDIMENT TRAPS WILL REQUIRE CLEANING OUT WHEN 30% OF DESIGN CAPACITY IS REACHED.
7. ALL INLET AND GULLY TRAPS TO BE CLEANED NOT HOSED AFTER EVERY RAINFALL EVENT, (1>5mm) OR AT LEAST ON A WEEKLY BASIS.
8. SEDIMENT REMOVED FROM ANY TRAPPING DEVICE TO BE RELOCATED, ENSURING FURTHER POLLUTION TO DOWNSTREAM ENVIRONMENTS WILL NOT OCCUR.
9. ALL SEEDING, HYDROSEEDING AND TURFING REQUIRES REGULAR WATERING, UNTIL EFFECTIVE COVER ESTABLISHED AND PLANTS ARE GROWING VIGOROUSLY. WATERING SHOULD VARY DEPENDING ON WEATHER AND SOIL CONDITIONS.
10. WATERING SHOULD START IMMEDIATELY AFTER PLANTING AND SHOULD COMPLY WITH THE FOLLOWING AS A MINIMUM:
    WEEK 1 3 WATERINGS/WEEK
    WEEK 2-6 2 WATERINGS/WEEK
    WEEK 7-12 1 WATERING/WEEK
11. EXCESSIVE VEGETATION GROWTH WILL BE CONTROLLED THROUGH MOWING OR SLASHING.
12. IT IS THE CONTRACTORS RESPONSIBILITY TO ENSURE INSPECTION, MAINTENANCE AND TESTING OF DEVICES IS UNDERTAKEN ON SITE.
13. THE CONTRACTOR TO KEEP DETAILED AND LEGIBLE RECORDS OF ALL INSPECTION AND MAINTENANCE UNDERTAKEN ON THE EROSION AND SEDIMENT CONTROL DEVICES.
14. ALL SITE WASTE INCLUDING GENERAL RUBBISH TO BE DISPOSED OF IN AN ENVIRONMENTALLY RESPONSIBLE MANNER IN ACCORDANCE WITH THE ENVIRONMENTAL PROTECTION (WASTE MANAGEMENT) POLICY 2000 AND ENVIRONMENTAL PROTECTION (WASTE MANAGEMENT) REGULATION 2000.
15. THE CONTRACTOR SHALL CONSTRUCT AND IMPLEMENT ADDITIONAL MEASURES AS NECESSARY TO ENSURE PROTECTION OF DOWNSTREAM ENVIRONMENTS.

SEDIMENT BASIN MAINTENANCE

1. THE CONTRACTOR SHALL KEEP DETAILED AND ACCURATE RECORDS OF THE MONITORING, TREATMENT, TESTING AND MAINTENANCE OF THE SEDIMENT BASIN INCLUDING RECORDED RAINFALL VOLUME, FLOCCULATING AGENTS USED AND TEST RESULTS PRIOR TO DEWATERING.
2. THE STORMWATER RUNOFF COLLECTED IN THE SEDIMENT BASIN SHALL BE MONITORED, TREATED AND TESTED PRIOR TO DISCHARGE, INCLUDING WATER TO BE REUSED ON SITE.
3. WATER TESTING TO BE UNDERTAKEN BY A SUITABLY QUALIFIED PERSON.
4. ALL LABORATORY TESTING TO BE UNDERTAKEN BY A NATA ACCREDITED LABORATORY.
5. ALL WATER PUMPED FROM THE SEDIMENT BASIN SHALL BE TESTED FOR ENVIRONMENTAL COMPLIANCE AGAINST THE RELEASE CRITERIA IN THE TABLE BELOW (AS A MINIMUM), UNLESS ALTERNATIVE (MORE STRINGENT) STANDARDS ARE SPECIFIED BY THE LOCAL AUTHORITY PRIOR TO RELEASE.

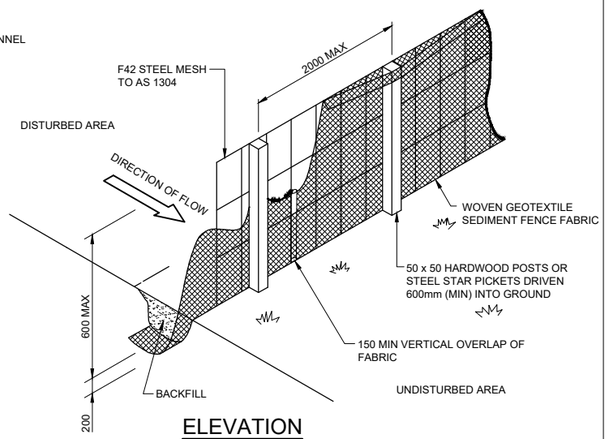
PARAMETER	RELEASE CRITERIA
SUSPENDED SOLIDS	50mg/l MAX
pH	WITHIN RANGE 6.5-8.5
VISUAL AMENITY	NO VISUAL PLUME

6. WATER TESTING TO BE UNDERTAKEN USING EITHER A HANDHELD PH/TURBIDITY METER OR SAMPLES COLLECTED FOR LABORATORY TESTING PRIOR TO BASIN DEWATERING.
7. THE SEDIMENT BASIN SHALL BE TREATED BY FLOCCULATION AFTER ALL RAINFALL EVENTS (> 5MM) USING GYPSUM OR ALUM. MANUAL DOSAGE OF BASIN SHALL BE UNDERTAKEN USING A MINIMUM RATE OF 32kg/100m3 FOR GYPSUM AND 1.5-8kg/100m3 FOR ALUM. HIGHER DOSAGE MAY BE REQUIRED DEPENDING ON SOIL TYPE AND APPLICATION TECHNIQUE.
8. THE CHOSEN FLOCCULENT SHALL BE SPREAD EVENLY OVER THE BASIN SURFACE AREA. THE BASIN WILL REQUIRE A PUMP SYSTEM TO SPRAY SLURRY OF FLOCCULANTS OVER SURFACE AT AN ANGLE OF 10 - 20 DEGREES.
9. THE TREATED BASIN SHALL BE DEWATERED WITH A PUMP SYSTEM WITH A FLOATING INLET TO ENSURE SETTLED SEDIMENT IS NOT ENTRAINED AND DISCHARGED.
10. BASIN DEWATERING SHALL OCCUR WITHIN 5 DAYS FROM CONCLUSION OF RAINFALL EVENT.
11. SEDIMENT BASINS WILL REQUIRE DEWATERING AND SEDIMENT CLEANOUT ONCE STORAGE CAPACITY REACHES 70%.
12. CAPTURED SEDIMENT WILL BE DISPOSED OF IN AN ENVIRONMENTALLY RESPONSIBLE MANNER AS TO NOT CAUSE FURTHER CONTAMINATION OR DOWNSTREAM POLLUTION. SEDIMENT SHOULD NOT BE DISPOSED OF IN CONCENTRATED FLOWS, WHERE IT CAN BE RE-ENTRAINED OR WHERE THE RECEIVING WATER HAS A PH OF < 5.5.
13. THE BASIN AND ALL OTHER CONTROL DEVICES WILL BE MAINTAINED IN AN OPERATIONAL STATE UNTIL SITE STABILISED.
14. REPAIR ANY SCOUR DAMAGE TO THE SEDIMENT BASIN BATTERS AND EMERGENCY SPILLWAY FOLLOWING RAINFALL EVENTS.
15. SEDIMENT BASIN SHOULD NOT BE CONSTRUCTED WITH SMOOTH INTERNAL SLOPES AND BASIN BATTERS SHOULD NOT BE STEEPER THEN 3(H):1(V).
16. BASINS SHOULD BE APPROPRIATELY FENCED AND MARKED BY WARNING SIGNS IF UNSUPERVISED PUBLIC ACCESS IS LIKELY AND PUBLIC SAFETY IS AT RISK.

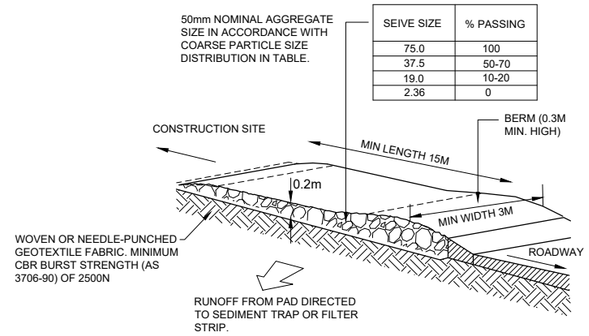


TEMPORARY GULLY TRAP DETAIL

SCALE N.T.S.



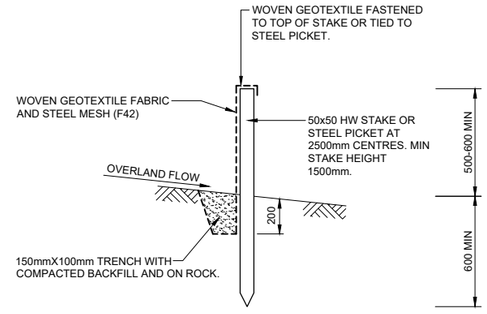
ELEVATION



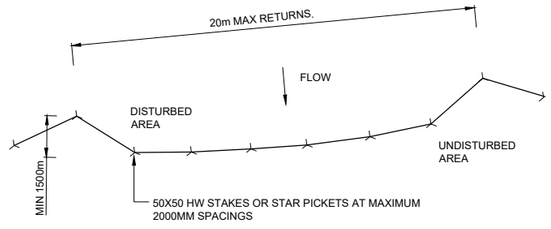
TEMPORARY STABILISED SITE ENTRY/EXIT (ROCK)

SCALE N.T.S.

NOTES:
1. STABILISED ACCESS SHOULD BE CLEANED AND MAINTAINED AFTER EVERY RAINFALL EVENT (>5mm) AND WHEN SEDIMENT ACCUMULATION IS NOTED.
2. FINE ACCUMULATED SEDIMENTS SHOULD BE REMOVED FROM AGGREGATE REGULARLY.



SECTION DETAIL

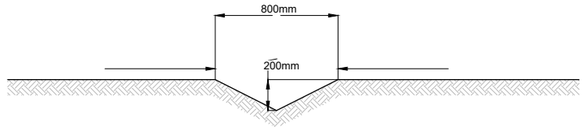


PLAN

SEDIMENT FENCE DETAIL

SCALE N.T.S.

NOTES:
1. HORIZONTAL BAR STEEL MESH TO BE FLUSH WITH TOP OF GEOTEXTILE FABRIC WITH NO VERTICAL BARS PROTRUDING PAST TOP OF SEDIMENT FENCE.
2. NO SHADE CLOTH TO BE USED FOR SEDIMENT FENCING.
3. CATCHMENT DRAINING TO SEDIMENT FENCE SHOULD BE MAX 0.6ha.
4. UPSTEAM SLOPE TO BE 1:2 max AND SLOPE LENGTH 60m MAX.
5. SEDIMENT FENCES ARE TO BE INSTALLED PARALLEL TO CONTOURS WHERE POSSIBLE AND HAVE RETURNS EVERY 20 METRES, TO LIMIT CONTRIBUTING CATCHMENT AND ENCOURAGE PONDING
6. SEDIMENT FENCES TO BE INSTALLED NO MORE THAN 5 METRES FROM DISTURBED AREAS OR STOCKPILES.



DIRTY WATER DIVERSION CHANNEL

NTS

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

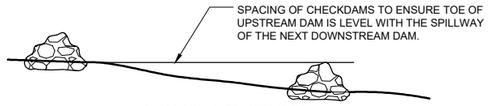
Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	-	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

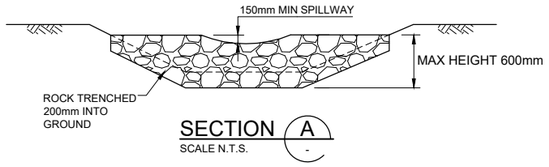
Sheet
EROSION AND SEDIMENT CONTROL DETAILS
SHEET 1 OF 2

Project No.	Sheet. No.	Revision
T-C0293.00	C0104	P2

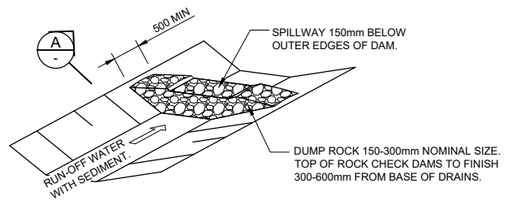
Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0102-5 - EROSION AND SEDIMENT.dwg C0103



LONG SECTION



SECTION A
SCALE N.T.S.

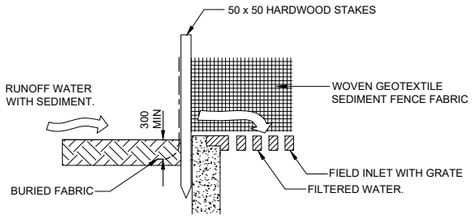


ELEVATION

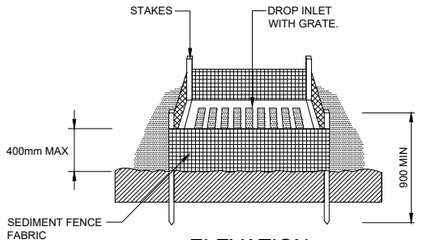
ROCK CHECK DAM DETAIL

SCALE N.T.S.

NOTES
1. INSPECT DAMS REGULARLY FOR SIGNS OF SCOUR, UNDERCUTTING AND SEDIMENT BUILD-UP.
2. MAINTAIN THE DAM SO THAT RUNOFF WILL FLOW THOUGH WASHED ROCK OR OVER SPILLWAY AND NOT ERODE STREAM BANKS.
3. REMOVE SEDIMENT ACCUMULATED BEHIND DAM WHEN NOTED.



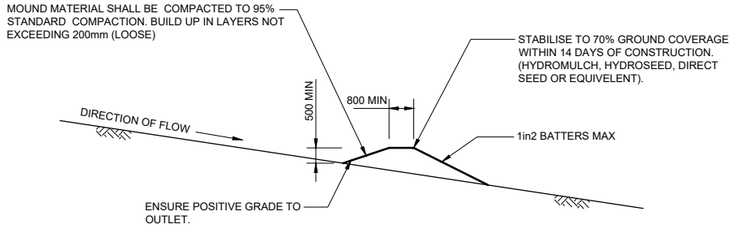
SECTION



ELEVATION

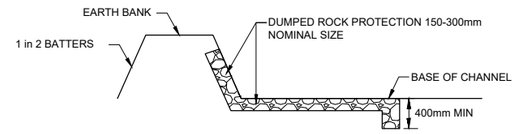
GEOTEXTILE FILTER FABRIC DROP INLET SEDIMENT TRAP

SCALE N.T.S.

