



Our Ref: OSK3426-0020  
Your Ref: A006067610

5 June 2023

Brisbane City Council  
GPO Box 1434  
Brisbane QLD 4000

**EMAIL:** [edasouth@brisbane.qld.gov.au](mailto:edasouth@brisbane.qld.gov.au)

Dear Sir/Madam,

**RE: INFORMATION REQUEST FOR – 26 CLOVERDALE RD, DOOLANDELLA QLD 4077**

We refer to the Brisbane City Council's Information Request (IR) issued on 6 September 2022 regarding the Development Application lodged by QLD International Investment Pty Ltd C/- Nexus Urban Consulting Pty Ltd. On behalf of our client, please find below our response to the civil engineering items:

**Flooding**

1. *The site is impacted by a significant and hazardous overland flow path and further reporting is required to demonstrate how the development meets the relevant benchmarks of the Flood overlay code and Stormwater code.*

*A Flood Impact Assessment and Flood Study certified by an RPEQ engineer is required to assess in detail the flood impacts and overland flow path on the site in the context of the proposed development.*

*The report must address the following items:*

- a) *Existing flooding conditions, based on existing upslope catchment flows (approved and constructed developments) and existing manning's values, and*

**RESPONSE:**

An updated HIA report has been provided that considered the existing upstream catchment conditions (including Manning's values) in the modelling of the existing flooding conditions at the site. Further information on the existing flooding conditions at the site has been provided within the updated HIA report.

- b) *Developed conditions, based on existing flows, site filling/excavation and developed manning's values, and*

**RESPONSE:**

An updated HIA report has been provided that considered the proposed development catchment conditions (including site earthworks and Manning's values) in the modelling of the post development flooding conditions at the site. Further information on the post development flooding conditions at the site has been provided within the updated HIA report.

c) *A sensitivity analysis that is used for setting lot and road levels, using fully developed ultimate upslope catchment flows, and a manning's of 0.10 in any vegetated/open space area.*

**RESPONSE:**

A sensitivity analysis for the proposed overland flow channel using fully developed upstream catchments and a 0.10 Manning's for any vegetated/open space area and the channel was modelled. The results were used to assist in setting the minimum proposed lot and internal road reserve levels. Further information on the sensitivity analysis has been provided within the updated HIA report.

d) *Flood depth, flood contour level, flood hazard and flood impact maps.*

**RESPONSE:**

Flood maps that include maximum water levels, depths, velocities, hazard (depth\*velocity product - DV) and flood impact (afflux) have been provided with the updated HIA report.

e) *A flood impact analysis as part of a flood study.*

**RESPONSE:**

A flood impact analysis has been provided with the updated HIA report.

2. *The channel located at the rear of the western lots and through freehold lots will result in fencing obstructions on each lot that would impact on flows.*

*Provide amended plans / further information to demonstrate the following:*

a) *No part of any lot shall experience flood hazard that is >0.4m<sup>2</sup>/s and or any depth 600mm or greater, nor subject to frequent/nuisance flows. Dedicate any required flood channel mitigation works to Council as land for drainage purposes.*

**RESPONSE:**

The existing overland flow channel will remain the primary flow path to the west and south of the developable portion. A supplementary overflow channel has been provided in a drainage easement to the west of the developable footprint which continues through the convent area in the proposed lots to the south. This covenant area consists of ecological and flood conditions and cannot encompass any construction.

b) *All parts of proposed lots have flood immunity to fully developed upslope catchment conditions with consideration to flows both in Cloverdale Road and the existing drain.*

**RESPONSE:**

All proposed lots have flood immunity for fully developed upstream catchments. The levels were set using a maximum of the sensitivity analysis model results or 500mm freeboard on top of the post development model results to ensure sufficient flood immunity for all lots.

c) *An easement through Lot 41 for the overland flow flooding.*

d) *Safe access to the rear of Lot 41 to allow for maintenance, being a culvert with driveway crossing.*

e) *An easement over creek/waterway flooding at the rear of Lot 41.*

**RESPONSE:** An easement has been provided through Lot 99 (formerly Lot 41) to the rear of the site for overland flow flooding and over the creek/waterway flooding at the rear of the site (Lot 99). Safe access to the rear of the site has been provided through a culvert crossing driveway over the proposed overland flow and existing natural channels.

## **Stormwater quantity and quality**

5. *The Conceptual Stormwater Management Plan has been reviewed and the following amendments are required to demonstrate compliance with Section A of the Stormwater code.*

a) *The existing half cul-de-sac to the east is serviced by a gully that has only allowed for a 0.205ha catchment from this site. The proposal significantly exceeds this allowance. Therefore, any new gullies and proposed lots 9 to 12 must drain to the bioretention basin via a new pipeline to the bioretention basin.*

**RESPONSE:** The updated CSWMP and earthworks for the proposed development will no longer discharge flows into the existing cul-de-sac. It is now proposed to capture and convey the major flows (up to 1% AEP) through the internal stormwater network and discharge flows directly into the existing drainage channel to the south. Due to the requirement to tie into the existing cul-de-sac, the flows captured and conveyed by the proposed stormwater network within the existing cul-de-sac will bypass the bio-retention basin and will not be included within the water quality modelling. Best Management Practices are to be implemented for the bypassing catchment with the flows to be treated by two bio-retention street pits.

b) *Provide a major flow path (5m wide pedestrian pathway) from the cul-de-sac to the waterway. This pathway is to contain stormwater infrastructure and be set 300mm lower than adjacent proposed lots and existing units to ensure major flows can be safely conveyed.*

**RESPONSE:** The major flows are proposed to be captured and conveyed within the stormwater network. Due to the levels of the existing cul-de-sac, a major overland flow path was not able to be constructed along the eastern boundary and as such it is proposed to convey the major flows through the pit and pipe network. A 5m wide pathway has been proposed from the proposed southern cul-de-sac down to the bio-retention basin to ensure adequate access is provided for the basin. The pathway has been designed at least 300mm lower than the adjacent lot levels to ensure any major flows can be safely conveyed towards the bio-retention basin.

c) *Works within the Cloverdale Road frontage are to pipe flows to the existing culvert.*

**RESPONSE:** The proposed works within the Cloverdale Road frontage will include a new pit and pipe network. This network will propose to discharge flows to the existing natural channel to the west of the subject site.

6. *The Conceptual Stormwater Management Plan has been reviewed and the following amendments are required to demonstrate compliance with Section B of the Stormwater code.*

a) *Show the proposed bioretention basin with a minimum filter depth of 500mm, in lieu of the 400mm currently shown.*

**RESPONSE:** The minimum filter media depth within the proposed bio-retention basin has been increased from 400mm to 500mm.

*b) Show the proposed streetscape bioretention in the cul-de-sac with a maximum ponding depth of 100mm. The current 300mm ponding depth shown is not supported. Additionally, the surface area of filter for each device would only be 1.5sqm, as per BSD9034. Remove these treatments and pipe stormwater to the proposed bioretention basin.*

**RESPONSE:** The two proposed streetscape bio-retention pods within the existing cul-de-sac have been modified so each pod only has 1.5m<sup>2</sup> of filter area. Due to the design restrictions for the development with a requirement to tie into the existing cul-de-sac, stormwater was not able to be piped from the north-eastern corner of the site into the proposed bio-retention basin. As a result, the stormwater is discharged into the proposed stormwater network within the existing cul-de-sac with two bio-retention streetscape pods proposed to treat stormwater runoff from that catchment. The influencing catchment will not be included within the water quality modelling with Best Management Practices to be implemented for the bypassing catchment with the flows to be treated by two bio-retention street pits.

