APPENDIX 6. INVESTIGATIONS – CIVIL ENGINEERING

mlei
CONSULTING ENGINEERS

BUILDINGS

LAND DIVISION

INFRASTRUCTURE

RESOURCES & INDUSTRIAL

DEFENCE

CODE AMENDMENT REPORT – CIVIL ENGINEERING

Gumeracha Road, O'Sullivan Beach

Reference A2020 – 10390_A

16 August 2021

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ADELAIDE + SYDNEY + MILDURA + PORT LINCOLN + DARWIN + MELBOURNE

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1. Introduction

MLEI have been engaged to prepare this report to provide an investigation on the proposed rezoning of land at Gumeracha Road for a proposed residential land division from civil engineering perspective at O'Sullivan Beach.

This report gives recommendations for the control and management of stormwater runoff from the proposed development, provides a preliminary stormwater management report (SMP) and an investigation on proposed infrastructure to service the land development in order to suit a residential consumer.

The report encompasses conceptual ideas on the management of stormwater on the development and infrastructure the design of individual elements on site such as the detailed stormwater collection conveyance systems, detailed road alignment and site finished levels are not within the scope of this report and will be covered within the detailed engineering design in the development stage of the project.

This service has been provided on an independent and professional basis. You can be assured that it seeks to present a factual, unbiased and balanced assessment.

2. Site Description

2.1 Site Characteristics

The overall development site is located at 36-70 Gumeracha Road, O'Sullivan Beach, consisting of a single greenfield site with a total area of 6.00 hectares. The site is currently vacant and unused and is proposed for 114 residential allotments.

The development site is bounded by Gumeracha road to the west, Baden road to the north and residential properties along the south. The eastern boundary is flanked by industrial developments.

It is intended that the site be developed comprising of low to medium density housing of varied form. The site is fairly steep and typically grades 3.5% approximately to the south west. The levels along the eastern boundary of the site are in the vicinity of 53.0m and along the western boundary of the site are 49.00m

Figure 1 - Site aerial view

2.2 Site Topography and vegetation

There is a level difference along the southern boundary to existing residential properties which will be taken into consideration to minimise impacts and ideally avoid the need for retaining walls to this boundary. The development will utilise the existing boundary levels along Gumeracha Road and Baden Terrace, detailed site modelling will ensure the development is constructible and will meet authority requirements. Tree removal will be determined on a case by case basis, in accordance with an arborist report.

2.3 Provision for open space

A requirement of 12.5 percent of the total site is to be dedicated as open space, of which only 20 percent of can be allocated to the management of stormwater – all other areas for stormwater management will need to be outside the areas of open space. Should the development not provide 12.5 percent, negotiations with Council and the developer will be organised to form a financial contribution.

3. Proposed Development

It is intended that the site be developed comprising of low to medium density housing of varied form, with 114 residential allotments currently proposed. A preliminary concept plan of the development can be seen below and found in Appendix A.

3.3 Stormwater Management Strategy

A preliminary stormwater management plan and report has been prepared, refer Appendix B, outlining an overall concept to meet Council requirements to manage stormwater flows from the site. Note this report is provided as an initial assessment for the purposes of the rezoning, further information will be provided to submit as part of a planning documentation set.

Existing infrastructure around the development within Council land has been provided by Council and can be found in Appendix C, as well as comments from Council on the proposed stormwater strategy and land development.

A stormwater detention basin is proposed in the south western corner, which will aid to retard additional flows as a result of the development.

There is no existing site drainage for the allotment, existing site drainage from neighbouring allotments currently runs underground through an easement within the allotment and is proposed to be maintained. The overland flow easement shown from the outfall from 51 Morrow

Road has been advised by Council as acceptable and does not require detention. Existing easements within the development site that are required in order to service neighbouring allotments will be maintained within the road reserve or rear of lot easements.

As required by Council, Calculations will be required at a later stage that demonstrate that the total flow from the site after development does not exceed the total flow pre-development for minor (20% AEP) and major (1%AEP) storms. Discharging to the existing underground drainage system should not exceed 20% AEP predevelopment flow.

Preliminary stormwater calculations have been done in order to determine an approximate size of the required detention basin to ensure flow restrictions are met to Council satisfaction. Future proposals, where detailed calculations will be provided in DRAINS Models and MUSIC Models to illustrate stormwater management, detention and quality and how the onsite system will connect into the existing infrastructure. Detailed calculations will be provided upon the result of the code amendment and final layout.

For future planning and engineering assessment, this development will adhere to the 'large scale' development criteria, as outlined in Council's Stormwater Design Guidelines (Dated Nov 2019), in Appendix C.

The objectives of the stormwater management plan is to determine the capacity of the stormwater detention and the availability to incorporate additional flows generated from the site in its developed state and demonstrate that the proposed stormwater system achieves the stormwater management practices to the satisfaction of City of Onkaparinga Council stormwater management objectives.

An indicative layout has been prepared for the proposed underground drainage system that will service the land division for this report, refer Appendix B. In accordance with Council requirements the underground drainage system is designed to cater for the minor (20% AEP) event, with the major (1% AEP) event to be conveyed safely within the road reserve. The concept drainage plan assumes allotments facing Baden Terrace and Gumeracha Road discharge stormwater directly to the street water tables. Residential allotments typically use a sealed downpipe network to convey roof drainage to above ground stormwater retention tanks with overflows connected to kerb outlets and overland flow toward the front of the property. The remainder of the land division will drain to a designated detention storage area created in a low spot at the south west of the development.

Division of the site that bypasses the detention basin will be dependent on the amount of flow generated from the site, ensuring total flow from the development meets Council requirements.

A surface basin is expected to gradually fill to the designed ponding level and empty accordingly with the restricted outlet and allowable flow.

3.4 Flood Protection

The subject site does not appear to be within the 100 year AEP floodplain. However the site levels have been carefully selected in a way that they protect proposed buildings from flood inundation. Finished floor levels are to be a minimum of 300mm above 1% AEP water levels maintaining a roadside swale to continue carrying flows in the current direction of travel aims to ensure that upstream flows do not enter the development.

4. Proposed Services Infrastructure

An infrastructure services assessment report has been prepared to form part of the feasibility phase of the land development. The report outlines existing and proposed services for the development and is attached in Appendix D. The findings of the report detail that through a combination of utilising existing networks with sufficient capacity and providing infrastructure extensions and upgrades, there is opportunity for the site to be developed for residential land use.

5. Summary

The proposed rezoning of the land to be intended for residential purposes proves achievable from a civil engineering perspective, with requirements outlined by Council and authorities deemed manageable.

Stormwater management requirements from Council are able to be achieved, initial assessment has been undertaken in a preliminary stormwater management report. Proposed infrastructure has been investigated and considered in an infrastructure assessment report. Council feedback has been considered and addressed within this report, hence through further development of engineering practices, the land parcel seems appropriate to be used for a residential land development.

6. Appendix A – Concept Plan of the Proposed Development

Lot Type	No's	%
15m + (Courtyard)	27	24
12.5m Premium Villa inc. tilider corners & 13.3 - 15m turnaround lots	34	30
11m (DG Villa)	15	13
10m (Villa)	36	31.5
15 x 15.5m (Cottage)	2	1.5
	114	100

Note
Whilst all care has been taken in the preparation of this plan;
it is important to note that some errors may occur when calculating areas of allotments.
This plan has been generated as an early concept plan to provide urban design insights and outcomes that relate to allotment arrangements and allotment typologies.

For confirmation of allotment areas, dimensions and all other site constraints such as trees, boundaries etc, it is recommended that a surveying consultant be utilised.

e=mc2tudio
evolving place

0 10 30 60
Scale 1:1000 @ A2

North

GUMERACHA ROAD - O'Sullivan Beach
Preliminary Concept Plan
AUGUST 2021

7. Appendix B – Preliminary Stormwater Management Report

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BUILDINGS

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STORMWATER MANAGEMENT REPORT

Gumeracha Road, O'Sullivan Beach

Reference A2020 – 10390_B

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1. Introduction

MLEI have been engaged to prepare this report and develop a preliminary stormwater management plan (SMP) for the proposed land division at Gumeracha Road, O'Sullivan Beach.

This report gives recommendations for the control and management of stormwater runoff from the proposed development and provides a preliminary SMP produced for planning purposes. The site in its current state has a natural fall of 1:25 towards the South West. The key criterion is the detention of stormwater and minimisation of discharge off site to Council's drainage infrastructure, each residential allotment will also be required to provide a minimum of 1kL of water to be re-used on site. The report encompasses conceptual ideas on the management of stormwater on the development. The design of individual elements on site such as the detailed stormwater collection conveyance systems are not within the scope of this management plan and will be covered within the detailed design in the development stage of the project.

The final stormwater drainage layout for the proposed development will be subject to final design and the site layout. Hence this report provides an overall strategy and demonstrates that the fundamental stormwater management requirements can be met, based on the City of Onkaparinga Stormwater Management criteria outlined in this report.

This service has been provided on an independent and professional basis. You can be assured that it seeks to present a factual, unbiased and balanced assessment.

2. Site Description

2.1 Site Characteristics

The overall development site is located at 36-70 Gumeracha Road, O'Sullivan Beach, consisting of a single greenfield site with a total area of 6.00 hectares. The site is currently vacant and unused and is proposed for 114 residential allotments.

The development site is bounded by Gumeracha road to the west, Baden road to the north and residential properties along the south. The eastern boundary is flanked by industrial developments.

It is intended that the site be developed comprising of low to medium density housing of varied form. The site is fairly steep and typically grades 3.5% approximately to the south west. The

levels along the eastern boundary of the site are in the vicinity of 53.0m and along the western boundary of the site are 49.00m

Figure 1 - Site aerial view

2.2 Existing Stormwater Infrastructure

Council's stormwater drainage network throughout the area consists of several catch pits along Gumeracha Road, with concrete pipe network located in the western verge. Drainage long sections have been provided in Appendix A.

An existing drainage easement runs parallel to Baden road approximately 128m north of southern boundary, containing an existing stormwater pipe from the western developments. An existing junction box containing a 1200mm diameter outlet pipe is located along the western boundary for a proposed connection.

2.3 Existing Site Drainage

As shown in Appendix A, the existing topography is reasonably steep and typically grades approximately 3.5% to the south west where it is anticipated all stormwater flow is carried overland to the kerb system on Gumeracha Road. There is no existing site drainage for the allotment, existing site drainage from neighbouring allotments currently runs underground through an easement within the allotment.

3. Proposed Development

It is intended that the site be developed comprising of low to medium density housing of varied form, with 114 residential allotments currently proposed. A preliminary concept plan of the development can be seen below and found in Appendix B.

4. Stormwater Management Strategy

The objectives of the stormwater management plan is to determine the capacity of the stormwater detention and the availability to incorporate additional flows generated from the site in its developed state and demonstrate that the proposed stormwater system achieves the stormwater management practices to the satisfaction of City of Onkaparinga Council

stormwater management objectives. Council stormwater management requirement can be found on their website.

The SMP will follow the below points.

- Stormwater runoff from site after development should not exceed runoff prior to development for a 1% Annual Exceedance Probability (AEP) stormwater event. Council have advised to calculate the pre-development flow based on the runoff coefficient of 0.25
- Stormwater Management Plan (SMP) will demonstrate the above and to ensure discharge points do not have any adverse impact on adjoining properties, Council infrastructure or the environment.

DRAINS computer modelling software is an industry standard tool used for the hydrological and hydraulic analysis of stormwater drainage systems. DRAINS models were compiled for both the pre-development and post-development scenarios to allow for comparison of flows.

A Horton/ILSAX hydrological model was used with the following design parameters, where applicable, in the DRAINS model analysis to Council requirements:

- Soil type = 3.
- Antecedent Moisture Content (AMC) = 2.5.
- Depression Storage: Paved = 1mm; Grassed = 5mm.
- Rainfall Storm event- generated in accordance with ARR, 2016 temporal patterns and
- Bureau of Meteorology Intensity, Frequency and Duration (IFD) depths.
- Minimum residential impervious area =75% and pervious area= 25%.

Within the development the primary focus for the management of stormwater is the application of standard stormwater management practices to the satisfaction of Council. For the purposes of this report we have adopted the following standard practices:

- Major System to be designed for 1% AEP (100 year ARI)
- Minor System designed to 20% AEP (5 year ARI)

Results for pre-development peak flow can be found below:

Storm Event	AEP (ARI)	Peak Flow
Major	1% (100)	1.29 m^3/s
Minor	20% (5)	0.258 m^3/s

Results for the post-development flow based on a 75% impervious area for residential allotment is as follows:

Storm Event	AEP (ARI)	Peak Flow
Major	1% (100)	1.65 m^3/s
Minor	20% (5)	0.658 m^3/s

5. Stormwater Capture and Disposal

An indicative layout has been prepared for the proposed underground drainage system that will service the land division, refer Appendix D. In accordance with Council requirements the underground drainage system is designed to cater for the minor (20% AEP) event, with the major (1% AEP) event to be conveyed safely within the road reserve. The concept drainage plan assumes allotments facing Baden Terrace and Gumeracha Road discharge stormwater directly to the street water tables. Residential allotments typically use a sealed downpipe network to convey roof drainage to above ground stormwater retention tanks with overflows connected to kerb outlets and overland flow toward the front of the property. The remainder of the land division will drain to a designated detention storage area created in a low spot at the south west of the development.

5.1 Detention Storage Options

The size of the storage methods have been determined in order to capture the increased runoff as a result of the proposed development, all volumes are dependent on the maximum water level and site design levels, hence are subject to change.

Surface Detention Basin

A surface basin is expected to gradually fill to the designed ponding level and empty accordingly with the restricted outlet and allowable flow. The depth of the proposed basin is 1.2m, 200mm of freeboard has been allowed. Maximum batter slopes shall be 1V:5H, rock retaining walls or gabion baskets may be provided and civil earthworks are subject to change. Based on a top of basin level of 50.00m AHD and an invert of basin of 48.80 the volume required in a surface storage basin is approximately 415m^3, which would require a top surface area of 570m^2.

The calculations are based on the concept plan, therefore further design and analysis will be necessary to determine the exact location and sizes of the pits and pipes in the network, to be undertaken in detailed design. Refer to Appendix C for catchment plan and calculations.

6. Proposed Stormwater Drainage Approach

6.1 Overall management Approach

Runoff will be directed to side entry pits and conveyed underground. Provision to accommodate the major storm event up to the 1 in 100 year AEP peak flow through the site will be facilitated through overland flow paths and roadways that will direct flow toward the basin.

Rainwater from the roof area is proposed to discharge to rainwater tanks via downpipes, and overflow from the tanks discharges to the road network.

Refer to Appendix D for Concept Stormwater Management Plan.

6.2 Flood Protection

The subject site does not appear to be within the 100 year AEP floodplain. However the site levels have been carefully selected in a way that they protect proposed buildings from flood inundation. Finished floor levels are to be a minimum of 300mm above 1% AEP water levels maintaining a roadside swale to continue carrying flows in the current direction of travel aims to ensure that upstream flows do not enter the development.

6.3 Stormwater Quality

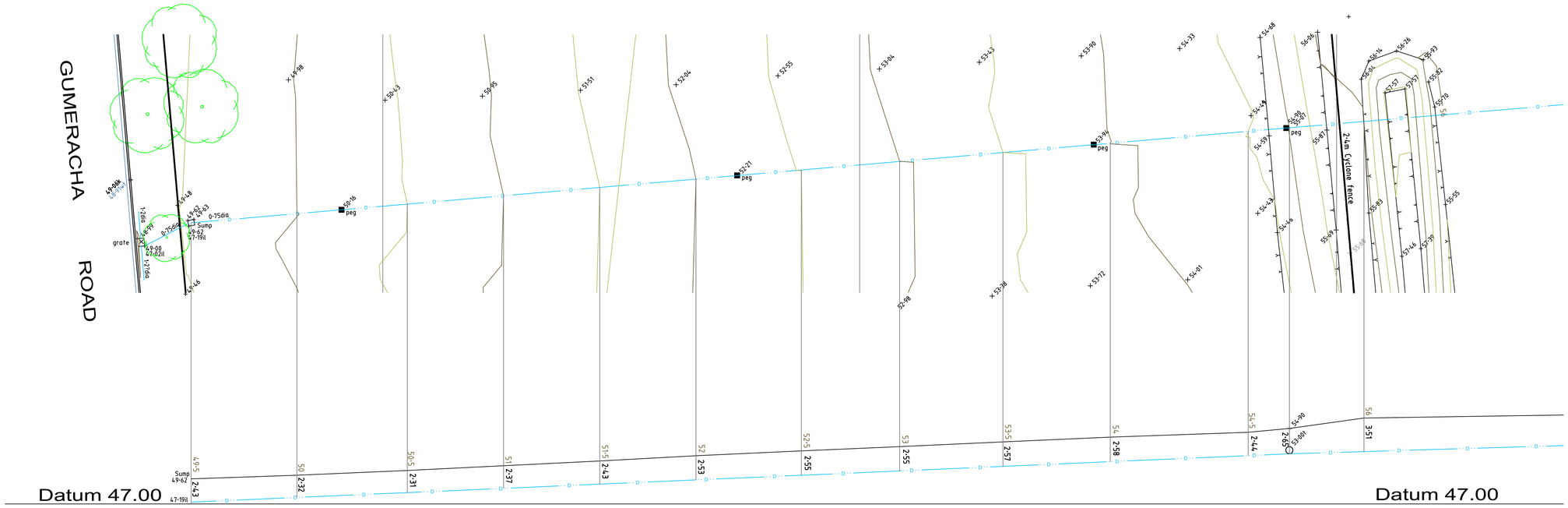
Stormwater quality is to be addressed during the planning documentation submission.

7. Summary

The post-development flow of the site is intended to be restricted to the pre-development flow rate for the 100 year AEP event, the method of on-site detention to retard any flows before entering Council's infrastructure has been proposed as a detention. The design requirements outlined in sections 4 and 6 have been adhered to. It has also been demonstrated that this proposal includes stormwater harvesting and reuse, as well as stormwater quality treatment.

8. Appendix A – Existing Site Plan

CROSS SECTION



CNR. GUMERACHA ROAD & BADEN TERRACE

O'SULLIVAN BEACH

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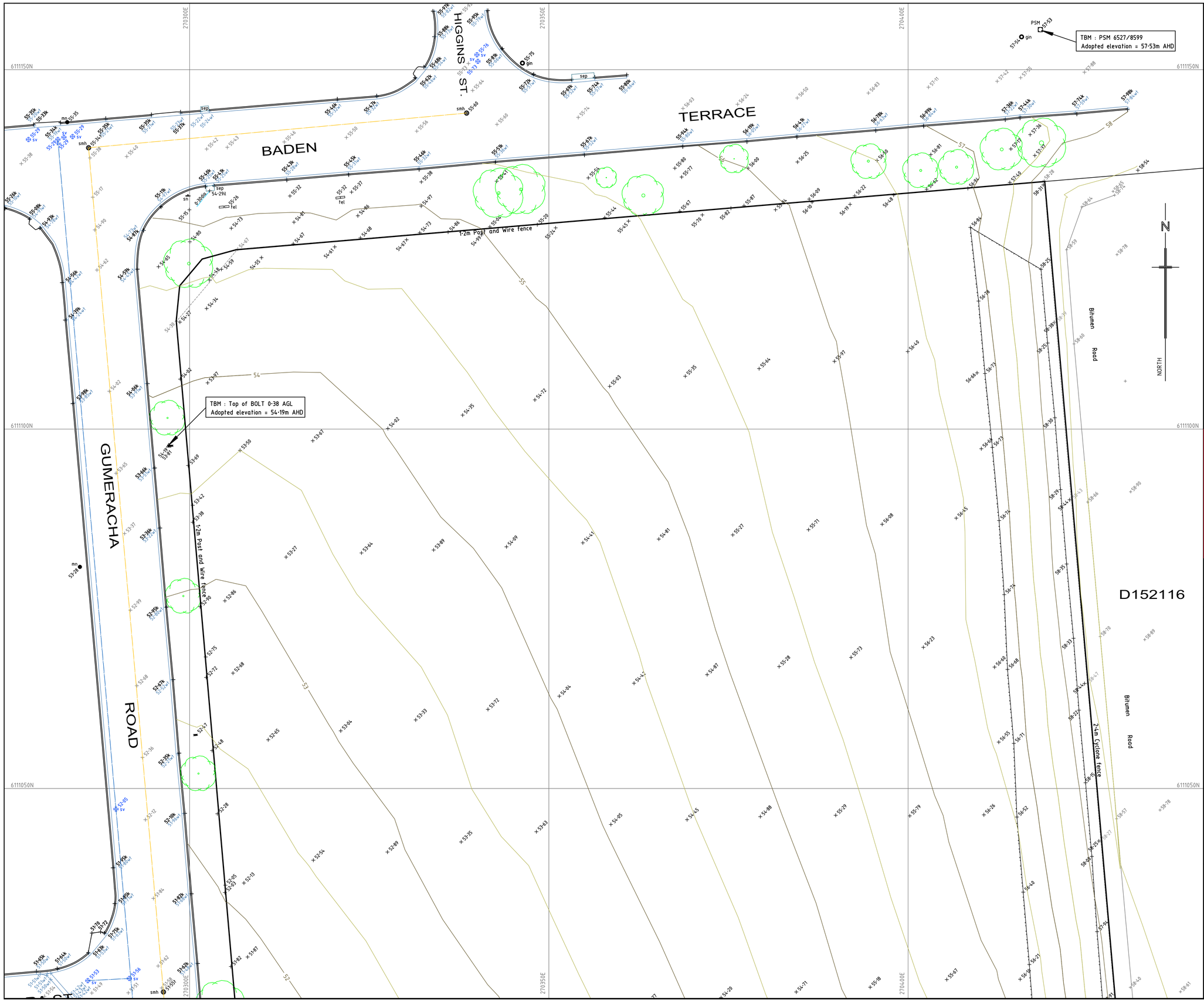

D152116

LEGEND

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TBM	Temporary bench mark		Grid line
peg	Peg		Top of bank
spk	Spike		Bottom of bank
mp	Metal pin		Change of grade
gin	GI nail		Top of levee bank
mn	Masonry nail		Bottom of levee bank
dh	Drill hole		Stormwater pipe
scr	Scribe		Edge of bitumen
txt	Texta		Edge of unmade road/track
pf	Picket		Edge of shoulder
+	Spot height		Watertable
	Unknown point		Back of kerb
grf	Grafed inlet pit		Building
	Domestic outlet		Building GI
iL	Invert		Edging sleeper/log/concrete
dpo	Downpipe - open		Underground ETSA
dpu	Downpipe - underground		Overhead ETSA
sp	Sump		Underground Telstra
sw	Stormwater IP		Overhead Telstra
sw	Stormwater manhole		U/G communication cables
sn	Sign		O/H communication cables
	Bollard		Underground gas
fL	Floor level		Underground sewer pipe
sL	Step level		Above-ground sewer pipe
wl	Watertable level		Underground water pipe
k	Back of kerb		Above-ground water pipe
	Rubbish bin		Unknown trench, service etc
fp	Flagpole		Brick fence
	Column centres		Stone fence
	Stobie pole		Cyclone fence
lp	Light pole		Post & wire fence
ETSA	ETSA pillar		Brush fence
ETSA	ETSA service		Picket fence
	ETSA cable marker		Tubular fence
	ETSA earth		GI fence
tel	Telstra JB		Colorbond fence
tel	Telstra pillar		Log fence
	Telstra cable marker		Guardrail
comm	Communication JB		Giveway line
gm	Gas meter		Continuity
gs	Gas service		Lane line 9x3
	Gas marker		Lane line 6x6
smh	Sewer manhole		Fence post
sip	Sewer IP		Stump
sio	Sewer IO		Tree
	Gully trap		Shrub
	Sewer vent		
	Sewer marker		
sv	Stop valve		
	Fire hydrant		
	Control value		
	Fire hose		
wm	Water meter		
tap	Tap		
	Water marker		

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NOTE :

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5. NO UNDERGROUND SERVICES HAVE BEEN LOCATED. PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE, PLEASE MAKE USE OF THE "DIAL-BEFORE-YOU-DIG" SERVICE.

REV.	DATE	DESCRIPTION	LC (Y/N)	BY

Client
JOHN KEFALIANOS

Project Description
DETAIL SURVEY
CNR. GUMERACHA RD. & BADEN TERRACE
O'SULLIVAN BEACH
ALLOTMENT 20 IN D115116 CT 6197/337
ALLOTMENT 67 IN F152643 CT 6136/727

THIS IS SHEET 1 OF 4 SHEETS

Drawing Scale 1 : 250m — Original Sheet Size A1

0 5 10 15 20 25
Scale — Metres

Notes

Contour interval = 0.5m

Levels are based on the Australian Height Datum derived from P.S.M. 6527/8599
Adopted elevation = 57.53

STATE SURVEYS
465b South Road
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Phone (08) 8293 2939
Facsimile (08) 8293 2949
Email info@statesurveys.com.au

Coord. Datum:	MGA 2020	Surveyed:	NP,EF&TT 27.08.20
Height Datum:	AHD	Calculated:	NP & EF 31.08.20
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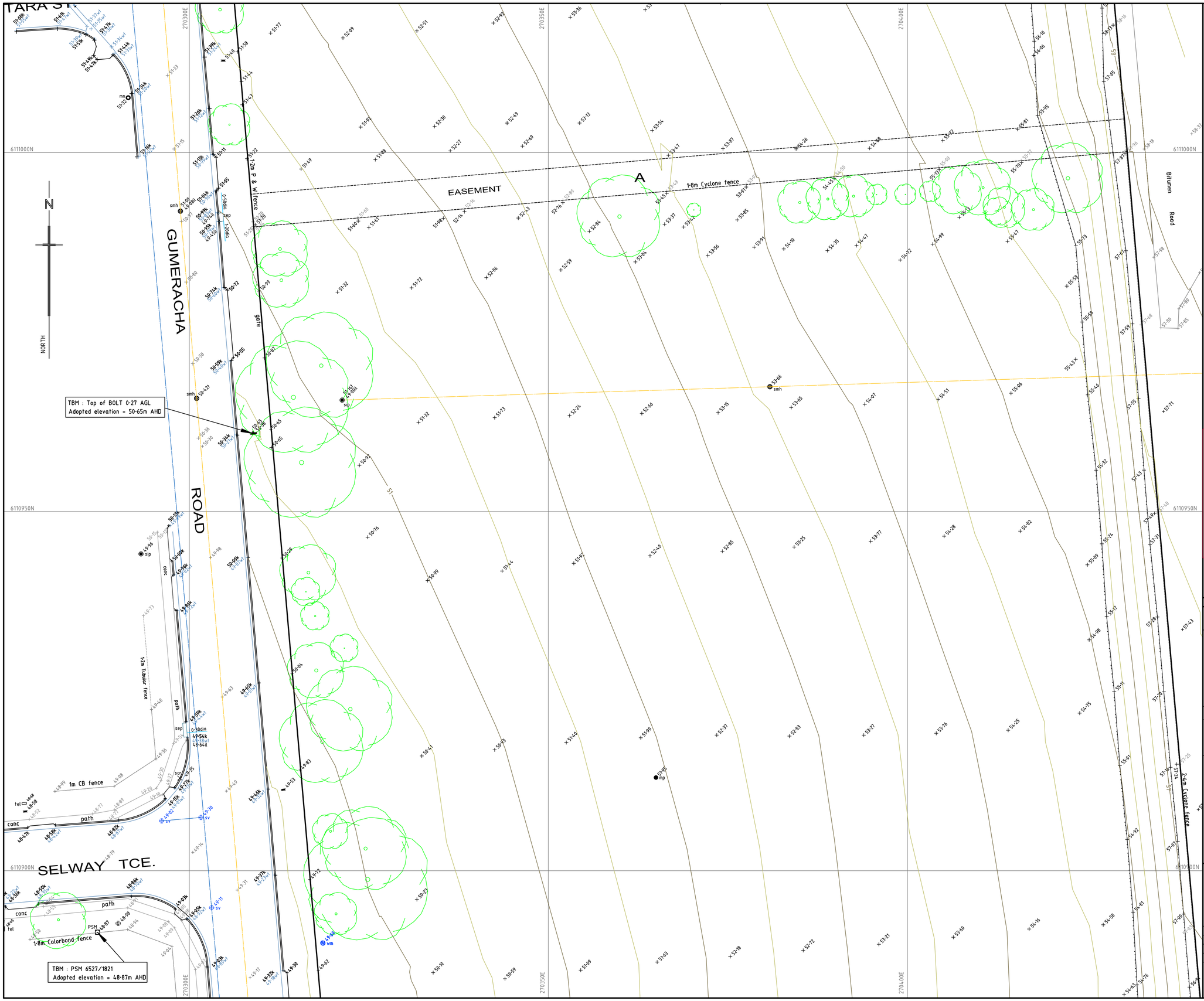
DWG File:	20289 DETAIL	Checked:	

Job Number 20289 — Revision



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txt	Texta		Edge of unmade road/track
pt	Picket		Edge of shoulder
+	Spot height		Watertable
	Unknown point		Back of kerb
grt	Grated inlet pit		Building
	Domestic outlet		Building GI
iL	Invert		Edging sleeper/log/concrete
dpo	Downpipe - open		Underground ETSA
dpu	Downpipe - underground		Overhead ETSA
sp	Sump		Underground Telstra
sw	Stormwater IP		Overhead Telstra
sw	Stormwater manhole		U/G communication cables
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	Sewer vent		
	Sewer marker		
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	Fire hydrant		
	Control value		
	Fire hose		
wm	Water meter		
tap	Tap		
	Water marker		

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Client
JOHN KEFALIANOS

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Job Number — Revision
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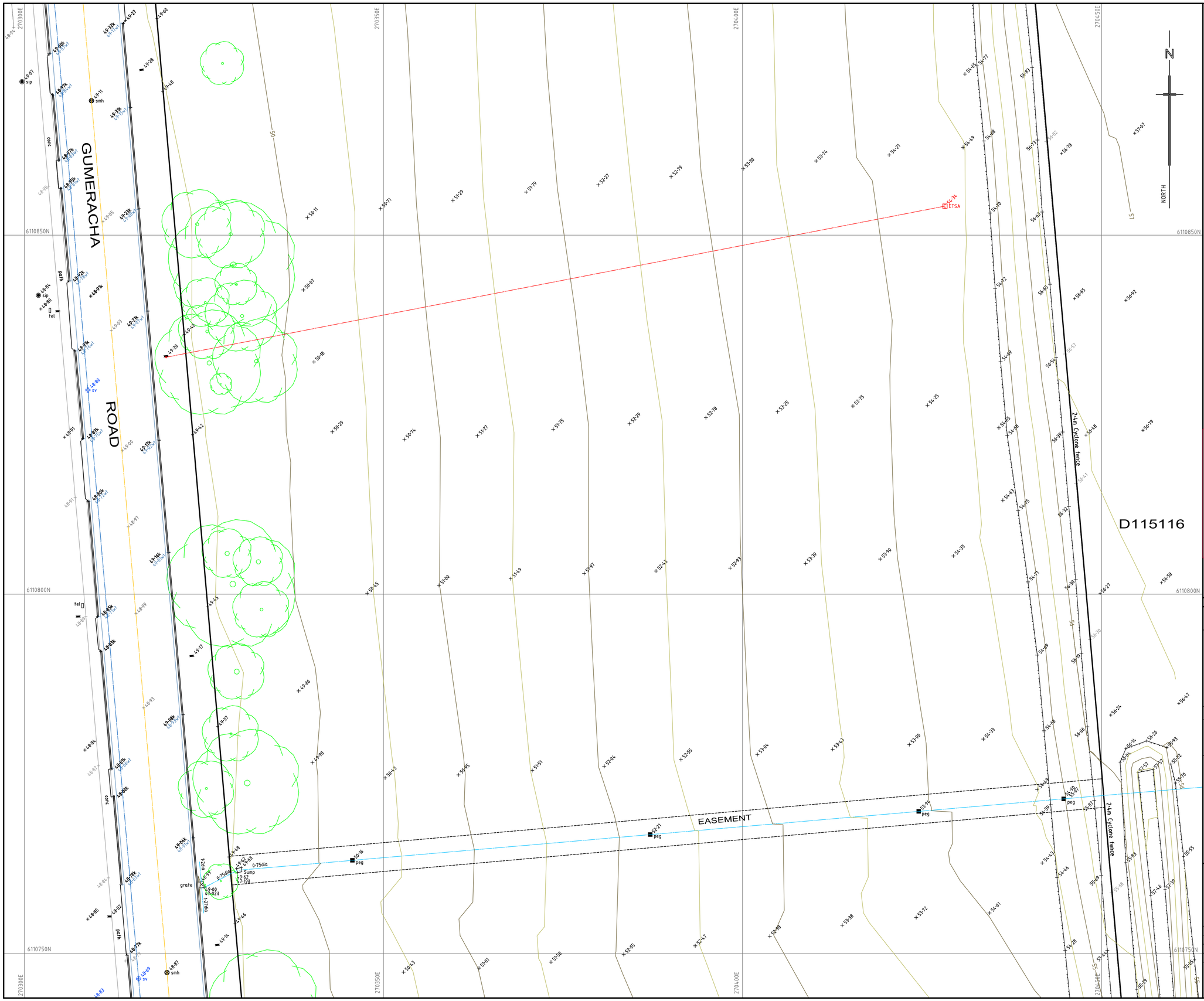

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	Unknown point		Back of kerb
grt	Grated inlet pit		Building
	Domestic outlet		Building GI
iL	Invert		Edging sleeper/log/concrete
dpo	Downpipe - open		Underground ETSA
dpu	Downpipe - underground		Overhead ETSA
sp	Sump		Underground Telstra
sw	Stormwater IP		Overhead Telstra
sw	Stormwater manhole		U/G communication cables
sn	Sign		O/H communication cables
	Bollard		Underground gas
fL	Floor level		Underground sewer pipe
sL	Step level		Above-ground sewer pipe
wl	Watertable level		Underground water pipe
k	Back of kerb		Above-ground water pipe
	Rubbish bin		Unknown trench, service etc
fp	Flagpole		Brick fence
	Column centres		Stone fence
	Stobie pole		Cyclone fence
lp	Light pole		Post & wire fence
ETSA	ETSA pillar		Brush fence
ETSA	ETSA service		Picket fence
	ETSA cable marker		Tubular fence
	ETSA earth		GI fence
tel	Telstra JB		Colorbond fence
tel	Telstra pillar		Log fence
	Telstra cable marker		Guardrail
comm	Communication JB		Giveway line
gm	Gas meter		Continuity
gs	Gas service		Lane line 9x3
	Gas marker		Lane line 6x6
smh	Sewer manhole		Fence post
sip	Sewer IP		Stump
sio	Sewer IO		Tree
	Gully trap		Shrub
	Sewer vent		
	Sewer marker		
sv	Stop valve		
	Fire hydrant		
	Control value		
	Fire hose		
wm	Water meter		
tap	Tap		
	Water marker		

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REV.	DATE	DESCRIPTION	LC (Y/N)	BY

Client
JOHN KEFALIANOS

Project Description
DETAIL SURVEY
CNR. GUMERACHA RD. & BADEN TERRACE
O'SULLIVAN BEACH
ALLOTMENT 20 IN D115116 CT 6197/337
ALLOTMENT 67 IN F152643 CT 6136/727

THIS IS SHEET 3 OF 4 SHEETS

Drawing Scale 1 : 250m — Original Sheet Size A1

0 5 10 15 20 25
Scale — Metres

Notes

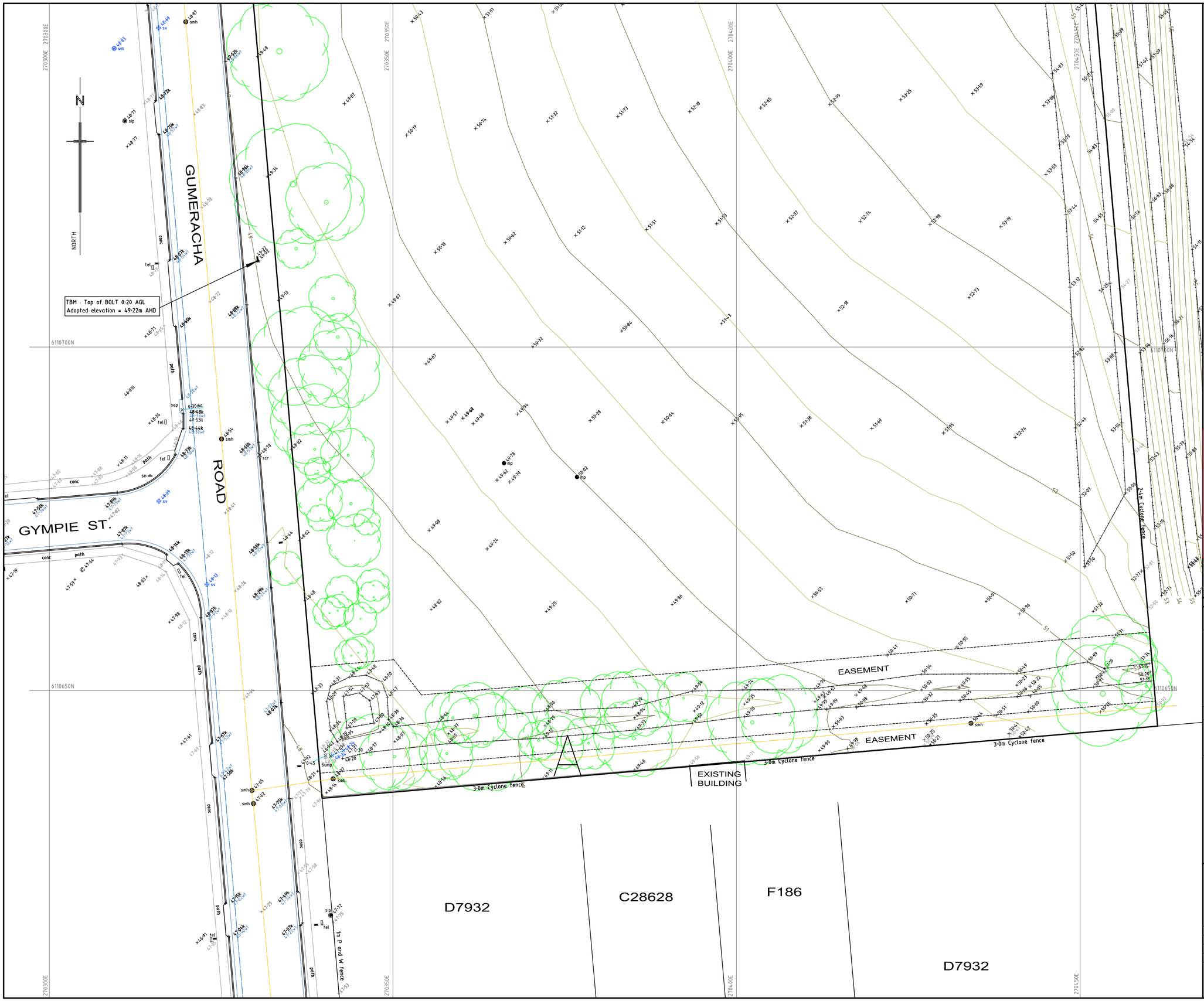
Contour interval = 0.5m

Levels are based on the Australian Height Datum derived from P.S.M. 6527/8599
Adopted elevation = 57.53

STATE SURVEYS
465b South Road
Keswick 5035
South Australia
Phone (08) 8293 2939
Facsimile (08) 8293 2949
Email info@statesurveys.com.au

Coord. Datum:	MGA 2020	Surveyed:	NP,EF&TT 27.08.20
Height Datum:	AHD	Calculated:	NP & EF 31.08.20
CALC File:	20289 DETAIL	Drawn:	AP 2.09.20
DWG File:	20289 DETAIL	Checked:	

Job Number — Revision
20289



LEGEND

PSM	Permanent survey mark		Offset line
TBM	Temporary bench mark		Grid line
peg	Peg		Top of bank
spk	Spike		Bottom of bank
mp	Metal pin		Change of grade
gin	GI nail		Top of levee bank
mn	Masonry nail		Bottom of levee bank
dh	Drill hole		Stormwater pipe
scr	Scribe		Edge of bitumen
txt	Texta		Edge of unmade road/track
pt	Picket		Edge of shoulder
+	Spot height		Watertable
	Unknown point		Back of kerb
grt	Grated inlet pit		Building
	Domestic outlet		Building GI
iL	Invert		Edging sleeper/log/concrete
dpo	Downpipe - open		Underground ETSA
dpu	Downpipe - underground		Overhead ETSA
sp	Sump		Underground Telstra
sw	Stormwater IP		Overhead Telstra
sw	Stormwater manhole		U/G communication cables
sn	Sign		O/H communication cables
	Bollard		Underground gas
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	Gully trap		Shrub
	Sewer vent		
	Sewer marker		
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	Fire hydrant		
	Control value		
	Fire hose		
wm	Water meter		
tap	Tap		
	Water marker		

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REV.	DATE	DESCRIPTION	LC (Y/N)	BY

Client
JOHN KEFALIANOS

Project Description
DETAIL SURVEY
CNR. GUMERACHA RD. & BADEN TERRACE
O'SULLIVAN BEACH
ALLOTMENT 20 IN D115116 CT 6197/337
ALLOTMENT 67 IN F 152643 CT 6136/727

THIS IS SHEET 4 OF 4 SHEETS

Drawing Scale 1 : 250m — Original Sheet Size A1

0 5 10 15 20 25
Scale — Metres

Notes

Contour interval = 0.5m

Levels are based on the Australian Height Datum derived from P.S.M. 6527/8599
Adopted elevation = 57.53m

STATE SURVEYS SURVEYORS
465b South Road
Keswick 5035
South Australia
Phone (08) 8293 2939
Facsimile (08) 8293 2949
Email info@statesurveys.com.au

Coord. Datum:	MGA 2020	Surveyed:	NP,EF&TT 27.08.20
Height Datum:	AHD	Calculated:	NP & EF 31.08.20
CALC File:	20289 DETAIL	Drawn:	AP 2.09.20
DWG File:	20289 DETAIL	Checked:	

Job Number — Revision
20289

9. Appendix B – Concept Plan of the Proposed Development

Lot Type	No's	%
15m + (Courtyard)	27	24
12.5m Premium Villa inc. tilider corners & 13.3 - 15m turnaround lots	34	30
11m (DG Villa)	15	13
10m (Villa)	36	31.5
15 x 15.5m (Cottage)	2	1.5
	114	100

Note
Whilst all care has been taken in the preparation of this plan;
it is important to note that some errors may occur when calculating areas of allotments.
This plan has been generated as an early concept plan to provide urban design insights and outcomes that relate to allotment arrangements and allotment typologies.