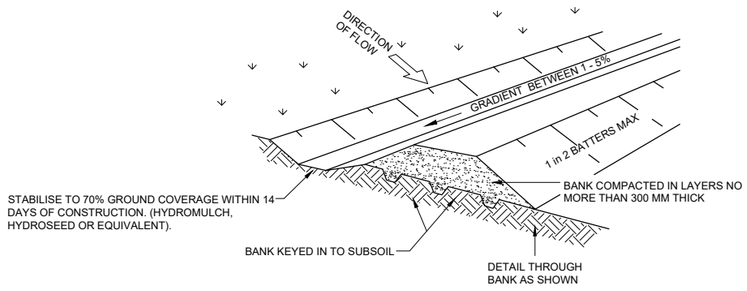


DIVERSION MOUND / BUNDWALL DETAIL

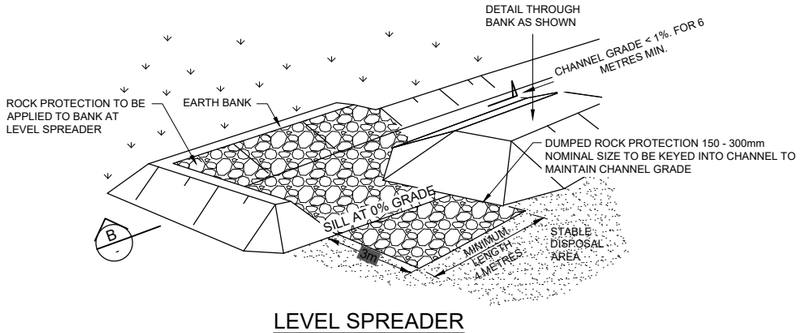
SCALE N.T.S.



SECTION B
SCALE N.T.S.



TYPICAL SECTION

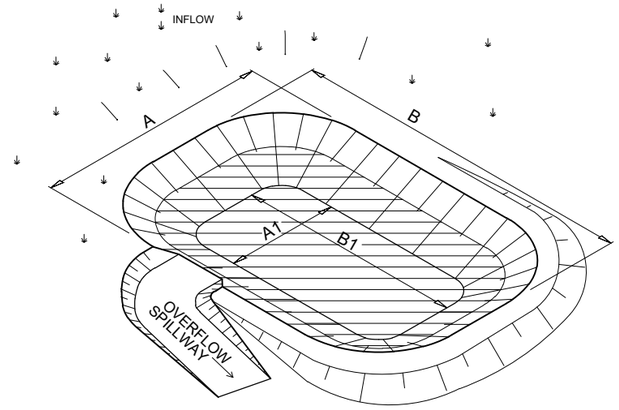


LEVEL SPREADER

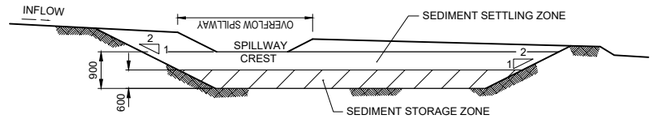
EARTH BANK (HIGH FLOW) DETAIL

SCALE N.T.S.

NOTES:
1. CONSTRUCT DRAINS WITH CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTIONS RATHER THAN V SHAPED.
2. CHANNEL AND LEVEL SPREADER TO BE MAINTAINED AFTER EVERY RAINFALL EVENT TO REMOVE ACCUMULATED SEDIMENT AND ENSURE INTEGRITY OF DUMPED ROCK.



PERSPECTIVE VIEW



TYPICAL SECTION

SEDIMENTATION BASIN

N.T.S.

NOTES: BASIN CAPACITY = SETTLING ZONE + SEDIMENT STORAGE ZONE

SETTLING ZONE = 10 x Cv x A x R = 10 x 0.5 x 1.0 x 21.3 = 106m^3/ha
AND
SEDIMENT STORAGE ZONE = 50% SETTLING ZONE
= 0.5 x 106m^3/ha
= 53m^3/ha
THEREFORE
BASIN CAPACITY = 159m^3/ha

THE BASIN IS TO BE A SLOW SETTLING BASIN WITH A SLOW DISCHARGE TO THE LEVEL OF REQUIRED STORAGE CAPACITY. THIS WILL MEAN THAT SEDIMENT WILL SETTLE OVER A PERIOD OF APPROXIMATELY 5 DAYS.

BASIN 1 = 5 x 159 = 795m^3 = 30m x 20m

BASIN 2 = 4.5 X 159 = 715m^3 = 25m x 20m

BASIN 3 = 2 X 159 = 318m^3 = 14m x 20m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	-	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
EROSION AND SEDIMENT CONTROL DETAILS
SHEET 2 OF 2

Project No.	Sheet. No.	Revision
T-C0293.00	C0105	P2

SITEWORKS LEGEND

- PROPOSED ASPHALT PAVEMENT
- PROPOSED CONCRETE FOOTPATH/PAVEMENT
- – CH 20.00 — PROPOSED ROAD CHAINAGE
- PROPOSED ROAD CENTRELINE
- PROPOSED UPRIGHT KERB AND GUTTER
- 12.50 — PROPOSED DESIGN CONTOURS
- PROPOSED TOP OF BATTER / PROPOSED TOE OF BATTER
- ● 22.500 — PROPOSED PAVEMENT LEVEL
- RW — PROPOSED BLOCK RETAINING WALL
- S — PROPOSED SEWER RETICULATION PIPE
- SW — PROPOSED STORMWATER DRAINAGE
- W — PROPOSED WATER RETICULATION PIPE
- 27.1 — EXISTING CONTOURS
- S — EXISTING SEWERAGE RETICULATION PIPE
- SW — EXISTING STORMWATER DRAINAGE PIPE
- W — EXISTING WATER RETICULATION PIPE
- EXISTING ELECTRICAL CABLE OVERHEAD
- UE — EXISTING ELECTRICAL CABLE UNDERGROUND
- T — EXISTING TELECOMMUNICATIONS CABLE
- Q100 (1% AEP) + 500MM FLOOD LINE
- STAGE BOUNDARY
- LL — LINEMARKING - LANE LINE
- CL — LINEMARKING - CONTINUITY LINE
- GL — LINEMARKING - GIVEWAY/HOLD LINE
- TL — LINEMARKING - TURN LINE
- DBL — LINEMARKING - DOUBLE BARRIER LINE
- HERITAGE RUINS SITE

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

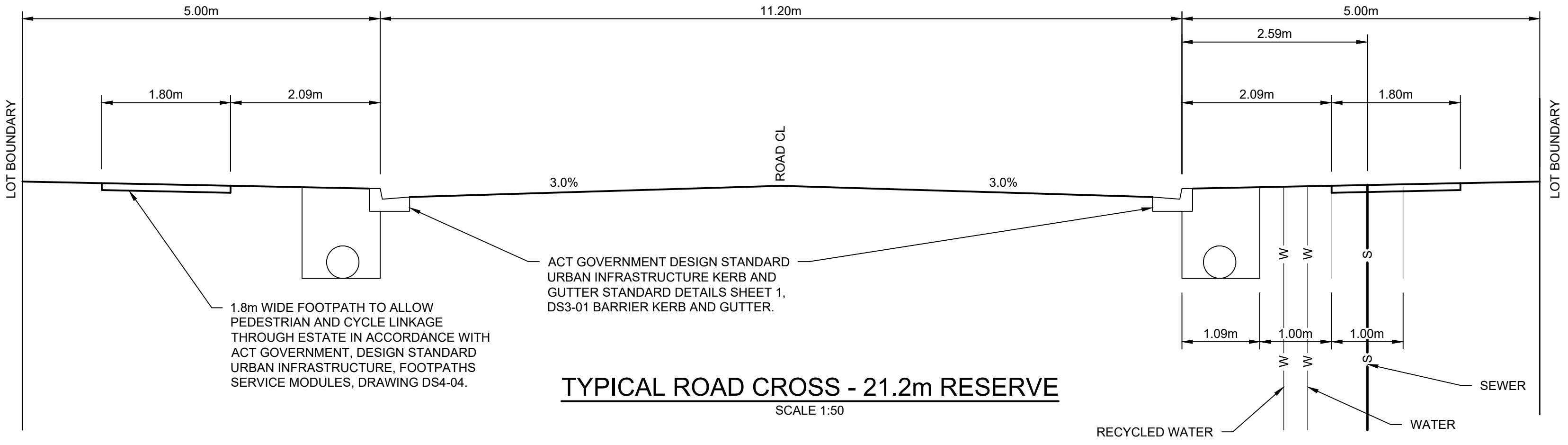
Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
ROADWORKS
PLAN

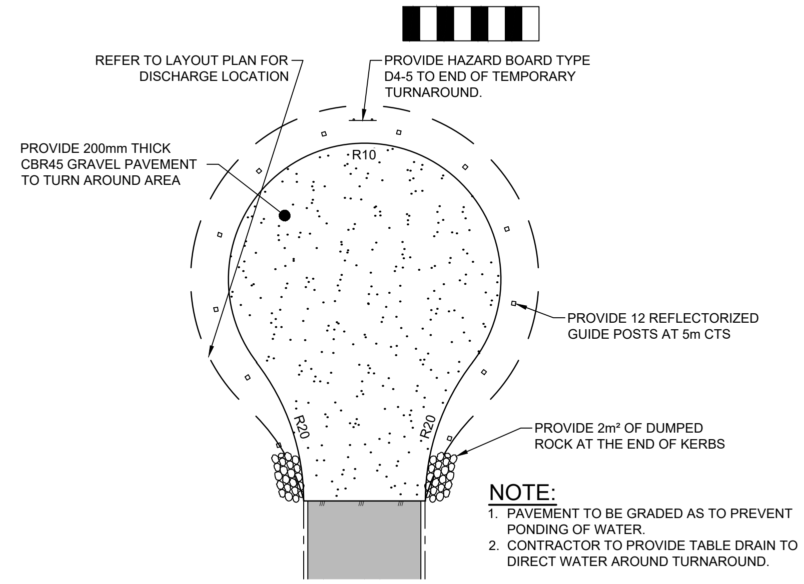
Project No.	Sheet. No.	Revision
T-C0293.00	C0201	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0201-3 - ROADWORKS.dwg C0201



TYPICAL ROAD CROSS - 21.2m RESERVE

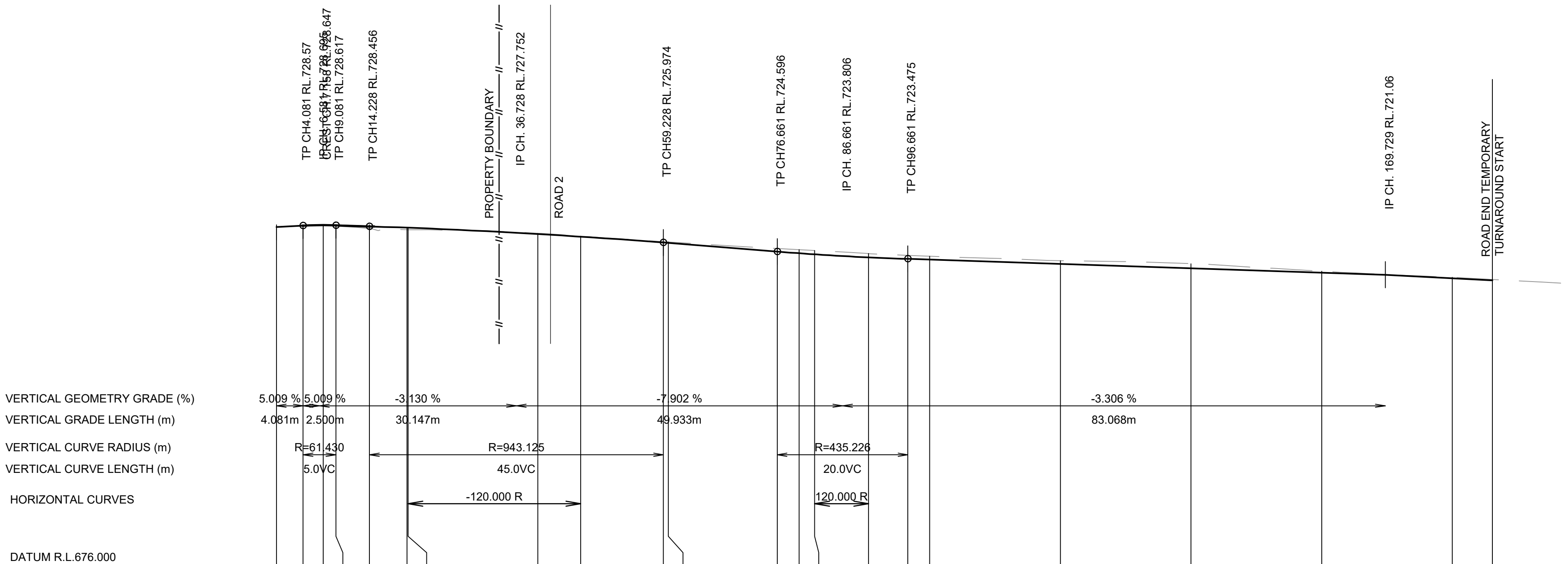
SCALE 1:50



NOTE:
1. PAVEMENT TO BE GRADED AS TO PREVENT PONDING OF WATER.
2. CONTRACTOR TO PROVIDE TABLE DRAIN TO DIRECT WATER AROUND TURNAROUND.

TYPICAL TEMPORARY TURN AROUND DETAIL

SCALE N.T.S.