*c) A high flow bypass is to be provided so only 3m<sup>nth</sup> flows are directed to the basin.*

**RESPONSE:** A low flow pipe will be constructed to direct low flows (minimum Q3 month) into the bio-retention basin and bypass high flows directly into the existing drainage channel.

*d) Provide additional sections of the basin with levels.*

**RESPONSE:** A typical bio-retention basin section is provided within the updated CSWMP and a cross section has been provide within the updated EIR. Further additional sections of the basin will be provided in the detailed design phase of the development.

*e) Ensure the waterway is designed as per natural channel design and rehabilitated.*

**RESPONSE:** No waterway has been proposed for the development. An overland flow channel has been designed and details are provided with the updated HIA report to direct upstream overland flows around the development.

## **Traffic and Refuse Collection**

7. *The development proposes more than 10 Lots, a new road reserve and an active transport link. Given this, a Traffic report (prepared by a Registered Professional Engineer of Queensland – RPEQ) is required to address section B of the Subdivision code and to demonstrate compliance with the benchmarks of the Transport, access parking and servicing code.*

*The report should include the following:*

a. *The RPEQ signed traffic report needs to demonstrate compliant sight distance and this new intersection and demonstrate that the proposed intersection with Cloverdale Rd complies with the Austroads Standards.*

**RESPONSE:** This item has been responded to within the updated Traffic Impact Assessment Report with the applicable site distance complied with. Refer to the Traffic Impact Assessment report for further details.

b. *Amended plans showing that all lot driveways are from the internal roads only, with no direct access to Cloverdale Road.*

**RESPONSE:** All driveways within the proposed development will be accessed from the internal road only. The location of individual lot owner driveways has not been shown and will be determined during detailed design.

8. *A concept plan showing the location of refuse bin presentation areas on the frontage of the proposed lots is required to address AO19.3 / PO19 of the Subdivision code.*

*This plan must include the following:*

a. *The location and width of all driveways and their wings along the kerb for the refuse bin presentation area on the frontage of every lot.*

**RESPONSE:** Driveways have been shown where required (i.e no other options), however the location of individual lot owner driveways has not been shown and will be determined during detailed design.

b. *The location of power poles, light poles, street sign poles – proposed and existing, street trees, power buoys and any other street furniture that may prevent the presentation of refuse bins on any Lot's frontage, preventing the efficient collection of refuse from the development.*

*Note: Location where presentation areas are not to be located are identified in Section 4.1(5) of the Refuse Planning Scheme Policy.*

**RESPONSE:** This can be conditioned for the development within the approved Development Application conditions and can be determined within the detailed design phase.

## **Earthworks**

9. Further information is required to fully assess the proposed earthworks against the Filling and excavation code.
- a) Provide additional sections on the concept earthworks plans to demonstrate and show how walls interface with neighbouring properties, detailing heights and configuration of retaining walls at the boundary of site to demonstrate compliance with AO1 / PO1 and AO2 / PO2 of the Filling and excavation code
  - b) Complete and submit an Erosion Hazard Assessment form

**RESPONSE:** Additional details and levels have been provided on the concept earthworks plans have been provided for the development and included as an attachment. An Erosion Hazard Assessment Form has been completed and submitted.

We trust that the above response satisfies your request. If you have any further queries, please do not hesitate to contact our office.

Yours faithfully,



Ben Grant  
**Graduate Engineer**

Certified by



Daley Curran  
RPEQ 26353  
**Principal Engineer**



# CONCEPTUAL STORMWATER MANAGEMENT PLAN

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**Proposed Residential Subdivision  
12, 18 & 26 Cloverdale Road, Doolandella**

**Lots 101-103 on RP90234**


For QLD International Investment Pty Ltd

5 June 2023

File No: OSK3426-0014-B

## DOCUMENT CONTROL SHEET

<b>Title:</b>	Conceptual Stormwater Management Plan
<b>Document No:</b>	OSK3426-0014-B
<b>Original Date of Issue:</b>	4 May 2022
<b>Project Manager:</b>	Daley Curran
<b>Author:</b>	Ben Grant
<b>Client:</b>	QLD International Investment Pty Ltd
<b>Client Contact:</b>	Stewart Somers
<b>Client Reference:</b>	12, 18 & 26 Cloverdale Road, Doolandella
<b>Synopsis:</b>	This <i>Conceptual Stormwater Management Plan</i> describes the existing site characteristics, and corresponding stormwater quantity and quality management controls to be implemented during the operation phase of the development.

Reviewed by RPEQ	Reg. No.	Signed	Date
Daley Curran	23653		5 June 2023

Revision/Checking History			
Revision No	Date	Checked By	Issued By
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A	20 June 2022	Aaron Pianta	Ben Grant
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QLD International Investment Pty Ltd – Alex Wu	1	PDF
Nexus Urban Consulting Pty Ltd – Stewart Somers	1	PDF

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## APPENDICES

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Appendix B	Intrax, Proposed Reconfiguration (Ref: S152485)
Appendix C	OSKA Consulting Group, Pre Development Catchment Plan (Ref: OSK3426/P003/B)
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Appendix F	OSKA Consulting Group, Sediment and Erosion Control Plan (Ref: OSK3426/P007/B); OSKA Consulting Group, Sediment and Erosion Control Details (Ref: OSK3426/P008/A)
Appendix G	OSKA Consulting Group, Response to Stormwater Code (Ref: OSK3426-0016)

## 1.0 INTRODUCTION

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### 1.1 Background

OSKA Civil Consultants has been commissioned by QLD International Investment Pty Ltd to prepare a Conceptual Stormwater Management Plan (CSWMP) to support a Development Application (DA) to the Brisbane City Council (BCC) for the proposed Residential Subdivision situated at 12, 18 & 26 Cloverdale Road, Doolandella.

This revision of the report (Revision B) was issued in response to Council Information Request (A006067610) dated 6 September 2022.

The subject site is described as Lots 101-103 on RP90234 and has a total site area of 6.34ha.

### 1.2 Scope

This CSWMP details the conceptual planning, layout and design of the stormwater management infrastructure for both the construction and operational phases of this development.

This CSWMP aims to:

- Establish the required performance criteria for both the existing and proposed stormwater quantity and quality improvement systems;
- Provide a conceptual design of stormwater infrastructure including stormwater quality improvement devices and stormwater quantity management controls;
- Demonstrate the modelled post-development stormwater quality discharging from the site does not adversely impact on the water quality and ecological values of downstream watercourses;
- Demonstrate stormwater runoff is conveyed through the site to a Lawful Point of Discharge (LPOD) in accordance with the Queensland Urban Drainage Manual (QUDM); and
- Provide reporting and monitoring mechanisms whereby the performance of this system can be measured enabling identification of corrective actions/alterations required to ensure the above mentioned objectives are maintained.

This CSWMP has been prepared in accordance with the IEAust *Australian Runoff Quality: Guide to Water Sensitive Urban Design*, Queensland State Planning Policy 2017, IPWEA *Queensland Urban Drainage Manual (QUDM) Fourth Edition (2017)* and Brisbane City Council (BCC) *City Plan 2014 – Planning Scheme Policy 6 – Infrastructure Design*.