For confirmation of allotment areas, dimensions and all other site constraints such as trees, boundaries etc, it is recommended that a surveying consultant be utilised.

e=mc2tudio
evolving place

0 10 30 60
Scale 1:1000 @ A2

North

GUMERACHA ROAD - O'Sullivan Beach
Preliminary Concept Plan
AUGUST 2021

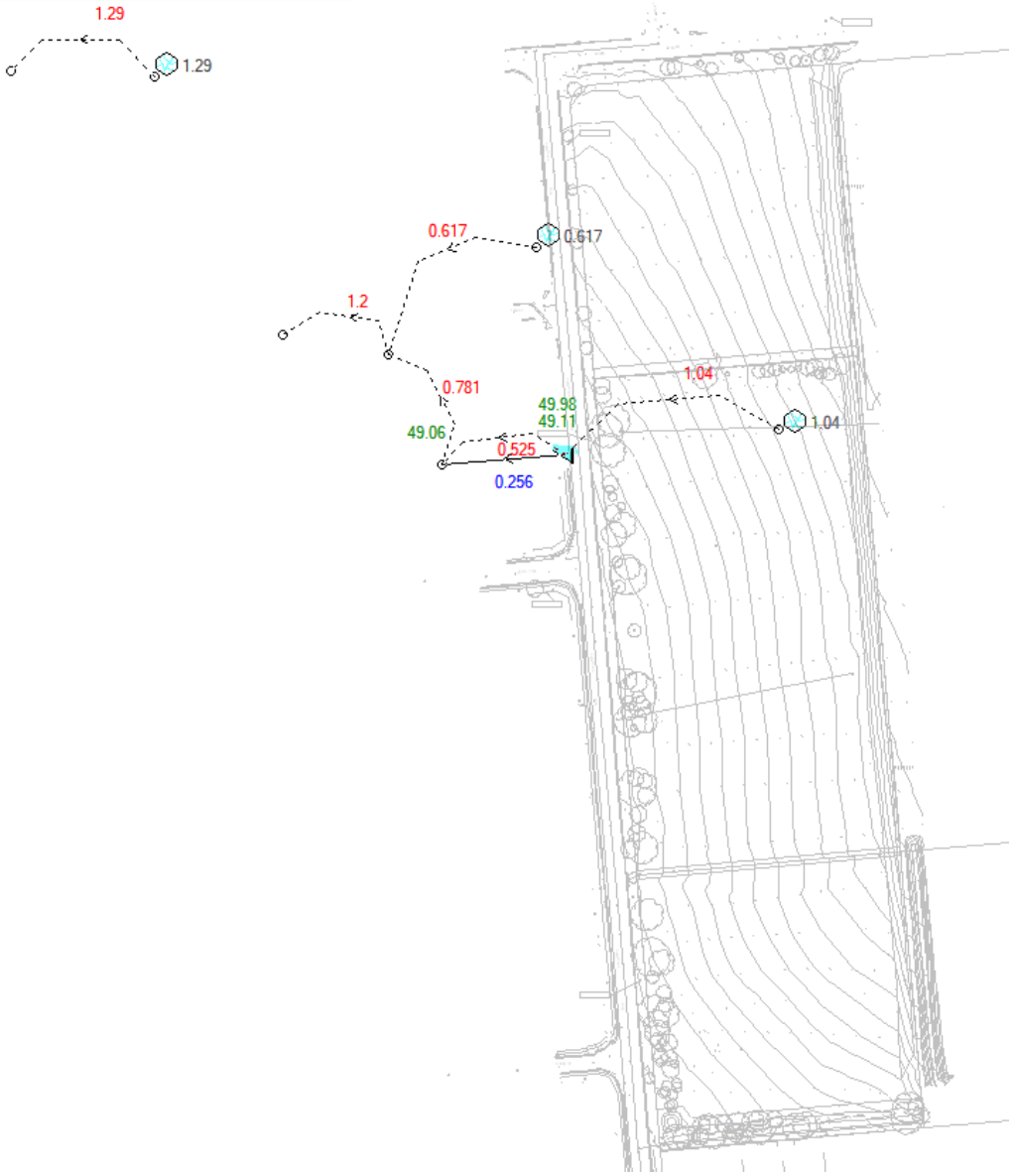
10. Appendix C – Stormwater Calculations

Post-development Catchment Analysis

Refer 'Stormwater Management Plan'

Catchment name	Total area (ha)	Land use type (ha)			Impervious fraction, f			Overall impervious fraction, f
		Residential	Road	Reserve	Residential	Road	Reserve	
Cat_unrestricted	2.2044	1.9761	0.2282	0.0000	0.75	0.90	0.10	76.6%
Cat_restricted	3.7957	2.6949	0.7785	0.3223	0.75	0.90	0.10	72.6%
Total	**6.0000**	**4.6710**	**1.0067**	**0.3223**	**0.85**	**0.9**	**0.1**	**0.8181**

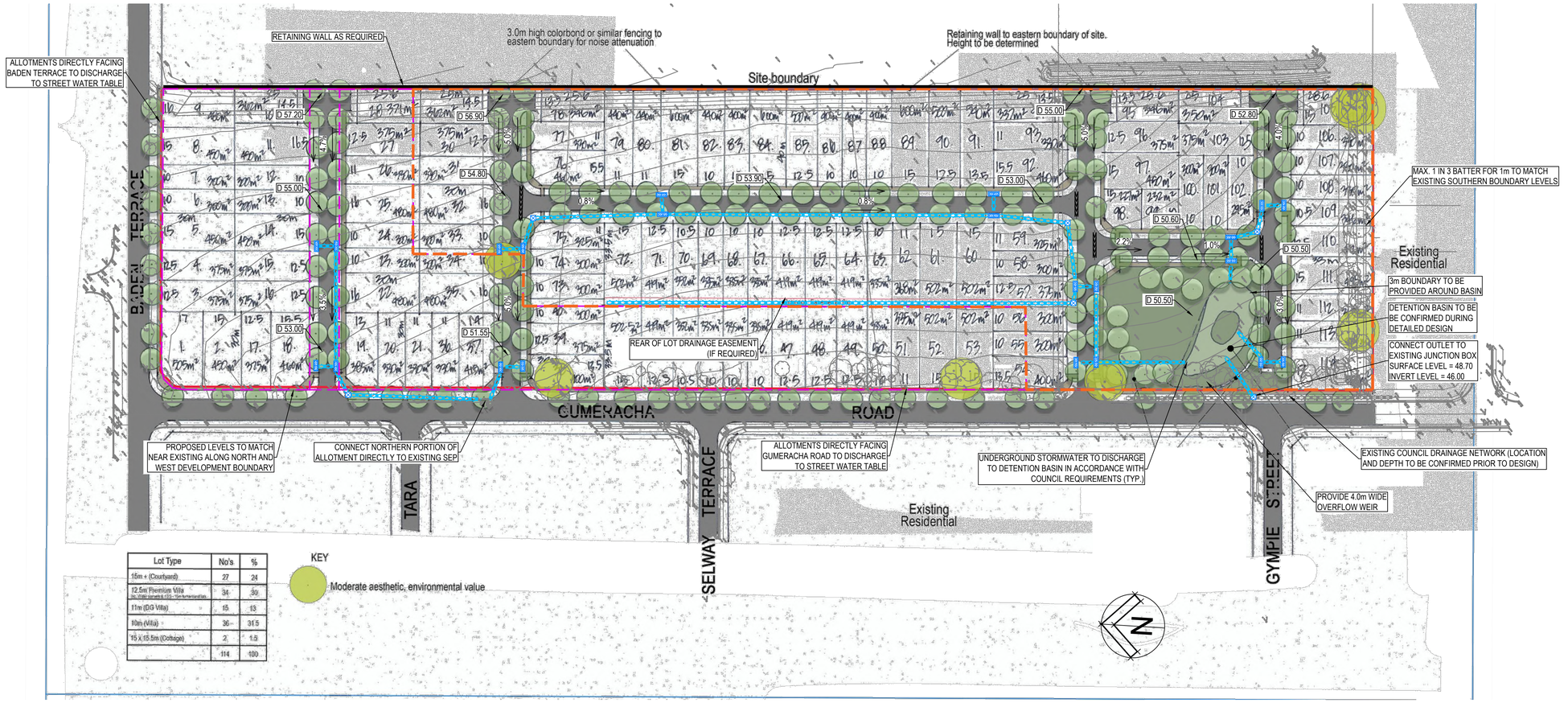
Results for median storm in critical 1% AEP ensembles using Lite hydraulic model.



11. Appendix D – Concept Stormwater Management Plan

LEGEND

- SURFACE DRAINAGE DIRECTION
- SPOON DRAIN
- 600 SQ JUNCTION BOX
- SIDE ENTRY PIT.
- UNDERGROUND DRAINAGE (INDICATIVE)



Lot Type	No's	%
15m + (Courtyard)	27	24
12.5m Premium Villa (inc. 20m corners & 12.5 - 15m fronted lots)	34	30
11m (DG Villa)	15	13
10m (Villa)	36	31.5
15 x 15.5m (Cottage)	2	1.5
	114	100

CATCHMENT CONTRIBUTING TO BASIN
TOTAL AREA = 3.7957ha
RESIDENTIAL = 2.6949ha
ROAD = 0.7785ha
RESERVE = 0.3223ha

CATCHMENT TO DISCHARGE FREELY
TOTAL AREA = 2.2044ha
RESIDENTIAL = 1.9761ha
ROAD = 0.2282ha

ISSUE	DATE	DESCRIPTION	DRAWN	DESIGNED	APPROVED
B	16/08/21	ISSUED FOR PRELIMINARY	MR	MR	CRG
A	09/12/20	ISSUED FOR PRELIMINARY	MR	MR	CG

10 0 10 20 30 40 50
SCALE 1:1000 @ A1 mm

ISSUED AS PRELIMINARY
NOT FOR CONSTRUCTION

CLIENT FINANCE LAB

mlei CONSULTING ENGINEERS
452 Pulteney Street, Adelaide SA 5000 Ph (08) 8231 2652 www.mlei.com.au

GUMERACHA ROAD LAND DIVISION
GUMERACHA ROAD, O'SULLIVAN BEACH
STORMWATER MANAGEMENT PLAN

DRAWN MR DESIGNER MR APPROVED CG DWG No. A2020-10390-0 SHEET SK01 REV B

8. Appendix C – Council stormwater management guide and references

Matthew Reade

From: Craig Jones <Craig.Jones@onkaparinga.sa.gov.au>
Sent: Thursday, July 1, 2021 2:51 PM
To: Matthew Reade
Cc: Richard Dekker; Jonathan Luke; John Mason; Michael Osborn
Subject: RE: A2020-10390 Gumeracha Road, O'Sullivan Beach

Hi Matthew

Further to your email, comments have now been provided from council's Asset and Technical Services team together with further comment from our Planning team.

In reviewing the proposal, there are some fundamental problems with the preliminary layout provided which should be addressed even at this early stage:

1. We will require suitable turning facilities on the cul-de-sacs shown.

   Whilst not necessary an engineering matter, the issue of interface with the adjoining industry type land uses will also need consideration. There may be opportunities through the internal road layout that assist in addressing this.

2. Location of new intersection to Gumeracha Road adjacent Gympie Street – a greater separation distance for an off-set T arrangement maybe required.

3. Vegetation - although the vegetation along Gumeracha Road and the southern boundary (and some internal locations) does not appear to be regulated or significant, we would strongly encourage their retention and for the layout to be design around them. We would suggest a tree assessment report be undertaken to confirm the trees status.

4. Topography – we note there is a level difference along the southern boundary to existing residential properties which needs to be taken into consideration to minimise impacts and ideally avoid the need for retaining walls to this boundary. Our preference would also be to retain the trees where possible.

5. Provision of open space - need to take into consideration the requirement for providing 12.5 percent of the total site as open space and further noting only 20 percent of that can be allocated to the management of stormwater – all other areas for stormwater management will need to be outside the areas of open space.

6. Drainage from more than half the site bypasses the proposed detention basin. This is not acceptable and can be rectified by routing the northern portion into the internal pipe system and relocating the detention basin further south to intercept more of the southern portion.

7. Calculations will be required at a later stage that demonstrate that the total flow from the site after development does not exceed the total flow pre-development for minor (20% AEP) and major (1%AEP) storms. Discharging to the existing underground drainage system should not exceed 20% AEP predevelopment flow.

   Any future proposal would need to provide detailed DRAINS Models and MUSIC Models to illustrate stormwater management, detention and quality and how the onsite system will connect into our existing infrastructure.

   In terms of a future planning and engineering assessment, we would consider this a 'large scale' development, as per the attached Stormwater Design Guidelines (Dated Nov 2019).

8. Inter-allotment drains will be required at several locations

9. The overland flow easement shown from the outfall from 51 Morrow Road is acceptable. This flow does not require detention.

As previous advised, if you have any specific engineering questions Richard Dekker can be contacted on 8384 0576 or richard.dekker@onkaparinga.sa.gov.au.

Should you have any other questions, please don't hesitate to contact me.

Regards

Craig Jones
Development Policy Planner
Planning and Regulatory Services
Ph (08) 8384 0617
www.onkaparingacity.com

From: Matthew Reade <mreade@mlei.com.au>
Sent: Thursday, 17 June 2021 3:50 PM
To: Craig Jones <Craig.Jones@onkaparinga.sa.gov.au>
Cc: Craig Glynn <cglynn@mlei.com.au>; Jonathan Luke <Jonathan.Luke@onkaparinga.sa.gov.au>
Subject: RE: A2020-10390 Gumeracha Road, O'Sullivan Beach

Hi Craig,

Just following up to see if anyone has been able to view this or a contact I could speak to?

Kind regards
Matthew Reade
B.E. (Civil & Structural)
Civil Engineer

MLEI Consulting Engineers
452 Pulteney Street
Adelaide SA 5000
P 08 8231 2832
mreade@mlei.com.au
mlei.com.au

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From: Craig Jones [mailto:Craig.Jones@onkaparinga.sa.gov.au]
Sent: Thursday, June 10, 2021 10:13 AM

To: Matthew Reade <mreade@mlei.com.au>
Cc: Craig Glynn <cglynn@mlei.com.au>; Jonathan Luke <Jonathan.Luke@onkaparinga.sa.gov.au>
Subject: RE: A2020-10390 Gumeracha Road, O'Sullivan Beach

Hi Matthew

Thanks for your email.

We'll pass it on to our Asset and Technical Service team for their attention and comment. We'll also see if they are okay with providing a direct contact person and let you know.

Regards

Craig Jones
Development Policy Planner
Planning and Regulatory Services
Ph (08) 8384 0617
www.onkaparingacity.com

From: Matthew Reade <mreade@mlei.com.au>
Sent: Wednesday, 9 June 2021 3:55 PM
To: Craig Jones <Craig.Jones@onkaparinga.sa.gov.au>
Cc: Craig Glynn <cglynn@mlei.com.au>; Jonathan Luke <Jonathan.Luke@onkaparinga.sa.gov.au>
Subject: A2020-10390 Gumeracha Road, O'Sullivan Beach

Hi Craig,

I've been passed your information to go through you as the Development Policy Team under the code amendment for Gumeracha Road, O'Sullivan Beach.

I'm looking to get some feedback from Council's perspective on proposed stormwater methodology. Overall the intent is to capture a portion of the site in a detention basin and allow the rest of the site to flow un-restricted to Council's infrastructure.

Jude has already given comments on allowable flows and the design will follow Council requirements. We are just looking from a high level that something similar to the attached is reasonable to progress with.

Feel free to contact me if you'd like to discuss.

Kind regards
Matthew Reade
B.E. (Civil & Structural)
Civil Engineer

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Stormwater Management Design Guide

February 2019

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1.0 Introduction

This guideline is intended to assist with the implementation of the Planning Scheme by providing guidance for the management of stormwater runoff as a resource.

This guideline compliments other information available that support integrated water management planning through the provision of specific guidance for flood and disaster management, waterway health objectives and acceptable outcomes for development.

The City of Onkaparinga (Council) Stormwater Management Design Guideline is intended to apply a standard approach to the interpretation and implementation of the relevant aspects of the Planning Scheme. They offer a degree of certainty to applicants, Council and the community. Where an applicant is proposing a solution that is different from the guidelines the onus is on the applicant to demonstrate the facts and circumstances to support the solution.

Council is committed to the successful implementation of integrated water management within the local government area. Fundamental to such a strategy is achieving satisfactory management of stormwater runoff from both a quality and quantity perspective. The main principles of stormwater management are as follows:

- To provide for the safety and welfare of the general and affected community, including protection from flooding, and the safe enjoyment of open space and other land adjacent to stormwater drainage infrastructure.
- To provide for free and unrestricted access and safety of staff and contractors required to construct and maintain all components of the network.
- To achieve stormwater quality improvement targets as set by State and Council policy.
- To contribute wherever possible to the enjoyment of open space.
- To integrate stormwater drainage quantity and quality management as part of a total streetscape/open space approach to maximise opportunities for multiple objectives (including safety, amenity, passive and/or active recreation, biodiversity, water quality and flood protection) to be achieved.
- To implement Water Sensitive Urban Design as a tool to manage flood protection, water quality and stormwater harvesting and reuse schemes.

1.1 Design Guide Scope

This guide provides detailed guidance on the design requirements, form and level of documentation required to facilitate approval for stormwater drainage for development within the City of Onkaparinga. It should be read in conjunction with Council's Development Plan and Conditions issued by Council in relation to the development application. The Development Plan includes area wide objectives regarding the management and protection of the environment, including specific objectives regarding water quality.

To satisfy Council's policy and the objectives of the development plan, Council has adopted stormwater management service standards which encompass flood protection objectives and water quality/environment protection objectives. Accordingly, Council's stormwater management design guidelines for development reflect requirements to achieve both flood protection and water quality protection/improvement.

Separate design guidelines have been prepared for different scales of development, as follows:

- Small scale – Single residential dwellings and infill residential land divisions, to a maximum of 4 dwellings, a maximum of 1500m^2 total site area and where no new public roads are to be created (refer Section 2).

- Large scale - All other residential, industrial and commercial developments (refer Section 3).

1.2 Objectives

Stormwater systems shall be designed to achieve the following:

- Prevent inundation of development and to ensure that surface flow paths convey floodwaters within suitable velocity/depth limits.
- Inconvenience to traffic and pedestrians as a result of storm events is minimised by controlled flow where possible.
- Consider all ultimate upstream and downstream catchment characteristics to achieve a total system which does not adversely affect existing stormwater systems or properties within the catchment.
- Stormwater quality targets are achieved by a combination of integrated stormwater treatment and filtration principles.
- The impacts of erosion and sediment on the environment are minimised.
- Minimise maintenance requirements.
- Enhance the urban landscape and biodiversity of the area.
- Demonstrate the adoption and integration of principles of Water Sensitive Urban Design including wherever possible, water conservation and passive or active re-use.
- Preserve natural drainage systems, including the associated environmental flows.

Access and ownership:

Components of the stormwater network that provide for network wide benefits for stormwater management shall be vested with the City of Onkaparinga.

Therefore:

- The drainage network is to be designed with the intention that wherever possible, all network drainage infrastructure (other than inter of allotment drainage) is to be located in public road, or within open space reserves where applicable and multiple objectives as per Section 1.2 are able to be met.
- Drainage components that only service two or less Torrens title allotments or any strata or community plan developments are to remain as private infrastructure in appropriately established private easements.
- Allotment drainage systems servicing more than Two Torrens title allotments are to be located in easements complying with Section 3.8.
- All access points into underground network drains (junction boxes) are to be located within the public road boundary or in open space.

1.3 Design Standards

The stormwater drainage system must be designed in accordance with:

- Council's Stormwater Management Design Guide.
- AS/NZS 3500.3:2003-Plumbing and Drainage- Part3: Stormwater Drainage.
- Building Code of Australia.

Other relevant design guides which may provide further supporting design guidance, that are recognized by Council include:

- Australian Rainfall and Runoff (ARR 2016) (www.arr.ga.gov.au).
- Australian Runoff Quality (ARQ).
- Water Sensitive Urban Design – Greater Adelaide Region Technical Manual – (DPLG, 2010).
- Queensland Urban Drainage Manual (2013).
- Department of Planning, Transport and Infrastructure (DPTI) Stormwater Design DD 300.
- Framework for the Integration of Flood and Stormwater Management into Open Space Version 1.1, August 2011, published by Healthy Waterways Limited.

1.4 Design Rainfall

Design Intensity-Frequency-Duration (IFD) Rainfall depths and temporal patterns shall be derived in accordance with Bureau of Metrology (BOM) and Australian Rainfall & Runoff (ARR 2016) for the Onkaparinga Council area. Reference is made to the Australian Rainfall and Runoff Data Hub (http://data.arr-software.org/) to obtain hydrological modelling data including IFD depths and temporal patterns. A PDF copy of the ARR Data hub input data and results shall be provided with the calculations.

ARR 2016 breaks much new ground, containing new theory and new terminology such as 'quantiles', 'ensembles' and Monte Carlo Analysis. Many parts require theoretical knowledge to fully understand, and are directed to experienced engineers.

ARR 2016 is supplemented by many other manuals, such as the Queensland Urban Drainage Manual (1992, 2007-08, 2013), Austroads Road Design Guides (2013), state highway authority department manuals, and development control manuals from municipal councils. In matters relating to water quality and conservation, ARR 2016 is complemented by Australian Runoff Quality, released by Engineers Australia in 2005.

The major system shall provide safe overland flow conveyance, whilst the minor system shall be designed to minimize the impact of nuisance inundation and unsafe flow depths and velocities during frequent events. The service standard for the network varies according to the level and type of development, as follows:

- Where the minor system is being relied upon to cater for major storm events (in addition to minor flows) – 1% Annual Exceedance Probability (AEP).
- As defined in Table 1 (Section 3.1).

Note that this document refer to AEP, which is defined as the probability that a given rainfall total accumulated over a given duration will be exceeded in any one year, which is in line with current industry practice. The conversion from Average Recurrence Interval (ARI) to AEP to the number of Exceedances per Year (EY) is shown below.

Australian Rainfall and Runoff terminology

Frequency Descriptor	EY	AEP (%)	AEP (1 in x)	ARI	Uses in Engineering Design
Very frequent	12				Water sensitive urban design
	6	99.75	1.002	0.17	
	4	98.17	1.02	0.25	
	3	95.02	1.05	0.33	
	2	86.47	1.16	0.50	
	1	63.2	1.58	1.00	
Frequent	0.69	50.00	2	1.44	Stormwater/pit and pipe design
	0.5	39.35	2.54	2.00	
	0.22	20.00	5	4.48	
	0.2	18.13	5.52	5.00	
	0.11	10.00	10.00	9.49	
Infrequent	0.05	5.00	20	20.0	Floodplain management and waterway design
	0.02	2.00	50	50.0	
	0.01	1.00	100	100	
Rare	0.005	0.50	200	200	
	0.002	0.20	500	500	
	0.001	0.10	1000	1000	
	0.0005	0.05	2000	2000	
Extremely Rare	0.0002	0.02	5000	5000	Design of high-consequence infrastructure (eg major dams)
			↓		
Extreme			PMP		

ARI – Average Recurrence Interval

AEP – Annual Exceedance Probability

EY – Number of Exceedance per Year

2.0 Small Scale Developments (single dwellings, minor infill land divisions)

Small scale developments are defined as single dwellings and infill land divisions, to a maximum of 4 dwellings, a maximum of 1500m^2 total site area and where no new public roads are to be created.

2.1 Engineering Survey Site Plan

An engineering survey site plan is required for all small scale developments. The engineering survey site plan should provide the basis for development of the stormwater management site plan and consist of the following details:

- Contours and spot levels on the existing land. The contour interval shall not be greater than 0.2m.
- All above and/or below ground existing features on the site, including fencing and type and trees with an estimate of the canopy spread.
- Existing easement(s), if any.
- Existing and proposed allotment boundaries.
- Existing infrastructure and impervious area such as buildings (including floor level), sheds, carports and paved/hardstand areas on the land.

- Adjacent road, footpath, stormwater pits and connecting pipes, downpipe connections, trees, verge and associated services.

2.2 Stormwater Management Site Plan

The stormwater management site plan (drawing) shall be based on the engineering survey site plan as defined in Section 2.1 and shall include sufficient detail to assess the suitability/capability of the proposed stormwater management arrangements for compliance with Council's service standards.

The stormwater management site plan (drawing) shall primarily show the proposed method of managing stormwater. The drawing, is to include:

- All above and/or below ground proposed features on the site including any existing or proposed easements and drainage reserves.
- Grading(contours) or spot levels for proposed finished surface levels, and expected drainage patterns (direction of flow). The contour interval shall not be greater than 0.2m.
- All pervious and impervious areas (buildings and covered/paved areas, paths and driveways with materials used, and any landscaping including plants, and mulched areas shown schematically).
- Proposed building finished floor level(s).
- Proposed earthworks (cut/fill line) and retaining walls on the site in association with the development. The top and bottom levels of the retaining wall are to be shown on the plan.
- The proposed depth of any fill or cut over stormwater drainage easements. (Note Council will not permit cut in excess of 200mm, or fill in excess of 500mm over any existing drainage easement).
- All existing Council owned and other public service infrastructure (trees, footpaths, stobie/light poles, stormwater side entry pits).
- All proposed stormwater management devices (downpipes, sumps, underground pipes, spoon drains, grated trench drains, culverts, detention, retention and/or other devices) including:
    - Location and size of proposed above ground retention tanks and stormwater detention tanks.
    - Inlet and outlet pipe sizes and orifice arrangement (if required), including level and size for all detention and stormwater drainage works.
    - Above and/or below ground stormwater discharge points into Council's existing drainage infrastructure.
    - Any easements required (whether for Council or private).
    - Sufficient levels to demonstrate that the proposed system will drain to the designated point of discharge.
    - Pump specification with flow rate if any sump & pump is used to manage surface runoff.

Note:

No private drainage (or other) infrastructure is to be installed or constructed in or over a Council easement, except where it provides a direct connection to Council's stormwater infrastructure.

2.3 General Design Requirements

General design requirements for all small scale developments include:

- Stormwater detention systems and/or Water Sensitive Urban Design (WSUD) techniques shall be integrated within the development for flood control as per the objectives in Section 1.2.
- Refer to Section 2.4 for on-site detention requirements.
- Roof and surface stormwater runoff from the site must be managed within the site, without increasing flood risk to buildings on the site and adjoining properties.
- Overland flow paths are to be provided within the site or sufficient pit and pipe capacity is provided to safely convey stormwater runoff from a 1% AEP storm event, to the agreed point of discharge.
- No overflow onto adjoining properties will be permitted, up to a 1% AEP storm event, unless there is a designated point of discharge to an existing easement, or drainage reserve or public road with attributes suitable to accept the flow.
- Any stormwater runoff discharging to an existing easement must not exceed the flow capacity of stormwater infrastructure within the easement (underground pipe or culvert plus any swale within the easement).
- Flows at discharge points shall be managed to ensure protection from scouring of natural/earth channels.
- All individual property stormwater drainage systems should be discharged direct to the Street front or inter allotment drainage system where available.
- Where the subject land is within 50m of the centerline of a watercourse, or as specifically requested by Council, in the absence of any available information from Council, floodplain mapping of nearby watercourses is to be undertaken to establish 1% AEP flood levels at the development site, to demonstrate that the development complies with Council's requirements for the development to be flood free and safe.
- Where overland flow is required to be conveyed by a swale, within an easement, a Land Management Agreement (LMA) is to be placed on all properties limiting the use of the affected land and requiring unobstructed openings of sufficient capacity in all fences across the easement/swale.

The following methods can be adopted for stormwater flow calculations:

- Rational Method (Methodology to be as outlined in Australian Rainfall and Runoff 2016).
- DRAINS model software.

The following methodologies may be used for flood modeling:

- HEC RAS – centerline and cross sections along watercourse – 2D model.
- 2D industry standard flood models e.g. TUFLOW, Mike and digital terrain model of resolution /accuracy to ±100mm.

A surface level profile, flood extent plot and flood modeling data files are to be provided with the submission.

2.4 On Site Detention (OSD) Requirements

Discharge of stormwater from the site, to Council's drainage system, must be effectively located and managed to minimise the risk of frequent excessive flow width and velocity in roadways, erosion of watercourses and flooding of properties.

On-site detention systems provide temporary storage of stormwater runoff from developments and restrict discharge from the site to a rate which Council's existing drainage system is more capable of accommodating.

Unless integrated into the overall design calculations for managing discharge off site, as part of a stormwater management plan for a land division, or otherwise prescribed in a development approval and included in a Land Management Agreement (LMA), on-site detention is not required for individual single dwellings in an approved greenfield land division.

If above ground tanks are used for detaining stormwater runoff from roofed areas then the on-site detention volume shall be calculated from Figure 1, based on the increase in impervious roof area. This method is only applicable for "Small Scale" developments as defined for the purposes of this Guide.

Where such development will result in a greater increase in the proposed roof area greater than 500m^2, to that shown in Figure 1, the detention system must be designed by a suitably qualified professional engineer. In this case pre and post development calculations are to be provided to demonstrate that the post-development flow rate does not exceed the equivalent pre-development flow rate, for the minor system design event, as defined in Table 1. In addition, 1% AEP storm flow path is required to be demonstrated.

Where the development is comprised of multiple allotments, the required detention volume for each lot is to be calculated based on the proposed roof area on each lot.

Detention storage shall be retrofitted to an existing dwelling, where such a dwelling is proposed to be retained as part of division of the property. Refer to Figure 2 for a split block example.

A minimum roof area of 90% must be connected to the on-site detention tank.

Outflows from detention tank systems are generally to be by gravity with 'free outlet' control. However, 'drowned outlets' may be permitted if supporting calculations can be provided showing that sufficient pressure head can be generated to direct 1% AEP flows to the street via a sealed system.

The design of the tank is to conform to one of the general arrangements shown in Figures 3 and 4. Orifice systems for on-site detention (OSD) tanks shall be located in a readily accessible area to facilitate regular inspection and maintenance, and the orifice plate should be clearly and permanently marked on the outside with "Do not remove except for maintenance" and "Re-install immediately after cleaning/maintenance".

Figure 1 - Minimum above ground detention capacity and required orifice diameter for a range of proposed roof areas

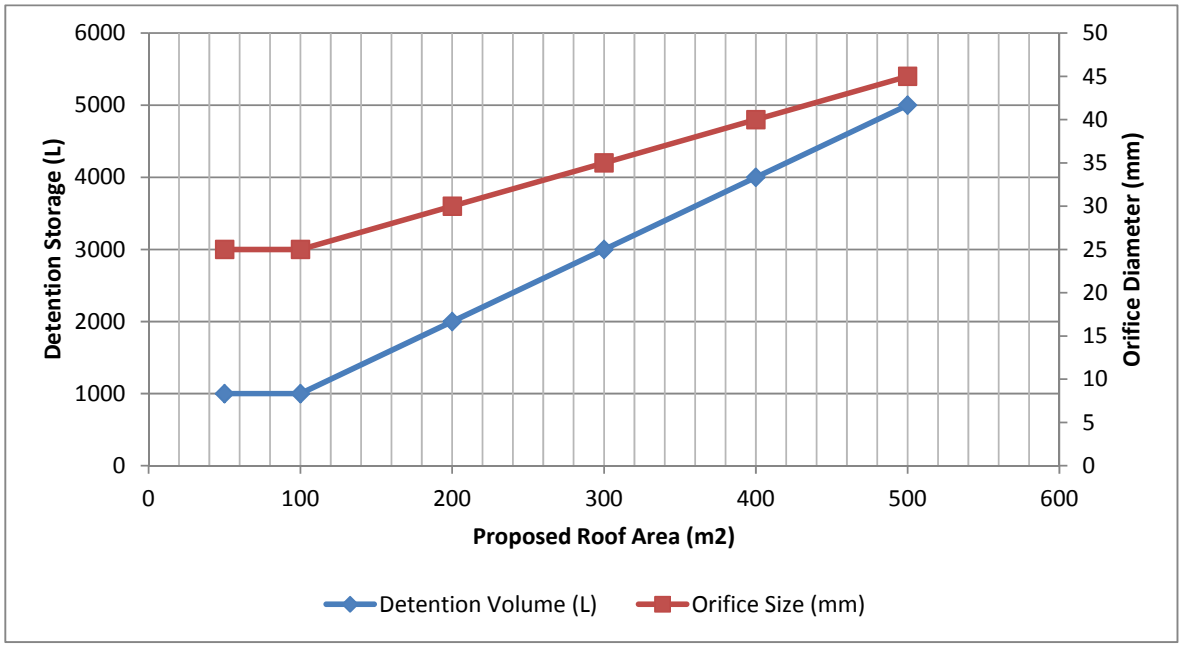
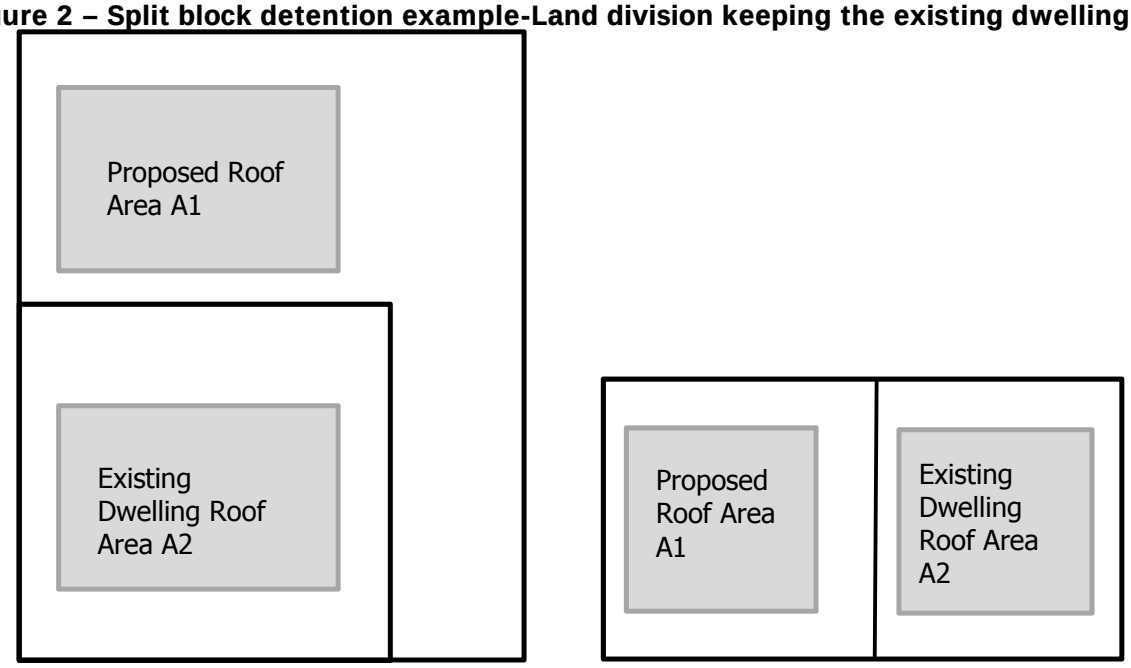


Figure 2 – Split block detention example-Land division keeping the existing dwelling



Scenario 1 Scenario 2

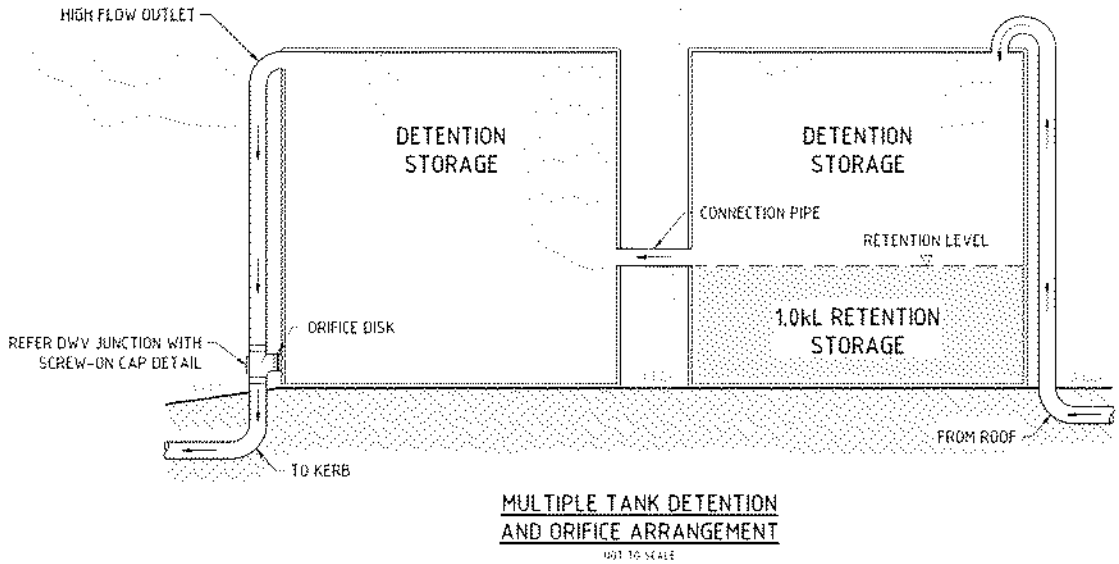
Note:

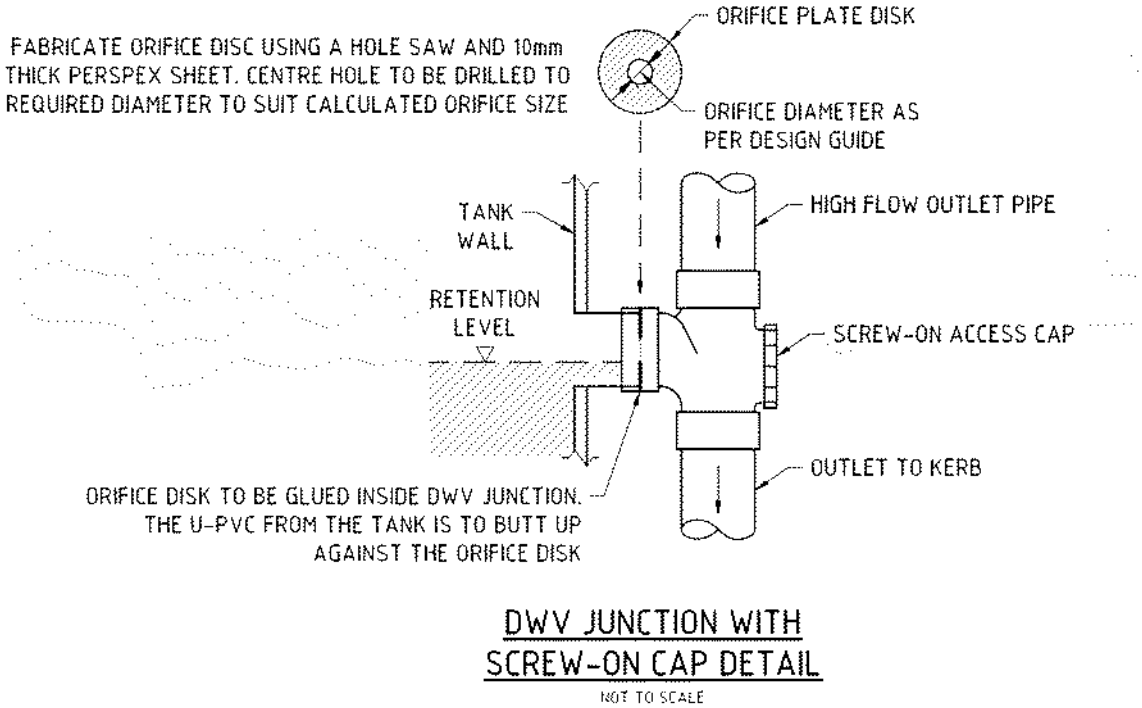
Determine detention storage and orifice diameter for roof area A1 using Figure 1.