CUT / FILL DEPTH TO EXISTING	0.000	0.000	0.120	0.128	0.312	0.304	0.302	-0.104	-0.073	-0.145	-0.159	-0.478	-0.546	-0.579	-0.572	-0.557	-0.527	-0.492	-0.700	-0.215	-0.136	-0.161
CONTROL LINE DESIGN SURFACE	728.366	728.57	728.647	728.617	728.456	728.258	728.252	727.297	726.89	725.974	725.913	724.596	724.345	724.181	723.717	723.475	723.365	722.704	722.043	721.381	720.509	720.180
CONTROL LINE CHAINAGE	0.000	4.081	7.158	9.081	14.228	20.000	20.144	40.000	46.555	59.228	60.000	76.661	80.000	82.395	90.617	96.661	100.000	120.000	140.000	160.000	180.000	186.143

LONGSECTION ROAD 1

SCALE 1:500

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

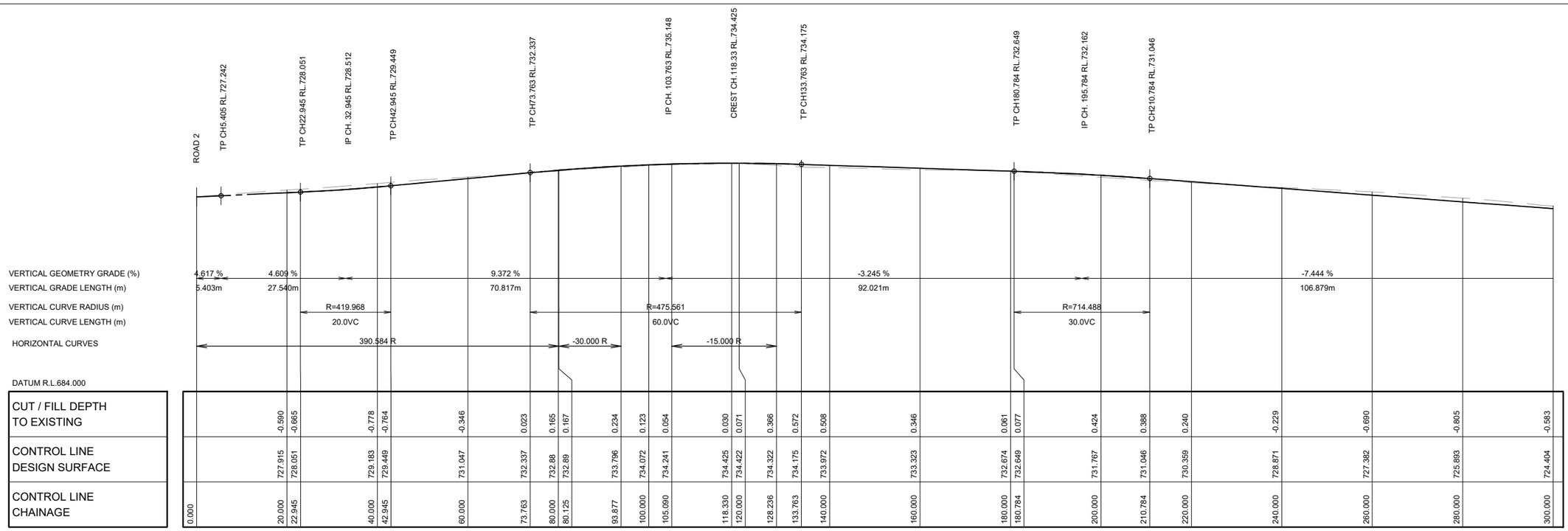
Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
ROADWORKS TYPICAL SECTION AND ROAD 1 LONGSECTION

Project No.	Sheet. No.	Revision
T-C0293.00	C0202	P2

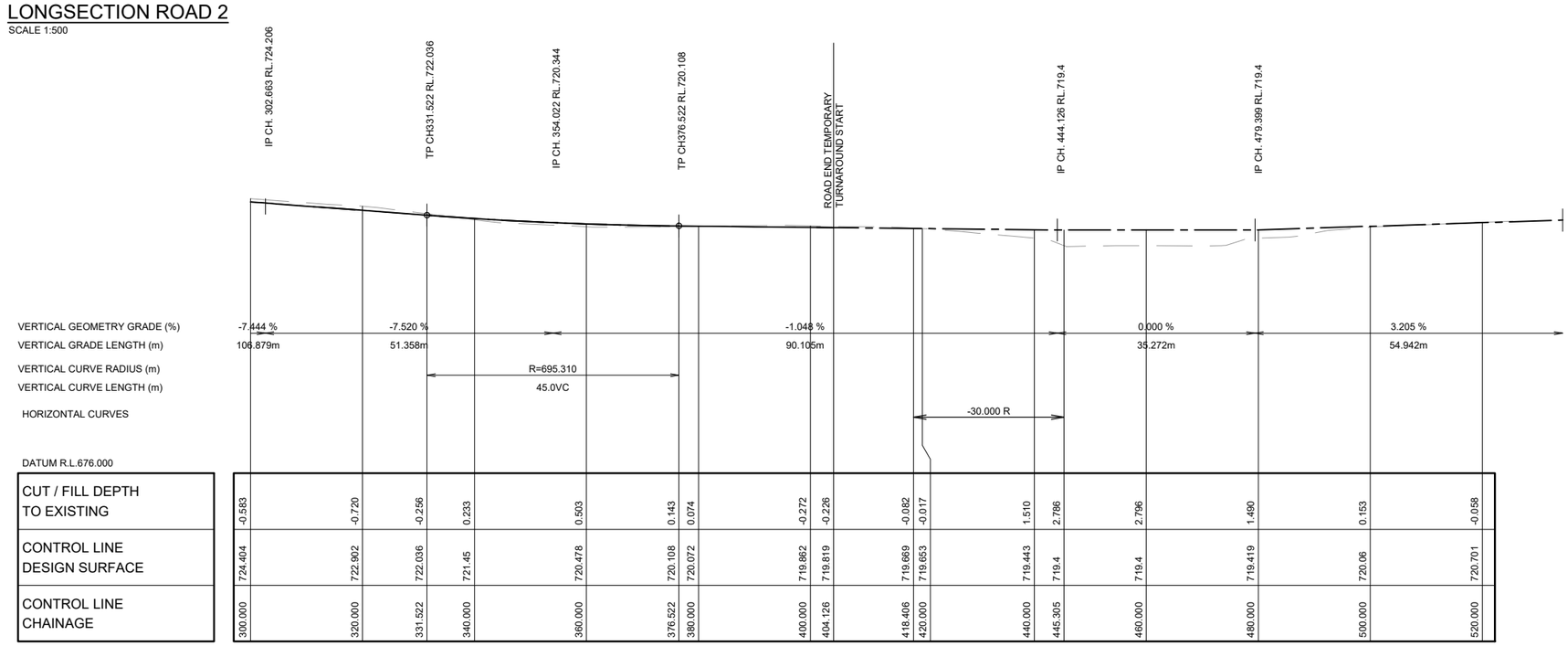
1:50 @ A1 1:100 @ A3 0 1 2 3 4 5 m

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0201-3 - ROADWORKS.dwg C0201



LONGSECTION ROAD 2

SCALE 1:500



LONGSECTION ROAD 2

SCALE 1:500

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	AS SHOWN	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
ROAD 2 LONGSECTION

Project No.	Sheet. No.	Revision
T-C0293.00	C0203	P2

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

300 mm 200 100 50 0 10 mm

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

ROAD 2

ROAD 1

21 20 19 18 17 16 15 14 13 12 11 10

9 8 7 6 5 4 3 2 1

RW

UE

300 mm
200
100
50
0 10 mm

SLOPE LEGEND

- AREAS GREATER THAN 20%
- AREAS LESS THAN 20%
- Q100 (1% AEP) + 300MM FLOOD LINE
- STAGE BOUNDARY

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

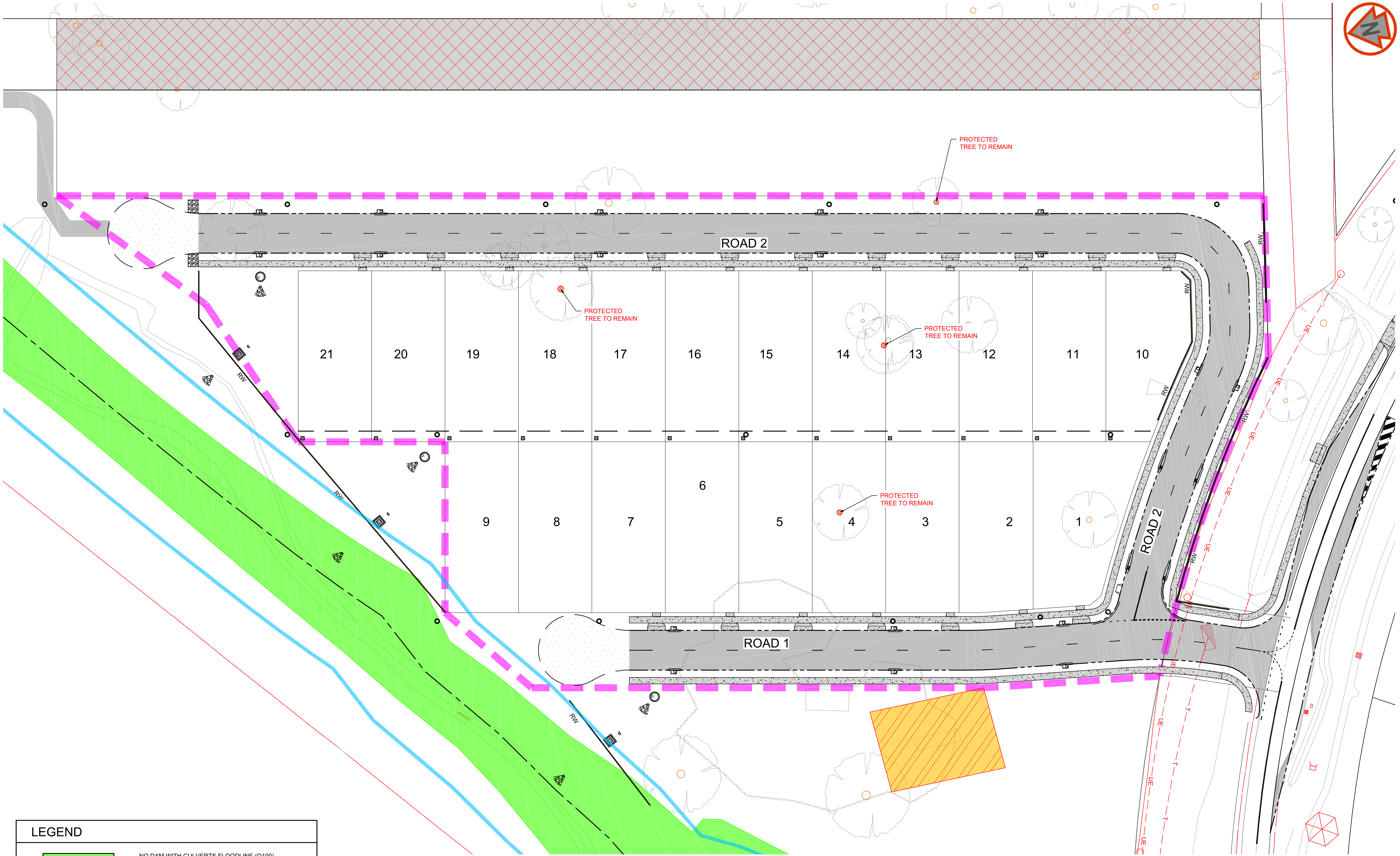
Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
SITEWORKS
SLOPE ANALYSISPLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0204	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0204 - SITEWORKS SLOPE.dwg C0204



NOT FOR CONSTRUCTION

LEGEND

- NO DAM WITH CULVERTS FLOODLINE (Q100)
- CROWN ROAD RESERVE - STAGE 2
- HERITAGE RUINS SITE
- PROTECTED TREE TO REMAIN — PROTECTED TREES TO REMAIN
- RIPARIAN
- STAGE BOUNDARY

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018

Drawn	Scales
DPP	1:500 @ A1

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
SITE CONSTRAINTS PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0205	P2

DUMPED ROCK SCOUR PROTECTION, REFER TEMPORARY TURNAROUND DETAIL ON C0202

PROTECTED TREE TO REMAIN

ROAD 2

ROAD 1

BASIN 1 - 290m³ 1.0m DEEP

DOMED FIELD INLET 845mm ABOVE BASE INVERT LEVEL WITH LOW FLOW INLET HEADWALL, OUTLET PIPE AND HEADWALL WITH SCOUR PROTECTION

OUTLET 1

BASIN 2 - 60m³ 1.0M DEEP

DOMED FIELD INLET 900mm ABOVE BASE INVERT LEVEL WITH LOW FLOW INLET HEADWALL, OUTLET PIPE AND HEADWALL WITH SCOUR PROTECTION

OUTLET 2

BASIN 3 - 270m³ 1.0M DEEP

DOMED FIELD INLET 850mm ABOVE BASE INVERT LEVEL WITH LOW FLOW INLET HEADWALL, OUTLET PIPE AND HEADWALL WITH SCOUR PROTECTION

OUTLET 3

2xØ375 CIRCULAR CONDUITS

GPT

STORMWATER LEGEND

SW	PROPOSED STORMWATER LINE
GP2/10 SL	PROPOSED STORMWATER INLET - SUMP INLET TYPE R
	PROPOSED STUCTURE NUMBER
S	PROPOSED SEWER MAIN
RM	PROPOSED SEWER RISING MAIN
W	PROPOSED WATER MAIN
	PROPOSED KERB INVERT
W	EXISTING WATER MAIN
S	EXISTING SEWER RETICULATION
SW	EXISTING STORMWATER PIPE
	EXISTING ELECTRICAL CABLE OVERHEAD
UE	EXISTING ELECTRICAL CABLE UNDERGROUND
T	EXISTING TELECOMMUNICATIONS CABLE
	Q100 (1% AEP) + 500MM FLOOD LINE
	STAGE BOUNDARY
	OVERLAND FLOW
	HERITAGE RUINS SITE

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
STORMWATER
PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0301	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0301 - STORMWATER.dwg C0301

CATCHMENT C1 - TOTAL AREA = 2.45ha

AREA OF POTENTIAL FUTURE LOTS = 1.7ha. BASED ON TABLE 1.1 OF QPRC HANDBOOK IMPERVIOUS PERCENTAGE IS 35% FOR 1000m² LOTS.
OUT OF REMAINING CATCHMENTS 0.09ha IS PERVIOUS AND 0.668ha IS IMPERVIOUS
TOTAL = 51% IMPERVIOUS AND 49% PERVIOUS

C1

24536m²

PROTECTED TREE TO REMAIN

ROAD 2

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

DETENTION BASIN 1

OUTLET 1

C2

6485m²

CATCHMENT C2 - TOTAL AREA = 0.65ha

BASED ON TABLE 1.1 OF QPRC HANDBOOK IMPERVIOUS PERCENTAGE IS 35% FOR 1000m² LOTS.
TOTAL = 35% IMPERVIOUS AND 65% PERVIOUS

