JUMPING CREEK ESTATE CIVIL ENGINEERING REPORT

SUBDIVISION DA
JUNE 2021

PREPARED FOR PEET PTY LTD

This report has been prepared by the office of Spiire
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1. INTRODUCTION

1.1 OVERVIEW

This development application (DA) has been prepared on behalf of PEET Pty Ltd (PEET). Its function is to support the DA documents which are being submitted for the Jumping Creek Estate, Queanbeyan legally known as Lot 5 in DP1199045.

The land proposed to be subdivided is legally described as Lot 5 DP 1199045 and is located at 28 Lonergan Drive, Queanbeyan, also known as Jumping Creek. From herein the land proposed to be subdivided will be referred to as the Site. The Site is approximately 3 km south east of the Queanbeyan City Centre and provides a total area of approximately 94.50 Ha. The Site is surrounded by undeveloped land to the north east and Ellerton Drive Extension and Greenleigh Estate low-density residential development to the North West.

The Site is vacant but contains the remnant mine sites and associated dispositions of spoil and mining activity debris. The Site also contains a sheep dip. The proposed access is from the Edwin Land Parkway/ Ellerton Drive Extension while pedestrian access from Greenleigh is via an Ellerton Drive Extension underpass. The Site also includes several heritage and indigenous sites including a Scar Tree. The Site has been subject to pest removal action about invasive weeds species.

The Site is located near Greenleigh and is characterised by a combination of undulating and flatter land bisected from the north by Jumping Creek and to the east by Valley Creek, which flow into the Queanbeyan River to south west.

There is a long history to the planning and rezoning of the Site to enable an appropriate subdivision of the land much of which is set out in the 2018 amended planning proposal prepared by the Queanbeyan Palerang Regional Council (QPRC). That amended planning proposal was approved by the NSW Minister of planning and changes recorded to the QPRC LEP 2012 on 23 November 2018.

1.2 DEVELOPMENT APPLICATION

The proposed development involves the creation of 218 residential lots and associated open space areas. The residential lots are proposed to be free-standing blocks ranging in size from 600m2 to 50ha.

The road network is comprised of local streets, with an 8m carriageway and varying verges widths to accommodate services. Two proposed egresses onto the Ellerton Drive Extension are proposed to allow for safe ingress and egress from the Site. These are further described in Section 4.

As part of the development, infrastructure will be constructed for sewer, water, stormwater, electricity and communications. Gas has been omitted from the development after receiving advice from Jemena that the site cannot be serviced.

The DA Drawing list is as follows:

DRAWING	DESCRIPTION	REVISION
CA000	COVER SHEET	A
CA002	DRAWING SCHEDULE	B
CA010	EXISTING SERVICES PLAN	-

CA020	GENERAL ARRANGEMENT PLAN	B
CA040	CONSTRUCTION MANAGEMENT CONCEPT PLAN	B
CA060	CONCEPT STAGING PLAN	B
CA100	HIERARCHY PLAN	B
CA120	TYPICAL CROSS SECTIONS - SHEET 1	A
CA121	TYPICAL CROSS SECTIONS - SHEET 2	A
CA160	ROAD DETAILS AND PATH NETWORK LAYOUT PLAN - SHEET 1	B
CA200	GRADING PLAN LAYOUT	B
CA220	LONGITUDINAL SECTION - ROAD 001 - SHEET 1	A
CA221	LONGITUDINAL SECTION - ROAD 001 - SHEET 2	A
CA222	LONGITUDINAL SECTION - ROAD 001 & ROAD 002 - SHEET 3	A
CA223	LONGITUDINAL SECTION - ROAD 003 - SHEET 1	A
CA224	LONGITUDINAL SECTION - ROAD 003 - SHEET 2	A
CA225	LONGITUDINAL SECTION - ROAD 003 - SHEET 3	A
CA227	LONGITUDINAL SECTION - ROAD 005 - SHEET 1	A
CA228	LONGITUDINAL SECTION - ROAD 009 SHEET 1	A
CA229	LONGITUDINAL SECTION - ROAD 009 SHEET 2	A
CA230	LONGITUDINAL SECTION - ROAD 009 SHEET 3	A
CA231	LONGITUDINAL SECTION - ROAD 011 - SHEET 1	A
CA232	LONGITUDINAL SECTION - ROAD 012 - SHEET 1	A
CA233	LONGITUDINAL SECTION - ROAD 012 - SHEET 2	A
CA234	LONGITUDINAL SECTION - ROAD 012 - SHEET 3	A
CA235	LONGITUDINAL SECTION - ROAD 013 - SHEET 1	A
CA236	LONGITUDINAL SECTION - ROAD 013 - SHEET 2	A
CA237	LONGITUDINAL SECTION - ROAD 014 -SHEET 1	A
CA238	LONGITUDINAL SECTION - ROAD 015 -SHEET 1	A
CA240	BUS ROUTE PLAN	A
CA250	TURNING MOVEMENTS LAYOUT	B
CA251	TURNING MOVEMENTS SHEET 1	B
CA252	TURNING MOVEMENTS SHEET 2	A
CA253	TURNING MOVEMENTS SHEET 3	B
CA270	SOUTHERN INTERSECTION GA	-
CA271	NORTHERN INTERSECTION GA	-
CA272	SAFE INTERSECTION SIGHT DISTANCE	-
CA273	SAFE INTERSECTION SIGHT DISTANCE	-
CA274	TURNING MOVEMENTS	A
CA275	TURNING MOVEMENTS	-
CA280	SLOPE ANALYSIS PLAN - EXISTING	A
CA290	SLOPE ANALYSIS PLAN - PROPOSED	B
CA300	DRAINAGE CATCHEMENT PLAN	B
CA320	DRAINAGE CONCEPT MASTER PLAN	B
CA400	SEWER CATCHMENT PLAN - SHEET 1	B

CA401	EXTENDED SEWER CATCHMENT PLAN	A
CA410	SEWER CATCHMENT DETAILS	A
CA420	SEWER CONCEPT MASTER PLAN - SHEET 1	B
CA421	SEWER CONCEPT MASTER PLAN - SHEET 2	A
CA480	SEWER LONGITUDINAL SECTION - SHEET 1	A
CA481	SEWER LONGITUDINAL SECTION - SHEET 2	A
CA482	SEWER LONGITUDINAL SECTION - SHEET 3	A
CA500	WATER CONCEPT MASTER PLAN - SHEET 1	B
CA501	WATER CONCEPT MASTER PLAN - SHEET 2	A
CA601	UTILITY CONCEPT MASTER PLAN	B
CA655	PROPOSED Q100 FLOOD EXTENT PLAN	A
CA700	WATER SENSITIVE URBAN DESIGN OUTCOMES PLAN	A
CA715	TYPICAL WETLAND SECTIONS	-
CA731	RIPARIAN CORRIDOR LAYOUT PLAN	A
CA733	RIPARIAN CORRIDOR OFFSET PLAN	A
CA735	RIPARIAN CORRIDOR DETAILS	-
CA800	SOIL AND WATER CONCEPT MANAGEMENT NOTES	A
CA801	SOIL AND WATER CONCEPT MANAGEMENT PLAN -PLAN PHASE 1	A
CA802	SOIL AND WATER CONCEPT MANAGEMENT PLAN -PLAN PHASE 2	A
CA803	SOIL AND WATER CONCEPT MANAGEMENT PLAN -PLAN PHASE 3	A
CA804	SOIL AND WATER CONCEPT MANAGEMENT PLAN -PLAN PHASE 4	A

1.3 CONSULTATION

The proposed development requires the assistance of variations authorities for it to proceed:

- Queanbeyan Palerang Regional Council
- The Natural Resource Access Regulator (NRAR)
- Essential Energy
- NBN
- Roads & Maritime Services (RMS)
- Office of Environment and Heritage (OEH)
- Q-City buses
- Rural Fire Service (RFS)
- NSW Heritage

As part of the engineering design development the following consultations have occurred:

- A meeting with QPRC representatives (Charbel Sleiman, Eli Ramsland) on the 31st of July 2018 attended by Ben Cargill & Leigh Holmes (Spiire) and Geoff Bunnett (Spacelab)
- A meeting with QRPC representatives (Gordon Cunningham, Palak Patel, Brendan Belcher) on 6 September 2018 attended by Mitchell Alexander (PEET), Ben Cargill (Spiire) and Geoff Bunnett (Spacelab).
- A meeting on Site with the NRAR (David Finnimore & Bryson Lashbrook) on the 7th of November 2018 attended by Mitchell Alexander (PEET), Ben Cargill (Spiire), Leigh Holmes (Spiire), Hamish Sinclair (Spacelab), Geoff Bunnett (Spacelab), John Easthope (Spacelab), John Franklin (Soil & Water), and representative from QPRC.
- A traffic memo sent to Eli Ramsland (QPRC) regarding the proposed intersection forms with the EDE
- A meeting with the QPRC DRC on December 13 2018 attended by QPRC, Spacelab, PEET (via phone) & Spiire representative.
- A meeting with QPRC representatives (Charbel Sleiman & Dirk Jol) on December 19 2018 attended by Ben Cargill (Spiire) and Lachlan O'Rielly (Spiire)
- Additional liaison with QPRC, OEH, RFS and NSW Heritage has occurred since lodgement in 2018 to arrive at the current layout.

In addition to these formal meetings, indirect email correspondence and phone calls between parties have also been occurring.

1.4 STAGING

The development is proposed to be completed in six stages as shown on Drawing 305492CA060. We note that this is subject to change and that as part of a CC application and subsequent subdivision certificate all lots will be serviced and accessible. However, a brief description of how staging could occur is as follows:

Stage 1 is proposed to include 27 residential blocks, the sewer pump station, rising main to Lonergan Drive, water main from the Greenleigh reservoirs along the EDE, overhead electrical along the EDE, Road 01/Ellerton Drive intersection, box culvert crossing of Road 01 and other associated services.

Stage 2A is proposed to include 18 residential blocks.

Stage 2B is proposed to include 73 residential blocks, the Road 02/Ellerton Drive intersection the works within Jumping Creek, Sediment Basin 1 and Bioretention Basin 1.

Stage 3A is proposed to include 43 residential blocks, Sediment Basin 2, Bioretention Basin 2 and Valley Creek works.

Stage 3B is proposed to include 63 residential blocks, the creek realignment and associated works on Valley Creek.

Stage 3C is proposed to include the remaining 12 residential blocks, the second culvert crossing of Valley Creek and the bridge crossing at the confluence of Valley and Jumping Creeks.

2. THE SITE

2.1 LOCATION

The land proposed to be subdivided is legally described as Lot 5 DP 1199045 and is located at 28 Lonergan Drive, Queanbeyan, also known as Jumping Creek. From herein the land proposed to be subdivided will be referred to as the Site. The Site is approximately 3 km south east of the Queanbeyan City Centre and provides a total area of 94.50 Ha. The Site is surrounded by undeveloped land to the north east and Ellerton Drive Extension and Greenleigh Estate low-density residential development to the North West.

The Site is vacant but contains the remnant mine Sites and associated dispositions of spoil and mining activity debris. The Site also contains a sheep dip. The proposed access is from the Edwin Land Parkway/ Ellerton Drive Extension while pedestrian access from Greenleigh is via an Ellerton Drive Extension underpass. The Site also includes several heritage and indigenous sites including a Scar tree.

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There is a long history to the planning and rezoning of the Site to enable an appropriate subdivision of the land much of which is set out in the 2018 amended planning proposal prepared by the QPRC. That amended planning proposal was approved by the NSW Minister of planning and changes recorded to the QPRC LEP 2012 on 23 November 2018.

2.2 THE TOPOGRAPHY, DRAINAGE AND ELEVATION

The Site falls in a number of directions, ultimately arriving at the two creek lines that discharge into the Queanbeyan River. The existing slopes on the site are shown on Drawing 305492CA280 (based on existing site survey). From this drawing there are a number of areas that are naturally steeper than 20% and this has guided the extent of the developable area.

The existing Site is heavily eroded due to years of neglect and is covered in significant areas of non-native vegetation. This is particularly evident along the creek corridor that has become overgrown with weeds and non-native vegetation mixed with a number of dumped car bodies and other items. Extensive work is required to remediate the site, particularly along the creek lines to bring it back to an acceptable standard.

Further information on the drainage for the site can be found in the Stormwater Strategy Management Report in Appendix D.

3. DEPARTURES FROM DESIGN SPECIFICATIONS

The following table outlines departures from the QPRC design specifications.

Table 1: Departures from QPRC Design Specifications

Design Specification	Rule/Criteria	Reason for Departure
D1.07.5	Access Street Kerb type flush or layback	The Streets have all be designed for a design speed of a local street and as such it is proposed to use upright kerb throughout the Estate
D1.07.5	Minimum verge width 5.0m	As discussed in a meeting with QPRC it is proposed to adopt 5.0m verges on the residential side of the road but adopt narrower verges where they do not front residential properties and the services do not require 5.0m. This is in accordance with D1.14.06 but contradictory to D1.14.11
D1.14.10	Cul-de-sac length to be less than 150m	Road 004 is approximately a 190m long cul-de-sac with residential development on one side. Whilst it is in excess of the 150m required by QPRC it is still compliant to the complete planning for bush fire protection 2006 that does not permit dead ends in excess of 200m and must have a minimum 12m radius turning circle.
D4.11.2	Subsoil location	We request the subsoil location to be in front of the kerb as shown in Figure D4.1 as this will provide a superior drainage interface with the granular pavements.
D7.21.10	Pollutant Retention Targets	As discussed in the meeting with QPRC on December 19 2018 we propose to not meet all the targets required under this table and instead meet Industry Best Practice (described further in the stormwater report in Appendix D).
D11.06.6	Water services perpendicular with the mains	It is proposed for some services to not be perpendicular with the mains as the geometry of the estate, due to the topography, involves a number of curves. The services are proposed to be as close to perpendicular as possible but given they will be on a radius perpendicular can't be achieved as well as 1m off the side boundary.

Design Specification	Rule/Criteria	Reason for Departure
D11.07.1(b)	Limiting the number of dwellings isolated during a shutdown	It is proposed to have only a single main crossing of the stormwater culverts across the creek. Whilst isolation valves will be provided elsewhere to limit affected residents during a shutdown if there is a burst in this section of the main a larger number of residents will be affected.
D12.06.1	Design requirements	The Design requirements are as per correspondence with QPRC attached in Appendix B
D12.07.5	Curved sewers	It is proposed to adopt curved sewers, using pipe deflection at the joints for some sewer mains. The reason for this is due to the geometry of the estate, which has been driven by the topography of the land. The length of curved sewers will be minimised but is necessary in some locations.
D12.20.07	Packaged Pump Units requiring concurrence from QPRC	It is proposed to use a package pump station for Jumping Creek.
Annexure D12-B	Sewer Design Requirements	The design has been undertaken in accordance with the previous version of D12, WSA02 and correspondence with QPRC in Appendix B.
D13.05.7	Maximum Splay	It is proposed to construct driveways such that they are 1m distance from the side boundary which may result in them not being perpendicular to the kerb where there is a curved road.

4. TRAFFIC ANALYSIS AND ROAD HEIRARCHY

A traffic study has been undertaken for the Site to verify all traffic generated by the development can be absorbed into the surrounding road network.

The traffic study has been undertaken by AECOM, a copy of this report, *Jumping Creek Subdivision, Traffic Impact Assessment 25-Jan-2019,* can be found in Appendix A. It should be noted that the traffic report is based on a higher yield (233) than the current layout (218) but no change to the design is proposed due to the lower yield number.

4.1 ROAD HEIRARCHY

Interconnecting roads are proposed as part of the development, comprising of local streets.

The street typologies are compliant with the carriageway width of the QPRC design specification D1 but has varying verge widths from minimum 2m to 5m cater for services. Departure from this verge width on non-residential sides of the streets was discussed with QPRC in the meeting that occurring on 19 December 2018.

4.2 TRAFFIC GENERATION & DISTRIBUTION

Traffic generation has been assessed by AECOM and it has been estimated that the development with generate a total of 2,330 additional movements, 10% of which will occur during the AM peak.

The trip distribution assigned to the development was determined using the 2016 Australian Bureau of Statistics (ABS) journey to work data. Karabar was taken as the closest suburb to estimate the trip distribution. This analysis found that the destination of work for car drivers from Karabar is split between key areas within Queanbeyan and the ACT as follows:

- Belconnen 3%
- City North and South Canberra 51%
- Gungahlin 3%
- Woden/Tuggeranong 12%
- Queanbeyan 22%
- Queanbeyan/Karabar 9%

4.3 INTERNAL ACCESS

Based on the traffic generation of 2,330 additional movements and a split of 80% and 20% between the two intersections all of the internal roads will have an Average Annual Daily Traffic (AADT) volume of less than 1,000 vehicles per day. Based on the QPRC design specification D1 streets within the development will therefore be Access Streets or Local Streets. Given the only difference between an Access Street and a Local Street is the design speed, all streets within the development comply with the QPRC design guidelines for a local street.

4.3.1 LOCAL STREET

The cross section for the local streets, shown on Drawing 305492CA120 & CA121, demonstrates that the requirements of the QPRC Design specification have been met, with the exception of the verge width. The verge widths are minimum 5.0m (as required by the specification) where they front residential lots, but have been reduced where they abut open space. Enough space has been left within the narrower verge for the provision of the required services. It is proposed to further develop these at detailed design.

The design parameters for the local streets are as follows:

- Design Speed – 40km/h
- Min. K value = 3.5 except where the design speed is unlikely to be achieved (intersections and 90 degree bends)
- Minimum vertical curve
    - Intersections = 6m
    - Elsewhere = 25m
- Absolute Maximum & Minimum Grades
    - Road 001 = 8% and 0.5% respectively
    - Elsewhere = 16% and 0.5% respectively
- Desirable Maximum & Minimum Grades
    - Road 001 = 8% and 0.5% respectively
    - Elsewhere = 12% and 1% respectively

4.4 EXTERNAL ACCESS

As part of these works two intersections are proposed with the Ellerton Drive Extension to facilitate safe ingress and egress from the Site.

The southern intersection is proposed to accommodate for all traffic movements, whilst the northern intersection is proposed to be a left in left out only. It is important to note that the northern intersection is provided to address bushfire requirements to have two egress points from the Site and is not required due to traffic generation.

Spiire has undertaken the geometric design of the intersections (Drawing 305492CA270 & 305492CA271) and have engaged AECOM to undertake the traffic analysis for the development based on a yield of 233 dwellings. It should be noted that the development is now only 218 dwellings, but as there is no proposed changes to the intersection configurations the report has not been amended to reflect the lower number.

4.4.1 EXISTING CONDITIONS

Based on the drawings provided by QPRC for the entire length of the Jumping Creek Estate the existing conditions are as follows.

- A 3.5m southbound travel lane
- A 2.5m shoulder/bicycle lane adjacent the southbound travel lane
- A 3.5m northbound travel lane
- A 3.5m northbound overtaking lane
- A 2.5m shoulder/bicycle lane adjacent the northbound travel lane
- A 2.5m shared path approximately 1.5m from the edge of the northbound travel lane
- A 3.6% grade heading uphill in the northbound direction

4.4.2 PROPOSED CONDITIONS

The proposed layouts have been designed to minimise the impact to the existing Ellerton Drive Extension design that is currently under construction whilst accommodating for future traffic volumes safely.

The proposed intersections have been designed to the following standards:

- Austroads Guide to Road Design – Part 3
- Austroads Guide to Road Design – Part 4
- Austroads Guide to Road Design – Part 4A
- RMS Supplements to Austroads Part 3, 4 & 4A

The design vehicle for both intersections was the 12.5m single unit truck and both intersections are proposed to be lit to the same category as the rest of the EDE (V3) from the commencement of the right turn lane into Jumping Creek from the south to the start of the left turn lane into Jumping Creek from the north. These lights are proposed to be set back 1.7m from the road shoulders.

Southern Intersection

The southern intersection is proposed to cater for the following movements:

- Left turn from Jumping Creek heading south
- Right turn from Jumping Creek heading north
- Right turn from the northbound direction of the EDE into Jumping Creek
- Left turn from the southbound direction of the EDE into Jumping Creek

To achieve each of these movements it is proposed to construct a seagull intersection at approximately chainage 3040m as shown on Drawing 305492CA270.

To achieve the right turn into the estate from the northbound carriageway it is proposed to construct a concrete median to the start of the existing overtaking lane and introduce a deceleration lane into the development. The overtaking lane would be altered to commence after the intersection with the Estate. This was chosen over introducing another lane in the

northbound direction to avoid conflict with northbound vehicles using the right hand lane to overtake and northbound vehicles using the right hand lane to turn into the Estate.

The absolute minimum distance for an overtaking lane on grades less than 8% in AUSTROADS is 450m with a desirable minimum of 650m. With the removal of the first 200m over the overtaking lane there is still in excess of the desirable minimum length for overtaking. Following conversations with QPRC this excess length was deliberate.

The design parameters for each of the movements are as follows (the following values, where applicable, have been adjusted for an upgrade or downgrade of 3.6%):

Right turn from the northbound direction of the EDE into Jumping Creek

Through lane width = 3.50m

Turn lane width = 3.5m

Deceleration length = 90m

Length of Parallel Deceleration Lane = 65m

Physical Taper length = 25.0m

Storage length = 15m

Design Speed = 80km/h

Left turn from the southbound direction of the EDE into Jumping Creek

Through lane width = 3.50m

Turn lane width = 3.5m

Deceleration length = 120m

Length of Parallel Deceleration Lane = 95m

Physical Taper length = 25m

Storage Length = 15m

Total length of Auxiliary Lane = 135m

Design Speed = 80km/h

Left turn from Jumping Creek heading South

Design Speed = 90km/h

Initial Safe Intersection Sight Distance (SISD) = 214m

Grade Correction (-3.6%) = 11m

SISD required = 225m

Northern Intersection

The northern intersection is proposed to cater for the following movements:

- Left turn from the southbound direction of the EDE into Jumping Creek
- Left turn from Jumping Creek heading south

To achieve each of these movements it is proposed to construct a left in left out intersection at approximately chainage 2860m, as shown on Drawing 305492CA270.

The design parameters for each of the movements are as follows (the following values, where applicable, have been adjusted for an upgrade or downgrade of 3.6%):

Left turn from southbound direction of the EDE into Jumping Creek

Through lane width = 3.50m

Turn lane width = 3.5m

Deceleration length = 120m

Length of Parallel Deceleration Lane = 95m

Physical Taper length = 25m

Storage Length = 15m

Total length of Auxiliary Lane = 135m

Design Speed = 80km/h

Left turn from Jumping Creek heading south

Design speed = 90km/h

Initial SISD = 214m

Grade correction (-3.6%) = 11m

SISD required = 225m

Following initial conversations with QPRC, given this access will not be gated, the subdivision layout was amended to discourage the use of this intersection given its' proximity to most lots. The revised layout successfully discourages use of this intersection in lieu of Road 001, and these volumes are reflected in the traffic report.

4.4.3 TRAFFIC

A traffic study for the proposed development was undertaken by AECOM in January 2019.

The traffic study includes traffic generations based on trip rates from the QPRC specification D1 as well as some commentary on more widely adopted numbers. The objectives of the traffic study were to assess the anticipated transport impacts of the proposed development including consideration of:

- Existing traffic and parking conditions surrounding the Site
- The traffic generating characteristics of the proposed development
- Suitability of the proposed access arrangement for the Site
- The transport impact of the proposed development proposal on the surrounding road network

The conclusions of this report were as follows:

- The proposed subdivision is expected to generate about 233 vehicle trips in peak hours (please note this was based on a higher yield that what is currently proposed, being 218, however no change to the intersection design is proposed)
- SIDRA modelling indicates that the proposed access arrangements are appropriate to accommodate the future forecast volumes
- The accesses are designed to assist safe traffic operation, with adequate safe intersection sight distance (SISD) and deceleration/acceleration lanes. The design and relatively low volumes will mean that these intersections will have negligible impact on the operation of Ellerton Drive Extension.

4.5 PUBLIC TRANSPORT

The traffic report prepared by AECOM indicates there are no public transport routes in the direct vicinity of the Site. The closest existing bus route is the bus 837, which travels between Queanbeyan and Googong via Old Cooma Road. There is also a route 839, which travels between Queanbeyan Interchange and Karabar via Baracks flat, as shown in the figure below.

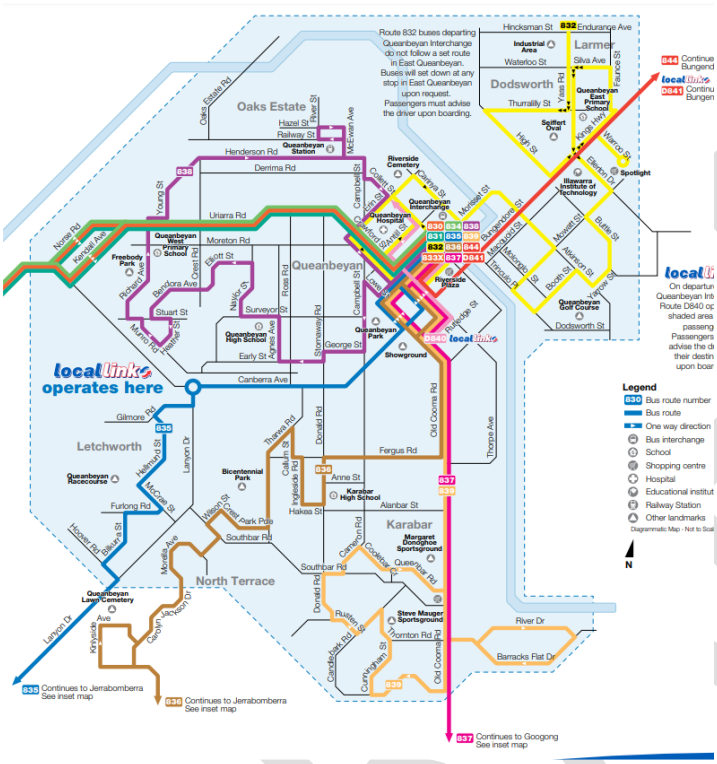


Figure 1 Queanbeyan Bus Network Map

As part of the development application process, and as required clause D1.21 in the QPRC design specifications we have made contact with QCity regarding a bus route within the development. It is proposed to utilise Road 01 until the roundabout with the intersection with Road 12 as the bus route, with turning at the roundabout designed for a 12.5m SU truck.

It is also possible for bus stops can be located so that no more than 5% of residents should have to walk in excess of 400 metres to catch a bus. The road has been designed in accordance with Table D1.6 for a local street and has the following characteristics:

- Carriageway 9.0m, therefore no requiring an indented bay
- Bus stop spacing 400 metres
- Maximum longitudinal gradient of 8%

A copy of the proposed bus route is shown on Drawing 205492CA240.

4.6 TURNING MOVEMENTS

Turning movements for the proposed development are shown on Drawings 305492CA250-253, CA274 & CA275

These movements demonstrate the following:

- The 12.5m design vehicle can turn at intersections between streets using the entire pavement area
- The 12.5m design vehicle can undertake a 3-point turn to navigate the cul-de-sac turning heads. It is noted that the cul-de-sac head is not a large as the QPRC design specification requires, but 15.0m is deemed to be excessive given the circumstances.
- The 12.5m design vehicle can successfully traverse the two round-abouts
- Two 12.5m design vehicles can pass each other on the 9.0m carriageway road.
- Minimum kerb return radius' of 8m has been achieved

4.7 PARKING

Parking is proposed to be within the carriageway as permitted within the QPRC design specification D1. At detailed design stage appropriate signage will be installed where required to control parking.

4.8 STREET LIGHTING

Street lighting is proposed to be provided within the road reserve, 1.7m from the back of the kerb in accordance with AS/NZS 1158 as shown on Drawings 305492CA120 & CA121

The street lighting columns are proposed to be frangible in accordance with QPRC design specification D1.34.

The design of the streetlights are proposed to be undertaken at the detailed design stage.

5. CYCLING AND PEDESTRIAN ACCESS

A 1.5m footpath has been allowed for on one side of all roads within the development as required by QPRC design standards. The footpath network can be seen on Drawing 305492CA160 – CA167.

In addition to the internal 1.5m footpaths a 2.5m shared path has been provided for on the Northern side of the Ellerton Drive Extension (by others). This shared path utilises a pedestrian underpass installed as part of the EDE to access the Jumping Creek Estate. It is proposed to connect to this shared path via connecting the internal 1.5m paths to the underpass.

An on road cycle lane has also been provided for (by others) within the shoulder of the Ellerton Drive Extension. No on road cycle, or shared bike paths are proposed within the Jumping Creek Estate.

6. SEWER MASTER PLAN

6.1 EXISTING SEWER INFRASTRUCTURE

The existing sewer infrastructure within the vicinity of the Site includes:

- A 150mm main services part of the Greenleigh Estate adjacent Lonergan Drive
- A 600mm trunk main servicing Karabar and Greenleigh and the end of the Beston Place

6.2 PROPOSED SEWER INFRASTRUCTURE

The proposed sewer infrastructure can be seen on Drawing 305492CA400 – CA481. It is proposed to construct a sewer pump station that will then transfer the estates sewerage via a rising main to a receiving gravity manhole in Lonergan Drive. It will then transition via gravity until it connects to the 600mm trunk main near Beston Place. It is proposed that an existing section of the 150mm main along the Queanbeyan River is upgraded to 225mm as per correspondence in Appendix E.

The design criteria for the sewer network, following consultation with QPRC and as per email correspondence on 30th October 2018 (a copy of which is included in Appendix B) has been designed in accordance with WSA02 2014-3.1 Appendix C and is as follows:

Sewerage Flows

Design Criteria	Value	Source
EP/Lot	3.5	WSA02
ADWF	210 L/EP/d	QPRC
PDWF	d x ADWF	WSA02
d	d = 0.01(log A)4 – 0.19(log A)3 + 1.4(log A)2 – 4.66log A + 7.57	WSA02
GWI	$0.025 \times A \times Portion_{wet}$	WSA02
Portion Wet	10%	QPRC
A	Gross Plan area of developments catchment in hectares	WSA02
RFI	0.028 * Aeff * C * I	WSA02
A_{eff}	$A \times (Density/150)^{0.5}$ for density < 150 EP/Ha	WSA02
Density	Total EP/gross hectares	WSA02
C	1.0	QPRC

I	$I_{1,2}$ x F_{size} x $F_{containment}$	WSA02
$I_{1,2}$	22.4 (2016IFD tables with 0.5EY)	QPRC
F_{size}	$(40/A_{eff})^{0.12}$	WSA02
$F_{containment}$	1.5	WSA02
C	1.0	QPRC
RDI	.028 * IIF x C x A_{eff}	
Material	PVC-U	QPRC
Sewer Pump Station Design		
Pump Rate	19.3L/s	QMax
Pump Control Volume	1,737 Litres	QMax
Pump Starts/Hr (S)	<10	QMax
Detention Time (T)	< 2 hours	QMax
Emergency Storage	8 hours x ADWF	QMax
Sewer Rising Main		
Flow Equation	$h = 10.67\ q^{1.85} / (c^{1.85}\ dh^{4.8655})$	QMax
Friction Factor	140	QMax
Minimum velocity	0.7m/s	QMax
Maximum velocity	3.0m/s	QMax
Material	Ductile Iron Concrete Lined	QPRC

As part of the detailed design for the gravity sewer network we will be proposing the use of curved sewers using pipe deflection to the minimum radius as per the manufacturer's requirement (300 x nominal pipe diameter) to minimise the amount of manufactured bends in the network. Due to the natural topography of the land the street layout has resulted in a number of bends so achieving straight lengths of pipes is not possible. We note this requires approval from QPRC, and as such we are requesting approval for this.

As part of the detailed design for the sewer rising main we will be proposing to deflect the pipe as per the manufacturer's requirements at the joints along Road 001. The exception to

this is between S17 & S18 as shown on Drawing 305492CA420 where manufactured bends (approximately four 11.25 degree) will be required.

It is proposed to construct a proprietary pump station as part of the Jumping Creek development. As part of the development application process we liaised with QMax on a conceptual pump station and rising main design, as we understand they have done a number of systems for QPRC. Based on the indicative numbers (to be refined at detailed design) they have proposed the following:

Pump Station

- Wet well diameter = 3.2m
- Valve chamber = Integral 1250D
- Wet Well Depth = 8.49m (to be confirmed at detailed design)
- 8 hours Emergency Storage – provided for in wet well at 53.43m3
- Nominal Pump Rate = 17.5 L/s
- Velocity at Pump Rate = 1.90m/s
- Pump Run time = 90 seconds
- Pump starts per hour = 8.69
- Internal Pipework – Stainless Steel
- Pump = FLYHT a Xylem Brand NP3153SH3-273

Rising Main

- Material – DICL
- Nominal size = 150mm
- Total length = 1063m
- Total Head = 34.13

A conceptual plan of a pump station and pump for Jumping Creek provided by QMax can be seen in Appendix F. It is proposed to further develop the design with QMax should the development proceed.

7. WATER SUPPLY MASTER PLAN

7.1 EXISTING WATER SUPPLY INFRASTRUCTURE

The existing water infrastructure within the vicinity of the Site includes:

- A 150mm main at the end of Lonergan Drive
- A 375mm main along the alignment of the EDE

7.2 PROPOSED WATER SUPPLY INFRASTRUCTURE

As part of the DA Urban Water Solutions (UWS) were engaged to assess the impact on the existing water system for the proposed development for 221 residential units, a copy of which can be found in Appendix C. It is noted that the water supply is based on a yield in excess of the final yield number (221 as opposed to 218) but no change to the design is proposed due to the drop in dwellings.

A summary of the report is provided below.

The design criteria used for the assessment were as follows:

Parameter	Value	Source
Peak Instantaneous Demand	0.15L/s/Tenement	Queanbeyan Design Spec D11.05
Average Day Demand	230kL/annum/equivalent tenement = 630L/day/tenement	Queanbeyan Design Spec D11.5
Maximum Service Pressure	Maximum service pressure is 800kPa = 81.598m	Queanbeyan Design Spec D11.5
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

Parameter	Value	Source
Maximum Velocity	≤ 2m/s under general operational conditions ≤ 4m/s under fire flow conditions	WSA 03-2011 Water Supply Code C13.1.6.4
Maximum Head loss	▸ 5m head/km for ≤ DN150 ▸ 3m head/km for ≥ DN200	WSA 03-2011 Water Supply Code C13.1.6.2
Material	Series 2 PVC-M PN 16	QPRC Queanbeyan Design Spec D11
Hydrant Spacing	60m	QPRC Queanbeyan Design Spec D11
Minimum pipeline radii using joint deflection	300 x pipe diameter	iPlex Pipelines

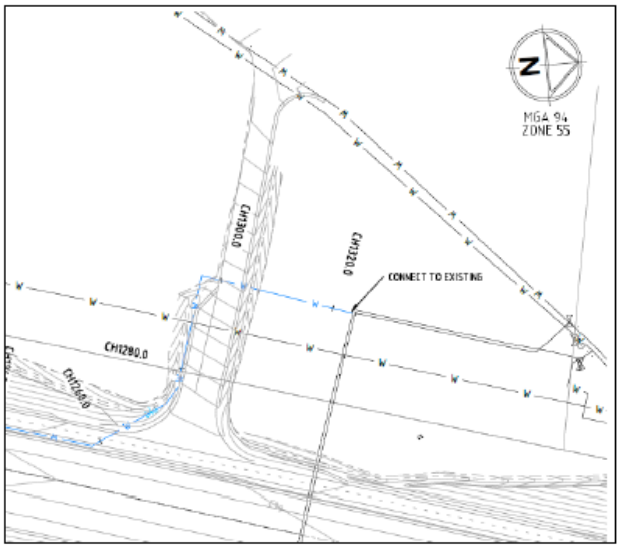
A simplified model of the QPRC network was built in InfoWorks WS from the GIS dated provided by QPRC in the email of 20th November 2018.

The boundary condition for the model is the East Queanbeyan Reservoir located on Severne Street, Greenleigh and has a base level of 686.8m and a Top Water Level of 691.4m. The water level in the reservoir was set at 60% full (as advised by QPRC) and has been included in the model as a fixed head with a water level of 689.56m AHD.

As the contours were only available for the development area the QPRC network was assumed to have the same ground level as the East Queanbeyan Reservoir.

The development was assessed connecting to the Greenleigh Reservoirs via a dedicated 200mm main supplying just Jumping Creek.

The modelling focussed on the network conditions downstream of the offtake boundary. For the purpose of the analysis the boundary condition for the offtake was assumed to be a constant head of 686.8m AD. The location is shown in the figure below:



The demands were supplied as a constant as no daily profile was provided by QPRC. The Peak Instantaneous Demand Flow (PID) and Fire Flow demands were development by applying the following scaling factors to the ADD scenario:

Scenario	Demand (L/s/Tenement)	Scaling Factor
Average Demand Flows (ADD)	0.008	1
Peak Instantaneous Demand Flows	0.150	20.6
Residential Fire Flow	0.100	13.7

Based on this is was determined that a dedicated DN200 main can supply the ADD and PID for the new development with a Pressure Reducing Valve (PRV). The predicted minimum pressures within the development exceed 20m. A notional 150mm valve with a pressure set point of 55m has been used. Using this setting all nodes are predicated to have a pressure above 40m and no node is above 81.5m (800kPa).

Correspondence with QPRC regarding the water supply can be found in Appendix B.

The proposed pipe network and pressures can be seen on Drawing 305494CA500.

7.3 RESERVOIR STORAGE

The average day demand for the estate was calculated at 148.7kL/day (236 properties x 630L/tenement/day).

No information was provided regarding the Peak Day Demand or the wider QPRC network so determining the capacity of the existing infrastructure was not possible. If it is assumed that the ADD is tripled to obtain the Peak Day scenario then the development would require 446kL of reservoir storage.

8. STORMWATER MASTERPLAN

The Stormwater Management Strategy report included in Appendix D outlines the key stormwater management and WSUD components as part of the DA for the proposed development at Jumping Creek, Queanbeyan. In addition, this report outlines the existing and proposed 1 in 100 year ARI flood modelling completed for Jumping and Valley Creeks flowing through the central area of the site.

The proposed development has been designed to convey 5 year ARI flows via a piped drainage network through the development prior to discharge into the proposed treatment measures for the site. In addition, the proposed development has been preliminarily designed to convey Gap flows (100 year ARI – 5 year ARI) through the proposed road reserves.

Detailed analysis of the maximum depth of flow of 200mm and maximum depth x velocity product of 0.4m2/s will be undertaken during detailed design and pipe sizes adjusted accordingly to comply with Council requirements.

Existing and proposed 1 in 100 year ARI flood models have been produced for the central area where Jumping and Valley Creeks converge. In order to convey 1 in 100 year ARI flows through Jumping and Valley Creeks in the central area of the development, three crossing arrangements have been proposed:

- Jumping Creek: 6 x 3000 mm x 3000mm cells (3 RBCs with 2 link slabs) with approximately 1m freeboard to the proposed road level in the 1% AEP
- Valley Creek: 5 x 2400 mm x 2400 mm cells (2 x RBCs with 2 link slabs) with approximately 1.3m freeboard to the proposed level in the 1% AEP
- Valley Creek Bridge Crossing: 19m span bridge, downstream of creek confluence

Due to the existing state of the site including the area containing existing creek network, rehabilitation of the riparian corridor is required. As part of the required creek rehabilitation, a creek diversion has been proposed to minimise short circuiting which is currently occurring due to scour and erosion, and to provide sufficient space for water quality treatment of development flows prior to discharge into the downstream network.

The proposed water quality treatment measures for the site include the following:

- 600m^2 sedimentation basin discharging into a 470m^2 bioretention basin prior to discharging into the downstream creek network to treat Catchment A
- 600m^2 sedimentation basin discharging into a 520m^2 bioretention basin prior to discharging into the downstream creek network to treat Catchment B
- Gross pollutant trap to treat minor Catchment C (1.7ha) flows

The entire report can be found in Appendix D.

9. UTILITIES

Underground shared trenching for electricity and telecommunications is proposed for the development within a common trench.

9.1 GAS

Gas has not been allowed for within the development following consultation with Jemena that it is not feasible to provide gas to the Site. A copy of this correspondence can be found in Appendix E.

9.2 NBN

NBN has confirmed that it can service the development from via connecting to the existing network at the end of Lonergan Drive. A copy of this correspondence is included in Appendix E.

9.3 ELECTRICITY

Essential Energy has confirmed that they can service the development via the following:

- Install substations assuming 6kVA per lot (as there is no gas)
- Install a linked UGOH connection on pole CE182421 to supply the padmount substations. Install a 3C 11kV 240mm cable from pole CE182421 to the first padmount substation
- To provide a HV ring from the last substation in the subdivision install a HV cable north inside the road reserve of the EDE. Install midspan poles between CE182333 and CE182334 relocating fuses 33-F10974 to pole CE182334 and upgrade the conductor between poles CE182333 and CE182334 to 7/4.50AAAC

More detailed advice on how the proposed development will be serviced with electricity can be found in Appendix E.

The electrical and communications will be provided via services in a common trench.

10. SITE RE-GRADING

10.1 EXISTING SLOPE

As shown on Drawing 305492CA280 the existing slope of the proposed developable area is predominantly 0 – 15% but includes isolated sections that are 15-25%. To the edge of the proposed standard residential lots the slopes increase to in excess of 25%.

10.2 PROPOSED SLOPE

As shown on Drawing 305492CA290 the proposed slope of the development is predominantly 0 – 15% with isolated sections that are 15-20%. As can be seen from the plan no residential lots has slope that is in excess of 20%. There are some areas within the Estate where the proposed slope (not existing) exceeds 25%. In these instances retaining walls or 1:1 rock batters will be proposed as part of detailed design.

10.3 SITE GRADING

As shown on Drawings 305492CA200 to 305492CA207 re-grading is proposed across the majority of the Site.

Whilst the amount of cut/fill has tried to be minimised the secondary connection point with the EDE (Road 002), has resulted in significant fill to this area of the development. The level of the EDE was fixed by others, and the requirement for a secondary egress for bushfire could not be avoided. Keeping a reasonable intersection spacing has resulted in the location of the Road 002/EDE intersection. Road 003 has been graded to 14% (just under of the absolute maximum percentage in accordance with Table D1.1), and designed with appropriate vertical curves, k values and site distances which has then driven the starting point for Road 003. Working back up the hill from the existing creek level, allowing for discharging of stormwater pipes has then created the level of Road 001 and Road 011. As a result there are isolated pockets of deep fill to ensure no trapped low points.

The remainder of the Site incorporates cut/fill that is in the order of 1-2m, with the exception of some isolated areas. Retaining walls/1:1 rock batters will be proposed as part of detailed design in isolated locations to prevent excessive batter spill but as a rule avoiding walls was the preferred result so as not to over engineer the outcome.

The current cut/fill balance (no boxing) is as per the table below:

Cut (m3)	212,000
Fill (m3)	486,000
Balance – Import (m3)	274,000

11. SEDIMENT AND EROSION CONTROL

As required by QPRC a concept sediment and erosion control strategy (ESC) plan has been prepared for the site and is shown on Drawings 305492CA800 to 305492CA804.

Due to the close proximity to the creek, and works in the creek, it will be imperative that appropriate measures are adopted to ensure that sediment does not wash into the waterway.

A final sediment and erosion control management plan (ESCMP) will be prepared by the Contractor as part of the Construction Management Plan (CMP) prior to commencement on site. The ESCMP will be in accordance with *Managing Urban Stormwater, Soils & Construction March 2004*.

The ESC concept strategy aims to minimise the extent of disturbed area, whilst maximising the size of the sediment basins to maximise the effectiveness of the controls. Each of the sediment basins have been indicatively sized for the 90th percentile event in accordance with Managing Urban Stormwater, Soils & Construction.

Values used for indicative sizing are below:

Parameter	**Value**	**Source**
5-day rainfall depth, 90th percentile. (R)	33mm	(Section 6, Table 6.3a Bluebook Volume 1).
R-Factor (Rainfall Erosivity).	1750	(Map 12, Appendix B Bluebook Volume 1)
Sediment Type.	Type D and F	(Table C24, Appendix C Bluebook Volume 1)
Soil Hydrological Group.	Group B and C	(Table C24, Appendix C Bluebook Volume 1)
Runoff Coefficient (Cv)	0.51 (For rainfall depth 33mm and worst case soil group C)	(Table F.3, Appendix F Bluebook Volume 1)
Settling Zone Volume (m^3)	10 * C_v * R * A	(J.4, Appendix J Bluebook Volume 1)
Sediment Storage Zone Volume (m^3)	Settling Zone Volume * 0.5	(J.4, Appendix J Bluebook Volume 1)

Parameter	Value	Source
Total Volume	Settling Zone Volume (m^3) + Sediment Storage Zone Volume (m^3)	(J.4, Appendix J Bluebook Volume 1)

	Basin A	Basin B	Basin C	Basin D
Scaling Factor		10		
R (mm)		33		
Cv		0.51		
Disturbed Area (Ha)	6.1	24.1*	19.3	1.7
Settling Zone Volume (m^3)	1,027	4,056	3,248	286
Sediment Storage Zone Volume (m^3)	514	2,028	1,624	143
Total Volume (m^3)	1,541	7,625**	4,872	429

*Disturbed Area for Basin B = 8.6 Ha, however the basin is servicing the upstream catchment which runs through the site during phase 3 of construction.

**Basin $B_{(total)}$ = Basin $A_{(total)}$ + Basin $B_{(SZV)}$ + Basin $B_{(SSZV)}$

The concept strategy consist of four phases. These four phases have been designed in conjunction with the Bluebook Volume 1 and the following standard drawings:

Bluebook Volume 1 – Standard Drawings

SD 5-4	Rock Check Dams
SD 5-5	Earth Bank (Low Flows) Diversion Drain
SD 5-6	Earth Bank (High Flows) Cut off Drain
SD 6-4	Earth Basin – Wet (sediment type D & F)
SD 6-7	Hay Bales
SD 6-8	Silt/Sediment Fence

The four phases are as follows:

- Phase 1: Drawing 305492CA801
  - Only strip the area associated with Stage 1 blocks
  - Construct Basin A, (1,541 m^3) upstream of the existing overland flow path.
  - Separate Stage 1 from the overland flow path underneath Ellerton Drive Extension via a catch drain to direct water towards the sediment basin
  - Install silt fences in at the downstream slope of disturbed areas
  - Utilise the natural grass buffers that exist to the west and east of the cul-de-sac to treat stormwater in these areas due to the steepness of the terrain
- Phase 2: Drawing 305492CA802

  It should be noted that this phase involves work within the creek and sediment controls cannot be designed for all storm events. To minimise the risk of sediment in downstream

waterways this phase of works minimises the extent of works to the absolute minimum required to complete.