## 2.0 SITE DESCRIPTION

### 2.1 Location

The subject site is located on 12, 18 & 26 Cloverdale Road, Doolandella. The site fronts Cloverdale Road to the north, Blunder Creek to the south, a residential lot to the west and an existing residential townhouse development to the east. The site covers a total combined area of 6.34ha, however the proposed development footprint covers an area of 2.379ha, with details as summarised in *Table 1* and as located in *Figure 1*.

**Table 1: Site Description**

Client	Lot and Property Description	Street Address
QLD International Investment Pty Ltd	Lot 103 on RP90234 Lot 102 on RP90234 Lot 101 on RP90234	12 Cloverdale Road, Doolandella 18 Cloverdale Road, Doolandella 26 Cloverdale Road, Doolandella



**Figure 1: Locality Plan (Source: Nearmap)**

## 2.2 Site Topography

The existing site generally slopes towards Blunders Creek to the south-east with spot heights ranging from approximately RL 24.00m AHD along the northern boundary to 18.41 m AHD at the top of the bank of Blunders Creek. The levels drop off further into Blunders Creek to the south, however the survey didn't pick up the corresponding levels. Based on the provided survey and aerial information, any stormwater runoff from roof and ground surfaces drains towards Blunders Creek to the south-east of the site.

Further information of the site survey has been provided by Terramap, Contour & Detail Survey (Ref: 3814/002) included as Appendix A.

## 2.3 Vegetation and Land Use

The subject site currently consists of 3 residential dwellings with landscaped/grassed areas to the front half of the lot with dense vegetation at the rear of the lot. The site is enclosed by a fence to the front along Cloverdale Road with the southern end of the site is situated on Blunders Creek. Access to the site is gained from the north via Cloverdale Road.

An aerial photograph taken on the 9 February 2022 of the subject site is included in *Figure 2*.



**Figure 2:** Aerial Image of the Site (Source: Nearmap – Image taken 9 February 2022)

## 2.4 Proposed Development

The proposed development is to subdivide into thirty-six (36) residential lots. The site will have an internal 14m wide road reserve which will provide access to all 36 lots. Access to the site will be gained from the north via Cloverdale Road which will provide access to the internal road reserve.

Refer to Appendix B for further proposed architectural details prepared by Intrax, Proposed Reconfiguration (Ref: S152485).

## 2.5 Proposed Conceptual Drainage

It is proposed that the majority of the site's captured stormwater be diverted to a proposed bio-retention basin with the remaining area to drain to proposed bio-retention street pods. The Stormwater Quality Improvement Devices (SQID) will treat the majority of the site's stormwater drainage to a minimum Q3-month standard, with the remainder (major Annual Exceedance Probability (AEP) storm flows) to bypass the SQID system.

The stormwater connection to the Lawful Point of Discharge (LPOD) is conceptual at this stage. The captured flows within the basin are piped to the existing natural drainage channel to the south and the flows within the bio pods are to be piped into a proposed sag gully pit within the existing cul-de-sac to the east.

## 2.6 Rainfall Data

Rainfall intensity data has been obtained from the Australian Bureau of Meteorology's 2016 Design IFD Rainfall System. The data has been extracted for the nearest grid cell at Latitude 27.6125 (S) and Longitude 152.9875 (E). The IFD data and average rainfall intensities used in this report are in accordance with the procedures outlined in Geosciences Australia, Australian Rainfall and Runoff 2019.

## 3.0 DATA

Data which has been sourced or provided, in order to prepare this report for the site, was gathered from the following sources:

- Detailed site survey provided by Terramap, Contour & Detail Survey (Ref: 3814/002) included as Appendix A;
- Proposed site layout provided by Intrax, Proposed Reconfiguration (Ref: S152485);
- LIDAR data for the subject site sourced from Australian Government Elevation and Depth Foundation Spatial Data (ELVIS), Date Source: 2014, DEM Data;
- Rainfall and Meteorological 2016 IFD Data by the Australian Bureau of Meteorology;
- Information Extracted from BCC Interactive Mapping – 2014;
- Brisbane City Council City Plan 2014 Planning Scheme;
- Aerial Imagery by Nearmap (Accessed on 1 March 2022); and
- MUSIC data sourced from Rainfall Station 40223, Brisbane.

## 4.0 SITE HYDROLOGY

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### 4.1 Background

The following sections define the method and parameters utilised within the hydrologics of the site, in order to establish a simulation of the anticipated flow regime and peak discharge at the Lawful Point of Discharge (LPOD). A Rational Method calculation has been provided for comparison of the pre and post developed catchments.

The Rational Method (Section 4.3 of the Queensland Urban Drainage Manual - QUDM 2017) is a suitable estimation technique, given its flexibility in its data requirements and is able to produce satisfactory estimates of peak site discharges based on the following data input:

- specific intensity frequency duration (IFD) data;
- length/type of flow path;
- contributing catchment areas; and
- coefficient of discharge.

### 4.2 Pre Development

#### 4.2.1 Catchment Definition and Lawful Point of Discharge

The pre-development site has a total contributing area of 6.34ha, however the development extent is only 2.379ha. The development extent has been analysed as two internal catchments (A and B) and pre-development Catchment A has a contributing area of 1.319ha and Catchment B has a contributing area of 1.061ha. Stormwater captured on the roof areas of Catchment A is conveyed via downpipes and discharged as sheet flow towards the existing natural drainage channel to the south. Any stormwater on the remaining ground surfaces is conveyed as sheet flow through the subject site towards the existing natural drainage channel. Stormwater captured on the roof areas of Catchment B is conveyed via downpipes and discharged as sheet flow towards the neighbouring property, Lot 105 on SP235699 to the east (Existing Point of Discharge). Any stormwater on the remaining ground surfaces is conveyed as sheet flow through the subject site towards the neighbouring property.

The existing Lawful Point of Discharge (LPOD) for Catchment A and B (for analysis in accordance with QUDM), is the existing natural drainage channel to the south and Lot 105 on SP235699 to the east respectively. It is to be noted that the existing natural drainage channel discharges to the nearby Blunder Creek.

The catchment area and LPOD for the subject site are shown on OSKA Consulting Group, Pre Development Catchment Plan (Ref: OSK3426/P003/B) included as Appendix C.

#### 4.2.2 Coefficient of Runoff

The pre-development coefficient of runoff (C year) was determined based on the fraction impervious method specified in QUDM. For the pre-development Catchment A, based on the provided survey information, has 0.136 ha of impervious surfaces, which equates to a fraction impervious (fi) of 0.10. Using a one hour, ten-year rainfall intensity ( $I_{10}$ ) of 61.7 mm/hr, a C10 value of 0.68 has been adopted for the pre-development Catchment A.

For the pre-development Catchment B, based on the provided survey information, has 0.092ha of impervious surfaces, which equates to a fraction impervious (fi) of 0.09. Using a one hour, ten-year rainfall intensity ( $I_{10}$ ) of 61.7 mm/hr, a C10 value of 0.67 has been adopted for the pre-development Catchment B.

The following pre-development coefficients of runoff (as shown in *Table 2*) have been adopted in accordance with QUDM Table 4.5.2, which apply the frequency factors for the standard Annual Exceedance Probability (AEP) design storms of 39%, 10%, 5% and 1% (corresponding to the 2, 10, 20 and 100 year Average Recurrence Interval (ARI) storms).