C3

21059m²

PROTECTED TREE TO REMAIN

DETENTION BASIN 2

OUTLET 2

CATCHMENT C3 - TOTAL AREA = 2.10ha

AREA OF POTENTIAL FUTURE LOTS = 1.5ha. BASED ON TABLE 1.1 OF QPRC HANDBOOK IMPERVIOUS PERCENTAGE IS 35% FOR 1000m² LOTS.
OUT OF REMAINING CATCHMENTS 0.607ha IS IMPERVIOUS
TOTAL = 54% IMPERVIOUS AND 46% PERVIOUS

ROAD 2

ROAD 1

DETENTION BASIN 3

OUTLET 3

NOT FOR CONSTRUCTION

STORMWATER CATCHMENT LEGEND

- PROPOSED STORMWATER CATCHMENT BOUNDARY
- C1 — PROPOSED STORMWATER CATCHMENT NUMBER
- SW — PROPOSED STORMWATER DRAINAGE PIPE
- 21.5 — PROPOSED DESIGN CONTOURS
- STAGE BOUNDARY
- Q100 (1% AEP) + 500MM FLOOD LINE

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
STORMWATER
CATCHMENT PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0302	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0301 - STORMWATER.dwg C0301

JOINS T-C0293.00 - C0502

SEWER LINE TO BE LOCALLY REALIGNED AND PROTECTED TO AVOID PROTECTED TREE

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

PROTECTED TREE TO REMAIN

ROAD 2

ROAD 1

21 20 19 18 17 16 15 14 13 12 11 10

9 8 7 6 5 4 3 2 1

720 721 722 723 724 725 726 727 728 729 730 731 732 733 734

2.59m

3.59m

SEWERAGE RETICULATION LEGEND

S	PROPOSED SEWER RETICULATION
RM	PROPOSED SEWER RISING MAIN
	PROPOSED SEWER MAINTENANCE SHAFT
	PROPOSED SEWER MANHOLE
X/X	PROPOSED SEWER STRUCTURE ID
W	PROPOSED WATER MAIN
	PROPOSED KERB INVERT
W	EXISTING WATER MAIN
S	EXISTING SEWER RETICULATION
SW	EXISTING STORMWATER PIPE
	EXISTING ELECTRICAL CABLE OVERHEAD
UE	EXISTING ELECTRICAL CABLE UNDERGROUND
T	EXISTING TELECOMMUNICATIONS CABLE
	Q100 (1% AEP) + 500MM FLOOD LINE
	STAGE BOUNDARY
	HERITAGE RUINS SITE

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018

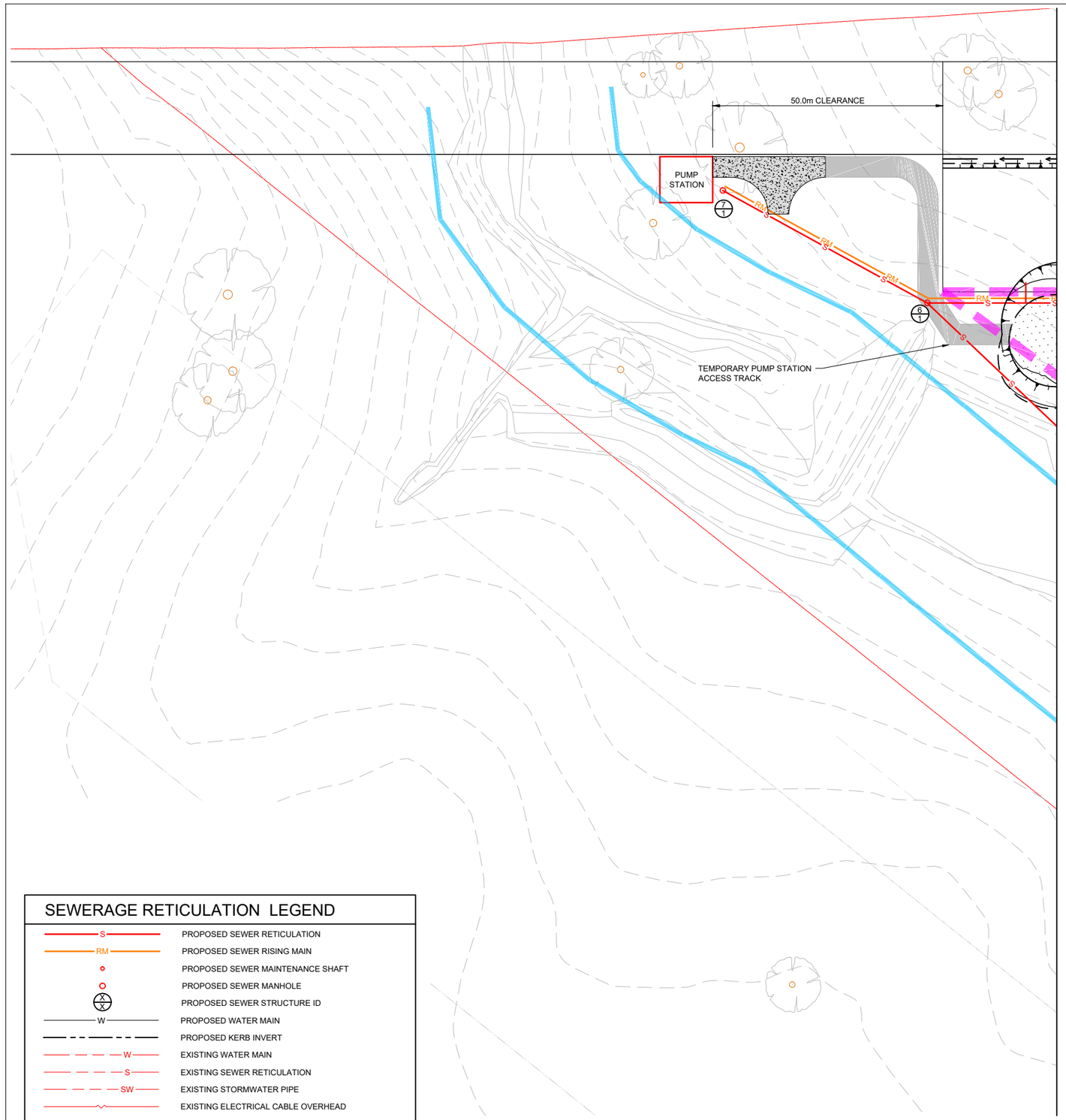
Drawn	Scales
DPP	1:500 @ A1

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
SEWERAGE LAYOUT PLAN
SHEET 1 OF 2

Project No.	Sheet. No.	Revision
T-C0293.00	C0501	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0501 - SEWER.dwg C0501



JOINS T-C0293.00 - C0501

SEWERAGE RETICULATION LEGEND

S	PROPOSED SEWER RETICULATION
RM	PROPOSED SEWER RISING MAIN
	PROPOSED SEWER MAINTENANCE SHAFT
	PROPOSED SEWER MANHOLE
X	PROPOSED SEWER STRUCTURE ID
W	PROPOSED WATER MAIN
	PROPOSED KERB INVERT
W	EXISTING WATER MAIN
S	EXISTING SEWER RETICULATION
SW	EXISTING STORMWATER PIPE
	EXISTING ELECTRICAL CABLE OVERHEAD
UE	EXISTING ELECTRICAL CABLE UNDERGROUND
T	EXISTING TELECOMMUNICATIONS CABLE
	Q100 (1% AEP) + 500MM FLOOD LINE
	STAGE BOUNDARY
	HERITAGE RUINS SITE

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

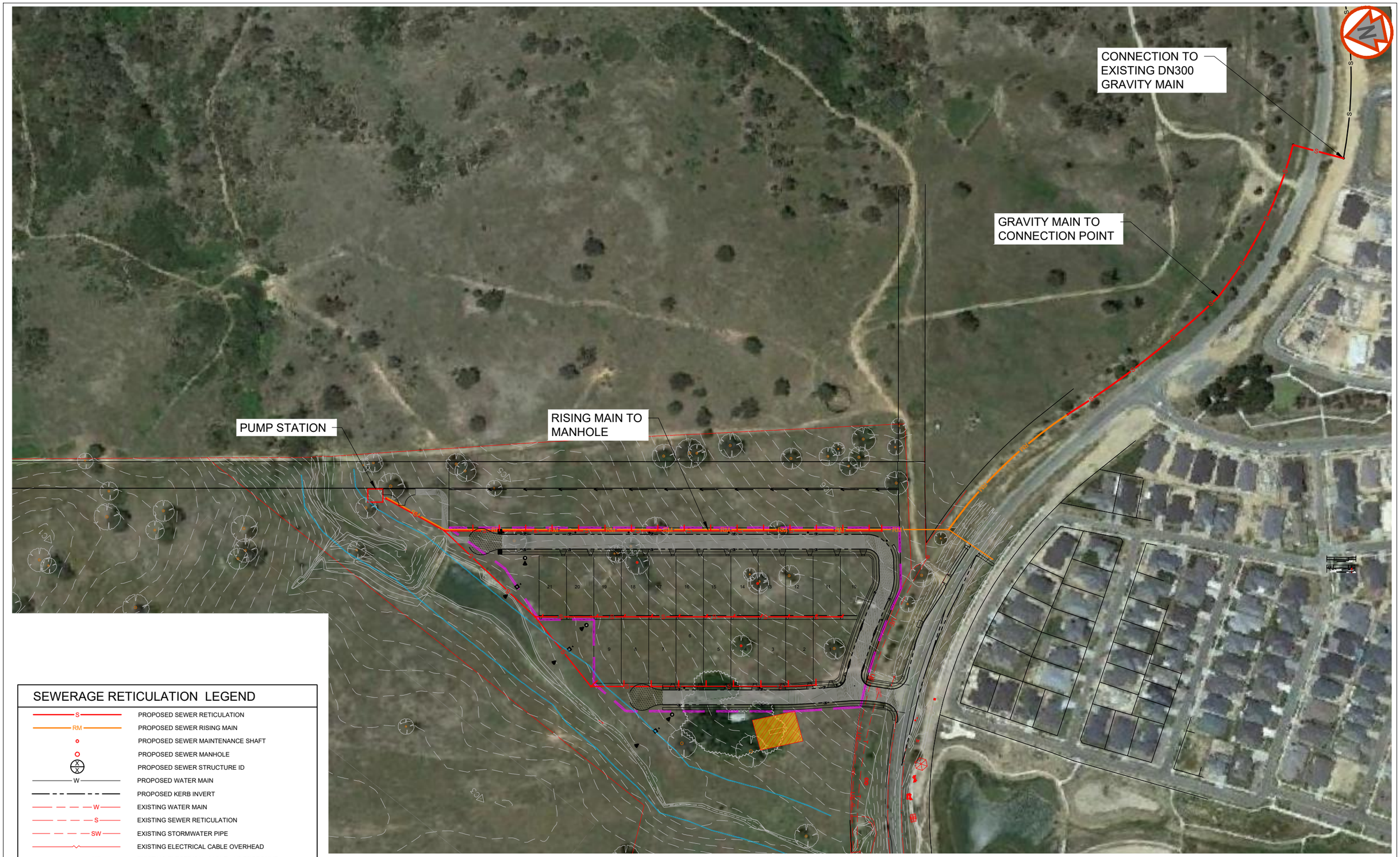
Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
SEWERAGE LAYOUT PLAN
SHEET 2 OF 2

Project No.	Sheet. No.	Revision
T-C0293.00	C0502	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0501 - SEWER.dwg C0501



SEWERAGE RETICULATION LEGEND

- PROPOSED SEWER RETICULATION
- PROPOSED SEWER RISING MAIN
- PROPOSED SEWER MAINTENANCE SHAFT
- PROPOSED SEWER MANHOLE
- PROPOSED SEWER STRUCTURE ID
- PROPOSED WATER MAIN
- PROPOSED KERB INVERT
- EXISTING WATER MAIN
- EXISTING SEWER RETICULATION
- EXISTING STORMWATER PIPE
- EXISTING ELECTRICAL CABLE OVERHEAD
- EXISTING ELECTRICAL CABLE UNDERGROUND
- EXISTING TELECOMMUNICATIONS CABLE
- Q100 (1% AEP) + 500MM FLOOD LINE
- STAGE BOUNDARY
- HERITAGE RUINS SITE

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	NTS	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
SEWERAGE CONNECTION PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0503	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0501 - SEWER.dwg C0501

END CAP FOR FUTURE STAGE CONNECTION

PROVIDE SCOUR VALVE FOR EACH WATER SERVICE

DN150 PVC-O PN16 S2 PIPE-RECYCLED

DN150 PVC-M PN16 SERIES 2 PIPE

WATER LINES TO BE LOCALLY REALIGNED AND PROTECTED TO AVOID PROTECTED TREE

PROTECTED TREE TO REMAIN

ROAD 2

ROAD 1

DN200 PVC-O PN16 S2 PIPE-RECYCLED

DN200 PVC-M PN16 SERIES 2 PIPE

DN300 PVC-O PN16 S2 PIPE-RECYCLED

DN300 PVC-M PN16 SERIES 2 PIPE

FOR POINT OF CONNECTION TO MUNICIPAL NETWORK REFER C0602

NOT FOR CONSTRUCTION

WATER RETICULATION LEGEND

- PROPOSED WATER MAIN
- PROPOSED RECYCLED WATER MAIN
- PROPOSED WATER CONDUIT FOR HOUSE CONNECTION
- PROPOSED METER
- PROPOSED FIRE HYDRANT
- PROPOSED SEWER RISING MAIN
- PROPOSED SEWER RETICULATION
- PROPOSED KERB INVERT
- EXISTING WATER MAIN
- EXISTING SEWER RETICULATION
- EXISTING STORMWATER PIPE
- EXISTING ELECTRICAL CABLE OVERHEAD
- EXISTING ELECTRICAL CABLE UNDERGROUND
- EXISTING TELECOMMUNICATIONS CABLE
- Q100 (1% AEP) + 500MM FLOOD LINE
- STAGE BOUNDARY
- HERITAGE RUINS SITE
- DN150 WATER MAIN
- DN200 WATER MAIN
- DN300 WATER MAIN