  - Only undertake works within Jumping Creek and Valley Creek (including the realignment)
  - Construct two sediment basins B and C (7,625 m^3 and 4,872 m^3 respectively) and cut of drains directing water to these basins either side of the works to capture the 90th percentile flows (clean) before they reach the area of works. This water will be pumped downstream of the works once the rain ceases (won't need treatment)
  - Install rock check dams in accordance with the standard drawing to slow the velocity of water coming through the site
  - Install hay bales within the creek corridor downstream to catch sediment from low flow events.
  - Separate these works from Stage 1 via a cut off drain from the Emergency Spillway of the Stage 1 sediment basin to the downstream end of the creek works
  - Divert the clean water running coming from Ellerton Drive Extension into the downstream end of the works via a diversion drain
  - Divert clean water coming from the south (from the island) via a diversion drain into the downstream end of the works.

- Phase 3 Drawing 305492CA803

It should be noted that as part of these works the clean water coming through the site from the other side of Ellerton Drive Extension will be treated as dirty water for the purposes of sizing the sediment basins.

  - Only strip the area of Stage 2 Civil works
  - Utilise Basin B constructed in Phase 2 downstream of the works but upstream of the works constructed in Phase 2
  - Divert the clean water coming from the North-East corner of the site around the works via a diversion drain

- Phase 4 Drawing 305492CA804

  - Only strip the area of Stage 3A, 3B & 3C Civil works
  - Utilise Basin B, C and D (7,625 m^3, 4,872 m^3 and 429 m^3 respectively) as well as diversion drains constructed in Phase 2 downstream of the works.
  - Divert clean water from the upstream catchment to the East around the disturbed area via a diversion drain.
  - Utilise the clean water diversion constructed in Phase 2 around the disturbed area of the Island.

It should be noted that it is assumed that the previous phase works are complete and stabilised prior to the commencement of the next phase with the exception of Phase 1 & 2 that could be constructed concurrently if required.

APPENDIX A TRAFFIC REPORT

Jumping Creek Subdivision

Traffic Impact Assessment

Jumping Creek Subdivision

Traffic Impact Assessment

Client: Spiire Australia Pty Ltd

ABN: 55 050 029 635

Prepared by

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Document Jumping Creek Subdivision

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Prepared by Nethmei Senarath

Reviewed by Neil Graham

Revision History

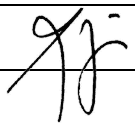
Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	08-Oct-2018	Draft	Jerome Catbagan Associate Director	
1	15-Oct-2018	Draft Final	Jerome Catbagan Associate Director	
2	17-Dec-2018	Final	Jerome Catbagan Associate Director	
3	25-Jan-2019	Final - Update	Jerome Catbagan Associate Director	

Table of Contents

Executive Summary

Spiire Australia Pty Ltd (ABN 55 050 029 635) requested AECOM Australia Pty Ltd (ABN 20 093 846 925) to prepare a traffic report regarding the Jumping Creek subdivision along the Ellerton Drive Extension. This report analyses the proposed access arrangements, safety and traffic impacts of the Jumping Creek subdivision.

The analysis in this report led to the following conclusions:

- The proposed subdivision is expected to generate about 233 vehicle trips in peak hours.
- SIDRA modelling indicates that the proposed access arrangements are appropriate to accommodate the future forecast volumes.
- The accesses are designed to assist safe traffic operation, with adequate safe intersection sight distance (SISD) and deceleration/acceleration lanes. The design and relatively low volumes will mean that these intersections will have negligible impact on the operation of Ellerton Drive.

1.0 Introduction

1.1 Background

Spiire Australia Pty Ltd (ABN 55 050 029 635) requested AECOM Australia Pty Ltd (ABN 20 093 846 925) to prepare a traffic report regarding the proposed Jumping Creek subdivision along the Ellerton Drive Extension. This report analyses the proposed access arrangements, safety and traffic impacts of the Jumping Creek subdivision.

1.2 Purpose of this Report

This report sets out an assessment of the anticipated transport impacts of the proposed development including consideration of:

- Existing traffic and parking conditions surrounding the site
- The traffic generating characteristics of the proposed development
- Suitability of the proposed access arrangements for the site
- The transport impact of the development proposal on the surrounding road network.

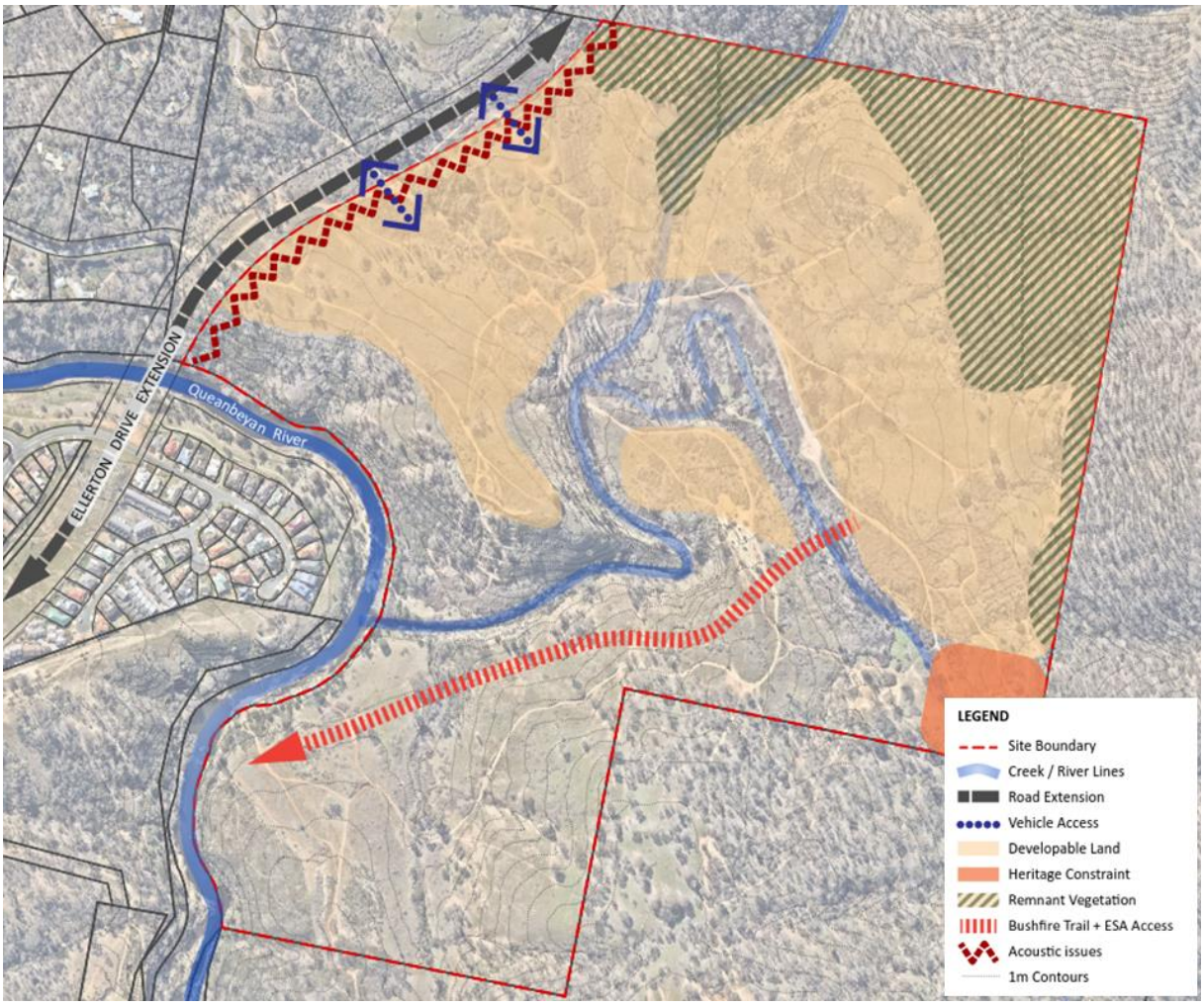
1.3 References

- RMS NSW Guide to Traffic Generating Developments (October 2002 Version 2.2)
- Traffic observations undertaken and as referenced in the context of this report
- Plans for the proposed development prepared by Spiire Pty Ltd
- *Part 3 – Queanbeyan Network Improvement Assessment Report – Appendix A* prepared by TDG, dated December 2014
- Other documents and data as referenced in this report.

2.0 Existing Conditions

2.1 The Site

The Jumping Creek site is currently undeveloped and is marked as “Developable Land” as shown in Figure 1. The main access and egress points are proposed from the Ellerton Drive Extension in Queanbeyan, NSW.



Source: SPACELAB, 2018

Figure 1 Site location

2.2 Road Network

Ellerton Drive Extension is currently under construction. The nearest existing roads that Ellerton Drive Extension will connect to will form an intersection with Old Cooma Road, Cooma Street and Edwin Land Parkway.

2.2.1 Old Cooma Road

Old Cooma Road is classified as an arterial road with a posted speed limit of 70 km/h approaching the intersection with Edwin Land Parkway. It provides connectivity to Canberra Avenue (via Cooma Street) to the north and Monaro Highway to the south. It is generally configured as a two-way road with one lane in either direction. Funding is available from the NSW Government to duplicate Old Cooma Road between Edwin Land Parkway and Googong Road.

2.2.2 Edwin Land Parkway

Edwin Land Parkway is classified as an arterial road with a posted speed limit of 70 km/h. It provides connectivity to Ellerton Drive Extension to the east and Tompsitt Drive and Lanyon Drive to the west. It is a two-way road, configured mostly as one lane heading towards the east and two lanes towards the west.

2.3 Existing Volumes

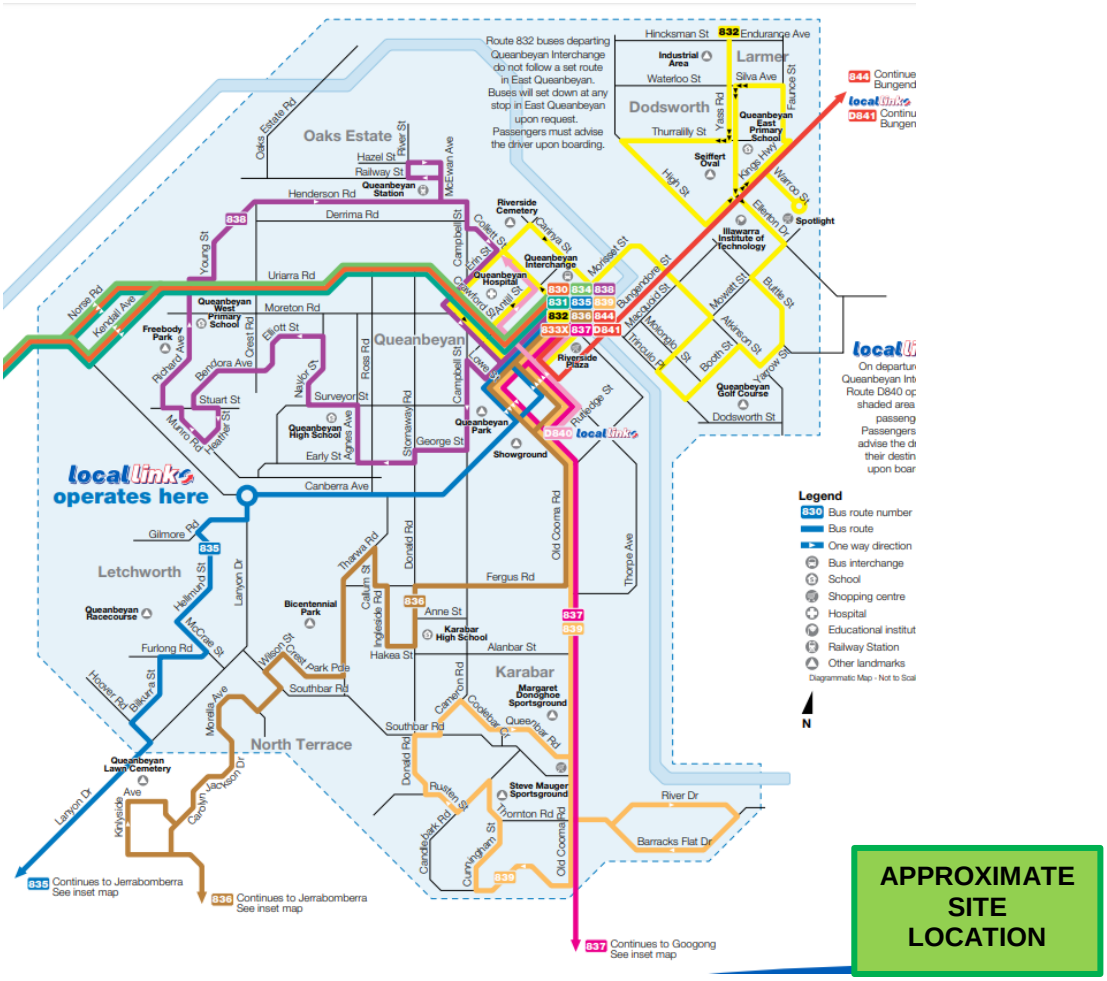
There are no existing volumes along Ellerton Drive Extension as there is no existing road infrastructure. Forecast volumes for this road are discussed in Chapter 4.0, as part of the analysis of future intersection accesses to Jumping Creek.

2.4 Road Safety

There is no record of crash history along Ellerton Drive extension as there is no existing road infrastructure.

2.5 Public Transport

As the site is currently undeveloped, there are no public transport routes in the direct vicinity of the site. The closest existing bus route is bus 837, which travels between Queanbeyan and Googong via Old Cooma Road. There is also route 839, which travels between Queanbeyan Interchange and Karabar via Barracks Flat, as shown in Figure 2.



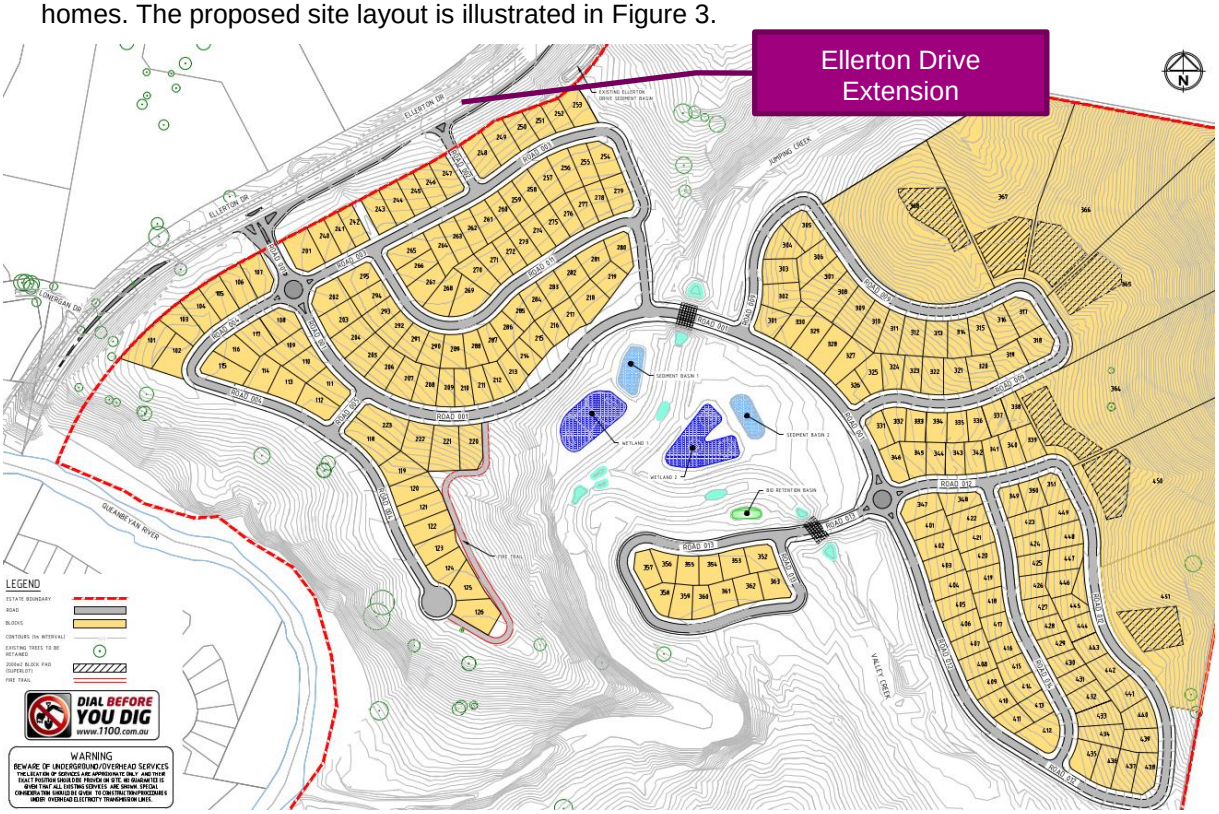
Source: QCity Transit, 2018

Figure 2 Queanbeyan bus network map

3.0 Development Proposal

3.1 Proposed Development

The Jumping Creek subdivision is a residential subdivision with 233 lots proposed for single dwelling homes. The proposed site layout is illustrated in Figure 3.



Source: Spiire, n.d.

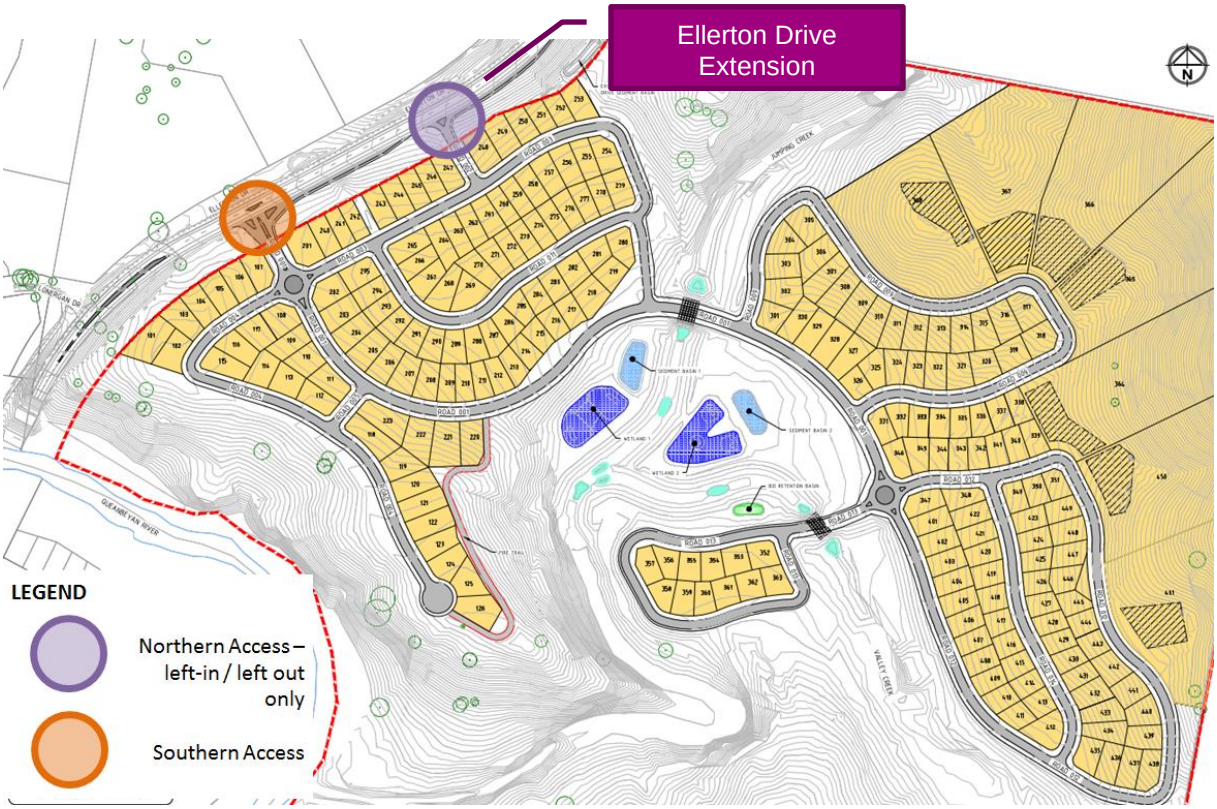
Figure 3 Proposed site layout

3.2 Vehicle Access

Two access points to the Jumping Creek subdivision are proposed from Ellerton Drive Extension as shown in Figure 4.

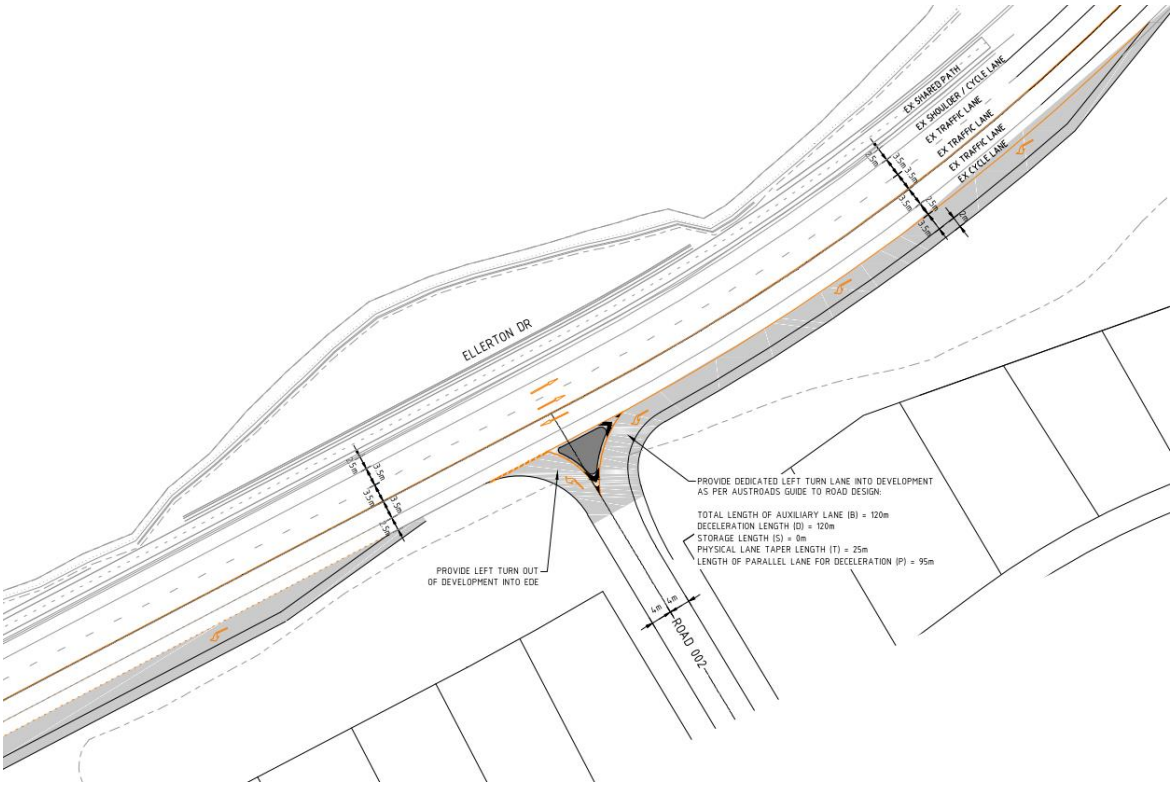
The nominated configuration for the northern access allows for a left in/left out movement and is primarily a secondary emergency egress, as shown in Figure 5.The proposed configuration for the southern access provides connectivity to Ellerton Drive extension for all traffic movements. A right-turn lane into the development and a protected lane for right-turns out of the development are proposed (Figure 6). Both access points will be priority controlled.

Part of the overtaking lane on Ellerton Drive is used to develop a protected right turn out of the southern access. The overtaking lane is about 1,250 m in length, including tapers, and is in excess of the desirable 850 m even with the protected right turn lane.



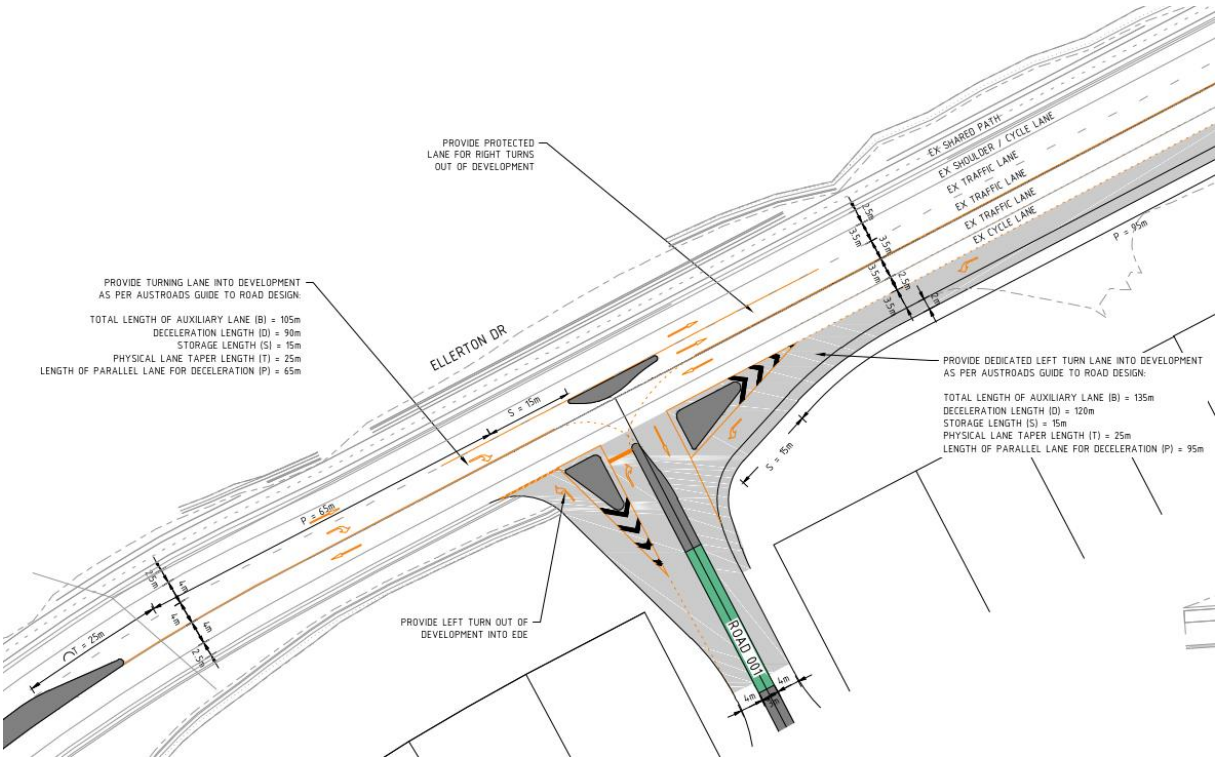
Source: Spiire, n.d.

Figure 4 Jumping Creek Subdivision access points



Source: Spiire, n.d.

Figure 5 Proposed northern access configuration



Source: Spiire, n.d.

Figure 6 Proposed southern access arrangement

3.3 Safety

The Ellerton Drive intersections have been designed for a posted speed limit of 80 km/h. Adequate safe intersection sight distance (SISD) is available at both proposed intersections compared with desirable sight distances indicated in AS2890 and *Austroads Part 4: Un-signalised and Signalised Intersections*. Adequate provision has also been provided for deceleration lanes on Ellerton Drive. In addition, an acceleration/merge lane is to be provided for right turns from the southern access onto Ellerton Drive, providing safe storage to allow a two-stage right turn.

The accesses are designed to assist safe traffic operation. The design and relatively low volumes will mean that these intersections will have negligible impact on the operation of Ellerton Drive. The design for the southern access shown in Figure 6 is satisfactory for the low volumes here and not having a median to separate turning traffic at the southern access is consistent with the rest of Ellerton Drive. Importantly, it is understood that the intersection will be well lit to assist safe operation at night.

4.0 Impact of the Development

4.1 Traffic Generation

The weekday peak hour vehicle trip rate for standard residential lots is 0.85 vehicles per dwelling, according to the RTA (now RMS) Guide to Traffic Generating Developments. A conservative estimate of 1 trip per dwelling in the peak hour has been applied. With 233 lots proposed, this equates to 233 vehicular trips in the peak hour.

The AM and PM peak hour traffic volume forecast on Ellerton Drive Extension was taken from *Part 3 – Queanbeyan Network Improvement Assessment Report – Appendix A* prepared by TDG, dated December 2014. Two-way peak hour 2031 forecast volumes are 613 vehicles per hour (vph) and 922 vph, for the AM and PM peak hour respectively.

4.2 Traffic Distribution

Trip distribution assigned to the adjoining road network was determined using the 2016 Australian Bureau of Statistics (ABS) journey to work data. Karabar was taken as the closest suburb to estimate trip distribution. This analysis found that the destination of work for car drivers from Karabar is split between key areas within Queanbeyan and the ACT as follows:

- Belconnen 3%
- City North and South Canberra 51%
- Gungahlin 3%
- Woden/Tuggeranong 12%
- Queanbeyan 22%
- Queanbeyan / Karabar 9%

The assumed inbound/outbound directional splits for trips to and from the Jumping Creek estate is summarised in Table 1. The splits were based on that recommended for a single residential dwelling in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th edition.

Table 1 Inbound / outbound splits

Land Use	Peak	Inbound	Outbound
Residential	AM	25%	75%
	PM	65%	35%

The assumed split of traffic between the northern and southern accesses was 20% and 80%, respectively. This traffic was distributed to Ellerton Drive Extension in accordance with the work destination proportions found above, resulting in the traffic forecasts shown in Figure 7 and Figure 8.

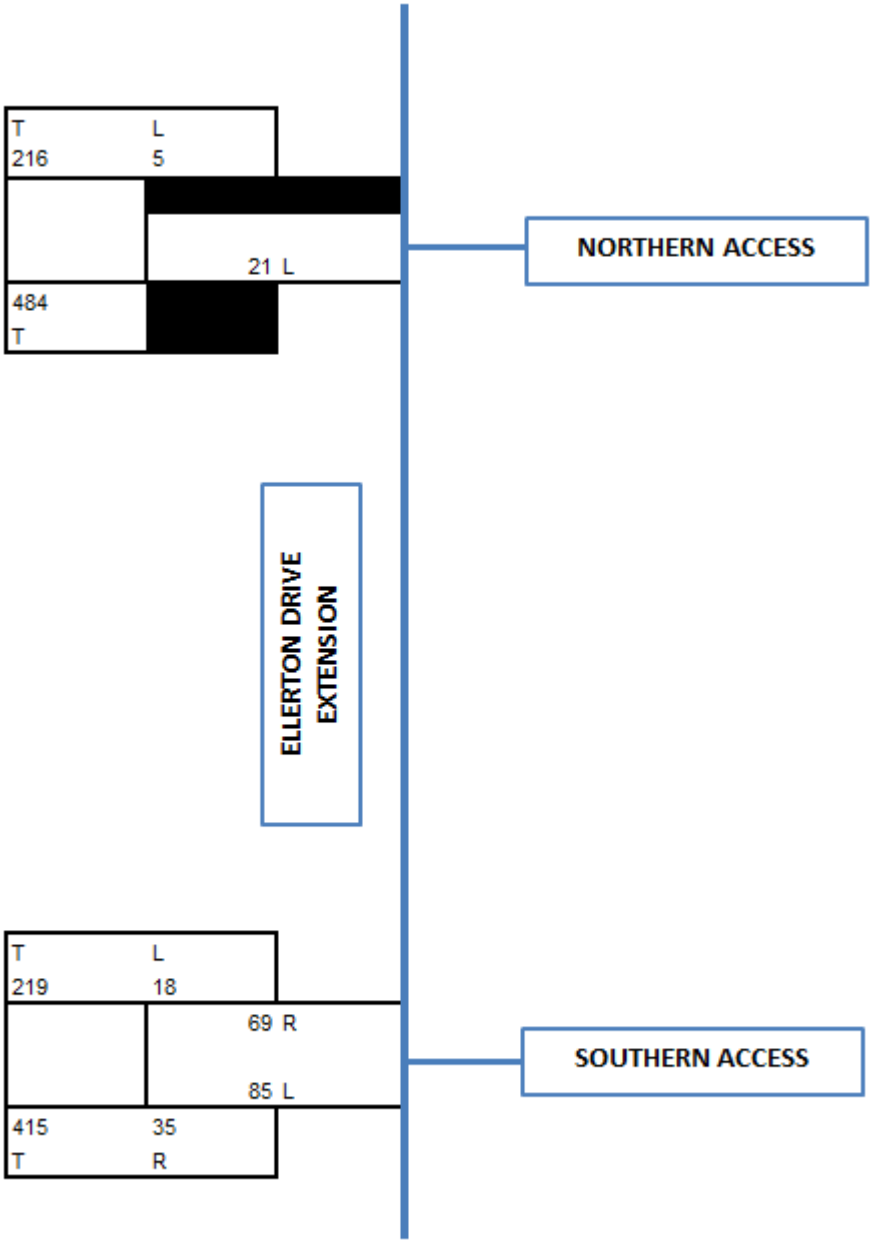


Figure 7 Future AM network forecast

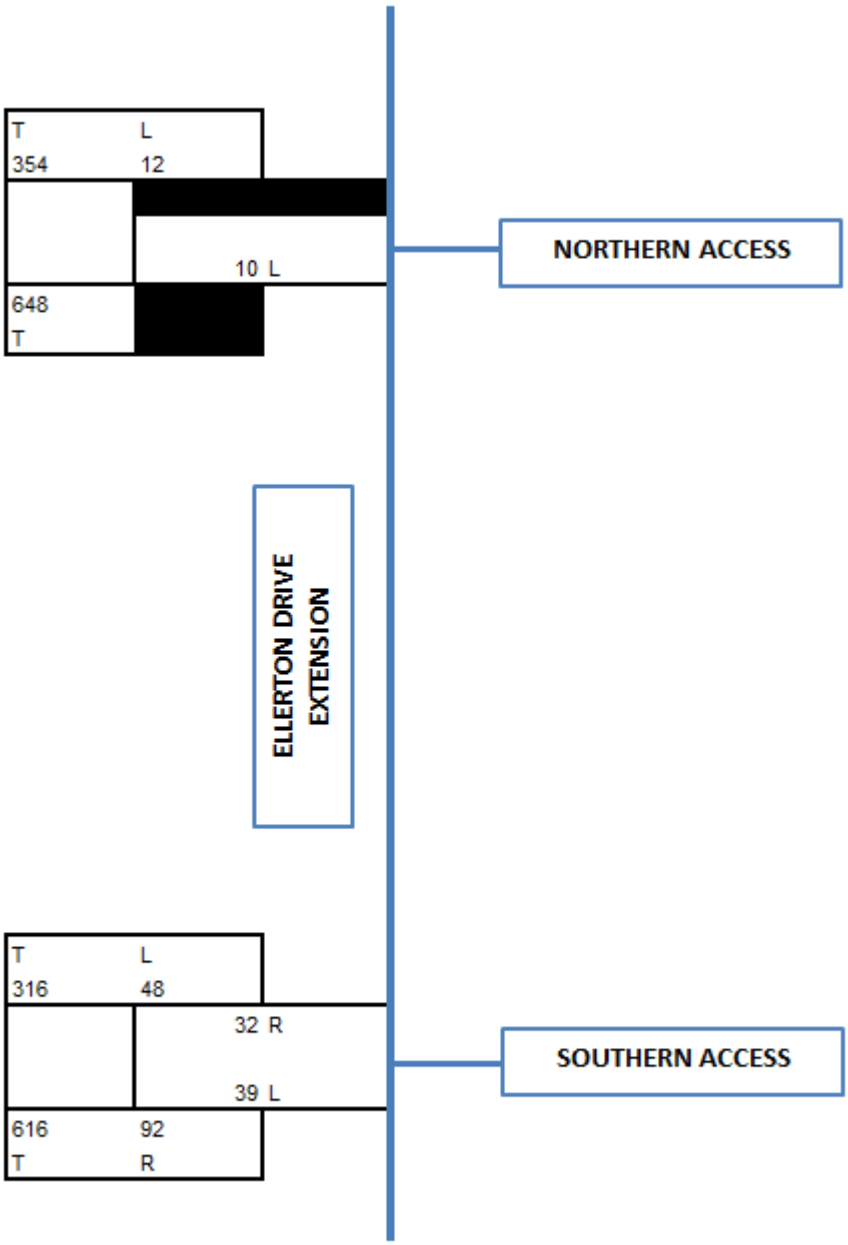


Figure 8 Future PM network forecast

4.3 Intersection Impacts

The expected traffic forecasts at each access was analysed in SIDRA Intersection 7.0. A summary of the results of this analysis are given in Table 2. The northern access was analysed as a two-stage crossing to reflect the “seagull intersection” layout. For more detailed results, see Appendix A.

Table 2 SIDRA intersection modelling results

Intersection	Peak	Degree of Saturation	Average Delay (s)	95th Percentile Queue (m)	Average LOS
Ellerton Drive Extension / Southern Access	AM	0.23	1.9	2.4	A
	PM	0.34	1.4	0.3	A
Ellerton Drive Extension / Northern Access	AM	0.13	0.2	0.5	A
	PM	0.20	0.1	0.3	A

The results of the SIDRA analysis indicates that the proposed access arrangements in Figure 5 and Figure 6 are appropriate to accommodate the future forecast traffic volumes. The small delays and queues indicate that all movements will operate at a Level of Service A.

5.0 Conclusion

The analysis in this report led to the following conclusions:

- The proposed subdivision is expected to generate about 233 vehicle trips in peak hours.
- SIDRA modelling indicates that the proposed access arrangements are appropriate to accommodate the future forecast volumes.
- The accesses are designed to assist safe traffic operation, with adequate safe intersection sight distance (SISD) and deceleration/acceleration lanes. The design and relatively low volumes will mean that these intersections will have negligible impact on the operation of Ellerton Drive.

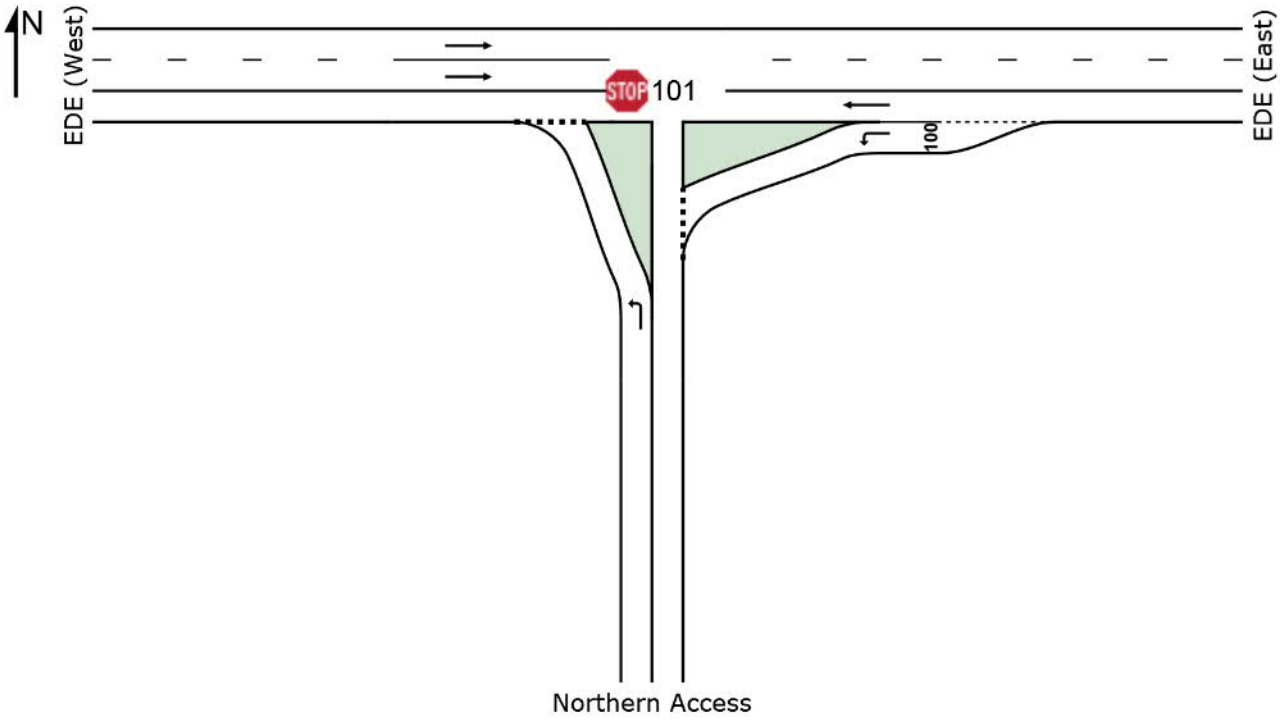
Appendix A

SIDRA Outputs

SITE LAYOUT

Site: 101 [EDE / North Acccess - AM]

New Site
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 101 [EDE / North Acccess - AM]

Network: N101 [AM Network]

New Site
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Northern Access													
1	L2	22	1.0	22	1.0	0.021	4.0	LOS A	0.1	0.5	0.31	0.53	25.2
Approach		22	1.0	22	1.0	0.021	4.0	LOS A	0.1	0.5	0.31	0.53	25.2
East: EDE (East)													
4	L2	5	1.0	5	1.0	0.003	5.6	LOS A	0.0	0.0	0.00	0.55	49.4
5	T1	227	3.0	227	3.0	0.119	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		233	3.0	233	3.0	0.119	0.1	LOS A	0.0	0.0	0.00	0.01	59.7
West: EDE (West)													
11	T1	509	3.0	509	3.0	0.133	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		509	3.0	509	3.0	0.133	0.0	NA	0.0	0.0	0.00	0.00	60.0
All Vehicles		764	2.9	764	2.9	0.133	0.2	NA	0.1	0.5	0.01	0.02	59.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101 [EDE / North Acccess - PM]

Network: N101 [PM Network]

New Site
Stop (Two-Way)

Movement Performance - Vehicles

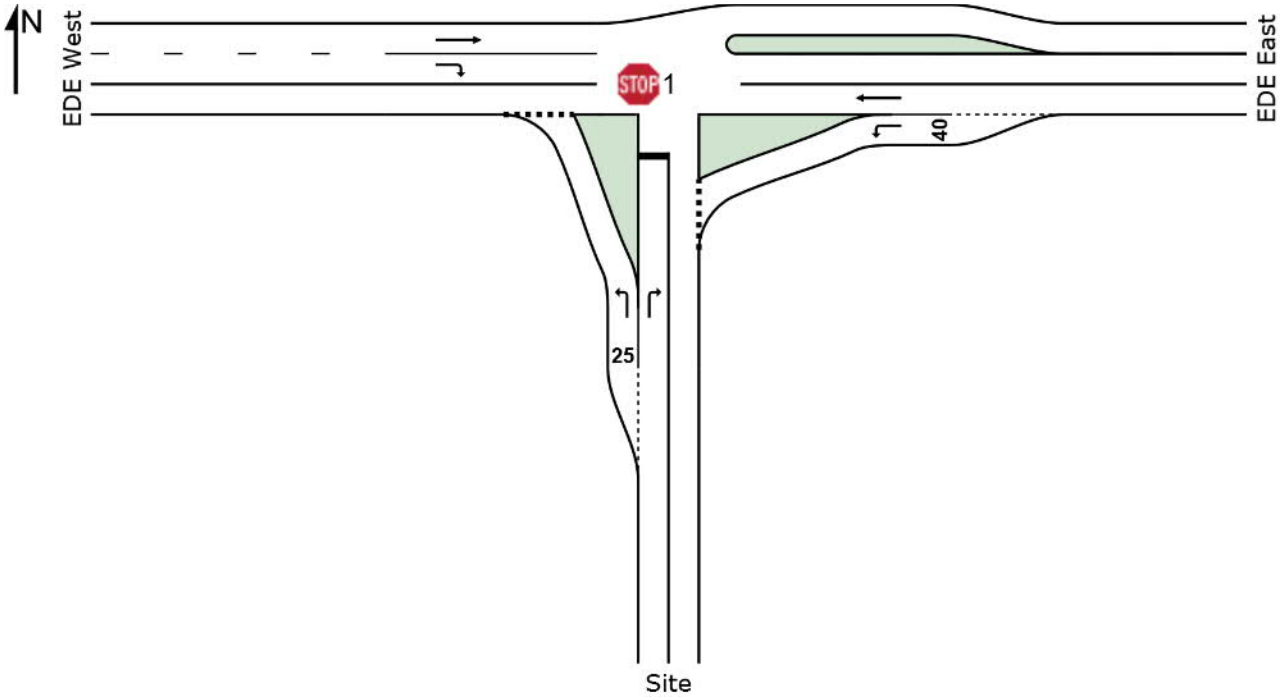
Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Northern Access													
1	L2	11	1.0	11	1.0	0.012	4.8	LOS A	0.0	0.3	0.40	0.56	22.8
Approach		11	1.0	11	1.0	0.012	4.8	LOS A	0.0	0.3	0.40	0.56	22.8
East: EDE (East)													
4	L2	13	1.0	13	1.0	0.007	5.6	LOS A	0.0	0.0	0.00	0.55	49.4
5	T1	373	3.0	373	3.0	0.195	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		385	2.9	385	2.9	0.195	0.2	LOS A	0.0	0.0	0.00	0.02	59.5
West: EDE (West)													
11	T1	682	3.0	682	3.0	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		682	3.0	682	3.0	0.178	0.0	NA	0.0	0.0	0.00	0.00	60.0
All Vehicles		1078	3.0	1078	3.0	0.195	0.1	NA	0.0	0.3	0.00	0.01	59.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

SITE LAYOUT

Site: 1 [EDE / South Access - AM]

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 1 [EDE / South Access - AM]

Network: N101 [AM Network]

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site													
1	L2	89	1.0	89	1.0	0.085	6.6	LOS A	0.3	2.2	0.32	0.58	53.1
3	R2	73	1.0	73	1.0	0.098	9.6	LOS A	0.3	2.4	0.38	0.97	46.8
Approach		162	1.0	162	1.0	0.098	8.0	LOS A	0.3	2.4	0.35	0.75	51.1
East: EDE East													
4	L2	19	1.0	19	1.0	0.014	5.7	LOS A	0.1	0.4	0.11	0.52	52.0
5	T1	231	3.0	231	3.0	0.121	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		249	2.8	249	2.8	0.121	0.4	LOS A	0.1	0.4	0.01	0.04	59.3
West: EDE West													
11	T1	437	3.0	437	3.0	0.228	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	37	1.0	37	1.0	0.025	6.2	LOS A	0.1	0.8	0.33	0.56	52.4
Approach		474	2.8	474	2.8	0.228	0.5	NA	0.1	0.8	0.03	0.04	58.7
All Vehicles		885	2.5	885	2.5	0.228	1.9	NA	0.3	2.4	0.08	0.17	57.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 1 [EDE / South Access - PM]

Network: N101 [PM Network]

Staged crossing Stage 1 (Minor Road) at three-way intersection with 5-lane major road. Major road turn lane is treated as a full-length lane.
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Site													
1	L2	41	1.0	41	1.0	0.044	7.1	LOS A	0.2	1.1	0.39	0.61	52.9
3	R2	34	1.0	34	1.0	0.058	11.1	LOS A	0.2	1.3	0.48	0.98	45.3
Approach		75	1.0	75	1.0	0.058	8.9	LOS A	0.2	1.3	0.43	0.78	50.4
East: EDE East													
4	L2	51	1.0	51	1.0	0.039	6.0	LOS A	0.2	1.1	0.20	0.52	51.6
5	T1	333	3.0	333	3.0	0.174	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		383	2.7	383	2.7	0.174	0.8	LOS A	0.2	1.1	0.03	0.07	58.7
West: EDE West													
11	T1	648	3.0	648	3.0	0.339	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	97	1.0	97	1.0	0.075	6.7	LOS A	0.3	2.3	0.41	0.62	52.1
Approach		745	2.7	745	2.7	0.339	0.9	NA	0.3	2.3	0.05	0.08	57.9
All Vehicles		1203	2.6	1203	2.6	0.339	1.4	NA	0.3	2.3	0.07	0.12	57.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.0 %
Number of Iterations: 5 (maximum specified: 10)

APPENDIX B QPRC CORRESPONDENCE

Benjamin Cargill

From: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Sent: Tuesday, 13 November 2018 10:34 AM
To: Benjamin Cargill
Cc: geoff bunnett; Hamish Sinclair; Mitchell Alexander; Martin Brown
Subject: RE: Jumping Creek - Proposed Intersection Forms

Hi Benjamin,

The 100mm conduit was a spare for any utility. Jemena's subcontractor Zinfra, did approach us about a 150mm conduit through the bridge however the design was already locked in with a 100mm conduit and RMS' construction tender had already closed by this time. We had not received any feedback during our consultation periods despite writing directly to Jemena. I requested that the fee to change the bridge design to accommodate the 150mm conduit be paid by Jemena and also requested that any variation fee to tender prices to accommodate the change be paid by Jemena. As no assurance was given that the extra costs were being paid for, the bridge design was not changed and no further correspondence has been received by Council until now.