**Table 2: Pre Development Coefficient of Runoff**

Catchment	C <sub>2</sub>	C <sub>10</sub>	C <sub>20</sub>	C <sub>100</sub>
PRE A	0.57	0.68	0.71	0.81
PRE B	0.57	0.67	0.71	0.81

#### 4.2.3 Time of Concentration

The Time of Concentration (TOC) for both pre development catchments has been calculated in accordance with QUDM Section 4.6.6 – Overland Flow. Friend's Equation ( $t = (107 * n * L^{0.333}) / S^{0.2}$ ) has been used to calculate the initial travel time using sheet flow. Please refer to *Table 3* for the calculated time of concentration for the pre developed catchments.

**Table 3: Pre Development Time of Concentration**

Catchment	Catchment Area (ha)	Catchment Properties	Time of Concentration		
			Overland flow Friend's Equation	Concentrated Overland Flow Figure 4.8	Total t <sub>c</sub>
Pre Development Catchment A	1.319	Average Grassed Surface	Horton's (n) = 0.045 L = 200m Slope = 2.7% t = 23 mins	N/A	23 mins
Pre Development Catchment B	1.061	Average Grassed Surface	Horton's (n) = 0.045 L = 165m Slope = 2.5% t = 22 mins	N/A	22 mins

#### 4.2.4 Design Flow Rates

Pre-development peak flow rates have been estimated for the adopted storms using design rainfall intensities from the Bureau of Meteorology IFD Data. The Rational Method ( $Q = 2.78 \times 10^{-3} CIA$ ) has been used to estimate the subject site's design peak flow rates. The pre-development peak flows for each catchment are presented in *Tables 4* and *5*.

**Table 4: Pre Development Catchment A Peak Flow Estimation – Rational Method**

PRE A					
Annual Exceedance Probability	AEP	39%	10%	5%	1%
Coefficient of Runoff	C	0.57	0.68	0.71	0.81
Area of Catchment (ha)	A	1.319	1.319	1.319	1.319
Average Rainfall Intensity (mm/h)	I	68	111	127	165
Peak Flow Rate (m <sup>3</sup> /s)	Q	0.143	0.274	0.331	0.491

**Table 5: Pre Development Catchment B Peak Flow Estimation – Rational Method**

PRE B					
Annual Exceedance Probability	<b>AEP</b>	39%	10%	5%	1%
Coefficient of Runoff	<b>C</b>	0.57	0.67	0.71	0.81
Area of Catchment (ha)	<b>A</b>	1.061	1.061	1.061	1.061
Average Rainfall Intensity (mm/h)	<b>I</b>	70	114	131	169
<b>Peak Flow Rate (m<sup>3</sup>/s)</b>	<b>Q</b>	<b>0.118</b>	<b>0.225</b>	<b>0.272</b>	<b>0.403</b>

## 4.3 Post Development

### 4.3.1 Catchment Definition and Lawful Point of Discharge

The post-development scenario has been analysed as a single catchment (A + B) with a total contributing area of 2.379ha.

Stormwater collected from the roof, road and ground areas of the post development catchment shall be conveyed via an internal network of pits and pipes, sized to capture the minor AEP events, and conveyed to either the proposed bio-retention basin or bio-retention tree pits. The captured flows within the basin and pits are then piped to the existing natural drainage channel (the catchment's LPOD) located to the south of the development footprint.

It is to be noted that the site is split into two catchments for water quality calculations (A and B). Catchment A (2.114ha) discharges to the proposed bio-retention basin and Catchment B (0.265ha) discharges to the bio-retention tree pits. All flows from both catchments ultimately discharged to the existing natural drainage channel to the south.

The post development catchment area and LPOD are detailed on OSKA Consulting Group, Post Development Catchment Plan (Ref: OSK3426/P004/B) included as Appendix D.

### 4.3.2 Coefficient of Runoff

The post-development coefficients of runoff (C year) were determined using the fraction impervious method as specified in QUDM.

Based on the supplied architectural plans, the post-development catchment has approximately 1.427ha of impervious surfaces which equates to a fraction impervious (fi) of 0.60. Using a one-hour, ten-year rainfall intensity (<sup>1</sup>I<sub>10</sub>) of 61.7 mm/hr, a C10 value of 0.78 has been adopted for the post-development catchment.

The following post-development Coefficients of Runoff (as shown in Table 6) have been adopted in accordance with QUDM Table 4.5.2, which apply the frequency factors for the standard Annual Exceedance Probability (AEP) design storms of 39%, 10%, 5% and 1% (corresponding to the 2, 10, 20 and 100-year ARI storms).

**Table 6: Post Development Coefficient of Runoff**

Catchment	<b>C<sub>2</sub></b>	<b>C<sub>10</sub></b>	<b>C<sub>20</sub></b>	<b>C<sub>100</sub></b>
POST	0.66	0.78	0.82	0.94

### 4.3.3 Time of Concentration

The Time Of Concentration for the post developed catchment has been calculated in accordance with QUDM Table 4.6.3 – Recommended roof drainage system travel times.

In accordance with Table 4.6.3 of QUDM, the post-development catchment will have a time of concentration that will incorporate 5 minutes of the roof to downpipes time plus 5 minutes of pipe flow. This equates to a total travel time of ten (10) minutes.

#### 4.3.4 Design Flow Rates

Post-development peak flow rates have been calculated for the adopted storms using design rainfall intensities from the Bureau of Meteorology 2016 IFD Data. The Rational Method ( $Q = 2.78 \times 10^{-3} CIA$ ) has been used to estimate the required design peak flow rates for the subject site. The post-development peak flows are presented in *Table 7*.

**Table 7: Post Development Catchment Peak Flow Estimation – Rational Method**

POST					
Annual Exceedance Probability	<b>AEP</b>	39%	10%	5%	1%
Coefficient of Runoff	<b>C</b>	0.66	0.78	0.82	0.94
Area of Catchment (ha)	<b>A</b>	2.379	2.379	2.379	2.379
Average Rainfall Intensity (mm/h)	<b>I</b>	100	162	186	240
<b>Peak Flow Rate (m<sup>3</sup>/s)</b>	<b>Q</b>	<b>0.437</b>	<b>0.834</b>	<b>1.005</b>	<b>1.486</b>

#### 4.4 Change in Flow Rates

The difference in peak flow rates calculated from the total pre and post developed catchments has been estimated via The Rational Method, with the results detailed in *Table 8*.

**Table 8: Change in Peak Flow Rates Estimation – Rational Method (Catchment A)**

Annual Exceedance Probability	<b>AEP</b>	39%	10%	5%	1%
Pre Developed Peak Flow Rate (m <sup>3</sup> /s)	<b>Q</b>	0.143	0.274	0.331	0.491
Post Developed Peak Flow Rate (m <sup>3</sup> /s)	<b>Q</b>	0.437	0.834	1.005	1.486
<b>Change in Peak Flow Rate (m<sup>3</sup>/s)</b>	<b>Q</b>	<b>+0.294</b>	<b>+0.560</b>	<b>+0.674</b>	<b>+0.995</b>

The proposed development has demonstrated via the Rational Method Assessment, that an increase in peak flow rates discharging to the existing natural drainage channel is anticipated. Typically On-Site Detention (OSD) will be required to mitigate flows to pre-development conditions, however in accordance with the BCC City Plan SC6.16 Chapter 7 Stormwater Drainage, it is proposed that no detention will be required. Section 7.5.2 denotes the requirements for when detention is not required, and the development meets the following points;

- **3a** - The development will not cause adverse impacts or actionable nuisance to surrounding properties;
- **3c** - the site discharges directly into the lower catchments of creeks or major drains where it would generally be undesirable to have detention where it may allow peak flows from the site to coincide with the wider catchment flood peak; and
- **3h** - the development site is located entirely within the 1% AEP floodplain (waterway/creek or river flooding sources).