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

300 mm
200
100
50
10 mm
0

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018

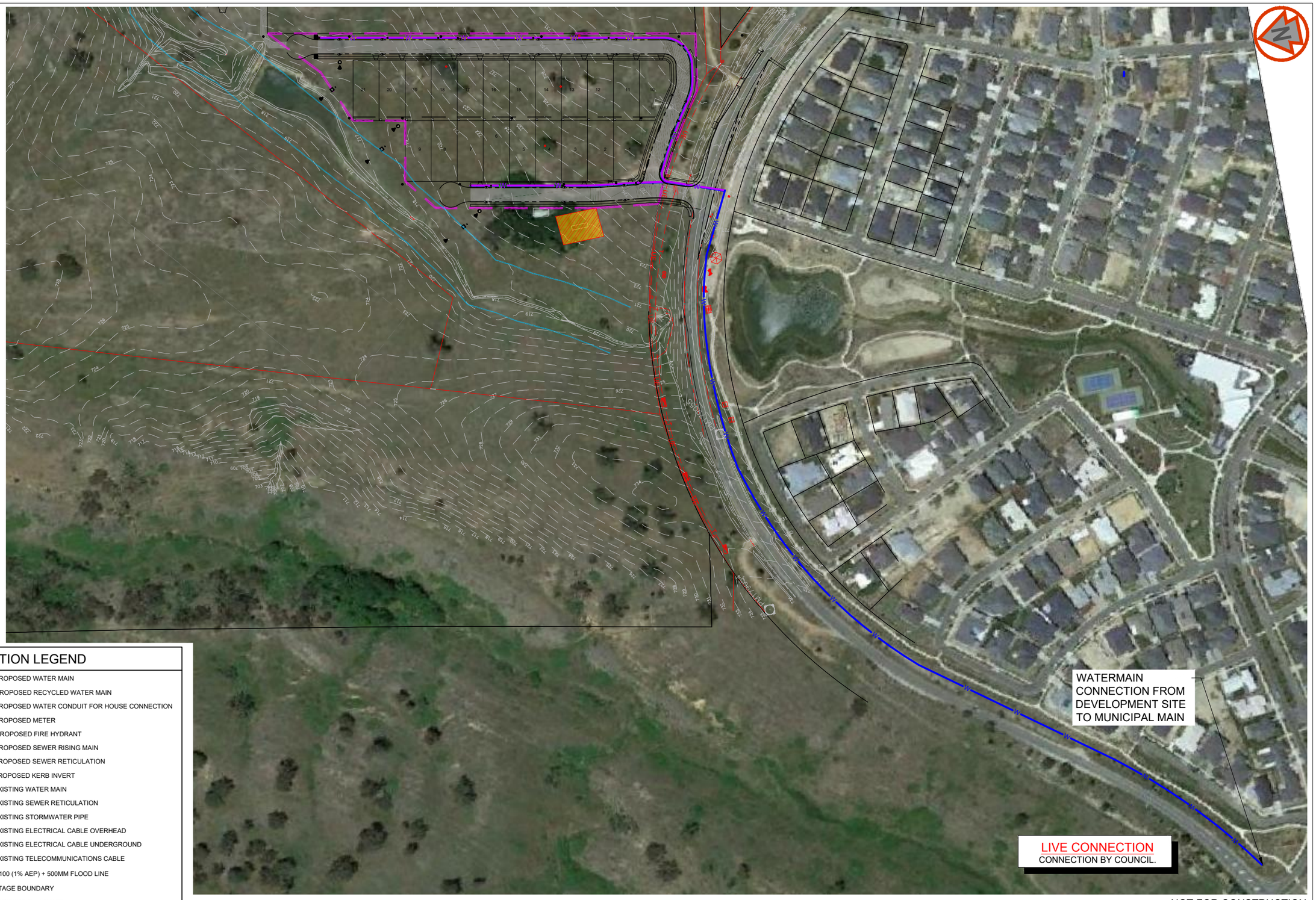
Drawn	Scales
DPP	1:500 @ A1

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
WATER LAYOUT
PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0601	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0601 - WATER.dwg C0601



WATER RETICULATION LEGEND

- PROPOSED WATER MAIN
- PROPOSED RECYCLED WATER MAIN
- PROPOSED WATER CONDUIT FOR HOUSE CONNECTION
- PROPOSED METER
- PROPOSED FIRE HYDRANT
- PROPOSED SEWER RISING MAIN
- PROPOSED SEWER RETICULATION
- PROPOSED KERB INVERT
- EXISTING WATER MAIN
- EXISTING SEWER RETICULATION
- EXISTING STORMWATER PIPE
- EXISTING ELECTRICAL CABLE OVERHEAD
- EXISTING ELECTRICAL CABLE UNDERGROUND
- EXISTING TELECOMMUNICATIONS CABLE
- Q100 (1% AEP) + 500MM FLOOD LINE
- STAGE BOUNDARY
- HERITAGE RUINS SITE
- DN150 WATER MAIN
- DN200 WATER MAIN
- DN300 WATER MAIN

1:1000 @ A1
1:2000 @ A3
0 10 20 30 40 50 60 70 80 90 100 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P1	INFORMATION ISSUE	TD	01.06.18
P2	FOR COUNCIL APPROVAL	TD	05.06.18

Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	TD	MAY 2018
Drawn	Scales	
DPP	1:1000 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
WATER CONNECTION
PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0602	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0601 - WATER.dwg C0601

EXISTING SERVICES TO BE PROTECTED OR LOWERED AS REQUIRED FOR FINAL SURFACE LEVELS.

1.8m PEDESTRIAN/CYCLE WAY

STANDARD BUSTOP, REFER STD DRG DS13-03-01

STANDARD CONCRETE CROSSOVER

RELOCATED SERVICE BAY AND SIGNAGE

PEDESTRIAN LINK TO EXISTING PATH NETWORK

SITEWORKS LEGEND

- PROPOSED ASPHALT PAVEMENT
- PROPOSED CONCRETE FOOTPATH/PAVEMENT
- S — PROPOSED SEWER RETICULATION PIPE
- SW — PROPOSED STORMWATER DRAINAGE
- W — PROPOSED WATER RETICULATION PIPE
- 27.1 — EXISTING CONTOURS
- S — EXISTING SEWERAGE RETICULATION PIPE
- SW — EXISTING STORMWATER DRAINAGE PIPE
- W — EXISTING WATER RETICULATION PIPE
- EXISTING ELECTRICAL CABLE OVERHEAD
- UE — EXISTING ELECTRICAL CABLE UNDERGROUND
- T — EXISTING TELECOMMUNICATIONS CABLE
- STAGE BOUNDARY
- LL — LINEMARKING - LANE LINE
- CL — LINEMARKING - CONTINUITY LINE
- GL — LINEMARKING - GIVEWAY/HOLD LINE
- TL — LINEMARKING - TURN LINE
- DBL — LINEMARKING - DOUBLE BARRIER LINE

1:250 @ A1
1:500 @ A3
0 4 8 12 16 20 24 m

NOT FOR CONSTRUCTION

Revision	Amendment	Approved	Revision Date
P2	FOR COUNCIL APPROVAL	TD	05.06.18

wsp
Canberra Office
+61 2 6133 2700
Level 2
99 Northbourne Avenue
Turner, ACT 2612

Designed	Approved	Approved Date
DPP	SS	MAY 2018
Drawn	Scales	
DPP	1:500 @ A1	

Project
SUNSET
RESIDENTIAL DEVELOPMENT STAGE 1
NSW

Sheet
EXTERNAL WORKS PLAN

Project No.	Sheet. No.	Revision
T-C0293.00	C0701	P2

Original Sheet Size A1 [841x594] Plot Date ---- Path G:\Projects - Other Offices\Canberra\T-C0293.00 - Sunset Residential Development\Deliver Civil\T-C0293.00 - C0701 - EXTERNALS.dwg C0701

A3 CALCULATIONS

Lots Serviced	No. of Lots RES	EP in - 3EP/Lot RES	Total EP	Gravity Catchment						Pump Flow In	Total Design Flow
				ADWF (l/s)	d	PDWF (l/s)	GWI (l/s)- Assume all lines are affected	IIF	Design Flow (l/s)		
120 Lots (Worst Case)	120	360	360	0.75	4.04	3.03	0.30	1.32	4.65		4.65

Storage Calculations		
8 hour vol	21600	l (ADWF)
Volume of wet well		
diam	2.3	m
Depth	5.2	m
Area	4.15	m2
Volume	21.60	m3
Volume	21604.73	l

Entire Development -- Worst Case (120x1000m2)			
LOT AREA (ha)	12	I(1,2) - Canberra	22
Aeff	3.10	Factor size	1.16
C	0.40	Factor containment	1.50
I	38.13		

Pump Sizing		
Design Flow	4.65	l/s
Design Flow	16749.85	l/hr
Diurnal Peak	16.12	%
Daily Load	14049.85	l
Pump Starts	8	cycle/hr
Cycles	7.5	mins
Pump Operation	1.5	min/cycle
Pump Operation	720	s/hr
Pump Rate	19.51	l/s

SUNSET DIVISION - STAGE 1
GRAVITY RETICULATION PRELIMINARY DESIGN

FILE	T-C0293.00	DATE
DESIGN	Ivana Galic	6/06/2018
CHECKED		
ISSUE	B	

RES - 3 EP/Lot

ADWF = ADD x EP
ADD = 180L/EP/day
PDWF = dxADWF

LOT AREA (ha) 5
Aeff 1.125463
C 0.4
I 42.35305

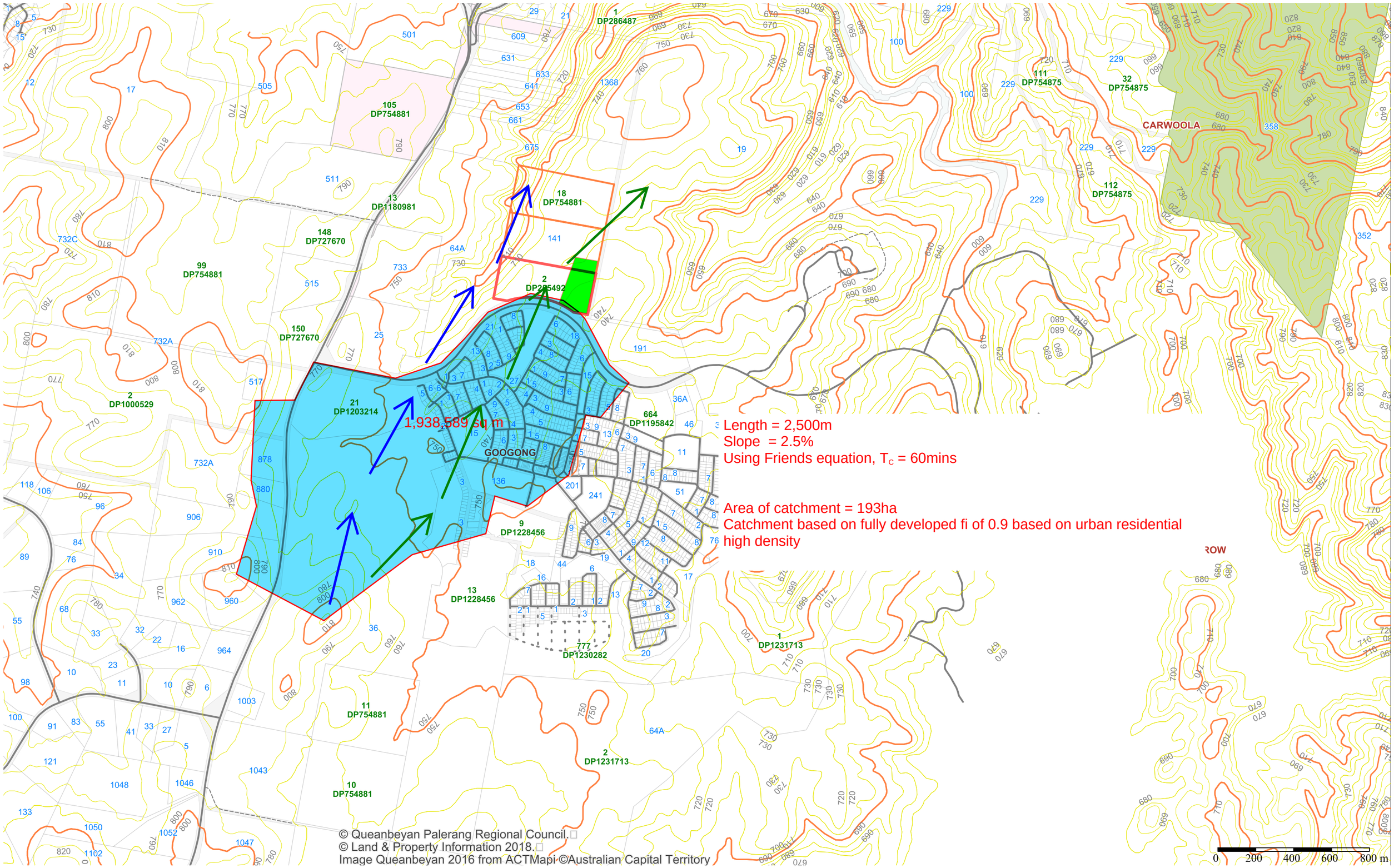
I(1,2) - Canberra 22
Factor size 1.283426
Factor containment 1.5 10yr ARI

Min Grade - DN250 = 0.5%
Min Grade - DN160 = 1%
Max Grade - 7%
Minimum Cover - 900mm