Regardless, the bridge design has now changed from a super T bridge to an incrementally launched post-tension box girder bridge (being designed by WBHO Infrastructure). I will speak with WBHO about your requirement for a 150mm gas conduit.

Any costs associated with assessing, designing and delays for this change would need to paid for by Jemena or Jumping Creek.

Regards,
Eli

From: Benjamin Cargill [mailto:Benjamin.Cargill@spiire.com.au]
Sent: Monday, 12 November 2018 8:54 PM
To: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Cc: geoff bunnett <geoff@spacelab.net.au>; Hamish Sinclair <hamish@spacelab.net.au>; Mitchell Alexander <Mitchell.Alexander@peet.com.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek - Proposed Intersection Forms

Hey Eli,

Further to the email below is the 100mm PVC service duct shown on the attached drawing meant to represent provision for gas?

We have received some advice from the gas authority (Jemena) that supply for Jumping Creek would need to come from over the Queanbeyan River to service the development. They had correspondence with Opus in May 2017 to provision for a 150mm (noting the drawing only shows 100mm) PVC conduit to be built into the western side of the bridge for the gas network but it is not clear if this has been allowed for.

.
Regards,

Benjamin Cargill
Associate
Civil Engineering

spiire

Suite 5 | Level 1, 243 Northbourne Avenue Lyneham ACT 2602
PO Box 6042 O'Connor ACT 2602

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spiire.com.au

From: Benjamin Cargill
Sent: Monday, 12 November 2018 7:23 AM
To: 'Eli Ramsland' <Eli.Ramsland@qprc.nsw.gov.au>; geoff bunnett <geoff@spacelab.net.au>
Cc: Mitchell Alexander <mitchell.alexander@peet.com.au>; Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek - Proposed Intersection Forms

Eli,

Many thanks for your comments.

1) No mention in the memo about the RFS' requirements for a second access point and what those requirements are. This information is required to help determine whether the second intersection is suitable and discussion on this should be included in the memo including comment on how you meet the requirements. Planning for Bushfire Protection 2006 requires an access design that enables safe evacuation away from an area whilst facilitating adequate emergency and operational response to the area requiring protection. The second intersection allows for ingress (for emergency vehicles) and egress (for residents) should the alternate access be rendered unusable due to a crash etc. and to assist with quick movement of residents in an emergency situation such as a bushfire. We will add a section on this in the memo and DA report that will accompany the drawings.
2) As mentioned previously, a central painted chevron would not remove conflicts between overtaking vehicles in the northbound lane and the right turn lane into Jumping Creek. Our design for the southern intersection included a concrete median, the formation and design currently being constructed caters for this concrete median to go in. Staging of works for Jumping Creek would be to build a new southbound lane and shoulder, then build the centre median to minimise disruption to traffic. Our previous design of the southern intersection is attached again for your information.
   Whilst the previous design is noted, it was done with no information regarding the current proposed Jumping Creek development. Noting the concern above RE: conflict between vehicles we can amend the chevron to become concrete, please note however that this may require some stormwater drainage to be constructed over the proposed 375mm diameter mains. The only reason I note this is that in a meeting with Gordon Cunningham, Brendan Belcher and Palak Patel from QPRC on September 5th 2018 the point was made that the development will be required to under bore Ellerton Drive with any services so as to not disturb the completed road but this won't be possible for the stormwater services. I have attached a plan noting the extent of concrete (12112018070509-0001), you will note it extends past Lonergan Drive which I assume QPRC would accept. Obviously the plan needs amending for the missing cycle lanes covered in item 7.
3) The northern intersection is a much closer option for the majority of your lots. Ensure that the subdivision layout is done in such a way that the northern intersection doesn't become the more attractive intersection to use. Otherwise the northern intersection would become the major intersection over the southern intersection, with higher volumes which would affect the storage required. Since the traffic report has changed the subdivision pattern has changed so that it is not a direct route for internal traffic via internal offset intersections. We believe this point is resolved with the revised layout

4) The main road through the subdivision is very long and I would like to see some traffic calming devices included on this road to control speeds. Noted – this can be undertaken during detailed design
5) The turning movement designs show that there is inadequate space for a turning 12.5m vehicle at both intersections and you need to adjust your design to suit. Noted, this will be adjusted with adjustments undertaken with point 7 below.
6) There doesn't appear to be any shoulders on your connecting roads and I think shoulders should be included. The connecting roads to the EDE from the development will be designed as a transition to the urban environment and as such kerb and gutter and not shoulders are used. The exact location of the start/stop of the shoulder to kerb transition will be resolved at detailed design.
7) EDE's shoulders allow for onroad cycle lanes to occur on both sides of the road. You need to include the continuation of the on road cycle lanes through your intersections as this will be a spine route connecting both the facilities on Edwin Land Parkway and future Old Cooma Road duplication. Noted – it was unclear from the information provided by QPRC that this was the intent of this so we simply moved the shoulder to the outside of our deceleration lanes. We will adjust the design to include these through both intersections.
8) Stormwater discharge flows from EDE are included in my comments. Can you please mark these up on a drawing just so there is no confusion as to where you are referring to? Based on the comments we assume the difference between culvert 09 and the swale is contained in the sediment basin during the different storm events?
9) During our consultations with Barracks Flat residents many commented that they wanted the Jumping Creek development to be out of their view. I note that there appears to be roads and lots at the top of the hill near the river which would be visible to the houses on Barracks Flat Drive. Noted.

Based on the above comments we will amend our drawings to reflect items 2, 5 & 7 and our memo to reflect item 1 and re-issue. If you could please advise on item 8 it would be appreciated.

If you have any questions let me know.

Regards,

Benjamin Cargill
Associate
Civil Engineering

spiire

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From: Eli Ramsland [mailto:Eli.Ramsland@qprc.nsw.gov.au]
Sent: Monday, 5 November 2018 9:45 AM
To: geoff bunnett <geoff@spacelab.net.au>
Cc: Benjamin Cargill <Benjamin.Cargill@spiire.com.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>; Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek - Proposed Intersection Forms

Hi Geoff,

Following on from my email last week, please find attached my comments on your memo regarding the proposed intersections for Jumping Creek.

Main comments are:

1) No mention in the memo about the RFS' requirements for a second access point and what those requirements are. This information is required to help determine whether the second intersection is suitable and discussion on this should be included in the memo including comment on how you meet the requirements.
2) As mentioned previously, a central painted chevron would not remove conflicts between overtaking vehicles in the northbound lane and the right turn lane into Jumping Creek. Our design for the southern intersection included a concrete median, the formation and design currently being constructed caters for this concrete median to go in. Staging of works for Jumping Creek would be to build a new southbound lane and shoulder, then build the centre median to minimise disruption to traffic. Our previous design of the southern intersection is attached again for your information.
3) The northern intersection is a much closer option for the majority of your lots. Ensure that the subdivision layout is done in such a way that the northern intersection doesn't become the more attractive intersection to use. Otherwise the northern intersection would become the major intersection over the southern intersection, with higher volumes which would affect the storage required.
4) The main road through the subdivision is very long and I would like to see some traffic calming devices included on this road to control speeds.
5) The turning movement designs show that there is inadequate space for a turning 12.5m vehicle at both intersections and you need to adjust your design to suit.
6) There doesn't appear to be any shoulders on your connecting roads and I think shoulders should be included.
7) EDE's shoulders allow for onroad cycle lanes to occur on both sides of the road. You need to include the continuation of the onroad cycle lanes through your intersections as this will be a spine route connecting both the facilities on Edwin Land Parkway and future Old Cooma Road duplication.
8) Stormwater discharge flows from EDE are included in my comments.
9) During our consultations with Barracks Flat residents many commented that they wanted the Jumping Creek development to be out of their view. I note that there appears to be roads and lots at the top of the hill near the river which would be visible to the houses on Barracks Flat Drive.

Regards,
Eli Ramsland

From: Eli Ramsland
Sent: Wednesday, 31 October 2018 10:41 AM
To: geoff bunnett <geoff@spacelab.net.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>; Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek - Proposed Intersection Forms

I will aim to meet your timing. As an initial and broad comment, the central painted chevron at the southern intersection is inadequate and should be a concrete median. I've attached the intersection design that OPUS developed for the southern access point into Jumping Creek (FSP stage). This design was provided to Mal Leslie at a meeting before tender issue was developed. Following the lack of commitment from Jumping Creek to fund the intersection, it was removed from the construction scope of works, however as explained to PEET previously, the current design of EDE caters for the intersection to be built by you at a later date. Hence why there is a longer overtaking than needed (it provides space for the concrete median to be built) etc.

I had previously provided the long section plans to Matthew Frawley from PEET on 2 May 2017. I had also provided Council's Release Coordinator the original AFC version with the understanding that he was passing this onto you along with other items you have raised in meetings but it doesn't sound like the plan was passed on, so apologies for

that. Please find attached the original AFC long section plans covering the Jumping Creek area. The long section is relatively the same as the version Matthew received last year.

Please note that the water connection into Jumping Creek has been removed from the construction scope of works. Without design work being undertaken, it is difficult to determine if it was suitable for the development as well as determine what the impacts would be on Council's water supply network. We have however installed a shared service trench with 1x150 gas, 4x100 telecommunications, 2x50 electrical and 4x125 electrical service conduits at approximately chainage 3045 of the road, running between Ch10 and 50 as shown in the attached FSP drawing.

From: geoff bunnett [mailto:geoff@spacelab.net.au]
Sent: Tuesday, 30 October 2018 4:47 PM
To: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>; Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek - Proposed Intersection Forms

Hello Eli,

Thanks for the update.

To provide some context for our timing, we need to finalise our design in the next two weeks, so your feedback would be appreciated before the end of this week.

We are also waiting on a set of current EDE AFC plans, can you please send these through also.

Geoff

Geoff Bunnett
Associate Director

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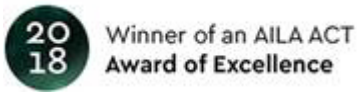

From: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Sent: Tuesday, 30 October 2018 4:28 PM
To: geoff bunnett <geoff@spacelab.net.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>;

Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek - Proposed Intersection Forms

My review is largely complete. Hopefully get something back to you soon.

From: geoff bunnett [mailto:geoff@spacelab.net.au]
Sent: Tuesday, 30 October 2018 4:04 PM
To: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>; Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek - Proposed Intersection Forms

Hello Eli,

Just following up on our EDE/JC intersection report feedback.

I also left a message for the same reason as this email just now.

Can you please get back to me.

Geoff

Geoff Bunnett
Associate Director

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Winner of an AILA ACT Award of Excellence

From: geoff bunnett
Sent: Wednesday, 24 October 2018 4:21 PM
To: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>; Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek - Proposed Intersection Forms

Thank you for the prompt response.

Q – when can we expect your feedback?

Geoff

Geoff Bunnett
Associate Director

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Winner of an AILA ACT Award of Excellence

From: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Sent: Wednesday, 24 October 2018 4:19 PM
To: geoff bunnett <geoff@spacelab.net.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>; Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek - Proposed Intersection Forms

Hi Geoff,

Sorry I missed your call. Yes I have received your previous email and report regarding intersections for Jumping Creek. Currently reviewing it and will let you know if we need any further information from you.

Regards,
Eli

From: geoff bunnett [mailto:geoff@spacelab.net.au]
Sent: Wednesday, 24 October 2018 4:17 PM
To: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>; Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: FW: Jumping Creek - Proposed Intersection Forms

Hello Eli,

I have followed this email sent last week up with a phone message earlier today.

Can you please let me know that you have received this email and the report, and if you would like us to come to QPRC to run through this with you?

Thanks, Geoff

Geoff Bunnett
Associate Director

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Winner of an AILA ACT Award of Excellence

From: geoff bunnett
Sent: Thursday, 18 October 2018 12:31 PM
To: Eli Ramsland <Eli.Ramsland@qprc.nsw.gov.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Mitchell Alexander <Mitchell.Alexander@peet.com.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: Jumping Creek - Proposed Intersection Forms

Hello Eli,

As per our discussion with Martin Brown today, he has suggested that you are the right person (in Pal's absence) to receipt/action the proposed intersection arrangements with the EDE for the Jumping Creek Estate (with accompanying traffic report and memo).

These designs are being worked up for inclusion with the DA submission and we would welcome early engagement on them with QPRC.

Could you please provide your review/comment? We are also happy to meet up with you as required.

I will give you a call later this week to follow up.

Geoff

Geoff Bunnett
Associate Director

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Winner of an AILA ACT Award of Excellence

Benjamin Cargill

From: Brendan Belcher <brendan.belcher@qprc.nsw.gov.au>
Sent: Tuesday, 30 October 2018 12:07 PM
To: geoff bunnett; Palak Patel; Mitchell Alexander
Cc: Benjamin Cargill; Gordon Cunningham; Dirk Jol; Graeme Harlor; Hamish Sinclair; Martin Brown
Subject: RE: Jumping Creek meeting minutes

Hi Geoff,

Please see below our responses.

https://queanbeyan-my.sharepoint.com/:u:/g/personal/belbre_qprc_nsw_gov_au/Ebx4ihCIUMVAmo4cKsoaALABYZz9gBZ2HVOgswakIuQ0LQ?e=4pUeKa

The attached link contains the GIS information for your investigations.

Cheers,

Brendan Belcher
Program Coordinator – Utilities Technical

Queanbeyan-Palerang Regional Council
Tel: 6238 8111
Web: www.qprc.nsw.gov.au
Mail: PO Box 90 Queanbeyan NSW 2620

Please note my email address has changed. Could you please update your records to brendan.belcher@qprc.nsw.gov.au.

From: geoff bunnett [mailto:geoff@spacelab.net.au]
Sent: Thursday, 11 October 2018 8:19 AM
To: Palak Patel; Mitchell Alexander
Cc: Benjamin Cargill; Gordon Cunningham; Brendan Belcher; Dirk Jol; Graeme Harlor; Hamish Sinclair; Martin Brown
Subject: RE: Jumping Creek meeting minutes
Importance: High

Hello Pal,

For clarity, Ben has requested confirmation/feedback on the below, from our initial request, hope this provides a more defined RFI for you:

Sewer

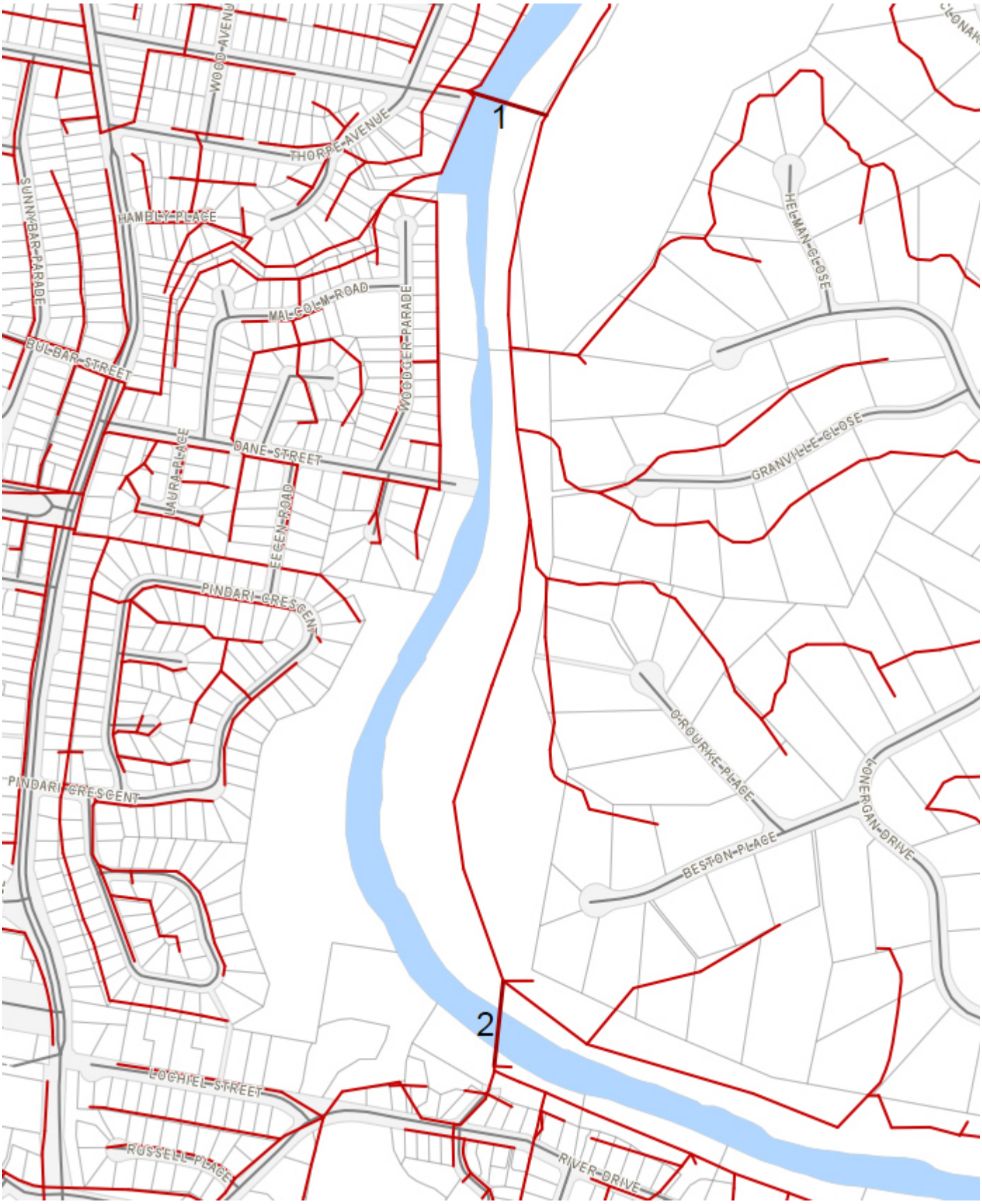
Network Design (refer to the attached document)

- Based on the documented order of precedence it appears WSA02 2014-3.1 Appendix C is the preferred method for calculating design flows, please confirm - Confirmed

  Within Appendix C we need the following confirmed;

  - ADWF – if we propose following document 5, our specification would say 180L/d/EP. Please confirm they accept this or propose an alternate – 210L/EP/day
  - Portionwet – if we propose following document 5 our specification would say 10%. Please confirm they accept this or propose an alternate - Accepted
  - C – if we propose following document 5 our specification would say 0.6. Please confirm they accept this or propose an alternate – Recent experience with contractors is that we are receiving a high amount of infiltration from rainfall events. A C value of 1 is considered appropriate and not overly conservative.
  - I1,2 – if we propose following document 5 our specification would say 21.4. Please confirm they accept this or propose an alternate – Please use the 2016 IFD tables with the 0.5EY recurrence. This gives a value of 22.4mm
  - Changing these numbers slightly has sometimes substantial impacts on the system design, particular the size of the storage vessels depending on the emergency storage duration. Noted.

- Confirm the capacity and or flow in the 600mm diameter trunk main near Beston Place. Based on the virtue of its size we are assuming it has capacity, but this assumption needs to be confirmed for the DA. The GIS available at the link above can be used to confirm the capacity of the mains. There are two flows that will need to be added. The first is from Kathleen Street SPS with a PWWF of 72L/s (Point 1). The second is from Lochiel Street SPS (which is actually off Riverside Drive) with a PWWF of 31L/s (Point 2). See image below.



Sewer Pump Station

In accordance with QPRC Specification D12.20.6 we propose to specify in the DA a proprietary system to be designed as part of the detailed design process. This is permitted where the area being serviced is small and/or inclusion contributes to an overall lesser depth of excavation in the system but requires concurrence from the Water Agency, please provide this confirmation. If it went to the detailed design process we would propose a firm such as Aquatec as this proprietary provider. We concur with this approach. We routinely use Qmax systems. We're happy to discuss further at the appropriate juncture.

Water

- Pressure of the existing watermain at the connection point for Jumping Creek (approximately near the pedestrian underpass of EDE) – the pressure can be determined from the linked GIS data
- Capacity of the existing watermain to service the subdivision of Jumping Creek – the capacity can be determined from the linked GIS data
- The Queanbeyan Design Specification D11 (attached) doesn't have specific items regarding reservoir design (there are only 2 references to reservoirs in the document)…it has a section on pump stations but we are not proposing a pump station unless for some reason we can't achieve the minimum static head. If there is a revised specification that has a specific reference to reservoir design can we please have a copy. Refer the specification for South Jerrabomberra - https://www.qprc.nsw.gov.au/Building-Development/Engineering-design-and-construction-specifications.

Stormwater

- We still need to know what water from Ellerton Drive is being discharged into Jumping Creek that we need to consider. We have undertaken flood modelling to determine the size of the culvert under Ellerton Drive but we can't model the sediment pond in the NE or any other discharge points that we may/may not know of. QPRC should have this information as part of the EDE design that can be provided to us in much the same way we will provide it to them with the Jumping Creek DA

Geoff Bunnett
Associate Director

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MASTER BUILDERS MEMBER

2018 Winner of an AILA ACT Award of Excellence

From: geoff bunnett
Sent: Friday, 5 October 2018 1:43 PM
To: 'Palak Patel' <Palak.Patel@qprc.nsw.gov.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Gordon Cunningham <Gordon.Cunningham@qprc.nsw.gov.au>; Brendan Belcher <brendan.belcher@qprc.nsw.gov.au>; Dirk Jol <Dirk.Jol@qprc.nsw.gov.au>; Graeme Harlor <Graeme.Harlor@qprc.nsw.gov.au>; Hamish Sinclair <hamish@spacelab.net.au>; Martin Brown <Martin.Brown@qprc.nsw.gov.au>
Subject: RE: Jumping Creek meeting minutes
Importance: High

Hello Palak,

Following on from your email response with information to assist us in preparing our DA set, we still require the following information that was requested in the meeting minutes:

- EDE drawing information: you have provided the plan/section details for in front of JC, but no other information on the design
- Water supply – we noted the Gordon/Brendon was going to provide feedback on the available capacity for JC out of Greenleigh
- Sewer – Tralee design parameters were to be issued as guidance for the design for JC
- Pump station approval process – is this a REF or DA?
- Conduits - we understand the typical detail was supplied, but the request was for EDE plans to highlight conduits, as well as the tie in for gas and electrical

Being provided a current AFC EDE set of plans would be very helpful for us to progress our DA for Jumping Creek.

Can you also provide the best contact in your planning team, who we can speak to in regard to the assessment of the DA?

Geoff

Geoff Bunnett
Associate Director

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Winner of an AILA ACT Award of Excellence

From: Palak Patel <Palak.Patel@qprc.nsw.gov.au>
Sent: Friday, 21 September 2018 9:47 AM
To: geoff bunnett <geoff@spacelab.net.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Gordon Cunningham <Gordon.Cunningham@qprc.nsw.gov.au>; Brendan Belcher <brendan.belcher@qprc.nsw.gov.au>; Dirk Jol <Dirk.Jol@qprc.nsw.gov.au>; Graeme Harlor <Graeme.Harlor@qprc.nsw.gov.au>
Subject: RE: Jumping Creek meeting minutes

Hi Geoff,

Thanks for sending over the meeting minutes.

In response to your email below, please find attached associated EDE drawing (for information only).

For jumping creek development, Council has accommodated a shared trench (refer to attachment) of empty conduits and a 2.4m box culvert for a future pedestrian underpass within Ellerton Drive Extension (EDE) project.

Also, please see the details below for the "Hierarchy of Specifications" for water and sewer infrastructure;

Water Design:

1. **Water Supply Code of Australia – Version 3.1 Planning and Design 2011**
2. **Queanbeyan Design Specification – D11 Water Reticulation (has specific items regarding reservoir design introduced specifically for this project)**
3. **Australian Standards**
4. **Consultant design specification**

Water Construction:

1. **Water Supply Code of Australia – Version 3.1 Construction 2011**
2. **Queanbeyan Construction Specification – C401 Water Reticulation**
3. **Australian Standards**
4. **Consultant design specification**

Sewer Design

1. **Sewer Pump Station Code of Australia – Version 2.1**
2. **Gravity Sewerage Code of Australia – Version 3.1 Part 1 Planning and Design**
3. **Queanbeyan Design Specification – D12 Sewerage System**
4. **Australian Standards**
5. **Consultant Design Specification**

Sewer Construction

1. **Sewer Pump Station Code of Australia – Version 2.1**
2. **Gravity Sewerage Code of Australia – Version 3.1 Part 2 Construction**
3. **Queanbeyan Construction Specification – C402 Sewerage System**
4. **Australian Standards**
5. **Consultant Design Specification**

Please contact myself should you have any queries.

Regards

Palak Patel
New Release Coordinator
Natural and Built Character

Queanbeyan-Palerang Regional Council
Tel: 02 6285 6202
Web: www.qprc.nsw.gov.au
Mail: PO Box 90 Queanbeyan NSW 2620

QPRC

From: geoff bunnett [mailto:geoff@spacelab.net.au]
Sent: Wednesday, 12 September 2018 5:10 PM
To: Palak Patel <Palak.Patel@qprc.nsw.gov.au>
Cc: Benjamin Cargill <benjamin.cargill@spiire.com.au>; Mitchell Alexander <mitchell.alexander@peet.com.au>
Subject: Jumping Creek meeting minutes

Hello Pal,

Please see attached meeting minutes from our meeting on the 5th Sep. I have also attached the previous meeting minutes as discussed so you can get some responses for us. One of the main items requested in the previous minutes was getting EDE drawing information (i.e. long sections, so we can consider the design for the 2x road connections for JC).

I have left the minutes in draft at this stage.

For timing for RFI's we would appreciate your responses within the week, as I understand Gordon/Brendon were looking into getting data or us (Tralee) straight after our meeting?

Geoff

Geoff Bunnett
Associate Director

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E: geoff@spacelab.net.au

Winner of an AILA ACT Award of Excellence

Benjamin Cargill

From: Brendan Belcher <brendan.belcher@qprc.nsw.gov.au>
Sent: Monday, 7 June 2021 10:18 AM
To: Mitchell Alexander; Gordon Cunningham
Cc: Benjamin Cargill
Subject: RE: Jumping Creek - Sewer and Water off Site Works

Hi Mitchell,

Your text in red for clarity.

Sewer:

- rising main connecting to existing sewer in Lonergan Dr with new manhole being built over existing pipe; - agreed
- vent stack adjacent connection point; and – this was subject to odour modelling. I don't believe we have seen this. The need for and arrangement of any vent stack and/or associated scrubbers if required will need to be confirmed by the odour model. I don't think it will be needed, but we'd like a check as the area there is in a pretty deep gully.
- upsize existing sewer pipe to 225mm dia between points D222 and D38 on plan below. Agreed

Water:

- 200mm dia main along Ellerton Dr connecting to existing from East Queanbeyan Reservoir and a PRV near Jumping Creek as indicated in plan below. Agree, however, connection is to the Greenleigh reservoirs not East Queanbeyan. The report figures shows connection to East Queanbeyan, whereas all conversations/data relates to the Greenleigh reservoirs.

We are comfortable that the above off-site works (excluding the vent stack matter at this time) are sufficient to provide for the development in its current form. Please note, further conditions may be applied on peripheral matters related to water and sewer from our Development Engineering or Planning sections.

Cheers,

Brendan Belcher
Program Coordinator – Utilities Technical

Queanbeyan-Palerang Regional Council
Tel: 1300 735 025
Web: www.qprc.nsw.gov.au
Mail: PO Box 90 Queanbeyan NSW 2620

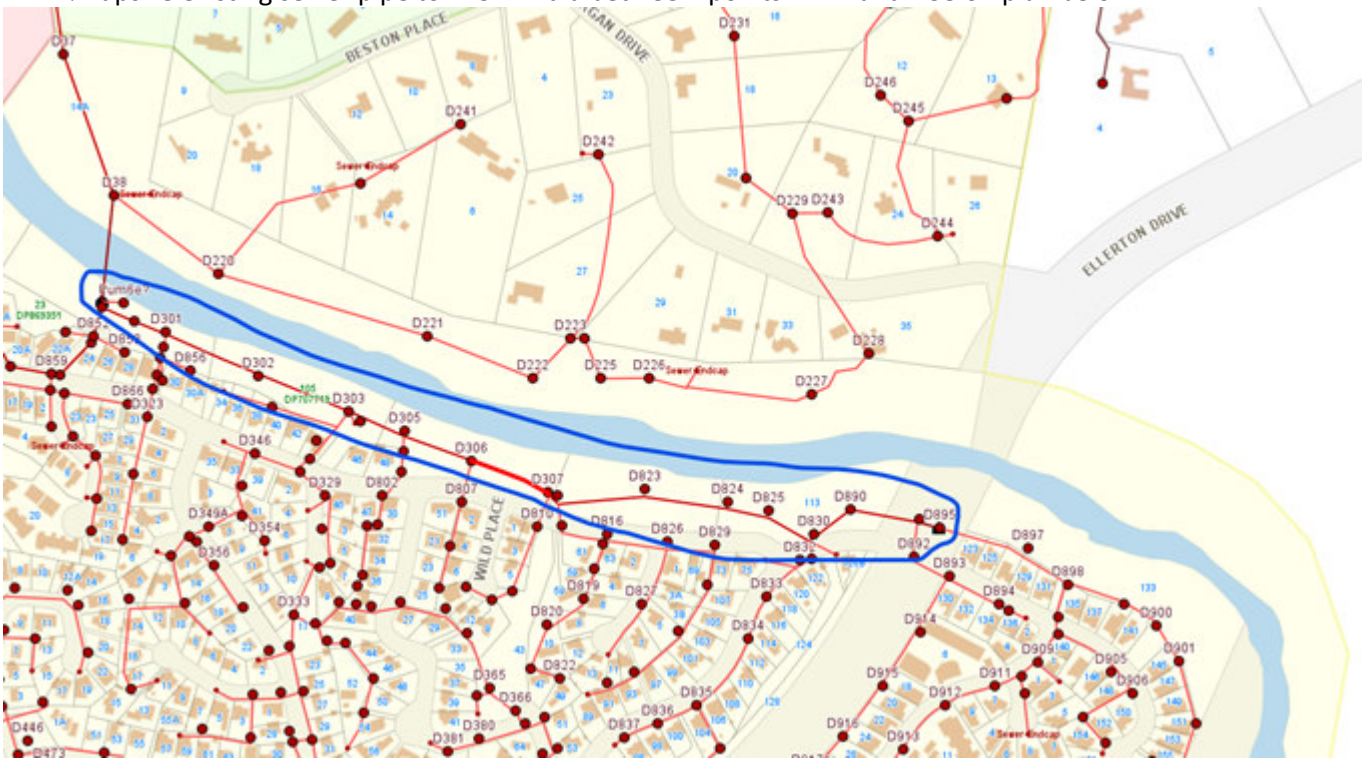
QPRC

From: Mitchell Alexander <Mitchell.Alexander@peet.com.au>
Sent: Friday, 4 June 2021 4:39 PM
To: Gordon Cunningham <Gordon.Cunningham@qprc.nsw.gov.au>
Cc: Brendan Belcher <brendan.belcher@qprc.nsw.gov.au>; Benjamin Cargill <Benjamin.Cargill@spiire.com.au>
Subject: Jumping Creek - Sewer and Water off Site Works

Gordon

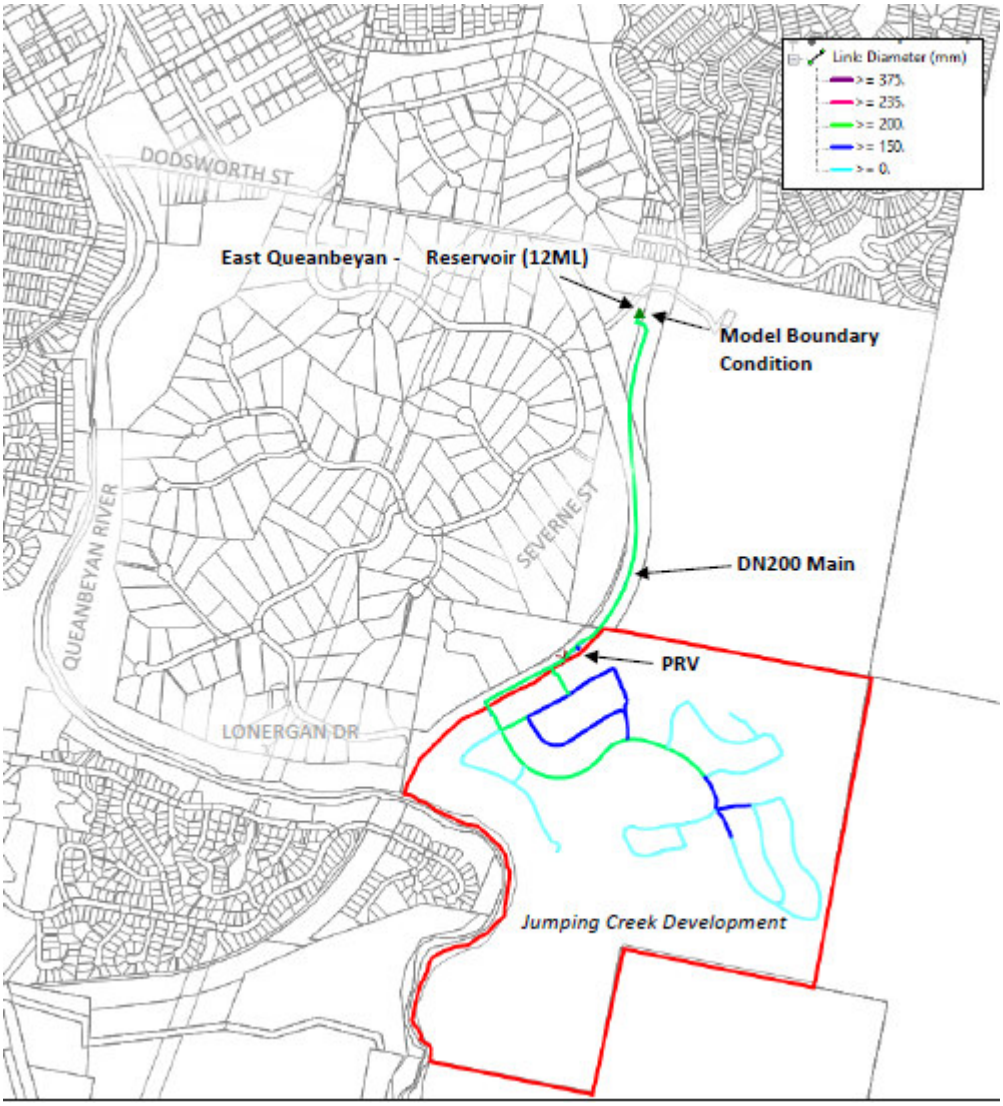
We're are wanting to obtain certainty as to what off-site works Council would require us to complete for the Jumping Creek development. We understand the below will be shown on masterplans that shall be approved as part of the DA and hence form a DA condition. I believe the 2 attached emails between Ben Cargill of Spiire and Brendan Belcher of QPRC details what has been agreed in relation off site sewer and water. In summary:
Sewer:

- . rising main connecting to existing sewer in Lonergan Dr with new manhole being built over existing pipe;
- . vent stack adjacent connection point; and
- . upsize existing sewer pipe to 225mm dia between points D222 and D38 on plan below.



Water:

- . 200mm dia main along Ellerton Dr connecting to existing from East Queanbeyan Reservoir and a PRV near Jumping Creek as indicated in plan below.



Can you confirm this is all that Council requires for off site sewer and water works.

Regards
Mitchell

Mitchell Alexander
Development Manager

Peet Limited
Level 3, 64 Allara Street Canberra City ACT 2600
PO Box 1000, Civic Square ACT 2608
Telephone (02) 6230 0800 | Facsimile (02) 6230 0811
Mobile 0413 432 440
www.peet.com.au

PEET

Perth | Melbourne | Brisbane | Canberra | Adelaide | Darwin

Benjamin Cargill

From: Benjamin Cargill
Sent: Wednesday, 15 July 2020 12:43 PM
To: Brendan Belcher
Subject: RE: Greenleigh zone pressures

Hey Brendan,

They used a constant head of 686.8m at the offtake

Regards,

Benjamin Cargill
Associate
Civil Engineering

spiire

Suite 5 | Level 1, 243 Northbourne Avenue Lyneham ACT 2602
PO Box 6042 O'Connor ACT 2602

t +61 2 6102 1003 +61 488 075 179
spiire.com.au

From: Brendan Belcher <brendan.belcher@qprc.nsw.gov.au>
Sent: Wednesday, 15 July 2020 11:19 AM
To: Benjamin Cargill <Benjamin.Cargill@spiire.com.au>; Gordon Cunningham <Gordon.Cunningham@qprc.nsw.gov.au>
Cc: Chelsea Corcoran <Chelsea.Corcoran@spiire.com.au>
Subject: RE: Greenleigh zone pressures

Thanks. Looks OK from the Utilities point of view. One question, what was the boundary condition used?

Thank your contractor for the brevity of the report.

Brendan Belcher
Program Coordinator – Utilities Technical

Queanbeyan-Palerang Regional Council
Tel: 6238 8111
Web: www.qprc.nsw.gov.au
Mail: PO Box 90 Queanbeyan NSW 2620

From: Benjamin Cargill [mailto:Benjamin.Cargill@spiire.com.au]
Sent: Wednesday, 15 July 2020 11:05 AM
To: Gordon Cunningham <Gordon.Cunningham@qprc.nsw.gov.au>; Brendan Belcher <brendan.belcher@qprc.nsw.gov.au>
Cc: Chelsea Corcoran <Chelsea.Corcoran@spiire.com.au>
Subject: RE: Greenleigh zone pressures

Gordon/Brendan,

Apologies for the delay on this one but please find attached the water modelling report from UWS. The main size ended up being 200mm with a single PRV as expected. We intend to submit this formally to QPRC so it can go in with the DA approval but thought it best to give you an advanced copy.

An update on the sewer is we expect revised survey today it's just been held up with the finishing up of the EDE so it could be opened.

Regards,
Benjamin Cargill
Associate
Civil Engineering

spiire

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From: Benjamin Cargill
Sent: Tuesday, 5 May 2020 8:33 AM
To: Gordon Cunningham <Gordon.Cunningham@qprc.nsw.gov.au>; Brendan Belcher <brendan.belcher@qprc.nsw.gov.au>
Subject: RE: Greenleigh zone pressures

Hey Brendan/Gordon,

Thanks for the below. We haven't got the water modelling updated yet but will add pipe sizes to the attached when it's done. We are using UWS who have done all our water modelling to date so hopefully it is a format/output you are comfortable with.

However, please find attached some preliminary designs for the external water at Jumping Creek (plans and long sections). Please take them as an advanced concept but not detailed design we are just keen to get feedback on the attached from yourself/Gordon before we get into modelling the rising main with correct pipe deflections (hence the sudden changes in direction that are currently shown). You will also note the alignment showing of the trunk water along the EDE which no doubt is incorrect as I don't believe it was hit/relocated as part of the EDE or that it traverses the cut/fill batters as shown.

We have done the same for the sewer along the creek but I am just waiting for a gap in the survey of the revised surface near the bridge prior to sending across as it won't look right if I send it how it is at the moment for a particular section. I'm hoping it isn't too far away so that I can get it across to you in the next fortnight as I'm keen to discuss whether we take some of your existing sewer from Greenleigh that you can't currently get to into this new main while we are down doing the works.

Happy to discuss over Microsoft teams/zoom etc. if you wish.

Regards,

Benjamin Cargill
Associate
Civil Engineering

spiire

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From: Brendan Belcher <brendan.belcher@qprc.nsw.gov.au>
Sent: Tuesday, 14 April 2020 8:47 AM
To: Benjamin Cargill <Benjamin.Cargill@spiire.com.au>
Cc: Gordon Cunningham <Gordon.Cunningham@qprc.nsw.gov.au>
Subject: Greenleigh zone pressures

Hi Ben,

Please find below static pressures from various locations around the Greenleigh pressure zone.

Point No.	Easting	Northing	Elevation	Code	Description	Location	Result	m Head	HGL
1508	6084635.062	704313.2222	650.6378	HY	Hydrant	Morris Cl.	400kPa	40	690.6
1510	6084451.69	704764.1809	647.3426	HY	Hydrant	Forster Ave.	420kPa	42	689.3
1511	6083849.958	704319.5761	656.0425	HY	Hydrant	Woodman Pl.	340kPa	34	690.0
1512	6083369.576	704214.9539	590.8236	HY	Hydrant	Lonergan Dr.	960kPa	96	686.8
1513	6083533.875	703504.8839	597.0795	HY	Hydrant	Beston Pl.	900kPa	90	687.0

1514	6084178.649	703662.8595	614.9246	HY	Hydrant	Severne St.	750kPa	75	689.9

The Greenleigh reservoirs have a ground level of 686.5 and a TWL of 692.5.

Trust that is sufficient for your modelling purposes.

Cheers,

Brendan Belcher
Program Coordinator – Utilities Technical

Queanbeyan-Palerang Regional Council
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Web: www.qprc.nsw.gov.au
Mail: PO Box 90 Queanbeyan NSW 2620

APPENDIX C WATER SUPPLY REPORT

SPIIRE

JUMPING CREEK
DEVELOPMENT ASSESSMENT REPORT

urbanwater solutions

Spiire
Jumping Creek
Development Assessment Report
8 July 2020
20042

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Prepared by	Checked by	Authorised by
1	A	Draft	8 July 20	CC	AP	AP

Table of Contents

Table of Figures

1 Introduction

Urban Water Solutions (UWS) was commissioned by Spiire to assess the impact on the existing water system from a proposed residential development at Jumping Creek, Greenleigh (NSW) and develop the internal servicing strategy for the development. This was documented in the Jumping Creek Development Assessment Report dated 18 January 2019. This analysis was undertaken to assess the suitability of an alternate supply option – a dedicated DN200 main supplying just the Jumping Creek development.

Queanbeyan-Palerang Regional Council (QPRC) are the local water authority that provides potable water supply services.

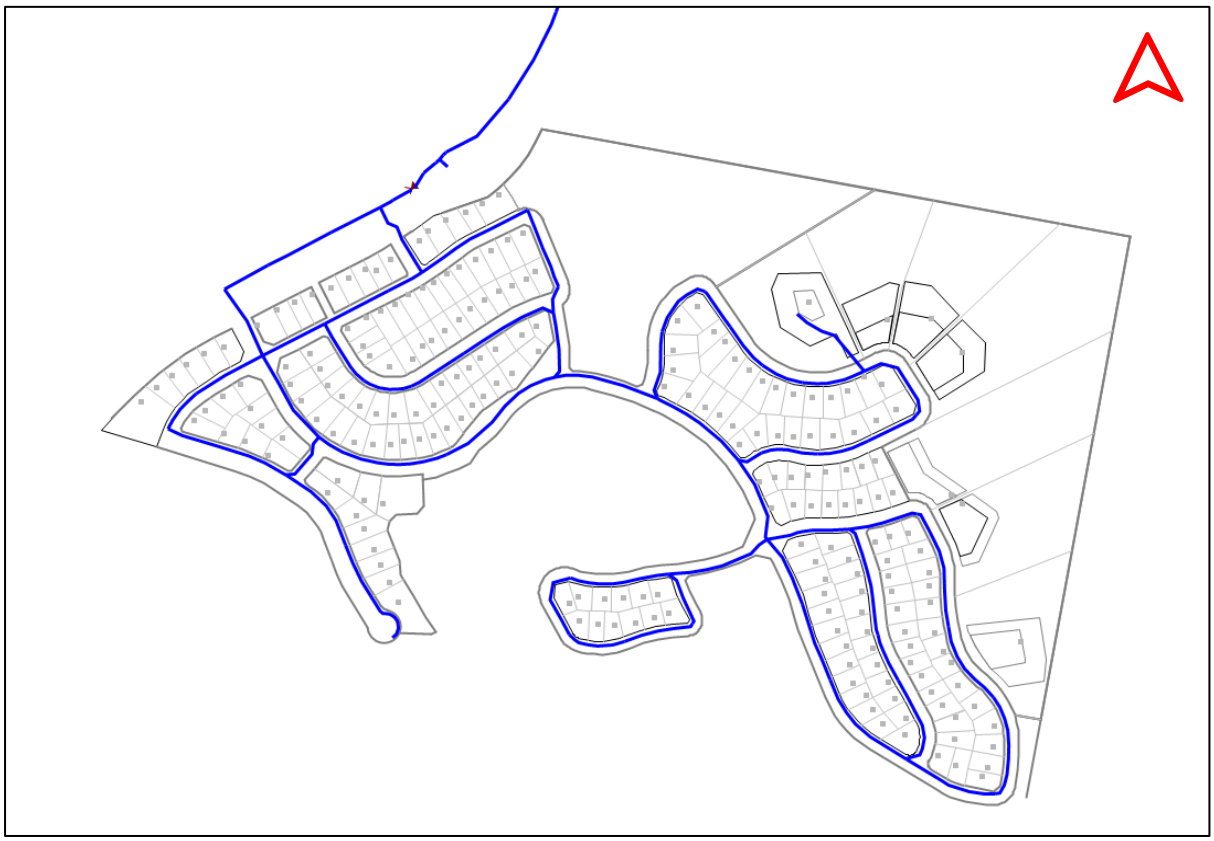
The proposed development will ultimately consist of 221 residential units.