Determine detention storage and orifice diameter for roof area A2 using Figure 1

A1(assumed roof area) – 70% of the site area

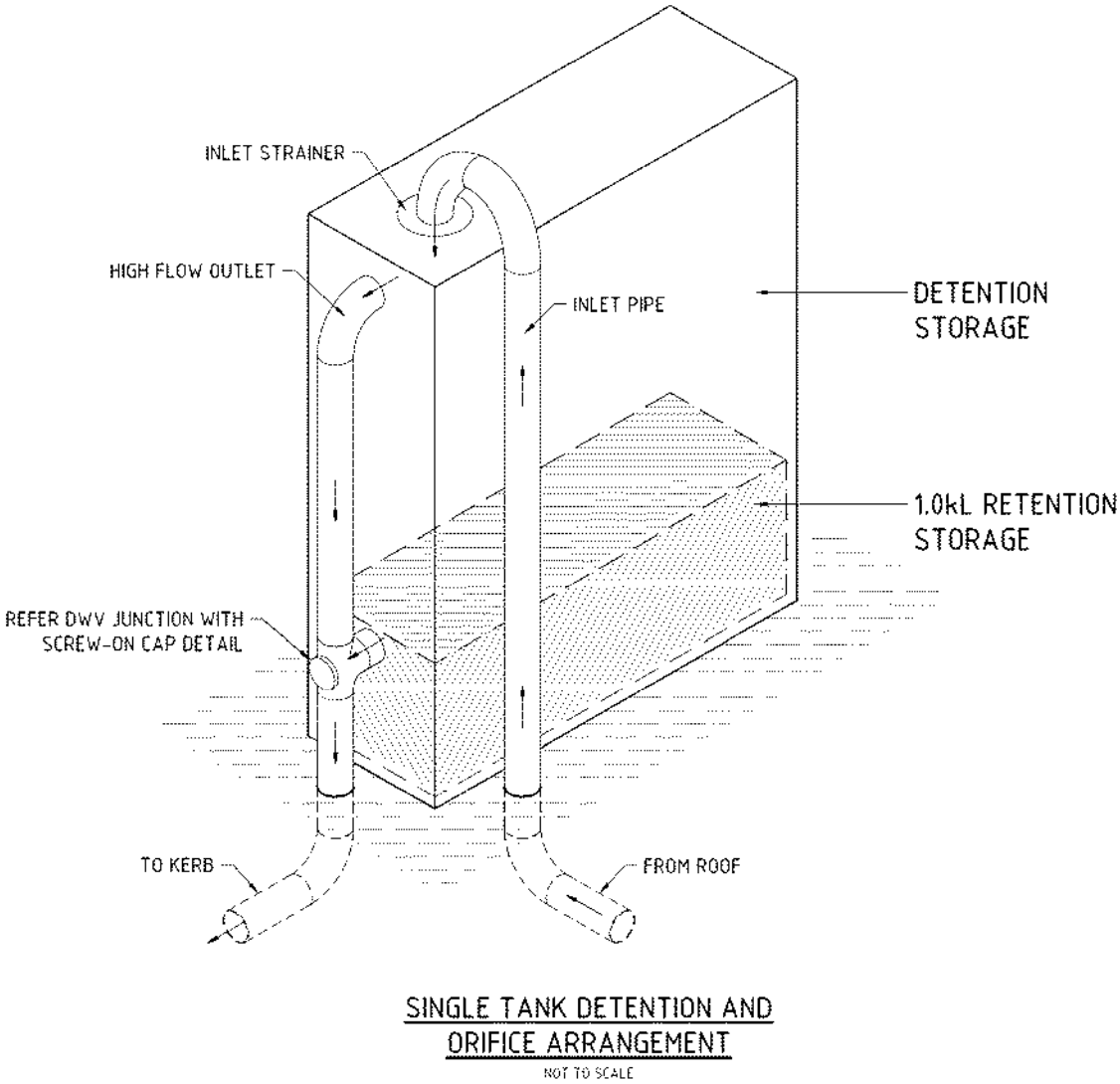
Figure 3 - Multiple detention tank arrangement





DWV – Drain Waste and Vent

Figure 4 - Single detention tank arrangement



Minimum 1kL retention tank is to be provided and plumbed to the house as per the State Government requirement given in www.sa.gov.au/planning/rescode website.

2.5 Minor Additions to Residential Dwellings or Industrial Buildings (increase to impervious area of less than 50m^2)

Additions to existing single dwelling houses of less than 50 m^2, are permitted to be connected to an existing stormwater drainage system without any OSD provided that the existing stormwater drainage system includes a roof drainage system and surface drainage system that are functional.

2.6 Options for properties that do not fall to the street

The following options are to be considered to manage stormwater runoff from a site that does not naturally fall to the street.

1. Connect to an inter allotment drain, should one be available.
2. Establish a private drainage easement through adjoining properties (subject to adjoining property owner approval and Council approval).
3. Roof water discharge to the street by a 'sealed system' and surface run-off to be collected and managed (for all events up to and including the 1% AEP event) via either:
    a. Pumping from a collection pit (maximum discharge to the street should not exceed pre development flow rate for the total site with battery operated warning alarm system). The pump specification and flow rate are to be submitted to Council. Minimum storage of 2,000 Liters (L) is required for pumping chamber, in addition to detention volume storage.

or

    b. One or more soakage pits with overflow pipe, should geotechnical testing of site soils support this practice (and not impact adversely on adjacent properties or proposed development of the site).
    The design should comply with On-site Retention of Stormwater-Minister's Specification SA 78AA.
    The overflow pipe must discharge into a sump and pump or spreader without inundating surrounding properties.
4. If options 3-a and 3-b are not possible and there is no safe overland flow path acceptable to Council for events up to and including the 1% AEP storm event, roof water and surface runoff should be collected in an adequate storage tank to cater for the 1% AEP critical storm duration event such that site runoff can be managed without flooding of buildings, undercrofts or adjoining properties. A pump with battery operated warning alarm system is to be provided and maximum discharge flow rate to the street should not exceed the predevelopment flow for the total site. The pump system shall be in accordance with Australian Standard AS/NZS3500.3. Note that the combined effective storage must equal at least the volume of run off expected from a storm of 10% AEP, lasting for 120 min.

Note: For all of the above options, calculations must be provided to demonstrate compliance with pre and post development discharge control scenarios for the 1% AEP critical storm duration, and system capacity is sufficient to prevent downstream discharge into private property in all events up to the 1% AEP. During demolition and earthworks stormwater is to be managed to prevent flooding adjacent properties. A Soil Erosion Drainage Management Plan (SEDMP) is required prior to undertaking any earthworks on site.

2.7 Alternate Detention Storage Options

If above ground rainwater detention tanks are not used for detaining stormwater runoff from roofed areas and alternative detention measures such as a vegetated basin or swale with an outlet to Council's stormwater system (including discharge to the kerb) are to be utilised, then the detention requirements are:

- A minimum roofed area of 90% must be connected to the detention system.
- The 5% AEP peak flow from the detention system is not to exceed 0.01 L/s/m^2 of roofed area. Provisions must be made for flows from a 1% AEP storm event to spill over the property boundary to the receiving roadway or easement/drainage reserve.

- A pit or headwall with an orifice plate will be required to control the discharge of stormwater from the detention system to the kerb. The orifice is to be readily accessible to facilitate unblocking if required.

2.8 Stormwater Design Report

A brief report will be required to accompany the calculations for any detention system to justify the detention volume. Additional information including any further plans and detailed drawings, in addition to the information stated in Section 2.2, is required in the accompanying brief report containing all the information supporting the proposed stormwater design. Such information would include all relevant calculations supporting all aspects of the stormwater design and specific details for construction where they differ from the standard detention tank requirements.

2.9 Minimum Finished Floor levels

Mainstream flooding is defined as water that flows over the banks of creeks and rivers. Properties affected by mainstream flooding for the 1% AEP flood event require minimum floor height. Freeboard describes a factor of safety expressed in millimeters above a flood level for flood protective or control works. Adding a freeboard to a flood level can greatly reduce the risk of a structure flooding.

In mainstream flooding, the minimum floor level is calculated by adding a 300 mm freeboard to the highest 1% AEP mainstream flood level for a particular property.

Where properties are adjacent to major trunk drainage channels and overland flow paths, the finished floor levels of new building developments should be a minimum of 300mm above the 1% AEP flood level adjacent to the development.

In the absence of any local flood level information all new building developments finished floor levels should be a minimum of 300mm above the top of kerb of the street fronting the development. In general, paved areas and driveways should grade away from the buildings and out to the street to provide an overland flow path for the major system (1% AEP). Where this cannot be achieved because the allotment grades to the rear, the floor levels should be set a minimum 150mm above the natural ground level at the face of the building at the highest point on the allotment.

2.9.1 Driveways, Paving and Path Drainage

Paved areas, driveways, etc. should be graded to direct stormwater runoff for the major storm flows away from the buildings and to provide an overland stormwater flow path towards the roadway, or drainage easement, or where this is not available, to a single collection point. Details of the collection system, including temporary storage, pump systems, soakage systems or other are to be shown on the stormwater management plan.

2.10 Stormwater Outlets and Scour Protection

Pipe drainage outfalls to new open channels and natural creeks must be designed to control the discharge velocity and spread the concentrated discharge to avoid erosion to the bed and banks. Wherever practical, vegetated swales or drainage channels must be provided downstream from the pipe outlet.

Provide scour protection to the main creek/waterway or flow path if the pipe or box culvert flow velocity is greater than 0.5 m/s.

All outlets are to be set back a distance of more than three times the bank height measured from the toe of a watercourse bank and angled into the direction of main channel flow. All stormwater outlets are to be located above the invert level of any adjacent waterway. The proposed location and the invert level should be determined by the developer/engineer, and justification provided to Council for approval.

Private drainage infrastructure is NOT to be installed on Council land, without prior Council approval. Any requirements for scour control should be managed within the private property boundary so that flows exiting the property comply with Council requirements for scour control. Note: no private infrastructure is to be installed within or over the Council drainage easement. . A permit is required for any alteration to levels on a Council drainage easement (including fill and cut), or for the installation or encroachment of any permanent structure. Please refer to Council's website "Encroachment Over Council Easements" for further information.

All stormwater outlet connections to street kerbs must comply with Council's standard drawings SD-213, 214 and 215. Inter and front of allotment drainage connections are to comply with Council's standard drawing SD-220 to SD-223.

3.0 Large Scale Development (> 4 lot Land Divisions, >1500 m^2 Sites, Includes New Public Road, if Applicable)

Large scale developments are defined as residential developments having greater than 4 lots, greater than 1,500 m^2 in area and include new public roads (if applicable), and all industrial and commercial developments.

3.1 Design Standards

Minimum design Annual Exceedance Probability (AEP) and Average Recurrence Intervals (ARI) for the major/minor systems are shown in Table 1. The ARI are shown in ( ).

Table 1 - Design Annual Exceedance Probability and Average Recurrence Intervals

Major and Minor System Design AEP		
Land Use and Road Hierarchy	**Major System**	**Minor System**
Industrial/Commercial	1% (100)	10% (10)
Urban Residential		
- Local Road*	1% (100)	20% (5)
- Distributor/Collector*	1% (100)	10% (10)
Rural Residential		
- Local Road*	1% (100)	20% (5)

*Road hierarchy based on Council's road network plan

All calculations must be carried out by a competent qualified professional engineer experienced in hydrologic and hydraulic design, utilising drainage models and calculations that are accepted as current industry standards. For the drainage in Department of Planning, Transport and Infrastructure (DPTI) roads, reference shall be made to the DPTI Stormwater Design DD300 for drainage standards.

A DRAINS model is required for all large scale land divisions and industrial/commercial development.

A MUSIC model is required for water quality improvement to meet Council's water quality targets is given section 4.0

Surface flow criteria for the major/minor systems are shown in Table 2.

Table 2 - Roadway Flow Width and Depth Limitations (longitudinal drainage)

Roadway Flow Width and Depth Limitation	Major Road(other than local residential road)	Minor Road (local residential road)
1. For Minor Storm		
(a) Normal Situation	Parking Lane width (usually 2.5 m) or breakdown lane width.	(i) Full pavement width with zero depth at crown; (ii) Where one way cross fall, to high side of road pavement, but not above top of kerb on low side.
(b) Where parking lane may become an acceleration, deceleration or turn lane.	1.0 m	Not applicable.
(c) Pedestrian crossings or bus stops	0.45 m	0.45 m
(d) At intersection kerb returns (including entrances to shopping centres and other major developments).	1.0 m	1.0 m
2. For Major Storm		
(a) Where floor levels of adjacent buildings are above road level.	(i) Total flow contained within the kerbs. (ii) Freeboard ≥ 300 mm to floor level of adjacent buildings, and with maximum flow depth of 150 mm.	(i) Total flow contained within the kerbs. (ii) Freeboard ≥ 300 mm to floor level of adjacent buildings, and with maximum flow depth of 150 mm.
(b) Where floor levels of adjacent building below or, less than 300 mm above top of kerb: (i) where 50 mm fall on footpath towards kerb; (ii) where less than 50 mm fall on footpath towards kerb.	Top of kerb.	Top of kerb.

Roadway Flow Width and Depth Limitation	Major Road(other than local residential road)	Minor Road (local residential road)
3. Pedestrian Safety **(Major and Minor Storms)** (a) No Obvious Danger (b) Obvious Danger **	 $d*V \leq 0.6\ m^2/s$ $d*V \leq 0.4\ m^2/s$	 $d*V \leq 0.6\ m^2/s$ $d*V \leq 0.4\ m^2/s$
4.Vehicle Safety Depth limit at kerb	$d*V \leq 0.6\ m^2/s$ $d \leq 150$ mm	$d*V \leq 0.6\ m^2/s$ $d \leq 150$ mm

** The risk to life is foreseeable.

3.2 Design Parameters

The following design parameters are to be used, where applicable, in the DRAINS model analysis: Where exception or exemption is sought it must be justified with technical backing. The DRAINS model parameters to be adopted are:

- Soil type = 3.
- Antecedent Moisture Content (AMC) = 2.5.
- Depression Storage: Paved = 1mm; Grassed = 5mm.
- Rainfall Storm event- generated in accordance with ARR, 2016 temporal patterns and Bureau of Meteorology Intensity, Frequency and Duration (IFD) depths.
- Minimum residential impervious area =75% and pervious area= 25%.
- Minimum commercial/industrial impervious area= 90% and pervious area=10%.
- Supplementary areas are not to be used unless otherwise approved by Council.

3.3 Engineering Survey Site Plan

An engineering survey site plan is required for all large scale developments. The engineering survey site plan should provide the basis for development of the stormwater management site plan and consist of the following details:

- Contours and spot levels on the existing land. The contour interval shall not be greater than 0.2 m.
- All above and/or below ground existing features on the site, including fencing and type and trees with an estimate of the canopy spread.
- Existing easement(s), if any.
- Existing and proposed allotment boundaries.
- Existing infrastructure and impervious area such as buildings (including floor level), sheds, carports and paved/hardstand areas on the land.
- Adjacent road, footpath, stormwater pits and connecting pipes, downpipe connections, trees, verge and associated services.

3.4 The Stormwater Management Site Plan

The stormwater management site plan shall be based on the engineering survey site plan and shall include sufficient details of the width and extents of all roads, reserves, allotment areas and orientation to assess the suitability/capability of the proposed stormwater management arrangements for compliance with Council's service standards.

The stormwater management site plan (drawing) shall primarily show the proposed method of managing stormwater. The plan is to include a drawing at a scale of minimum 1:200 showing:

- All above and/or below ground proposed features on the site including any existing or proposed easements and drainage reserves.
- Grading(contours) or spot levels for proposed finished surface levels, and expected drainage patterns (direction of flow). The contour interval shall not be greater than 0.2m.
- All pervious and impervious areas (buildings and covered/paved areas, paths and driveways with materials used, and any landscaping including plants, and mulched areas shown schematically).
- Proposed building finished floor level(s).
- Proposed earthworks (cut/fill line)/retaining walls on the site in association with the development. The top and bottom levels of all retaining walls are to be shown on the plan.
- The proposed depth of any fill or cut over stormwater drainage easements. (Note Council will not permit cut in excess of 0.2m, or fill in excess of 0.5m over any existing drainage easement).
- All existing Council owned and other public service infrastructure (trees, footpaths, stobie/light poles, stormwater side entry pits).
- All proposed stormwater management devices (downpipes, sumps, underground pipes, spoon drains, culverts, detention, retention and/or other devices) including:
    - Location and size of proposed above ground retention tanks and stormwater detention tanks.
    - Inlet and outlet pipe sizes and orifice arrangement (if required), including level and size for all detention and stormwater drainage works.
    - Above and/or below ground stormwater discharge points into Council's existing drainage infrastructure.
    - Any easements required (whether for Council, or private).
    - Sufficient levels to demonstrate that the proposed system will drain to the designated point of discharge.
    - Pump specification with flow rate if any sump & pump is used to manage surface runoff.

3.5 Stormwater Management Report

The purpose of the stormwater management report is not only to substantiate the detailed design, but to identify the drainage constraints and to clearly demonstrate that the drainage system can be integrated into the site's overall stormwater management and proposed layout.

The stormwater management report must include the following information.

- Introduction
    - Identify the individual or company etc. that the plan is being submitted for (i.e. the client) and who (company) has prepared the report.

    - Brief description of the proposed development and whether it is a small or large scale development in terms of these Guidelines.

- Existing Development
    - Description of the existing development and a plan (figure/drawing) showing the site boundary, existing pervious and impervious catchment areas on the site.
    - The plan must show any external catchments that will contribute stormwater runoff to the site or will be diverted around the site, and watercourses in close proximity to the site that may have an impact due to flood extents.
    - Description of existing stormwater assets and any drainage easements or reserves.

- Proposed Stormwater Management Strategy
    - Description of the proposed development and a plan showing the proposed pervious and impervious catchment areas.
    - A dot point summary of Council's key design criteria/requirements relevant to the particular development.
    - A description of the proposed stormwater management strategy.
    - A plan showing the proposed stormwater management strategy, including proposed pits, pipes, detention and stormwater quality improvement measures and proposed design levels (spot levels or concept design contours).

- Analysis of the Stormwater Management Strategy
    - A summary of the hydrologic and hydraulic modelling input data and assumptions, including a table showing the existing and proposed development catchment areas and percentage impervious fractions.
    - Summary of the existing and proposed development peak flow rates for the minor and major storm events. Images of the existing and proposed development DRAINS modelling results are to be shown in an appendix.
    - Commentary on the hydrologic and hydraulic modelling results.
    - Commentary on any specific details of the proposed system including requirements for orifice plates, orifice diameter and centre or invert level.
    - A summary of the stormwater quality modelling input data and assumptions.
    - An image showing the MUSIC model catchments and treatment train with the treatment train effectiveness summary table to demonstrate full or partial compliance with Council's targets in Section 3.8.
    - Commentary on the stormwater quality modelling results.

- Maintenance
    - A table with a general asset description (pits, GPT, swales etc.) and the required frequency of inspection and cleaning.
    - Commentary on any particular inspection and maintenance activities to be undertaken during the life of the asset.
    - A schedule of design life expectations for all components.

- Conclusion
    - Summary of the proposed development, stormwater strategy and results.

The following information is to be provided to Council with the Stormwater Management Report:

- DRAINS model.
    - DRAINS model soft copy (.drn) with background image.
    - Sub-catchment plan indicating catchment area.

- MUSIC model
    - MUSIC model soft copy (.sqz) using Council's input data and background sub catchment image.
- Detention volume and water quality measure verification
    - Detention or water quality treatment features design drawings are required to verify the volume/area and performance. The following information is to be submitted to Council:
        - CAD file
        - A copy of the Design Documentation (PDF Format).
        - The Proposed Design Surface in AutoCAD .DWG format (3D Triangles).
        - Proposed Weir Level/Overflow Levels and widths.
        - Sufficient details of plant species and extents of specified plantings.
        - Sufficient details of any filtration media.
        - Any other information required to verify claimed performance.

Certification by a qualified Civil engineer that if constructed in accordance with the design, the stormwater management scheme will achieve the modelled performance, and that the scheme and areas allowed for any components of the scheme is sufficient to address the anticipated form and density of development for the site.

3.6 Stormwater Design Requirements

The following stormwater design requirements and approvals are required for all large scale developments:

- The peak flow rate leaving the development should not exceed the pre development flow rates for minor and major system storm events, as defined in Table 1. In this case, detention volume shall be calculated for the gap flow between pre and post development peak flows. Detention basin shall be designed so that peak flow from the proposed development up to 1%AEP does not exceed the existing peak flow from the site. Peak flows (pre and post development) are to be calculated using same methodology.
- If the developer believes that the existing drainage system may be able to safely convey more than the pre-development flow rate for both the minor and major post development storm events, as defined in Table 1, then the developer may choose to undertake a detailed analysis of the receiving stormwater system. If there is sufficient flow capacity for the post development flow rate for both minor and major storm event, developer will require to having a commercial agreement with Council and contribution can be negotiated based on the detention volume.
- All properties are protected from a 1% AEP storm event with freeboards to floor levels as defined in Section 2.9.
- Secondary protection drainage flow path is provided allowing a surcharge due to 50% blockage of sag pits and 20% blockage of on grade pits.
- Flow widths for minor and major storm events are to be in accordance with Table 2.
- The product of flow velocity and depth is not to exceed the values defined in Table 2.
- Drainage calculations and modeling method should consider the ultimate, (maximum density) development case. Hydrologic and hydraulic calculations are to be undertaken using DRAINS and stormwater quality modelling is to be undertaken using MUSIC, for all land developments.

- Watercourses, open drains and flow path are to be aligned such that they are free flowing and free of obstructions, and located on public road, open space, drainage reserve or easements. Where an overland flow is proposed along an easement, a Land Management Agreement shall be put in place to prevent the use of the land for any other purpose and to prevent obstruction of the flow path by fencing and retaining works.
- Local underground drainage systems have the capacity to convey peak flow rates resulting from a minor AEP storm event with the hydraulic grade line being no closer than 150 mm from the water table level.
- At a sag point, the underground drainage system accommodates a minimum of the flows resulting from a minor AEP storm event with 50% blockage provided there is a defined overland flow path for the gap flow to flow from a 1% AEP storm event. If there is not a defined overland flow path through a drainage reserve/easement then the underground drainage accommodates the flows resulting from a 1% AEP storm event.
- A minimum pipe size of 375mm Reinforced Concrete Pipe (RCP) is to be adopted for all road drainage. The minimum pipe grade is 0.5% unless otherwise approved. Technical justification to be provided for lesser grades.
- All side entry pits shall be double side entry pits (1900 mm x 600 mm) and junction boxes shall be minimum 900 mm x 900 mm in accordance with Council's Standard Drawings.
- Pipes used in network and trunk drainage shall be reinforced Concrete Pipe (RCP) with rubber ring joints and a minimum strength class 2, appropriate for the conditions.
- Plastic heavy duty sewer grade pipes or Fibre Reinforced Concrete (FRC) pipes, minimum diameter of 150mm are to be used for front and rear allotment drainage, where provided, in a Council easement.
- Stormwater pipe installation shall comply with the requirement of current Australian Standard AS/NZS 3725.
- Design calculations shall include:
    - A plot of the peak hydraulic grade line for the minor storm event.
    - A check of flow widths and flows across junctions as stipulated in Table 2.
    - A check of road flow capacity and overland flow path capacity (if any) based on full road cross section to confirm 1% AEP flows are contained within the road reserve.
- Junction boxes shall be provided:
    - On all drainage lines at all changes in alignment and grade.
    - At a maximum spacing of 80 m for up to diameter 450 mm pipe.
    - At a maximum spacing of 100 m for diameter 525 mm or more.
- 150 mm upright kerb and gutter in accordance with Council standards and AS 2876 is to be used for all kerbing work within the development unless otherwise agreed by Council.
- Safe and convenient all weather access shall be provided for personnel, plant and equipment for maintenance and cleaning activities for any water quality or detention facilities located on Council land.
- Unless otherwise approved by Council, all Side Entry Pits shall be double chamber units compliant with current Council standard details SD-206 and 207. Side Entry Pits shall be set in a concrete lintel frame having Terra Firma Lids with 2 x Bianco Class B lock down covers. The colour of the lid should be approved by Council.

- Device/facility sizing and design must provide for optimum maintenance intervention intervals recommended by manufacturers or regular inspection to determine the frequency of the cleaning and de-silting.
- All network drainage infrastructure, including open channels, detention, retention or water quality improvement infrastructure, is required to be located entirely within land owned by Council, either as public road or dedicated drainage reserve.
- Overland flow path for 1%AEP shall be demonstrated.
- In accordance with Council's Development Plan, land area proposed to serve a stormwater management purpose, in excess of 10% of the required open space area, will not be included within the developers 12.5% allocation of land for public open space. The only exception to this will be if it can be demonstrated to the satisfaction of Council that the area affected by the proposal satisfies the guiding principles for passive, active or recreational open space as described in Framework for the Integration of Flood and Stormwater Management into Open Space Version 1.1, August 2011, published by Healthy Waterways Limited.
- Developers are encouraged to provide water management systems which contribute to multiple objectives and integrate landscape principles and features into water management systems to facilitate the incorporation of drainage systems as open space.
- Land otherwise classified as operational open space including drainage easements and drainage reserves, or which otherwise does not satisfy Council's open space requirements, shall not contribute to the 12.5% open space.
- Where the subject land is within 50m of the centerline of a watercourse, or as specifically requested by Council, in the absence of any available information from Council, floodplain mapping of nearby watercourses is to be undertaken to establish 1% AEP flood levels at the development site, to demonstrate that the development complies with Council's requirements for the development to be flood free, or safe.
- Where overland flow is required to be conveyed by a swale within an easement, a Land Management Agreement is to be placed on all properties limiting the use of the affected land and requiring unobstructed openings of sufficient capacity in all fences across the easement/swale.

3.7 Provision of Drainage for Future Upstream Development of Adjacent Properties

The following provisions must be made in any new development for future upstream developments:

- Provision must be made for the future orderly development of adjacent properties with respect to stormwater drainage where at least part of those upslope properties would drain through the development, or the most feasible location for stormwater drainage infrastructure to service those properties is within the development.
- If a piped drainage connection is provided for up-slope development, the drainage infrastructure and any drainage reserve required to accommodate the infrastructure must fully extend to the boundary of the up-slope site to ensure that the up-slope property owner does not have to undertake works in the down-slope property to connect to this stormwater infrastructure.
- The development is to design any up-slope stormwater connection for fully developed catchment flows. In the case of an up-slope greenfield catchment the development can assume that stormwater detention will be provided on the up-slope catchment to limit post

development flow rates to greenfield flow rates or an agreed percentage impervious fraction to be provided by Council. The surface flows should be managed to prevent flooding of the developed area either by cut off drains (as a temporary measure), or combination of cut off drains and drainage network.

- Where land upstream will not be developed, or has not been provided with inter allotment drainage network, protection from flooding or inundation from up-slope surface flows in the form of embankments, swales and/or other drainage infrastructure must be provided. The protection must be located either within an easement on adjacent land, or within a drainage reserve within the current development. The width and extent of any easements created must provide a direct connection to a public road or Council owned open space and must provide adequate access for Council plant to undertake required maintenance of the embankment or swale within the easement. Where the swale/embankment is to be provided in an easement, Land Management Agreement must be placed on all affected properties to prevent obstruction of the swale by fences or other development, structures or works.

3.8 Inter Allotment Drainage

Inter allotment drainage lines are installed within dedicated easements by the developer at the time of construction of the subdivision to facilitate the draining of surface water from lots that are unable to drain to the street.

Every attempt should be made in determining site gradients and levels, to provide for allotment run off to be directed directly to a road, and not via inter of allotment drainage.

If no other option is available to allow direct discharge to a road, inter allotment drainage shall be provided and contained within an easement as detailed in Council's standard drawings.

Any easement for all runs exceeding one single allotment shall be in long form under Section 232d of the real Property Act, in favor of Council.

Where a drain on private land services one allotment only, any easement is to be in the name of the allotment it services, and not in Council's name. Where inter allotment drainage is to be provided (at no cost to Council) servicing more than two allotments, they shall be in the name of the Council and shall be an absolute minimum of 3 m wide (if solely for stormwater drainage, or 4 m wide if combined with SA water for sewer or water supply) with a minimum of 1.2 m clearance from the edge of the pipe to the easement boundary.

Where the pipe diameter is 900mm or more, the easement shall be increased in width by 1m (in addition to any other requirements for increased width). Where the depth to invert of inter allotment drainage pipe exceeds 1.5 m at any point between any two junction boxes, the easement width shall be increased by a factor of 1:1 for each additional 0.5 m in depth.

The ground level on the easement shall be graded at the same level, and gradient as the balance of the allotment, to minimize the potential for building developers to seek to add fill or cut on the easement.

Drainage junction boxes shall be located at all changes in: direction, pipe size, grade and at the beginning and end of the run. For the purposes of maintenance the maximum spacing between junction boxes is to be 40 m. Pits and junction boxes shall be constructed in accordance with Council's Standard Drawings. Minimum size of the junction box shall be 900 mm x 900 mm.

Front of allotment underground drainage directly connected into Council's network drainage system shall be provided for industrial/commercial land divisions, and along all one-way cross-fall roads and flush kerb roadways.

Rear allotment drainage shall be designed and constructed to convey peak flows from a 1% AEP storm event, from the potential pervious and impervious areas of the allotment unless there is an

overland flow path provided via a drainage reserve or drainage easement established for this purpose.

3.9 Open Channels and Watercourses

It is an objective of Council's development plan that wherever possible, natural systems, including watercourses and lakes should be protected and preserved.

There is also a legal obligation under the Natural Resources Management Act to protect watercourses and the ecosystems.

Accordingly, development along and around watercourses should be designed to be sensitive to the ecological values the watercourse provides, and any works proposed in or adjacent to the watercourse should be designed and constructed so that they have minimal impact on the health of the watercourse.

Discharge to a suitable natural watercourse or channel may be allowed subject to:

- The ongoing responsibility for management of stormwater discharging into a watercourse on private property will be subject to the provisions of the Natural Resources Management Act, and shall not be Council's responsibility. However, details for design and construction of the discharge are to be provided for approval under Council's delegated powers under the Development Act.
- Compliance with Council's water quality targets shown in Section 4.0.
- The watercourse shall be protected against erosion at the point of discharge. In this regard an outfall apron or energy dissipation structure shall be provided and shall not obstruct flows in the watercourse.
- If erosion control works are required at the point of discharge onto a private watercourse, an easement to Council is required to cover the extent of any works, and an appropriate buffer to facilitate access. The easement is to connect and interface with a public road or reserve to facilitate access.
- Generally, only a single discharge point to the watercourse from the development will be permitted, unless topographical constraints dictate otherwise i.e. individual discharges from individual allotments will not be accepted.
- Permanent scour protection must be provided wherever flow velocity exceeds 0.5 m/s for an unvegetated channel:
    - The use of geofabric or fibre matting is not acceptable for permanent scour protection.
    - Techniques using flow velocity control and/or rock chutes, drop structures or lining must be used.
    - Where rock chutes or drop structures are proposed, they are to be designed using specialist models in accordance with best practice guidelines.
    - If vegetation is required to achieve bed stabilization, then a landscaping plan (using indigenous native aquatic and semi aquatic plants) must be provided and implemented, and commitment made to maintenance and establishment for a minimum of 12 months.
- Reference is made to the Queensland Urban Drainage Manual, 2013 for assistance in designing and stabilizing open channels or watercourses.

3.10 Culverts/Road Crossings

Culvert design shall be in accordance with Guide to Road Design - 'Part 5B: Drainage – Open Channels, Culverts and Floodways', Austroads.

The effect of a 50 percent blockage in culverts should be considered in overland flow calculations.

Minimum requirements for rural, local, collector and distributor roads:

- For collector and distributor roads, sufficient flow capacity will be provided in combination between under road bridge or culvert, and overland flow to limit overland flow velocity and depth to low hazard (less than 0.4 m^2/s) in a 1% AEP storm event.
- For local roads, sufficient flow capacity will be provided in under road bridge or culvert, to convey a 5% AEP storm event.
- For rural roads, sufficient flow capacity will be provided in under road bridge or culvert, to convey a 5% AEP storm event.
- There is no tangible adverse impact on upstream or downstream flood extents or hazard level as a result of compliance with the above.

Minor drainage pipe/conduit systems shall conform to the following requirements:

- Minimum pipe size 375mm
- Minimum box culvert size 600mm wide x 450mm high at minimum 2% grade unless otherwise approved by Council.
- Minimum flow velocity 0.5 m/s.
- Minimum pipe grade 0.5%, unless otherwise approved by Council.

Erosion control measures shall be provided at the upstream and downstream ends of culvert crossings, in accordance with Guide to Road Design - 'Part 5B: Drainage – Open Channels, Culverts and Floodways', Austroads.

3.11 Detention System

3.11.1 Detention Basin above Ground

Detention basin design is to consider the following aspects relating to public safety and maintenance:

- All detention systems must be designed with simple, safe, cost-effective maintenance in mind.
- Maximum water depth shall be 1.2 m in the 1% AEP storm event.
- Detention basins should have maximum side slopes of 1V:5H or flatter within the basin.
- Alternative embankment construction designs for the other banks will be accepted providing the design can demonstrate:
    - Landscape integration and aesthetic and amenity added value (i.e. it must look good).
    - Structural integrity.
    - Maintainability.

    - Where embankment grades are less than 1V:5H, and height is greater than 1.0m, appropriate safety railing must be provided for protection from falls.
- A low flow vegetated swale/channel from the inlet to the outlet is mandatory in all above ground detention basins and is to be designed to convey the peak 1EY flow rate entering the basin.
- The minimum clear width around the top of all banks and walls on a detention basin is 3m. A width of 3m is required where access is not available across open space or direct from a public road. If landscaping is to be provided, the minimum width is to be provided clear of any landscaping elements.
- A galvanised steel mesh frame angled over the depth of the headwall apron is to be provided on all outlet structures to reduce the risk of blockage and people being trapped against the headwall during high flow events.
- Pipe systems shall contain the design outflow through the detention basin wall with suitable bulkhead (trench-stop) protection to prevent water infiltration and "piping" between the conduit and the surrounding material.
- The pipe outlet structure shall be designed to avoid blockages, where a catchment may be the source of significant amounts of vegetation matter. Outlets should include a device for energy dissipation.
- Minimum basin slope from inlet to outlet and across the basin shall be 1%. The risk of sediment accumulation is to be considered in the design of the basin.
- Access for maintenance vehicles shall be provided by an all-weather access track to the satisfaction of Council.

3.11.2 Spillways and Outlet Weirs

The following provisions must be made with respect to spillways and outlet weirs:

- Where it has been identified that there is a potential risk to loss of life and significant damage as a result of a retention/detention basin embankment failure, the basin is to be designed in accordance with Australian National Committee on Large Dams (ANCOLD) guidelines.
- Overflow weirs or spillways must be designed to convey at least the 1% AEP peak discharge, assuming that the basin storage is full and the low-level outlet(s) are blocked. Refer also to the ANCOLD guidelines for any requirements to size the spillway for a more significant storm event.
- The overspill must not inundate nor concentrate flows onto adjoining properties.
- Spillways need to be designed to ensure they will not scour and are suitably anchored.
- Spillways are to be located as close to natural ground level as possible (e.g. where the embankment crest is lowest) and preferably in insitu material.
- Minimum freeboard of 300mm above the estimated 1% AEP water level is required to top of embankment level.