The development does not propose any stormwater detention as the site is located directly upstream from Blunder Creek and the creek doesn't affect any residential properties, therefore the increase in peak flow rates is not anticipated to cause any adverse effects to surrounding properties.

The site is also located at the lower end of the catchment for Blunder Creek and if detention is provided it is anticipated that the peak flows may coincide with the wider catchments flood peak. The development is also significantly flood effected with the majority of the pre-developed site effected by the 1% creek flooding as shown in Appendix B of the Knobel Engineers, *Hydraulic Impact Assessment* (Ref: K3426-0008-D), and any detention provided is anticipated to become flooded.

In accordance with the BCC City Plan and the points raised above the development does not propose to provide any stormwater detention.

#### **4.5 External Catchments**

The subject site and the surrounding area were examined to determine if any localised external catchments will contribute to the subject site. The site was deemed to contain an influencing localised external catchment to the north-west. The external catchment flows are to be conveyed through the site via a drainage channel along the western and southern boundaries. The catchment and channel have been analysed and designed through the updated Hydraulic Impact Assessment with the drainage channel to run through the site before connecting back into the existing natural channel to the south-east. For further information about the external catchment and drainage channel see the *Hydraulic Impact Assessment* prepared by OSKA Consulting Group (Ref: OSK3426-0008-D).

## 5.0 STORMWATER QUALITY ASSESSMENT

### 5.1 Background

The development of the land has the potential to increase the pollutant loads within stormwater runoff and downstream watercourses. During the construction phase of the development, disturbances to the existing ground have the potential to significantly increase sediment loads entering downstream drainage systems and watercourses. The operational phase of the development will potentially increase the amount of sediments and nutrients washing from the site.

The following sections describe the construction and operational phase controls and water quality modelling of the proposed treatment train in compliance with Council guidelines.

### 5.2 Construction Phase

A high risk of stormwater pollution will occur from the site during the construction phase due to erosion and sediment transportation off-site to the receiving environment. The majority of this risk results from construction activities disturbing the site and exposing areas of soil to the direct erosive influence of the environment.

The following section outlines the procedures necessary to minimise erosion and control sediment during construction in accordance with the International Erosion Control Association (IECA) Best Practice ESC Document.

#### 5.2.1 Key Pollutants

The key pollutants have been identified for the Construction Phase of this development.

Table 9: Key Pollutants, Construction Phase

Pollutant	Sources
Litter	Paper, construction packaging, food packaging, cement bags, material offcuts.
Sediment	Exposed soils and stockpiles during earthworks and building works.
Hydrocarbons	Fuel and oil spills, leaks from construction equipment and temporary car park areas.
Toxic Materials	Cement slurry, asphalt primer, solvents, cleaning agents, and wash waters (e.g., from tile works).
Acids or Alkaline substances	Acid sulphate soils, cement slurry and wash waters.

#### 5.2.2 Sediment and Erosion Controls

Sediment and Erosion Control devices (S&EC) employed on the site shall be designed and constructed in accordance with the International Erosion Control Association (IECA) Best Practice ESC Document as shown on OSKA Consulting Group, Sediment and Erosion Control Plan (Ref: OSK3426/P007/B); OSKA Consulting Group, Sediment and Erosion Control Details (Ref: OSK3426/P008/A) included as Appendix F.

### **Pre-Construction**

- Stabilised site access/exit onto Cloverdale Road to the north;
- Sediment fences to be located around the perimeter of the site;
- Sediment trap to be installed in the south of the site;
- Dust fencing to be installed if required; and
- Educate site personnel to the requirements of Erosion and Sediment Control Plan.

### **Initial Construction**

- Maintain construction access/exit, sediment fencing, dust fences and all other existing controls as required;
- Construct diversion drains to convey disturbed site run-off to the temporary sediment traps; and
- Confine construction activities to stages to minimise areas of disturbance at any given time.

### **Second Stage Construction**

- Maintain construction access/exit, sediment fencing, dust fences, diversion drain and all other existing controls as required;
- Progressively revegetate finished areas where applicable;
- Divert runoff from undisturbed areas around disturbed areas; and
- Drainage structure protection around field inlets and gully pits.

During construction, all areas of exposed soils allowing dust generation are to be suitably treated. Treatments will include covering the soil and watering. Road accesses are to be regularly cleaned to prevent the transmission of soil on vehicle wheels and eliminate any build-up of typical road dirt and tyre dust from delivery vehicles.

Adequate waste disposal facilities are to be provided and maintained on the site to cater for all waste materials such as litter, hydrocarbons, toxic materials, acids or alkaline substances.

## **5.2.3 Water Quality Monitoring and Inspections**

To ensure that the water quality objectives are being met during the construction phase of the development, water quality monitoring shall be conducted. Water quality monitoring shall use a calibrated probe or sampling and testing at a NATA registered laboratory.

**Location:** Monitoring Stations MS1 shown on OSKA Consulting Group, *Sediment and Erosion Control Plan* (Ref: OSK3426/P007/B).

**Parameters:** Site discharge criteria shown on OSKA Consulting Group, *Sediment and Erosion Control Plan* (Ref: OSK3426/P007/B).

**Frequency:** Following at least 30 mm of rainfall in a 24-hour period.

The contractor shall be responsible for the inspection and maintenance of all sediment and erosion control devices. Additional controls and review of existing controls shall be undertaken in response to the results of the above-mentioned monitoring program.

## 5.2.4 Reporting

An inspection report shall be written by a suitably qualified and experienced scientist/engineer following each water quality monitoring episode. The report shall include at least the following information:

- Name, address and real property description for the development site;
- Council file reference number (if known);
- Monitoring locations;
- Performance criteria;
- Results for each monitoring location, identifying any breaches of performance criteria;
- Recommended corrective actions to be taken and additional sediment and erosion controls, if required; and
- Inspection reports shall be provided to the contractor for their action and compilation in an on-site register.

If the above-mentioned performance criteria are exceeded and results from the downstream monitoring stations show significant deterioration from upstream results (if applicable), the contractor shall implement all recommendation of the inspection report within one (1) working day of receipt of the report.

## 5.3 Operational Phase

The following sections provide details of the Stormwater Quality Improvement Devices (SQID's) proposed for the operational phase of the development. OSKA Consulting Group, Conceptual Stormwater Management Plan (Ref: OSK3426/P005/B); OSKA Consulting Group, Conceptual Stormwater Management Details (Ref: OSK3426/P006/B) in Appendix E illustrates the size and location of the proposed SQID's.

### 5.3.1 Stormwater Quality Objectives

To protect the water quality of the downstream watercourses the following Water Quality Objectives (WQO's) have been applied to stormwater runoff from the site in accordance with BCC SC6 (SC6.16 – C7) Stormwater Drainage and the criteria within 7.9.3 Permanent Methods of Water Quality Control.

Best Management Practices (BMP) are required to be demonstrated for all Development Applications within the Brisbane City Council and are recommended to be implemented by the developer. Where practicable, methods such as first flush devices, and discharging stormwater to landscaped/grassed areas prior to discharge to the LPOD, are to be incorporated into the site's stormwater strategy, where the opportunity is available.

The following load reduction targets must be achieved when assessing the post-development treatment train (comparison of unmitigated developed case versus developed mitigated case).