1.1 Location

The development site is located east of Lonergan Drive and Queanbeyan River, Greenleigh, and has a total area of approximately 100ha, of which 17.4ha is to be developed for habitation. A locality plan is presented in Figure 1-1 and a site plan is provided in Figure 1-2.

Figure 1-1: Development Location

Figure 1-2: Site Plan (as at April 24, 2020)



2 Water Supply System

2.1 Introduction

Spiire provided network information in GIS files and UWS built the hydraulic model of the water supply system in InfoWorks WS. The model was utilised to assess the impact of the additional demand from the development at Jumping Creek on the water supply network.

The following three scenarios were tested:

- Average Demand Flows (ADD)
- Instantaneous Demand Flows (PDD)
- Residential Fireflow

2.2 Design Criteria

The following design criteria were applied in this assessment:

Table 2-1: Water Design Criteria/ Parameters

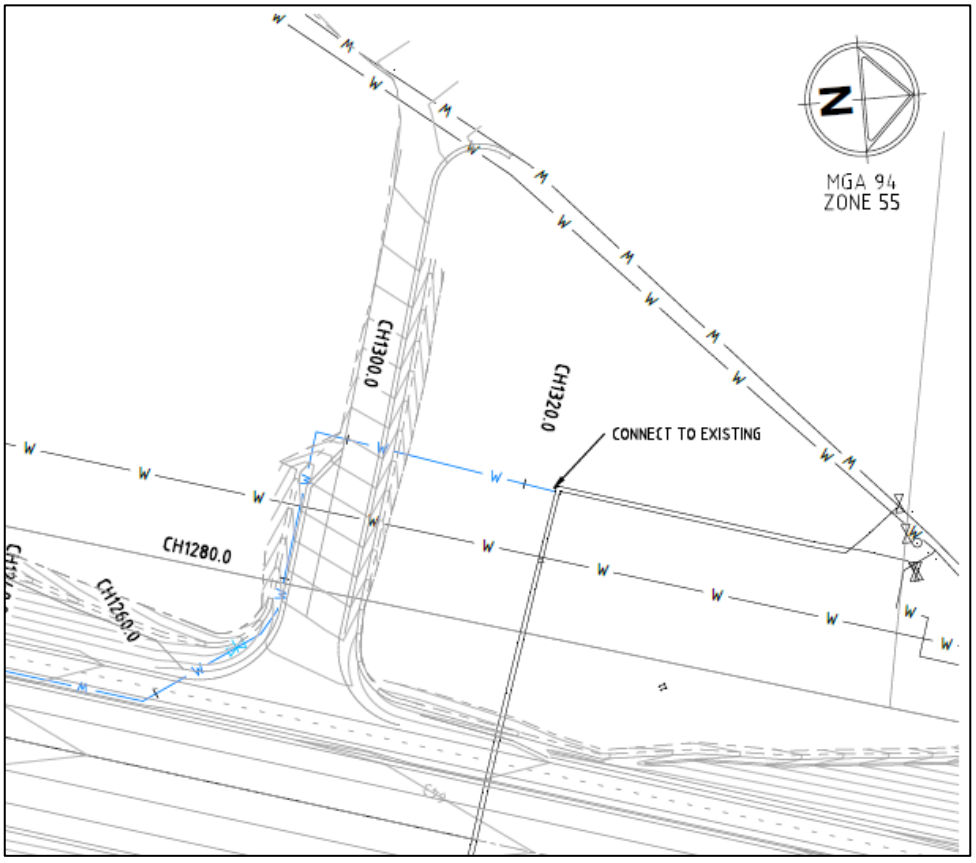
Parameter	Low Density Residential	Source
Peak Instantaneous Demand	0.15L/s/Tenement	QPRC Design Spec[1] D11.05 #2
Average Day Demand	230kL/annum/equivalent tenement *= 630 L/day/tenement*	QPRC Design Spec[1] D11.5 #2
Maximum Service pressure	Maximum pressure is 800kPa *=81.598m*	QPRC Design Spec[1] D11.5 #4
Minimum Service Pressure	20m	WSA 03-2011 Water Supply Code T2.3
Firefighting*	15L/s	AS2419.1 2005
Firefighting Pressure Requirements*	15m min at the flowing hydrant	AS2419.1 2005
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 ≤ 4m/s under fire flow conditions	WSA 03-2011 Water Supply Code C13.1.6.4
Maximum Headloss	5m head/km for ≤ DN150 3m head/km for ≥ DN200	WSA 03-2011 Water Supply Code C13.1.6.2
Material	Series 2 PVC-M PN16	QPRC Design Spec[1] D11.09 #3

[1] Queanbeyan-Palerang Regional Council Development Design Specification Version 1 – January 2019

2.3 Hydraulic Modelling

This modelling focusses on the network conditions downstream of the offtake point. For this the purpose of this analysis the boundary condition for offtake has been assumed to be a constant head of 686.80mAD. The location is shown in Figure 2-1.

Figure 2-1: Connection Point



Source: Drg No 307257SK122

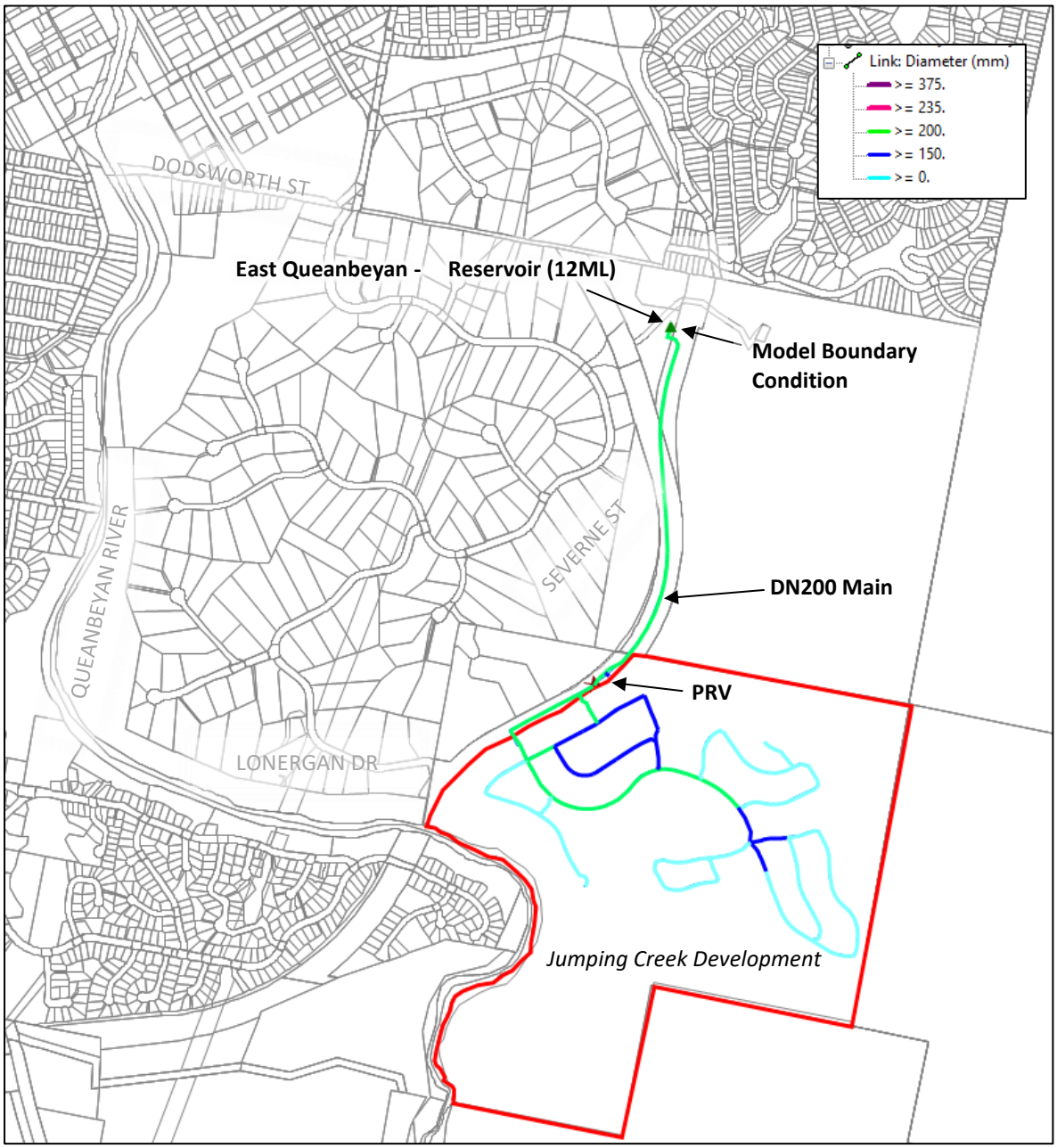
Customer points were included in the model – each with an Average Day Demand of 630 L/EP/day. No Non-Residential customers were included in the model

Pipes servicing the development were modelled using their nominal diameter. A review of the Series 2 PVC-M PN16 Iplex reference material[2] showed that the internal diameters would be slightly larger, hence a conservative assumption.

The development was assessed connecting to the QPRC network via a proposed DN200 main (Figure 2-2). The intent of this analysis is to size the transfer main to supply the development.

[2] http://www.iplex.com.au/resources/catalogues/PVC-M_16Aug2010_Lo.pdf

Figure 2-2: DN200 Connection Points



Model Configuration

The InfoWorks WS model has been configured to test three different scenarios. The base model is the Average Day Demand (ADD) model. The demands are applied as a constant and do not have a daily profile. The Peak Instantaneous Demand Flow (PID) and Fire Flow demands were developed by applying a scaling factor to the ADD scenario.

Table 2-2: Water Design Criteria/ Parameters

Scenario	Demand (L/s/Tenement)	Scaling Factor
Average Demand Flows (ADD)	0.0073	1
Peak Instantaneous Demand Flows (PID)	0.150	20.6
Residential Fire Flow	0.100	13.7

2.4 System Performance Results

This section presents the results of the hydraulic modelling for the Jumping Creek development.

Supply by DN200 main with no pressure reduction

During ADD supply using the proposed DN200 main results in pressures within the estate predicted to be above 70m at all nodes. 80% of nodes are predicted to have pressures above 81.5m (800 kPa). As a result, using a 200mm main without pressure reduction will result in many nodes exceeding the maximum service pressure and does not meet QPRC design standards.

Supply by DN200 main with a Pressure Reducing Valve

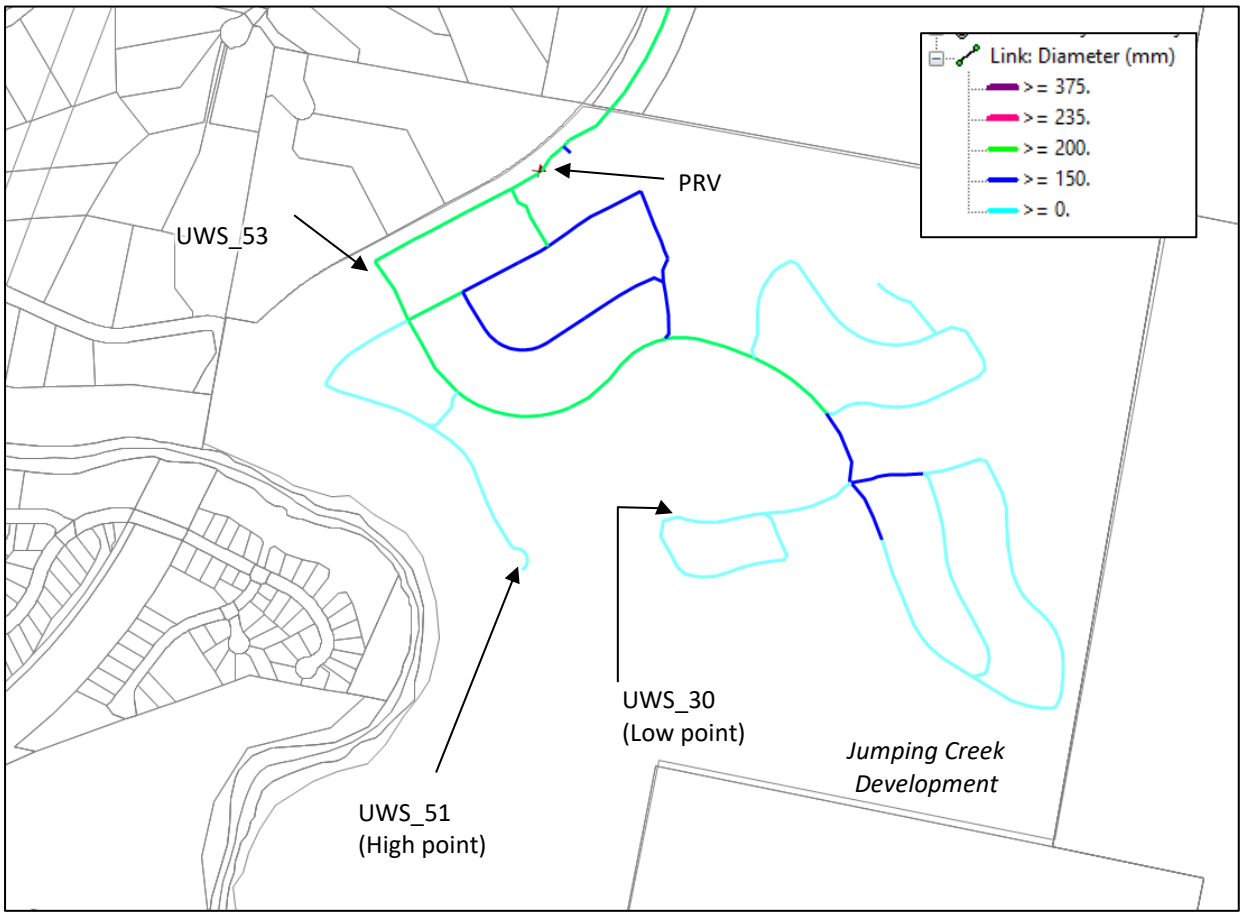
The proposed DN200 main can supply the ADD and PID for the new development. The predicted minimum pressures within the development exceed 20m.

It is necessary to install a Pressure Reducing Valve (PRV) to limit pressures within the estate to 800kPa. For this analysis, a notional 150mm valve with pressure set point of 55m has been used. With this PRV setting all nodes are predicted to have a pressure above 40m, and no node is above 81.5m (800 kPa).

The internal servicing pipework was sized to ensure that maximum headlosses stay below 5m/km (≤ DN150) and 3m/km (≥ DN200) and to ensure velocities in the development stay below 2m/s during PDD.

Figure 2-3 shows the recommended connection points, internal development pipe layout and pipe sizes.

Figure 2-3: Recommended Pipe Dimensions and Connection Points



Error! Reference source not found. shows pressures in the DN200 supply and at key locations in the development.

Table 2-3: Pressure Summary

Location	ADD (m)	PDD (m)
Supply pre estate retic (Node ID UWS_53)	64.40	63.13
Highest Point in Development (Node ID UWS_51)	50.42	48.92
Lowest Point in Development (Node ID UWS_30)	80.43	78.06

Fire Flow

Simulations were run to confirm that the development can service a 15L/s fire flow while maintaining a residual pressure of at least 15m in the supply main.

As this is a purely residential development no Non-Residential demand was included in the baseline demand. Base demand from existing customer as well as the Jumping Creek development was included in the assessment of fire flow.

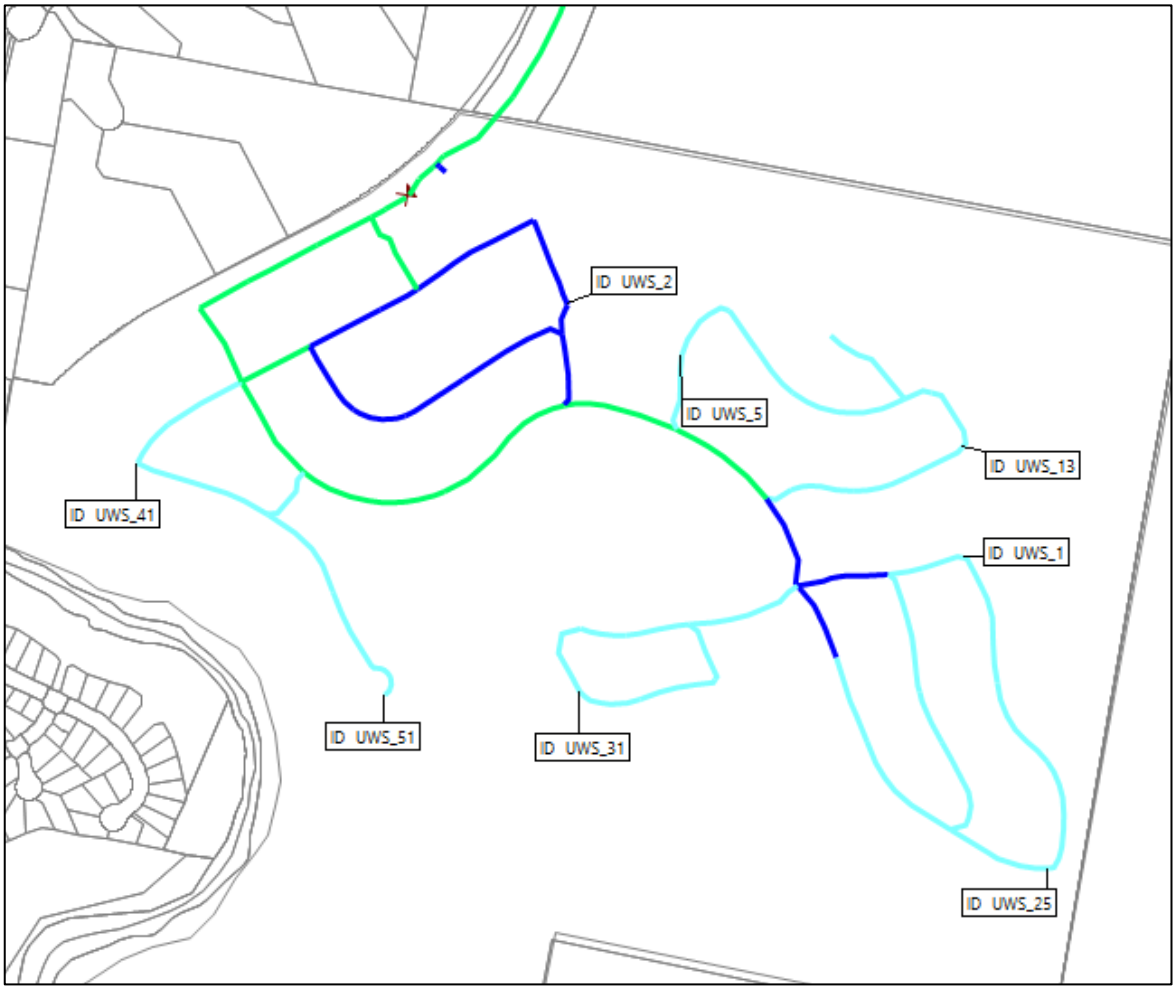
Table 2-4 presents the summary fire flow results for various locations in the Jumping Creek development. These locations are shown in Figure 2-4.

Table 2-4: Fire Flow Summary Results

Node Tested	Location	Result (maximum flow available with 15m residual pressure)
UWS_1	100mm UPVC main	15 L/s @55.2 m 47.8L/s @15m
UWS_13	100mm UPVC main	15 L/s @54.2 m 45.5L/s @15m
UWS_2	150mm UPVC main	15 L/s @67.6 m 73.4L/s @15m
UWS_25	100mm UPVC main	15 L/s @59.1 m 46.4L/s @15m
UWS_31	100mm UPVC main	15 L/s @69.2 m 40.9L/s @15m

Node Tested	Location	Result (maximum flow available with 15m residual pressure)
UWS_41	100mm UPVC main	15 L/s @52.4 m 52.5L/s @15m
UWS_5	100mm UPVC main	15 L/s @74.1 m 60.9L/s @15m
UWS_51	100mm UPVC main	15 L/s @38.8 m 27.8L/s @15m

Figure 2-4: Fire Flow Test Locations



2.5 Water Supply Assessment Summary

The analysis showed that the new development at Jumping Creek can be supplied with a DN200 main, however pressure reduction will be required to prevent excess pressures in the estate.

The proposed internal layout was developed using DN100, DN150, DN200 and DN225 Series 2 PVC-M PN16 (approximately 5,100m).

A Pressure Reducing Valve is required to control the pressure within the development. A set point of 55m was adopted for the modelling.

APPENDIX D STORMWATER REPORT

STORMWATER MANAGEMENT STRATEGY

JUMPING CREEK, QUEANBEYAN
24/06/2021

PREPARED FOR PEET PTY LTD

This report has been prepared by the office of Spiire

Level 6, 414 La Trobe Street PO Box 16084 **Melbourne** Victoria 8007

Issue Date	Rev No	Authors	Checked	Approved
25/01/2019	1	SC, LC	MY, KW	LH
24/06/2021	2	Updates by RC, CC		RC

Spiire Job Number: 305492

Citation: Spiire 2021, STORMWATER MANAGEMENT STRATEGY Report for PEET PTY LTD.
Authors: S. Cant, L.Cottrell, updates by R. Carnegie and C. Cosgriff Spiire Australia Pty Ltd. Project Number 305492

File Name: G:\30\305492\Water\General\Reports\W_REP_305492_2_Jumping Creek SWMS.docx

Cover photo: Courtesy of Spiire Pty Ltd

TABLE OF CONTENTS

1. INTRODUCTION

This Stormwater Management Strategy has been prepared on behalf of PEET Pty Ltd (PEET). Its function is to support the DA documents which are being submitted for the Jumping Creek Estate, Queanbeyan, legally known as Lot 5 in DP1199045.

The land proposed to be subdivided is legally described as Lot 5 DP 1199045 and is located at 28 Lonergan Drive, Queanbeyan, also known as Jumping Creek. From herein the land proposed to be subdivided will be referred to as the Site. The Site is approximately 3 km south east of the Queanbeyan City Centre and provides a total area of approximately 94.50 Ha. The Site is surrounded by undeveloped land to the north east and Ellerton Drive Extension and Greenleigh Estate low-density residential development to the North West.

The Site is vacant however contains the remnant mine sites and associated dispositions of spoil and mining activity debris. The Site also contains a sheep dip. The proposed access is from the Edwin Land Parkway/ Ellerton Drive Extension while pedestrian access from Greenleigh is via an Ellerton Drive underpass. The Site also includes several heritage and indigenous sites including a Scar Tree. The Site has been subject to pest removal action due to invasive weeds species.

The Site is located near Greenleigh and is characterised by a combination of undulating and flatter land bisected from the north by Jumping Creek and to the east by Valley Creek, which flow into the Queanbeyan River to south west.

There is a long history to the planning and rezoning of the Site to enable an appropriate subdivision of the land much of which is set out in the 2018 amended planning proposal prepared by the Queanbeyan Palerang Regional Council (QPRC). That amended planning proposal was approved by the NSW Minister of planning and changes recorded to the QPRC LEP 2012 on 23 November 2018.

1.1 SCOPE

The scope of this report includes the following:

- Jumping Creek and Valley Creek Rehabilitation
- Existing and Proposed Flood Modelling within the creek network
- Water Sensitive Urban Design requirements for the development in order to meet water quality targets prior to discharge into the creek network
- Drainage sizing requirements in order to capture and convey 5 year ARI (Q5) flows through the development to the downstream water quality treatment assets
- Analysis of 100 year ARI (Q100) overland flow paths through the development

2. STORMWATER MANAGEMENT

2.1 STORMWATER MANAGEMENT OBJECTIVES

- Attenuate post development Q5 and Q100 flows to pre development rates
- Capture and convey Q5 development flows via piped drainage to the downstream water quality treatment assets
- Conveyance of Q100 flows overland (or via piped drainage where necessary) through the proposed road network and/or drainage reserves to the downstream creek network

Note: Water Quality treatment objectives are discussed in detail in Section 3.1.

2.2 HYDROLOGICAL ANALYSIS

2.2.1 EXISTING CONDITIONS

With the outlet point at the junction with the Queanbeyan River, areas for the Valley Creek and Jumping Creek watersheds were delineated based on contour information obtained from SIX Maps NSW. These areas were further subdivided into smaller catchment areas as part of the development of an existing conditions RORB model (see Figure 1). Catchment centroids, junctions, and routing reaches that are needed for the RORB model were also determined (see Figure 2). Total watershed area is 36 km^2.

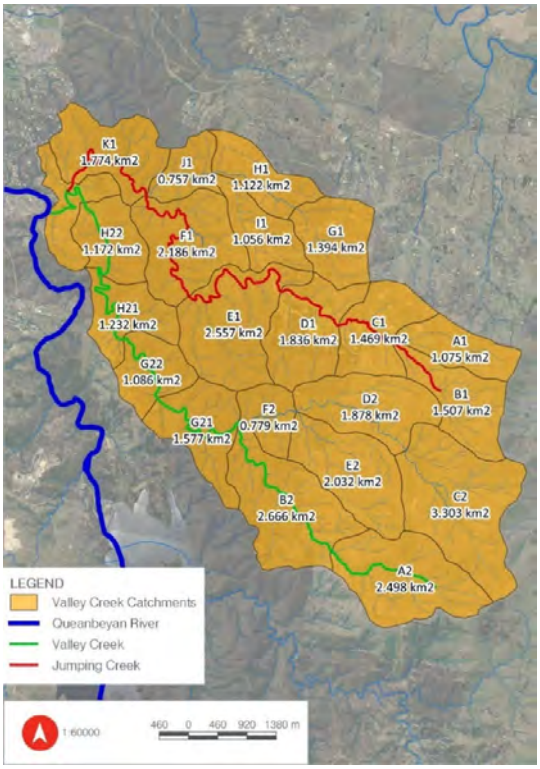


Figure 1: Valley Creek Watershed Area

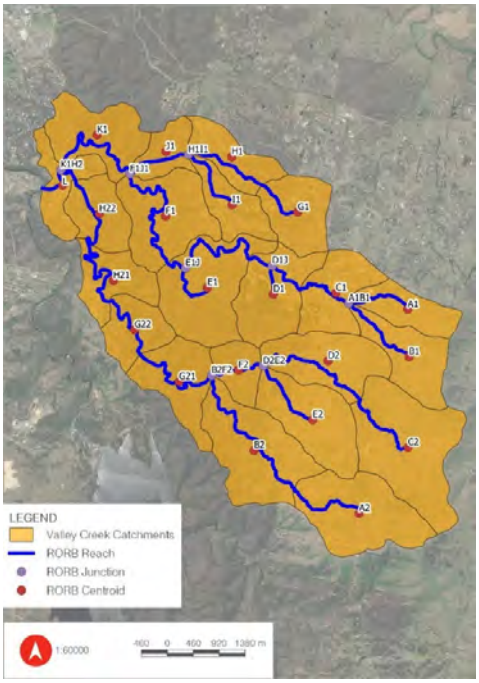


Figure 2: Valley Creek RORB Geometry

Peak flow targets for the watershed outlet at the Queanbeyan River were acquired from the Regional Flood Frequency Estimation (RFFE) tool in accordance with ARR2016. Values for the AEPs considered in this assessment can be seen in Table 1.

Table 1: Valley Creek Peak Flows from RFFE

AEP (assumed ARI)	Valley Creek Peak Flow at Queanbeyan River (m^3/s)
20% (5yr)	46.8
10% (10yr)	71.5
5% (20yr)	102
1% (100yr)	201

Because the 1% AEP event is the primary focus in this analysis, the 1% AEP peak flow was used to determine the RORB parameters (k_c, m) for the watershed. The parameters and losses used for the watershed were acquired from the ARR data hub and can be seen in Table 2.

Table 2: Parameters for Valley Creek RORB Model

Parameter	Value
k_c	1.40
m	0.8

Parameter	Value
Initial Loss (IL, mm)	22.0
Continuing Loss (CL, mm/h)	4.1

With relation to the proposed development location, flows coming from the upstream areas of Valley Creek and Jumping Creek are of importance to the site flood conditions. The RORB flows from end points of catchments K1 (Jumping Creek) and H2 (Valley Creek) were used to represent the upstream runoff at the location of the site in the TUFLOW hydraulic model (see Table 3). These are the same in existing and proposed conditions.

Table 3: Valley Creek and Jumping Creek Upstream Peak Flows

ARI	Valley Creek Upstream Flow (m^3/s)	Jumping Creek Upstream Flow (m^3/s)
5yr	22.4	21.3
10yr	34.6	32.0
20yr	51.1	48.0
100yr	107.2	101.2

Catchment L represents the location of the proposed development within the full watershed (see Figure 3). Table 4 shows the calculated existing peak flows for this catchment as determined in RORB.

Table 4: Catchment L Existing Conditions Peak Flows

ARI	Catchment L Existing Flow (m^3/s)
5yr	3.2
10yr	3.7
20yr	7.2
100yr	13.4

Figure 3: Catchment L (Development Area)

2.2.2 PROPOSED CONDITIONS

The proposed development layout is shown in Figure 4. The fraction impervious for Catchment L was revised to include the development, which is assumed to be fully within the catchment. All other parameters from the existing model (k_c, m, IL/CL) were left unchanged. This created the proposed RORB model. Table 5 shows the calculated proposed peak flows for Catchment L.

Table 5: Catchment L Proposed Conditions Peak Flows

ARI	Catchment L Proposed Flow (m^3/s)
5yr	4.0
10yr	5.5
20yr	10.8
100yr	17.7

Figure 4: Catchment L with Proposed Layout

2.3 HYDRAULIC ANALYSIS

2.3.1 EXISTING CONDITIONS

A TUFLOW hydraulic model was created to analyse and determine the existing flooding conditions at the proposed site of the development. Ground survey data was used to create an existing conditions terrain surface. Figure 5 shows the extent of the hydraulic analysis, along with boundary locations and roughness values. A cell size of 2 metres was used.

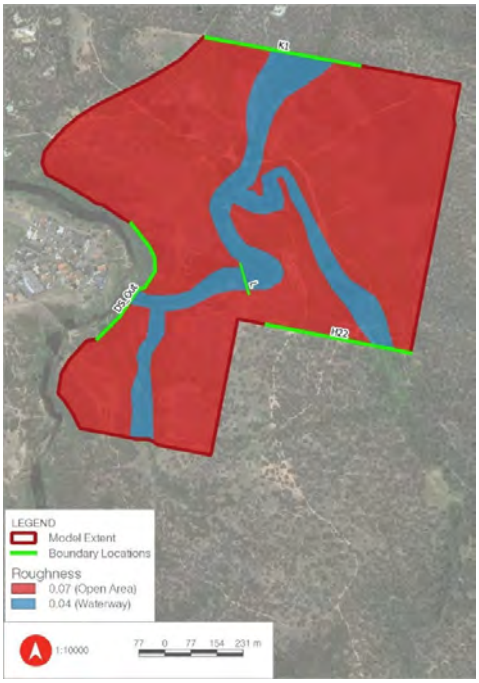


Figure 5: TUFLOW Existing Model Parameters

As a sanity check, the existing conditions peak flow to the Queanbeyan River as calculated in TUFLOW was obtained and compared to that from RORB. Table 6 shows the comparison between the TUFLOW and RORB flows for the respective ARIs. It shows very similar results, with the peak flows within no more than 6% of each other. shows the existing conditions flood depths and extents for the 100-year ARI event.

Table 6: RORB and TUFLOW Peak Flows at the Queanbeyan River

ARI	RORB Peak Flow (m^3/s)	TUFLOW Peak Flow (m^3/s)	Percent Difference
5yr	43.4	40.8	6.0%
10yr	66.6	65.1	2.3%
20yr	97.9	96.2	1.7%
100yr	201.3	192.8	4.2%

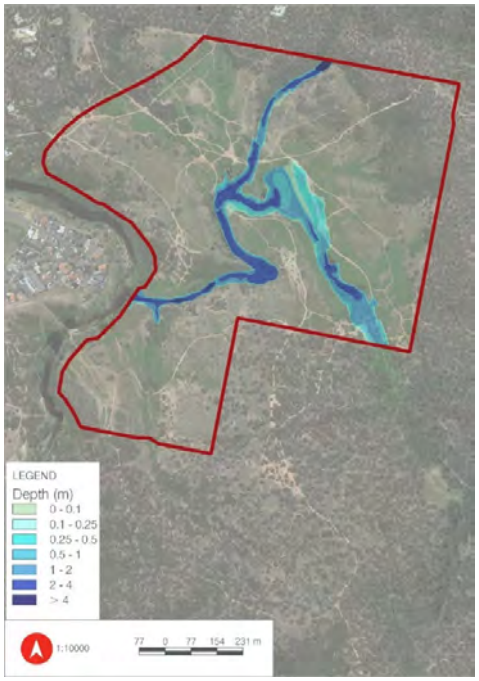


Figure 6: 100yr Existing Conditions Flood Depth and Extents

2.3.2 PROPOSED CONDITIONS

The existing TUFLOW hydraulic model was revised to include the proposed development terrain to create the proposed conditions model for determining the proposed flooding conditions. Roughness values representing the developed areas were also revised (see Figure 7) and proposed conditions flows were used. All other model parameters remained unchanged from the existing model. Figure 8 shows the proposed conditions flood depths and extents for the 100-year ARI event. Figure 9 shows the 100-year flood impacts. Major creek crossings were sized as follows:

- Jumping Creek: 5 x 3000 mm x 3000 mm cells (3 x RBCs with 2 link slabs) with approximately 1.0m freeboard to the proposed road level
- Valley Creek - Upstream: 5 x 2400 mm x 2400 mm cells (3 x RBCs with 2 link slabs) with approximately 1.3m freeboard to the proposed road level
- Valley Creek – Downstream of Confluence: 19m single span bridge, with approximately 2.2m freeboard to proposed road levels

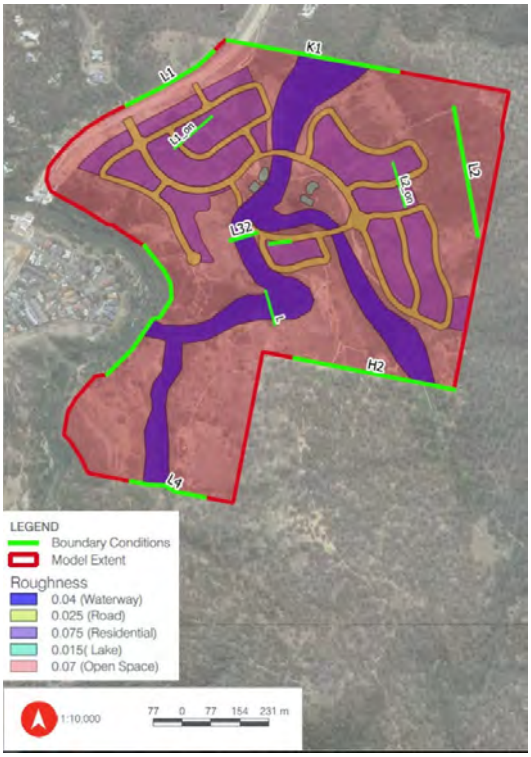


Figure 7: TUFLOW Proposed Model Parameters – refer to latest plans for layout

Figure 8: 100yr Proposed Conditions Flood Depth and Extents

As shown in Figure 9, there is some raising of 1 in 100 year ARI flood levels upstream of the confluence bridge crossing and culvert crossings, however all afflux is contained within the development area, i.e. there are no flood level increases outside of the property boundary. The Creek rehabilitation and realignment is discussed in detail in Section 2.4.

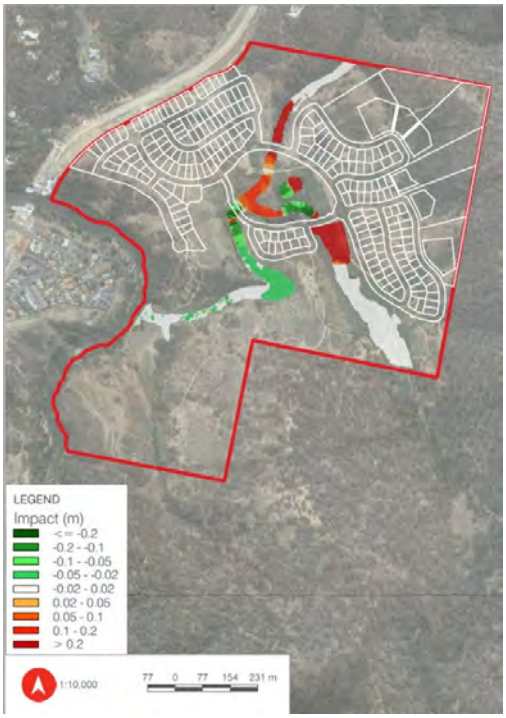


Figure 9: 100yr Flood Impact

Figure 10 shows proposed conditions maximum velocity x depth locations. As shown, the velocity x depth product is greater than 0.5 in a large proportion of the creek corridor. This, however, is expected in the proposed scenario due to the existing velocity distribution. As shown in Figure 11 and Figure 12, there are minimal changes to the overall velocity within the creek corridor from existing to proposed conditions. Changes upstream and downstream of the culverts are expected and thus rock protection will be put in place as scour and erosion protection. Further detail, including rock sizing and extent within the waterway as well as batter slope treatment requirements, will be provided at the detailed design phase of the project.

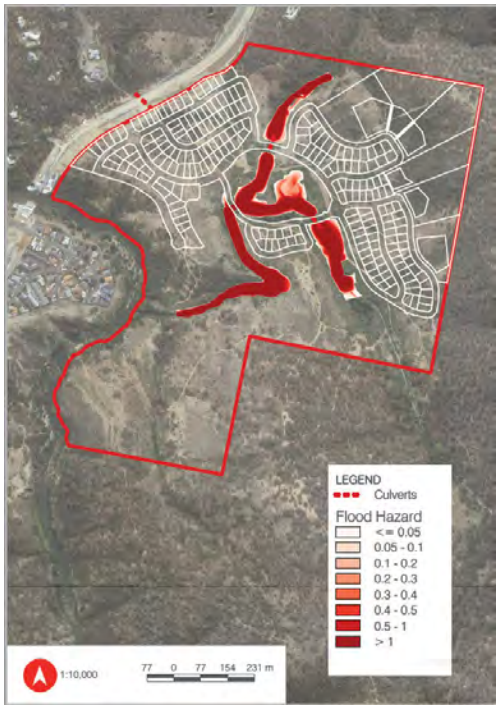


Figure 10: 100yr Proposed Conditions Flood Hazard

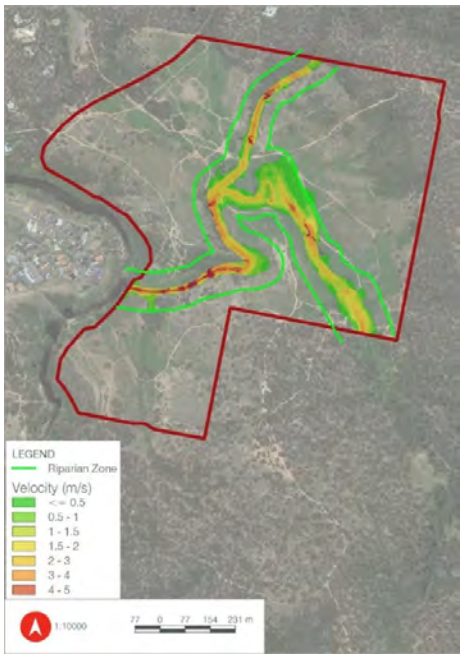


Figure 11: 100yr Existing Conditions Flood Velocity

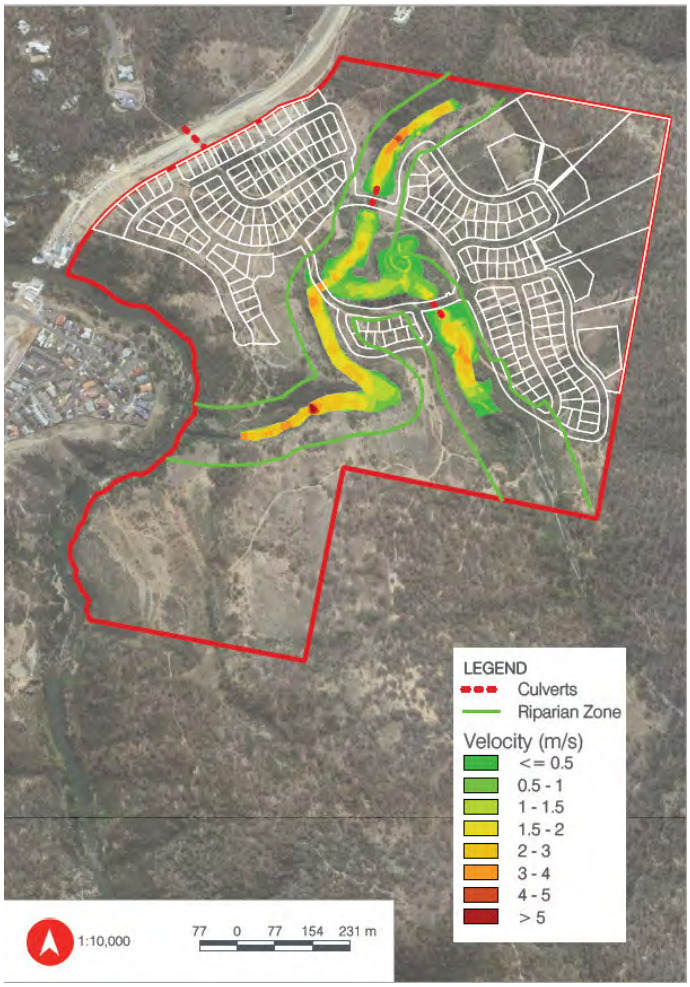


Figure 12: 100yr Proposed Conditions Flood Velocity

2.3.3 CULVERT CROSSING SENSITIVITY ANALYSIS

As a sensitivity check, the proposed conditions model was run with a 20% blockage factor on each of the creek culvert crossings in accordance with ARR2016 Blockage Assessment Form (Appendix D). This was modelled to simulate a situation where large tree branches, brush, and other forest debris building up at the upstream end of the culvert crossings may cause reduced available flow area through the culverts.

Results show that in a 20% blockage scenario at the Jumping Creek crossing, the Q100 flood level shows a freeboard of approximately 0.65 m, while at the Valley Creek crossing, the Q100 flood level shows a minimum freeboard of approximately 850 mm, (See Figure 13). It is assumed that it is highly unlikely that a 20% blockage scenario will occur on all culverts at each of the crossings due to the large size of the culverts, the proposed clearing of weeds including trees within the existing creek corridor and the velocities flowing through both the existing and proposed creek scenarios. Therefore, this 20% blockage scenario has been assessed only as a sensitivity to ensure that there is no overtopping in such a situation. As such, the no blockage scenario has been adopted as the Q100 flood level for the site.

Figure 13: 100yr Proposed Conditions Flood with 20% Culvert Blockage

2.4 RIPARIAN CORRIDOR

As outlined in Section 2.2.1, the proposed development is located upstream of where two creeks converge prior to discharge into the Queanbeyan River. As a result, analysis of the Riparian Corridor in its existing state has been undertaken in consultation with the Natural Resources Access Regulator (NRAR) NSW. As a result of this assessment, a creek realignment has been proposed within the site extent.

Figure 14, provided by NRAR, has been annotated to show that that the creek network flowing through the development consists of a 5th order stream and a 6th order stream prior to discharge into the Queanbeyan River which has been detailed as a 7th order stream.

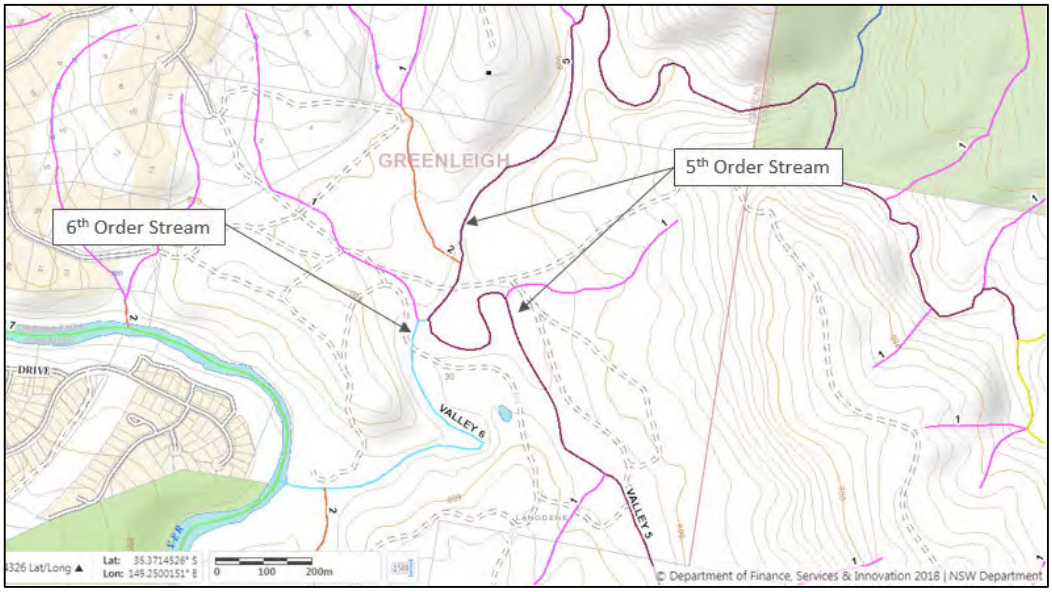


Figure 14: Strahler Order of Stream - NRAR

The *Guidelines for Riparian Corridors on Waterfront Land (Department of Primary Industries – Office of Water NSW Government, 2012)* outlines that 4th order streams and greater have a total Riparian Corridor of 80m + channel width.

The existing top of bank has been determined based on the high water mark (assumed to be the Q100 level). The Riparian Corridor including the inner and outer 50% of this zone has then been determined from the top of bank.

The proposed development layout is located outside the inner 50% of the existing Riparian Corridor, except at the proposed creek crossings, in accordance with NRAR requirements. Water quality treatment infrastructure including Sediment Basins, Wetlands and a Bioretention Basin are located within the Riparian Corridor. These elements will contribute to enhancing the habitat value of the rehabilitated creek.