3.11.3 Inlets and Outlets

Basin design is to consider the following aspects relating to public safety and maintenance:

- Vegetated screenings can be provided, but these must be located sufficiently away as to not affect the hydraulic performance of the inlet and outlet structures, or interfere with maintenance access.
- Outlets may utilise pits, weirs, pipes and box culverts.
- Where the outlet is within a wet retention basin (wetland) or bio-retention basin, a concrete apron should extend at least 1m from these structures to minimise vegetation growing adjacent to it and impacting on the hydraulics of the outlet.
- Outlet screens that minimise blockages are to be used.
- Outlet structures generally consist of orifice plates (fixed to the outlet structure) or culverts placed at a low level in the basin to cater for the discharge of normal outflows.
- Minimum outlet orifice size shall be 150mm in diameter.
- Where an orifice plate is provided:
    - The structure should be secured to prevent illegal access.
    - The plate shall be fixed so that it can be removed.
    - Clear, safe, all weather access for emergency and routine clearing must be provided.
    - A debris protection screen in front of the outlet is required.
    - A gross pollutant trap is required upstream of the orifice plate, to remove gross pollutants and reduce the risk of blockage, if the orifice diameter is less than 375 mm.

3.11.4 Use of Underground Detention System

Council does not support the installation of underground detention storage in the form of oversized pipes and box culverts (on the trunk drainage line) because they will generally not provide sufficient detention in a drainage system and if not designed correctly are likely to adversely impact on drainage design requirements and may cause unwanted, accelerated sedimentation, resulting in underperformance by the drainage system.

Underground detention systems are only permitted if Council agrees, in special circumstances.

The following provisions must be complied with in respect to underground detention systems:

- If oversize pipes or box culvert or any approved devices for storage are proposed, the loss of storage associated with the structure being on a slope must be factored into the volume calculations.
- The base must have fall to the outlet (minimum grade 0.5%) and from all edges towards the flow path to prevent permanent ponding occurring.
- Long term ponding of water over the floor of the detention system will not be acceptable i.e. Outlets are to be located at invert level of unit to prevent permanent ponding within unit.
- A minimum 900mm x 900mm grated maintenance access and venting opening must be provided over the underground detention outlet.

- Installation of step irons is required where pit depth is greater than 1.2m.
- The detention system is to be structurally designed and certified to adequately withstand all expected service loads and provide adequate service life.
- An overflow or bypass outlet for flows exceeding a 1% AEP storm event, or in the event of accidental blockage, must be provided ensuring any overflow is not directed into private property.
- Locate the detention system outside of the tree protection zone of trees that must be retained.
- In areas of high water tables or floodplains the tank is to be designed to ensure it resists buoyancy effects.
- Gross pollutants/litter/coarse sediments shall be removed prior to discharge into the detention system with a primary treatment system sized to treat the peak flow rate to the detention basin.
- An air vent shall be installed at a suitable location.

3.12 Design Requirements for a Service Station/Car Wash

In the stormwater management plan, the following requirements shall be met/provided in addition to all other relevant requirements:

- Surface runoff from under the canopy area must be treated to remove hydrocarbons in accordance with EPA requirements, prior to discharge to the Council drainage system.
- Car wash and Auto wash surface runoff must be connected to the sewer in accordance with EPA requirements, and is to be shown on the drawing.
- External surface runoff (not under the canopy) is to be treated by an approved sediment and oil removal device prior to discharging to the detention system.
- Roof water from canopies and buildings on the site must be discharged to the Council drainage system separately, via a detention system otherwise in accordance with these guidelines.
- The manufacturer's specification for all treatment devices should be provided.
- Detention system details should be shown in the drawings.

4.0 Stormwater Quality Management

Council's service levels for stormwater quality management acknowledge the influence of the Adelaide Coastal Waters Study and Regional Natural Resources Management Plans and our stormwater management obligations under the agreement with State Government.

Stormwater quality improvement devices are required when:

- Development is for the division of land into 10 or more allotments.
- The development has 10 or more car spaces.
- New public road is created.
- Where discharge is to occur directly into a watercourse or receiving water body a minimum of compliance with gross pollutant and suspended solids treatment targets is mandatory.

Stormwater runoff quality in outflows from new development shall have load reduction (when compared to untreated Stormwater outflows) improvement equivalent to:

- 80% reduction in Total Suspended Solids (TSS).
- 60% reduction in Total Phosphorous (TP).
- 45% reduction in Total Nitrogen (TN).
- 90% reduction in Gross Pollutants.

There are a number of guiding principles that underpin the objectives for stormwater management and the implementation of WSUD in the Greater Adelaide Region. These principles should be addressed when undertaking the planning and implementation of stormwater management on a site or at a catchment level.

Council supports the use of a variety of purpose specific and suited WSUD treatments to achieve water quality targets. Integrated WSUD techniques are detailed in the Water Sensitive Urban Design Guide for Greater Adelaide. A treatment train approach shall be applied and demonstrated using Primary, Secondary and Tertiary WSUD techniques, as shown below.

Stages of the treatment train

Treatment	Processes	Pollutants	Typical application
Primary treatment	• physical screening • rapid sedimentation	• gross pollutants • coarse sediment	• grassed swales • litter traps • sediment ponds
Secondary treatment	• fine particle sedimentation • filtration techniques	• fine sediment • attached pollutants	• swales • infiltration trenches • porous paving • bio-retention systems
Tertiary treatment	• enhanced sedimentation and filtration • biological uptake • absorption onto sediments	• nutrients • dissolved heavy metals	• bio-retention/ bio-infiltration systems and wetlands

Source (Melbourne Water)

Stormwater quality modeling must be undertaken based on works proposed as new development or infrastructure extension, renewal or upgrades.

A MUSIC model is required to simulate the proposed stormwater quality treatment train in order to demonstrate compliance with Council stormwater quality target requirements. The stormwater quality improvement performance must be demonstrated using MUSIC version 6 or latest. Water quality calculations are to be carried out by a qualified engineer as per the guidelines given in Australian Runoff Quality and MUSIC guidelines.

4.1 Carpark Stormwater Quality Treatment Requirements

Developments with 10 or more car spaces are required to incorporate into the drainage system a device capable of removing oil and sediment from the driveway and carpark stormwater run-off. An appropriate oil separator or interceptor must be provided on site, treating all run off from impermeable areas (excluding roofing), and prior to discharge into Council's drainage system.

The oil separator or interceptor must be sized to treat 50% of the 1EY peak flow rate.

Design drawings must show the manufacturer, type and model of any proposed proprietary stormwater quality treatment device.

Sediment and oil removal devices must be maintained in accordance with the manufacture's maintenance procedure and the maintenance requirements are to be documented in the

stormwater management plan. Safe and convenient access shall be provided for personnel, plant and equipment for maintenance and cleaning activities.

4.2 Stormwater Quality Treatment Devices and MUSIC Modelling

Appropriate stormwater quality treatment measures for a development, dependent on site constraints and opportunities, will be required to achieve the stormwater quality improvement targets shown in Section 4.0. This section describes typical stormwater quality improvement measures and provides parameters to be used when preparing a MUSIC model to simulate the performance of the proposed stormwater quality improvement measures.

The default parameters in MUSIC for the first order decay k-C* model used to define the treatment efficiency of each treatment device should be used unless local relevant treatment performance monitoring can be used as reasonable justification for modification of the default parameters. Reference should be made to the MUSIC User Manual.

In order to avoid any confusion relating to treatment node input data, the following advice for modelling stormwater quality treatment systems within the City of Onkaparinga is provided.

Note: The following stormwater treatment measures are **not** to be modelled within the MUSIC program: Natural waterways, Natural wetlands, Naturalised channel systems, Environmental buffers and ornamental Lake/Pond systems.

Stormwater Treatment Parameters

Stormwater Treatment Measures	Selected Key Parameter Values and Design Guidance
Bioretention systems (basins & swales) 	High flow bypass = generally 50% off the 1EY flow (to be calculated by consulting Engineer). Extended detention depth = 0.3 m (for basins) Saturated hydraulic conductivity = 180 mm/hr Filter depth = 0.5-0.8 m TN content of filter media = >600mg/kg Orthophosphate content of filter media = >30mg/kg Exfiltration rate = 0 mm/hr Basins are typically lined, have a submerged zone with carbon present and the basin will be vegetated with effective nutrient removal plants. Note that a submerged (saturated) zone requires a specially designed outlet pit configuration.
Gross pollutant traps (GPT) 	Gross pollutant removal rates should be obtained for the specific GPT type proposed. Additional information is available in this guideline and from the MUSIC Modelling Guideline. High flow bypass = generally 50% of the 1EY flow (to be calculated by GPT manufacturer).

Stormwater Treatment Measures	Selected Key Parameter Values and Design Guidance
	GPT should only be used for primary treatment, to remove gross pollutants and coarse sediment. No further nutrient (TN and TP) treatment should be attributed to a GPT i.e. nitrogen and phosphorous reductions from GPT's must be set to zero. The Total Suspended Solids (TSS) removal rate cannot exceed 25%.
Wetlands	High flow bypass = 1EY flow (to be calculated by consulting Engineer). Inlet pond volume calculated using: • Inlet pond surface area = 10% of macrophyte zone (storage surface) area. • Inlet pond depth = 0.6m (minimum) Extended detention depth = 0.25 - 0.75 m based on outlet design Notional detention time target = 72 hours.
Swales	Bed slope = 1-4% Vegetation heights of 0.05-0.5 m are acceptable; however MUSIC assumes that swales are heavily vegetated when modelling their treatment performance. Mown grass swales should not be expected to provide significant stormwater treatment and should not be modelled in MUSIC.
Rainwater tanks	Rainwater tank will be considered as part of the treatment train if it is a combined system with on-site detention and retention (at least 90% of the roof area connected). In this case, a Land Management Agreement is required. At least 50 m^2 roof area is contributed to the rainwater tank for each dwelling. Demand for toilet flushing is 85 litre per day and for laundry 120 litre per day for each dwelling. It should be noted that in "lumping" rainwater tanks into one node, the designer has to ensure that the performance of the "lumped" tank will be identical to an individual tank. Ensure that depth above overflow is kept the same as for a single tank (i.e. the headspace is the same), the volume, surface area and demand are all scaled by the number of tanks, and the overflow pipe diameter is scaled by the *square root* of the number of tanks, as the overflow capacity for the lumped tank is a function of the increase in cross sectional area of the overflow pipe, rather than the diameter.

Rainfall & Evaporation Inputs

The rainfall and evaporation data recommended for MUSIC modelling within the City of Onkaparinga is the Noarlunga Weather Station, station number 023885. Council requires all stormwater quality modelling to use the Noarlunga Weather Station 6-minute rainfall data. A modelling period of 01/01/2005 to 01/10/2009 is available from Council. You are required to contact Council to obtain the MUSIC model meteorological template file (.mlb extension).

Average Noarlunga potential evapotranspiration (PET) data is to be adopted for MUSIC modelling. The monthly PET values are shown below.

Daily Evapotranspiration for Noarlunga

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PET (mm/day)	7.3	6.5	4.5	3.5	2.2	1.5	1.8	2.4	3.7	4.8	5.6	7.4

4.3 Rainwater Tanks

Rainwater tanks can be effective in reducing peak flow rates from roofed areas and reducing the volume of stormwater runoff from a development, if there is significant reuse potential on site.

Rainwater tanks will only be considered as part of the treatment train if it is a combined system with on-site detention and retention. At least 90% of the roof area must be connected to the tank and a Land Management Agreement is put in place, imposing the rainwater tank requirements to be enforced on all subsequent building development. Otherwise, the effect of rainwater tanks shall be ignored for hydrologic and water quality calculations.

4.4 Gross Pollutant Traps

Gross pollutants traps (GPT) (including trash racks) are structures that use physical processes to trap solid waste such as litter and coarse sediment. They should only be used for primary treatment, to remove gross pollutants and coarse sediment. No further nutrient (TN and TP) treatment should be attributed to a GPT i.e. nitrogen and phosphorous reductions from GPT's must be set to zero. The Total Suspended Solids (TSS) removal rate cannot exceed 25%.

Selection of the type of gross pollutant trapping device for a particular application must occur as part of the conceptual design process. Unless being used to treat inflows into an underground detention system, the GPT is to be designed to treat half of the peak 60% AEP storm event flow rate. Flows up to the peak 1% AEP storm event will bypass the systems via an alternative bypass arrangement.

Additionally, at specifically defined locations it may be necessary to design GPTs to treat flows greater than half of the peak 60% AEP storm event flow rate. This requirement will be based on an assessment of the capacity of the receiving waterway downstream of the GPT to accept the pollutant load and the hydraulics of the drainage system. If treating flows into an underground detention system, the GPT must treat 100% of the peak inflow rate.

An appropriate head loss "k" value is to be adopted in hydraulic calculations to account for head losses associated with the GPT.

The location for installation of a GPT should be based on an assessment of the stormwater drainage catchment both upstream and downstream of the proposed site. The assessment should identify the size, hydrological and hydraulic response of the catchment, identify the source and type of pollutants likely to be generated by the catchment both present and in the future. Where

provided as primary treatment for a biofilter or wetland, the GPT should be located as close as practicable to the inlet point to the wetland or biofilter, and upstream of all other inlets.

GPT devices are to be located such that a downstream overland flow path through public road or open space is available to carry any surcharge flows which may occur as a result of blockages or other causes.

The design of removable basket collection system must ensure that floatable contaminates do not overspill the basket during lifting/cleanout operations. Design should make provision to enable the device to be cleaned by a mechanical vacuum induction truck and basket lift-out, with plant that is readily available.

An all weather access track suitable for use by Council maintenance vehicles is required to provide access from a public road to the site of the GPT, to facilitate cleaning.

4.5 Sedimentation Basins

Sedimentation basins serve to remove coarse to medium-sized sediments (typical target size of particles is 125µm or larger) and are located immediately downstream of a GPT. They facilitate the settling of particles through temporary detention and the reduction of flow velocities. A sedimentation basin should always be constructed upstream of a bio filtration system or wetland.

Determining the critical size of a sedimentation basin is crucial to:

- Prevent smothering of downstream treatment measures (if the basin is too small).
- Avoid the accumulation of smaller particles of higher contaminant concentrations (in the case of over-sized basins).
- Prevent the need for frequent desilting.

Key considerations in the design of sedimentation basins include:

- The design flow rate through the sedimentation basin should be the peak 1EY flow rate.
- A bypass structure should provide for flow bypass of downstream macrophyte zones within wetlands for storm events in excess of the design flow rate and up to the 1% AEP storm event. Weirs are often a suitable method of controlling surface flows so that large events can bypass a treatment measure, while allowing the required flow to pass through the system.
- Sedimentation basins are often large structures requiring substantial area and are important assets when constructed upstream of wetlands. When available space is constrained, the sediment basin size should not be compromised if forming part of a treatment train. If the site constrains the total size of the treatment system, the macrophyte zone in the wetland should be reduced accordingly.
- The sedimentation basin should be designed to remove 95% of particles greater than 125µm in a 1EY storm event.
- Approach batter slopes should be no steeper than 1V:5H. All edges should have safety benches of at least 1.5m to 3.0m wide from the edge of the normal top water level.
- Safety benches should have a maximum grade of 1V:8H for the first 1.5m – 3.0m before changing to a 1V:5H grade for at least the next 0.5m. Beyond this the grade may be a maximum of 1V:3H. It is recommended that an independent safety audit be conducted for each design.

4.6 Constructed Wetlands

Constructed wetland systems are shallow, extensively vegetated water bodies that remove pollutants through enhanced sedimentation, fine filtration and pollutant uptake processes. Stormwater runoff is passed slowly through the vegetated areas, which filter sediments and pollutants, and biofilms establish on the plants, which absorb nutrients and other contaminants. Wetlands are well suited to treat large volumes of stormwater runoff and have the advantage of improving local amenity and providing habitat diversity. Key design issues to consider include:

- Verifying the size and configuration for treatment, determining design flows, designing the inlet zone (see sedimentation basins), layout of the macrophyte zone; hydraulic structures, selecting plant species and planting densities and providing access for maintenance.
- The constructed wetland should treat at least 90% of Mean Annual Runoff through the use of a stored event volume above the normal standing water level of the wetland.
- A high flow bypass should be capable of taking flows in excess of design flows (typically a 1EY storm event).
- The wetland design must meet safety requirements and implement reasonable safety measures. This includes fencing, safety batters, signage and benching.
- Approach batter slopes should be no steeper than 1V:5H. All edges should have safety benches of at least 1.5m to 3.0m wide from the edge of the normal top water level.
- Safety benches should have a maximum grade of 1V:8H for the first 1.5m – 3.0m before changing to a 1V:5H grade for at least the next 0.5m. Beyond this, may be up to a maximum of 1V:3H. The safety bench should be densely planted with emergent macrophytes such that casual entry will be difficult.
- Ensure that the required detention time is achieved by using outlet risers to control flows.
- The riser outlet pipe should be sized to act as an emergency overflow equivalent to the 1EY AEP peak flow rate.
- A minimum of a 0.3m freeboard for the embankment is required.
- Where possible, wetlands should be constructed in the base of detention basins to reduce land uptake.
- When considering the macrophyte zone layout, it is important to optimise hydraulic efficiency (i.e. reduce dead zones and short circuiting of water). The optimal hydraulic efficiency value for constructed wetlands should be not less than 0.5 and greater than 0.7 where possible.
- The wetland should be divided into four macrophyte zones, an open water zone, submerged marsh zone, deep marsh zone and shallow marsh zone. The percentage allocation of each zone is outlined in Table 9.2, Section 9.6.3 of the WSUD Engineering Procedures: Stormwater Manual (Melbourne Water, 2005) and should be followed. Refer to the plant species list in the Council Addendum of the WSUD Engineering Procedures: Stormwater Manual (Melbourne Water, 2005) for suitable vegetation options.
- Wetlands require large areas of land for construction and are unsuited to steeply sloping land.
- A geotechnical investigation is required prior to design to determine soil profiles and infiltration rates. Hydrogeological investigations may also be required in areas where there is a likelihood of groundwater discharge or high seasonal water tables.

4.7 Vegetated Swales

Vegetated swales convey stormwater, provide removal of coarse and medium sediment and can reduce the runoff volume from a development. Vegetated swales are similar to bioretention swales, but are less effective in removing nitrogen from stormwater, as they do not feature the filtering component and convey water on the surface only.

The longitudinal slope of a swale is the most important consideration. Swales are most efficient with slopes of 1% to 4%. Lower than this, swales can become waterlogged and/or have stagnant pooling, while steeper slopes may have high flow velocities, with potential erosion and vegetation damage risks.

Where swales are publicly accessible, flow depths and velocities must be acceptable from a public risk perspective.

Vehicle and pedestrian traffic should be kept off swales as they may damage vegetation and create preferential flow paths. Appropriate mitigation measures should be implemented to restrict traffic.

Swale side slopes depend on Council regulations, traffic access and the provision of crossings. Typically 1V:9H side slopes are suitable. For maintenance requirements, grassed swales requiring mowing must not have side slopes steeper than 1V:5H.

4.8 Permeable Pavement

Permeable pavements are porous surfaces which overlay an aggregate layer of crushed stone or gravel. Stormwater runoff passes through the permeable pavement to the aggregate layer before it is discharged to a piped drainage system. This process reduces peak flow rates from the site by providing detention storage and increasing the time of concentration for stormwater to enter the downstream drainage system and improves the quality of stormwater runoff by removing site pollutants.

Permeable paving can be used to:

- Reduce site impervious areas.
- Reduce the volume of stormwater that is discharges to the external drainage system.
- Provide retention and detention storage on the site.
- Delay and slow the rate of stormwater flow through the development to the discharge point.
- Improve the quality of stormwater runoff from the site.

Permeable paving may be used subject to the following conditions:

- Permeable paving is only used within areas of car parking or pedestrian pathways. This does not include driveway and On Site Detention (OSD) areas.
- Permeable paving is graded towards a piped drainage system so that runoff is controlled where a rainfall event exceeds the infiltration rate of the pavement.
- Where permeable paving is located upstream of OSD systems, all treated and bypass water from the permeable paving shall be directed to the OSD.
- The permeable pavement provided must be a hard stand material or bonded asphaltic material such as pervious concrete.

It is noted that the use of permeable pavements in the Adelaide region needs to be considered with caution with regards to allowing direct infiltration into clay soils. In such cases where reactive clay soil exists there is a potential for movement of structural footings, pavement etc.

In such cases, the use of an impermeable liner can be used to ensure seepage water is collected via sub surface drainage and directed to the street drainage system.

Certification and standard drawings of the permeable paving must be provided. The certification shall demonstrate that the permeable paving is suitable for its intended use (i.e. withstands the loads from cars, etc.).

4.9 Infiltration System

Infiltration system, in the right soil conditions, can be effective in reducing the stormwater runoff volume discharged to the street drainage system. They are highly effective at improving soil moisture conditions around trees and the landscape to enhance tree growth, health and shade. However, specific design requirements must be met in order to effectively use these techniques.

Infiltration devices include:

- Trenches
- Wells
- Beds

Infiltration devices are generally gravel filled (excluding well) and designed to be incorporated into other WSUD elements or on their own. Stormwater runoff needs to be pre-treated to remove sediments, litter and organic matter prior to discharge into an infiltration device. Reference is made to "On-Site Retention of Stormwater", Ministers Specification SA 78AA, September 2003.

4.10 Detention Basins

Refer Section 3.11 for general design requirements for detention basins.

For water quality purposes, vegetated detention basins can be effective at removing sediment, nitrogen and phosphorus. Detention basins with vegetated low flow channels and invert can be included in the treatment train. Depending on the basin configuration, it may be more appropriate to simulate the treatment performance of a detention basin low flow channel as a vegetated swale. Treatment performance shall only be accepted for minor flow rates that do not exceed the capacity of the low flow channel.

Detention basins with a concrete lined low flow channel and invert, with no provision to retain standing water, or non- vegetated are not permitted to be used as a treatment measure in the treatment train.

4.11 Bio-filtration Systems (Bioretention, Infiltration and Raingardens)

It is Council's preference that for large scale land divisions, secondary and tertiary stormwater quality treatment control is achieved through the provision of wetlands with appropriate active depth limitations, in conjunction with integrated WSUD street scale components, in lieu of detention basins and biofilters located on drainage, or open space reserves.

Individual biofilters with an area in excess of 200m^2 will not be accepted as a water quality treatment system as they are unable to be effectively maintained and do not facilitate community use of the area.

Appropriate maintenance access provisions (access ramps, machinery access) are to be specifically incorporated into the design, to the satisfaction of Council.

Where bio-filtration systems are proposed, they are to be designed in accordance with the report titled 'Adoption Guidelines for Stormwater Bio-filtration Systems –Summary Report, *Cities as Water Supply Catchments – Sustainable Technologies'*

The concept design stage must establish the optimal combination of bio-filtration system surface area, filter media saturated hydraulic conductivity, depths of media and extended detention depth using a continuous simulation modelling approach such as MUSIC software. Any adjustment of design parameters during the detailed design stage will require the continuous simulation

modelling to be rerun to assess the impact on the overall treatment performance of the bio-filtration system.

Bio-filtration systems are to be designed as submerged systems with a liner (minimum 1 mm thick HDPE liner).

The design of the inflow systems to bio filtration basins needs to consider a number of functions:

- Scour protection – In most biofiltration applications stormwater flows will enter the biofiltration basin as concentrated flow (piped, channel or open channel) and as such is it is important to slow and spread flows using appropriate scour (rock) protection. If inflow to the biofiltration basin is via sheet flow at a concrete edge strip or openings in a kerb, then scour protection must be provided along all batters where water can enter the basin.
- Coarse sediment forebay – Where stormwater runoff from the catchment is delivered directly to a biofiltration basin without any coarse sediment management (through vegetated swale or buffer treatment) a coarse sediment forebay is to be included in the design. The forebay is to remove coarse sediment (>1 mm) from stormwater to minimise the risk of vegetation in the biofiltration basin being smothered
- Constant low base flows have to be taken into consideration during the concept design phase as constant low base flows can blind the filter material and promote weed growth within permanently saturated areas.

In relation to biofiltration systems, temporary protective layers must be installed and left in place throughout the allotment building phase to ensure sediment laden waters do not clog the filtration media and building traffic does not enter the biofiltration system.

At the completion of the allotment building phase the temporary measures (i.e. geofabric and turf) are removed along with all accumulated sediment and the bio-filtration system re-profiled and planted in accordance with the approved plant schedule. Establishment of the vegetation to design condition can require more than two growing seasons, depending on the vegetation types, during which regular watering and removal of weeds will be required.

Planting schedules for all biofiltration systems are to be shown on the civil plans.

4.12 Stormwater Quality Management Fee

Where development is for the division of land into 10 or more spaces or allotments, and stormwater quality improvements, consistent with Council service standard, cannot be conveniently or cost effectively provided on site, provided there is no direct discharge proposed into a watercourse, the developer has an option to pay Council a contribution rate per hectare in lieu of provision of providing the required infrastructure.

Stormwater quality in outflows from new development, at each stage, shall have load reduction improvement as stated in Section 4.0. A MUSIC model is required for each stage of development.

The stormwater quality contribution shall be determined, based on the level of stormwater quality improvement achieved, compared to the required stormwater improvements as listed in Section 4.0, and using a weighted average (as determined in accordance with the weightings listed below), multiplied by Council's estimated cost for provision of this infrastructure. Currently the contribution is $17,931/ha total area (as current for 2017/18 financial year). Contact Council for the updated contribution in future financial years.

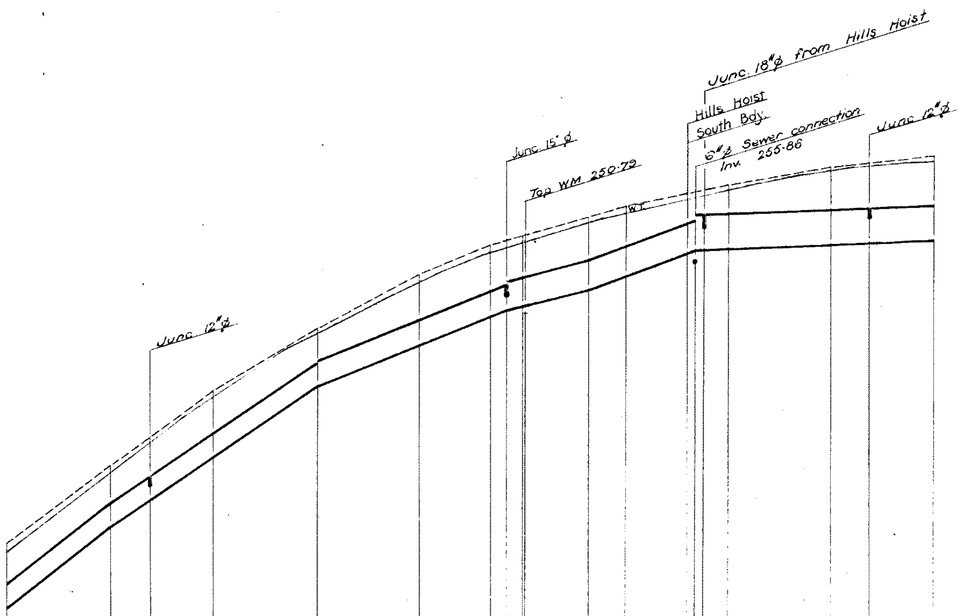
The management fee is paid into a reserve fund and is used to fund other Council projects which provide equivalent water quality improvement performance within the catchment.

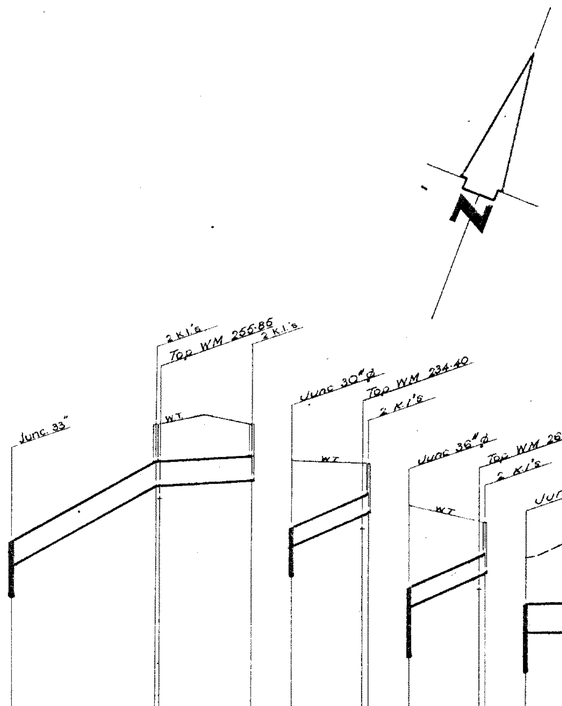
Pro rata reduction to the fee (if applicable) shall be determined using the following weightings, combined to provide a weighted average:

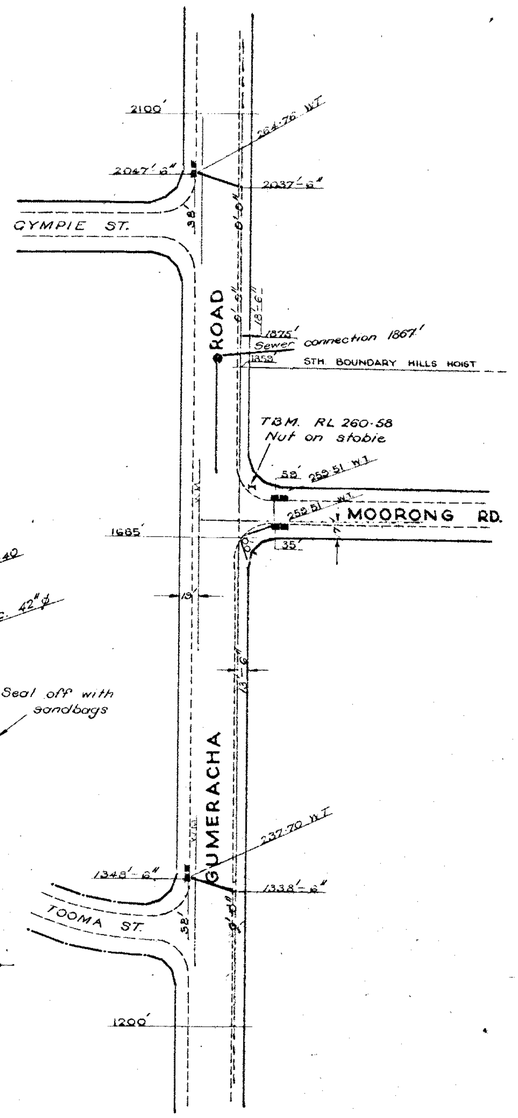
- Gross pollutant reduction (Gross Pollutant) = 25% of target load reduction
- Total Suspended solids (TSS) = 25% of target load reduction
- Total Nitrogen reduction (TN) = 25% of target load reduction
- Total Phosphorous reduction (TP) = 25% of target load reduction.

Note that if stormwater is proposed to discharge directly into a watercourse or receiving waters, then stormwater quality service level compliance is required, and the option of payment of a service charge is extinguished.

The final stormwater quality management fee will be determined on completion of the entire development and any previous overpayment or underpayment, as subsequently amended due to further staging works, will be refunded or collected.







DATUM 210·00

GRADE	30"ø 8·10%	30"ø 7·00%	33"ø 4·16%	36"ø 2·76%	36"ø 3·93%	42"ø 0·48%
DESIGN INVERT	221·29 229·30 232·00 236·90 243·30 247·46 250·37 250·82 251·40					
REF. LEVEL PEG	227·72 235·50 " 243·01 243·28 254·69 267·62 " "			Peg 1800 243·79	254·57 256·55 Peg 1860 257·32	
CUT TO DRAIN INV.	6·52 6·20 3·59 6·71 5·98 7·28 7·25 6·68 6·22			8·36	6·58 4·66 6·45	7·68 2·45 8·38
CHAINAGE	1200 1300 1336'6" 1400 1500 1600 1670 1685 1700 1765 1800 1855 1867 1875 1900 2000 2037'6" 2100					

Scale 1" : 80' ; 1" : 8'

DAT 240·00

GRADE	15"ø 11·46%	15"ø 1·00%
DESIGN INVERT	252·43 256·50 256·74	
REF. LEVEL PEG	261·70 " "	
CUT TO DRAIN INV.	5·13 1·12 5·88	
CHAINAGE	0·0 1685 35' 37' 65'	

1"=20' 1"=4'

DAT 220 DAT 250

GRADE	12"ø 4·46%	12"ø 4·60%	18"ø 0·20%
DESIGN INVERT	233·50 235·20	260·52 262·26	259·24 259·28
REF. LEVEL PEG	Peg 1300	Peg 2000	
CUT TO DRAIN INV.	2·00 0·35	4·85 3·37	
CHAINAGE	0'0" 1336'6" 38'	0'0" 2037'6" 38'	0'0" 1875' 18'6"

1"=40' 1"=4'

REV'N	DETAILS	REV'D	CHKD.	APVD.	DATE
3.	Connection to Hills Hoist added	J.C.T	G.J.V.R		5.3.70
2.	Rd. crossing at 2037'6" altered	J.C.T			20.12.66
1.	Drain, design, altered between 1765 - 2100'	J.C.T			20.12.66

DRAIN 3

O'SULLIVAN BEACH

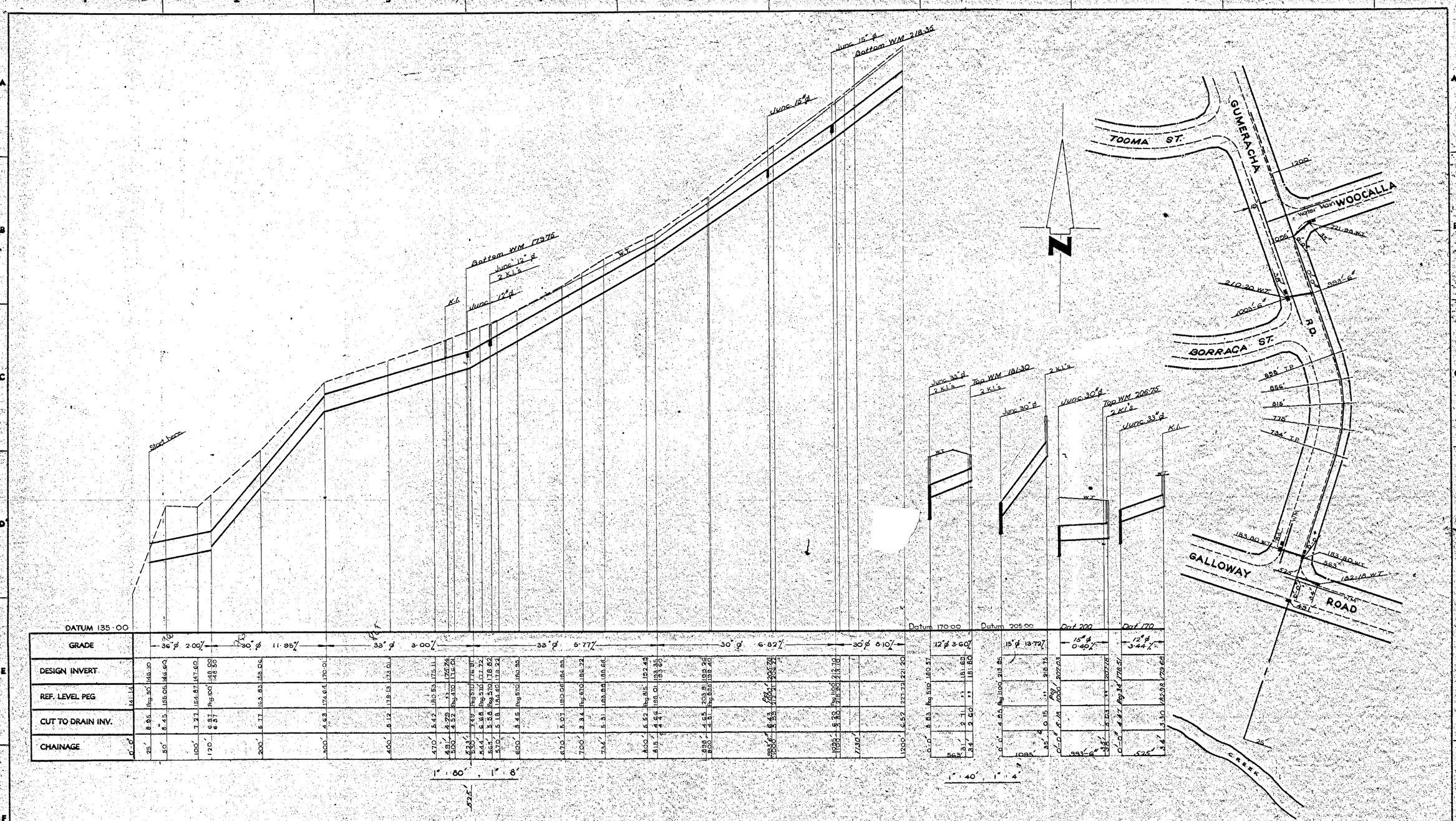
GUMERACHA ROAD

SOUTH AUSTRALIAN HOUSING TRUST

DESIGNED	L. FOWLER	14.11.66	DRAWING No.
DRAWN	G.J.V.R.	26.8.66	C.B. 30
CHECKED	J.C.T.	21.10.66	
APPROVED			
SCALE	As shown		

215

Onk000025.00



REV'N	DETAILS	REV'D	CHKD.	APVD.	DATE
1	12" ø connection at 525' added	J.Q.T	S.J.V.F		5.7.68.