- 80% reduction in Total Suspended Sediment (TSS);
- 60% reduction in Total Phosphorus (TP);
- 45% reduction in Total Nitrogen (TN); and
- 90% reduction in litter (sized 5 mm or greater).

### 5.3.2 Post Development MUSIC Modelling

To assess the potential quantities of pollutants anticipated to be discharged from the site, the water quality modelling package 'Model for Urban Stormwater Improvement Conceptualisation' (MUSIC) V6.3 by eWATER has been applied. MUSIC Modelling Parameters and delineated data have been sourced from Water by Design, MUSIC Modelling Guidelines, and where possible, via online MUSIC Link data.

Rainfall data has been sourced from Rainfall Station 40223, (Brisbane) using a date range from 1 January 1990 to 31 December 1990 and a 6 Minute Time Step, in accordance with BCC requirements.

### 5.3.3 Stormwater Quality Improvement Devices

A Water Sensitive Urban Design (WSUD) approach has been adopted for the site. One (1) bio-retention system has been proposed as the most suitable SQUID's to treat runoff from the subject site's developed area as it can readily be integrated into the proposed landscaping and revegetation works.

The proposed SQUID has been provided for modelling purposes only and is subject to council approval. Accordingly, similar alternative devices may be adopted with council review and approval.

The adopted MUSIC catchment areas for the subject site are as follows;

**Table 10: Adopted MUSIC Catchment Areas**

Catchment	Area (m <sup>2</sup> )	% Impervious
Roof - A (Residential)	6 665	100
Road - A (Residential)	3 738	60
Ground – A (Residential)	10 733	20
Roof – B (Residential)	860	100
Road – B (Residential)	817	60
Ground – B (Residential)	977	20
<b>TOTAL Site</b>	<b>23 790</b>	

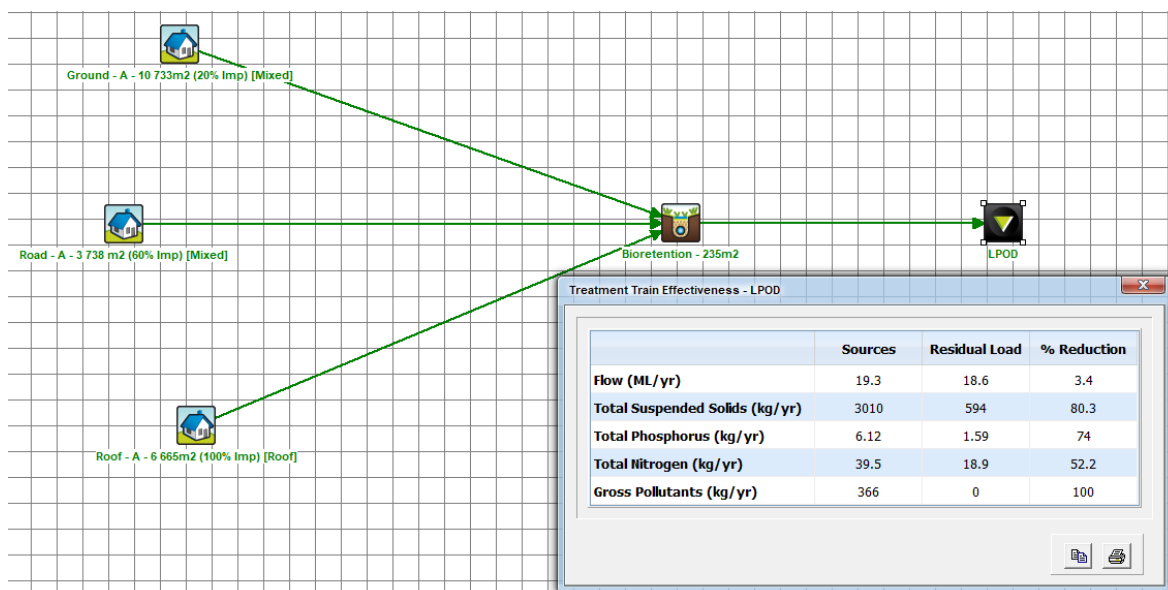
Stormwater runoff captured from the roof, road and ground areas from Catchment A will be captured and conveyed by the proposed pit and pipe network and discharged into the proposed bio-retention basin. The low flows (minimum Q3 month flow) from Catchment A will be discharged directly to the bio-retention basin with the high flows to bypass the basin and discharge to the existing drainage channel to the south.

Stormwater runoff captured from the roof, road and ground areas from Catchment B will be conveyed to the proposed bio-retention street pods.

Catchment B has been excluded from the water quality MUSIC modelling due to the requirement of the development to tie into the existing cul-de-sac to the east. The existing cul-de-sac burdens the proposed development as it was not previously built to a level not suitable design levels for the subject site, especially considering the flooding conditions. As such, stormwater gravity discharge to the south of the site (LPOD), is not able to be achieved on top of the bioretention basin to the south. The development will implement Best Management Practices by treating the runoff from Catchment B via 2 bio-retention basin street pits.

It should be noted that this area is minor (Catchment B) compared to the greater site area (Catchment A) which complies with the required water quality treatment targets.

An illustration of the MUSIC model of the adopted operational treatment train for the post-development site has been provided in *Figure 3*.



**Figure 3:** Operational Phase Treatment Train (Source: MUSIC)

### 5.3.4 Design Parameters of the Stormwater Quality Improvement System

Detailed design of the stormwater treatment train shall be in accordance with the Water Sensitive Urban Design (WSUD), Technical Design Guidelines for South East Queensland – Version 1 (June 2006).

## **BIO-RETENTION BASIN**

A bio-retention basin is designed to pond stormwater, allowing it to percolate through a layer of filter media, typically sandy loam. Runoff passing through the filter media is collected with a perforated pipe discharging to the downstream drainage infrastructure. The bio-retention basin shall be located to treat all stormwater from the development area. The inlet of the bio-retention basin is to be equipped with a sediment forebay to allow a control point at the entrance to the bio for maintenance and removal of sediment accumulation. It will also dissipate flows reducing pipe exit velocity and limit the occurrence of potential scour of the sensitive downstream constructed bio-retention media surface.

The bio-retention basin has been modelled with the following properties:

- Filter media Sandy Loam;  
5 – 10% Organic Content in accordance with AS1289.4.1.1;  
Average D50 0.45 mm;  
 $K_{sat}$  200 mm/hr;  
TN Content = 400 mg/kg  
Orthophosphate Content = 30 mg/kg
- Filter media depth 0.50 m;
- Drainage layer 0.20 m;
- Extended detention depth 0.20 m;
- Seepage 0 mm/hr;
- Filter Area 235 m<sup>2</sup>;
- Surface Area 260 m<sup>2</sup>.

The filter area and surface area used in the model have been sized in accordance with MUSIC Modelling Guidelines Version 3.0-2018 Section 4.5.2. As the bio-retention basin does not have vertical sides in the entire extended detention zone, the filter area and surface area are not equal, as reflected in OSKA Consulting Group, *Conceptual Stormwater Management Plan* (Ref: OSK3426/P005/B) and OSKA Consulting Group, *Conceptual Stormwater Management Details* (Ref: OSK3426/P006/B) included at Appendix E.

## **BIO-RETENTION STREET PODS**

The proposed bio-retention street pods are to be designed and constructed in accordance with the BCC specifications in the standard drawings BSD-8331, BSD-8332, BSD-8333 and BSD-8334.