2.4.1 CREEK REHABILITATION AND REALIGNMENT

The existing creeks located within the site extent are in a highly degraded form due to creek scour and erosion, and significant infestation of weeds leading to a build-up of debris and organic matter. This area of the site has also been subjected to extensive unauthorised vehicle access resulting in areas of concentrated erosion gullies as well as the dumping of used car bodies (Refer to Figure 15 to Figure 12).

Due to the extensive rehabilitation work required to remove the weed species, make the area safe for residents, and removal of dumped items (such as car bodies) the area in the middle of the site is proposed to be rehabilitated to ensure creek flows remain within the creek corridor, and erosion is mitigated. As such, work is proposed within the extent of the Riparian Corridor where required, and the riparian corridor is to be re-instated to have a higher ecological value as part of the development as shown on Drawings 305492CA731 to 305492CA735.

Figure 15: Photo- Erosion gullies from vehicle access

Figure 16: Erosion and evidence of car parts

Figure 17: Shale rock, exposed surfaces with minimal vegetation, and existing Poplar trees to be removed

Figure 18: Extensive Sediment Build up, Shale rock, evidence of vehicle access

Figure 19: Erosion and weeds to be removed

Figure 20: Extensive weed growth – to be removed

In consultation with NRAR, a creek diversion has also been proposed within this portion of the site. The creek diversion has been proposed to minimise short circuiting of high flows which is currently occurring at the creek convergence point due to significant scour and erosion due to exposed surfaces and existing velocities flowing through this section of creek. In addition, this diversion will allow sediment basins, wetlands and a bio retention basin to be located downstream of the proposed development to treat water to best practice treatment requirements prior to discharge into the Queanbeyan River and provide landscape amenity and enhanced habitat value to the riparian corridor.

The proposed creek rehabilitation concept design includes a pool and riffle sequence. In addition, the realigned section of waterway has been designed with a gradual bend in accordance with advice from NRAR.

A fluvial geomorphology report will be undertaken as part of the design process in accordance with NRAR advice.

2.4.2 STORMWATER DETENTION

As outlined in *D5 - Stormwater Drainage Design* (QPRC, 2019), predevelopment peak discharge rates are not to be exceeded in the 1 in 5 Year ARI and 1 in 100 Year ARI storm events.

Table 7 shows the peak discharges at the outlet to the Queanbeyan River. The proposed peak discharge is slightly higher (3.5%) than the existing peak discharge in the 1 in 5 Year ARI event. The overall flood model for Jumping and Valley Creeks as detailed in section 2.2.2 is, however, conservative in that the development flows have been input directly into the creek upstream of the culverts in order to provide a representative indication of the 1 in 100 year ARI Flood Levels upstream and downstream of the site. The 1 in 5 year ARI internal development drainage network was not modelled in the overall flood model for Jumping and Valley Creeks due to the size of overall upstream catchment, and the inability to accurately model this level of detail. This drainage network however, in addition to the proposed water quality treatment assets for the site can provide increased conveyance length for developed flows, as well as a degree of stormwater detention storage which is likely to reduce the 1 in 5 year ARI flow conditions.

The proposed 1 in 100 Year ARI flow at the outlet to the Queanbeyan River is 0.26% lower than existing flow rates. Any additional detention would reduce flows entering the Queanbeyan River to well below the existing flows and thus alter the existing flow regime. As such, stormwater detention to further reduce peak discharges has been determined to be not required for the site.

Table 7: Peak Flows to the Queanbeyan River

ARI	Existing Peak Flow (m^3/s)	Proposed Peak Flow (m^3/s)
5yr	40.8	42.3
100yr	192.8	192.3

2.5 MINOR DRAINAGE NETWORK AND OVERLAND FLOWS THROUGH THE SITE

The development drainage network has been designed to have a minimum 1 in 5 year ARI flow capacity. Preliminary pipe sizing for much of the system has been undertaken using the Rational Method of flow calculation. For external catchments west of Ellerton Drive, flows have been provided by QPRC. The flow for external Catchment L, flowing through the site is 1.75m3/s as provided by Council. Flows from this external catchment have been taken into consideration in drainage pipe sizing and road capacity calculations. For external catchments east of the site, the Kinematic Wave Equation has been used to determine the external 1 in 100 year flows contributing to the development drainage network.

At this stage of the design, drainage grades have been determined based on preliminary road grading. Further analysis based on final road grading and adjacent services may lead to changes to required drainage pipe diameters. Minimum conduit sizes within proposed road reserves are 375mm diameter as outlined in *D5 - Stormwater Drainage Design* (QPRC, 2019). Preliminary drainage sizing based on drainage catchments is shown on Drawing 305492CA300. Rational calculations and corresponding pipe sizing calculations have been supplied on Drawing 305492CA320 and in Appendix A.

Overland Qgap (Q100 – Q5) flow capacities within road reserves have been calculated in PC Convey based on preliminary road grading. As outlined in Council Guidelines, *The velocity x depth product of flow across the footpath and within the road reserve shall be such that safety of children and vehicles is considered. The maximum allowable depth of water is 0.2m and the maximum velocity x depth product of 0.4m^2/s is permitted.*

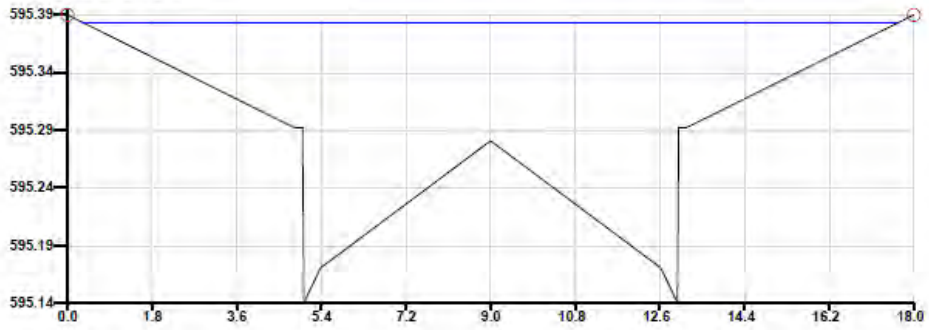
A PC Convey Section showing the typical road configuration at a critical flow capacity location on Road 011 is provided in Figure 21. The maximum flow conveyed along this road is 1.04m^3/s which is less than the road capacity of 1.69m^3/s. Therefore, based on preliminary road grading, Road 011 has capacity to safely convey flow to the downstream creek network.

During detailed design, the proposed drainage network and thus overland flow through the development will be further refined.

PC Convey Sections, including diversion catch drain capacity calculations, are provided in Appendix C.

PROJECT: 305492
RD011 Max Cap
Print-out date: 25/01/2019 - Time: 9:19
Data File: T:\30\305492\Civil\12D\Design Calcs\305492 RD011 Max Cap 1%.dat

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 2.0 cumecs

There is no pipe discharge
Overland / Channel / Watercourse discharge = 2.00 cumecs

3. RESULTS: Water surface elevation = 595.384m

Grade = 1 in 100

	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.00	1.69	0.00	1.69
D(Max) = Max. Depth (m):	0.00	0.24	0.00	0.24
D(Ave) = Ave. Depth (m):	0.00	0.10	0.00	0.10
V = Ave. Velocity (m/s):	0.00	0.98	0.00	0.98
D(Max) x V (cumecs/m):	0.00	0.24	0.00	0.24
D(Ave) x V (cumecs/m):	0.00	0.10	0.00	0.10
Froude Number:	0.00	0.99	0.00	0.99
Area (m^2):	0.00	1.72	0.00	1.72
Wetted Perimeter (m):	0.00	17.55	0.00	17.55
Flow Width (m):	0.00	17.30	0.00	17.30
Hydraulic Radius (m):	0.00	0.10	0.00	0.10
Composite Manning's n:	0.000	0.022	0.000	0.022
Split Flow?	-	-	-	No

4. CROSS-SECTION DATA:

SEGMENT NO.	LEFT HAND POINT CHAINAGE (m)	LEFT HAND POINT R.L. (m)	RIGHT HAND POINT CHAINAGE (m)	RIGHT HAND POINT R.L. (m)	MANNING'S N
1	0.000	595.391	4.850	595.294	0.035
2	4.850	595.294	5.000	595.294	0.035
3	5.000	595.294	5.030	595.144	0.013
4	5.030	595.144	5.380	595.174	0.013
5	5.380	595.174	9.000	595.283	0.015
6	9.000	595.283	12.620	595.174	0.015
7	12.620	595.174	12.970	595.144	0.013
8	12.970	595.144	13.000	595.294	0.013
9	13.000	595.294	13.150	595.294	0.013
10	13.150	595.294	18.000	595.391	0.013

Figure 21: Road 011 Allowable Flow Capacity (PC Convey)

3. WATER QUALITY

3.1 WATER QUALITY OBJECTIVES

Water Quality treatment objectives for the site have been adopted in accordance with the Australian Runoff Quality (ARQ 2016) Guidelines (Engineers Australia).

The guidelines seek to minimise the detrimental effects of urbanisation on receiving waterways.

Table 8 lists the Best Practice water quality treatment objectives.

Table 8: Water Quality Best Practice Treatment Objectives

Pollutant	Best Practice Treatment Objectives
Total Suspended Solids (TSS)	80% retention of the typical urban load
Total Phosphorus (TP)	45% retention of the typical urban load
Total Nitrogen (TN)	45% retention of the typical urban load
Litter[1]/Gross Pollutants (GP)	90% retention of the typical urban load

Best Practice Treatment Targets have been considered as optimum for the proposed site in comparison to Pollutant Retention Objectives outlined in Table D7.2 of the Development Design Specification D7 Erosion Control and Stormwater Management (QPRC, 2018) which require 65% retention of average annual load of Total Phosphorus (TP) and Total Nitrogen (TN).

Best Practice Targets have been adopted with consideration of the following elements:

- Asset sizing in relation to incoming impervious catchment area and resulting bioretention basin performance and long term sustainability.
  - In order to meet 65% retention of Total Nitrogen in comparison to 45% (Best Practice) Bioretention Basin assets are required to be between 3 and 4 times larger. This will lead to assets receiving insufficient flows to ensure long term plant survival and optimum nutrient uptake.
- Effective life cycle costs including capital, operation and maintenance costs as outlined in the QPRC Guidelines.
  - Oversized assets will have higher maintenance and operation costs due to both size and performance.
- The existing ecosystem within the downstream Jumping Creek and Valley Creek network is considered highly disturbed due to previous land use and thus creek rectification works are required to enhance the natural environment. As a result, the downstream system is not considered an unmodified, intact ecosystem with high conservation value. Therefore, the significant treatment requirements in the Table D7.2 of the Development Design Specification D7 Erosion Control and Stormwater Management (QPRC, 2018) are not necessary.

3.2 PROPOSED WATER QUALITY TREATMENT

In order to meet the water quality objectives, the following treatment assets have been proposed for the site:

- Catchment A treatment: 600m^2 sediment basin with a 470m^2 bioretention basin, discharging to Jumping Creek
- Catchment B treatment: 600m^2 sediment basin with a 520m^2 bioretention basin, discharging to Valley Creek
- Catchment C treatment (1.7ha only): gross pollutant trap, discharging to Valley Creek

Catchment A and B treatment is also proposed to include a GPT asset. Asset sizing and design will be confirmed in detailed design.

3.2.1 MUSIC MODELLING

Model for Urban Stormwater Improvement Conceptualisation (MUSIC v6.2.1) has been used to determine the Water Quality requirements for the site.

3.2.2 WATER QUALITY CATCHMENT DELINEATION

The impervious percentage for the proposed development is 65% in accordance with Residential land use (average lot size of 600-800m^2) as per Table D5.6 of the Development Design Specification, part D5 (QPRC, 2019). The MUSIC Catchment Delineation is shown in Figure 22.

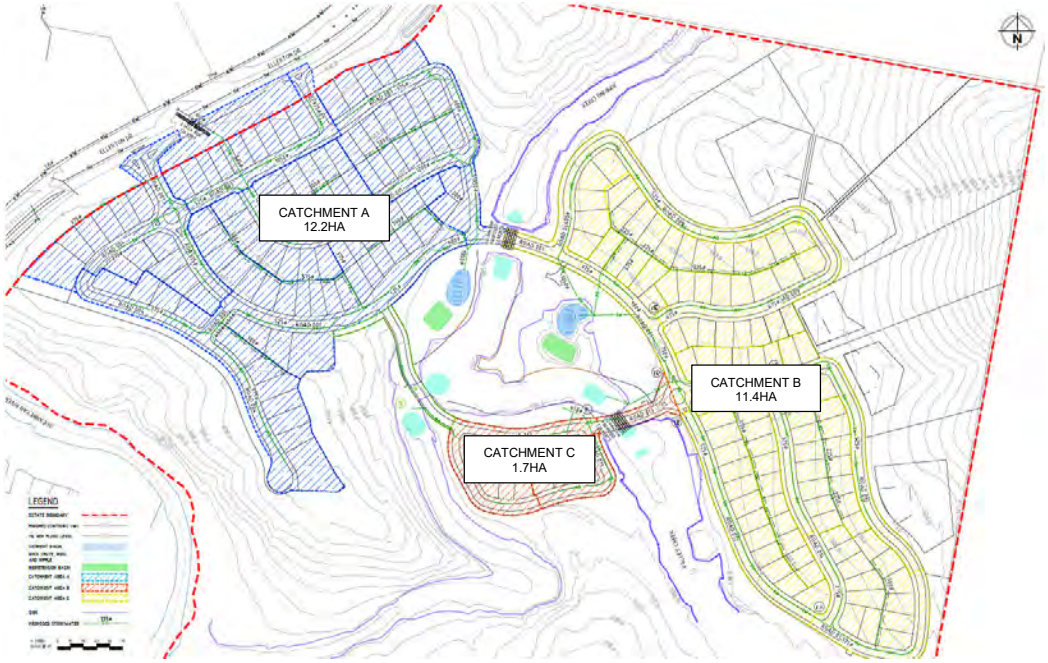


Figure 22: WSUD Catchment Delineation

3.2.2.1 Rainfall

Rainfall data adopted in MUSIC is from the Canberra Airport for a representative 10 year period from 1968 to 1977 (annual rainfall of 655.3mm). This 10 year rainfall period is reflective of the average rainfall for the region over a 10 year period. The Canberra Airport rainfall station has been selected as it is < 10km away and recommended in Section B.2 of the Waterways: Water Sensitive Urban Design General Code (ACT).

3.2.2.2 Rainfall Runoff Parameters

The Rainfall Runoff Parameters outlined in Table 9 have been adopted in MUSIC as per Stormwater Municipal Infrastructure Standards 08 (ACT Government, 2019).

Table 9: Rainfall Runoff Parameters

Parameter	Urban – Value Adopted
Impervious Area Properties	
Rainfall Threshold (mm/day)	0
Pervious Area Properties	
Soil Storage Capacity (mm)	40
Soil Initial Storage (% of Capacity)	25
Field Capacity (mm)	25
Infiltration Capacity Coefficient – a	200
Infiltration Capacity Coefficient – b	1
Groundwater Properties	
Initial Depth (mm)	1
Daily Recharge Rate (%)	25
Daily Baseflow Rate (%)	1
Daily Deep Seepage Rate (%)	15

3.2.3 WATER QUALITY TREATMENT ASSETS

3.2.3.1 Proposed Sediment Basins

Two sediment basins have been proposed for the site:

- Sediment basin 1 is located on the western side of Jumping Creek
- Sediment basin 2 is located on the eastern side of Jumping Creek

The proposed sedimentation basins have been designed with consideration of the design parameters outlined in the Development Design Specification D7 Erosion Control and Stormwater Management (QPRC, 2018).

Sedimentation Basin node parameters modelled in MUSIC are provided in Table 10 and . Table 11.

Table 10: Sedimentation Basin Treatment Node Parameters

Sedimentation Basin Node Parameter	Sediment Basin 1	Sediment Basin 2
Surface Area (m^2)	600	600
Extended Detention Depth (m)	0.45	0.45
Permanent Pool Volume (m^3)	464	495
Exfiltration Rate (mm/hr)	0	0
Evaporative Loss as % of PET	75	75
Notional Detention Time (hrs)	12	12
CSTR Cells	2	2

Table 11: Additional Sediment Basin Sizing Criteria

Sedimentation Basin Node Parameter	Sediment Basin 1	Sediment Basin 2
Catchment Area (Ha)	12.2	11.4
Dry Out Area (m^2)	250	250
Permanent Pool Depth (m)	1.5	1.5
Clean Out Frequency (years)	5	5

3.2.3.2 Proposed Bioretention Basin

Two bioretention basins have been proposed for the site:

- Bioretention basin 1 is located on the western side of Jumping Creek, connected to sediment basin 1
- Bioretention basin 2 is located on the eastern side of Jumping Creek, connected to sediment basin 2

The proposed bioretention systems have been modelled using the Bioretention Basin node parameters provided in Table 12. Preliminary Bioretention Basin design parameters are provided in Table 13.

Table 12: Bioretention Node Parameters

Parameter	Bioretention Basin 1	Bioretention Basin 2
Low Flow By-pass (m^3/s)	0	0
High Flow By-pass (m^3/s)	0.8	0.5
Extended Detention Depth (m)	0.30	0.30
Surface Area (m^2)	470	500
Filter Area (m^2)	470	500

Parameter	Bioretention Basin 1	Bioretention Basin 2
Unlined Filter Media Perimeter (m)	0.01	.01
Saturated Hydraulic Conductivity (mm/hour)	200	200
Filter Depth (m)	0.60	0.60
TN Content of Filter Media (mg/kg)	400	400
Orthophosphate Content of Filter Media (mg/kg)	30	30
Exfiltration Rate (mm/hr)	0	0
Base Lined?	Yes	Yes
Vegetation Properties	Vegetated with Effective Nutrient Removal Plants	Vegetated with Effective Nutrient Removal Plants
Underdrain Present	Yes	Yes
Submerged Zone with Carbon Present	Yes	Yes

Table 13: Preliminary Bioretention Design Parameters

Bioretention Design Parameters	Bioretention Basin 1	Bioretention Basin 2
Top of filter media RL (m)	585.20	584.10
Overflow Pit Level (m)	585.50	584.40
Filter Media Area (m^2)	470	520

3.3 WSUD TREATMENT TRAIN

The proposed treatment train as modelled in MUSIC is shown in Figure 23

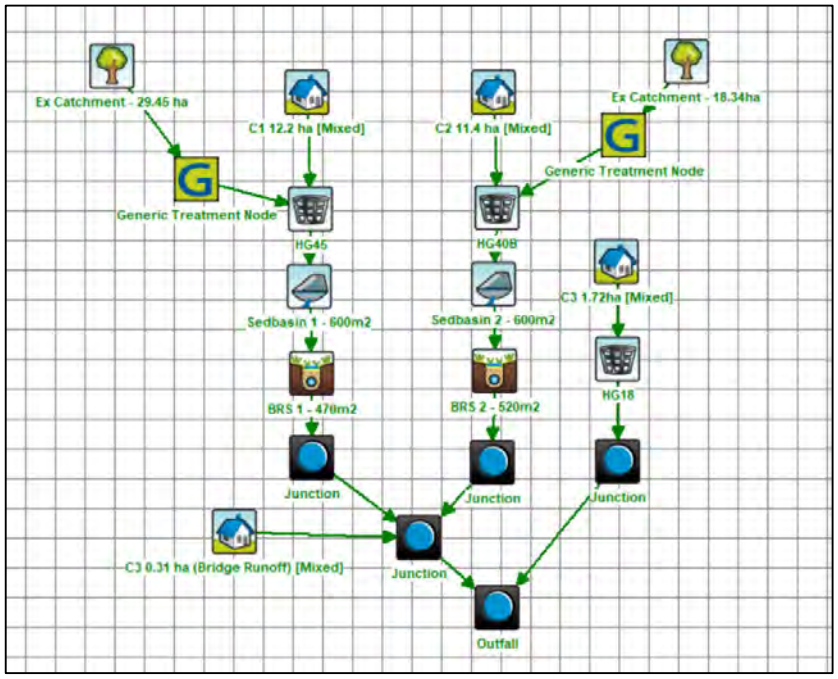


Figure 23: MUSIC Treatment Train

3.3.1 TREATMENT TRAIN EFFECTIVENESS

The treatment train effectiveness of the proposed system is detailed in Table 14. As shown, the proposed treatment system meets Best Practice Water Quality Targets.

Table 14: Percentage Reduction in Stormwater pollutants for the site

Pollutant	Percentage Reduction
Reduction in average annual suspended solids (SS) export load	83.6
Reduction in average annual total phosphorus (TP) export load	53.1
Reduction in average annual total nitrogen (TN) export load	53.0

4. SUMMARY

This report completed by Spiire for PEET outlines the key stormwater management and Water Sensitive Urban Design components of the site at Jumping Creek, Queanbeyan. In addition, this report outlines the existing and proposed 1 in 100 year ARI flood modelling completed for Jumping and Valley Creeks flowing through the central area of the site.

The proposed development has been designed to convey 5 year ARI flows via a piped drainage network through the development prior to discharge into the proposed treatment measures for the site. In addition, the proposed development has been preliminarily designed to convey Gap flows (100 year ARI – 5 year ARI) through the proposed road reserves. Detailed analysis of the maximum depth of flow of 200mm and maximum depth x velocity product of 0.4m^2/s will be undertaken during detailed design and pipe sizes adjusted accordingly to comply with Council requirements.

Existing and proposed 1 in 100 year ARI flood models have been produced for the central area where Jumping and Valley Creeks converge. In order to convey 1 in 100 year ARI flows through Jumping and Valley Creeks in the central area of the development, three crossing arrangements have been proposed:

- Jumping Creek Culvert Crossing: 5 x 3000 mm x 3000 mm RBCs
- Valley Creek Culvert Crossing: 5 x 2400 mm x 2400 mm RBCs
- Valley Creek Bridge Crossing: 19m span bridge, downstream of creek confluence

Due to the existing state of the site including the area containing existing creek network, rehabilitation of the riparian corridor is required. As part of the required creek rehabilitation, a creek diversion has been proposed to minimise short circuiting which is currently occurring due to scour and erosion, and to provide sufficient space for water quality treatment of development flows prior to discharge into the downstream network.

The proposed water quality treatment measures for the site include the following:

- 600m^2 sedimentation basin discharging into a 470m^2 bioretention basin prior to discharging into the downstream creek network to treat Catchment A
- 600m^2 sedimentation basin discharging into a 520m^2 bioretention basin prior to discharging into the downstream creek network to treat Catchment B
- Gross pollutant trap to treat minor Catchment C (1.7ha) flows

APPENDIX A– RATIONAL CALCULATIONS AND DRAINAGE SIZING

Project:	**JUMPING CREEK SUBDIVISION**	**Designed:**	S Beff
Reference No:	**305492**	**Checked:**	MY

Polynomial Coefficients

ARI	a	b	c	d	e	f	g
5	3.32517	-6.34E-01	-3.83E-02	8.87E-03	8.27E-04	-3.22E-04	-8.75E-06
10	3.45299	-6.39E-01	-3.46E-02	8.25E-03	5.78E-04	-2.30E-04	-1.91E-05
20	3.60265	-6.44E-01	-3.15E-02	8.38E-03	2.94E-04	-2.25E-04	-1.35E-05
50	3.77562	-6.51E-01	-2.73E-02	8.89E-03	-2.30E-04	-2.68E-04	9.38E-06
100	3.89374	-6.55E-01	-2.47E-02	8.77E-03	-4.32E-04	-2.40E-04	8.97E-06

100yr URBAN ARI Drainage Calculations

DEVELOPED CATCHMENT

Catchment	Street	Area (ha)	∑A (ha)	C100	C5	Ae 100 (ha)	∑Ae 100 (ha)	Ae 5 (ha)	∑Ae 5 (ha)	Flow Length (m)	Velocity 100y (m/s)	Velocity 5y (m/s)	Tc 100 (mins)	Tc 5 (mins)	Int 100 (mm/hr)	Int 5 (mm/hr)	Q100 m3/s	Qpipe m3/s	Qgap m3/s	DESIGN FLOW m3/s	
Node R																					
EXT M		0.01	0.01	0.57	0.45	0.01	0.01	0.00	0.00	15	0.8	1.5	5.31	5.17	184.64	96.98	0.003	0.000	0.003	0.00	
R1		0.17	0.17	0.78	0.62	0.13	0.13	0.11	0.11	100	0.8	1.5	7.08	6.11	163.59	90.78	0.060	0.026	0.034	0.03	375Ø @ 1:100 GRADE CAP = 0.18 m3/s OK
R2		0.43	0.43	0.78	0.62	0.34	0.34	0.27	0.27	135	0.8	1.5	7.81	6.50	156.59	88.55	0.146	0.065	0.081	0.07	375Ø @ 1:100 GRADE CAP = 0.18 m3/s OK
R3		1.06	1.06	0.78	0.62	0.83	0.83	0.66	0.66	300	0.8	1.5	11.25	8.33	131.60	79.86	0.303	0.145	0.157	0.15	
							1.30		1.03	300	0.8	1.5	11.25	8.33	131.60	79.86	0.477	0.228	0.249	0.23	450Ø @ 1:100 GRADE CAP = 0.29 m3/s OK
OVERALL CHECK		*1.70*	*1.70*	*0.78*	*0.62*	*1.33*	*1.33*	*1.05*	*1.05*	*300*	*0.8*	*1.5*	*11.25*	*8.33*	*131.60*	*79.86*	*0.485*	*0.234*	*0.251*	*0.23*	

Project:	**JUMPING CREEK SUBDIVISION**	**Designed:**	S Beff
Reference No:	**305492**	**Checked:**	MY

Polynomial Coefficients

ARI	a	b	c	d	e	f	g
5	3.325171	-6.34E-01	-3.83E-02	8.87E-03	8.27E-04	-3.22E-04	-8.75E-06
10	3.452987	-6.39E-01	-3.46E-02	8.25E-03	5.78E-04	-2.30E-04	-1.91E-05
20	3.602647	-6.44E-01	-3.15E-02	8.38E-03	2.94E-04	-2.25E-04	-1.35E-05
50	3.775621	-6.51E-01	-2.73E-02	8.89E-03	-2.30E-04	-2.68E-04	9.38E-06
100	3.893744	-6.55E-01	-2.47E-02	8.77E-03	-4.32E-04	-2.40E-04	8.97E-06

100yr URBAN ARI Drainage Calculations

DEVELOPED CATCHMENT

Catchment	Street	Area (ha)	∑A (ha)	C100	C5	Ae 100 (ha)	∑Ae 100 (ha)	Ae 5 (ha)	∑Ae 5 (ha)	Flow Length (m)	Velocity 100y (m/s)	Velocity 5y (m/s)	Tc 100 (mins)	Tc 5 (mins)	Int 100 (mm/hr)	Int 5 (mm/hr)	Q100 m3/s	Qpipe m3/s	Qgap m3/s	DESIGN FLOW m3/s	
Node Y8																					
EXT K		1.15	1.15	0.57	0.45	0.65	0.65	0.52	0.52	75	0.8	1.5	6.56	5.83	169.11	92.47	0.306	0.133	0.174	0.13	0
Y8		1.14	1.14	0.78	0.62	0.89	0.89	0.70	0.70	410	0.8	1.5	13.54	9.56	119.68	75.26	0.296	0.147	0.149	0.15	0
							1.54		1.22	485	0.8	1.5	15.10	10.39	112.94	72.51	0.484	0.246	0.238	0.25	375Ø @ 1:100 GRADE CAP = 0.18 m3/s 1.587465024 UNDERSIZED okay for 2%
Node YA																					
EXT G		0.32	0.32	0.57	0.45	0.18	0.18	0.14	0.14	50	0.8	1.5	6.04	5.56	175.15	94.27	0.088	0.038	0.051	0.04	0
Y1		1.60	1.60	0.78	0.62	1.25	1.25	0.99	0.99	220	0.8	1.5	9.58	7.44	142.36	83.75	0.494	0.230	0.264	0.23	0
							1.43		1.13	220	0.8	1.5	9.58	7.44	142.36	83.75	0.566	0.264	0.302	0.26	375Ø @ 1:100 GRADE CAP = 0.18 m3/s 1.587465024 UNDERSIZED okay for +2%
Node YB																					
YA																	0.566	0.264	0.302	0.26	
Y2		1.40	1.40	0.78	0.62	1.09	1.09	0.87	0.87	290	0.8	1.5	11.04	8.22	132.83	80.32	0.403	0.193	0.210	0.19	0
							1.09		0.87	510	0.8	1.5	15.63	10.67	110.90	71.65	0.903	0.436	0.467	0.44	525Ø @ 1:100 GRADE CAP = 0.43 m3/s 1.986656835 UNDERSIZED okay for +2%
Node YC																					
EXT H		1.64	1.64	0.57	0.45	0.93	0.93	0.74	0.74	110	0.8	1.5	7.29	6.22	161.51	90.12	0.417	0.184	0.233	0.18	0
Y3		0.82	0.82	0.78	0.62	0.64	0.64	0.51	0.51	320	0.8	1.5	11.67	8.56	129.21	78.97	0.230	0.111	0.119	0.11	0
Y4		1.33	1.33	0.78	0.62	1.04	1.04	0.82	0.82	250	0.8	1.5	10.21	7.78	138.07	82.23	0.398	0.188	0.211	0.19	0
							2.61		2.07	450	0.8	1.5	14.38	10.00	115.97	73.75	0.840	0.423	0.417	0.42	450Ø @ 1:100 GRADE CAP = 0.29 m3/s 1.792634138 UNDERSIZED okay for +2%
Node YD																					
YC																	0.840	0.623	0.217	0.42	0.2 *reduced gapflow to suit road capacity
YD																	0.903	0.436	0.467	0.44	
Y5		1.39	1.39	0.78	0.62	1.09	1.09	0.86	0.86	300	0.8	1.5	11.25	8.33	131.60	79.86	0.397	0.191	0.206	0.19	0
							1.09		0.86	550	0.8	1.5	16.46	11.11	107.81	70.33	2.068	1.227	0.841	1.23	750Ø @ 1:100 GRADE CAP = 1.11 m3/s 2.519943648 UNDERSIZED
Node YE																					
YD																	2.068	1.397	0.671	1.23	0.17 *reduced gapflow to suit road capacity
EXT I		2.48	2.48	0.57	0.45	1.41	1.41	1.11	1.11	140	0.8	1.5	7.92	6.56	155.65	88.25	0.608	0.273	0.335	0.27	0
Y6		1.65	1.65	0.78	0.62	1.29	1.29	1.02	1.02	285	0.8	1.5	10.94	8.17	133.46	80.55	0.478	0.228	0.249	0.23	0
							2.69		2.13	650	0.8	1.5	18.54	12.22	100.93	67.30	2.824	1.796	1.028	1.80	900Ø @ 1:100 GRADE CAP = 1.81 m3/s 2.845629317 OK
Node YF																					
YE																	2.824	2.096	0.728	1.80	0.3 *reduced gapflow to suit road capacity
EXT K		1.15	1.15	0.57	0.45	0.65	0.65	0.52	0.52	75	0.8	1.5	6.56	5.83	169.11	92.47	0.306	0.133	0.174	0.13	0
Y7		1.28	1.28	0.78	0.62	1.00	1.00	0.79	0.79	300	0.8	1.5	11.25	8.33	131.60	79.86	0.365	0.176	0.190	0.18	0
Y8		1.14	1.14	0.78	0.62	0.89	0.89	0.70	0.70	410	0.8	1.5	13.54	9.56	119.68	75.26	0.296	0.147	0.149	0.15	0
							2.54		2.01	800	0.8	1.5	21.67	13.89	92.37	63.33	3.476	2.450	1.026	2.45	1050Ø @ 1:100 GRADE CAP = 2.73 m3/s 3.15362115 OK
OVERALL CHECK		*18.50*	*18.50*	*0.78*	*0.62*	*14.43*	*14.43*	*11.47*	*11.47*	*800*	*0.8*	*1.5*	*21.67*	*13.89*	*92.37*	*63.33*	*3.703*	*2.018*	*1.685*	*2.02*	*0*

0
0

Mannings Pipe Calculator

	Pipe
Pipe Type	RCP
Diameter	750 mm
Slope	1 in 100
n	0.0130 mm
OUTPUT DATA	
v	2.520 m/s
Qcap	**1.113 m3/s**

Pipe Type	Mannings (n)	C-W (k)
RCP	0.013	0.6

Project:	**JUMPING CREEK SUBDIVISION**	**Designed:**	S Beff
Reference No:	**305492**	**Checked:**	MY

Polynomial Coefficients

ARI	a	b	c	d	e	f	g
5	3.325171	-6.34E-01	-3.83E-02	8.87E-03	8.27E-04	-3.22E-04	-8.75E-06
10	3.452987	-6.39E-01	-3.46E-02	8.25E-03	5.78E-04	-2.30E-04	-1.91E-05
20	3.602647	-6.44E-01	-3.15E-02	8.38E-03	2.94E-04	-2.25E-04	-1.35E-05
50	3.775621	-6.51E-01	-2.73E-02	8.89E-03	-2.30E-04	-2.68E-04	9.38E-06
100	3.893744	-6.55E-01	-2.47E-02	8.77E-03	-4.32E-04	-2.40E-04	8.97E-06

100yr URBAN ARI Drainage Calculations

DEVELOPED CATCHMENT

Catchment	Stree	Area (ha)	∑A (ha)	C100	C5	Ae 100 (ha)	∑Ae 100 (ha)	Ae 5 (ha)	∑Ae 5 (ha)	Flow Length (m)	Velocity 100y (m/s)	Velocity 5y (m/s)	Tc 100 (mins)	Tc 5 (mins)	Int 100 (mm/hr)	Int 5 (mm/hr)	Q100 m3/s	Qpipe m3/s	Qgap m3/s	DESIGN FLOW m3/s	
Swale to convey north east external flows around site																					
EXT E*		17.50	17.50														2.510	0.000	2.510	2.51	*Flow provided by QRPC
EXT L		0.63	0.63	0.57	0.45	0.36	0.36	0.28	0.28	250	0.8	1.5	10.21	7.78	138.07	82.23	0.137	0.000	0.137	0.14	overand flow only
																	2.647	0.000	2.647	2.65	
Node BA																					
B1		1.98	1.98	0.78	0.62	1.55	1.55	1.22	1.22	305	0.8	1.5	11.35	8.39	130.99	79.64	0.563	0.271	0.292	0.27	
							1.55		1.22	305	0.8	1.5	11.35	8.39	130.99	79.64	0.563	0.271	0.292	0.27	375Ø @ 1:100 GRADE CAP = 0.18 m3/s 1.587465024 UNDERSIZED Okay for 2.5%
Node BB(oversized pipe to reduce road flow)																					
EXT F*		10.10	10.10														1.750	1.500	0.250	1.75	*Flow provided by QRPC
B2		0.58	0.58	0.78	0.62	0.45	0.45	0.36	0.36	110	0.8	1.5	7.29	6.22	161.51	90.12	0.203	0.090	0.113	0.09	
																	1.953	1.590	0.363	1.59	750Ø @ 1:100 GRADE CAP = 1.11 m3/s 2.519943648 UNDERSIZED Okay for 2.5%
Node BC																					
BB																	1.953	1.590	0.363	1.59	
BA																	0.563	0.271	0.292	0.27	
B3		1.23	1.23	0.78	0.62	0.96	0.96	0.76	0.76	205	0.8	1.5	9.27	7.28	144.63	84.55	0.386	0.179	0.207	0.18	
							0.96		0.76	375	0.8	1.5	12.81	9.17	123.17	76.64	2.844	2.022	0.822	2.02	825Ø @ 1:100 GRADE CAP = 1.44 m3/s 2.685257588 UNDERSIZED Okay for 2%
Node BD																					
BC																	2.844	2.222	0.622	2.02	0.2 *reduced gapflow to suit road capacity
B4		2.77	2.77	0.78	0.62	2.16	2.16	1.71	1.71	335	0.8	1.5	11.98	8.72	127.49	78.31	0.766	0.372	0.394	0.37	
							2.16		1.71	585	0.8	1.5	17.19	11.50	105.27	69.23	3.477	2.552	0.925	2.55	900Ø @ 1:100 GRADE CAP = 1.81 m3/s 2.845629317 UNDERSIZED Okay for 2%
Node BE																					
BD																	3.477	2.702	0.775	2.55	0.15 *reduced gapflow to suit road capacity
B5		2.11	2.11	0.78	0.62	1.65	1.65	1.30	1.30	285	0.8	1.5	10.94	8.17	133.46	80.55	0.611	0.292	0.319	0.29	
							1.65		1.30	710	0.8	1.5	19.79	12.89	97.28	65.64	3.922	2.939	0.983	2.94	1050Ø @ 1:100 GRADE CAP = 2.73 m3/s 3.15362115 UNDERSIZED Okay for 2%
Node BF																					
B6		1.86	1.86	0.78	0.62	1.45	1.45	1.15	1.15	300	0.8	1.5	11.25	8.33	131.60	79.86	0.531	0.255	0.276	0.26	
B7		1.85	1.85	0.78	0.62	1.44	1.44	1.14	1.14	280	0.8	1.5	10.83	8.11	134.10	80.79	0.538	0.257	0.281	0.26	
							2.90		2.29	580	0.8	1.5	17.08	11.44	105.63	69.38	0.850	0.442	0.408	0.44	525Ø @ 1:100 GRADE CAP = 0.43 m3/s 1.986656835 UNDERSIZED Okay for 2%
Node BG																					
BF																	0.850	0.442	0.408	0.44	
BE																	3.922	3.339	0.583	3.34	0.4 *reduced gapflow to suit road capacity
B8		0.51	0.51	0.78	0.62	0.40	0.40	0.32	0.32	100	0.8	1.5	7.08	6.11	163.59	90.78	0.181	0.079	0.101	0.08	
							0.40		0.32	810	0.8	1.5	21.88	14.00	91.86	63.09	4.874	3.837	1.037	3.84	1200Ø @ 1:100 GRADE CAP = 3.90 m3/s 3.44723442 OK
OVERALL CHECK		*23.00*	*23.00*	*0.78*	*0.62*	*17.94*	*17.94*	*14.26*	*14.26*	*810*	*0.8*	*1.5*	*21.88*	*14.00*	*91.86*	*63.09*	*4.578*	*2.499*	*2.079*	*2.50*	

0
0
0
0
0

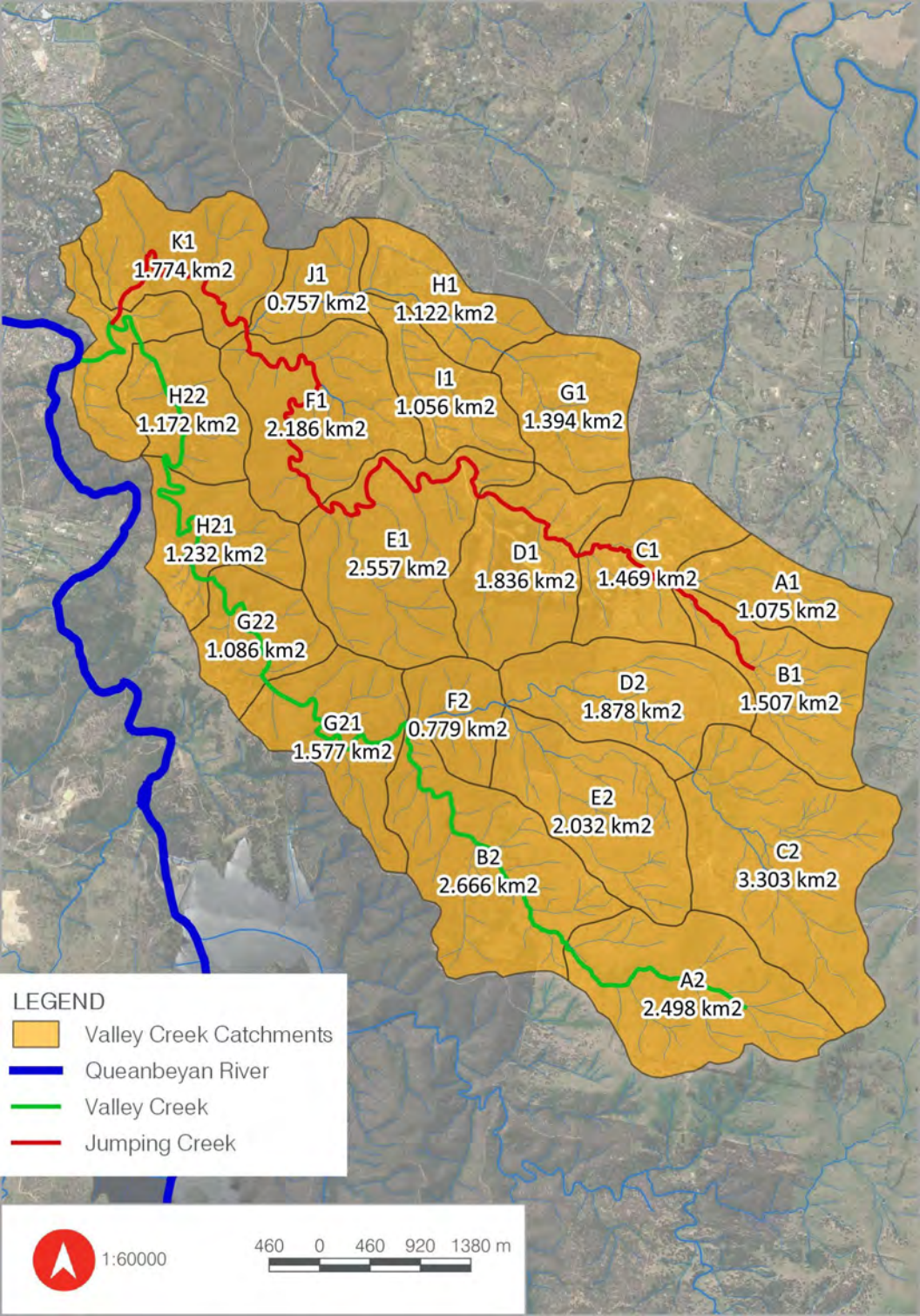
MAX ACCEPTABLE FLOW THROUGH ROAD RESERVE
1.15
Qgap MAX

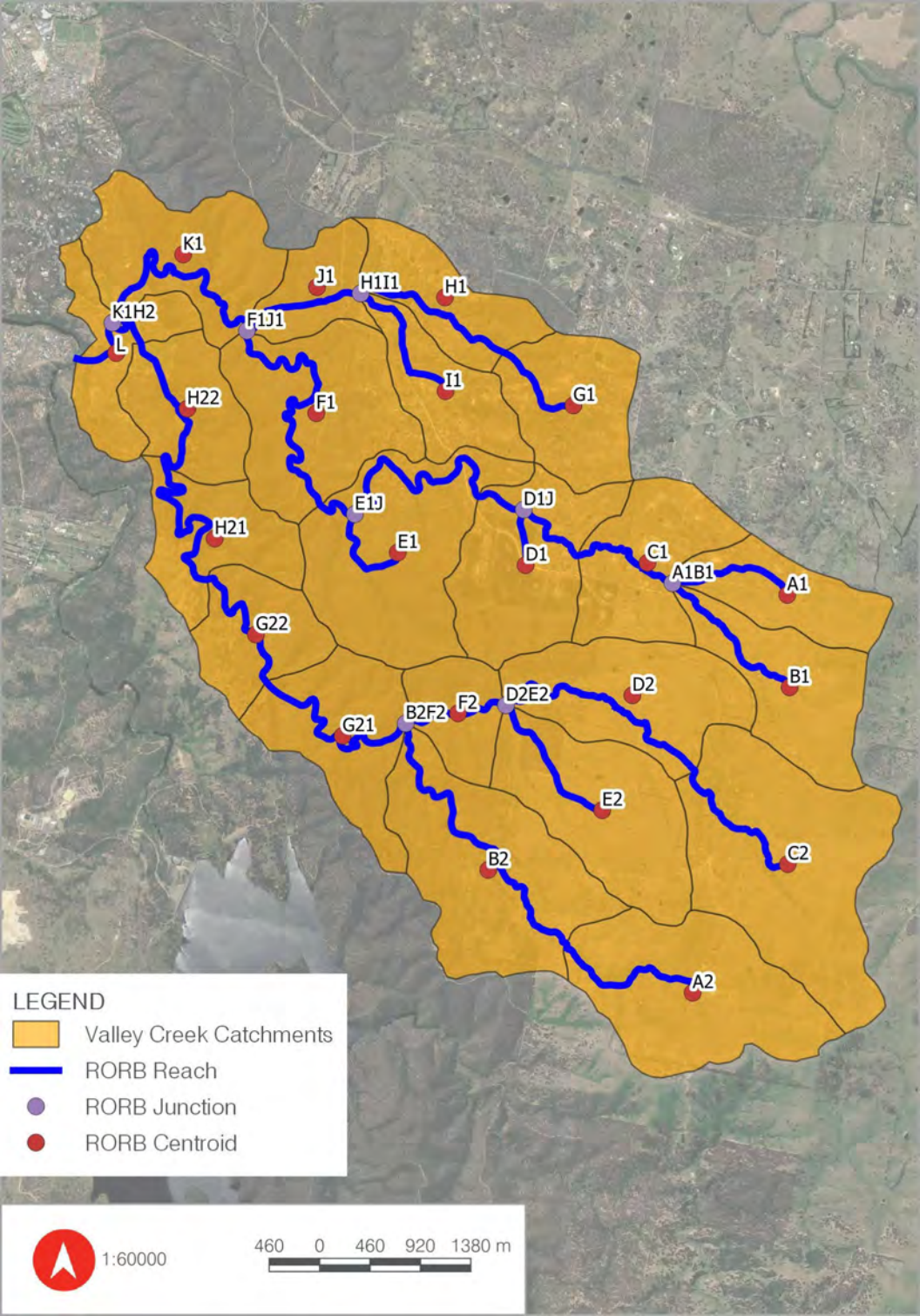
Mannings Pipe Calculator

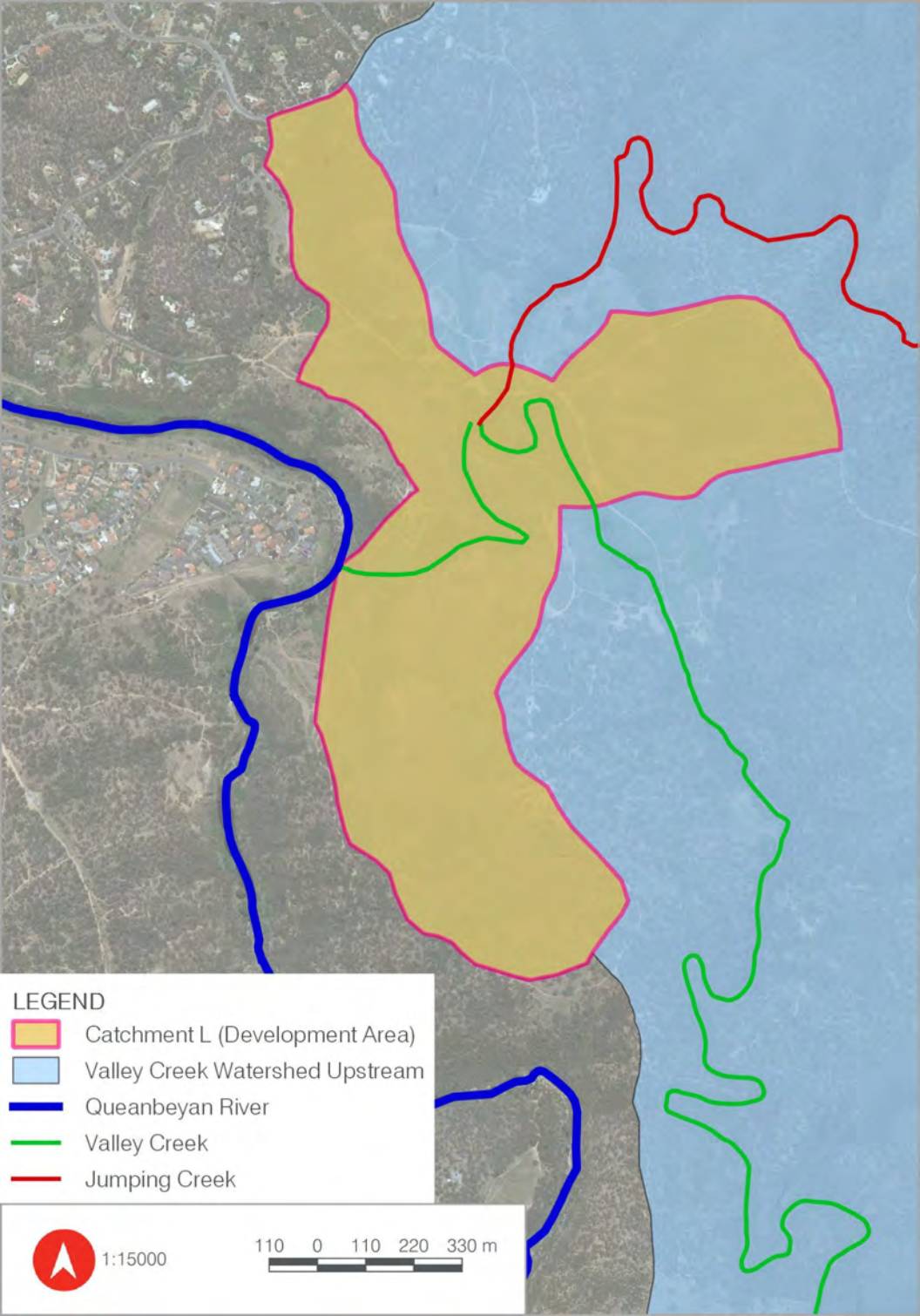
	Pipe
Pipe Type	RCP
Diameter	1,050 mm
Slope	1 in 100
n	0.0130 mm
OUTPUT DATA	
v	3.154 m/s
Qcap	**2.731 m3/s**