DRAIN 3

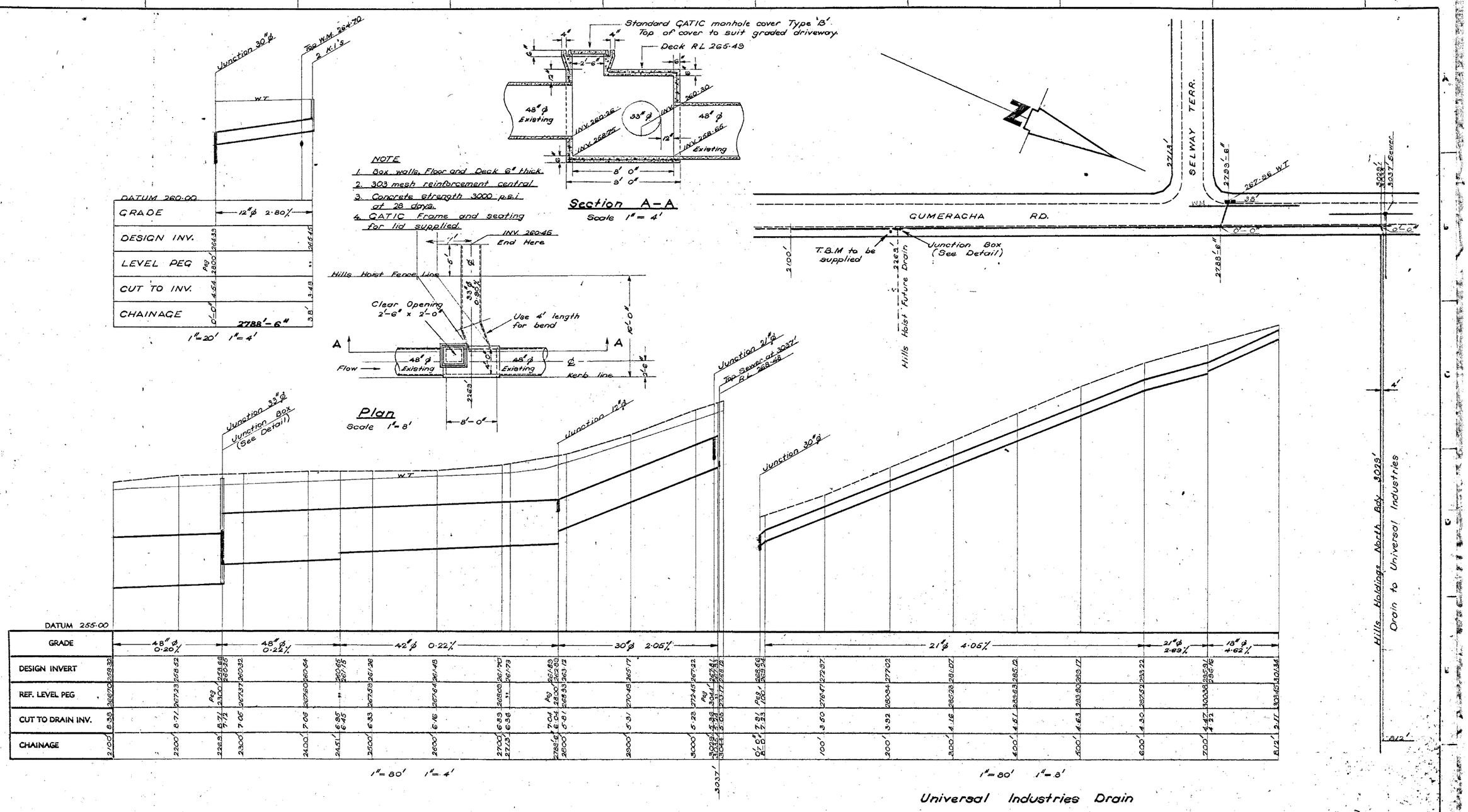
O'SULLIVAN BEACH

GUMERACHA ROAD

SOUTH AUSTRALIAN HOUSING TRUST

			DRAWING No.
DESIGNED	L. POWELL	14.11.66	C.B. 28
DRAWN	S.J.V.F.	8.8.66	
CHECKED	J.Q.T	21.10.66.	
APPROVED			
SCALE	As Shown		

2116



REV'N	DETAILS	REV'D	CHKD.	APVD.	DATE
4.	Box lid altered	J.C.T.			9.3.67
3.	Junction Box detail added	J.C.T.	L.F.		27.2.67
2.	Drain design of Universal Ind. altered between 700'–812'	J.C.T.	L.F.		20.12.66
1.	Drain design altered between 4.62' – 2788'-6"	J.C.T.	L.F.		20.12.66

O'SULLIVAN BEACH

DRAIN 3

Gumeracha Road and from Universal Industries

SOUTH AUSTRALIAN HOUSING TRUST

DESIGNED	L. Fawcett	14.11.66	DRAWING No.
DRAWN	J.C.T.	11.11.66	CB 32
CHECKED	E.J.V.P.	14.11.66	
APPROVED			
SCALE	AS SHOWN		

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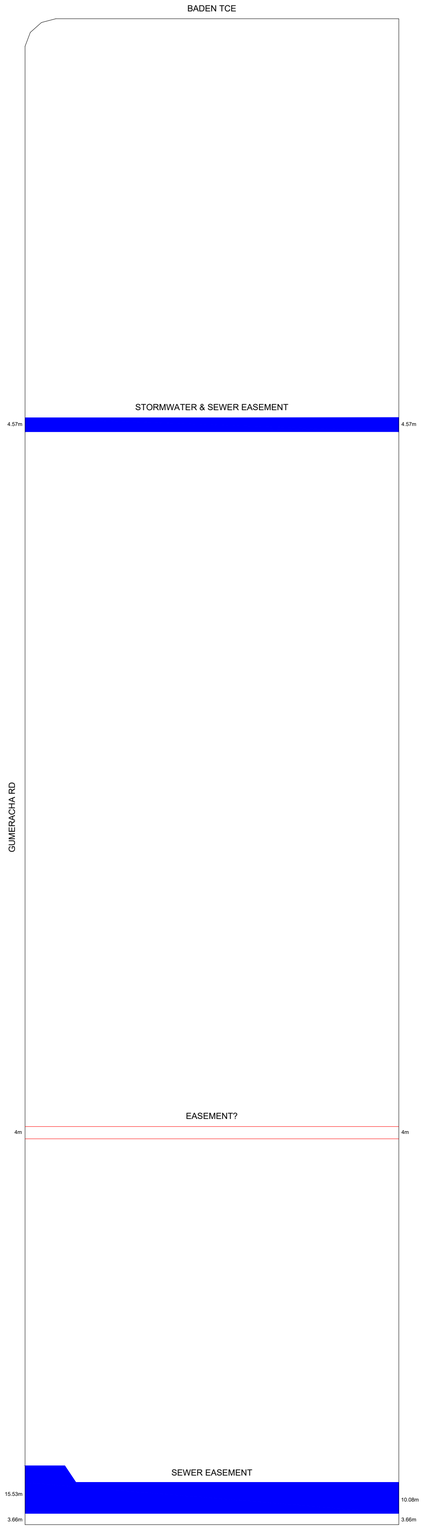
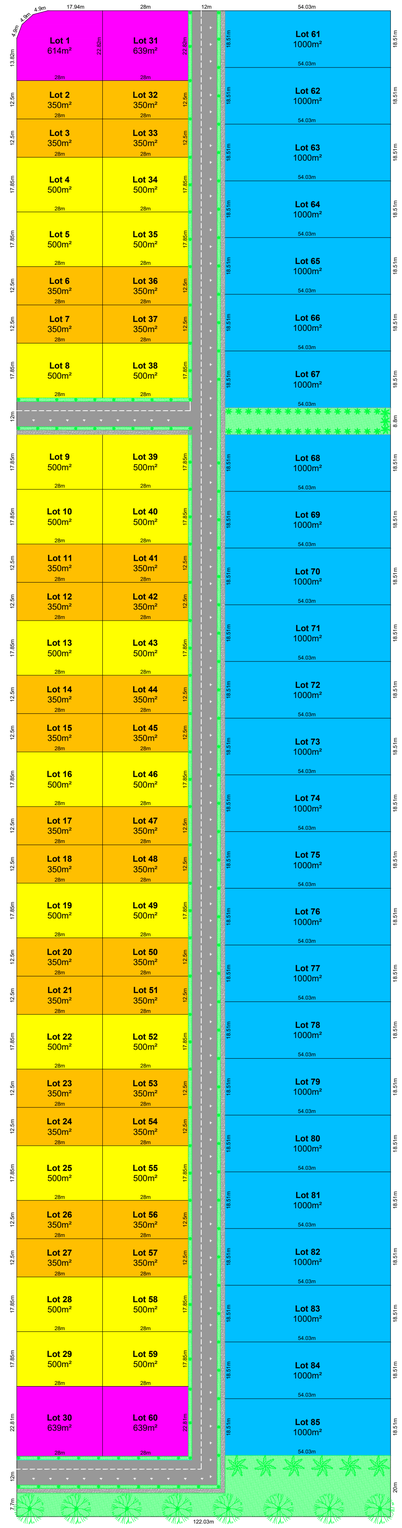


BLOCK SHOWING EASEMENTS



PROPOSED ALLOTMENTS

LOT SIZE	LOT DIMENSIONS	LOT QTY
350m²	12.5m x 28.0m	32
500m²	17.85m x 28.0m	24
614m²	22.82m x 28.0m	3
639m²	22.82m x 28.0m	1
1000m²	18.51m x 54.03m	25
TOTAL		85

PROPOSED ALLOTMENTS (GOOGLE MAPS OVERLAY)
NOT TO SCALE

PRELIMINARY

Rev	Description	Draw	Chk	App	Issue Date
A	PRELIMINARY ISSUE	NK			02.06.20

SCALE 1:1000 AT ORIGINAL SIZE

DO NOT SCALE DRAWING
DRAWING MUST BE PRINTED IN COLOUR

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AUSTRALIA
Phone: 1300 KEF CON
Email: contact@kefconsult.com
www.kefconsult.com

Drawn	N. KEFALIANOS
Checked	
Approved	
Scale at A1	1:1000
This drawing must not be used for construction unless signed as approved	

Client	-
Project	PROPOSED LAND DIVISION - O'SULLIVAN BEACH
Title	CORNER OF BADEN TCE & GUMERACHA RD O'SULLIVAN BEACH
Drawing No.	OSUL-SK-001
Revision	A
Original Size	A1

9. Appendix D – Infrastructure Assessment Report

mlei
CONSULTING ENGINEERS

BUILDINGS

LAND DIVISION

INFRASTRUCTURE

RESOURCES & INDUSTRIAL

DEFENCE

INFRASTRUCTURE SERVICES ASSESSMENT

Gumeracha Road, O'Sullivan Beach

Reference A2020 – 10390_B

21 May 2021

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Finance Lab

Project Reference: 2020-10390

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Report Revision History

Revision	Status	Date	Prepared by	Reviewed by
A	Draft	24.07.2020	MR	LG
B	Final	21.05.2021	MR	CRG

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1. INTRODUCTION

MLEI Consulting Engineers has been engaged by Finance Lab to prepare an Infrastructure Assessment to form a part of feasibility assessment in the due diligence period for the proposed residential subdivision development at Gumeracha Road, O'Sullivan Beach.

As part of the infrastructure service assessment MLEI has reviewed existing services assets and liaised with the relevant service authorities to determine any possible infrastructure capacity constraints and identify possible options for servicing this development where civil infrastructure can be supplied and or augmented for supply.

This report summaries the outcome and tables the possible options for servicing the development. It outlines the current and proposed site development, existing services infrastructure in the vicinity of the site and the extension or adjustments to authority services infrastructure required to service the proposed residential development.

Figure 1.0 – Subject Land included in DPA

The utilities that have been investigated as part of this report are as follows:

- Stormwater
- Potable water reticulation
- Sewer reticulation
- Telecommunication
- Electrical supply (SAPN)
- Traffic
- Gas supply

2. SITE DESCRIPTION

Finance Lab requested MLEI to undertake an Infrastructure services assessment to form part of a feasibility investigation based on a future residential subdivision development of the subject land shown in Figure 1.0.

The overall development site is located at 36-70 Gumeracha Road, O'Sullivan Beach, consisting of a single greenfield site with a total area of 6.00 hectares. The site is currently vacant and unused and is located within an Industry zone to be repurposed for 102 residential allotments.

The development site is bounded by Gumeracha road to the west, Baden road to the north and residential properties along the south. The eastern boundary is flanked by industrial developments.

It is intended that the site be developed comprising of low to medium density housing of varied form. The site is fairly steep and typically grades 3.5% approximately to the south west. The levels along the eastern boundary of the site are in the vicinity of 53.0m and along the western boundary of the site are 49.00m

An existing drainage easement runs parallel to Baden road approximately 106m south of Baden road. This easement is vested to SA Water for a 225diameter sewer main. Refer SA Water Waste water drawings.

There are a few existing mature trees along Gumeracha road and along the southern boundary adjoining the existing houses.

Gumeracha road is kerbed along the length of the site and fenced from approximately 35m south of Tara terrace intersection up to the southern end of the site. There are three driveway cross overs, one at the Intersection of Selway terrace and two approximately 30m and 40m south of Tara Terrace.

Baden terrace is kerbed along the complete length of proposed site. There is no visible access / driveway crossover for this parcel of land along Baden terrace

3. REFERENCES

The preliminary Infrastructure Assessment has been based on the following:

- Conceptual development plan provided by Finance Lab attached in Appendix A;
- Correspondence with City of Onkaparinga attached in Appendix B;
- Correspondence with SA Water attached in Appendix C;
- Correspondence with NBN attached in Appendix D;
- Correspondence with APA Group attached in Appendix E;
- Dial before you dig (DBYD) investigation attached in Appendix F.

4. INFRASTRUCTURE ASSESSMENT

4.2 Stormwater Drainage Infrastructure

The stormwater drainage system for the project is based on preliminary correspondence with the City of Onkaparinga Council and a dial before you dig (DBYD) investigation, refer appendix B & F, and a desktop study undertaken by MLEI.

4.2.1 Existing Infrastructure

The existing stormwater drainage system consists of a stormwater concrete pipe along the eastern side of Gumeracha Road, ranging from a depth of 1.22 at Baden terrace intersection to a depth of 2.32m south of Gympie street.

There are approximately nine pits along Gumeracha road of which an existing pit near the intersection of Gumeracha Road and Selway Terrace at which point the stormwater pipe size increases to 1050mm in diameter. Stormwater plans can be found in Appendix B with Council correspondence.

4.2.2 City of Onkaparinga Council Criteria

Refer to City of Onkaparinga Stormwater Management Design Guide, found on Council's website for comprehensive details on Council's stormwater requirements. In summary relevant to this development:

- The peak flow rate leaving the development should not exceed the pre development flow rates for minor (20% AEP) and major (1% AEP) system storm events. Detention basin shall be designed so that peak flow from the proposed development up to 1%AEP does not exceed the existing peak flow from the site.
- Pre-development flow should be calculated based on the runoff coefficient of 0.25.

4.2.3 Proposed Infrastructure

Each allotment is expected to discharge to the street drainage network. Allotments falling to the back will discharge to proposed connections at the back. The stormwater from these easements and the roads is required to be collected and detained in order to restrict the post-development flows. The proposed detention systems can be investigated into various concepts of viz. underground culverts, partly underground and partly on the ground (reserve spaces), all above ground. The feasibility of each option depends on various factors. Inverts of discharge points and its impact on downstream properties, council's acceptance of underground detention, maintenance requirements and schedules, hydraulic grades of downstream system, cost, safe access and community safety etc.

4.2.4 Required Works

The anticipated stormwater works are as follows:

- Allotments facing Gumeracha Road or Baden Terrace are to discharge to the existing road through kerb outlets which is finally captured by existing SEP's and drains into council's infrastructure. This may require addition of SEP's along the roads to keep the 100year stormwater depth to a minimum acceptable.
- Allotments facing Gumeracha Road or Baden Terrace are to discharge through a direct connection into the underground system. A further assessment of existing systems capacity to cater for additional loading will be required.
- In a kerb outlet scenario, we can engineer to direct all stormwater from existing properties back into the development detention basin. Treat and detain before discharge into council's existing Infrastructure if the existing system is incapable of handling additional loads.
- For the internal allotments, the major 100-year storm is to be restricted to the pre-development conditions.
- On-site stormwater quality treatment will be required, which can be achieved by incorporating a proprietary unit such as an Ecosol Storm Pit, Stormceptor and litter baskets into the stormwater network. Due to the limited space available, the use of on surface treatment systems such as vegetated or bio-retention swales / basins are not practical.

4.2.5 Anticipated Costs

The anticipated stormwater works are as follows:

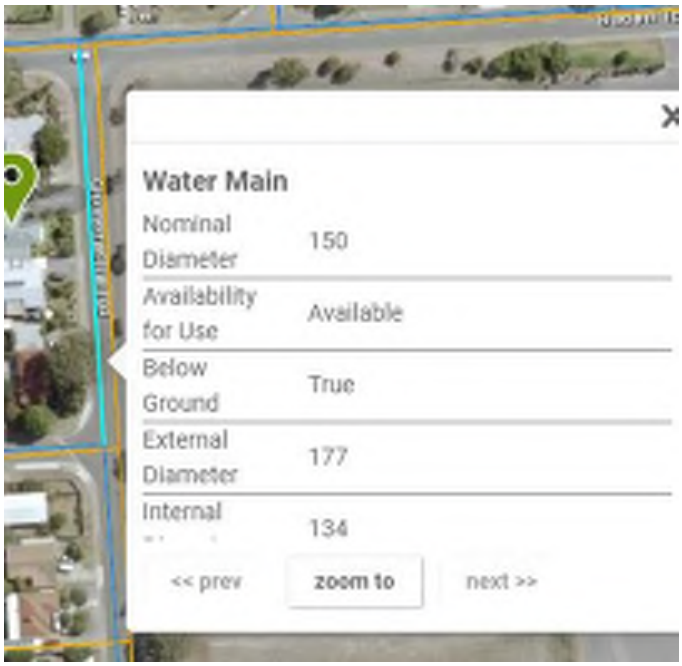
- If the proposed development adopts the option of utilising individual kerb outlets, there are minimum construction associated costs for minor works such as the required number of driveway crossovers to meet Council standards and any other service connections; however cost associated with direct discharge to council system (no detention) / contribute to upgrades of downstream system will require further discussions and negotiations with council.
- Council may request a cost contribution for properties fronting existing roads towards water quality and detention.
- If the proposed development adopts the option of providing direct connection into the underground infrastructure, a portion of the construction works will likely include the extension of the existing stormwater infrastructure and reinstatement of the road which Council may seek a bond amount on. This amount is relative to the construction cost of works within the public domain and held for a duration of 12 months.

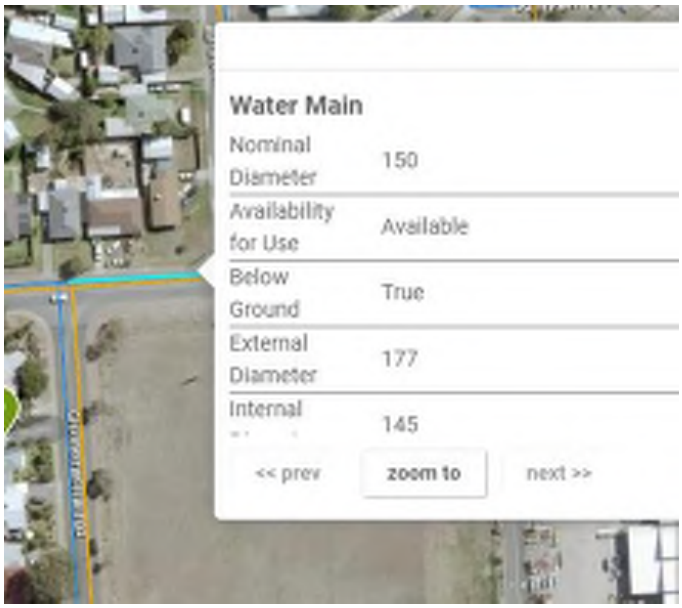
4.3 Potable Water Supply

The potable water reticulation works for the project is based on DBYD information, refer appendix F, advice from SA Water, refer appendix C, and a desktop study undertaken by MLEI.

4.3.1 Existing Infrastructure

The existing water network consists of a DN150 AC pipe along Gumeracha Road and a DN150 CICL Water Main along Baden Terrace. Exiting houses west of Gumeracha and north of Baden are feed by these mains.





4.3.2 Proposed Infrastructure

The Aqua map study and advice from SA Water indicates these mains are available for supply and can be utilised. Water main into the land development and individual connections to each allotment along existing road are proposed to be supplied by this Infrastructure main via “Tees” at proposed intersections and looping them back to the existing main according to SA Water requirements.

SA Water advised the following infrastructure requirements and provided figure 2.0:

<u>Distribution main</u>

- Construct a new DN150 branch and main off the Ex.150 AC main in Gumeracha Rd, shown at A on Figure 2.0 to service development. NOTE: SA Water to pay for upsizing of the DN150 main from DN100.
- Construct a new DN150 branch and main off the Ex.150 AC main in Gumeracha Rd, shown at B on Figure 2.0 to service development.

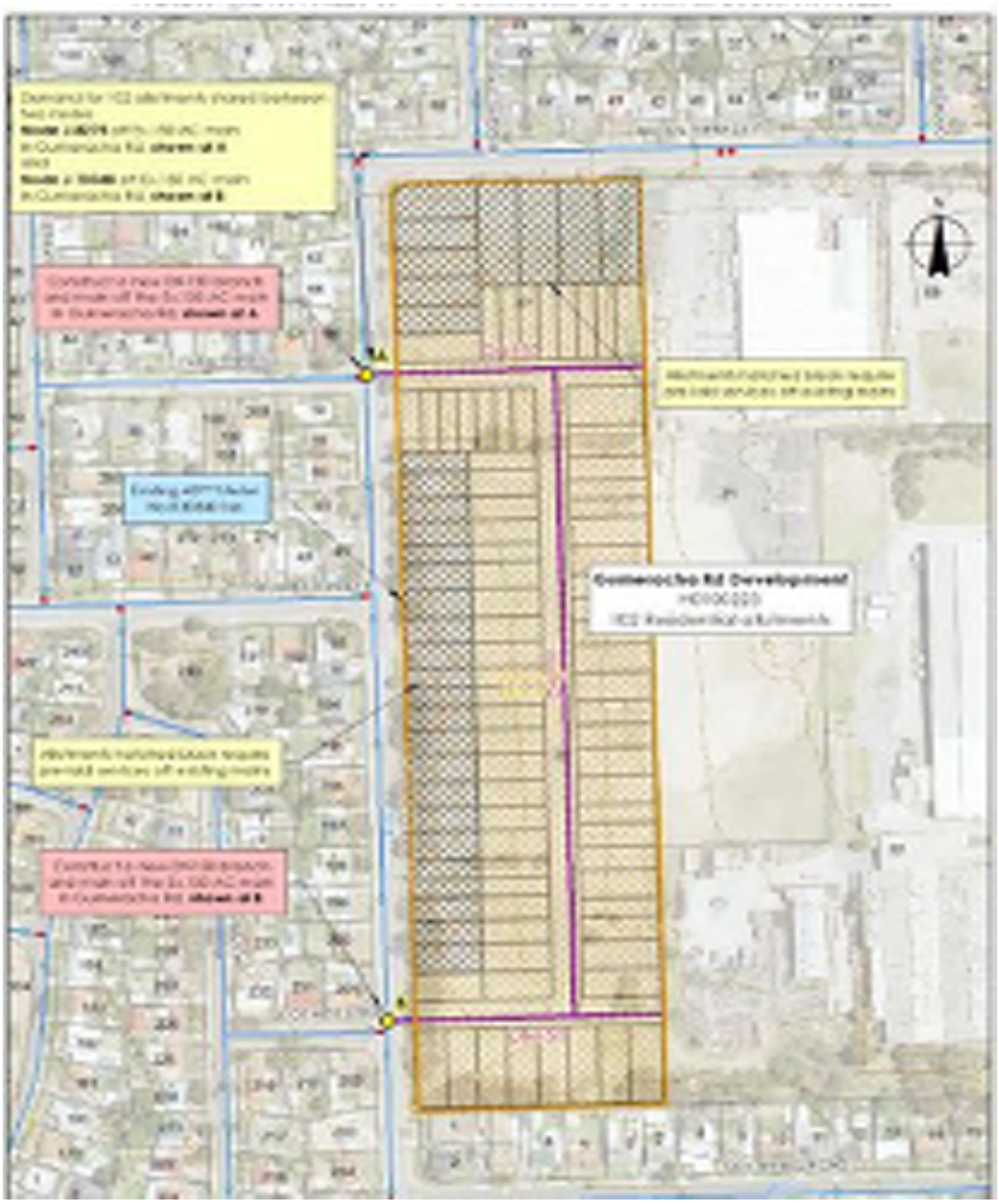


Figure 2.0 - SA Water proposal

4.3.3 Required Works

The anticipated potable water supply reticulation main and connections are as follows:

- The development can connect directly into the existing DN150 water mains available;
- A tee at proposed intersections with all fittings and fixtures (Stop valves, tees & flanges) will be required. This will also include civil works for trenches and any dog legs if required.
- All new connections for allotments facing Gumeracha road and Baden terrace will require traffic management and civil works for trenches and asphalting along these trenches are part of these works.

4.3.4 Anticipated Costs

- The developer will be responsible for the full cost of internal mains, connections to the existing mains and a new DN150 branch; and
- Standard SA Water fees and charges would be applicable for the connection to the external main.
- SA Water will be responsible for upsizing the existing DN100 main to a DN150 main.

4.4 Sewer Infrastructure

The sewer reticulation works for the project is based on DBYD information, refer appendix F, advice from SA Water, refer appendix C, and a desktop study undertaken by MLEI.

4.4.1 Existing Infrastructure

A 150 along Baden terrace is seen to be available on SA Water Infrastructure network. The existing gravity sewerage network consists of a DN150 running south from the Intersection of Baden Terrace up to the easement south of Tara street. A DN225 VC pipes that runs within the allotment in an easement and constructed at a grade of approximately 3.0% flowing towards the existing maintenance hole on Gumeracha Road. The sewer infrastructure increases to a DN300VC at the maintenance hole, heading south along Gumeracha Road at a grade of 1.7%and Baden Terrace. Refer images below demonstrating network availability.

Existing DN225 VC within site

Existing DN300 VC on Gumeracha Road

4.4.2 Proposed Infrastructure

Provide sewer connections from each allotment fronting Gumeracha road and Baden terrace to be connected into the existing infrastructure. Realign existing sewer main in easement and propose a new easement location.

Provide a new Maintenance shaft / maintenance hole at proposed road intersection and lay off internal sewer from this point.

Based on the investigation carried out by SA Water, sewage services are available to the proposed development subject to the following:

- The construction of the sewer infrastructure must be in accordance with SA Water Network Infrastructure Standards.
- That any of the existing sewage mains currently traversing the site continue to service upstream connections/sewage Customers, and that any modifications that may result from the proposed development comply with SA Water's network infrastructure standard, including accessibility requirements.

To note the final reticulated network's layout and location of discharge points to be determined by the Reticulations Network Team (part of SA Water's Engineering Services group) as discharge points were selected for modelling purpose only.

The above advice is based upon a desk top investigation and modelling, whilst SA Water endeavours to encapsulate all of the works potentially incurred to service the above mentioned proposal, there is a possibility that requirements may vary upon a more thorough investigation

being conducted, alterations to the number of allotments being created, the number of fixture units, peak flows and/or a change in the nature of development will have implications upon this advice provided and a new investigation will be required. Should everything remain the same this advice is valid for 12 months.

4.4.3 Required Works

The anticipated sewer reticulation main and connections are as follows:

- It is anticipated that the development can connect directly into the existing sewer mains available; and
- It is expected that a network analysis undertaken by SA will determine that the existing infrastructure has sufficient capacity to support the development.

4.4.4 Anticipated Costs

- The developer will be responsible for the full cost of internal mains and connections to the existing mains;
- Standard SA Water fees and charges would be applicable for the connection to the external main; and
- All new connections for allotments facing Gumeracha road and Baden terrace will require traffic management and civil works for trenches and asphalting along these trenches are part of these works.
- The developer will be responsible for the full cost of internal mains and connections to the existing mains;
- Costs associated with the extension of the sewer main is subject to a further design to be prepared by SA Water upon lodgement of a formal application.

4.5 Telecommunication Supply

The telecommunication works for the project is based on preliminary correspondence with NBN and DBYD information, refer appendix D & F, respectively, and a desktop study undertaken by MLEI.

4.5.1 Existing Infrastructure

NBN Co have confirmed that they will be the telecommunications provider for the subject area. The site is located within the NBN service available area and currently there are no pits seen along existing road supplying to the proposed site.

4.5.2 Proposed Infrastructure

Connect NBN to each allotment.

4.5.3 Required Works

The anticipated telecommunication supply works are as follows:

- NBN have confirmed that there is sufficient capacity to service the development;
- No backhaul charges will apply if the development is serviced by the existing technology Fibre to the Node (FTTN);

4.5.4 Anticipated Costs

- Standard NBN fees and charges would be applicable for the connection to the existing infrastructure.
- Design and construct of the pit and pipe design.

4.6 Gas Supply

The gas supply for the project is based on DBYD information, refer appendix F, and a desktop study undertaken by MLEI.

4.6.1 Existing Infrastructure

The existing APA infrastructure near the development shows a high pressure main of 110 Kpa P8 in 200 CI along Baden Terrace and a 110Kpa P8 in 150 CI along Gumeracha road. It is buried at a depth of 0.8m – 1.3m from the surface and around 0.8m-1.2m from the existing property boundaries along north of Baden terrace and west of Gumeracha road. Refer DBYD results in appendix F.

4.6.2 Proposed Infrastructure

The proposed infrastructure is to provide individual gas connections to each allotment.

4.6.3 Required Works

Civil works trenches are to be prepared and notified to APA to undertake works

4.6.4 Anticipated Costs

- APA usual do not seek full capital cost on any new gas infrastructure to be funded by the developer, however once more information is available we can provide further comments,
- Standard APA fees and charges would be applicable for the connection to the existing infrastructure.

4.7 Electrical Supply

Electrical supply for this project is based on preliminary investigation on available map viewing software and DBYD information, refer appendix F, and a desktop study undertaken by MLEI.

4.7.1 Existing Infrastructure

There is an existing high voltage overhead 11kva supply along Baden terrace. There is another 11kva high voltage overhead line 130m north of Gympie. An 11kva is seen on offset arm along Gumeracha road. The same is not seen on Location viewer and not received in dial before you dig. We will await further clarification from SAPN. The closest substation is the port stanvac generator station or the Noarlunga sub station.

Refer snip of SA MapViewer below for existing SAPN infrastructure near the proposed development site.

4.7.2 Proposed Infrastructure

We assume the existing 11kva is sufficient to supply electricity to this site. Internal transformers will be required, approximately 3 pad mount transformers are anticipated for this development.

4.7.3 Required Works

The anticipated SAPN supply works are to provide transformers and connect to the existing 11kVa power network.

4.7.4 Anticipated Costs

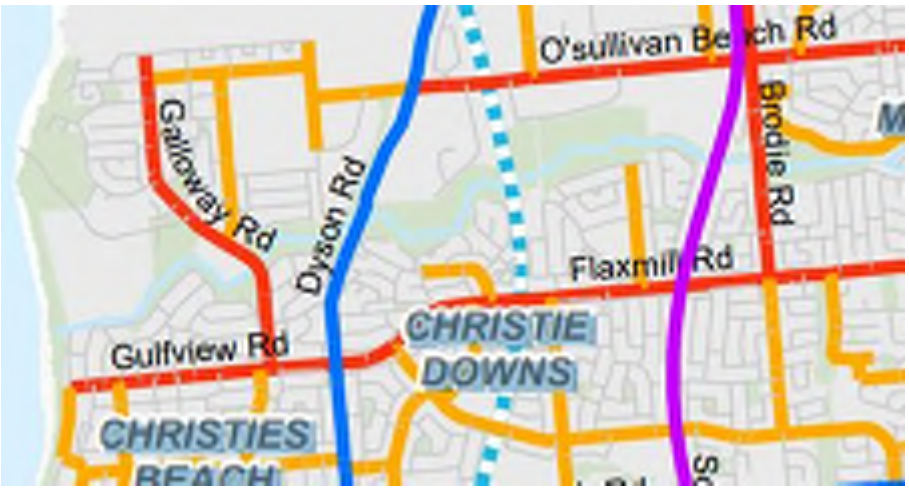
- SAPN will provided augmentation charges and contestable fees to the developer on application of which 60% are rebated back to the developer upon completion.
- Standard SAPN fees and charges would be applicable for the connection to the existing infrastructure.

4.8 Traffic

The high-level traffic assessment is based on preliminary conversations with Council, Google aerial imagery, and the conceptual development plan, refer appendix A.

4.8.1 Existing Infrastructure

The location of the site is under the care and control of the City of Onkaparinga. Gumeracha Road and Baden Terrace are both categorised as collector roads under Council's road network plan. Refer extract from road network plan hierarchy.



4.8.2 Local government Requirements

Council's road network plan can be found online for a comprehensive outline of their requirements. Correspondence with Council resulted in the following information:

- Council determines the width of the footpath based on the type of road adjacent.
  - 1.8 meters for arterial, and sub-arterial roads – offset from the back of the kerb on both side of the road
  - 1.5 meters for collector and distributor roads – offset from the back of the kerb on both side of the road – Based on this, we require a provision of 1.5m plain concrete path on eastern side of Gumeracha Rd (between Moorong Road and Baden Terrace) and 1.5m plain concrete path at southern side of Baden Terrace (between Gumeracha Road and Morrow Rd)
  - 1.2 meters for local roads – offset or at the back of the kerb on one side of the road
- DDA Compliant kerb ramps
  - Kerb ramps to be plain concrete with Terracotta Cautional tactile indicators to the full width.
  - It is preferable for kerb ramps to be installed at TP with clear visibility on both sides – landing to match the level of footpath
- Consideration must be given to the existing congestion at the roundabout of Galloway and Gumeracha Roads during school peak periods.

- Internal roads of 7.2m minimum width with 150mm upright kerbing and inverts to allow property access.

4.8.3 Proposed Works

Internal sealed road network plan to suit allotments and traffic control in accordance with Council requirements. Traffic volumes will be based on an assumed nine (9) vehicle trips per allotment per day.

4.8.4 Required Works

The anticipated traffic works are as follows:

- Construct a minimum 14.2m local road reserve with minimum 7.2m road width and 1.2m footpath width.
- Sight distances at each access driveway should achieve a 45m or better in order to meet the minimum requirements of Stop Sight Distance in accordance with Australian Standards.

4.8.5 Anticipated Costs

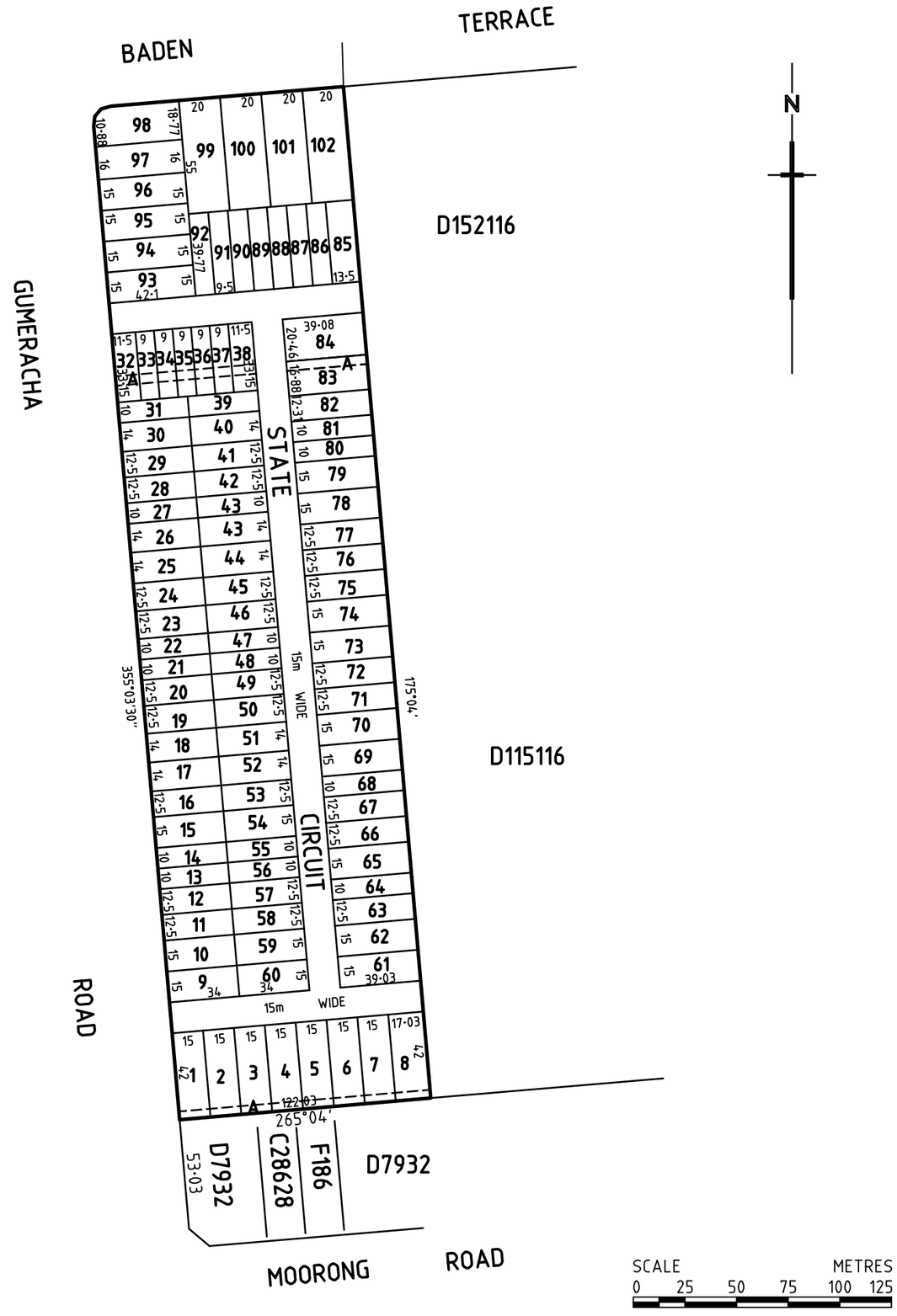
- All costs associated with traffic movements is dependent on the final layout of the development and would form part of the construction works incorporated in design of roads, landscape along the verge and possibly fence heights at intersection.

5. EXCLUSIONS

Items not considered in the Infrastructure services assessment are as follows:

- Fees associated with works regarding surveying, engineering, planning and landscaping;
- Demolition Works;
- Geotechnical investigation into the existing soil conditions and soil type to determine its suitability for construction;
- Site remediation from contaminants, soil assumed to be free of contaminants;
- Investigation into the existing water table depth and any associated impacts;
- Earthworks;
- Recycled water infrastructure;
- Physical investigation of existing services to confirm information supplied by authorities and assumptions outlined within this report;
- Landscaping or entry statement works; and

OPTION 4



DEVELOPMENT NUMBER:

CONCEPT

DIVISION TYPE: TORRENS TITLE

VERSION: 29/06/2020

SHEET 1 OF 1 SHEETS

PLAN OF DIVISION

ALLOTMENT 20 IN D115116
ALLOTMENT 67 IN F152643

TITLE REFERENCE(S):
CT6136/727
CT6197/337

HUNDRED: NOARLUNGA
AREA: OSULLIVAN BEACH
COUNCIL: CITY OF ONKAPARINGA

COUNCIL ZONE: RESIDENTIAL
COUNCIL POLICY AREA:

TOTAL SITE AREA: 5·998ha

NO. EXISTING ALLOTMENT(S): 2
NO. PROPOSED ALLOTMENT(S): 102
NO. ADDITIONAL ALLOTMENT(S): 99

MAP REF: 6527-15-G

SITE ADDRESS: GUMERACHA ROAD
BADEN TERRACE
O'SULAVANS BEACH

STATE SURVEYS
465B SOUTH ROAD, KESWICK SA 5035
TELEPHONE: 8293 2939
FACSIMILE: 8293 2949
EMAIL: planning@statesurveys.com.au

REFERENCE: 20289 DRAWN BY: AP

7. Appendix B – Correspondence with Council

Matthew Reade

From: Jude Nirmalaraja <Jude.Nirmalaraja@onkaparinga.sa.gov.au>
Sent: Thursday, July 9, 2020 10:37 AM
To: Leanne Gawde
Cc: Dawyd Pinter
Subject: RE: 36-70 Gumeracha road, O'Sullivan Beach SA
Attachments: ONKARD201010_03_VERTIPLAN002_00031.pdf; ONKARD201010_03_VERTIPLAN002_00032.pdf; ONKARD201010_03_VERTIPLAN002_00033.pdf; OSUL-SK01-RA.pdf

Hi Leanne,

Sorry for the late in responding to your email. I have attached the existing drainage drawings in this vicinity.

For the new residential development, predevelopment flow should be calculated based on the runoff coefficient of 0.25.