Mannings 'n'	0.013
Angle at 75% depth	240

MH	Design Population				Design Flow (D/S of MH)								Sewer Details					Preliminary Design Data					Flow Area 75% Full	Perimeter	R=A/P	Flow Velocity at75% Depth of Flow		Capacity at 75% Depth of Flow		% of Capacity at PWWF		SEWER MAIN SCHEDULE		
					Gravity Catchment																													
	Lots Serviced	No. of Lots RES	EP in - 3EP/Lot RES	Total EP	ADWF (l/s)	d	PDWF (l/s)	GWI (l/s)- Assume all lines are affected	IIF	Design Flow (l/s)	Pump Flow In	Total Design Flow	Diameter (PVC OD)	Internal Dia. (m)	Design GL (m AHD)	Length (m)	Min. Grade	UIL (m AHD)	DIL (m AHD)	Grade	Depth to Invert (m)	Cover to Pipe Soffit (m)				At Min. Grade	At Design Grade	At Min. Grade (l/s)	At Design Grade (l/s)	At Min. Grade	At Design Grade	DN 160 (m)	DN250 (m)	DN300 (m)
STAGE 1 TO PROPOSED PUMP STATION																																	
1/1	1	1.0	3	**3**	0.01	4.97	0.0	0.1	0.5	0.7		**0.7**	160	0.15	725.25	42	0.0125	724.20	721.95	0.0536	1.05	0.90	0.0142	0.3142	0.0453	1.09	2.26	15.53	32.14	4%	2%	42		
2/1	2,3	2.0	6	**9**	0.02	4.97	0.1	0.1	0.5	0.8		**0.8**	160	0.15	723.00	83	0.0125	721.95	718.70	0.0392	1.05	0.90	0.0142	0.3142	0.0453	1.09	1.93	15.53	27.48	5%	3%	83		
3/1	4, 5, 6, 7	4.0	12	**21**	0.04	4.97	0.2	0.1	0.5	0.9		**0.9**	160	0.15	719.75	45	0.0100	718.70	716.70	0.0444	1.05	0.90	0.0142	0.3142	0.0453	0.98	2.06	13.89	29.28	6%	3%	45		
4/1	8, 9	2.0	6	**27**	0.06	4.97	0.3	0.1	0.5	0.9		**0.9**	160	0.15	717.75	68	0.0095	716.70	715.95	0.0110	1.05	0.90	0.0142	0.3142	0.0453	0.95	1.03	13.54	14.58	7%	6%	68		
5/1	MH3/2, 20, 21	12.0	36	**63**	0.13	4.97	0.7	0.1	0.5	1.3		**1.3**	160	0.15	717.00	95	0.0075	715.95	715.20	0.0079	1.05	0.90	0.0142	0.3142	0.0453	0.85	0.87	12.03	12.34	11%	11%	95		
6/1	MH4/3, 36, 37, 38	17.0	51	**114**	0.24	4.97	1.2	0.1	0.5	1.8		**1.8**	160	0.15	719.00	51	0.0065	715.20	714.80	0.0078	3.80	3.65	0.0142	0.3142	0.0453	0.79	0.87	11.20	12.30	16%	15%	51		
7/1		0.0	0	**114**	0.24	4.97	1.2	0.1	0.5	1.8		**1.8**	160	0.15	718.25	5	0.0065	714.80	714.70	0.0200	3.45	3.30	0.0142	0.3142	0.0453	0.79	1.38	11.20	19.64	16%	9%	5		
SPS 1		0.0	0	**114**	0.24	4.97	1.2	0.1	0.5	1.8		**1.8**	160	0.15	717.25		0.0065	714.70			2.55	2.40	0.0142	0.3142	0.0453	0.79	0.00	11.20	0.00	16%		0		
1/2	10	1.0	3	**3**	0.01	4.97	0.0	0.1	0.5	0.7		**0.7**	160	0.15	730.50	103	0.0125	729.45	722.30	0.0694	1.05	0.90	0.0142	0.3142	0.0453	1.09	2.57	15.53	36.59	4%	2%	103		
2/2	11, 12, 13, 14, 15	5.0	15	**18**	0.04	4.97	0.2	0.1	0.5	0.8		**0.8**	160	0.15	724.75	88	0.0100	722.30	716.40	0.0670	2.45	2.30	0.0142	0.3142	0.0453	0.98	2.53	13.89	35.96	6%	2%	88		
3/2	16, 17, 18, 19	4.0	12	**30**	0.06	4.97	0.3	0.1	0.5	1.0		**1.0**	160	0.15	718.60	42	0.0090	716.40	716.00	0.0095	2.20	2.05	0.0142	0.3142	0.0453	0.93	0.95	13.17	13.55	7%	7%	42		
5/1	20, 21	2.0	6	**36**														717.00																
1/3	22	1.0	3	**3**	0.01	4.97	0.0	0.1	0.5	0.7		**0.7**	160	0.15	734.50	110	0.0125	733.45	728.40	0.0459	1.05	0.90	0.0142	0.3142	0.0453	1.09	2.09	15.53	29.76	4%	2%	110		
2/3	23, 24, 25, 26, 27, 28	6.0	18.0	**21**	0.04	4.97	0.2	0.1	0.5	0.9		**0.9**	160	0.15	729.90	80	0.0100	728.40	722.85	0.0694	1.50	1.35	0.0142	0.3142	0.0453	0.98	2.57	13.89	36.58	6%	2%	80		
3/3	29, 30, 31, 32	4.0	12.0	**33**	0.07	4.97	0.3	0.1	0.5	1.0		**1.0**	160	0.15	723.90	73	0.0090	722.85	719.05	0.0521	1.05	0.90	0.0142	0.3142	0.0453	0.93	2.23	13.17	31.68	8%	3%	73		
4/3	33, 34, 35	3.0	9.0	**42**	0.09	4.97	0.4	0.1	0.5	1.1		**1.1**	160	0.15	720.10	68	0.0085	719.05	715.25	0.0559	1.05	0.90	0.0142	0.3142	0.0453	0.90	2.31	12.80	32.83	9%	3%	68		
6/1	36, 37, 38	3.0	9	**51**														719.00																
SPS 1				**114**	0.24	4.97	1.2	0.1	0.5	**1.8**		**1.8**																Sewer to Proposed PS Total Lengths				953	0	0

Created on 15/05/2018

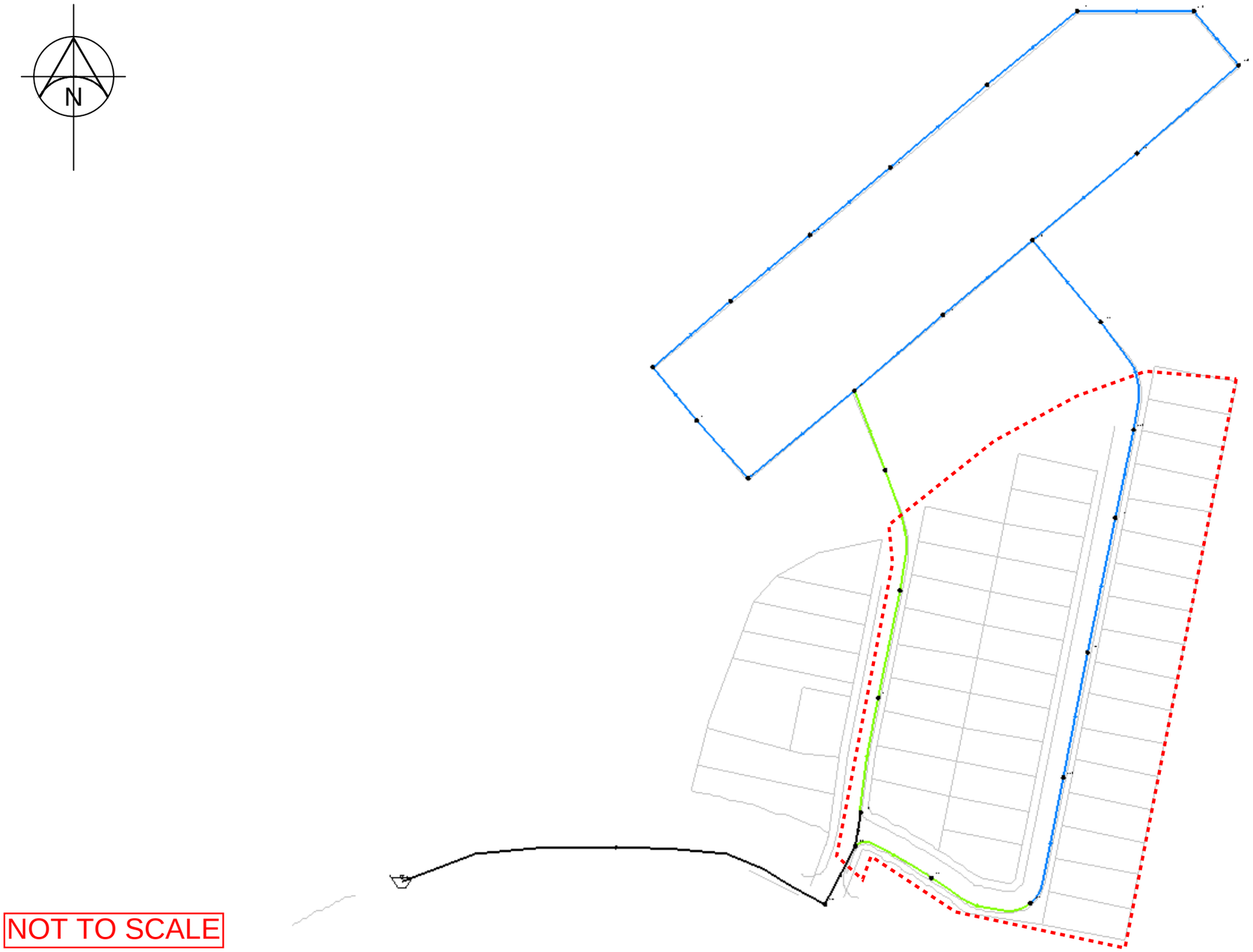


Queanbeyan Palerang Regional Council
256 Crawford St
Queanbeyan NSW 2620
Phone: (02) 6285 6000
www.qprc.nsw.gov.au

Projection: GDA94 / MGA zone 55

WATER RETICULATION - WATER DEMAND CALCULATIONS

Junction	Lots Serviced	EP (3EP/Lot)	EP/ET Conversion	
			Instantaneous Flow 0.15L/s	ADD 230L/EP/day
1	0	0	0	0.000
2	2	6	0.9	0.016
3	3	9	1.35	0.024
4	4	12	1.8	0.032
5	0	0	0	0.000
6	6	18	2.7	0.048
7	6	18	2.7	0.048
8	4	12	1.8	0.032
9	6	18	2.7	0.048
10	6	18	2.7	0.048
11	6	18	2.7	0.048
12	6	18	2.7	0.048
13	6	18	2.7	0.048
14	6	18	2.7	0.048
15	6	18	2.7	0.048
16	6	18	2.7	0.048
17	6	18	2.7	0.048
18	6	18	2.7	0.048
19	6	18	2.7	0.048
20	0	0	0	0.000
21	3	9	1.35	0.024
22	7	21	3.15	0.056
23	8	24	3.6	0.064
24	8	24	3.6	0.064
25	3	9	1.35	0.024
26	0	0	0	0.000
TOTAL	120	360	54	0.958



SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

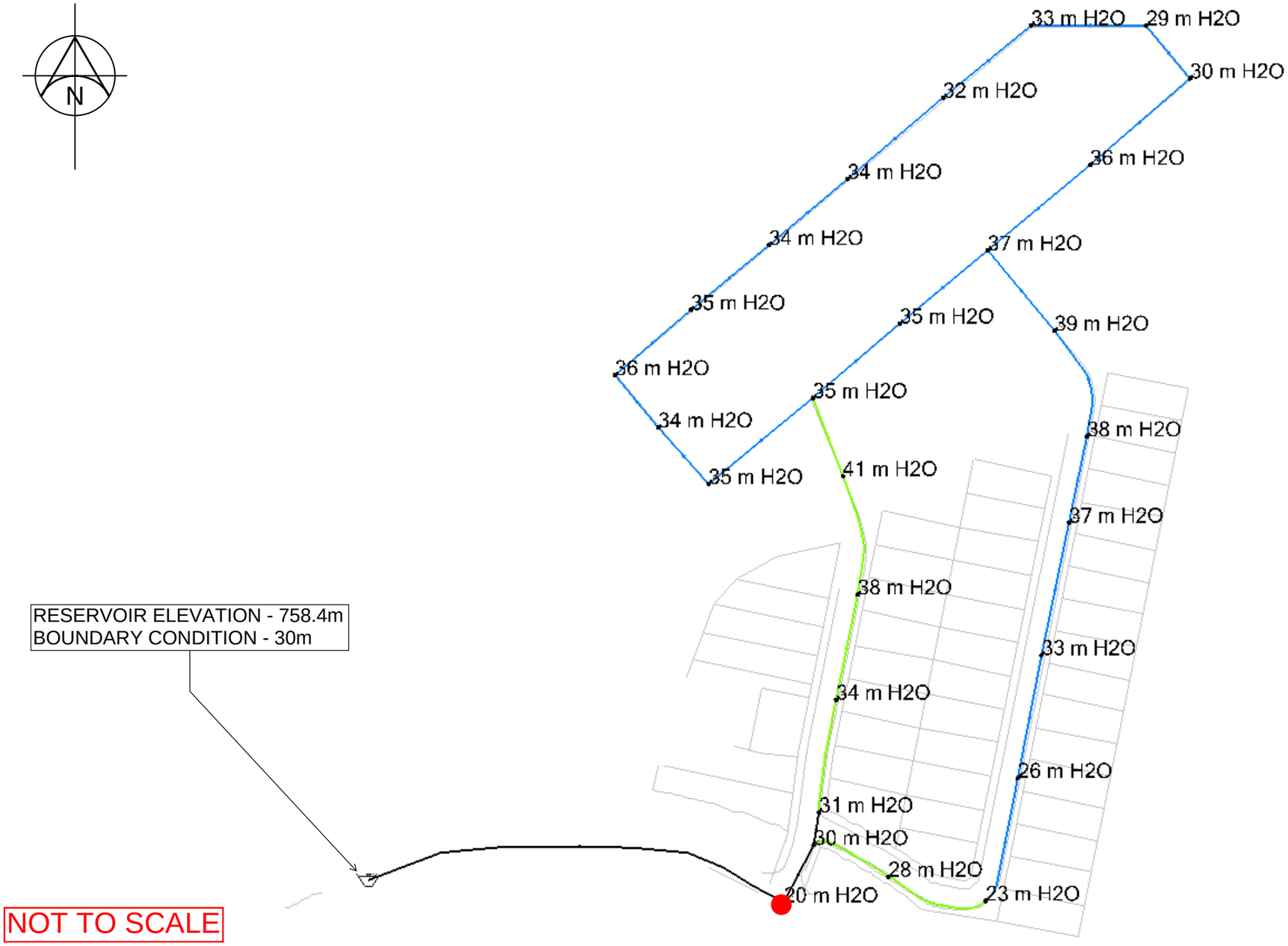
Drawn	Scales

Project
SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet
WATER RETICULATION PIPE SIZING

Project No.	Sheet. No.	Revision
T-C0293.00	SK01	A

Original Sheet Size A1 [841x594]



KEY:

JUNCTION WHERE WORST CASE PRESSURE OCCURS

38 — MINIMUM PRESSURE (mH2O)

SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

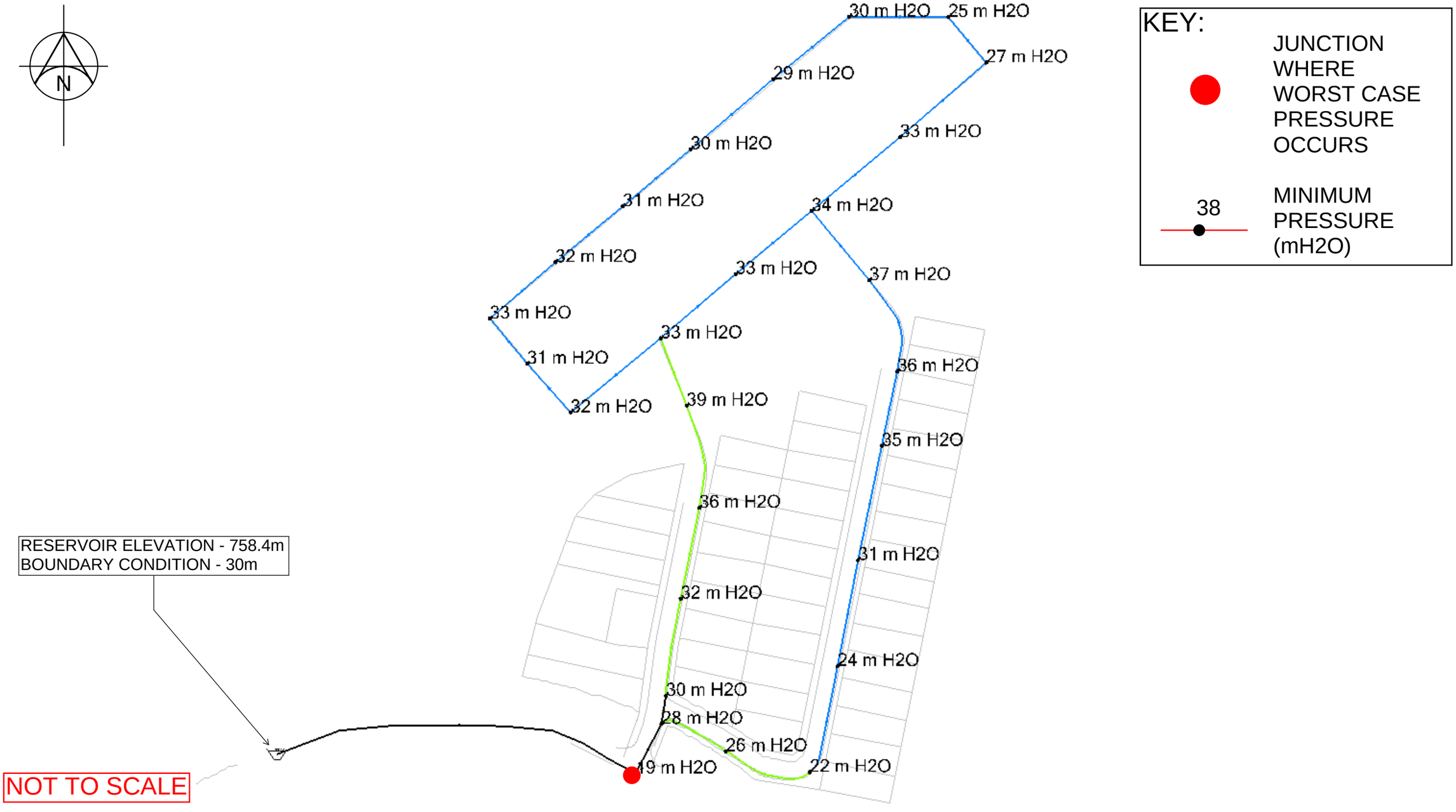
Drawn	Scales

Project: SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet: SCENARIO 1 - MINIMUM PRESSURE DURING AVERAGE DAY DEMANDS

Project No.	Sheet. No.	Revision
T-C0293.00	SK02	A

Original Sheet Size A1 [841x594]



SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

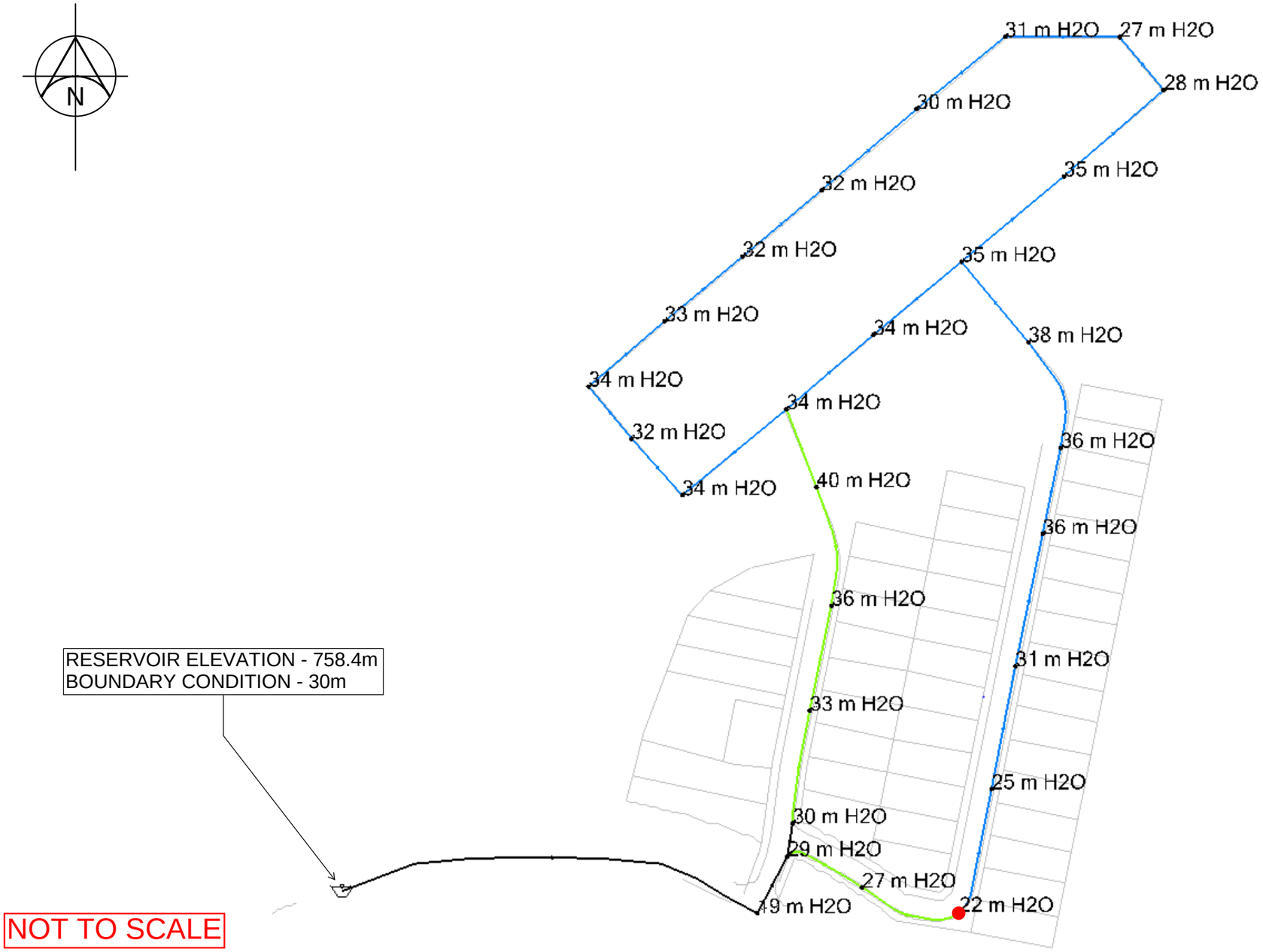
Drawn	Scales

Project
SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet
SCENARIO 2 - MINIMUM PRESSURE DURING INSTANTANEOUS PEAK DEMANDS

Project No.	Sheet. No.	Revision
T-C0293.00	SK03	A

Original Sheet Size A1 [841x594]



SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

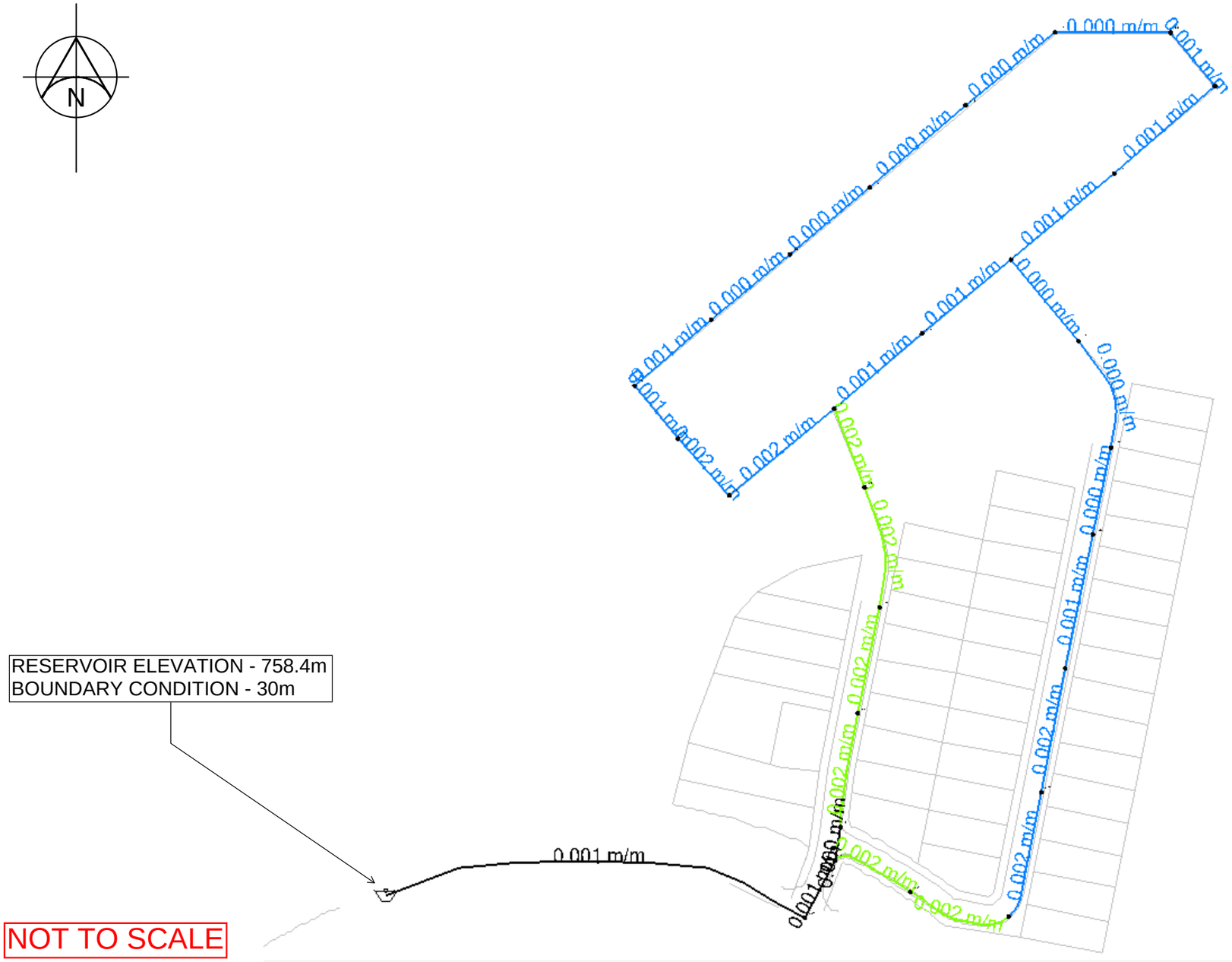
Drawn	Scales

Project
SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet
SCENARIO 3 - MINIMUM PRESSURE DURING 10L/s RESIDENTIAL FIREFLOW + 2/3 INSTANTANEOUS DEMAND

Project No.	Sheet. No.	Revision
T-C0293.00	SK04	A

Original Sheet Size A1 [841x594]



SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

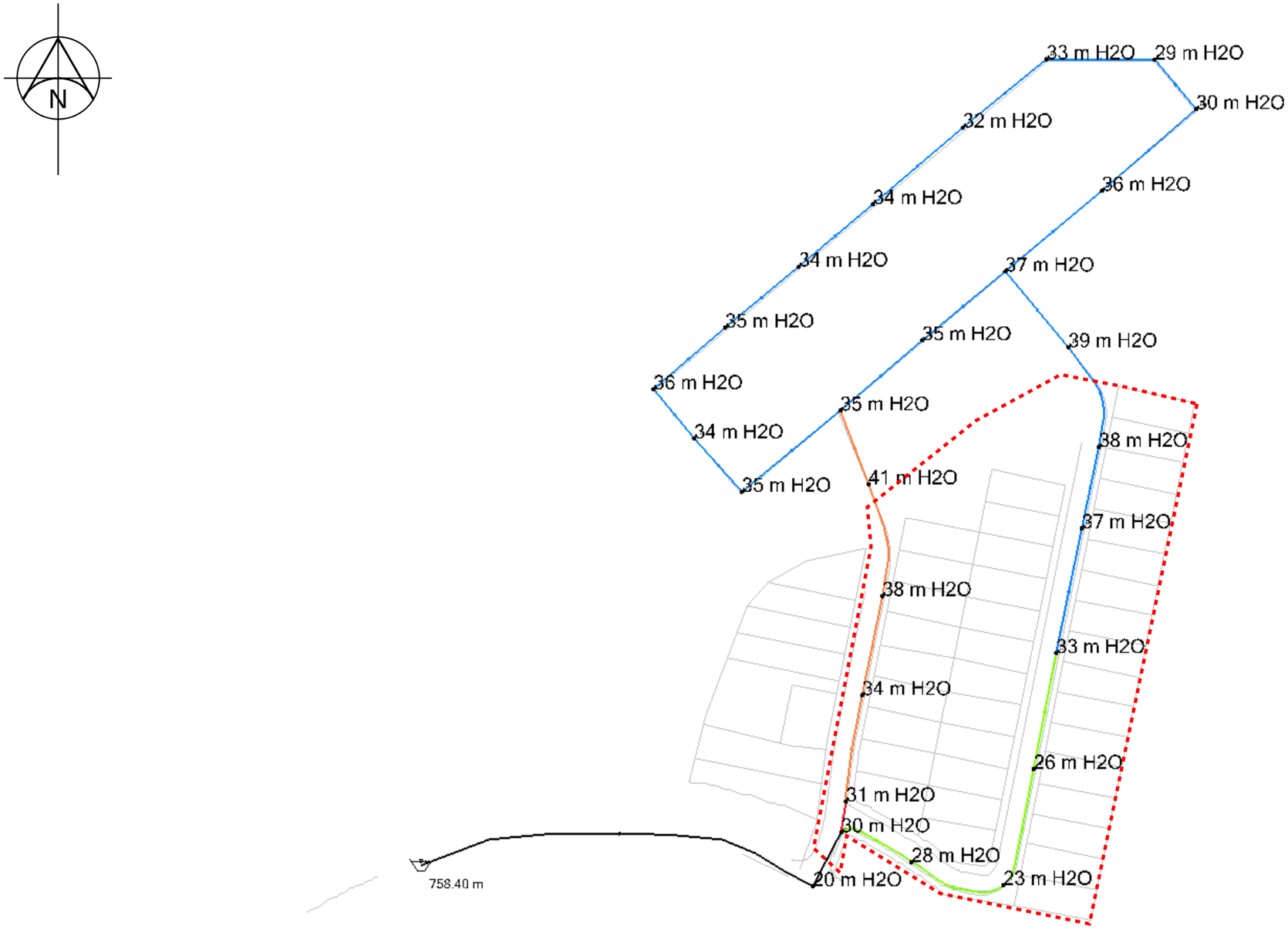
Drawn	Scales

Project
SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet
HEADLOSS DURING INSTANTANEOUS DEMAND