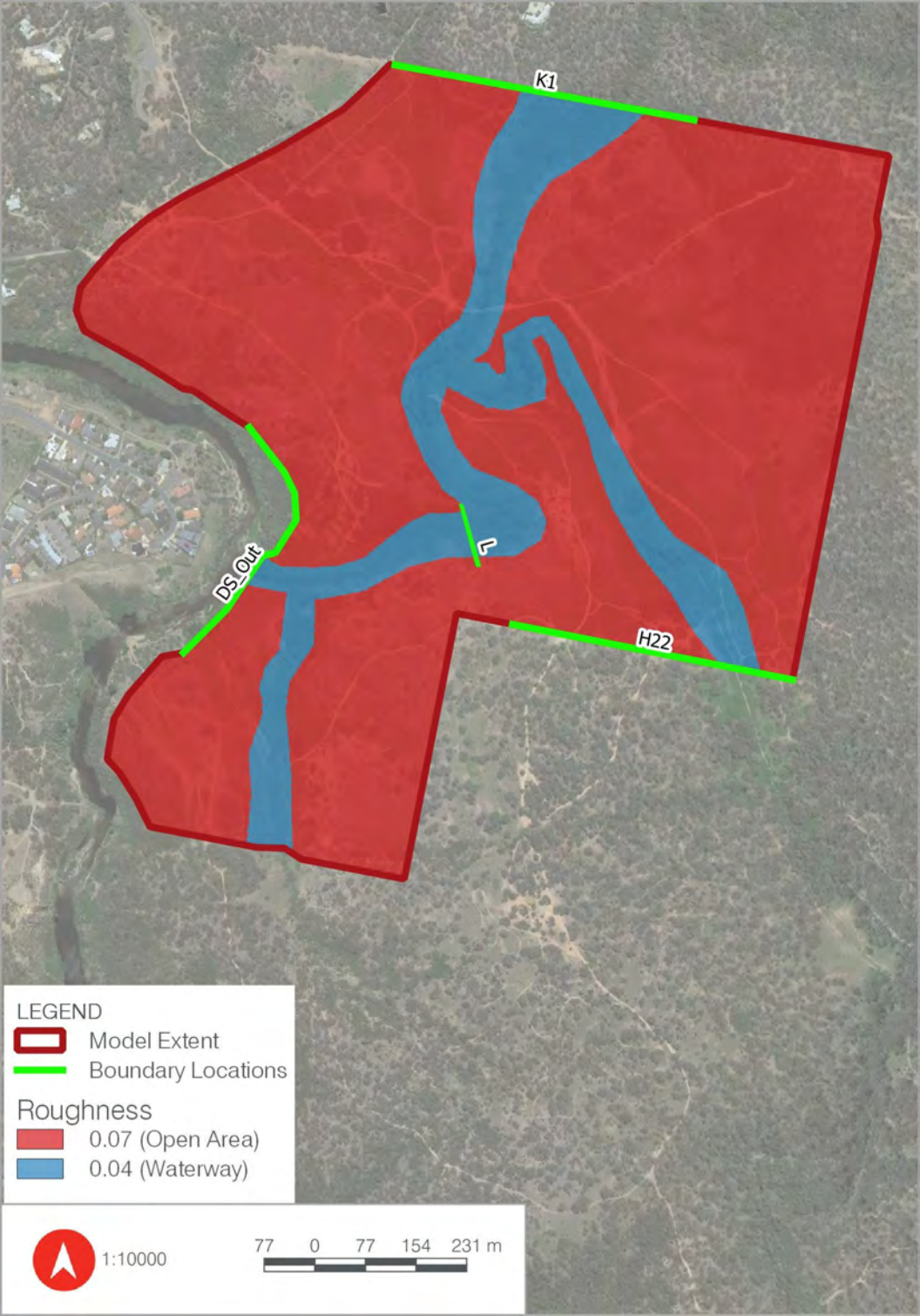
Pipe Type	Mannings (n)	C-W (k)
RCP	0.013	0.6

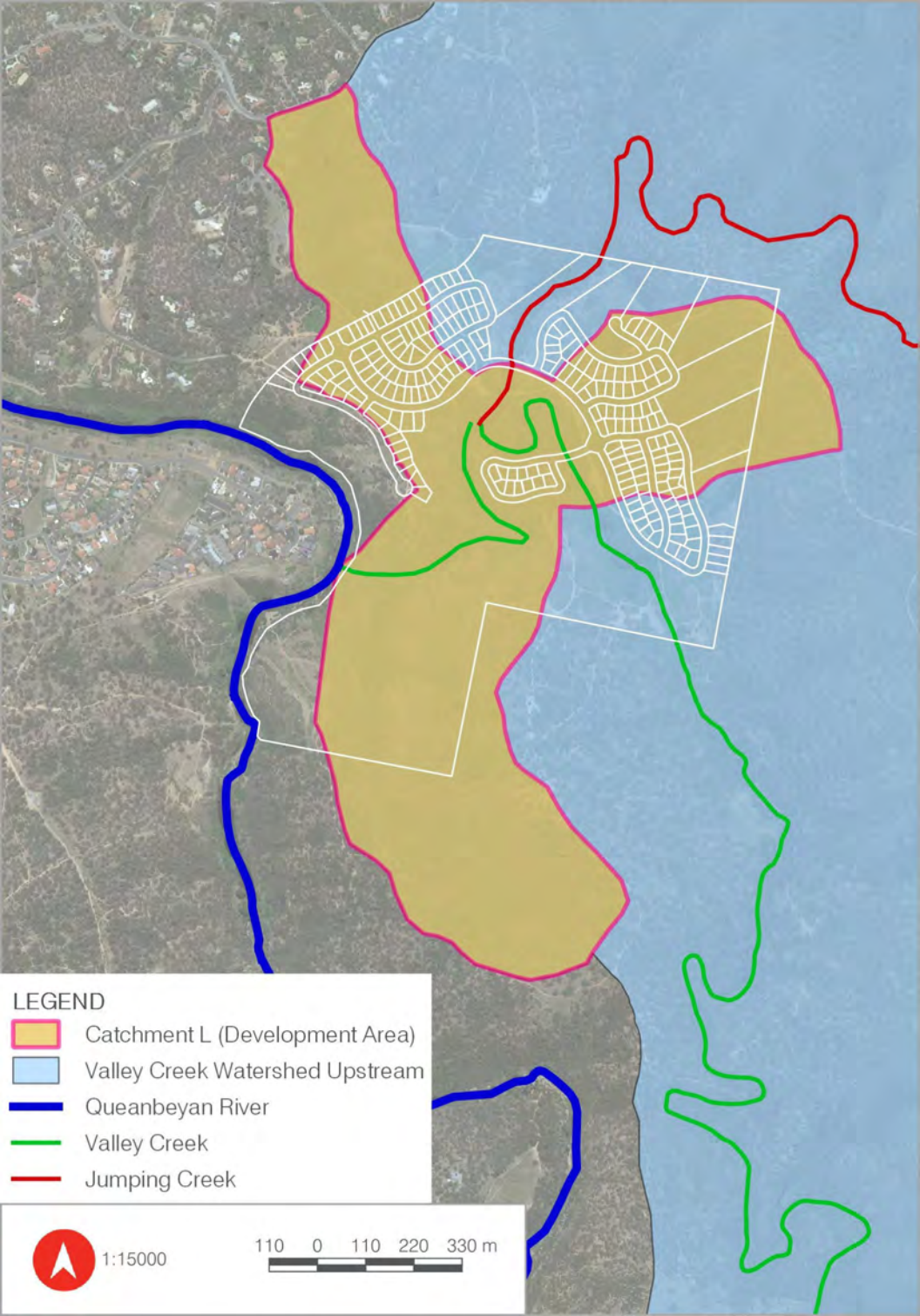
APPENDIX B – FLOOD MODELLING RESULTS

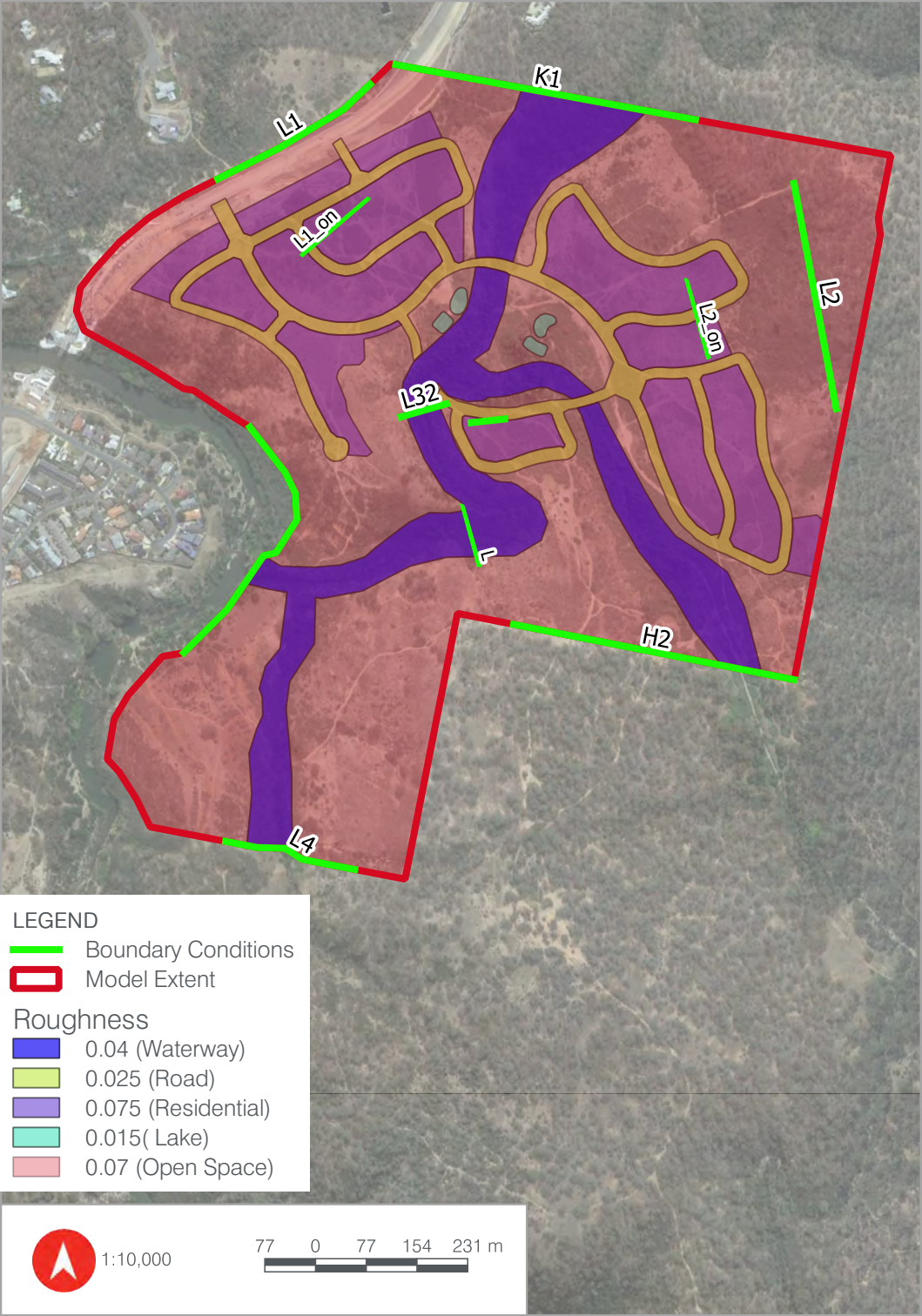

K1
1.774 km2
J1
0.757 km2
H1
1.122 km2
I1
1.056 km2
G1
1.394 km2
H22
1.172 km2
F1
2.186 km2
H21
1.232 km2
E1
2.557 km2
D1
1.836 km2
C1
1.469 km2
A1
1.075 km2
G22
1.086 km2
B1
1.507 km2
D2
1.878 km2
F2
0.779 km2
G21
1.577 km2
E2
2.032 km2
C2
3.303 km2
B2
2.666 km2
A2
2.498 km2
LEGEND
Valley Creek Catchments
Queanbeyan River
Valley Creek
Jumping Creek
1:60000
460 0 460 920 1380 m

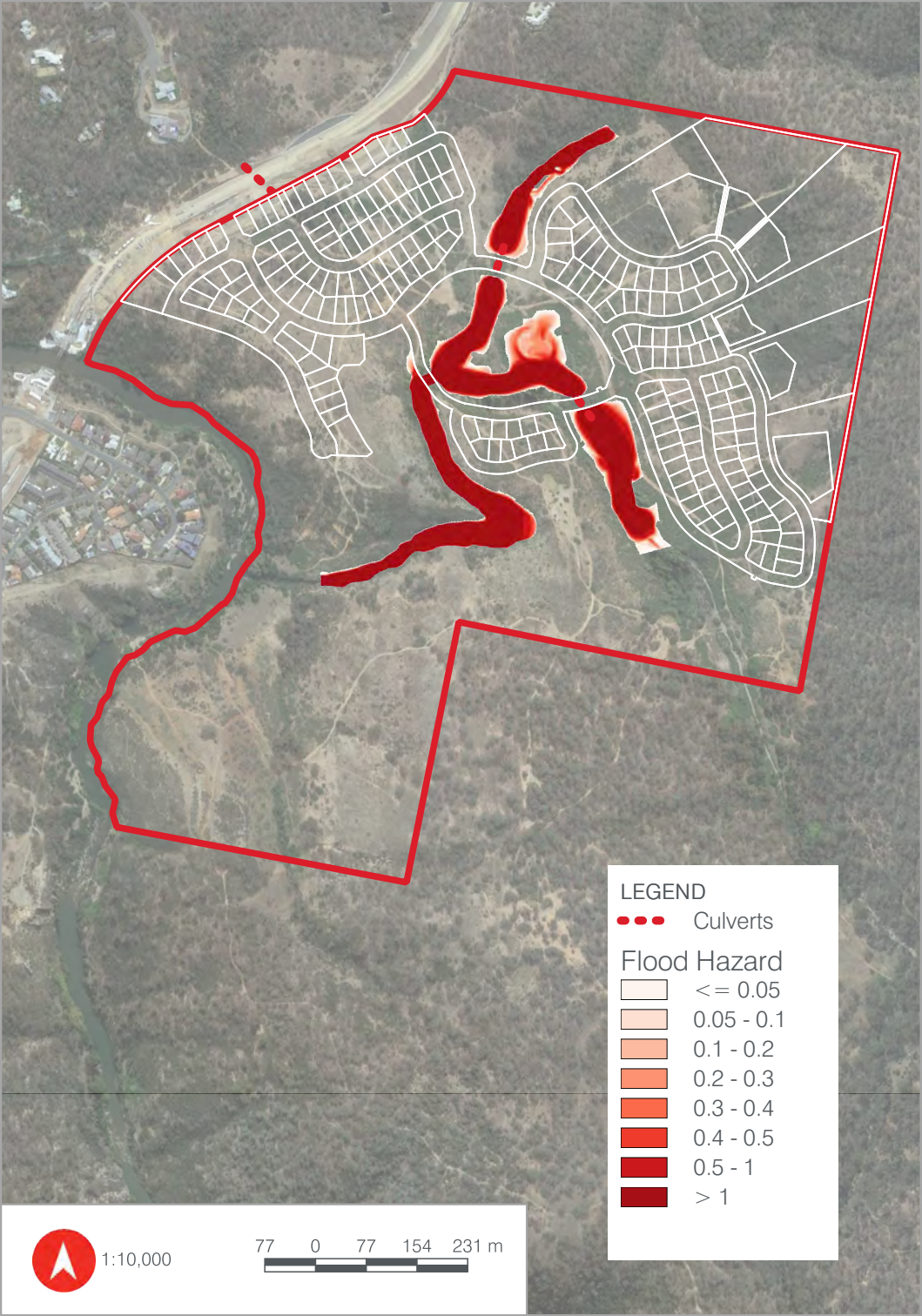

K1
J1
H1I1
H1
K1H2
F1J1
L
I1
G1
H22
F1
E1J
D1J
H21
E1
D1
C1
A1B1
A1
G22
B1
D2
D2E2
F2
B2F2
G21
E2
C2
B2
A2
LEGEND
Valley Creek Catchments
RORB Reach
RORB Junction
RORB Centroid
1:60000
460 0 460 920 1380 m

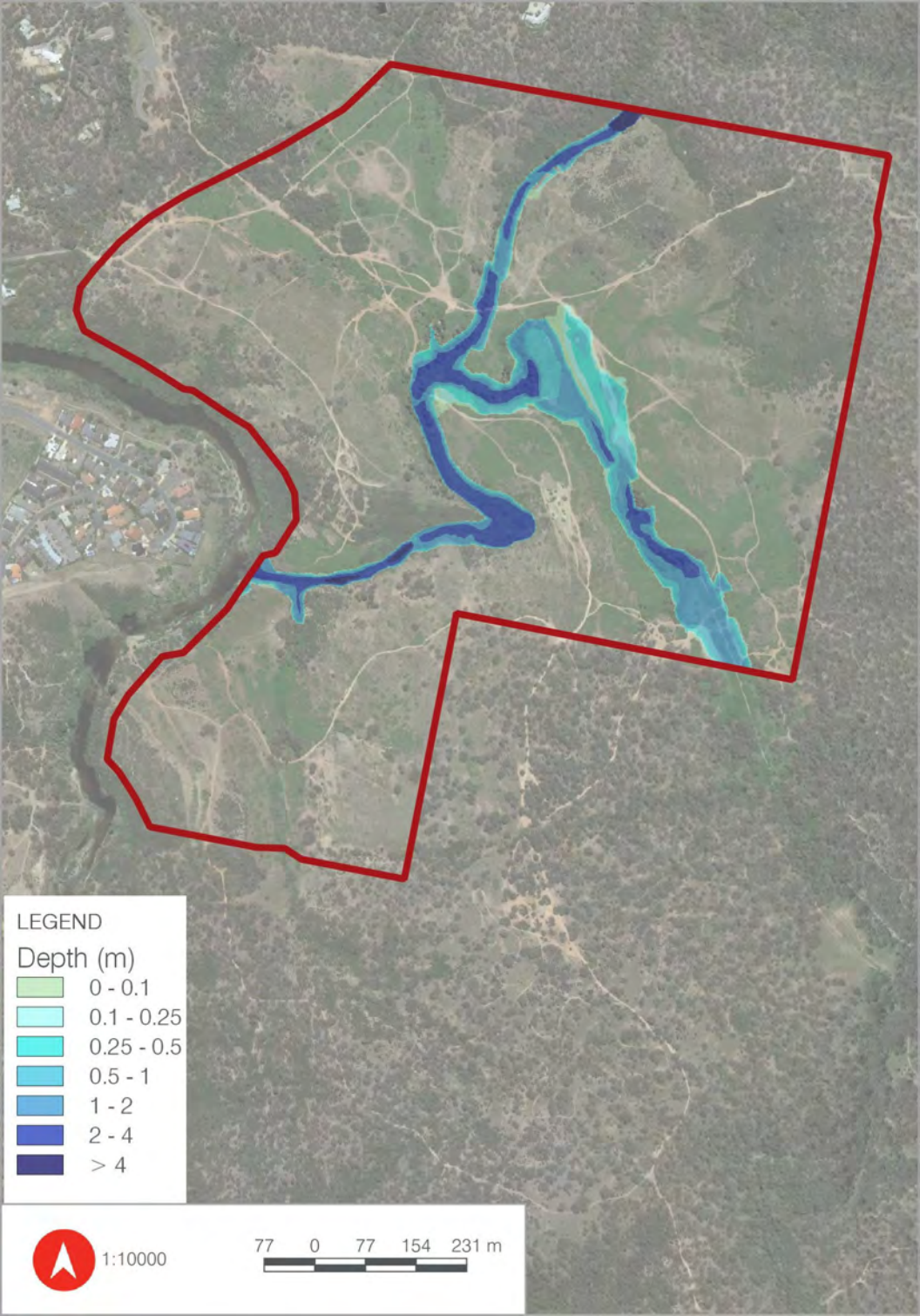

LEGEND
Catchment L (Development Area)
Valley Creek Watershed Upstream
Queanbeyan River
Valley Creek
Jumping Creek
1:15000
110 0 110 220 330 m

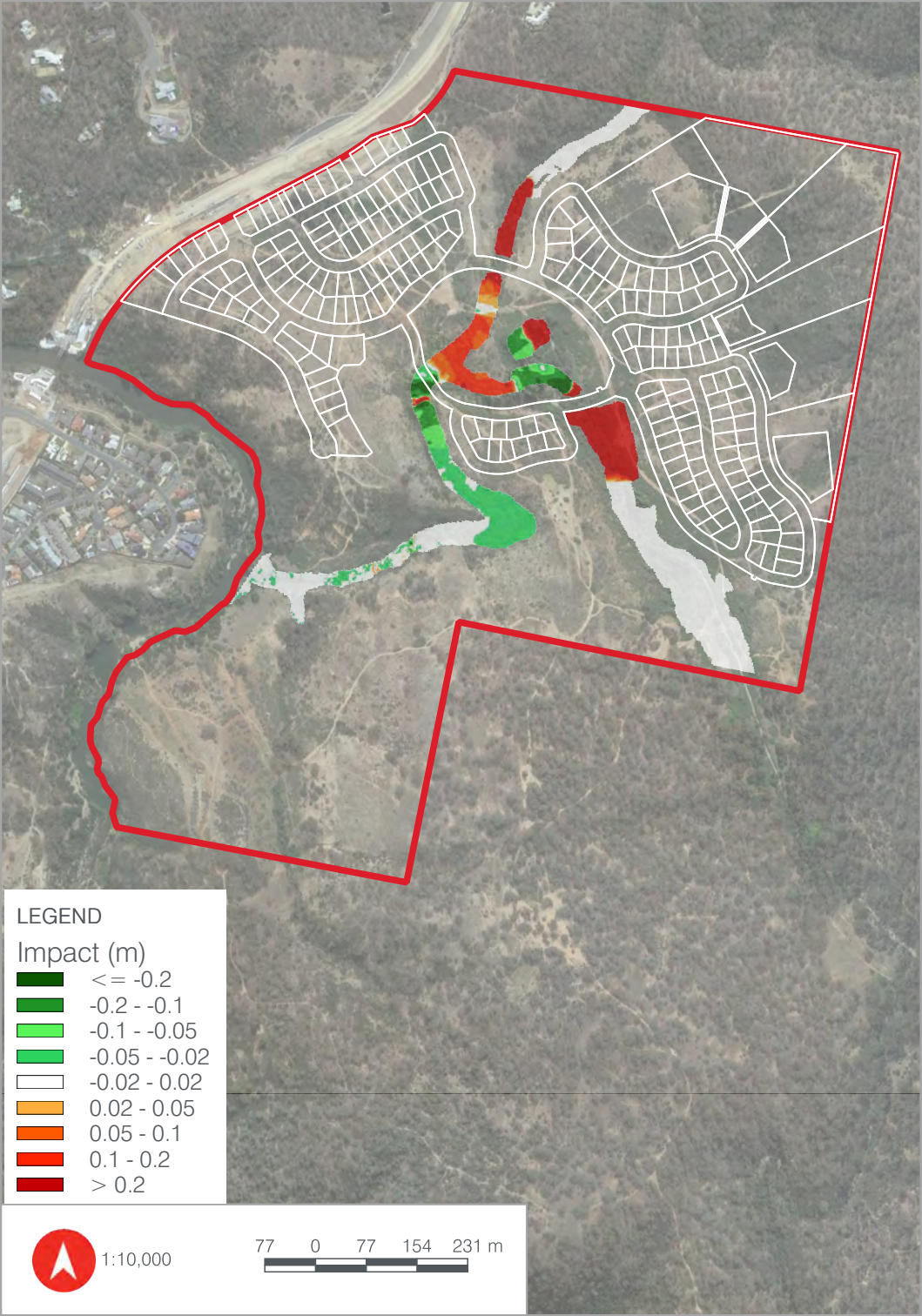

K1
DS_Out
H22
LEGEND
Model Extent
Boundary Locations
Roughness
0.07 (Open Area)
0.04 (Waterway)
1:10000
77 0 77 154 231 m

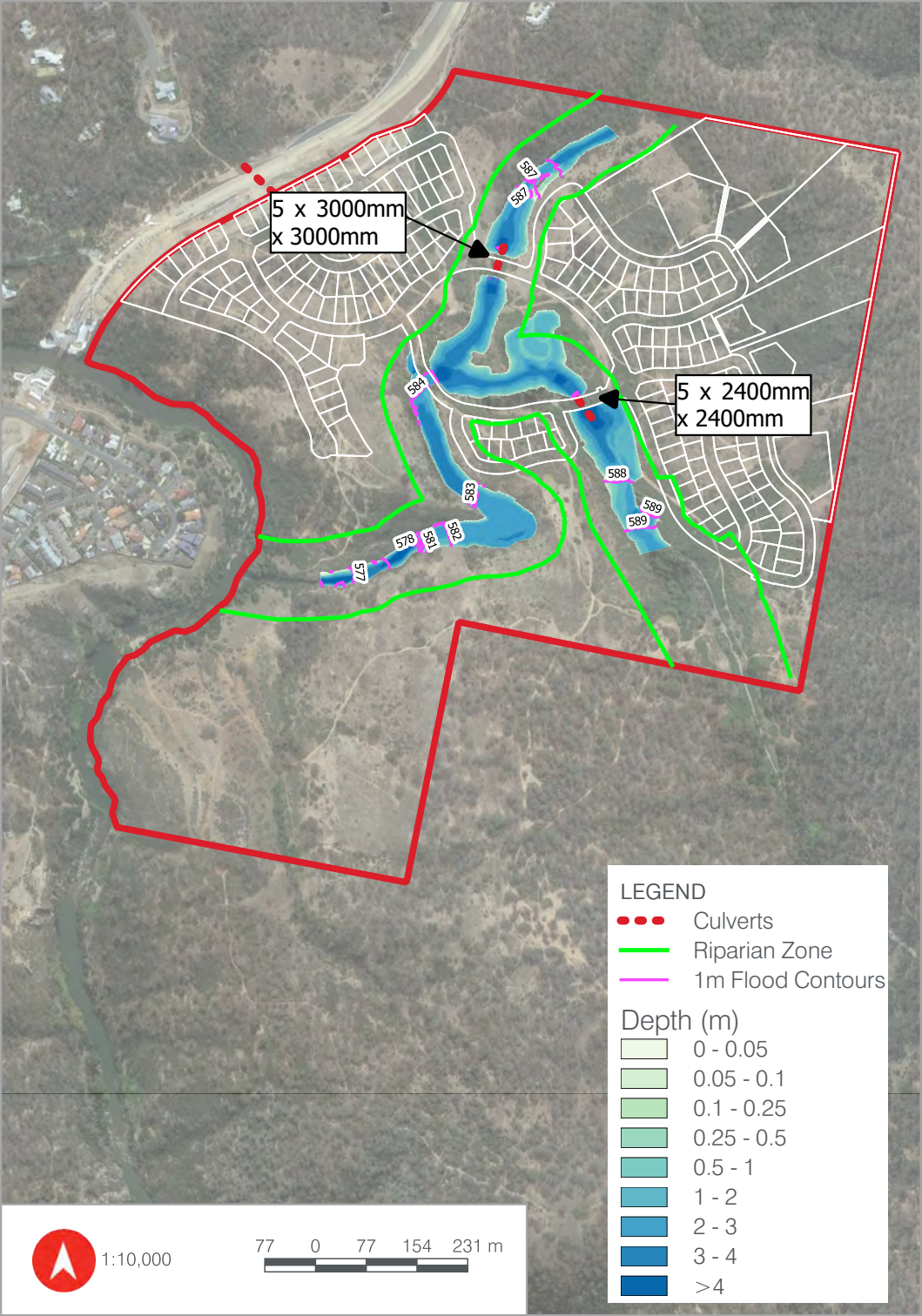

LEGEND
Catchment L (Development Area)
Valley Creek Watershed Upstream
Queanbeyan River
Valley Creek
Jumping Creek
1:15000
110 0 110 220 330 m

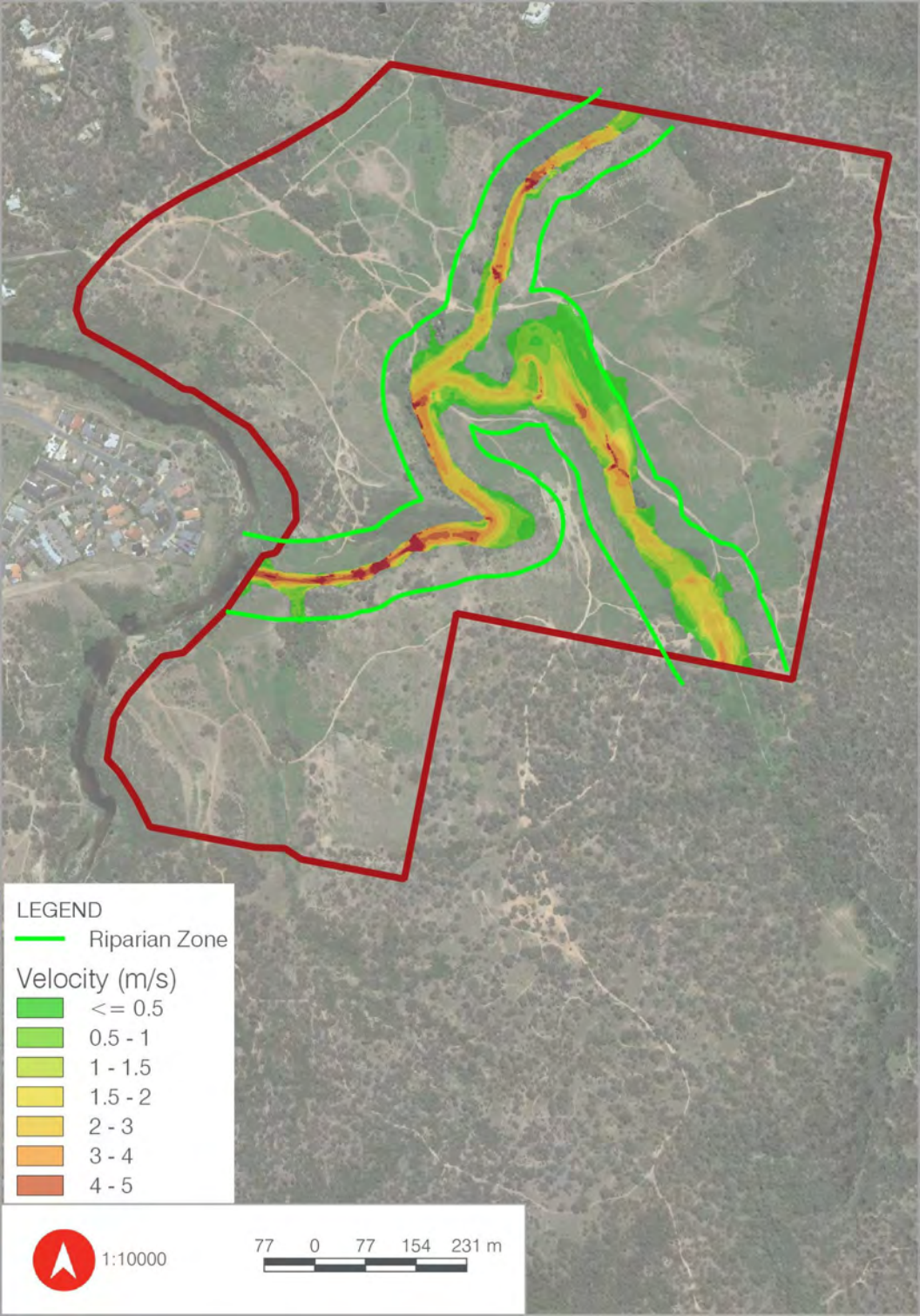

K1
L1
L1_on
L2
L2_on
L32
H2
L4
LEGEND
Boundary Conditions
Model Extent
Roughness
0.04 (Waterway)
0.025 (Road)
0.075 (Residential)
0.015(Lake)
0.07 (Open Space)
1:10,000
77 0 77 154 231 m

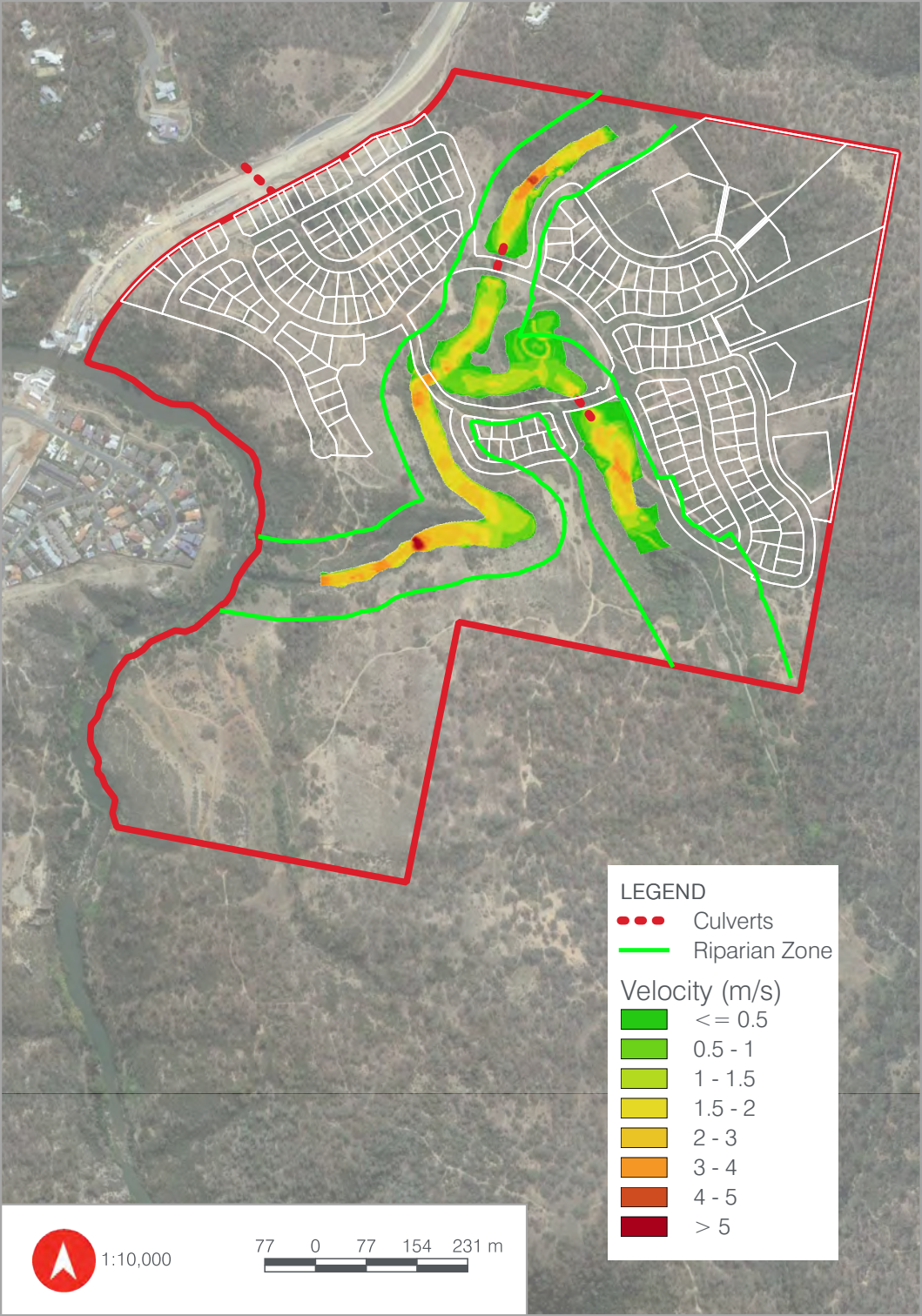

LEGEND
Culverts
Flood Hazard
<= 0.05
0.05 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 1
> 1
1:10,000
77 0 77 154 231 m


LEGEND
Depth (m)
0 - 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 1
1 - 2
2 - 4
> 4
1:10000
77 0 77 154 231 m


LEGEND
Impact (m)
<= -0.2
-0.2 - -0.1
-0.1 - -0.05
-0.05 - -0.02
-0.02 - 0.02
0.02 - 0.05
0.05 - 0.1
0.1 - 0.2
> 0.2
1:10,000
77 0 77 154 231 m


5 x 3000mm
x 3000mm
5 x 2400mm
x 2400mm
587
587
594
583
578
581
582
577
588
589
589
LEGEND
Culverts
Riparian Zone
1m Flood Contours
Depth (m)
0 - 0.05
0.05 - 0.1
0.1 - 0.25
0.25 - 0.5
0.5 - 1
1 - 2
2 - 3
3 - 4
>4
1:10,000
77 0 77 154 231 m

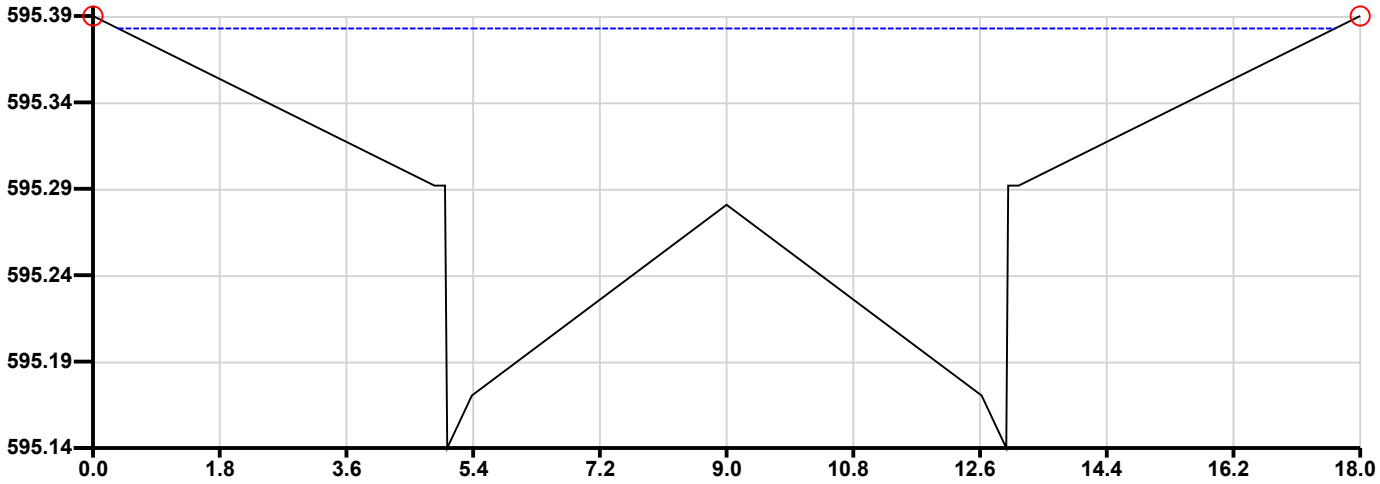

LEGEND
Riparian Zone
Velocity (m/s)
<= 0.5
0.5 - 1
1 - 1.5
1.5 - 2
2 - 3
3 - 4
4 - 5
1:10000
77 0 77 154 231 m


LEGEND
Culverts
Riparian Zone
Velocity (m/s)
<= 0.5
0.5 - 1
1 - 1.5
1.5 - 2
2 - 3
3 - 4
4 - 5
> 5
1:10,000
77 0 77 154 231 m

APPENDIX C - PC CONVEY CROSS SECTIONS

PROJECT: 305492
RD011 Max Cap
Print-out date: 25/01/2019 - Time: 9:19
Data File: T:\30\305492\Civil\12D\Design Calcs\305492 RD011 Max Cap 1%.dat

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 2.0 cumecs

There is no pipe discharge
Overland / Channel / Watercourse discharge = 2.00 cumecs

3. RESULTS: Water surface elevation = 595.384m

Grade = 1 in 100

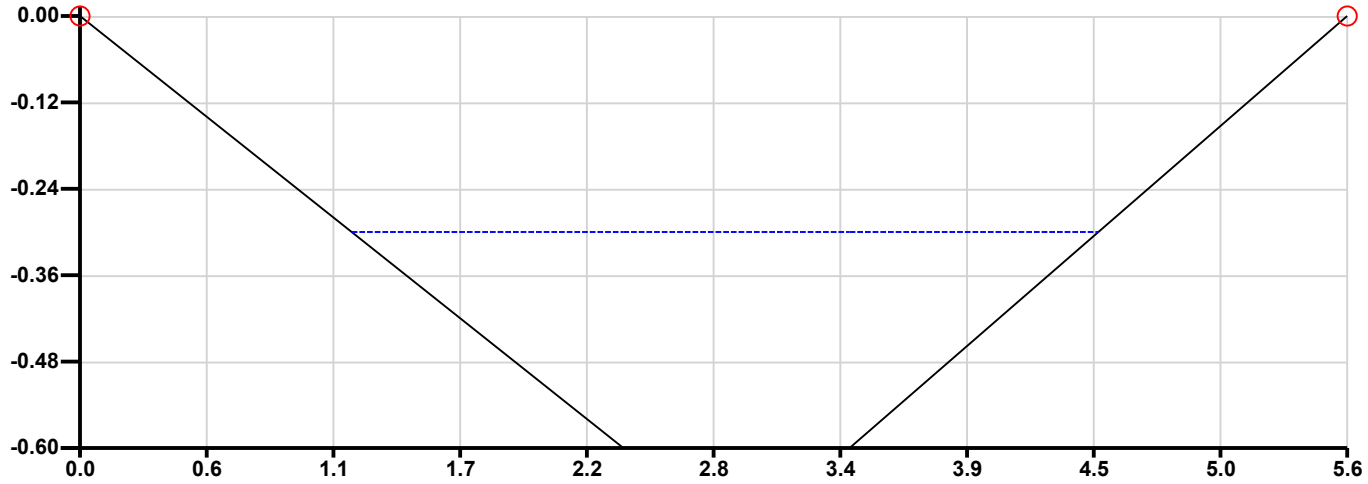
	LEFT OVERBANK	MAIN CHANNEL	RIGHT OVERBANK	TOTAL CROSS-SECTION
Discharge (cumecs):	0.00	1.69	0.00	1.69
D(Max) = Max. Depth (m):	0.00	0.24	0.00	0.24
D(Ave) = Ave. Depth (m):	0.00	0.10	0.00	0.10
V = Ave. Velocity (m/s):	0.00	0.98	0.00	0.98
D(Max) x V (cumecs/m):	0.00	0.24	0.00	0.24
D(Ave) x V (cumecs/m):	0.00	0.10	0.00	0.10
Froude Number:	0.00	0.99	0.00	0.99
Area (m^2):	0.00	1.72	0.00	1.72
Wetted Perimeter (m):	0.00	17.55	0.00	17.55
Flow Width (m):	0.00	17.30	0.00	17.30
Hydraulic Radius (m):	0.00	0.10	0.00	0.10
Composite Manning's n:	0.000	0.022	0.000	0.022
Split Flow?	-	-	-	No

4. CROSS-SECTION DATA:

	LEFT HAND POINT		RIGHT HAND POINT		
SEGMENT NO.	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	MANNING'S N
1	0.000	595.391	4.850	595.294	0.035
2	4.850	595.294	5.000	595.294	0.035
3	5.000	595.294	5.030	595.144	0.013
4	5.030	595.144	5.380	595.174	0.013
5	5.380	595.174	9.000	595.283	0.015
6	9.000	595.283	12.620	595.174	0.015
7	12.620	595.174	12.970	595.144	0.013
8	12.970	595.144	13.000	595.294	0.013
9	13.000	595.294	13.150	595.294	0.013
10	13.150	595.294	18.000	595.391	0.013

PROJECT: 305492 EX CULVERT SWALE
Comment
Print-out date: 24/01/2019 - Time: 16:19
Data File: G:\30\305492\Civil\12D\Design Calcs\305492 EX CULVERT SWALE 3%.dat

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 2.0 cumecs

There is no pipe discharge
Overland / Channel / Watercourse discharge = 2.00 cumecs

3. RESULTS:

Note: Q = discharge, Ave. Vel. = average flow velocity for cross-section at this water surface elevation.
Fr. No. = Froude Number at this water surface elevation; if Fr < 1 then flow is subcritical.
WP = wetted perimeter, Hydr. Rads. = hydraulic radius = Area/WP at this water surface elevation.
SF indicates whether or not Split Flow occurs at this water surface elevation.
Comp n = composite Manning's n value for cross-section at this water surface elevation.