Regards,

Jude Nirmalaraja
Senior Stormwater Engineer
Technical Services
Ph: 8384 0168
Mob: 0404 855 005
Website: www.onkaparingacity.com

ONKAPARINGA

From: Leanne Gawde <lgawde@mlei.com.au>
Sent: Thursday, 25 June 2020 11:43 AM
To: Jude Nirmalaraja <Jude.Nirmalaraja@onkaparinga.sa.gov.au>
Subject: 36-70 Gumeracha road, O'Sullivan Beach SA

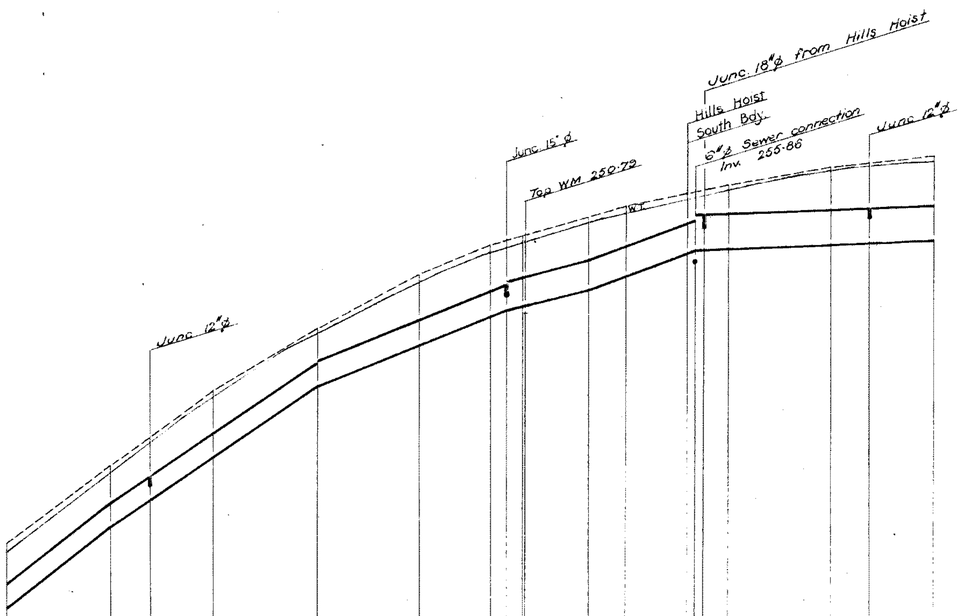
Hi Jude,

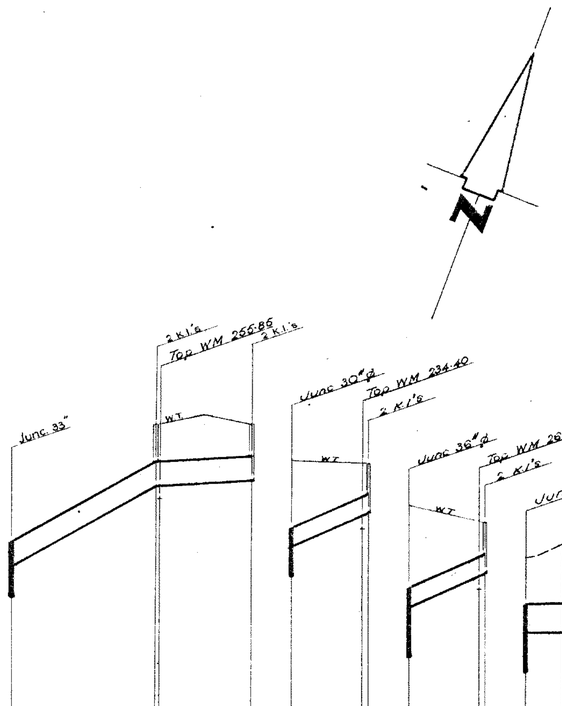
We are undertaking a feasibility assessment of the attached land division. There is an existing 1050 dia pipe on the southern end of the site on Gumeracha road. Can you please advise any specific criteria's required for stormwater. This is in due diligence period hence your prompt attention is greatly appreciated

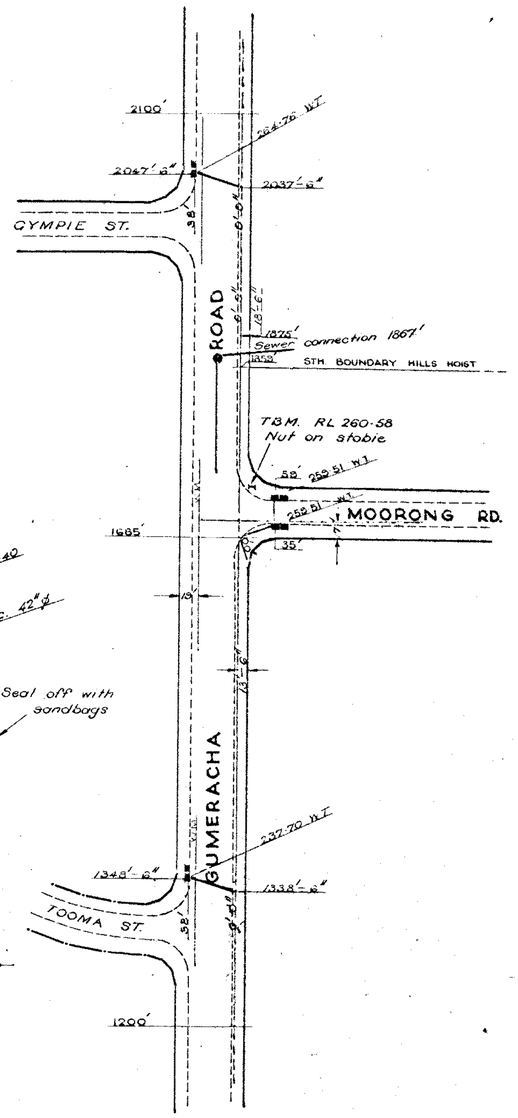
Kind regards
Leanne Gawde
Land Development Lead / Project Manager

mlei
CONSULTING ENGINEERS

MLEI Consulting Engineers







DATUM 210·00

GRADE	30"ø 8·10%	30"ø 7·00%	33"ø 4·16%	36"ø 2·76%	36"ø 3·93%	42"ø 0·48%
DESIGN INVERT	221·29 229·30 232·00 236·90 243·30 247·46 250·37 250·82 251·40					
REF. LEVEL PEG	227·72 235·50 " 243·01 243·28 254·69 267·62 " "			Peg 1800 243·79	254·57 256·55 Peg 1860 257·32	
CUT TO DRAIN INV.	6·52 6·20 3·59 6·71 5·98 7·28 7·25 6·68 6·22			8·36	6·58 4·66 6·45	7·68 2·45 8·38
CHAINAGE	1200 1300 1336'6" 1400 1500 1600 1670 1685 1700 1765 1800 1855 1867 1875 1900 2000 2037'6" 2100					

Scale 1" : 80' ; 1" : 8'

DAT 240·00

GRADE	15"ø 11·46%	15"ø 1·00%
DESIGN INVERT	252·43 256·50 256·74	
REF. LEVEL PEG	261·70 " "	
CUT TO DRAIN INV.	5·13 1·12 5·88	
CHAINAGE	0·0 1685 35' 37' 65'	

1"=20' 1"=4'

DAT 220 DAT 250

GRADE	12"ø 4·46%	12"ø 4·60%	18"ø 0·20%
DESIGN INVERT	233·50 235·20	260·52 262·26	259·24 259·28
REF. LEVEL PEG	Peg 1300	Peg 2000	
CUT TO DRAIN INV.	2·00 0·35	4·85 3·37	
CHAINAGE	0'0" 1336'6" 38'	0'0" 2037'6" 38'	0'0" 1875' 18'6"

1"=40' 1"=4'

REV'N	DETAILS	REV'D	CHKD.	APVD.	DATE
3.	Connection to Hills Hoist added	J.C.T	G.J.V.R		5.3.70
2.	Rd. crossing at 2037'6" altered	J.C.T			20.12.66
1.	Drain, design, altered between 1765 - 2100'	J.C.T			20.12.66

DRAIN 3

O'SULLIVAN BEACH

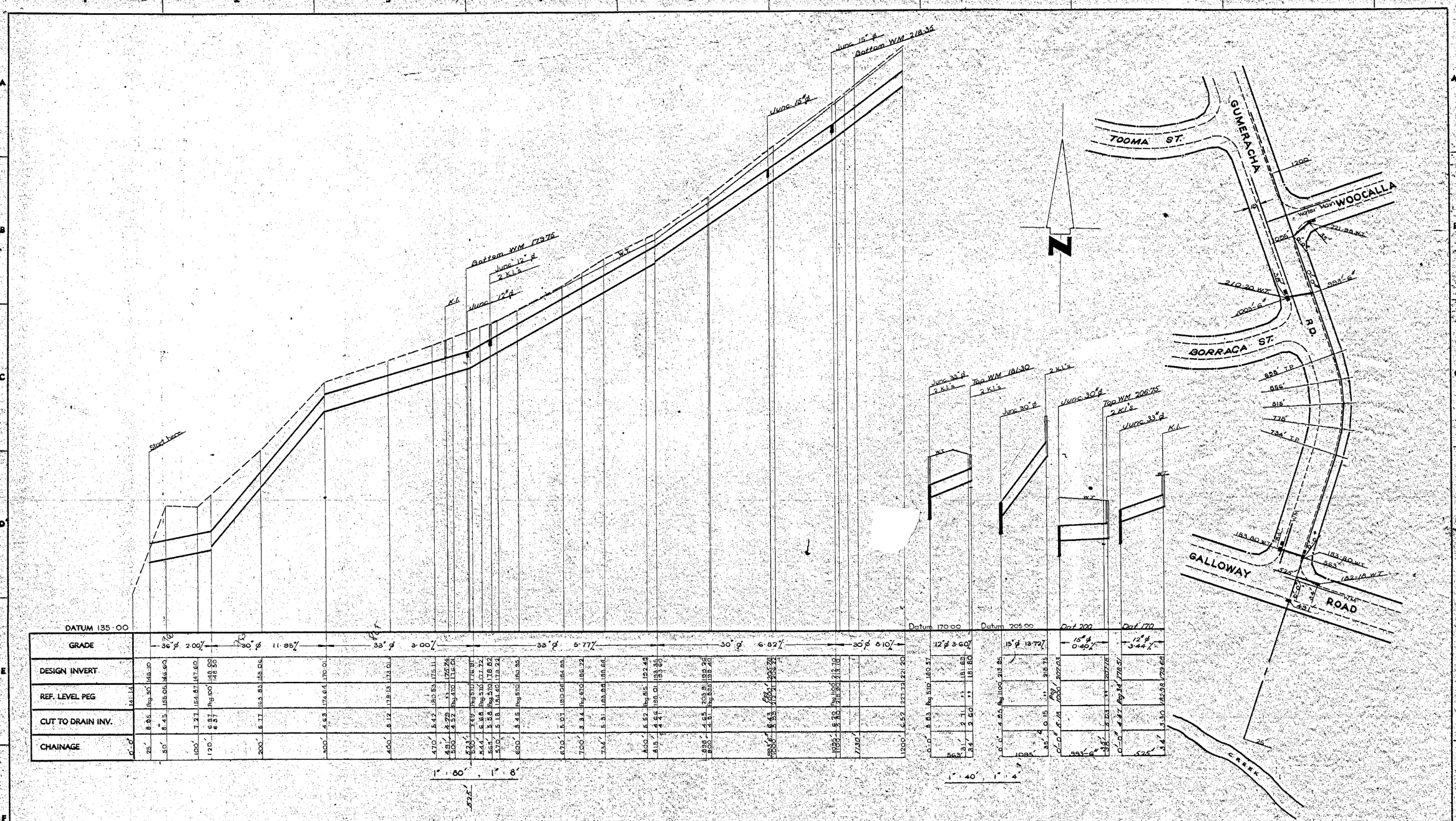
GUMERACHA ROAD

SOUTH AUSTRALIAN HOUSING TRUST

DESIGNED	L. FOWLER	14.11.66	DRAWING No.
DRAWN	G.J.V.R.	26.8.66	C.B. 30
CHECKED	J.C.T.	21.10.66	
APPROVED			
SCALE	As shown		

215

Onk000025.00



REV'N	DETAILS	REV'D	CHKD.	APVD.	DATE
1	12" ø connection at 525' added	J.Q.T	S.J.V.F		5.7.68.

DRAIN 3

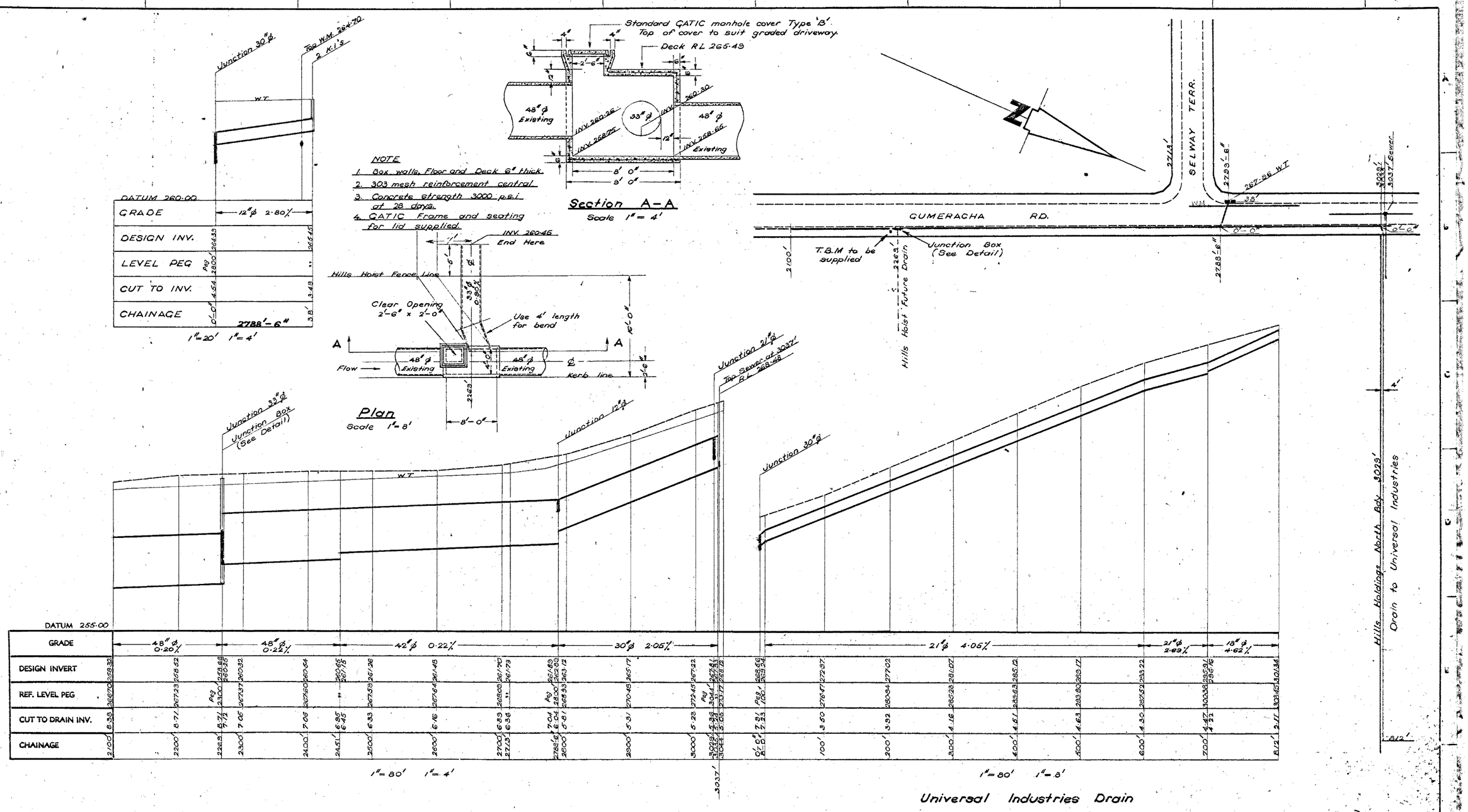
O'SULLIVAN BEACH

GUMERACHA ROAD

SOUTH AUSTRALIAN HOUSING TRUST

			DRAWING No.
DESIGNED	L. POWELL	14.11.66	C.B. 28
DRAWN	S.J.V.F.	8.8.66	
CHECKED	J.Q.T	21.10.66.	
APPROVED			
SCALE	As Shown		

2116



REV'N	DETAILS	REV'D	CHKD.	APVD.	DATE
4.	Box lid altered	J.C.T.			9.3.67
3.	Junction Box detail added	J.C.T.	L.F.		27.2.67
2.	Drain design of Universal Ind. altered between 700'–812'	J.C.T.	L.F.		20.12.66
1.	Drain design altered between 4.62' – 2788'-6"	J.C.T.	L.F.		20.12.66

O'SULLIVAN BEACH

DRAIN 3

Gumeracha Road and from Universal Industries

SOUTH AUSTRALIAN HOUSING TRUST

DESIGNED	L. Fawcett	14.11.66	DRAWING No.
DRAWN	J.C.T.	11.11.66	CB 32
CHECKED	E.J.V.P.	14.11.66	
APPROVED			
SCALE	AS SHOWN		

Onk000027.00

Matthew Reade

From: Leanne Gawde
Sent: Friday, June 26, 2020 2:18 PM
To: Callum Sleep
Cc: Dawyd Pinter
Subject: 36-70 Gumeracha road, O'Sullivan Beach SA

Thanks Callum,

The below is sufficient in terms of roads. Any specific requirement for stormwater? I am looking at discharging to the 1050dia on Gumeracha road. Appreciate your response

Regards
Leanne

From: Callum Sleep <Callum.Sleep@onkaparinga.sa.gov.au>
Sent: Friday, 26 June 2020 1:54 PM
To: Leanne Gawde <lgawde@mlei.com.au>
Cc: Dawyd Pinter <Dawyd.Pinter@onkaparinga.sa.gov.au>
Subject: RE: 36-70 Gumeracha road, O'Sullivan Beach SA

Good afternoon Leanne

My footpath planner colleague has the following to say,
"Council determines the width of the footpath based on the type of road adjacent.

- 1.8 meters for arterial, and sub-arterial roads – offset from the back of the kerb on both side of the road
- 1.5 meters for collector and distributor roads – offset from the back of the kerb on both side of the road – Based on this, we require a provision of 1.5m plain concrete path on eastern side of Gumeracha Rd (between Moorong Rd and Baden Tce) and 1.5m plain concrete path at southern side of Baden Tce (between Gumeracha Rd and Morrow Rd)
- 1.2 meters for local roads – offset or at the back of the kerb on one side of the road

DDA Compliant kerb ramp

- Kerb ramps to be plain concrete with Terracotta Cautional tactile indicators to the full width.
- We prefer the kerb ramps to be installed at TP with clear visibility on both sides – landing to match the level of footpath

"
from a roads perspective we will require

consideration given to the existing congestion at the roundabout of Galloway and Gumaracha Rds during school peak periods.
internal roads of 7.2m minimum width with 150mm upright kerbing and inverts to allow property access.

our road network plan available at,
http://archive.onkaparingacity.com/onka/council/policies_strategies/supporting_strategies_plans/road_network_plan.jsp
should give you all the details of what we require.
For further information please refer to City of Onkaparinga's Technical Services Standard Details. If you don't have a copy you can obtain it by contacting at mail@onkaparinga.sa.gov.au or phone (08) 8384 0666.

regards
Callum

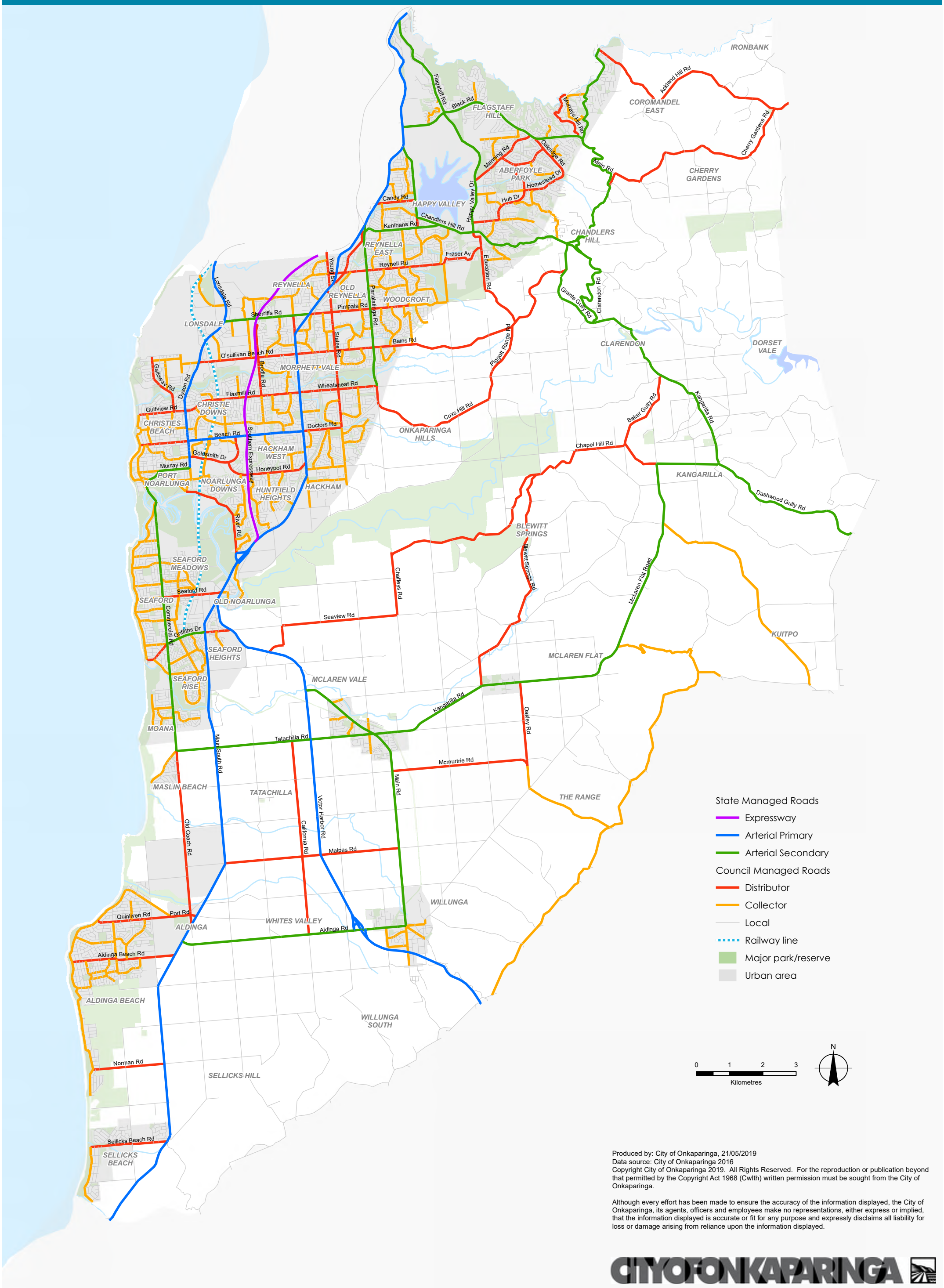
From: Leanne Gawde <lgawde@mlei.com.au>
Sent: Thursday, 25 June 2020 11:45 AM
To: Callum Sleep <Callum.Sleep@onkaparinga.sa.gov.au>
Subject: 36-70 Gumeracha road, O'Sullivan Beach SA

Hi Callum,

We are undertaking a feasibility assessment of the attached land division and would like council's feedback on any specific requirements for the development regarding traffic, road network, pedestrian connectivity etc.
Appreciate your response

Kind regards
Leanne Gawde
Land Development Lead / Project Manager

Road Network Hierarchy



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CITY OF ONKAPARINGA

8. Appendix C – Correspondence with SA Water

Matthew Reade

From: Wilkinson, Alex <Alex.Wilkinson@sawater.com.au>
Sent: Thursday, July 30, 2020 1:55 PM
To: Leanne Gawde
Cc: Stanway, Craig
Subject: Requirements 36-70 Gumeracha Road, O'Sullivan Beach H0100223

Hi Leanne

I hope you are well.

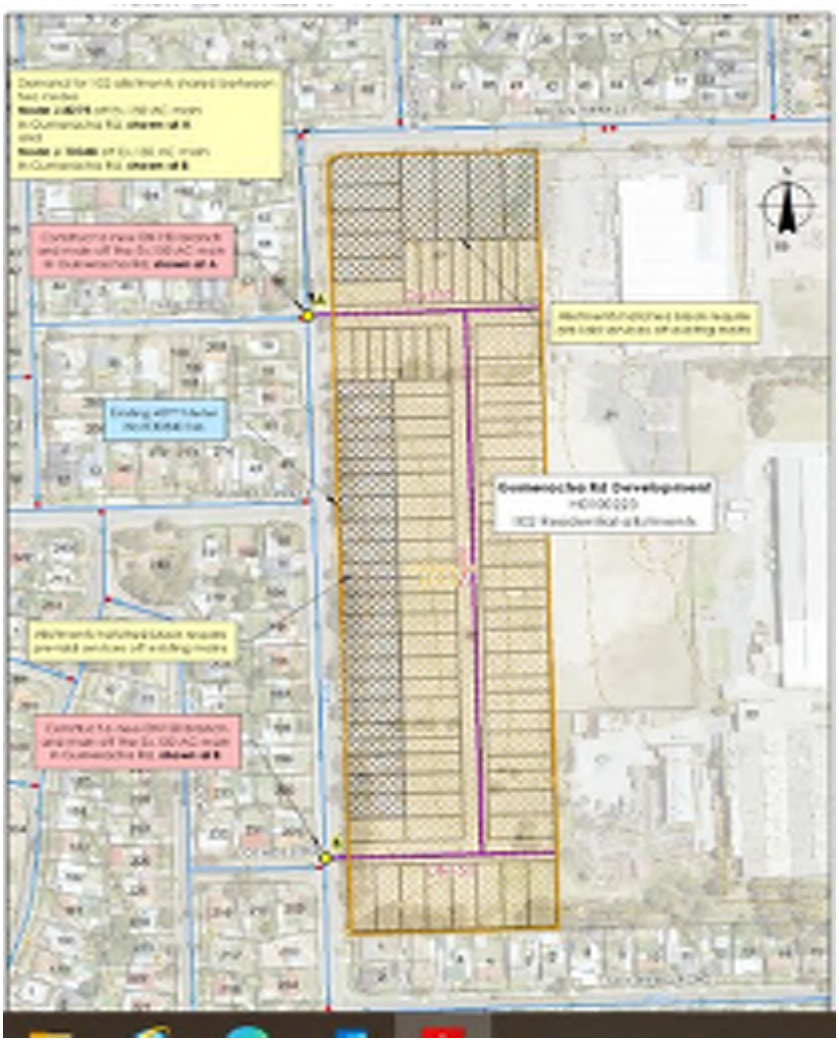
Thank you for requesting a preliminary investigation into **36-70 Gumeracha Road, O'Sullivan Beach SA** for 102 allotments.

Please see below SA Water's response to the information provided for the above mentioned preliminary investigation.

Water

Based on Systems Planning investigation, the network has sufficient capacity to support the proposed, development subject to:

Distribution main
• Construct a new DN150 branch and main off the Ex.150 AC main in Gumeracha Rd, **shown at A on Figure 1** to service development. NOTE: SA Water to pay for upsizing of the DN150 main from DN100.
• Construct a new DN150 branch and main off the Ex.150 AC main in Gumeracha Rd, **shown at B on Figure 1** to service development.



Sewer

Based on the investigation carried out herein, sewage services are available to the proposed development subject to the following:

- The construction of the sewer infrastructure must be in accordance with SA Water Network Infrastructure Standards.

- That any of the existing sewage mains currently traversing the site continue to service upstream connections/sewage Customers, and that any modifications that may result from the proposed development comply with SA Water's network infrastructure standard, including accessibility requirements.

To note the final reticulated network's layout and location of discharge points to be determined by the Reticulations Network Team (part of SA Water's Engineering Services group) as discharge points were selected for modelling purpose only.

The above advice is based upon a desk top investigation and modelling, whilst SA Water endeavours to encapsulate all of the works potentially incurred to service the above mentioned proposal, there is a possibility that requirements may vary upon a more thorough investigation being conducted, alterations to the number of allotments being created, the number of fixture units, peak flows and/or a change in the nature of development will have implications upon this advice provided and a new investigation will be required. Should everything remain the same this advice is valid for 12 months.

Please do not hesitate to contact me if you have any comments or queries.

Kind regards

Alex Wilkinson
Account Manager - Land Development
SA Water
M 0436 684 899
E alex.wilkinson@sawater.com.au

Be green - read on the screen

South Australian Water Corporation disclaimer

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9. Appendix D – Correspondence with NBN and SAPN

Leanne Gawde

From: Jodie Lunn <jodielunn@nbnco.com.au>
Sent: Thursday, 16 July 2020 6:37 PM
To: Leanne Gawde
Subject: RE: 36-70 Gumeracha road, O'Sullivan Beach SA

Follow Up Flag: Flag for follow up
Flag Status: Flagged

NBN Classification - Commercial

Hi Leanne,

We can absolutely deliver Fibre to the Premises to this development, there will be no headworks costs, just the per premises contribution of $600 (inc GST) per lot (invoiced on a stage by stage basis). Under our standard Master Developer Agreement the developer would be responsible for design and construct of the pit and pipe to **nbn** guidelines.

We'd welcome a new development application, which can be made online via the 'get started' button at https://www.nbnco.com.au/develop-or-plan-with-the-nbn/new-developments

Happy to catch up with yourself and/or the developer to discuss further.

Cheers

Jodie

Jodie Lunn
Senior Business Development Manager SA/NT
New Developments; Business, Enterprise & Government
+61 412 050773
jodielunn@nbnco.com.au
business nbn™

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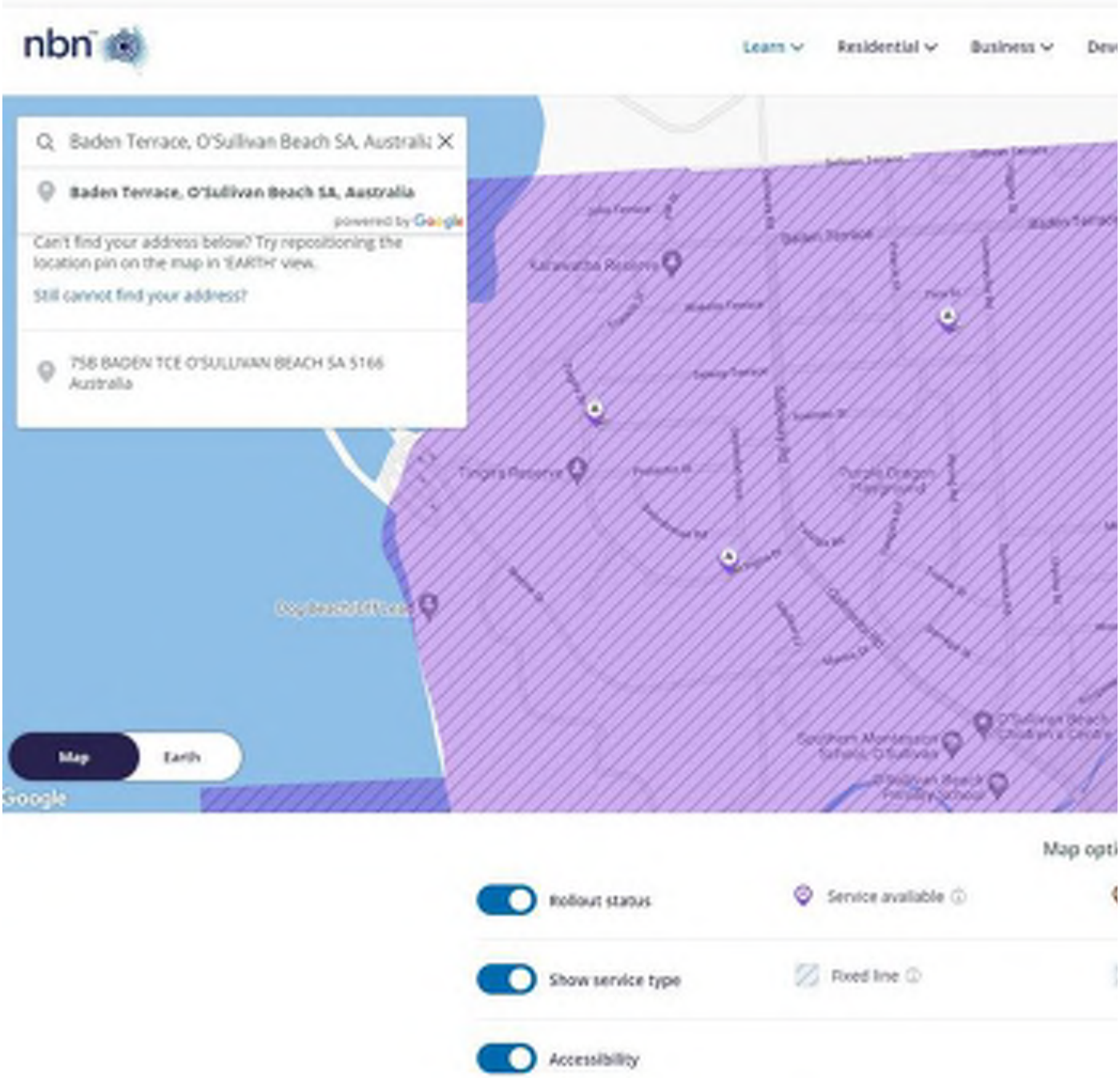
nbn acknowledges and pays respects to the traditional custodians of all the lands on which we work.

From: Leanne Gawde <lgawde@mlei.com.au>
Sent: Wednesday, 15 July 2020 1:21 PM
To: Jodie Lunn <jodielunn@nbnco.com.au>
Subject: [External] 36-70 Gumeracha road, O'Sullivan Beach SA

This message is from an **external sender - be cautious**, particularly with links and attachments.
Hi Jodie,

Can you please advise if this land division can be supplied with NBN? Please find attached land development layout. This will be undertaken in three stages and around three years. Can we get Fibre to this area? Are there any headworks and cost associated with the same for the developer. Appreciate your prompt response



Kind regards
Leanne Gawde
Land Development Lead / Project Manager

mlei
CONSULTING ENGINEERS

Leanne Gawde

From: Darren Hayes <Darren.Hayes@sapowernetworks.com.au>
Sent: Thursday, 23 July 2020 11:58 AM
To: Leanne Gawde
Cc: Darren Milligan
Subject: RE: Gumeracha road, O'Sullivan's beach - SAPN electrical supply options
Attachments: 20289 Proposal (4).pdf

Hi Leanne,

Hope you are well.

Thanks for your email requesting indicative electrical supply options, and any headworks that may be required for this potential 102 lot residential development, as per your attached plan & email.

I will need to do some investigation to confirm what the supply options & any headworks might be.

Hopefully I can get back to your early next week once I have a better idea of what will be required.

Please let me know any problems or if you need any further info.

regards

Darren Hayes
Senior Network Project Officer

Direct: 08 8275 0956
Mobile: 0400 147 658
darren.hayes@sapowernetworks.com.au
---
33 Ayliffes Road St Marys SA 5042
sapowernetworks.com.au

SA Power Networks Empowering South Australia

From: Darren Milligan <Darren.Milligan@sapowernetworks.com.au>
Sent: Wednesday, 22 July 2020 3:24 PM
To: Leanne Gawde <lgawde@mlei.com.au>
Cc: Darren Hayes <Darren.Hayes@sapowernetworks.com.au>
Subject: RE: Gumeracha road, O'Sullivan's beach

Hi Leanne

Thank you for your enquiry.

Darren Hayes has been assigned to your project and will your contact point if you need any further information.

Darren will be in contact soon for any further details and I have copied him into this email for your convenience.

Regards

Darren Milligan
Customer Solutions Manager St Marys

Phone: (08) 8275 0902
Mobile: 0400 661 805
Email: darren.milligan@sapowernetworks.com.au

33 Ayliffes Road
St Marys SA 5042
www.sapowernetworks.com.au

SA Power Networks Empowering South Australia

From: Leanne Gawde <lgawde@mlei.com.au>
Sent: Wednesday, 22 July 2020 12:38 PM
To: Darren Milligan <Darren.Milligan@sapowernetworks.com.au>
Subject: Gumeracha road, O'Sullivan's beach

External email! - Think before you click.

Hi Darren,

Thank you for your time today. Please see below screen shot of the parcel of land. It is bounded by Baden terrace along the northern end, Gumeracha road on the west, existing houses on the south and Industrial allotments on the east.
Attached land development layout for your reference. Can you please advise if SAPN can service these houses at no extra cost. If head works are required can you please advise the extent and approximate costs to the developer.
I am aware we will require transformers internally and I am factoring in approximately 3 pad mount transformers unless if the lots facing Gumeracha can be serviced from Gumeracha road.

Appreciate your response

Kind regards
Leanne Gawde
Land Development Lead / Project Manager

MLEI Consulting Engineers
452 Pulteney Street
Adelaide SA 5000
P 08 8231 2832
lgawde@mlei.com.au
mlei.com.au

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****

10. Appendix E – Correspondence with APA Group

Leanne Gawde

From: Matthew Reade
Sent: Thursday, 23 July 2020 3:25 PM
To: Zofia.Kramer@apa.com.au
Cc: Leanne Gawde
Subject: RE: 36-70 Gumeracha road, O'Sullivan Beach SA

Hi Zofia,

Following up on the below, let me know if you require anything further.

Kind regards
Matthew Reade
B.E. (Civil & Structural)
Civil Engineer

MLEI Consulting Engineers
452 Pulteney Street
Adelaide SA 5000
P 08 8231 2832
M 0447 567 677
mreade@mlei.com.au
mlei.com.au

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From: Leanne Gawde
Sent: Thursday, June 25, 2020 11:38 AM
To: Zofia.Kramer@apa.com.au
Subject: 36-70 Gumeracha road, O'Sullivan Beach SA

Hi Zofia,
We are undertaking feasibility of the attached residential land division development. Can you please confirm if APA can supply gas for the development at no extra cost. Should there be any headworks please advise us at your earliest convenience.

Appreciate your prompt response.