### 5.3.5 Post Development Modelling Results - Mitigated

The modelled Stormwater Quality Improvement Devices (SQID) have demonstrated a reduction in the amount of sediments and nutrients discharging from the proposed residential development. *Table 11* illustrates the effectiveness of the SQID's in the treatment train for the development.

**Table 11: Treatment Train Effectiveness at Receiving Node**

Parameter	Post	Post Mitigated	Reduction	Water Quality Objectives
Flow (ML/yr)	19.3	18.6	3.4 %	-
TSS (kg/yr)	3 010	594	80.3 %	80 %
TP (kg/yr)	6.12	1.59	74.0 %	60 %
TN (kg/yr)	39.5	18.9	52.2 %	45 %
Gross Pollutants (kg/yr)	366	0	100 %	90 %

The results demonstrate that the proposed SQID's meet the intended Water Quality Objectives for Suspended Solids, Gross Pollutants, Phosphorous and Nitrogen levels, in accordance with the Brisbane City Council Requirements.

## 6.0 OPERATIONAL PHASE MAINTENANCE REQUIREMENTS

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The proposed stormwater management devices will require maintenance and monitoring to ensure that they function as designed. The following section provides an outline of the necessary maintenance tasks for the proposed devices.

### 6.1 Bio-retention Basin

The most intensive period of maintenance is during the plant establishment period (first two years) when weed removal and replanting may be required. It is also the time when large loads of sediments could impact on plant growth particularly in developing catchments with poor building controls.

#### **Maintenance is primarily concerned with:**

- Maintenance of flow to and through the bio-retention basin;
- Maintaining vegetation;
- Preventing undesired overgrowth vegetation from taking over the bio-retention basin;
- Removal of accumulated sediments; and
- Litter and debris removal.

#### **Vegetation maintenance will include:**

- Fertilising plants;
- Removal of noxious plants or weeds; and
- Re-establishment of plants that die.

Sediments accumulated at the inlets need to be monitored. Depending on the catchment activities the deposition of sediment can tend to smother plants and reduce the ponding volume available. Should excessive sediment build-up it will impact on the plant health and require removal before it reduces the infiltration rate of the filter media. The proposed SQIDs will require regular maintenance and monitoring to ensure that they function as designed.

### 6.2 Bio-retention Street Pod

The most intensive period of maintenance is during the plant establishment period (first two years) when weed removal and replanting may be required. It is also the time when large loads of sediments could impact on plant growth particularly in developing catchments with poor building controls.

#### **Maintenance is primarily concerned with:**

- Maintenance of flow to and through the bio-retention street pod;
- Maintaining vegetation;
- Preventing undesired overgrowth vegetation from taking over the bio-retention street pod;
- Removal of accumulated sediments; and
- Litter and debris removal.

#### **Vegetation maintenance will include:**

- Fertilising plants;
- Removal of noxious plants or weeds; and
- Re-establishment of plants that die.

Sediments accumulated at the inlets need to be monitored. Depending on the catchment activities the deposition of sediment can tend to smother plants and reduce the ponding volume available. Should excessive sediment build-up it will impact on the plant health and require removal before it reduces the infiltration rate of the filter media. The proposed SQIDs will require regular maintenance and monitoring to ensure that they function as designed.

It is to be noted that shrubs or small plants must be used within the pods as the depth within the pods is too small to allow for trees in accordance with BSC requirements.

**Table 12: Bio-retention Basin and Pod Maintenance Schedule**

<b>Bio-retention Basin Maintenance Checklist</b>			
<b>Inspection Frequency: 3 Monthly</b>	<b>Date of Visit:</b>		
<b>Location:</b>			
<b>Description:</b>			
<b>Site Visibility:</b>			
<b>Inspection Items</b>	<b>Yes</b>	<b>No</b>	<b>Action Required (Details)</b>
Sediment accumulation at inflow points?			
Litter basin?			
Erosion at inlet or other key structures (e.g. crossovers)?			
Traffic damage present?			
Evidence of dumping (Building waste, oils etc)?			
Vegetation condition satisfactory (density, weeds etc)?			
Replanting required?			
Mowing required?			
Clogging of drainage points (sediment or debris)?			
Evidence of ponding?			
Damage/vandalism to structures present?			
Surface clogging visible?			
Drainage system inspected?			
Resettling of system required?			
<b>Comments:</b>			

## 7.0 ASSET HANDOVER

The proposed stormwater quality devices shall be dedicated to the owner/body corporate following the time of practical completion for the proposed development. An Asset Handover Checklist is provided as *Table 13* as a guideline for the necessary steps to be taken prior to the end of the maintenance period.

**Table 13: Asset Handover Checklist**

<b>Asset Location:</b>		
<b>Construction By:</b>		
<b>Maintenance Period:</b>		
<b>Treatment:</b>	<b>Y</b>	<b>N</b>
Actual treatment performance equivalent to design:		
<b>Maintenance:</b>		
Maintenance Plans Provided:		
Inspection and maintenance undertaken as per maintenance plan:		
Inspection and maintenance forms provided:		
Asset inspected for defects:		
<b>Asset Information:</b>		
Design assessment checklist provided:		
As constructed plans provided:		
Copies of all permits provided:		
Digital files provided:		

## 8.0 CONCLUSIONS

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OSKA Civil Consultants has been commissioned by QLD International Investment Pty Ltd to prepare a Conceptual Stormwater Management Plan (CSWMP) to support a Development Application (DA) to the Brisbane City Council (BCC) for the proposed residential subdivision situated at 12, 18 & 26 Cloverdale Road, Doolandella. This CSWMP intends to provide an optimised stormwater management system that would be compatible and readily integrated into the proposed site use.

This CSWMP details the conceptual planning, layout and design of the stormwater management infrastructure for both the construction and operational phases of this development and satisfies the requirements of the Brisbane City Council Guidelines.

A hydrological analysis demonstrated that the anticipated post-development peak flow rates discharging to the existing natural drainage channel is higher than the pre-development flow rates, however in accordance with the BCC City Plan SC6.16 Chapter 7 Stormwater Drainage and Section 7.5.2 it is not proposed to provide and stormwater detention.

The development is proposing to discharge all site flows into the existing drainage channel to the south and will no longer discharge flows onto the neighbouring property to the east (6 Cloverdale Road) as was the case in the pre development scenario (Pre Development Catchment B).

OSKA Civil Consultants has adopted a Water Sensitive Urban Design (WSUD) approach, in accordance with the State Planning Policy, to managing the stormwater runoff from the proposed development by treating stormwater runoff within one (1) bio-retention basin with 235m<sup>2</sup> of bio filter area (Catchment A) and two bio-retention street pods with 1.50m<sup>2</sup> of filter area each (Catchment B). The SQID's utilised within the proposed development have been adopted to demonstrate a potential treatment system, pending council approval.

A monitoring and maintenance plan for the proposed infrastructure has been included. A sediment and erosion control plan is provided for the construction phase of the development and shall be implemented by the contractor and developer.