Grade = 1 in 33.333

Water Surface Elevation (m)	Q (m^3/s)	Ave. Vel. (m/s)	D(Ave) (m)	D(Ave) x V(Ave) (m^3/s-m)	Fr. No.	Area (m^2)	WP (m)	Flow Width (m)	Hydr. Rads. (m)	Comp. n	SF?
-0.59	0.0	0.22	0.01	0.00	0.73	0.01	1.08	1.08	0.01	0.035	No
-0.58	0.0	0.35	0.02	0.01	0.81	0.02	1.16	1.15	0.02	0.035	No
-0.57	0.0	0.45	0.03	0.01	0.86	0.03	1.24	1.23	0.03	0.035	No
-0.56	0.0	0.53	0.04	0.02	0.90	0.05	1.32	1.31	0.04	0.035	No
-0.55	0.0	0.60	0.04	0.03	0.93	0.06	1.40	1.38	0.04	0.035	No
-0.54	0.0	0.67	0.05	0.03	0.95	0.07	1.48	1.46	0.05	0.035	No
-0.53	0.1	0.73	0.06	0.04	0.97	0.09	1.55	1.54	0.06	0.035	No
-0.52	0.1	0.79	0.06	0.05	0.99	0.10	1.63	1.61	0.06	0.035	No
-0.51	0.1	0.85	0.07	0.06	1.01	0.12	1.71	1.69	0.07	0.035	No
-0.50	0.1	0.90	0.08	0.07	1.02	0.14	1.79	1.77	0.08	0.035	No
-0.49	0.1	0.95	0.08	0.08	1.04	0.16	1.87	1.84	0.08	0.035	No
-0.48	0.2	0.99	0.09	0.09	1.05	0.18	1.95	1.92	0.09	0.035	No
-0.47	0.2	1.04	0.10	0.10	1.06	0.19	2.03	2.00	0.10	0.035	No
-0.46	0.2	1.08	0.10	0.11	1.07	0.22	2.11	2.07	0.10	0.035	No
-0.45	0.3	1.12	0.11	0.12	1.08	0.24	2.19	2.15	0.11	0.035	No
-0.44	0.3	1.16	0.12	0.13	1.09	0.26	2.27	2.23	0.11	0.035	No
-0.43	0.3	1.20	0.12	0.15	1.10	0.28	2.35	2.30	0.12	0.035	No
-0.42	0.4	1.24	0.13	0.16	1.11	0.30	2.43	2.38	0.13	0.035	No
-0.41	0.4	1.28	0.13	0.17	1.12	0.33	2.51	2.46	0.13	0.035	No
-0.40	0.5	1.31	0.14	0.18	1.12	0.35	2.58	2.53	0.14	0.035	No
-0.39	0.5	1.35	0.15	0.20	1.13	0.38	2.66	2.61	0.14	0.035	No

3. RESULTS: (continued)

Note: Q = discharge, Ave. Vel. = average flow velocity for cross-section at this water surface elevation.
Fr. No. = Froude Number at this water surface elevation; if Fr < 1 then flow is subcritical.
WP = wetted perimeter, Hydr. Rads. = hydraulic radius = Area/WP at this water surface elevation.
SF indicates whether or not Split Flow occurs at this water surface elevation.
Comp n = composite Manning's n value for cross-section at this water surface elevation.

Grade = 1 in 33.333

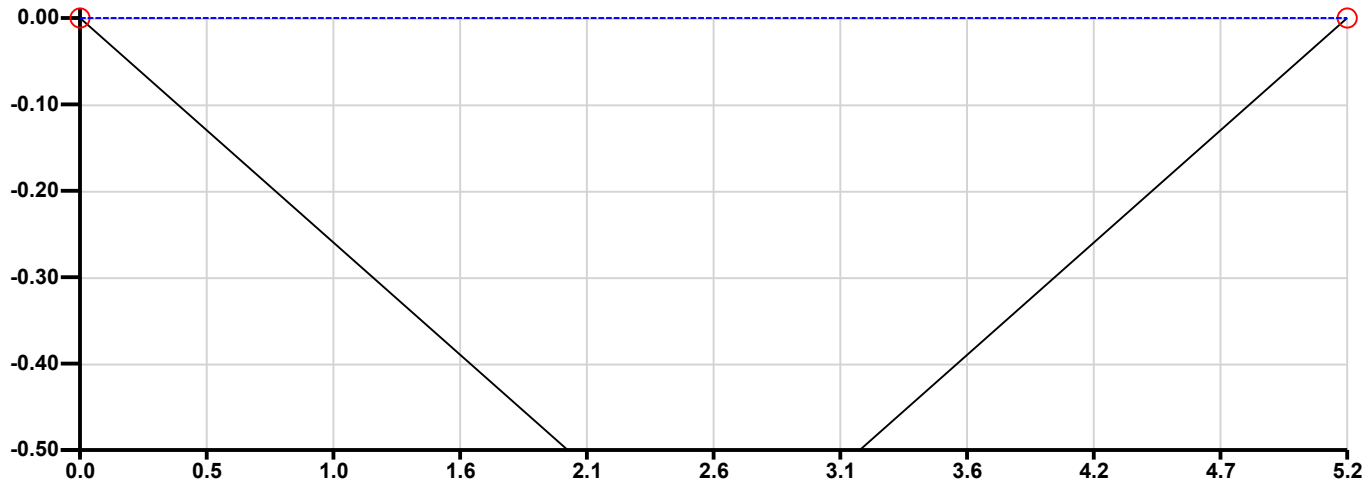
Water Surface Elevation (m)	Q (m^3/s)	Ave. Vel. (m/s)	D(Ave) (m)	D(Ave) x V(Ave) (m^3/s-m)	Fr. No.	Area (m^2)	WP (m)	Flow Width (m)	Hydr. Rads. (m)	Comp. n	SF?
-0.38	0.6	1.38	0.15	0.21	1.14	0.41	2.74	2.69	0.15	0.035	No
-0.37	0.6	1.42	0.16	0.22	1.14	0.43	2.82	2.76	0.15	0.035	No
-0.36	0.7	1.45	0.16	0.24	1.15	0.46	2.90	2.84	0.16	0.035	No
-0.35	0.7	1.48	0.17	0.25	1.16	0.49	2.98	2.92	0.16	0.035	No
-0.34	0.8	1.52	0.17	0.26	1.16	0.52	3.06	2.99	0.17	0.035	No
-0.33	0.9	1.55	0.18	0.28	1.17	0.55	3.14	3.07	0.18	0.035	No
-0.32	0.9	1.58	0.18	0.29	1.17	0.58	3.22	3.15	0.18	0.035	No
-0.31	1.0	1.61	0.19	0.31	1.18	0.61	3.30	3.22	0.19	0.035	No
-0.30	1.1	1.64	0.20	0.32	1.19	0.65	3.38	3.30	0.19	0.035	No
-0.29	1.1	1.67	0.20	0.34	1.19	0.68	3.46	3.38	0.20	0.035	No
-0.28	1.2	1.70	0.21	0.35	1.20	0.71	3.54	3.45	0.20	0.035	No
-0.27	1.3	1.73	0.21	0.37	1.20	0.75	3.61	3.53	0.21	0.035	No
-0.26	1.4	1.76	0.22	0.38	1.21	0.78	3.69	3.61	0.21	0.035	No
-0.25	1.5	1.79	0.22	0.40	1.21	0.82	3.77	3.68	0.22	0.035	No
-0.24	1.6	1.82	0.23	0.41	1.21	0.86	3.85	3.76	0.22	0.035	No
-0.23	1.7	1.84	0.23	0.43	1.22	0.89	3.93	3.84	0.23	0.035	No
-0.22	1.7	1.87	0.24	0.45	1.22	0.93	4.01	3.91	0.23	0.035	No
-0.21	1.8	1.90	0.24	0.46	1.23	0.97	4.09	3.99	0.24	0.035	No
-0.20	2.0	1.93	0.25	0.48	1.23	1.01	4.17	4.07	0.24	0.035	No
-0.19	2.1	1.95	0.25	0.50	1.24	1.05	4.25	4.14	0.25	0.035	No
-0.18	2.2	1.98	0.26	0.51	1.24	1.10	4.33	4.22	0.25	0.035	No
-0.17	2.3	2.01	0.27	0.53	1.25	1.14	4.41	4.30	0.26	0.035	No
-0.16	2.4	2.03	0.27	0.55	1.25	1.18	4.49	4.37	0.26	0.035	No
-0.15	2.5	2.06	0.28	0.57	1.25	1.23	4.57	4.45	0.27	0.035	No
-0.14	2.7	2.09	0.28	0.59	1.26	1.27	4.64	4.53	0.27	0.035	No
-0.13	2.8	2.11	0.29	0.60	1.26	1.32	4.72	4.60	0.28	0.035	No
-0.12	2.9	2.14	0.29	0.62	1.26	1.36	4.80	4.68	0.28	0.035	No
-0.11	3.0	2.16	0.30	0.64	1.27	1.41	4.88	4.76	0.29	0.035	No
-0.10	3.2	2.19	0.30	0.66	1.27	1.46	4.96	4.83	0.29	0.035	No
-0.09	3.3	2.21	0.31	0.68	1.28	1.51	5.04	4.91	0.30	0.035	No
-0.08	3.5	2.24	0.31	0.70	1.28	1.56	5.12	4.99	0.30	0.035	No
-0.07	3.6	2.26	0.32	0.72	1.28	1.61	5.20	5.06	0.31	0.035	No
-0.06	3.8	2.29	0.32	0.74	1.29	1.66	5.28	5.14	0.31	0.035	No
-0.05	4.0	2.31	0.33	0.76	1.29	1.71	5.36	5.22	0.32	0.035	No
-0.04	4.1	2.33	0.33	0.78	1.29	1.76	5.44	5.29	0.32	0.035	No
-0.03	4.3	2.36	0.34	0.80	1.30	1.82	5.52	5.37	0.33	0.035	No
-0.02	4.5	2.38	0.34	0.82	1.30	1.87	5.60	5.45	0.33	0.035	No
-0.01	4.6	2.41	0.35	0.84	1.30	1.92	5.67	5.52	0.34	0.035	No
0.00	4.8	2.43	0.35	0.86	1.30	1.98	5.75	5.60	0.34	0.035	No

4. CROSS-SECTION DATA:

SEGMENT NO.	LEFT HAND POINT CHAINAGE (m)	LEFT HAND POINT R.L. (m)	RIGHT HAND POINT CHAINAGE (m)	RIGHT HAND POINT R.L. (m)	MANNING'S N
1	0.000	0.000	2.400	-0.600	0.035
2	2.400	-0.600	3.400	-0.600	0.035
3	3.400	-0.600	5.600	0.000	0.035

PROJECT: 305492 EAST RD003 RD011 SWALE
Comment
Print-out date: 24/01/2019 - Time: 15:58
Data File: G:\30\305492\Civil\12D\Design Calcs\305492 RD011 RD003 SWALE.dat

1. CROSS-SECTION:



2. DISCHARGE INFORMATION:

100 year (1%) storm event

Total discharge = 2.4 cumecs

There is no pipe discharge
Overland / Channel / Watercourse discharge = 2.400 cumecs

3. RESULTS:

Note: Q = discharge, Ave. Vel. = average flow velocity for cross-section at this water surface elevation.
Fr. No. = Froude Number at this water surface elevation; if Fr < 1 then flow is subcritical.
WP = wetted perimeter, Hydr. Rads. = hydraulic radius = Area/WP at this water surface elevation.
SF indicates whether or not Split Flow occurs at this water surface elevation.
Comp n = composite Manning's n value for cross-section at this water surface elevation.

Grade = 1 in 10

Water Surface Elevation (m)	Q (m^3/s)	Ave. Vel. (m/s)	D(Ave) (m)	D(Ave) x V(Ave) (m^3/s-m)	Fr. No.	Area (m^2)	WP (m)	Flow Width (m)	Hydr. Rads. (m)	Comp. n	SF?
-0.49	0.0	0.18	0.01	0.00	0.59	0.01	1.28	1.28	0.01	0.035	No
-0.48	0.0	0.29	0.02	0.01	0.66	0.03	1.36	1.36	0.02	0.035	No
-0.47	0.0	0.37	0.03	0.01	0.71	0.04	1.45	1.44	0.03	0.035	No
-0.46	0.0	0.44	0.04	0.02	0.74	0.05	1.53	1.52	0.04	0.035	No
-0.45	0.0	0.50	0.04	0.02	0.76	0.07	1.61	1.60	0.04	0.035	No
-0.44	0.0	0.56	0.05	0.03	0.78	0.09	1.69	1.68	0.05	0.035	No
-0.43	0.1	0.61	0.06	0.04	0.80	0.10	1.78	1.76	0.06	0.035	No
-0.42	0.1	0.66	0.07	0.04	0.81	0.12	1.86	1.84	0.07	0.035	No
-0.41	0.1	0.70	0.07	0.05	0.83	0.14	1.94	1.92	0.07	0.035	No
-0.40	0.1	0.74	0.08	0.06	0.84	0.16	2.02	2.00	0.08	0.035	No
-0.39	0.1	0.78	0.09	0.07	0.85	0.18	2.11	2.08	0.09	0.035	No
-0.38	0.2	0.82	0.09	0.08	0.86	0.20	2.19	2.16	0.09	0.035	No
-0.37	0.2	0.86	0.10	0.09	0.87	0.22	2.27	2.24	0.10	0.035	No
-0.36	0.2	0.90	0.11	0.10	0.88	0.25	2.35	2.32	0.10	0.035	No
-0.35	0.3	0.93	0.11	0.10	0.89	0.27	2.44	2.40	0.11	0.035	No
-0.34	0.3	0.97	0.12	0.11	0.89	0.29	2.52	2.48	0.12	0.035	No
-0.33	0.3	1.00	0.12	0.12	0.90	0.32	2.60	2.56	0.12	0.035	No
-0.32	0.4	1.03	0.13	0.13	0.91	0.35	2.68	2.64	0.13	0.035	No
-0.31	0.4	1.06	0.14	0.15	0.92	0.37	2.77	2.72	0.13	0.035	No
-0.30	0.4	1.09	0.14	0.16	0.92	0.40	2.85	2.80	0.14	0.035	No
-0.29	0.5	1.12	0.15	0.17	0.93	0.43	2.93	2.88	0.15	0.035	No

3. RESULTS: (continued)

Note: Q = discharge, Ave. Vel. = average flow velocity for cross-section at this water surface elevation.
Fr. No. = Froude Number at this water surface elevation; if Fr < 1 then flow is subcritical.
WP = wetted perimeter, Hydr. Rads. = hydraulic radius = Area/WP at this water surface elevation.
SF indicates whether or not Split Flow occurs at this water surface elevation.
Comp n = composite Manning's n value for cross-section at this water surface elevation.

Grade = 1 in 10

Water Surface Elevation (m)	Q (m^3/s)	Ave. Vel. (m/s)	D(Ave) (m)	D(Ave) x V(Ave) (m^3/s-m)	Fr. No.	Area (m^2)	WP (m)	Flow Width (m)	Hydr. Rads. (m)	Comp. n	SF?
-0.28	0.5	1.15	0.15	0.18	0.93	0.46	3.01	2.96	0.15	0.035	No
-0.27	0.6	1.18	0.16	0.19	0.94	0.49	3.10	3.04	0.16	0.035	No
-0.26	0.6	1.21	0.17	0.20	0.94	0.52	3.18	3.12	0.16	0.035	No
-0.25	0.7	1.23	0.17	0.21	0.95	0.55	3.26	3.20	0.17	0.035	No
-0.24	0.7	1.26	0.18	0.22	0.95	0.58	3.34	3.28	0.17	0.035	No
-0.23	0.8	1.29	0.18	0.24	0.96	0.62	3.43	3.36	0.18	0.035	No
-0.22	0.9	1.31	0.19	0.25	0.96	0.65	3.51	3.44	0.19	0.035	No
-0.21	0.9	1.34	0.19	0.26	0.97	0.68	3.59	3.52	0.19	0.035	No
-0.20	1.0	1.36	0.20	0.27	0.97	0.72	3.67	3.60	0.20	0.035	No
-0.19	1.1	1.39	0.21	0.29	0.98	0.76	3.76	3.68	0.20	0.035	No
-0.18	1.1	1.41	0.21	0.30	0.98	0.79	3.84	3.76	0.21	0.035	No
-0.17	1.2	1.44	0.22	0.31	0.99	0.83	3.92	3.84	0.21	0.035	No
-0.16	1.3	1.46	0.22	0.32	0.99	0.87	4.00	3.92	0.22	0.035	No
-0.15	1.4	1.48	0.23	0.34	0.99	0.91	4.09	4.00	0.22	0.035	No
-0.14	1.4	1.51	0.23	0.35	1.00	0.95	4.17	4.08	0.23	0.035	No
-0.13	1.5	1.53	0.24	0.36	1.00	0.99	4.25	4.16	0.23	0.035	No
-0.12	1.6	1.55	0.24	0.38	1.00	1.03	4.33	4.24	0.24	0.035	No
-0.11	1.7	1.58	0.25	0.39	1.01	1.08	4.42	4.32	0.24	0.035	No
-0.10	1.8	1.60	0.25	0.41	1.01	1.12	4.50	4.40	0.25	0.035	No
-0.09	1.9	1.62	0.26	0.42	1.02	1.16	4.58	4.48	0.25	0.035	No
-0.08	2.0	1.64	0.27	0.44	1.02	1.21	4.66	4.56	0.26	0.035	No
-0.07	2.1	1.67	0.27	0.45	1.02	1.26	4.75	4.64	0.26	0.035	No
-0.06	2.2	1.69	0.28	0.47	1.03	1.30	4.83	4.72	0.27	0.035	No
-0.05	2.3	1.71	0.28	0.48	1.03	1.35	4.91	4.80	0.27	0.035	No
-0.04	2.4	1.73	0.29	0.50	1.03	1.40	4.99	4.88	0.28	0.035	No
-0.03	2.5	1.75	0.29	0.51	1.03	1.45	5.08	4.96	0.29	0.035	No
-0.02	2.7	1.77	0.30	0.53	1.04	1.50	5.16	5.04	0.29	0.035	No
-0.01	2.8	1.79	0.30	0.54	1.04	1.55	5.24	5.12	0.30	0.035	No
0.00	2.9	1.81	0.31	0.56	1.04	1.60	5.32	5.20	0.30	0.035	No

4. CROSS-SECTION DATA:

	LEFT HAND POINT		RIGHT HAND POINT		
SEGMENT NO.	CHAINAGE (m)	R.L. (m)	CHAINAGE (m)	R.L. (m)	MANNING'S N
1	0.000	0.000	2.000	-0.500	0.035
2	2.000	-0.500	3.200	-0.500	0.035
3	3.200	-0.500	5.200	0.000	0.035

APPENDIX D– BLOCKAGE ASSESSMENT FORM

BLOCKAGE ASSESMENT FORM

STRUCTURE : Valley Creek & Jumping Creek culverts

OPENING WIDTH: 14.4 (J) 12 (V) m

Australian Rainfall & Runoff

DEBRIS TYPE/MATERIAL/L_{10}/SOURCE AREA - *There may be more than one material type to consider!*

Debris Type/Material	L_{10}	Source Area	How Assessed
logs/branches/brush	5m	Valley & Jumping Creeks	photos, site visit

DEBRIS AVAILABILITY (HML) – *for the selected debris type/size and its source area*

Availability	Typical Source Area Characteristics	Notes
High	• *Dense forest, thick vegetation, extensive canopy, difficult to walk through with considerable fallen limbs, leaves and high levels of floor litter.* • *Streams with boulder/cobble beds and steep bed slopes and banks showing signs of substantial past bed/bank movements.* • *Arid areas, where loose vegetation and exposed loose soils occur and vegetation is sparse.* • *Urban areas that are not well maintained and/or old paling fences, sheds, cars and/or stored loose material etc., are present on the floodplain close to the water course.*	✓
Medium	• *State forest areas with clear understory, grazing land with stands of trees* • *Source areas generally falling between the High and Low categories.*	
Low	• *Well maintained rural lands and paddocks, with minimal outbuildings* • *Streams with moderate to flat slopes and stable beds and banks.* • *Arid areas where vegetation is deep rooted and soils resistant to scour* • *Urban areas that are well maintained with limited debris present in the source area.*	

DEBRIS MOBILITY (HML) - *for the selected debris type/size and its source area*

Mobility	Typical Source Area Characteristics	Notes
High	• *Steep source area with fast response times and high annual rainfall and/or storm intensities and/or source areas subject to high rainfall intensities with sparse vegetation cover.* • *Receiving streams that frequently overtop their banks.* • *Main debris source areas close to streams*	
Medium	• *Source areas generally falling between the High and Low categories.*	✓
Low	• *Low rainfall intensities and large, flat source areas.* • *Receiving streams that Infrequently overtop their banks.* • *Main source areas well away from streams*	

DEBRIS TRANSPORTABILITY (HML) - *for the selected debris type/size and stream characteristics*

Transportability	Typical Transporting Stream Characteristics	Notes
High	• *Steep bed slopes (> 3%).and/or high stream velocity (V>2.5m/sec)* • *Deep stream relative to vertical debris dimension (D>0.5L_{10})* • *Wide streams relative to horizontal debris dimension. (W>L_{10})* • *Streams relatively straight and free of constrictions/snag points.* • *High temporal variability in maximum stream flows*	✓
Medium	• *Streams generally falling between High and Low categories*	
Low	• *Flat bed slopes (< 1%).and/or low stream velocity (V<1m/sec)* • *Shallow stream relative to vertical debris dimension (D<0.5L_{10})* • *Narrow streams relative to horizontal debris dimension.(W<L_{10})* • *Streams meander with frequent constrictions/snag points.* • *Low temporal variability in maximum stream flows*	

BLOCKAGE ASSESMENT FORM

Australian Rainfall & Runoff

SITE BASED DEBRIS POTENTIAL 1%AEP (HML) - *for the selected debris type/size arriving at the site*

Debris Potential	Combinations of the Above (any order)	Notes
DP_{High}	HHH or HHM	HHM
DP_{Medium}	MMM or HML or HMM or HLL	
DP_{Low}	LLL or MML or MLL	Eg. MML, therefore DP_{Low} selected

AEP ADJUSTED SITE DEBRIS POTENTIAL (HML) - *for the selected debris type/size*

Event AEP	At Site 1% AEP Debris Potential			AEP Adjusted At Site Debris potential
	DP_{High}	DP_{Medium}	DP_{Low}	
AEP > 5% *(frequent)*	Medium	Low	Low	Eg. Low
AEP 5% - AEP 0.5%	High	Medium	Low	Eg. Low
AEP < 0.5% *(rare)*	High	High	Medium	Eg. Medium

Debris Blockage

MOST LIKELY DESIGN INLET BLOCKAGE LEVEL (B_{DES}%) *for the selected debris type/size*

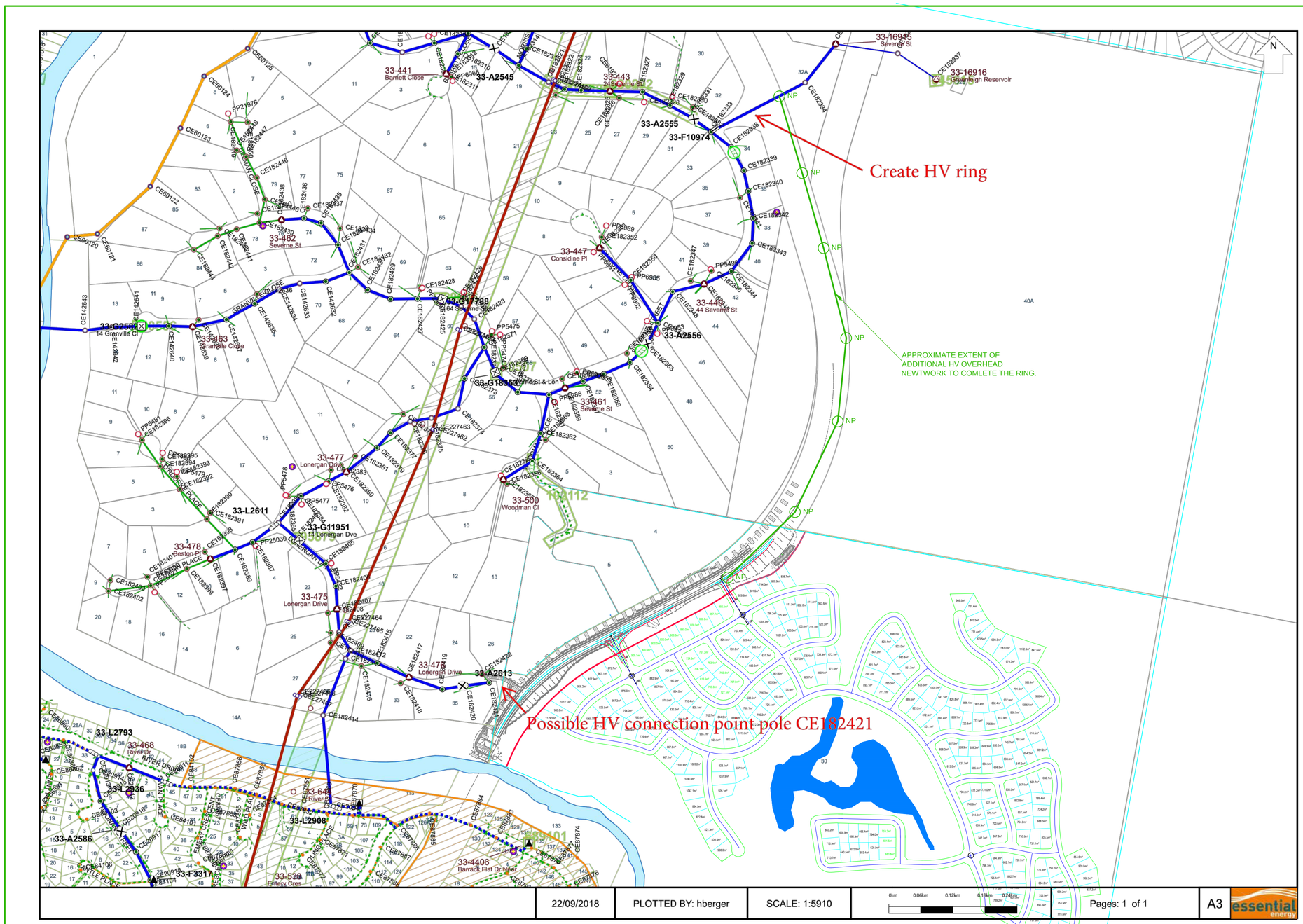
Control Dimension Inlet Width W (m)	At-Site Debris Potential (Generally)		
	High	Medium	Low
$W < L_{10}$	100%	50%	25%
$W \geq L_{10} \leq 3*L_{10}$	20%	10%	0%
$W > 3*L_{10}$	10%	0%	0%

Event AEP	Bdes %
AEP > 5% ***(frequent)***	Eg. Low – 0%
AEP 5% - AEP 0.5%	Eg. Low – 0%
AEP < 0.5% ***(rare)***	Eg. Medium – 10%

Refer Guideline if opening H<0.33W

take $L_{10} \sim 5m$

APPENDIX E UTILITIES CORRESPONDENCE



	22/09/2018	PLOTTED BY: hberger	SCALE: 1:5910	0km 0.06km 0.12km 0.18km 0.24km	Pages: 1 of 1	A3

NORTH POINT

NOTES

CERTIFIED BY ESSENTIAL ENERGY	
Certificate No	
Date Approved	
Examiners Signature	
This certification is subject to Essential Energys Standard Cert Terms	

NOTES.

1. FOR SYMBOLS AND ADDITIONAL LEGEND REFER CEM7001.
   - DISTRIBUTION PILLAR
   - CABLE PIT
   - STREET LIGHT
   - LV CABLE ROUTE
   - ROAD CROSSING CONDUITS
   - NEW OVERHEAD HV CABLE
   - EXISTING OVERHEAD HV CABLE
   - POLE - LV
   - POLE - HV
   - POLE MOUNTED SUBSTATION
2. REFER CIVIL SURVEY DRAWINGS FOR PRECISE SETOUT.
3. CONFIRM ALL DIMENSIONS AND ASSET LOCATIONS ON SITE.
4. CONFIRM DETAILS OF EXISTING ASSETS ON SITE. ADVISE DISCREPANCIES TO DESIGNER BEFORE CARRYING OUT INSTALLATION..
5. RETURN ALL REDUNDANT ESSENTIAL ENERGY ASSETS TO QUEANBEYAN DEPOT.
6. THE EIA REVIEW OF ENVIRONMENTAL FACTORS MUST BE TAKEN INTO ACCOUNT BY THE LEVEL 1 ASP IN CONJUNCTION WITH THIS PLAN INCLUDING EIA 4.10 TRANSPORTING TRANSFORMERS AND 4.12, 4.22 TRAFFIC CONTROL.

REV	DATE	AMENDMENT	AUTH
A	28/09/18	PRELIMINARY FOR COORDINATION	TM

PROPRIETOR

PEET PTY LTD

PO BOX 100
CIVIC SQUARE, ACT 2608

NETWORK DISTRIBUTOR

ESSENTIAL ENERGY

WORKS AREA: QUEANBEYAN
DI RECORD No TBC

ELECTRICAL DESIGNER

TONI MURY AND ASSOCIATES PTY LTD
CONSULTING ENGINEER
ACCREDITATION No 2777

3/146 SHACKLETON CIRCUIT
MAWSON, ACT 2607
ph: 0418 636 748 em: toni@mury.com.au

PROJECT

JUMPING CREEK RESIDENTIAL DEVELOPMENT
LOT 5 DP1199045

LGA: QUEANBEYAN - PALERANG

DRAWING

Network Power Supply
Construction Plan
Street Lighting

SCALE (A1)	1: 2000	DRAWN	TM	APPROVED	
DATE	AUG 2018	CKD	TM		

PROJECT	DRG. NO.	NO. IN SET
1807	E01	2

DESIGN INFORMATION PACKAGE
FOR Project: 117591 Subdivision - 30 Lonergan Dr Greenleigh - Jumping Creek Residential Development

Design Information Issue Date: 26/09/2018.

Toni Mury & Associates Pty Ltd
PO Box 493
GOULBURN NSW 2580

Introduction

Thank you for your application requesting electrical reticulation design information for the proposed supply to **Lot 5, DP 119045**

Project Address: 30 Lonergan Dr Greenleigh NSW 2620

Customer Name: Peet Pty Ltd

General

1. The project number **117591** has been established and shall be used for all future reference and payment transactions.

2. The content of this Design Information Package has been compiled on the basis of certain conditions and restrictions. The designer shall incorporate these requirements within the electrical reticulation design prepared for presentation to Essential Energy.

3. The Design Information Package will be valid for a period of 120 days from the above date. If an updated package is required, please send an email request to contestableworks@essentialenergy.com.au and quote the project number.

4. Essential Energy is providing this information in good faith, to assist you to complete designs for certification. Essential Energy cannot and does not warrant the accuracy or completeness of the information and does not accept any liability for inaccuracies or lack of information. It is the responsibility of the applicant or Accredited Service Provider to independently confirm the accuracy or otherwise, of any information.

Connection Point & Specific Design Information

The regulatory category for the project is: **Urban Residential Subdivision**

The nominated connection point on the network will be at Asset No: **pole CE182421.**

Connection Point Voltage: **11,000 Volts 3Ø**

Existing Asset Details

The existing High Voltage Conductor is: **Not Specified - see Design Information for details**
The existing Low Voltage Conductor is: **Not Specified - see Design Information for details**

New Asset Details:

The Minimum size for the New HV conductor / cable required: **11kV 240mm 3 Core AL XLPE**
The Minimum size for the New LV conductor / cable required: **LV 240mm 4 Core AL XLPE**

The New Substation size required is: **Custom - SEE NOTES**

- New Substation HV Fuses are: **Custom - SEE NOTES**
- New Substation LV Fuses are**: 400 Amp Fuse**

Refer to CEOS5099 – Distribution: Transformer Fusing

Pre Allocated Asset Numbers are as follows:
Not Specified

To request additional Asset Numbers please email Contestable Works stating the number and type required.

Primary Tap setting

Primary Tap setting for this transformer is to be included on the drawing for certification.

The primary tap setting for this transformer: 11,275/430/250V Tap

Earth Fault Protection Settings for Neutron Earthing Analysis

Site Asset Number:
Phase to Earth fault level at site (Amps): 2060A
X/R ratio at site: 1.75
Number of interconnected Substations: Designer to determine
Estimated number of connections per substation: Designer to determine
SEF Active: Y
Upstream protective device: HV substation fuses

Project Specific Comments:

Proposed 242 Lot residential subdivision of Lot 5 DP119045

Install padmount substations within the subdivision designer to determine the size and location of the new substations based on LV drop calculations using an ADMD of 4kVA per lot for reticulated gas 6kVA per lot for no gas

Install a linked UGOH connection on pole CE182421 to supply padmount substations. Install a 3C 11kV 240mm cable from pole CE182421 to the first padmount substation.

To provide a HV ring from the last substation in the subdivision install a HV cable north inside the road reserve of the new Edwin Land Parkway. Install a midspan pole between poles CE182333 and CE182334. Relocate fuses 33-F10974 to pole CE182334. Upgrade the HV conductor between poles CE182333 and CE182334 to 7/4.50AAAC

All substations within the subdivision are to part of ring feed with a HV cable in and HV cable out. Provide spare HV switches in the new substations to allow for possible future stages. Install spare conduits from the substations to possible future stages.

Each lot is to be supplied utilising the Essential Energy pit/pillar system . Underground Low Voltage(UGLV) will extend in the proposed road reserve to supply all lots and required street lighting. Three-phase supply needs to be provided to each lot.

Provide LV interconnections between the LV circuits within the subdivision.

Provide an LV interconnection with the new subdivision and the existing LV in Lonergan Drive.

All new cables are to be in the road reserve and not blocks

The existing HV conductor at pole CE182421 is 7/4.50 AAC Mercury
The existing LV conductor at pole CE182421 is 7/3.00 AAC Libra
The existing HV conductor between poles CE182335 and CE182337 is 3/2.00 SC/GZ

500kVASubstations protected by 40A HV fuses and 400A LV fuses.
315kVA Substations protected by 31.5A HV fuses and 400A LV fuses

Zone Substation: Queanbeyan South
Feeder: QSH5242 Queanbar St

SEF: On at QSH5242
Voltage : 11kV

The nearest Essential Energy Depot is: **Queanbeyan**

Project Funding Arrangements

Essential Energy's policy CEOP2513.06 Connection Policy – Connection Charges sets out the circumstances in which Essential Energy requires a retail customer or real estate developer to pay the cost of connecting their premises or development to Essential Energy's network.

A copy of CEOP2513.06 can be downloaded from Essential Energy's website: www.essentialenergy.com.au.

In accordance with CEOP2513.06 the following funding arrangements will apply to this project:

Essential Energy funded:

- NIL

Customer funded:

- All works

Pioneer Scheme - Reimbursement

General

AER requires that Essential Energy administer a Pioneer Scheme from 1 July 2014 in accordance with the requirements of the AER Connection Charge Guidelines for Electricity Retail Customers – Under Chapter 5A of the National Electricity Rules, and Essential Energy's Connection Policy as approved by the AER.

Requirements of the Pioneer Scheme are outlined in Essential Energy's document *CEO2513.06 Connection Policy – Connection Charges*.

Project specific

The customer is required to complete and sign a CEOF6283 Pioneer Scheme Application Form regardless of whether a pioneer scheme is being implemented or not. The Level 3 ASP must submit the form with the design package for certification.

Essential Energy's records indicate that there is **not** a pre-existing pioneer scheme attached to the infrastructure where you request a connection.

The amount payable to Essential Energy by your customer is **$ .00**

Essential Energy will make this amount payable to the Original customer before connection of the new customer will be permitted.

Ancillary Network Service (ANS) Charges

Compulsory network fees for this project are calculated in accordance with the Australian Energy Regulator (AER), Charges for Monopoly Services.

Your client is to be advised of any compulsory network fees that are applicable to this project.

Total fees for the Design Information stage of this project are **$1,396.93**
Note that invoicing sent to you (separately) will detail the breakup of this amount.

Other fees that may be applied to this project are listed in the document titled 'Price Schedule for Ancillary Network Services - 1 July 2017' that can be found at Essential Energy's website:
(http://www.essentialenergy.com.au/content/electricity-network-pricing-and-information).
Alternatively, further information on the Schedule of rates can be located on the AERs website:
http://www.aer.gov.au/node/11485

*** Note - ANS fees exclude GST and are subject to annual price increases in accordance with the National Regulatory Framework. Care should be taken to select the fee appropriate to this project type. Design certification fees will be based on the date of receipt of a complete and correct submission for certification. All other fees will be based on the work completion date. (eg. date of outage, commissioning, inspection).**

GENERAL DESIGN INFORMATION

Project correspondence

All correspondence and submissions for the project should be sent to:

contestableworks@essentialenergy.com.au

To avoid delays, please include the project number **117591** in the email subject line.

Design Standards

Applicable Essential Energy design standards include:

- CEOM7001 – Network Services – Design Construction Drawings,
- CEOM7097 – Overhead Design Manual,
- CEOM7098 – Underground Design Manual
- CECM1000.70 - Environmental Impact Assessment NSW
- CEOM5113.02 - High Voltage A.C. Distribution Earthing

Other applicable standards or regulations include:

- Work Health and Safety Act 2011 (NSW)
- Work Health and Safety Regulation 2011 (NSW)
- Electricity Supply Act 1995 (NSW)
- Environmental Planning and Assessment Act 1979 (NSW)
- AS/NZS 7000:2010 Overhead Line Design
- AS1158 : Road Lighting
- AS 2067: Power installations exceeding 1kV A.C.
- Energy Networks Association EG-0 Power System Earthing Guide.
- Appropriate WorkCover NSW standards, guides and directives.
- Appropriate Environmental Protection Authority of NSW standards, guides and directives.

Network Optimisation

The Level 3 ASP must ensure that the design is carried out in such a way as to optimise future network operating and maintenance costs rather than solely minimising initial connection costs. Consideration should be given to utilising or upgrading existing assets (eg. poles and transformers) where possible.

When assessing connection proposals, Essential Energy will use network optimisation considerations to determine which connection proposals are acceptable.

Other Services

The Level 3 ASP must carry out a Dial Before You Dig search and is responsible for ensuring that the design does not impact on other services, e.g. telecommunication, gas, water etc. DYBD information should be clearly shown on the design.

In the event the works or design needs to be varied, amended or rectified due to a conflict with other services, the Level 3 ASP is responsible for any subsequent redesign required.

The Level 3 ASP must also ensure that the design will not conflict with proposed services to be installed in conjunction with the development.

Materials

All materials specified in the design must comply with CEOM7004 – Materials Inventory: Contestability (Approved)

Non-standard materials may only be used with written permission from Essential Energy. Please submit requests to the Contestable Design & Certification department with full details justification and engineering certification where required.

All assets to be removed from the Essential Energy network within this project are to be nominated on the operational form CEOF 2098 and returned to the Essential Energy regional store located at **Queanbeyan**. The stores contact for this project is **02 6214 9529** who can be contacted during office hours on **Craig Hoare**. This requirement should be clearly noted on the project design.

Work Health and Safety

The Work Health and Safety Act 2011 (NSW) and the Work Health and Safety Regulation 2011 (NSW) assign significant responsibilities to designers, constructors and the person who commissions the works.

Regulation 295 of the Work Health and Safety Regulation 2011 requires a designer to provide a designer safety report to the person who commissioned the design. For the purpose of this legislation the connection applicant is the person who commissions the design and Essential Energy is the entity who will take ownership of the assets upon connection to the network.

A copy of the designer safety report must be included with every design or design amendment submitted to Essential Energy for certification.

At a minimum, the Designer Safety Report **must** include:

- a description of the purpose for which the plant or structure was designed;
- the results of any calculations, testing, analysis or examination;
- any conditions necessary to ensure that the plant, or structure is without risks to health and safety when used for a purpose for which it was designed, or when carrying out any activity related to the plant or structure such as construction, maintenance, and demolition.

The Designer Safety Report should be written with an appropriate level of detail to match the size and complexity of the project.

The Level 3 ASP should link or attach the Designer Safety Report to the design construction plans (and other relevant documents) to ensure the safety information contained within the report is considered by future parties who may work on the designed assets (e.g. during construction, maintenance, decommissioning, demolition etc. phases of the asset lifecycle).

Easements

The Level 3 ASP should consider easements requirements during the design route analysis.

The customer is responsible for all costs associated with the easement creation including solicitor fees, surveying costs and compensation payable to affected landowners.

Where easements are to be created outside of land to be subdivided, satisfactory arrangements must be in place prior to submitting a design package for certification. For further information, please refer to CEOP8046 *Network Planning: Easement Requirements*.

Easements over Crown land, Crown roads or waterways must be obtained by Essential Energy through the compulsory acquisition process. Please contact the Contestable Design & Certification team for further advice.

Approvals

The Level 3 ASP must seek approvals from the local council, all road controlling authorities and any land occupier affected by the proposed electrical works. The Electricity Supply Act 1995 (NSW), State Environmental Planning Policy (Infrastructure) 2007 (NSW) and the Roads Act 1993 (NSW) have specific requirements in this regard.

In accordance with Section 45 of the Electricity Supply Act, notification of the proposed works must be given to the local council. The council is allowed up to 40 days to comment and the ASP required must duly consider all responses received.

In accordance with Regulation 42 of the State Environmental Planning Policy (Infrastructure) 2007, notification of proposed substations, or works on an existing substation, must be given to both the local council and to occupiers of all adjacent land. The council and adjacent land owners are allowed up to 21 days to comment. The Level 3 ASP must duly consider all responses received.

For works in, on or over a classified road, Section 138 of the Roads Act requires the proponent to obtain consent from the appropriate road controlling authority, and either consent, or concurrence from the RMS.

Copies of notices to the local council and occupiers of adjacent land, any comments received or a letter stating that no response was received, and any required consent letters are to be provided to Essential Energy with the certification package.

Copies of notices to the RMS (and other road controlling authorities where applicable) and the written consent received must be provided to Essential Energy with the certification package for any works on classified roads.

Design Certification

Please note the following information regarding design package submissions:

1. In addition to specific requirements outlined in aforementioned clauses, the design package shall be prepared in accordance with the technical design requirements as specified in Essential Energy's Design and Construction standards.

2. All relevant documents shall be submitted with the design for certification. (see Required Documents Schedule)

3. Essential Energy will carry out an initial review of the design package and issue certification of the design drawing to indicate that the package is compliant.

4. If it is found that the design package is not compliant with Essential Energy's technical or drawing standards, or specific design requirements, a rejection notice will be issued outlining the reasons for rejection. Design rechecking charges will be applied.

5. Certification will remain valid for a period of 6 months. If construction of the proposed works has not commenced before this period expires, the design package must be updated and re-submitted for certification prior to submission of the Notice to Commence Construction.

In certifying any design, Essential Energy makes no warranty, express or implied, that the design is:

1. Fit for its intended purpose
2. Suitable for the site conditions
3. Free of design defects (i.e. errors and omissions)

The Level 3 ASP (and Level 1 ASP at commencement of construction) acknowledges that Essential Energy has not inspected the site, and therefore, is unfamiliar with the site conditions.

Design certification is granted exclusively based on the submitted design with respect to the construction standards in force at the time. It has no reference to any underlying assumptions or conditions.

Responsibility for the correctness and suitability of the design remains with the Level 3 ASP after certification. Essential Energy will request the Level 3 ASP to correct any design defects discovered after certification is granted and resubmit the design package for certification. Design rechecking charges will be applied.

Environmental

Environmental Impact Assessment

An environmental impact assessment of the project will be required. The assessment is to be completed in accordance with Essential Energy's Environmental Impact Assessment (EIA) Policy CECM1000.70.

A completed *CEOF1070.01 Environmental Impact Assessment: Screening Worksheet*, and *CEOF1070.02 Review of Environmental Factors Worksheet*, must be submitted with design construction plans and other documents for

certification by Essential Energy. An information *sheet CEOH1070.02a REF Worksheet: Information Sheet for use by Accredited Service Providers* is available in Essential Energy's online document library to assist ASPs with the completion of CEOF1070.02.

Please ensure ALL required supporting documentation such as threatened species searches, evidence of community consultation, and notifications to council are included.

Please note, Essential Energy is offering Environmental Impact Assessment training for Level 3 ASPs in early 2017. From 1 July, 2017, this training will be mandatory for any person that completing an EIA for a contestable works project.

Vegetation Management

CEOP2010 Vegetation Clearing Guidelines for New Power Lines outlines the requirements for the clearing of vegetation prior to the installation of new overhead and underground powerlines. The document details responsibilities of Level 3 ASPs in the preparation of their design.

If the project requires the clearing (or trimming) of vegetation, the Level 3 ASP must:

1. Ensure their EIA contains details of the required clearing and approvals for the work.
2. Prepare a Site Specific Vegetation Clearing Management Plan (SSVCMP).
3. Specify the width of the required Clearing Zone taking into account the minimum Clearing Zone dimensions (Section 3.2.5) and other factors such as conductor blowout.
4. Include a reference to the SSVCMP on the design construction plan.
5. Ensure the Level 1 ASP who will construct the project is provided a copy of the SSVCMP.

The SSVCMP plan must address all the issues identified in the Environment Impact Assessment. For example, site remediation to prevent the onset of erosion. A list of the minimum information to be included in SSVCMP is in Section 4 of CEOP2010. Essential Energy's certifying officer will assess the submitted EIA and SSVCMP prior to certifying the design.

Clearing works must not commence until design certification has occurred.

Substation Sites

Substations must comply with the requirements of Essential Energy standard construction drawings and design manuals. Level 3 ASPs are reminded of the following requirements:

General:

- Unimpeded access is to be provided for Essential Energy vehicles and staff to substation sites. All substations shall be placed in a location which allows access for a crane borer/erector.
- All padmount substations that are to be installed above the 1:100 year flood level for the local area. Evidence that this requirement is satisfied is to be obtained from the local council, and made available to Essential Energy.
- If an existing substation structure is being altered for any reason, then the structure is to be brought up to the current Essential Energy standards.