Project No.	Sheet. No.	Revision
T-C0293.00	SK05	A

Original Sheet Size A1 [841x594]



NOT TO SCALE

SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

Drawn	Scales

Project: SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet: WATER RETICULATION PIPE SIZING

Project No.	Sheet. No.	Revision
T-C0293.00	SK01	A

Original Sheet Size A1 [841x594]

SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

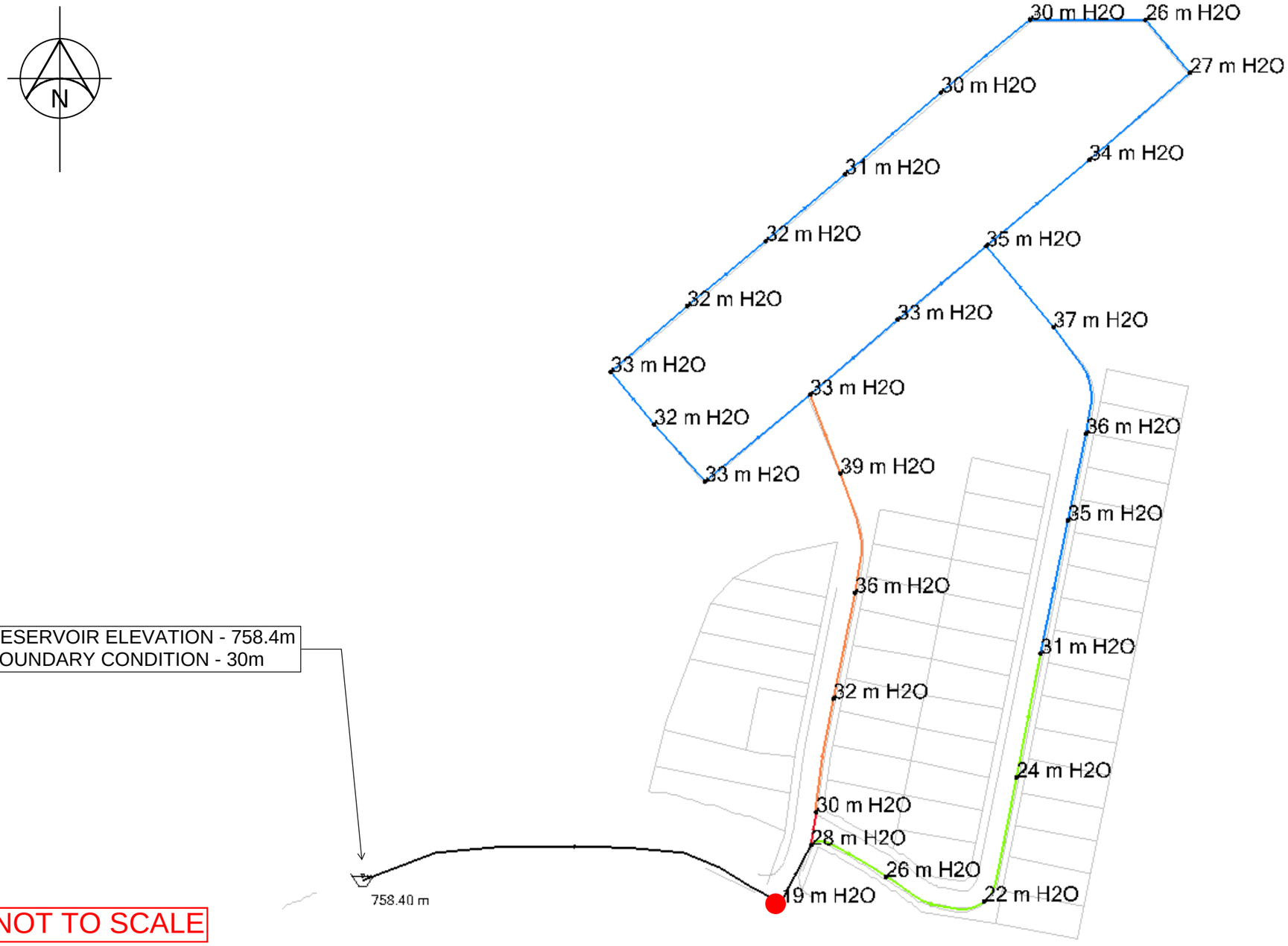
Drawn	Scales

Project
SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet
SCENARIO 1 - MINIMUM PRESSURE DURING AVERAGE DAY DEMANDS

Project No.	Sheet. No.	Revision
T-C0293.00	SK02	A

Original Sheet Size A1 [841x594]



KEY:

JUNCTION WHERE WORST CASE PRESSURE OCCURS

38 MINIMUM PRESSURE (mH2O)

SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

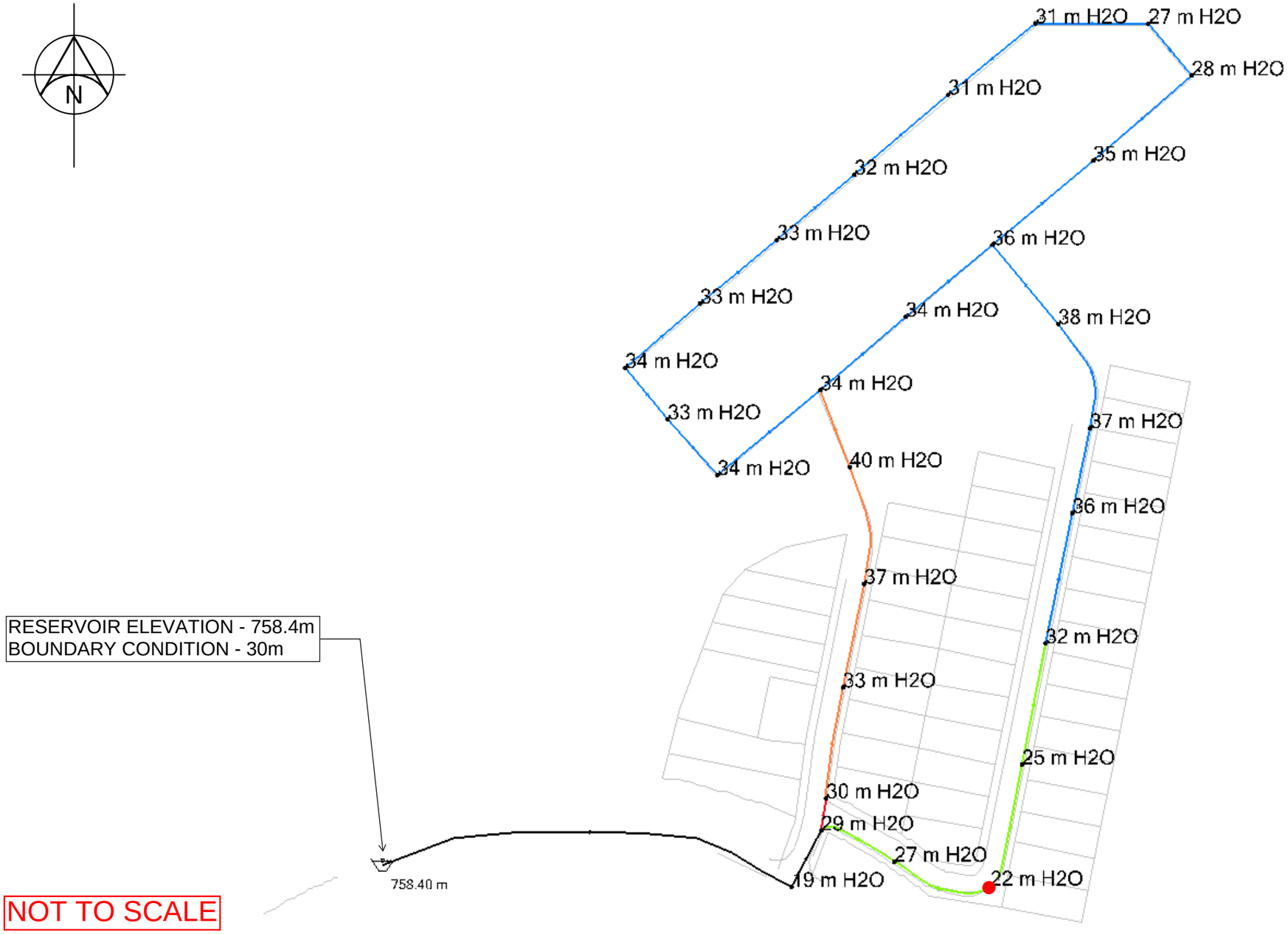
Drawn	Scales

Project: SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet: SCENARIO 2 - MINIMUM PRESSURE DURING INSTANTANEOUS PEAK DEMANDS

Project No.	Sheet. No.	Revision
T-C0293.00	SK03	A

Original Sheet Size A1 [841x594]



SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

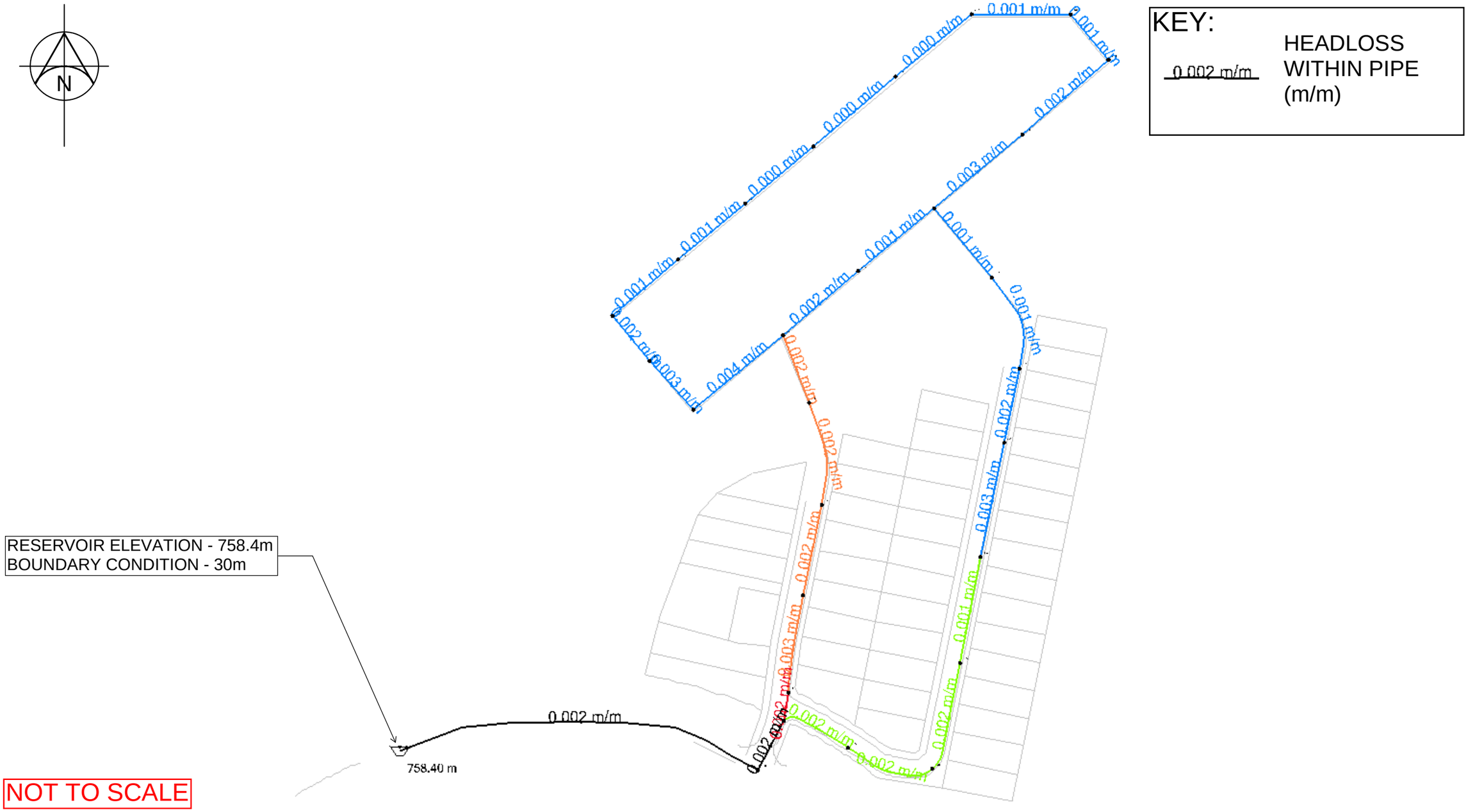
Drawn	Scales

Project
SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet
SCENARIO 3 - MINIMUM PRESSURE DURING 10L/s RESIDENTIAL FIREFLOW + 2/3 INSTANTANEOUS DEMAND

Project No.	Sheet. No.	Revision
T-C0293.00	SK04	A

Original Sheet Size A1 [841x594]



SITE PLAN

Revision	Amendment	Approved	Revision Date

OPUS
Brisbane Office
+61 7 3838 2400
PO Box 99
Spring Hill QLD 4004
Australia

Approved	Approved Date

Drawn	Scales

Project
SUNSET RESIDENTIAL DEVELOPMENT - GOOGONG

Sheet
HEADLOSS DURING INSTANTANEOUS DEMAND

Project No.	Sheet. No.	Revision
T-C0293.00	SK05	A

Original Sheet Size A1 [841x594]