Kind regards
Leanne Gawde
Land Development Lead / Project Manager

MLEI Consulting Engineers
452 Pulteney Street
Adelaide SA 5000
P 08 8231 2832
lgawde@mlei.com.au
mlei.com.au

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11. Appendix F – Dial Before You Dig Information

WATER RETICULATION

DBYD Sequence No: 99214300

- Water Valves
- Water Main
- Water Main (Decommissioned)
- Decommissioned Asbestos Mains
- Water Pillar Hydrant
- Water Hydrant
- CP Facility
- CP = Cathodic Protection
- CP Anode/Cathode Cables
- CP Electricity Supply Cables
- CP Anode Bed Outlines
- Railway
- Land Parcels
- Water Meter*
- Shifted Water Meter*

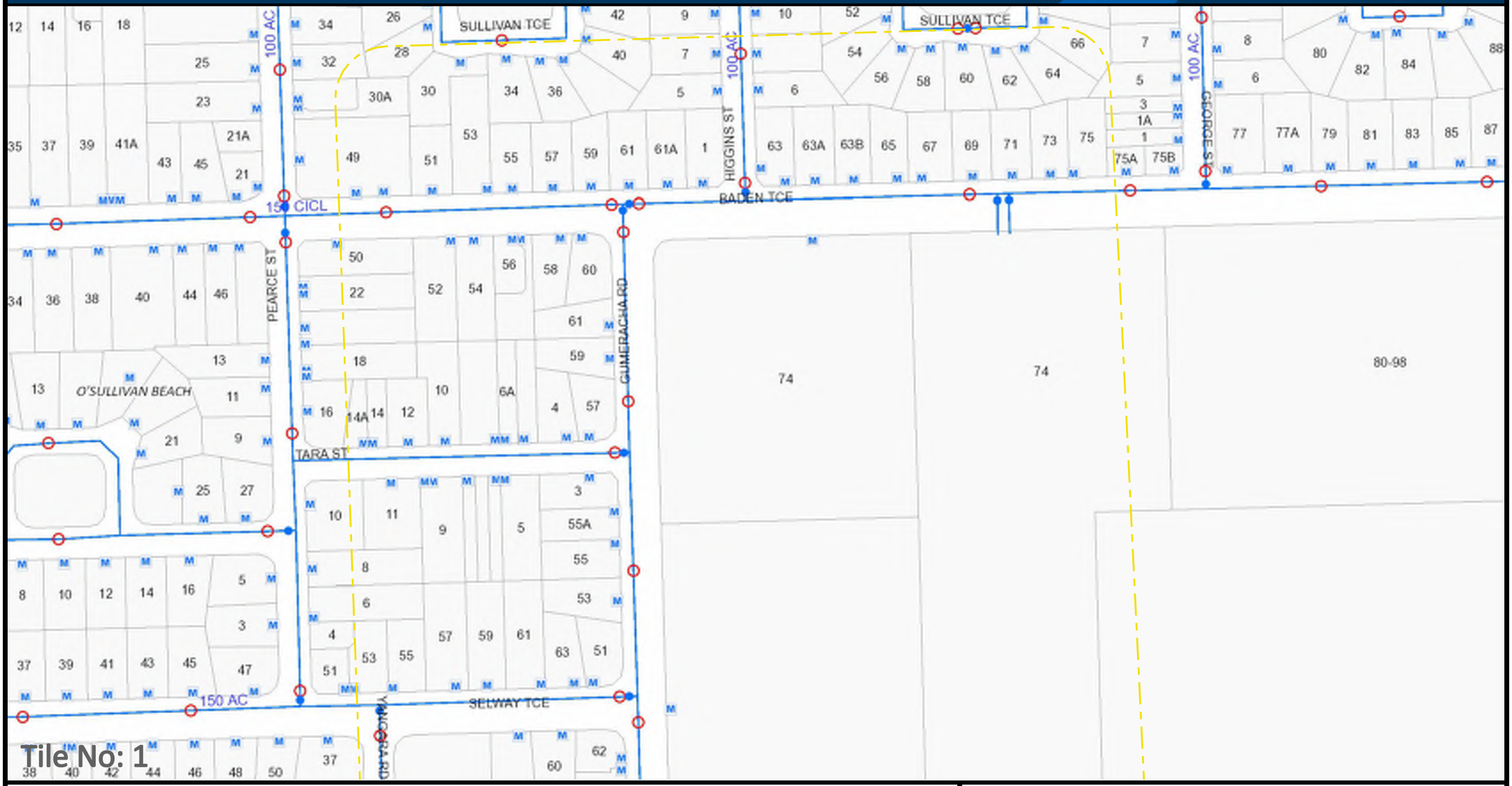
* Connection between water meter and pipe not shown

Scale @ A4: 1:5125

This advice and/or information is given for your private use only. The accuracy of the advice and information is not guaranteed, and no responsibility is accepted by the crown, the South Australian Water Corporation or their officers, agents or servants for any loss or damage caused by reliance upon this advice and/or information, as a result of any error, omission, incorrect description or statement therein whether caused by negligence or otherwise.

WATER RETICULATION

DBYD Sequence No: 99214300



- Water Valves
- Water Main
- Water Main (Decommissioned)
- Decommissioned Asbestos Mains
- Water Pillar Hydrant
- Water Hydrant
- CP Facility
- CP = Cathodic Protection
- CP Anode/Cathode Cables
- CP Electricity Supply Cables
- CP Anode Bed Outlines
- Railway
- Land Parcels
- Water Meter*
- Shifted Water Meter*

* Connection between water meter and pipe not shown

Scale @ A4: 1:2500

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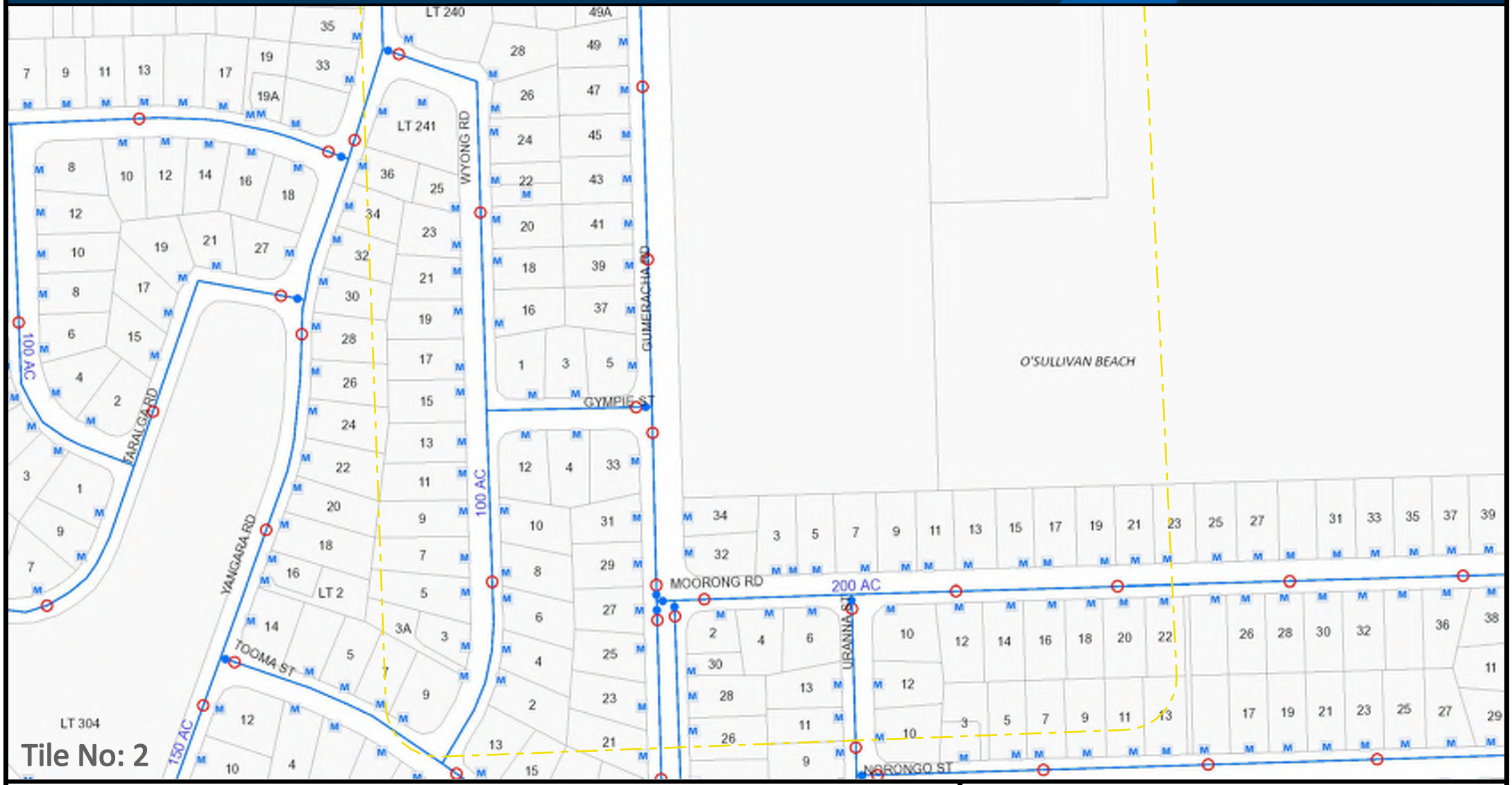
WATER RETICULATION

DBYD Sequence No: 99214300



Tile No: 2

- Water Valves
- Water Main
- Water Main (Decommissioned)
- Decommissioned Asbestos Mains
- Water Pillar Hydrant
- Water Hydrant
- CP Facility
- CP = Cathodic Protection
- CP Anode/Cathode Cables
- CP Electricity Supply Cables
- CP Anode Bed Outlines
- Railway
- Land Parcels
- Water Meter*
- Shifted Water Meter*

* Connection between water meter and pipe not shown

Scale @ A4: 1:2500

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WASTEWATER RETICULATION

DBYD Sequence No: 99214300

- GIP
- Valve
- Maintenance Hole
- Maintenance Shaft
- Inspection Opening
- Wastewater Connections
- Decommissioned Asbestos Mains
- Ancillary Pipes
- Gravity Mains
- Low Pressure
- Pumping Mains
- Vacuum Mains
- Railway
- Land Parcels
- CP Facility
- CP Anode/Cathode Cables
- CP Electricity Supply Cables
- CP Anode Bed Outlines

CP = Cathodic Protection

Scale @ A4: 1:5125

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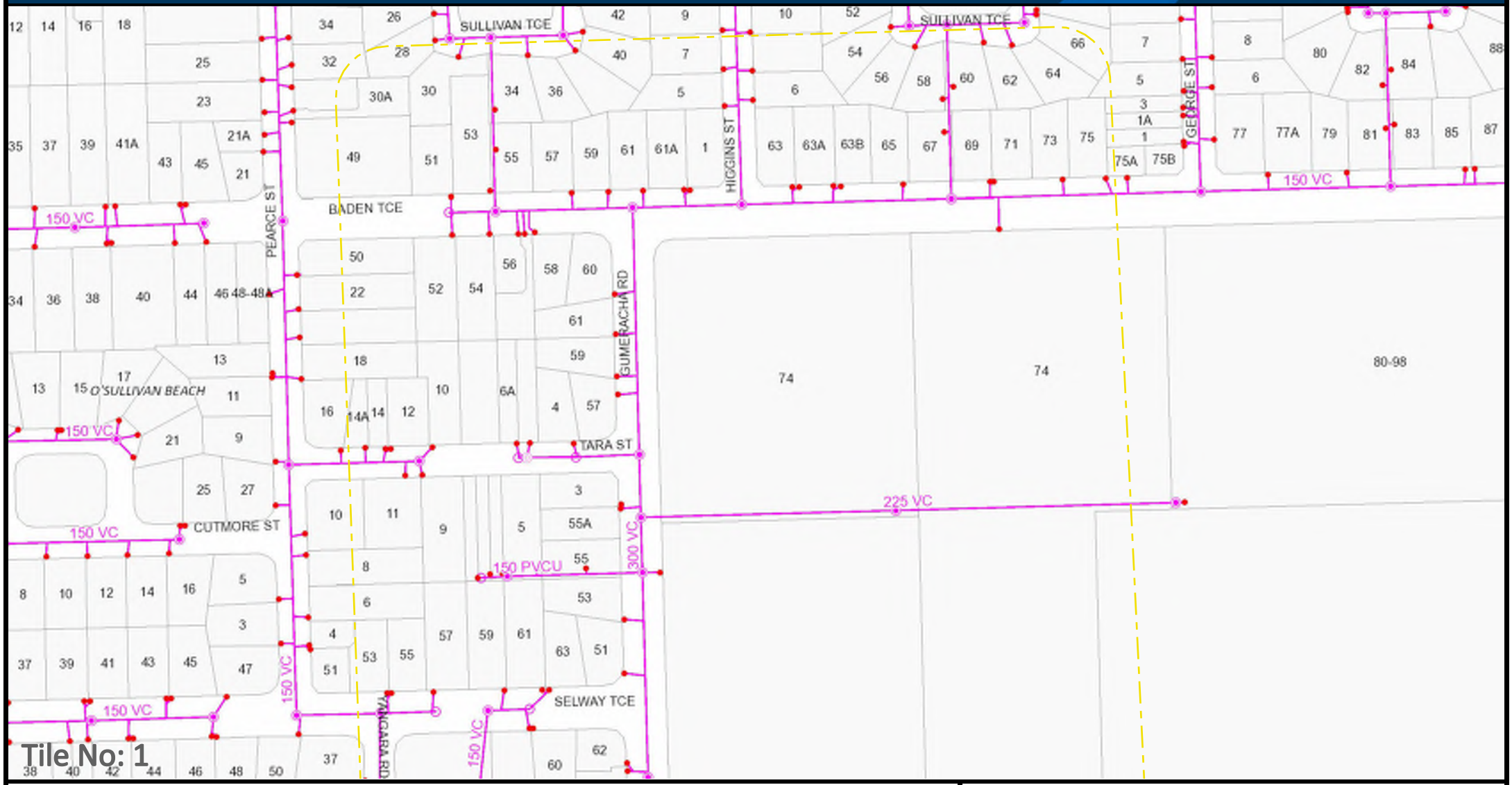
WASTEWATER RETICULATION

DBYD Sequence No: 99214300



- GIP
- Valve
- Maintenance Hole
- Maintenance Shaft
- Inspection Opening
- Wastewater Connections
- Decommissioned Asbestos Mains
- Ancillary Pipes
- Gravity Mains
- Low Pressure
- Pumping Mains
- Vacuum Mains
- Railway
- Land Parcels
- CP Facility
- CP Anode/Cathode Cables
- CP Electricity Supply Cables
- CP Anode Bed Outlines

CP = Cathodic Protection

Scale @ A4: 1:2500

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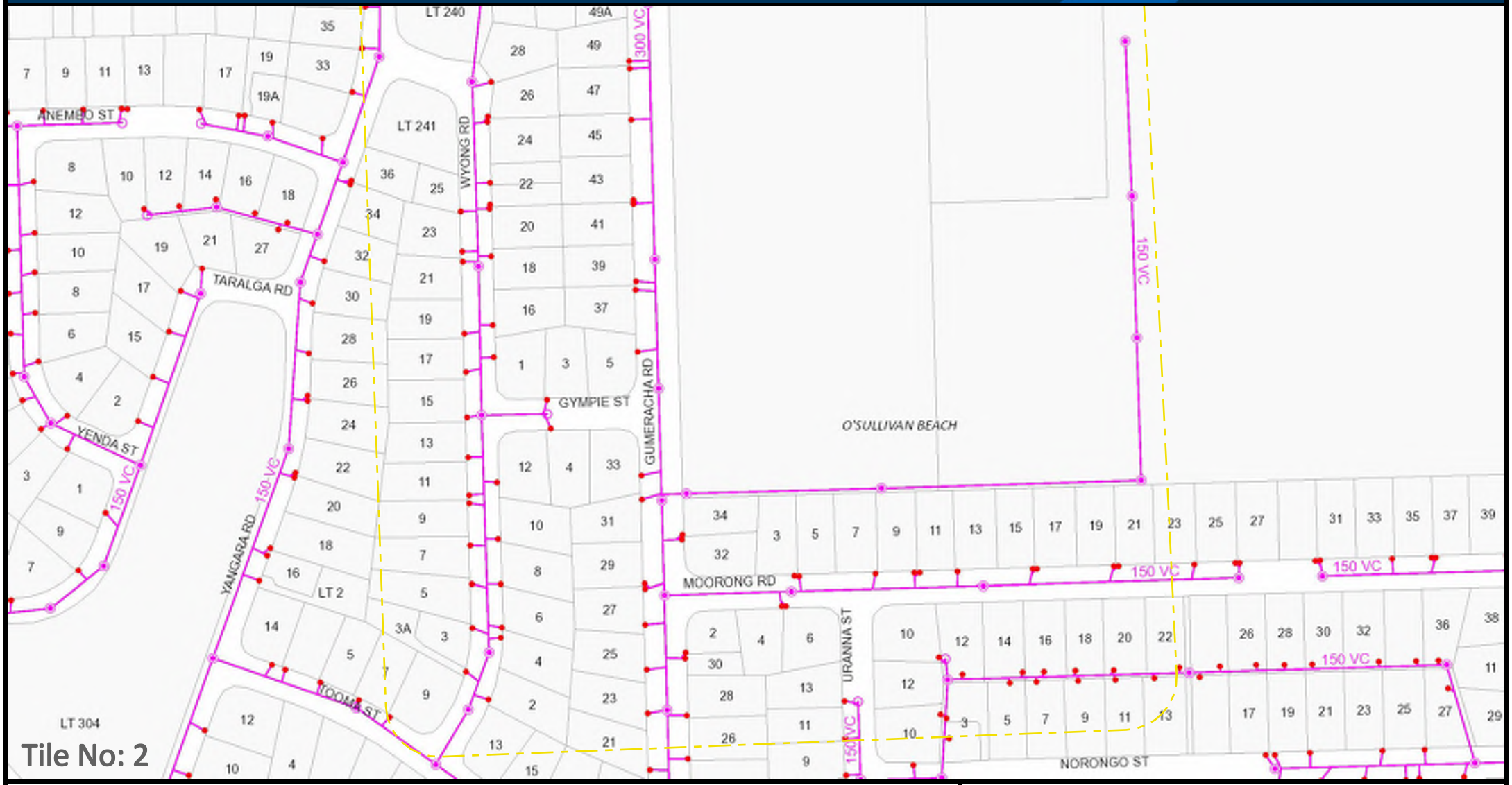
WASTEWATER RETICULATION

DBYD Sequence No: 99214300



- GIP
- Valve
- Maintenance Hole
- Maintenance Shaft
- Inspection Opening
- Wastewater Connections
- Decommissioned Asbestos Mains
- Ancillary Pipes
- Gravity Mains
- Low Pressure
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- CP Facility
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- CP Anode Bed Outlines

CP = Cathodic Protection

Scale @ A4: 1:2500

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LEGEND

IT'S HOW WE CONNECT

For more info contact a Telstra Accredited Locater or Telstra Plan Services 1800 653 935

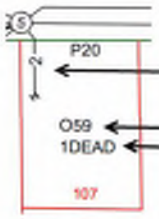
Exchange
(major cable present)

Footway access chamber
(can vary from 1-lid to 12-lid)

or **Pillar/cabinet**
(above the ground / free standing)

Above ground complex equipment housing (eg RIM)
Please Note: This equipment is powered by 240V electricity.

OC **other carrier**



2 pair lead-in to property from pit in street

1 pair working (pair ID 059)
1 pair dead (i.e. spare, not connected)

Single to multiple round conduit
Configurations 1, 2, 4, 9 respectively
P100 (Attached text denotes conduit type and size)

Multiple square conduit
Configurations 2, 4, 6 respectively
E85 (Attached text denotes conduit type and size)

Some examples of conduit type and size:
A - Asbestos cement, P - PVC / plastic, C - Concrete, GI - Galvanised iron, E - Earthenware.
Conduit sizes *nominally* range from 20mm to 100mm.

P50	50mm PVC conduit
P100	100mm PVC conduit
A100	100mm asbestos cement conduit
E 85	85mm square earthenware conduit

Cable jointing pit
(number indicating pit type)

Elevated cable joint
(above ground joint on buried cable)

Telstra Plant in shared utility trench

Aerial Cable
(above ground)

Aerial Cable
(attached to joint use pole e.g. power)

Direct buried cable

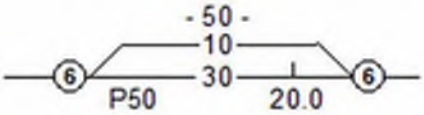
M **Marker post installed**

TR **Buried transponder**

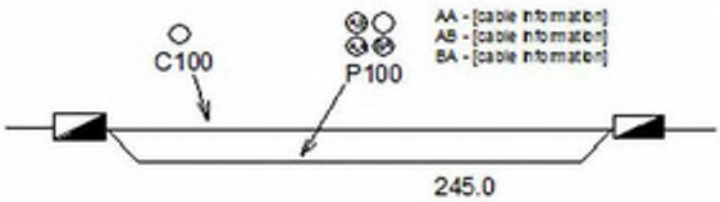
MT **Marker, transponder**

SMOF **Optical fibre cable direct buried**

Some examples of how to read Telstra plans:

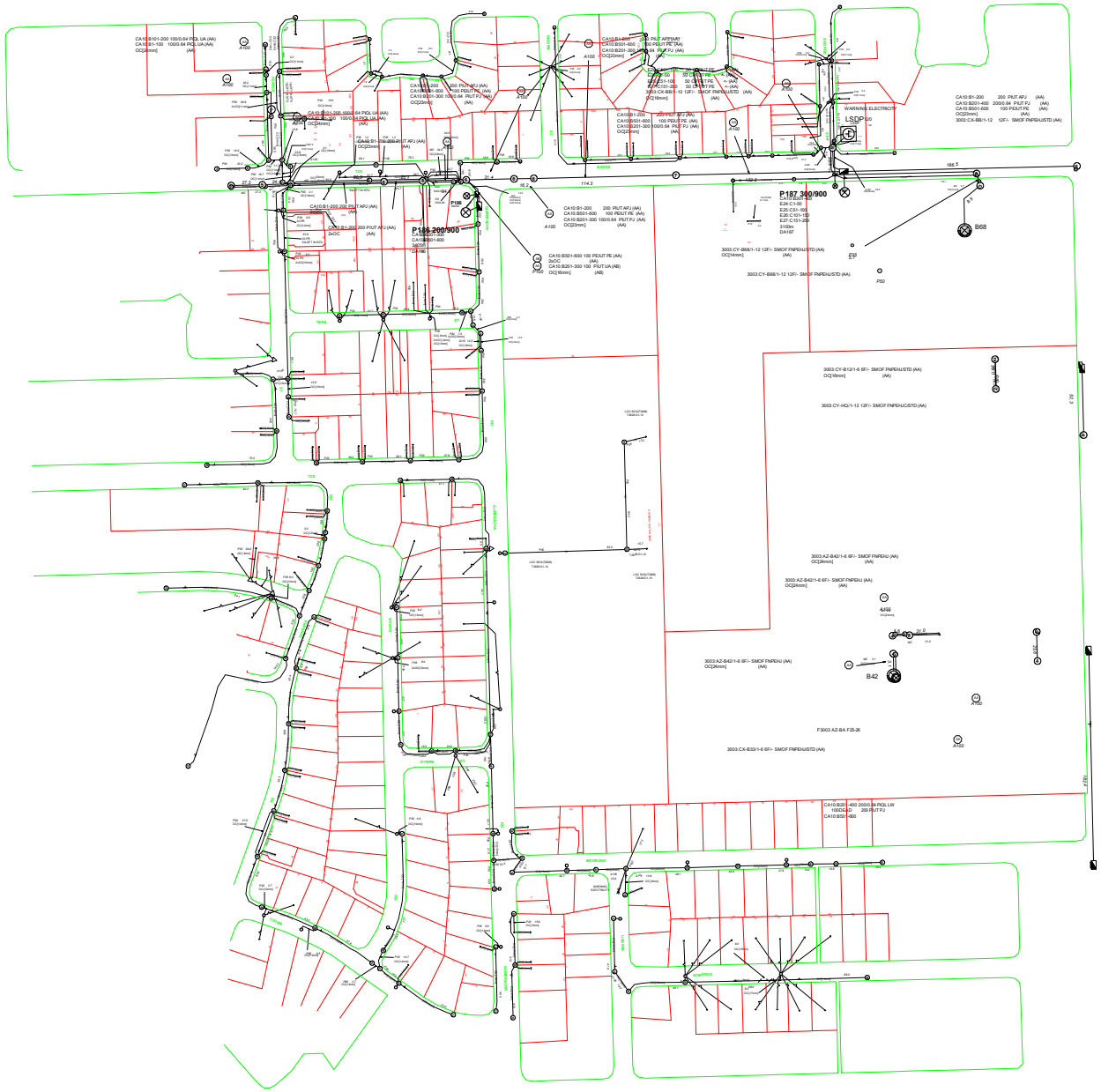


One 50mm PVC conduit (P50) containing a 50-pair and a 10-pair cable between two 6-pits, 20.0m apart, with a direct buried 30-pair cable along the same route.



Two separate conduit runs between two footway access chambers (manholes) 245m apart. A nest of four 100mm PVC conduits (P100) containing assorted cables in three ducts (one being empty) and one empty 100mm concrete duct (C100) along the same route.

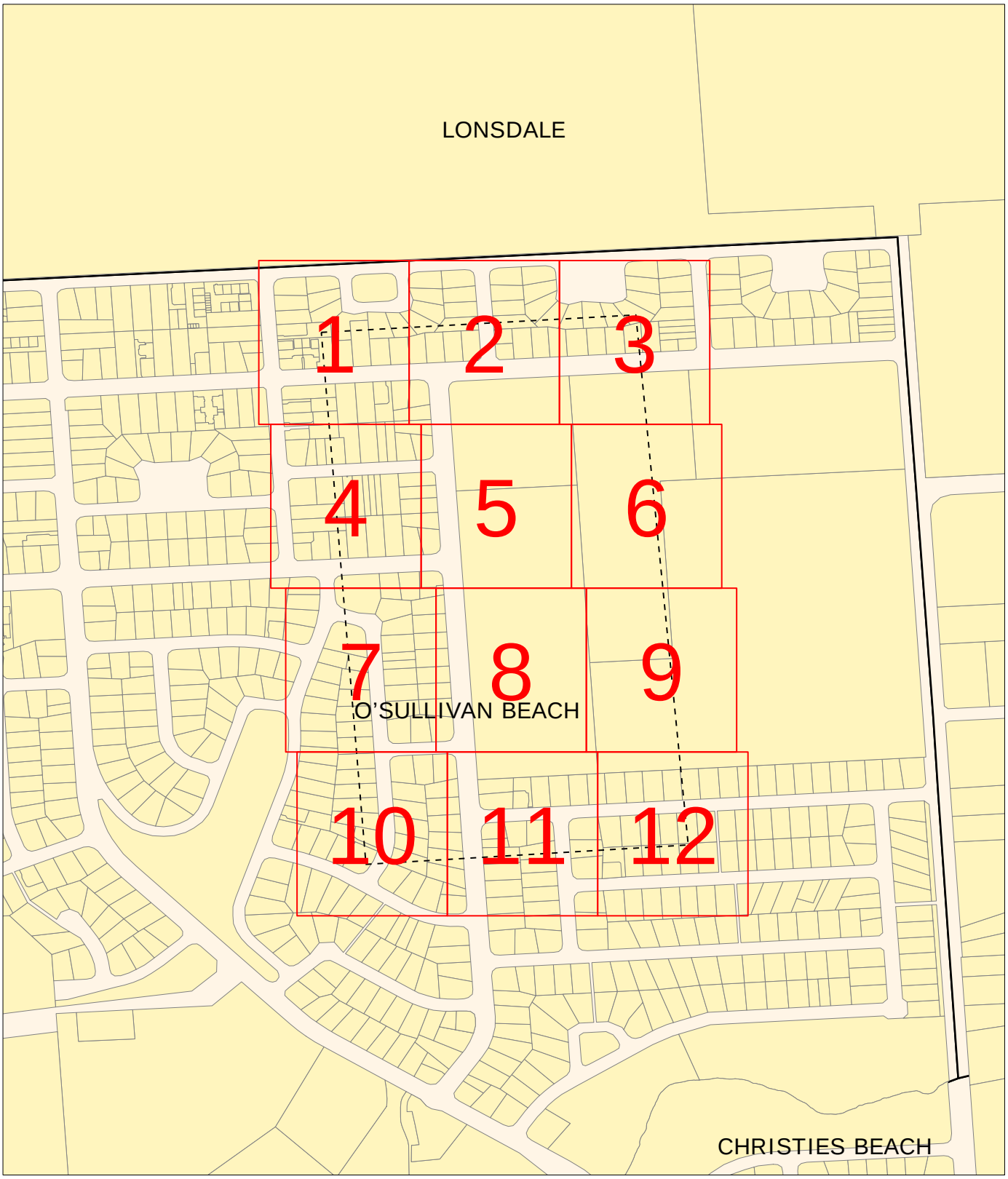
WARNING: Telstra plans and location information conform to Quality Level 'D' of the Australian Standard AS 5488 - Classification of Subsurface Utility Information. As such, Telstra supplied location information is indicative only. Spatial accuracy is not applicable to Quality Level D. Refer to AS 5488 for further details. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans. FURTHER ON SITE INVESTIGATION IS REQUIRED TO VALIDATE THE EXACT LOCATION OF TELSTRA PLANT PRIOR TO COMMENCING CONSTRUCTION WORK. A plant location service is an essential part of the process to validate the exact location of Telstra assets and to ensure the asset is protected during construction works. The exact position of Telstra assets can only be validated by physically exposing it. Telstra will seek compensation for damages caused to its property and losses caused to Telstra and its customers.


P186 200/900
P187 300/900
LSOP
B68
B42
WARNING ELECTRICITY

Overview Map

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Disclaimer: The Plan/Sketch is supplied at your request and is subject to your agreement that SA Power Networks shall not be liable or responsible for the correctness or otherwise of any such information supplied pursuant to this request. Upon acceptance of this condition SA Power Networks grants you permission to use the Plan/Sketch as a guide to the location of SA Power Networks assets. The Plan/Sketch must be returned to SA Power Networks if you fail to accept the conditions of use.

N

0 0.06km

LEGEND:

1 Detail Map

DBYD Requested Area

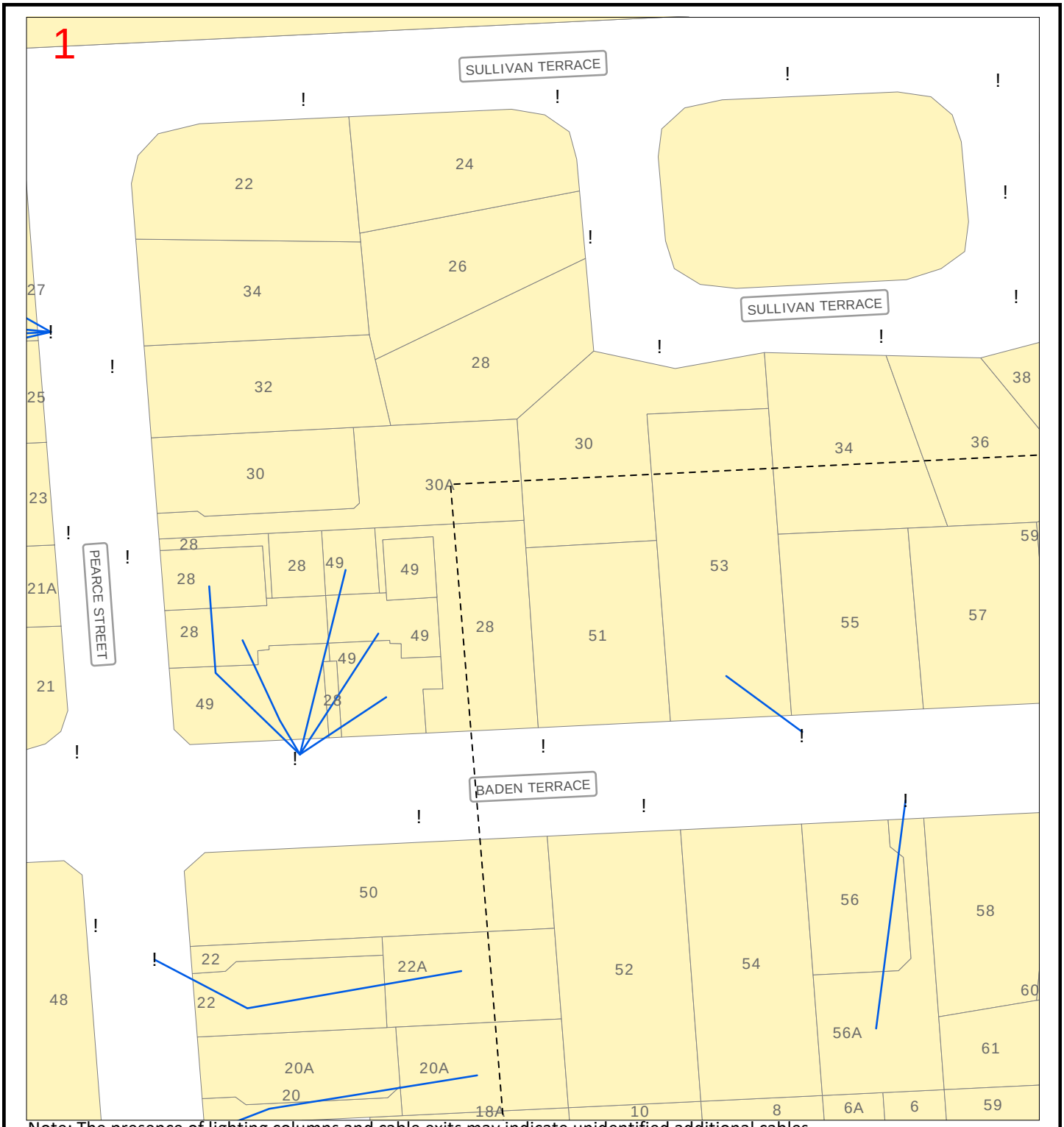
Powered by dbyd

Date: 30/06/2020

Map 1

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

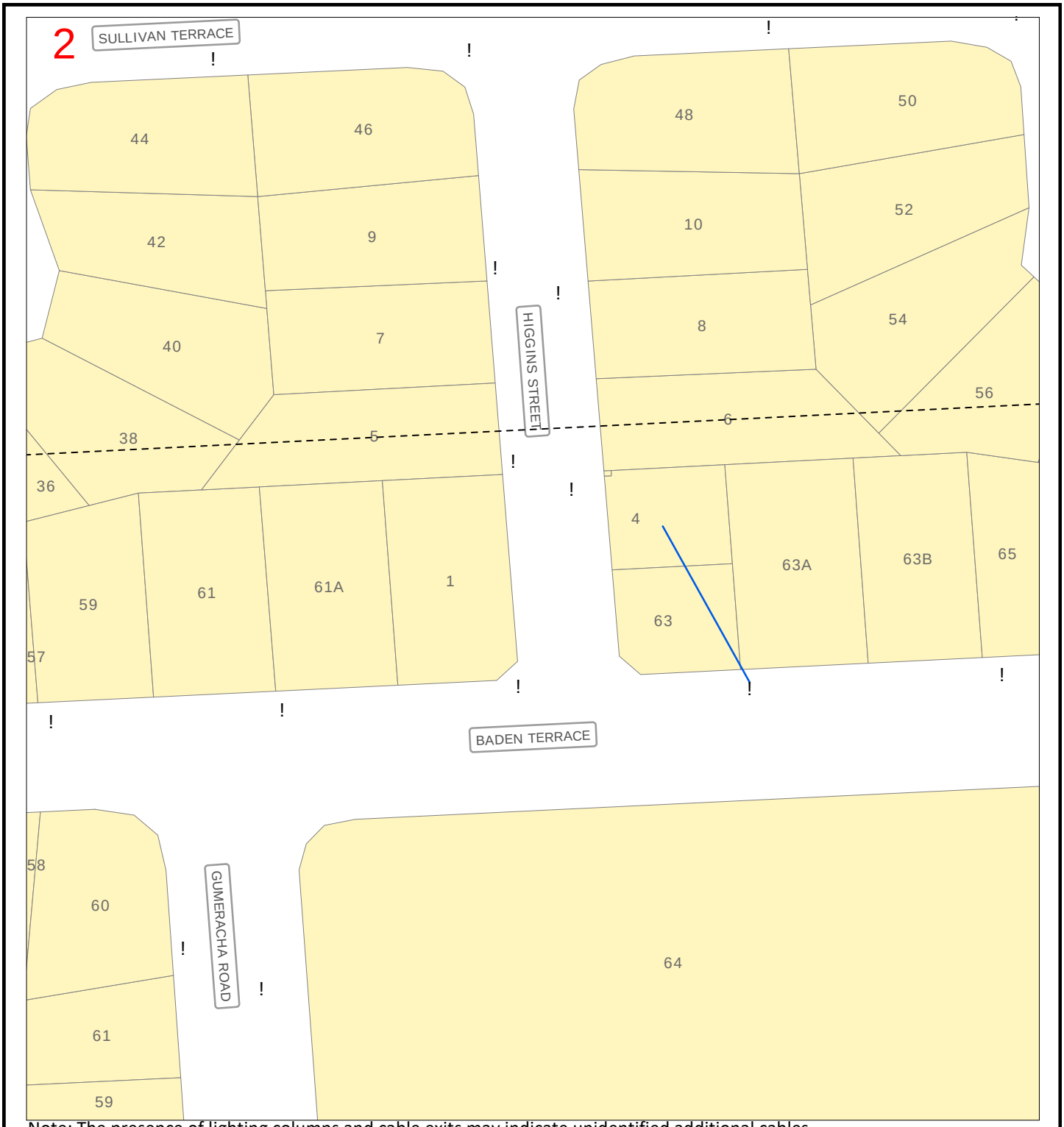
Powered by dbyd x-info

Date: 30/06/2020

Map 2

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

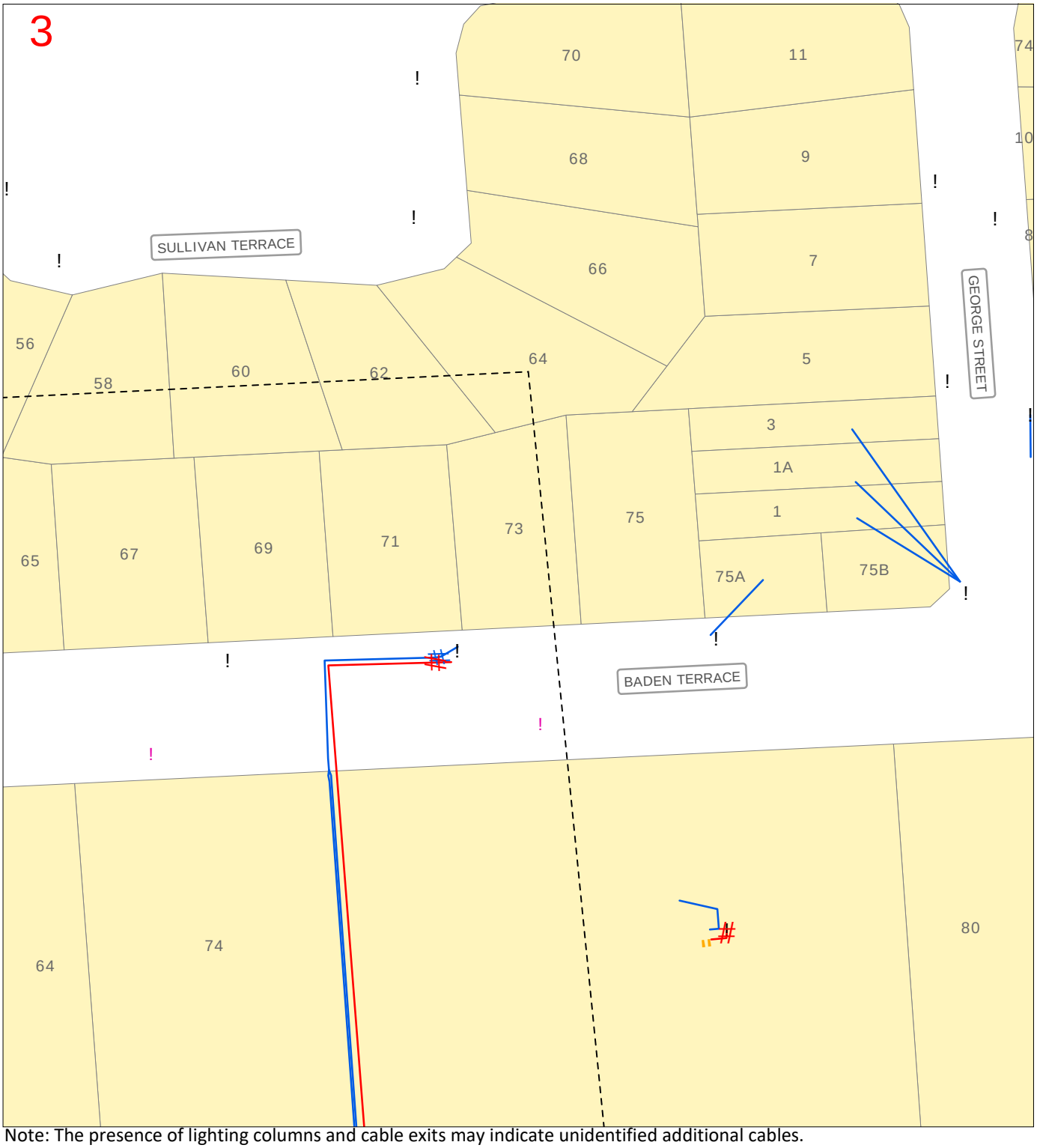
Powered by dbyd x-info

Date: 30/06/2020

Map 3

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

Powered by dbyd x-info

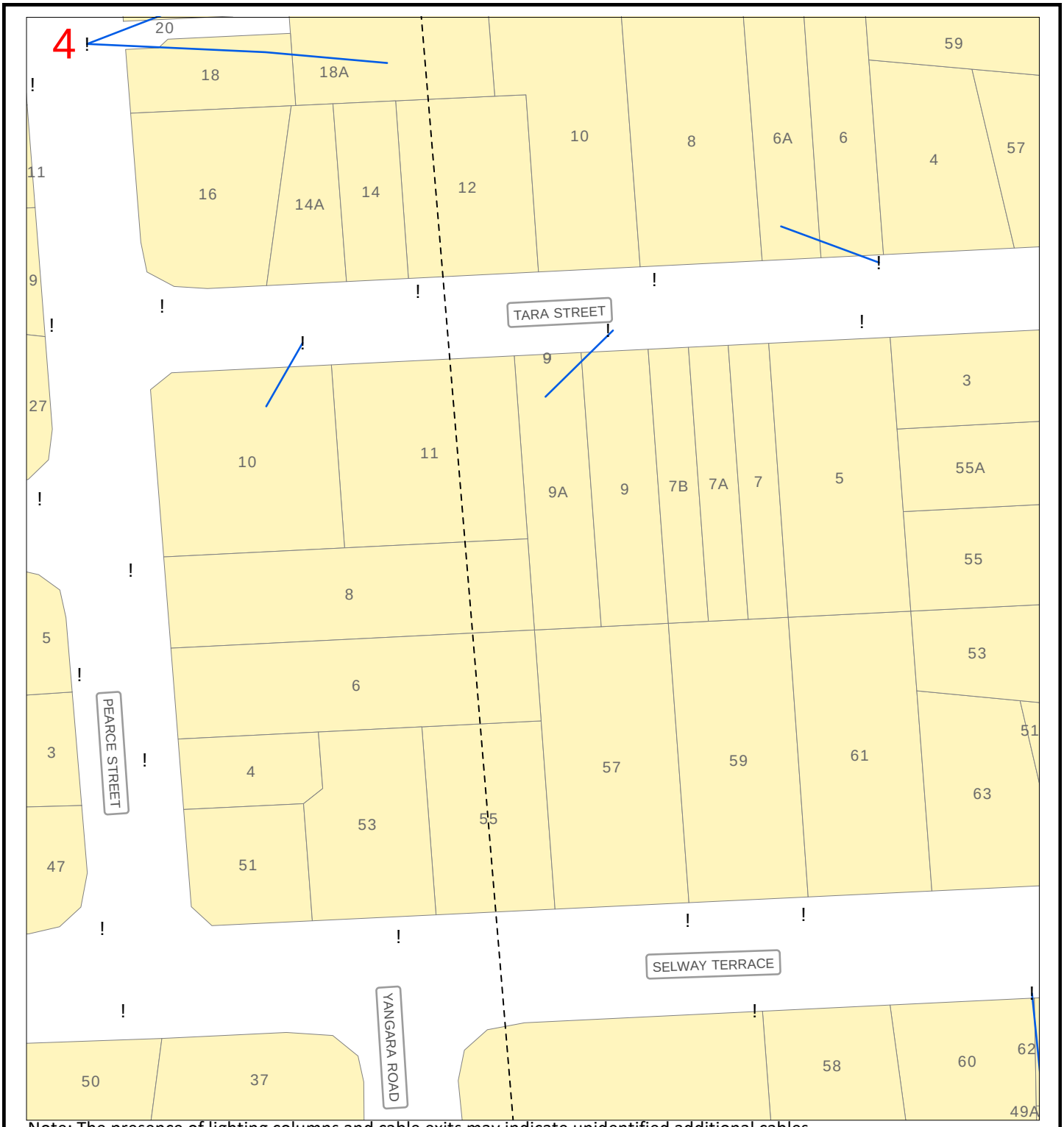
Date: 30/06/2020

SA Power Networks

Map 4

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

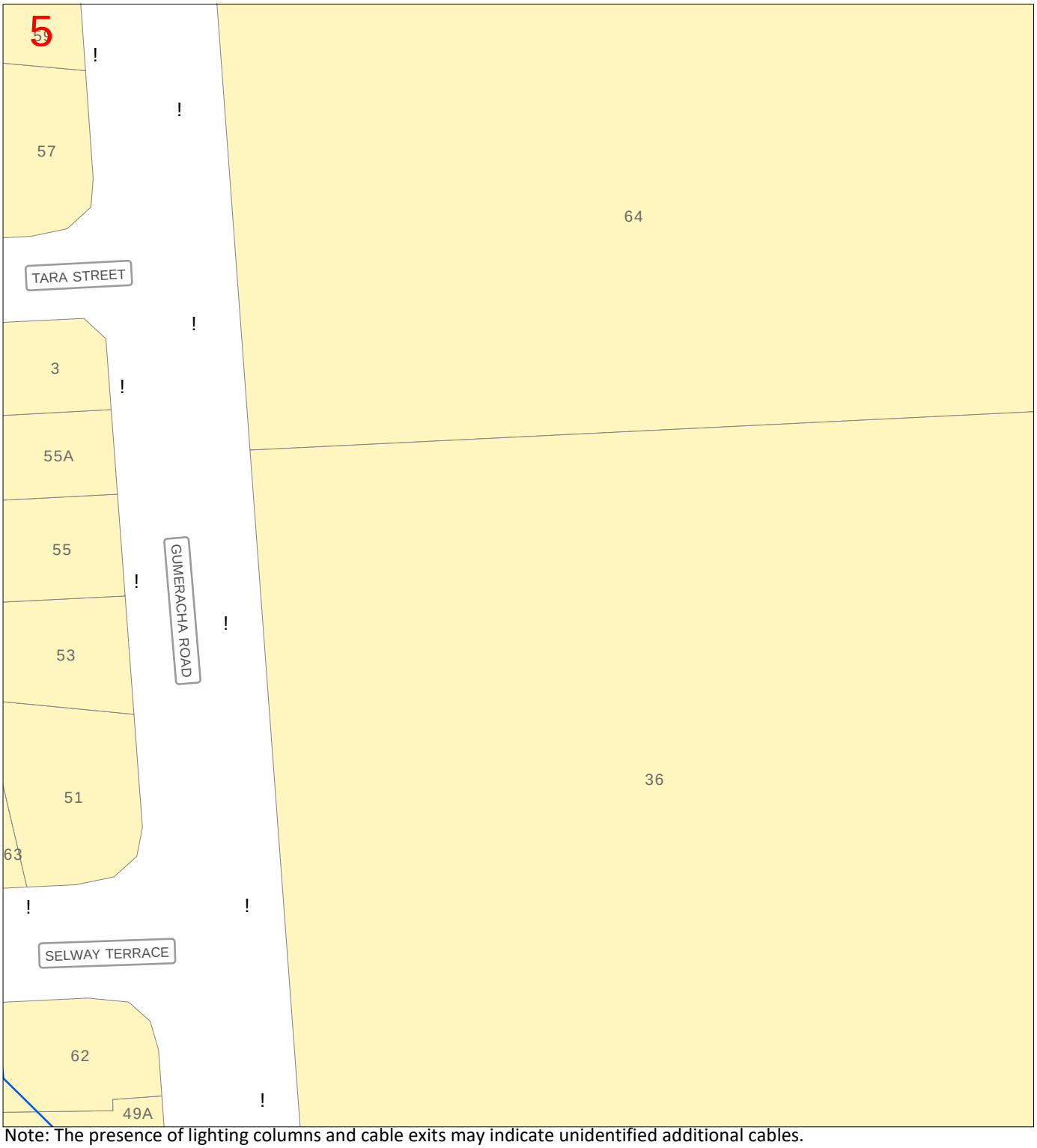
Powered by x-info dbyd

Date: 30/06/2020

Map 5

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

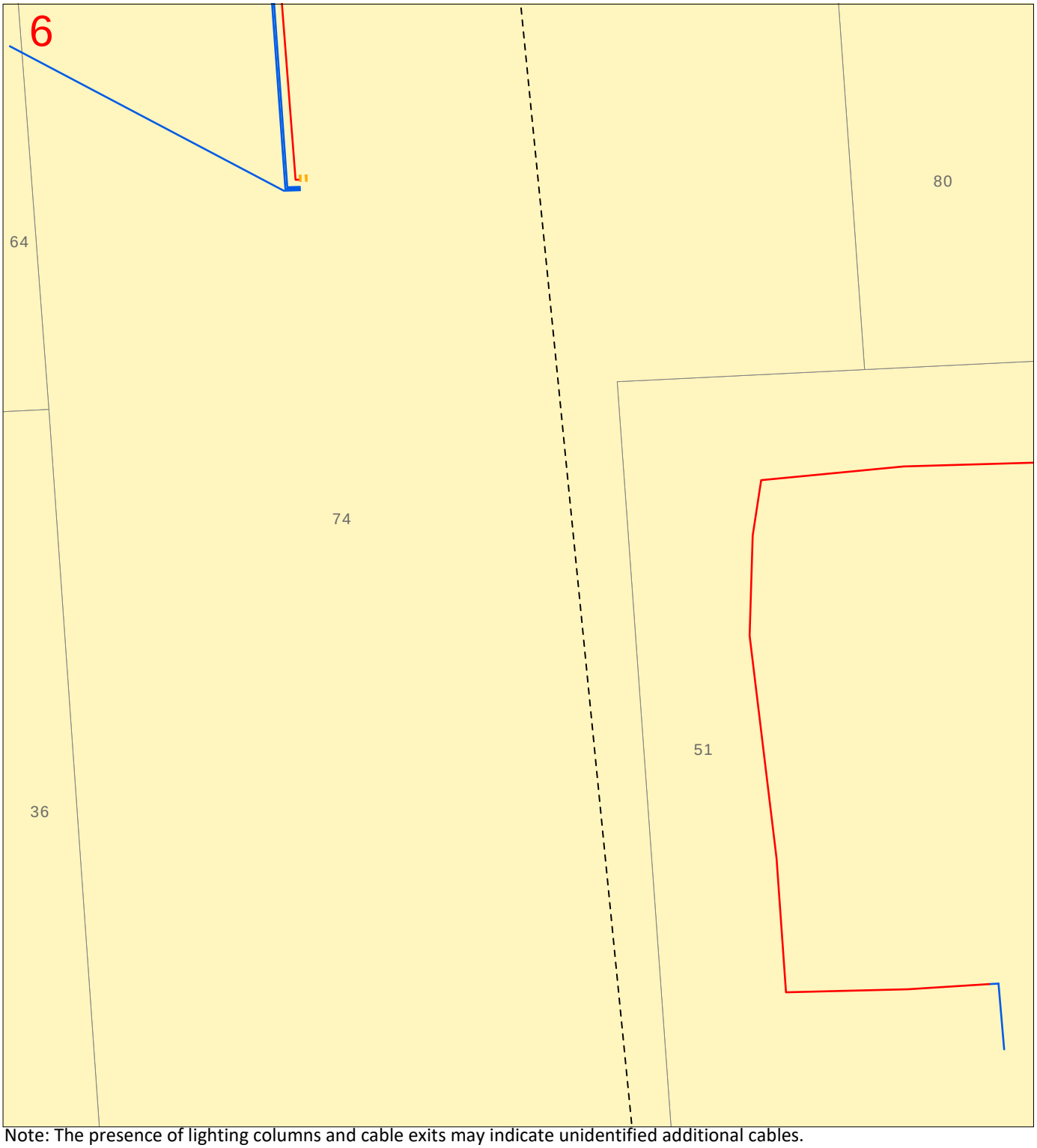
Powered by dbyd x-info

Date: 30/06/2020

Map 6

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

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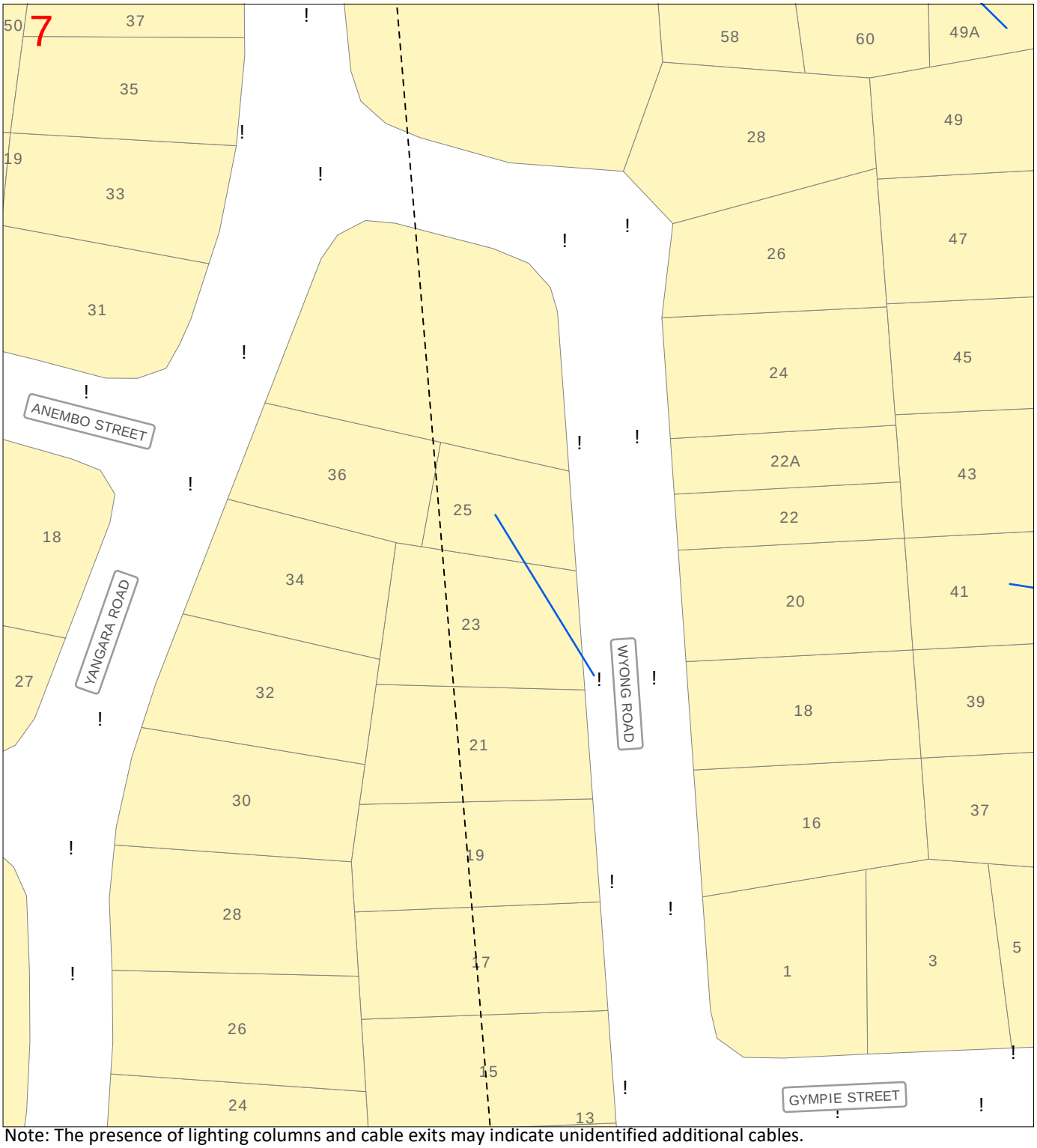
Date: 30/06/2020

SA Power Networks

Map 7

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

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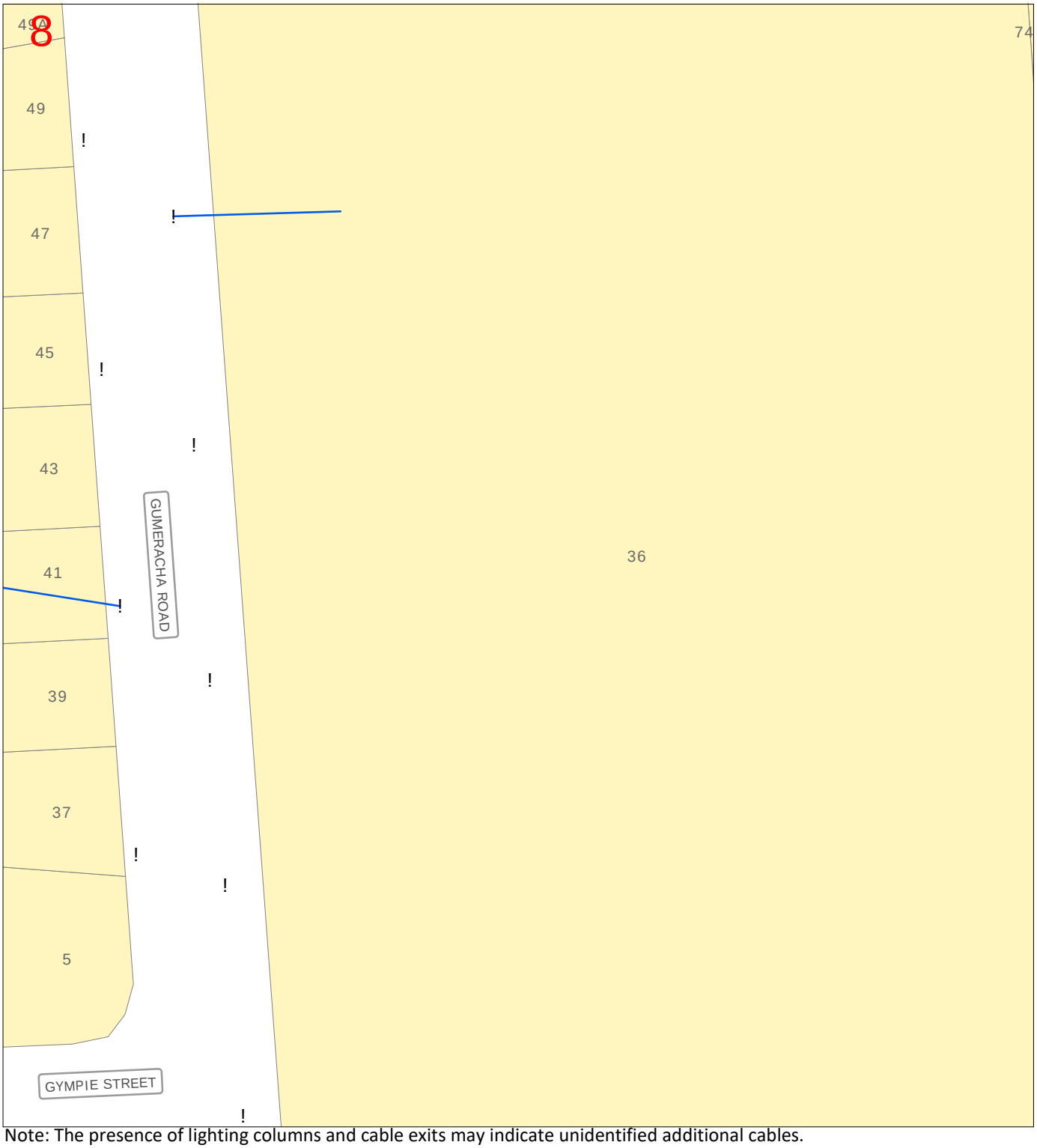
SA Power Networks

Map 8

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

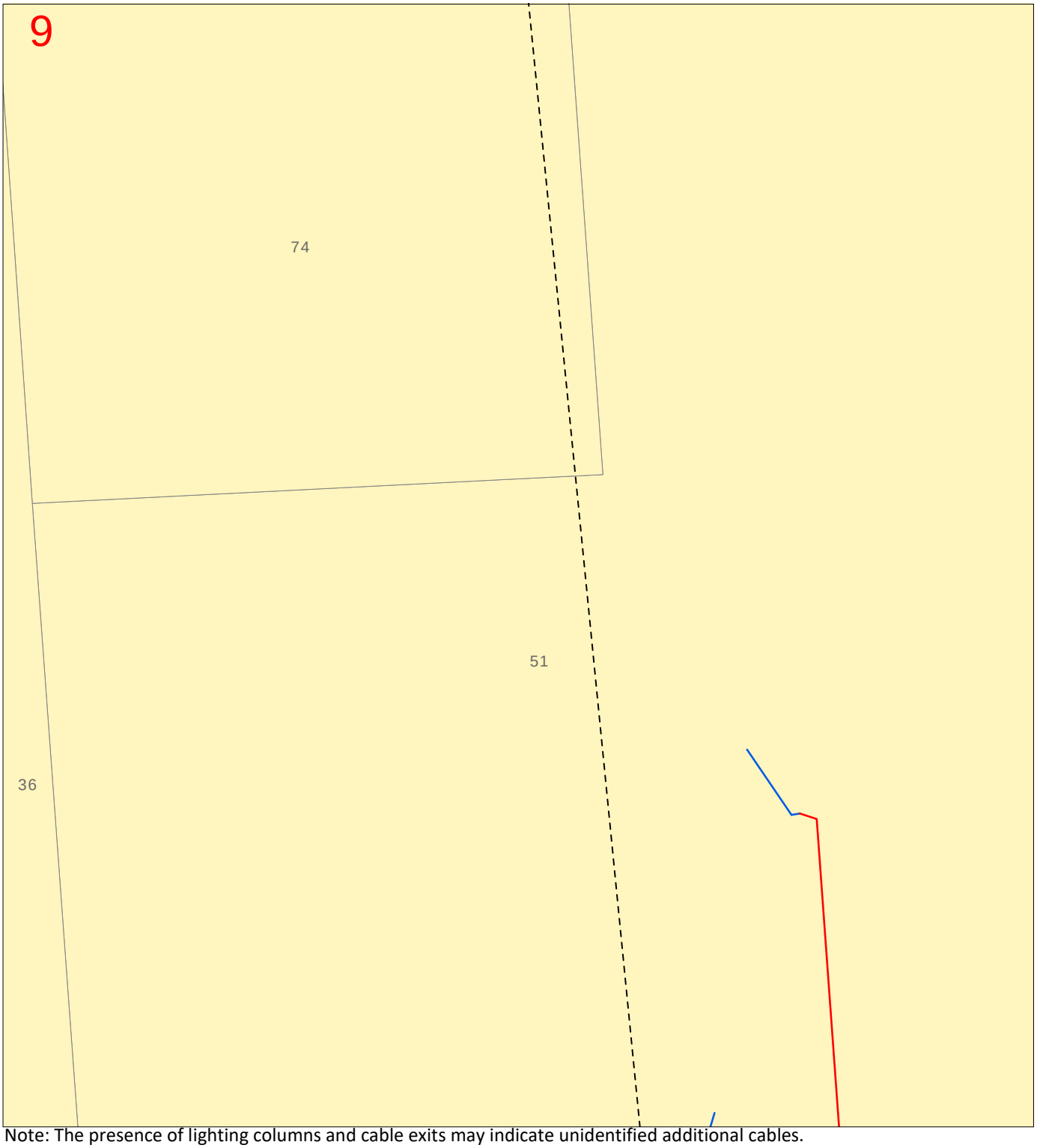
0 0.009km

SA Power Networks

Map 9

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

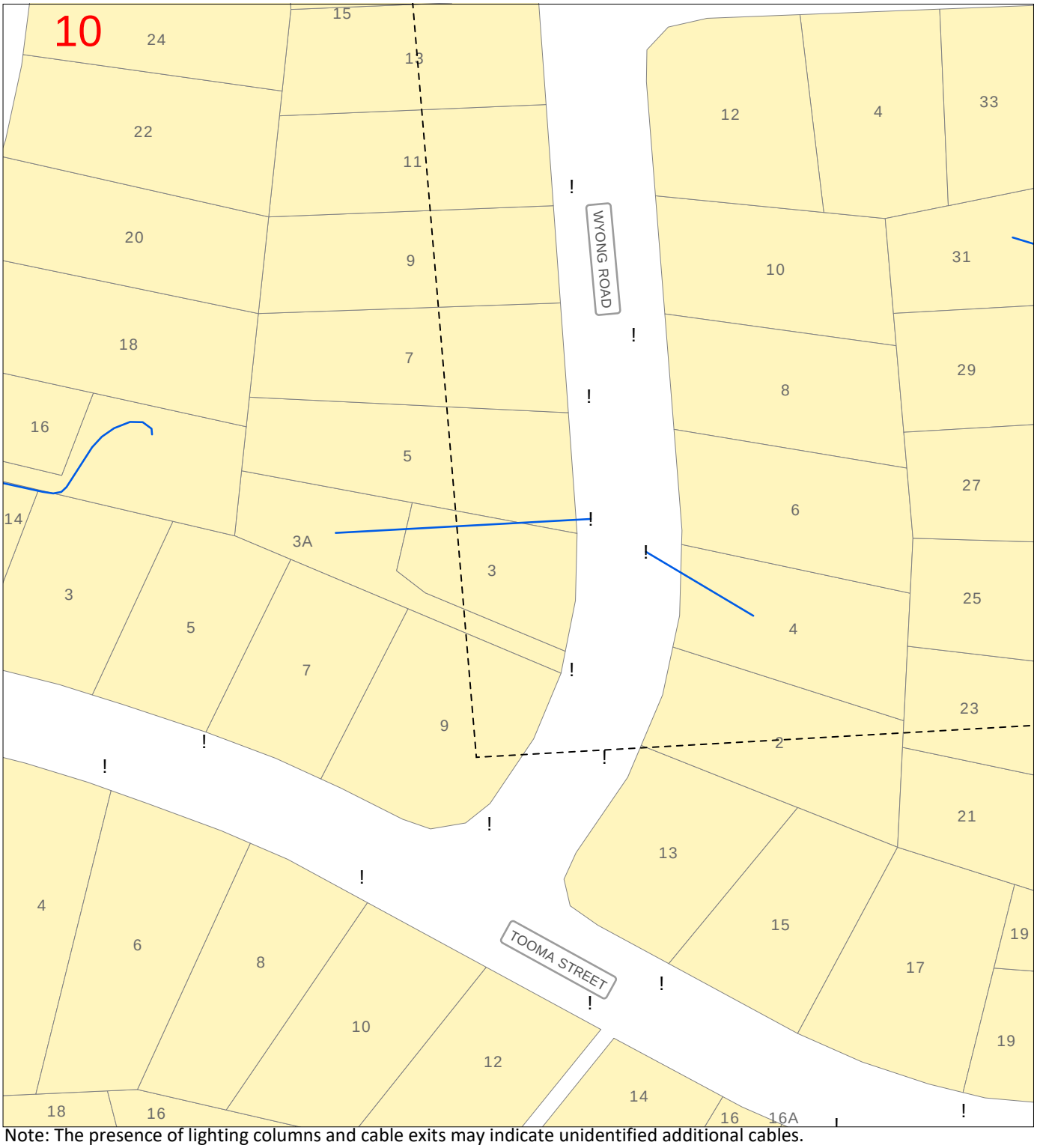
Date: 30/06/2020

SA Power Networks

Map 10

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

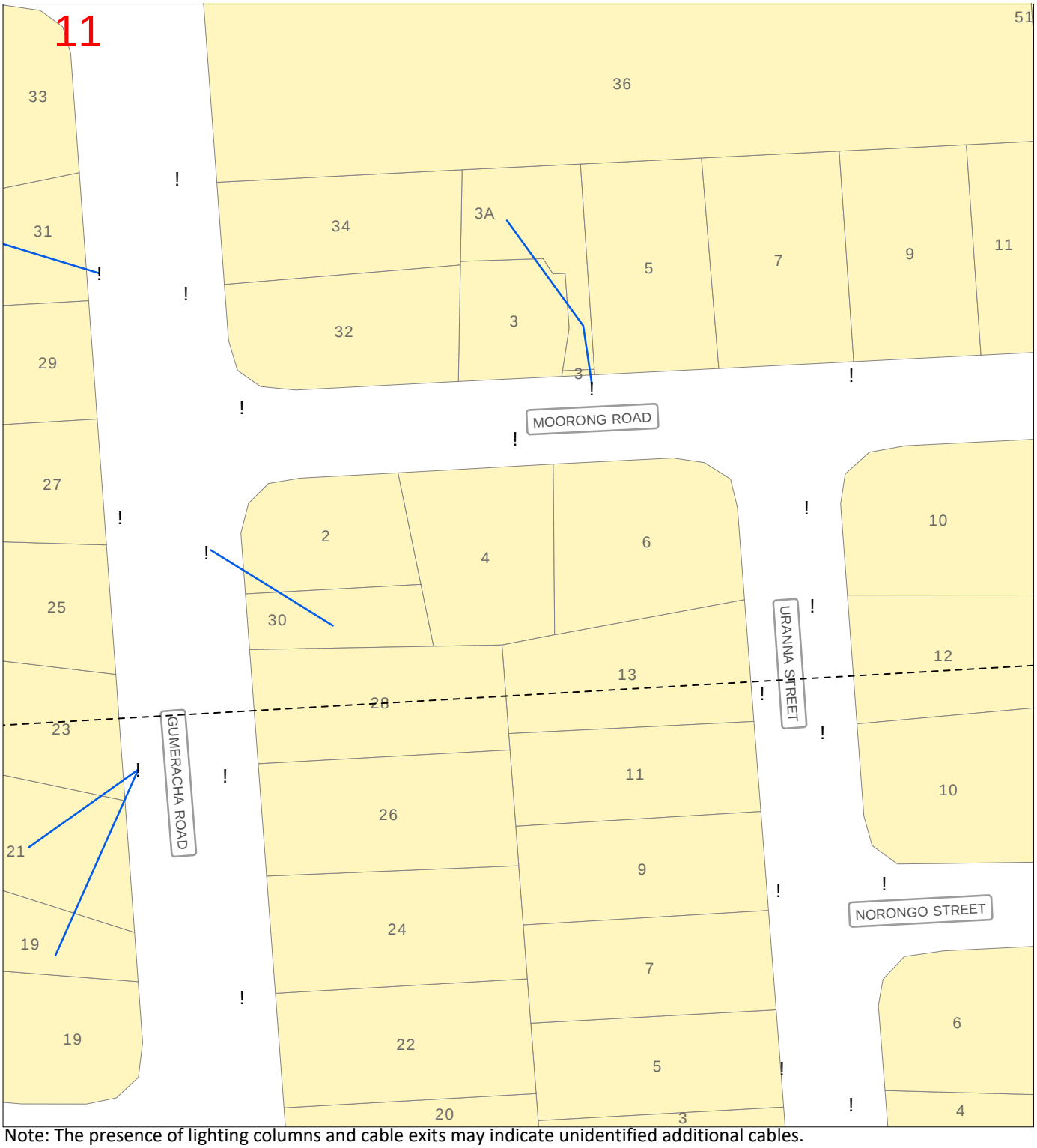
Powered by x-info dbyd

Date: 30/06/2020

Map 11

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach



Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

Powered by dbyd x-info

Date: 30/06/2020

Map 12

Sequence No: 99214297

Gumeracha Road O'Sullivan Beach

Note: The presence of lighting columns and cable exits may indicate unidentified additional cables.

LEGEND:

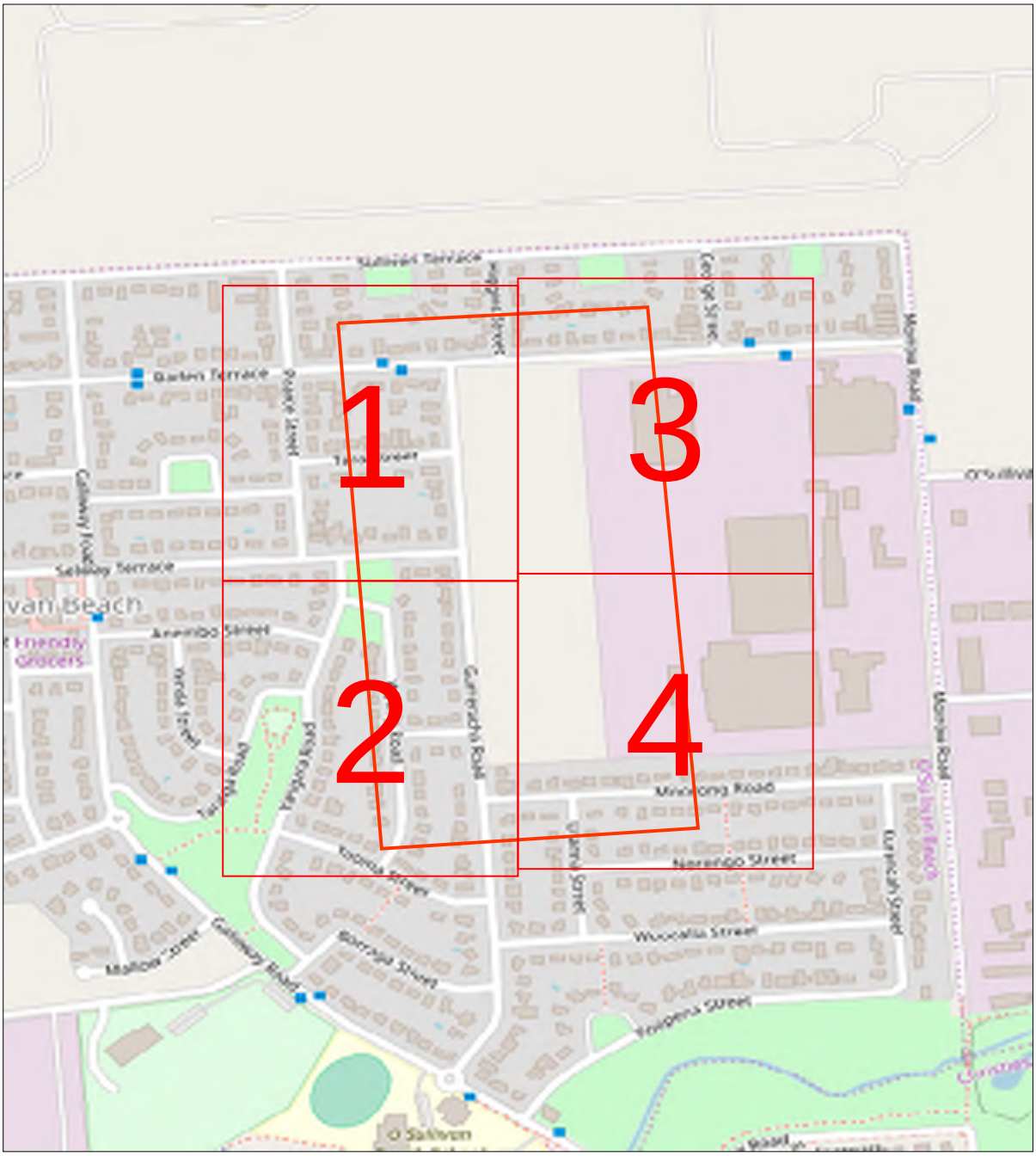
Cable Exits	Cables		
66kV/132kV	66kV/132kV	DBYD Requested Area	Fibre Optic Cable/Duct
33kV	33kV	HV Switching Cubicle	Fibre Manhole/Pit
19kV	19kV	Transformer Cubicle	Pilot Cable
11kV	11kV	Cable Joint Bay	Pilot Manhole/Pit
7.6kV	7.6kV	LV Switching Cubicle/Pit	Substation
Not In Service	Not In Service	Service Pit/Pillar	Electricity Pole
Low Voltage	Low Voltage	Earthing Grid	Light Column

N

0 0.009km

Powered by dbyd x-info

Site Address	Gumeracha Road O'Sullivan Beach 5166	**Sequence No**	99214299
Name	Mr Matthew Reade		
Email	mreade@mlei.com.au		



Scale 1: 6000	NORTH	Enquiry Area / Map Key Area

Site Address	Gumeracha Road O'Sullivan Beach 5166	**Sequence No**	99214299
Email	mreade@mlei.com.au	**Map Reference**	UbdAde 175J16,175K16,185J1,185J2,185J3,185K1,185K2,185K3

Before you commence any works you are required to complete the attached 'Work In The Vicinity Of Critical Gas Assets' request form and forward this to APA asap

ITEM	SYMBOL	TERMS	ITEM	SYMBOL
LOW PRESSURE 1.2 - 1.7kPa		B = BOUNDARY	DIAL BEFORE YOU DIG REQUESTED AREA	
MEDIUM PRESSURE 35 - 100kPa		D = DEPTH	PRIORITY MAIN COVERAGE	
HIGH PRESSURE 70 - 350kPa		Bok = BACK OF KERB		
TRANSMISSION PRESSURE 900 - 15000kPa		Fok = FRONT OF KERB		
PROPOSED MAIN (COLOUR BY PRESSURE)				
ABANDONED MAIN				

Map Key

1	3
2	4

Scale 1:1000

0 0.01km

NORTH

Site Address	Gumeracha Road O'Sullivan Beach 5166	**Sequence No**	99214299
Email	mreade@mlei.com.au	**Map Reference**	UbdAde 175J16,175K16,185J1,185J2,185J3,185K1,185K2,185K3

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HIGH PRESSURE 70 - 350kPa		Bok = BACK OF KERB		
TRANSMISSION PRESSURE 900 - 15000kPa		Fok = FRONT OF KERB		
PROPOSED MAIN (COLOUR BY PRESSURE)				
ABANDONED MAIN				

Map Key

1	3
2	4

Scale 1:1000

0 0.01km

NORTH

Site Address	Gumeracha Road O'Sullivan Beach 5166	**Sequence No**	99214299
Email	mreade@mlei.com.au	**Map Reference**	UbdAde 175J16,175K16,185J1,185J2,185J3,185K1,185K2,185K3

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MEDIUM PRESSURE 35 - 100kPa		D = DEPTH	PRIORITY MAIN COVERAGE	
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PROPOSED MAIN (COLOUR BY PRESSURE)				
ABANDONED MAIN				

Map Key

1	3
2	4

Scale 1:1000

0 0.01km

NORTH

Site Address	Gumeracha Road O'Sullivan Beach 5166	**Sequence No**	99214299
Email	mreade@mlei.com.au	**Map Reference**	UbdAde 175J16,175K16,185J1,185J2,185J3,185K1,185K2,185K3

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LOW PRESSURE 1.2 - 1.7kPa		B = BOUNDARY	DIAL BEFORE YOU DIG REQUESTED AREA	
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PROPOSED MAIN (COLOUR BY PRESSURE)				
ABANDONED MAIN				

Map Key

1	3
2	4

Scale 1:1000

0 0.01km

NORTH