Earthing:

- All earthing shall comply with the Essential Energy's policy CEOM5113.02 High Voltage A.C. Distribution Earthing Procedure.
- All earthing designs shall be based on Essential Energy's distribution earthing design software package (Neutron). A copy of the Neutron software package is available on request through neutron@essentialenergy.com.au.
- Level 3 ASPs are required to print an Earthing Report from Neutron and submit it with the design construction drawings for certification.
- Full details of the earthing design must be included on the design drawing.
- Should the customer be upgrading an existing substation, then the suitability of the existing earthing should be assessed for compliance with the current standards. If the existing earthing does not comply, it must be upgraded accordingly.

Voltage Drop Calculations

Where the design requires and alteration to the load on a Low Voltage circuit the Voltage Drop shall be determined using 'LVDROP' software (Version 5.48 or later). CEOM7097 and CEOM7098 provide detailed information on

LVDROP's parameter settings, appropriate load allowances for different development types, and the maximum allowable voltage drop in an LV circuit.

An LVDROP report should be submitted with the design for certification where applicable.

Street Lighting

For projects containing public street lighting, the Level 3 ASP must include a completed CEOF6127 – Public Lighting: Installation and Connection Consent in their design package submitted for certification. CEOF6127 must be signed by an authorised officer of the local council.

CEOF6127 formalises council's agreement:

- That the street lighting design must comply with AS1158.
- To pay annual charges for the lighting applicable from the date of energisation
- To any other project specific requirements

The requirement to submit CEOF6127 applies to both new lighting and upgrades of existing lighting.

Preventing Interference to Other Network Customers

Level 3 ASPs must be aware:

All motor starting must comply with the NSW Service and Installation Rules. Motors will require an approved form of reduced current starting, and motor re-starting to be delayed or non-automatic (manual) following a power outage.

Large motors, arc furnaces, rectifiers (e.g. welders), large inverters, single phase to three phase converters, x-ray machines etc. can degrade the power quality at the customer's own installation and cause adverse effects to the supply of other customers and to Essential Energy's equipment e.g. interference with the frequency injection signal.

The effects from such equipment on power quality may include:

- Voltage sags and swells;
- Harmonics & Inter-harmonics;
- Voltage fluctuations;
- Voltage unbalance;
- Impulsive and oscillatory transients;
- Notching.

Any new load must comply with the relevant Australian Standards, NSW Service and Installation Rules and the Electricity Supply Act 1995 to prevent interference to other customers and electrical equipment.

Level 3 ASPs must notify Essential Energy if it is determined that the customer's load is likely to cause interference to Essential Energy's network.

Entry into Private Property

Only an authorised officer of Essential Energy may exercise Notice of Entry powers described in the NSW Electricity Supply Act 1995.

Level 3 ASPs providing contestable design services are not authorised officers of Essential Energy.

During a design investigation, the Level 3 ASP and/or their customer, must obtain the land owner or occupier consent to enter the land and carry out surveying and design related tasks.

Schedule of Documents to be submitted with the Certification Package:

- ☐ Electrical plan for certification (in pdf and dwg format)
- ☐ LVDROP report showing voltage drop calculations
- ☐ Pole and conductor loading calculations
- ☐ Neutron earthing report
- ☐ Designer safety report
- ☐ Site Specific Vegetation Clearing Management Plan (where applicable)
- ☐ Evidence of easement creation or Deed of Agreement
- ☐ All Local Council, Land Occupier, RMS and other authority correspondence and consent
- ☐ Enhancement Letters
- ☐ CEOF9082 – Consent Form – Customer Funded Project.
- ☐ CEOF9093 – Consent Form – Schedule of Works Required.
- ☐ CEOF6127 – Public Lighting: Installation and Connection Consent.
- ☐ CEOF6011 – Design Submission Form
- ☐ CEOF6283 – Contestable Works: Pioneer Scheme Application (Land Owner Only) or
  CEOF6283.01 – Contestable Works: Pioneer Scheme Application (Land Owner and Leaseholder)
- ☐ CEOF1070.01 – Environmental Impact Assessment: Screening Worksheet
- ☐ CEOF1070.02 – Review of Environmental Factors Worksheet and related searches and approval documents
- ☐ CEOF2098 – Company Form (Network) Returned Redundant Materials Check List
- ☐ AHIMS Report
- ☐ Flora / Fauna search results
- ☐ Dial Before You Dig (DBYD) reference number

Essential Energy forms are available at: www.essentialenergy.com.au/content/contestable-works

Incomplete or incorrect certification packages will be rejected (Design rechecking charges will apply to subsequent submissions).

Design information issued by **Name**: Heinrich Berger

Contact Number: 6214 9698

List of attachments:

- ☐ Smallworld
- ☐ Enmac
- ☐ Pole Data
- ☐ Environmental Report

Benjamin Cargill

From: Danealle Jones <daneallejones@nbnco.com.au>
Sent: Monday, 30 November 2020 2:22 PM
To: Lachlan O'Reilly
Cc: Benjamin Cargill
Subject: RE: Jumping Creek - DEV-00103159

NBN Classification - Commercial

Hi Lachlan

Yes zero.

***nbn** has a Shutdown Period from 24th December till 11th January 2021*

For further updates on you Development please log in to your Developer Portal, ask me how today!
https://nbnco-customer.force.com/directcustomer/s/login/

Any questions please contact me anytime, have a great day.

Kind regards,

Danealle Jones
Relationship Manager
New Developments | Enterprise | Customer Engagement | Operations
M +61 439 419 714 | **E** daneallejones@nbnco.com.au

Level 6, 100 Mount Street, North Sydney NSW 2060

From: Lachlan O'Reilly <Lachlan.O'Reilly@spiire.com.au>
Sent: Monday, 30 November 2020 11:07 AM
To: Danealle Jones <daneallejones@nbnco.com.au>
Cc: Benjamin Cargill <Benjamin.Cargill@spiire.com.au>
Subject: [External] Jumping Creek - DEV-00103159

Hey Danealle,

Can you please confirm for me that there is a zero backhaul component for this development,

Cheers!

Lachlan O'Reilly
Graduate
Civil Engineering

spiire Ballarat Office Now Open

Suite 5 | Level 1, 243 Northbourne Avenue Lyneham ACT 2602
PO Box 6042 O'Connor ACT 2602

t +61 2 6102 1013
spiire.com.au

Benjamin Cargill

From: Steve Donnelly <Steve.Donnelly@jemena.com.au>
Sent: Monday, 12 November 2018 9:03 AM
To: Benjamin Cargill
Subject: RE: Jumping Creek - Gas Supply

Hi Ben

As discussed on the phone this morning, the existing medium pressure gas network in Greenleigh Estate does not have the capacity to supply the proposed Jumping Creek Development. Major infrastructure upgrade works will be required to make gas available to the development. This includes the upgrade of the district regulator on the corner of Mowatt Street and Buttle Street and the laying of approximately 4,500 metres x 160mm PE gas main. If access to the development via the new bridge on the Queanbeyan bypass can be arranged we be able to supply the development via a 1,500 metre x 110mm PE extension from Cooma Street.

Don't hesitate to contact me if you wish to discuss this matter in further detail.

Regards

Steve Donnelly
Network Development Manager
Jemena
Unit 1, 5-7 Johns Place, Hume, ACT 2620
(02) 6192 6270 | 0427 401 803
steve.donnelly@jemena.com.au | www.jemena.com.au

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bring ng energy to life

From: Benjamin Cargill <Benjamin.Cargill@spiire.com.au>
Sent: Monday, 12 November 2018 8:21 AM
To: Steve Donnelly <Steve.Donnelly@jemena.com.au>; Jim Dawson <James.Dawson@zinfra.com.au>
Subject: RE: Jumping Creek - Gas Supply

Hey Steve,

Hope you had a good weekend!

I'm not trying to be a pain I'm just checking to see if there is any further progress on this one yet? If not, do you know when there might be as I will put a note in my diary to not disturb you again before that date.

Regards,

Benjamin Cargill
Associate
Civil Engineering

spiire

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PO Box 6042 O'Connor ACT 2602

t +61 2 6102 1003 +61 488 075 179
spiire.com.au

Inspiiring people and places
VIC | NSW | & NOW ACT

From: Steve Donnelly [mailto:Steve.Donnelly@jemena.com.au]
Sent: Tuesday, 30 October 2018 9:16 AM
To: Benjamin Cargill <Benjamin.Cargill@spiire.com.au>; Jim Dawson <James.Dawson@zinfra.com.au>
Subject: RE: Jumping Creek - Gas Supply

Hi Ben

I'm chasing up our design/capacity engineer. I'll let you know when I've got a response.

Regards

Steve Donnelly
Network Development Manager
Jemena
Unit 1, 5-7 Johns Place, Hume, ACT 2620
(02) 6192 6270 | 0427 401 803
steve.donnelly@jemena.com.au | www.jemena.com.au

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From: Benjamin Cargill <Benjamin.Cargill@spiire.com.au>
Sent: Tuesday, 30 October 2018 9:05 AM
To: Jim Dawson <James.Dawson@zinfra.com.au>; Steve Donnelly <Steve.Donnelly@jemena.com.au>
Subject: Re: Jumping Creek - Gas Supply

Gday jim/Steve,

Any word back from Jemena yet?

Regards
Ben

Get Outlook for iOS

From: Jim Dawson <james.dawson@zinfra.com.au>
Sent: Monday, October 22, 2018 2:07 pm
To: Steve Donnelly
Cc: Benjamin Cargill
Subject: FW: Jumping Creek - Gas Supply

Steve,

Can you send this onto Jemena, and enquire about the capacity of the existing network to supply JC.

Thanks mate

Dawco

From: Benjamin Cargill <Benjamin.Cargill@spiire.com.au>
Sent: Monday, 22 October 2018 12:55 PM
To: Steve Donnelly <Steve.Donnelly@jemena.com.au>; Jim Dawson <James.Dawson@zinfra.com.au>
Subject: RE: Jumping Creek - Gas Supply

Jim

Screenshot from Google maps of where Jumping Creek sits in relation to Greenleigh.

Pink = approximate Ellerton drive extension alignment
Blue = approximate Jumping Creek extent
Red dot = NBN/Elec connection point

If you need anything more let me know.

Regards,

Benjamin Cargill
Associate
Civil Engineering

spiire

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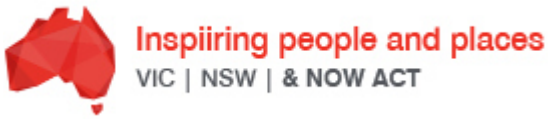

From: Benjamin Cargill
Sent: Monday, 22 October 2018 12:44 PM
To: Steve Donnelly <Steve.Donnelly@jemena.com.au>; 'Jim Dawson' <James.Dawson@zinfra.com.au>
Subject: Jumping Creek - Gas Supply

Steve/Jim,

As discussed on Friday we are connecting into the NBN/elec network at the location shown below for Jumping Creek.

Could you let us know what is required from a gas perspective to service the site? The estate is circa 250 dwellings for the load calcs. I've attached a layout plan for you in PDF.

Regards,
Benjamin Cargill
Associate
Civil Engineering

spiire

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PO Box 6042 O'Connor ACT 2602

t +61 2 6102 1003 +61 488 075 179
spiire.com.au

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This is a confidential message intended for the named recipient(s) only. The contents herein are privileged to the sender and the use thereof is restricted to the intended purpose. If you have received this e-mail in error, please do not use, disclose, distribute, copy, print or relay on this email. If receipt is in error, please advise the sender by reply email. Thank you.
****

APPENDIX F CONCEPT SEWER PUMP STATION DESIGN

Q-MAX SEWAGE PUMPING STATION DESIGN

(To be viewed in conjunction with attached data report)

Project Details

Client	SPIIRE - CANBERRA
Date	18/06/2021
SPS Location	QUEANBEYAN NSW
Project Name / Ref	JUMPING CREEK - QUEANBEYAN SUBDIVISIC
Description	218 LOTS SPS
REF No.	4197.REV.4.1

Pump Well

Well Internal Diameter	3.2	m
Valve chamber	Integral 1250D	

Design Flow or PWWF Calculation

Calculation Method	WSA Sewerage Code		
Development Type	Residential		
Gross Hectares of Development	38.2	382,000	m2
Number of allotments	218		
EP per allotment ratio	3.5	L/d per EP	210
Equivalent Population (EP)		**763**	

IIF Calculation:

Location for Rainfall intensity	South Jerrabomberra	
Leakage Severity Coefficient 0.2 = Low Impact, 0.8 = High Impact	Soil aspect ↓	Network defects ↓
	0.5	0.5

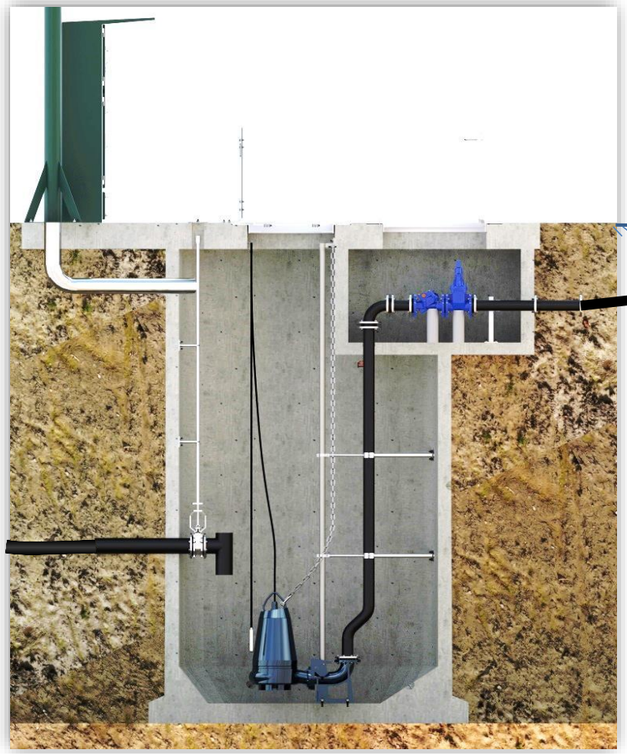
Note: Leakage coefficients shown above are estimated values only and should be verified with the relevant local authority.

ARI Interval @ 1.5 hrs duration	2 years
Portion Wet (factor for gravity mains below water table)	0.1

Calculated ADWF in L/s :	1.855
Calculated Design Flow in L/s :	15.275

Emergency Storage (ADWF)

Duration Required	8	hrs
Storage Required	53.43	m^3
Wet Well Storage, MTWL to Overflow RL	53.00	m^3
Include Collection Manhole Storage?	☐	
Approx Manhole volume		
Include gravity retic. Storage?	☐	
Available Storage	53.00	m^3
Additional Storage Required:	NOT REQUIRED.	



DELETE CELL

Surface RL	**586.50**	m AHD
Under slab RL	586.25	m AHD
Overflow RL	**585.80**	m AHD
	S21 M-H	

Inlet IL	**578.878**	m AHD
MTWL	578.756	m AHD
TWL	578.606	m AHD
BWL	**578.410**	m AHD
Internal IL	**578.010**	m AHD
Depth of WW	8.490	m

CONVERT TO NEAREST STANDARD DEPTH ☐

Rising Main

Material	DICL FLANGE	
Internal Diameter	157	mm
Nominal Size	150	
Class	FLANGE	
Length	1063	m
RM Capacity	20,579.00	L

Fittings	Qty	K
Pipe Exit	1	1
90° bend	2	1
45° bend		0.4
22.5° bend	2	0.2
Swing Check Valve	1	1
Tee	1	1.2
Gate Valve, fully open	1	0.15

RM Velocity	0.904	m/s
RM Detention Time	3.080	hrs

RM Highest point

RM Highest point	**604.564**

Head

Static Head	26.15	m
Internal Pipework Friction Head	0.594	m
RM Friction Head	7.135	m
Fittings Kinematic Head	0.2397	m
Total Head	**34.13**	m

Pump

Minimum Calculated Rate	☐	15.27	l/s
Nominal Pump Rate		17.50	l/s
Selected Pump BWL from IL		400	mm
PDWF incoming		5.59	l/s
Pump run time		90	secs
Control volume BWL to TWL		1575.00	L
Max Pump starts per hour		8.69	

Internal Pipework

Material	STAINLESS STEEL
Size	DN100, SCHED 10, GR 316
Velocity at pump rate	1.90 m/s

Date 18/06/2021
Ref. No. 4197.REV.4.1

SPIIRE - CANBERRA
Suite 5, Level 1, 243 Northbourne Ave
CANBERRA ACT 2601
Attn: Ben Cargill

Dear Ben,

JUMPING CREEK - QUEANBEYAN SUBDIVISION
218 LOTS SPS

Please find below preliminary estimates of the proposed pumping station requirements for your consideration.

FLOW CALCULATIONS

Flow calculation Method	= WSA Sewerage Code		
Development Type	= Residential		
Number of allotments	= 218		
Estimated gross development area (A)	= 38.2	Hectares	
EP per allotment ratio	= 3.5		
Number of Equivalent Persons (EP)	= 763		
ADWF Average Dry Weather Flow (ADWF)	= 0.0025	L/s (i.e. 210 L/d x 763 EP	**= 1.86 L/s**

WSA DESIGN FLOW FORMULA: **= PDWF + GWI + IIF**

PDWF = d x ADWF

Where **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 of the development's catchment, in hectares

d is calculated to be: **= 3.012**

PDWF is calculated to be: **= 5.5871972 L/s**

GWI = 0.025 x A x **$Portion_{Wet}$**

Where **GWI** is groundwater ingress in L/s

$Portion_{Wet}$ is the portion of planned pipe network estimated to have groundwater table levels in excess of pipe inverts. For example if 70% of the sewer system is below groundwater table levels then PortionWet = 0.7. Default for estimates unless otherwise able to be accurately determined is 1.0

PortionWet value used for this design assumption is = **0.1**

GWI is calculated to be: **= 0.0955**

IIF = 0.028 x **A_{Eff} x C x I**

Where **IIF** is the peak (rainfall dependant) inflow and infiltration that may enter the sewer network for Residential developments, **A_{Eff} =** A x (**Density**/150)$^{0.5}$ for **Density** <150 EP/Ha

Density is the development EP density per gross hectare

Density is calculated to be: **= 19.9738**

C is the IIF leakage coefficient that defines the contribution of rainfall runoff to sewer flows via IIF. C comprises the sum of contributions from "soil movement" aspect and "network defects" aspect, with total being minimum 0.4 (low impact) and maximum 1.6 (high impact). C should be finally nominated by the relevant local authority and values shown here are general estimates only.

A_{Eff} is calculated to be: **= 13.939536**

assuming **C** combined sum is 1.0 (medium range impact)

I = $I_{1,2}$ x $Factor_{Size}$ x $Factor_{Containment}$

Where **$I_{1,2}$** is the Local water authority specified 'X' hour duration rainfall intensity at the location for an average recurrence interval of 'X' years, (commonly referred to as ARI).

QPRC Advised **$I_{1,2}$**(ARI) **for South Jerrabomberra 10 years: = 22.4**

$Factor_{Size} = (40/A)^{0.12}$

$Factor_{Size}$ is calculated to be: **= 1.005540565**

$Factor_{Containment}$ reflects local environmental aspects and regulations on wet weather sewage containment (overflow frequency). The design should incorporate the ARI of sewage overflows, specified by the Local water authority.

Given the specified ARI, **$Factor_{Containment}$** may be taken from Table B3.

Table B3 – CONTAINMENT FACTOR VERSUS ARI

ARI	1 month	3 months	6 months	1 year	2 years	5 years	10 years
$Factor_{Containment}$	0.2	0.4	0.6	0.8	1.0	1.3	1.5

$Factor_{Containment}$ = 1.0 from South Jerrabomberra 10 years

I is calculated to be: **= 24.575411 $I_{1,2}$**

IIF is calculated to be: **= 9.59196**

Therefore Design Flow is summarised as **5.587197 [PDWF] + 0.0955 [GWI] + 9.592 [IIF]**

= 15.27 L/s

PUMP STATION

Pump wet well internal diameter:	=	3.2	m
Surface level at pump station:	=	586.500	RL
Pump station inlet level:	=	578.878	RL
Bottom of wet well:	=	578.01	RL
Pump station area:	=	8.042477193	m2

PUMPING REQUIREMENTS

Proposed nominal pump rate:	=	17.50	L/s
Duty Pump start (TWL)	=	578.6058352	RL
Standby Pump start (MTWL)	=	578.7558352	RL
Pump stop (BWL)	=	578.41	RL
Depth of "dead" storage	=	400	mm

Normal operating control volume

TWL 578.60584 – BWL 578.41 x 8.042477193 m2 = 1.575 m3

Effective Pumped rate (pump flow rate 17.50 – 5.59 L/s PDWF) = 11.91 L/s

Time to fill control volume at PDWF	=	1,575.00	L	/	5.59	L/s	=	281.89 seconds
Pumping run time to clear control volume at effective Pumped rate	=	1,575.00	L	/	11.91	L/s	=	132.21 seconds
Cycle Time	=	Fill Time + Empty Time					=	414.11 seconds
Maximum number of pump starts per hour	=	3600 Seconds / Cycle Time					=	8.693 Starts/ hour

EMERGENCY STORAGE RETENTION REQUIREMENTS

Assumed required retention period at ADWF	=	8	hours
ADWF	=	1.855	L/s
Retention volume required 8 hours x 3600 seconds x ADWF	=	53.43	m3
Overflow level	=	585.80	RL
Pumpwell storage volume provided, MTWL to overflow level:	=	53.002	m3
Total retention volume available, no additonal installation:	=	53.00	m3

Additional Emergency storage required:	=	
Suggested Emergency Storage type:		Concrete Pour in
Diameter:	=	
Height:	=	
Capacity at overflow RL:	=	0

HYDRAULIC HEAD/LOSS CALCULATIONS

Maximum elevation	=	604.56	RL
Bottom Water Level (BWL) at pump	=	578.41	RL
Rising main length	=	1063	Mtrs
Pump rate	=	17.50	L/s
Head loss (static)	=	26.15	Mtrs
Pipe and fittings, inc.internal and rising main (friction)	=	7.97	Mtrs
Total pumping head (Static + Friction)	**=**	**34.13**	**Mtrs**

INTERNAL PIPEWORK

Material	=	STAINLESS STEEL
Size & Class	=	DN100, SCHED 10, GR 316
Internal Diameter	=	108.2 mm
Hazen Williams Coefficient	=	100
Design Velocity at pump rate	=	1.90 m/sec

RISING MAIN

Nominal Size	=	150	mm
Material	=	DICL FLANGE	
Class	=	FLANGE	
Internal Diameter	=	157	mm
Hazen Williams Coefficient	=	122	
Design Velocity at pump rate	=	0.904	m/sec
Rising main volume	=	20,579.00	Litres
Rising main detention time		3.08	hours

Volume 20,579.00 / 1.855 ADWF / 3600 seconds

PRELIMINARY PUMP SELECTION DETAILS

Pump Manufacturer	=	FLYGT
Pump selected	=	NP3153.185 SH 3~273
Rated Power	=	15 kW
Speed	=	2900 RPM
Impeller type	=	Semi open Channel
Actual System curve pump rate	=	17.6 L/s

This design data is based on perameters (i.e. levels, rising main route, number of EP) as provided by Spiire, as at 18 June 2021

Mike Urquhart

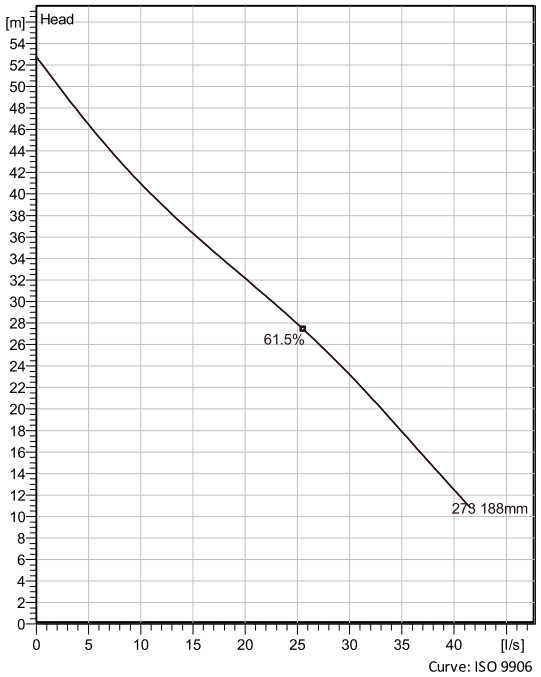
Estimator – Waste Water Solutions
Q-Max Pumping Systems
1800 678910
0418 608 857
mike.u@qmaxpumping.com.au

NP 3153 SH 3~ 273

Patented self cleaning semi-open channel impeller, ideal for pumping in most waste water applications. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



Configuration

Motor number
N3153.185 21-18-2FB-W 11KW

Installation type
P - Semi permanent, Wet

Impeller diameter
188 mm

Discharge diameter
80 mm

Pump information

Impeller diameter
188 mm

Discharge diameter
80 mm

Inlet diameter
150 mm

Maximum operating speed
2900 rpm

Number of blades
2

Max. fluid temperature
40 °C

Materials

Impeller
Hard-Iron

Project	**Created by**		
Block	**Created on**	6/18/2021	**Last update** 6/18/2021

NP 3153 SH 3~ 273

Technical specification

Motor - General

Motor number N3153.185 21-18-2FB-W 11KW	**Phases** 3~	**Rated speed** 2900 rpm	**Rated power** 11 kW
Approval No	**Number of poles** 2	**Rated current** 18 A	**Stator variant** 7
Frequency 50 Hz	**Rated voltage** 415 V	**Insulation class** H	**Type of Duty** S1
Version code 185			

Motor - Technical

Power factor - 1/1 Load 0.94	**Motor efficiency - 1/1 Load** 89.5 %	**Total moment of inertia** 0.0336 kg m²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.93	**Motor efficiency - 3/4 Load** 91.0 %	**Starting current, direct starting** 128 A	
Power factor - 1/2 Load 0.88	**Motor efficiency - 1/2 Load** 92.0 %	**Starting current, star-delta** 42.7 A	

Project		**Created by**			
Block		**Created on**	6/18/2021	**Last update**	6/18/2021

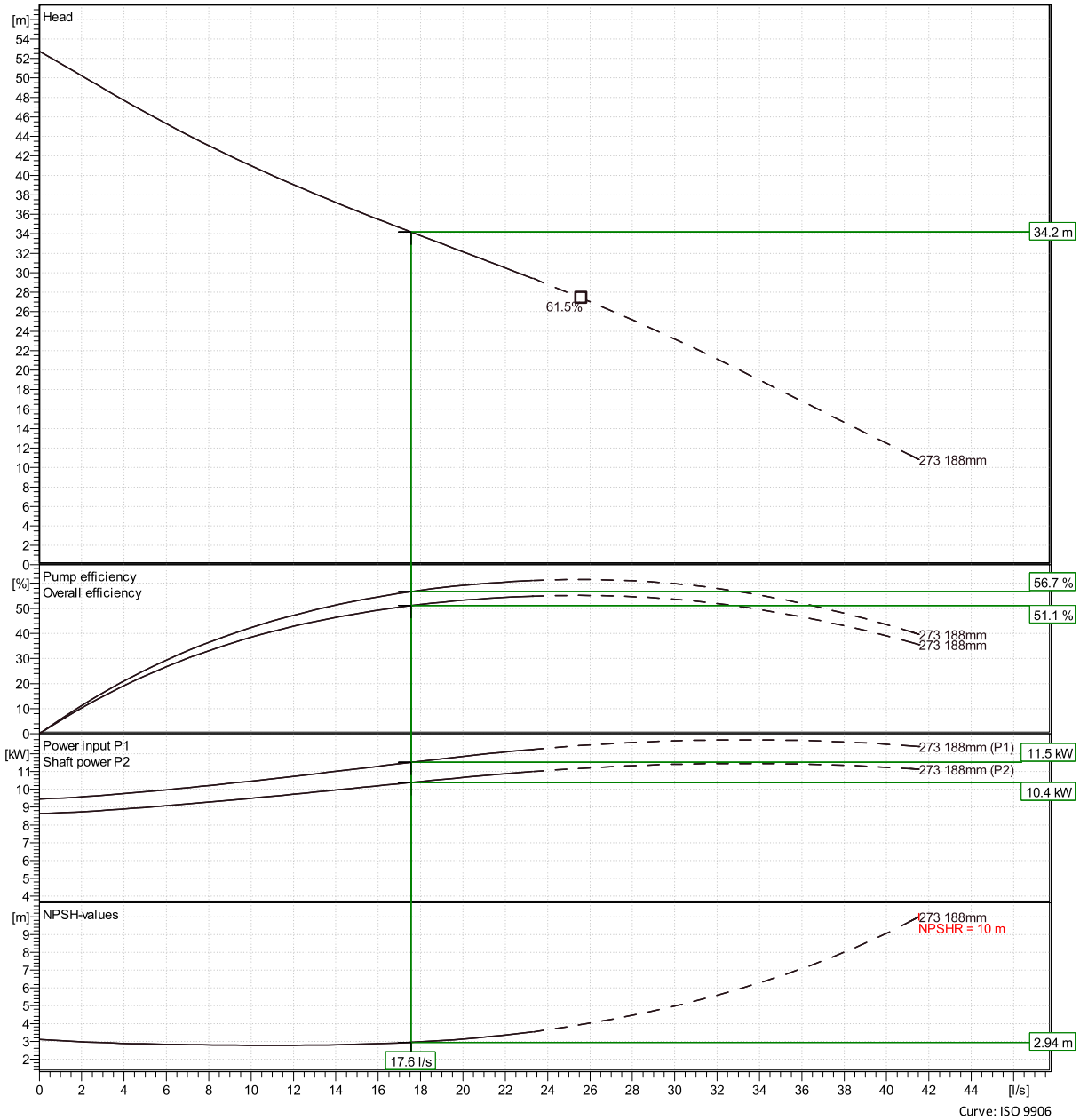
NP 3153 SH 3~ 273

Performance curve

Duty point

Flow	Head
17.6 l/s	34.2 m

Curves according to: Water, pure 4 °C, 999.9 kg/m³, 1.5692 mm²/s



Curve: ISO 9906

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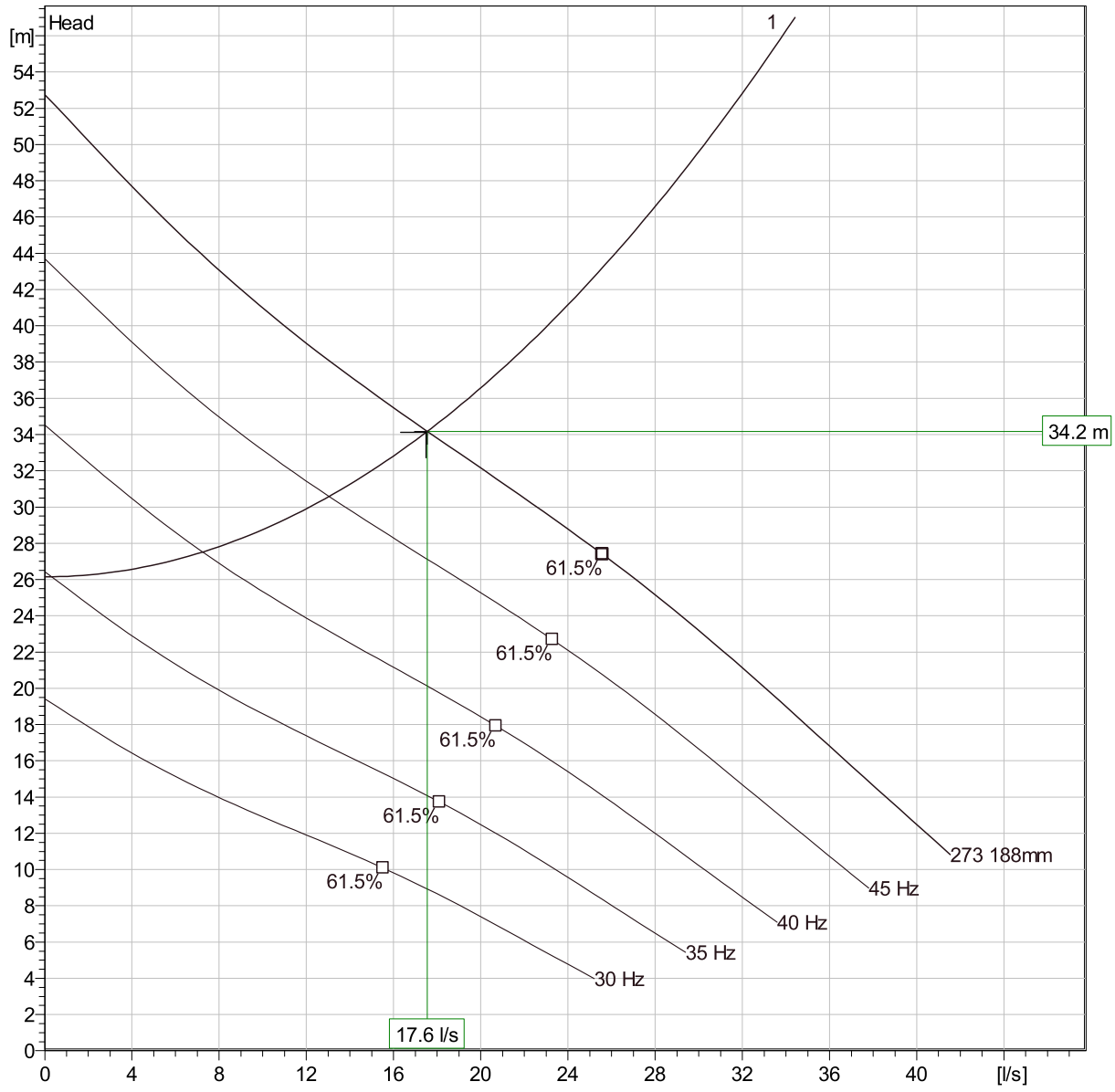
Block		**Created on**	6/18/2021	**Last update**	6/18/2021

NP 3153 SH 3~ 273

Duty Analysis

Curves according to: Water, pure ,4 °C,999.9 kg/m³,1.5692 mm²/s



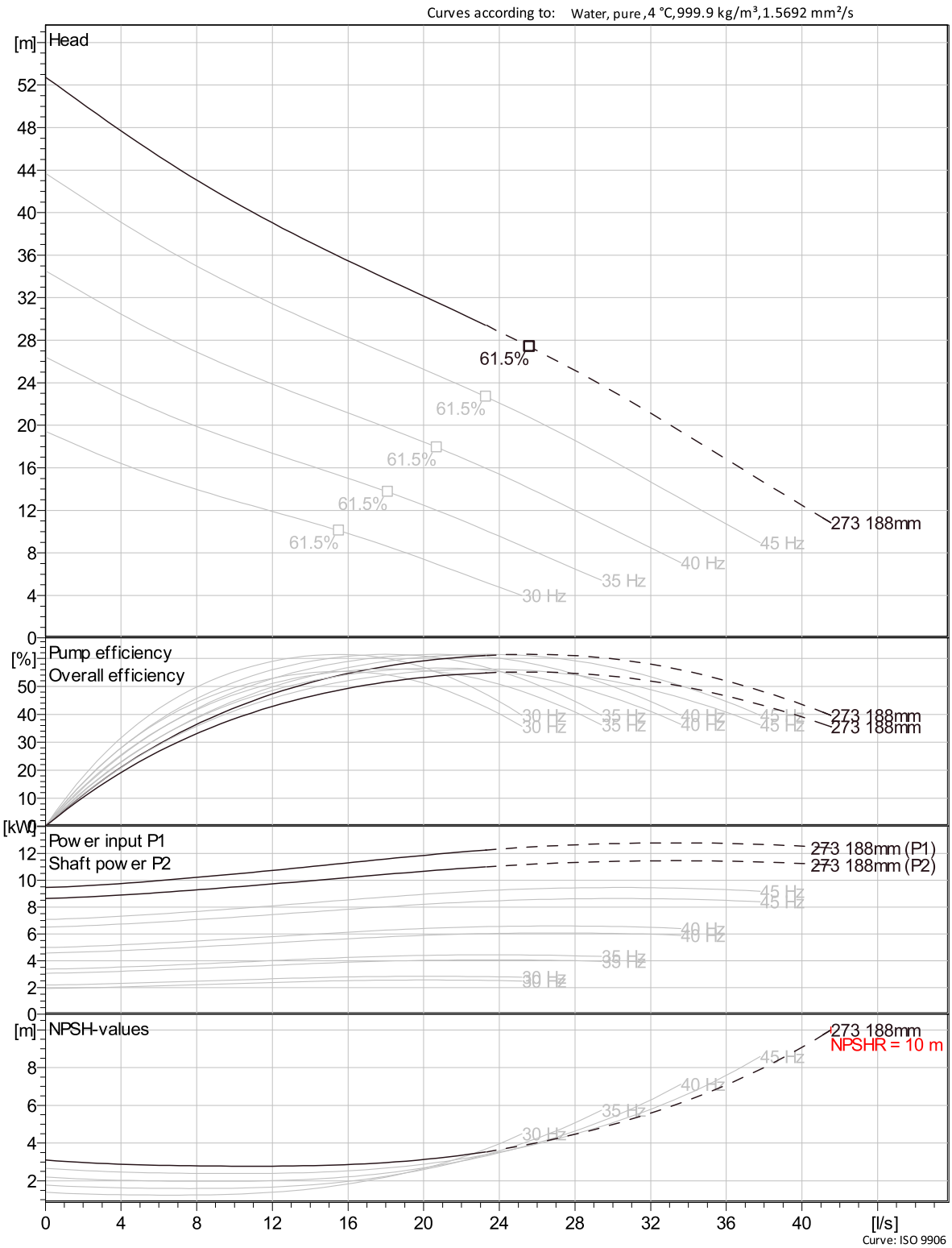
Operating characteristics

Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1	17.6 l/s	34.2 m	10.4 kW	17.6 l/s	34.2 m	10.4 kW	56.7 %	0.182 kWh/m	2.94 m

Project		**Created by**			
Block		**Created on**	6/18/2021	**Last update**	6/18/2021

NP 3153 SH 3~ 273

VFD Curve



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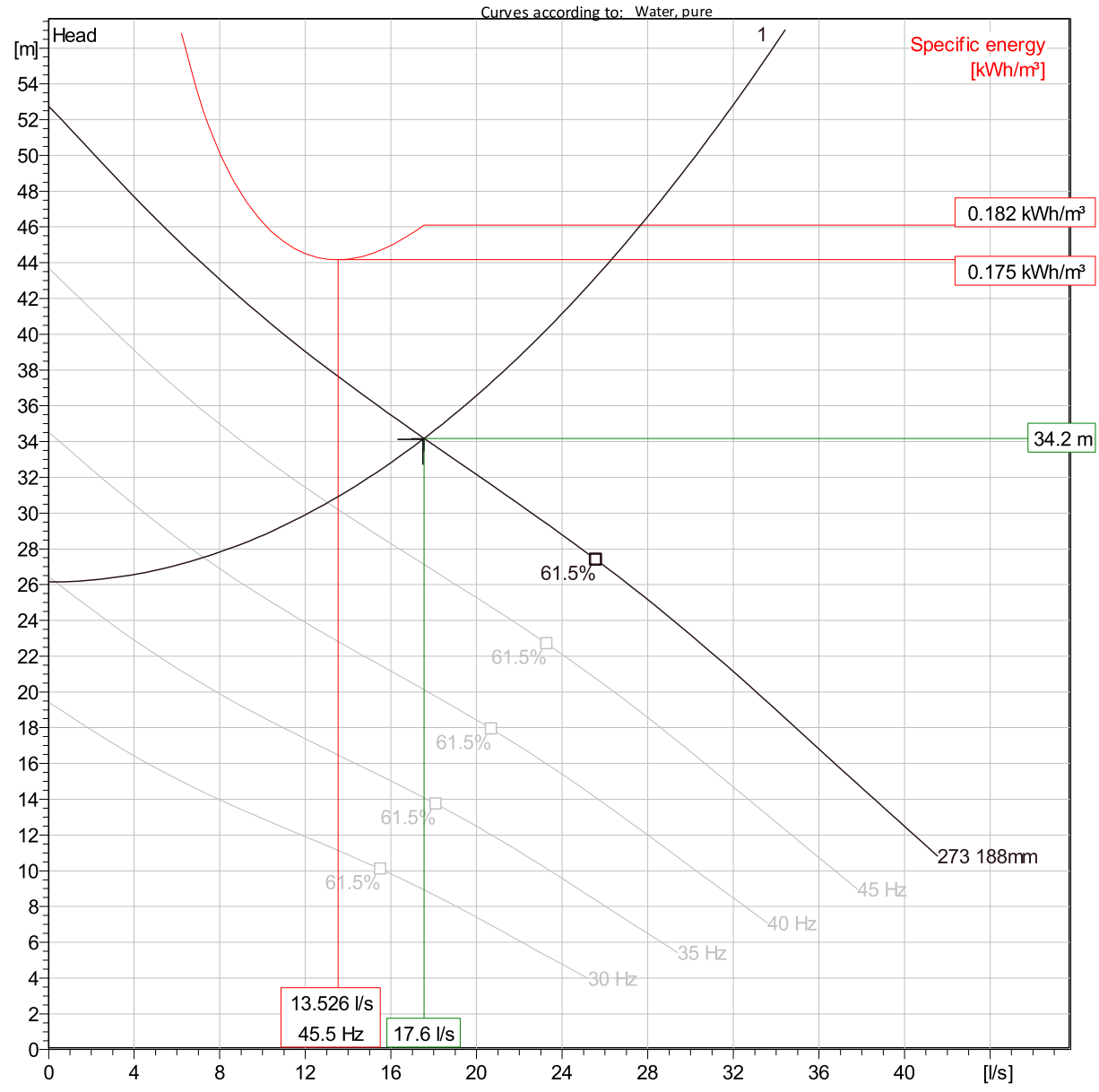
Block		**Created on**	6/18/2021	**Last update**	6/18/2021

NP 3153 SH 3~ 273

VFD Analysis



Operating characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific Energy	NPSHre
1	50 Hz	17.6 l/s	34.2 m	10.4 kW	17.6 l/s	34.2 m	10.4 kW	56.7 %	0.182 kWh/m	2.94 m
1	45 Hz	13 l/s	30.6 m	7.53 kW	13 l/s	30.6 m	7.53 kW	51.9 %	0.175 kWh/m	2.42 m
1	40 Hz	7.19 l/s	27.5 m	4.95 kW	7.19 l/s	27.5 m	4.95 kW	39.2 %	0.208 kWh/m	1.98 m
1	35 Hz	0.206 l/s	26.2 m	3.05 kW	0.206 l/s	26.2 m	3.05 kW	1.73 %	4.52 kWh/m	1.77 m
1	30 Hz									

Project		**Created by**			
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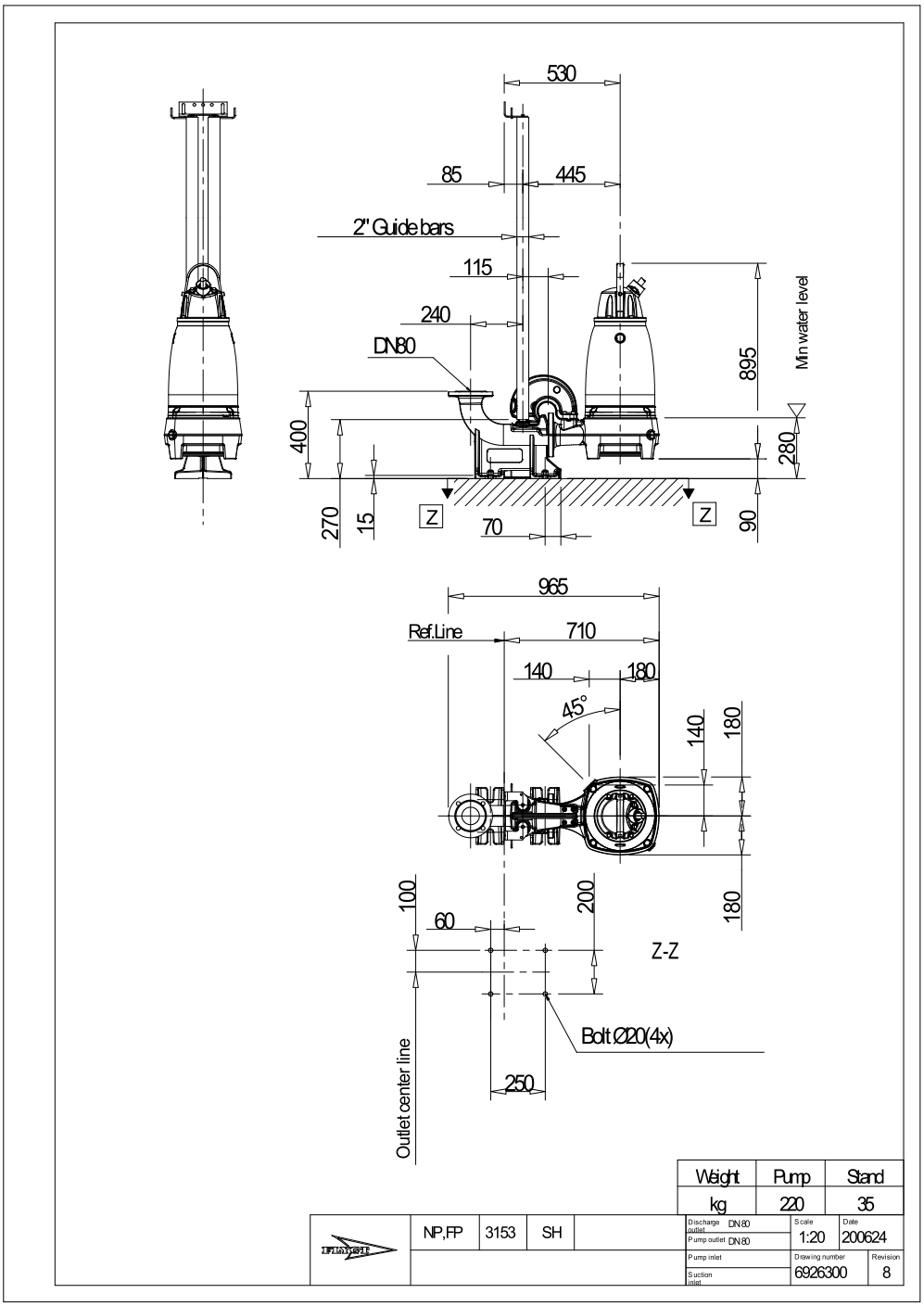
NP 3153 SH 3~ 273

Dimensional drawing



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