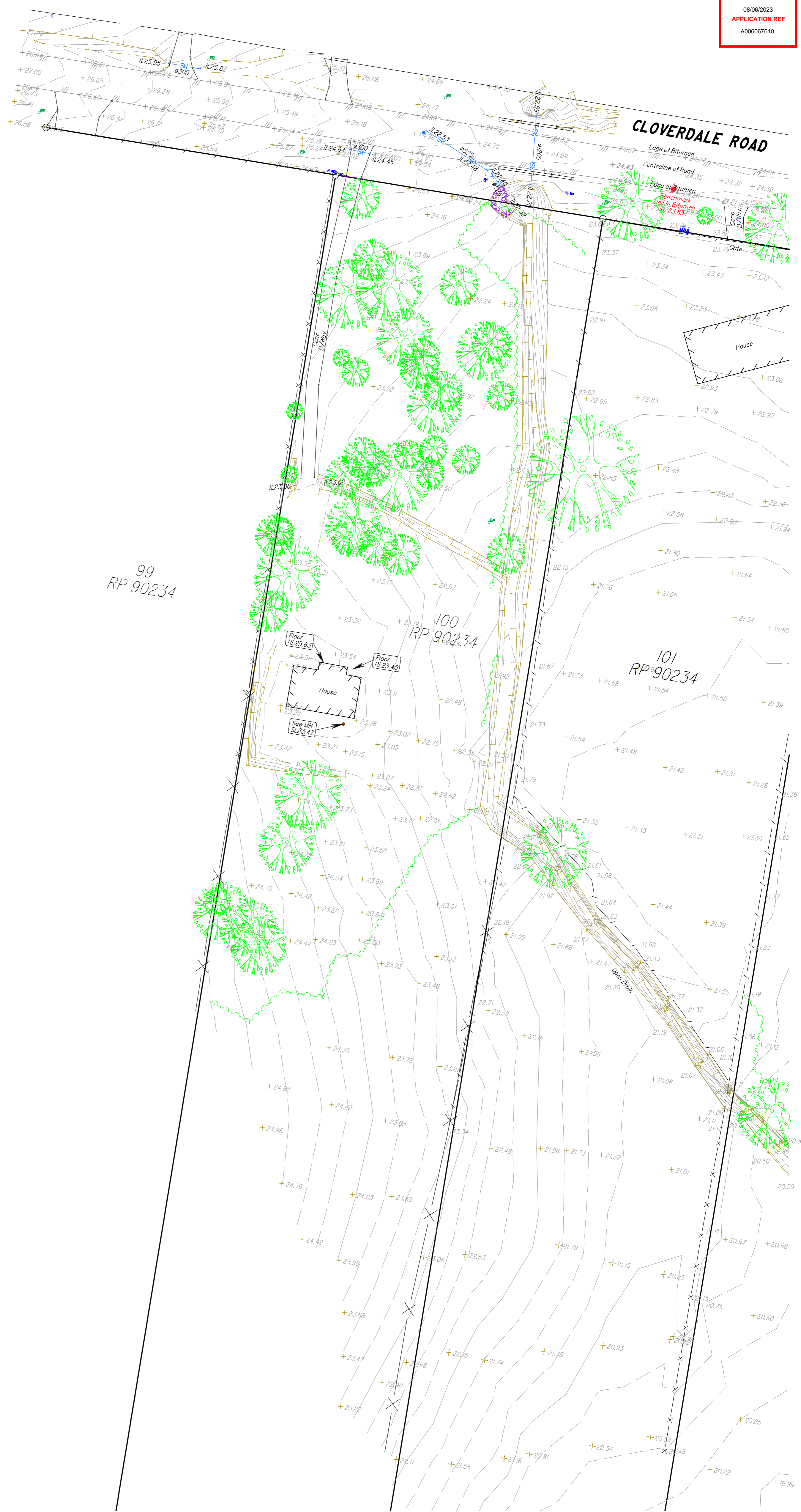
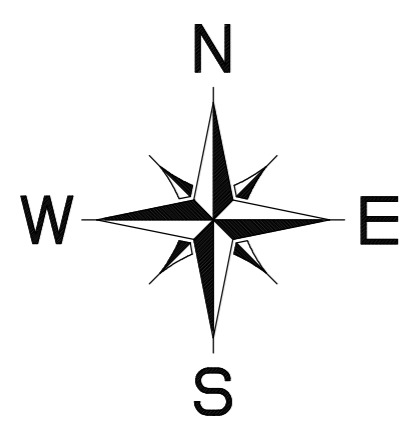
This stormwater quality strategy has been defined by demonstrating the preliminary requirements and layout of the proposed development to demonstrate compliance with the State Planning Policy 2017 and the Brisbane City Council (BCC) City Plan 2014 Planning Scheme.

APPENDIX

**A**

Terramap, Contour &  
Detail Survey (Ref: 3814/002)

**BCC DS**  
 Plans/Documents  
 RECEIVED  
 08/06/2023  
 APPLICATION REF  
 A006067610.



**LEGEND**

EDGE OF KERB	
OVERHEAD ELECTRICITY	
BUILDING WALL	
CROWN OF BITUMEN	
FENCE LINES	
PROPERTY BOUNDARY	
STORMWATER	
SEWER MAIN	
WATER VALVE/METER	
FIRE HYDRANT	
TELSTRA PIT	
ELECTRICITY PIT/POLE	
SURVEY MARKS	
STORMWATER MH/GRATE	
SEWER MH	

- Notes**
- This plan is prepared for the client from a combination of field survey and existing records for the purpose as instructed by the client and should not be used for any other purpose.
  - The title boundaries shown hereon were not marked by the author at the time of survey and have been determined by plan dimension only and not by field measurement.
  - Services shown hereon have been located where possible by field survey. If not able to be located known services have been plotted from the records of relevant authorities where available and have been noted accordingly on this plan. Where such records do not exist or are considered inadequate, a notation has been made hereon.
  - Contours depicted are surveyed ground levels and may not represent Ground Level as defined by the planning scheme for the overall determination of height.
  - Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services. This note is an integral part of this plan.

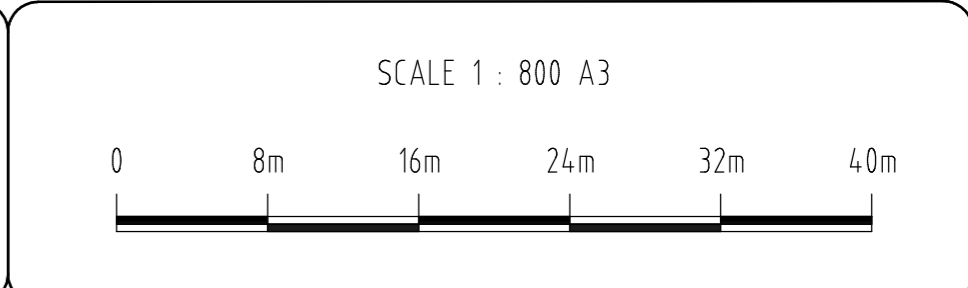


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 reception@terramap.com.au

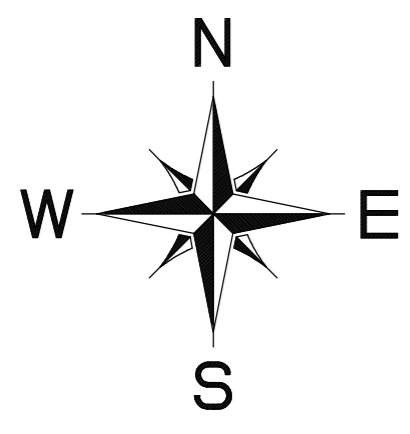
**Alex Wu**

SURVEYOR:	JO
DATE OF SURVEY:	11/5/17
CONTOUR INTERVAL:	0.25m
LEVEL DATUM:	AHD DERIVED
ORIGIN:	PSM 186215 RL20.590
MERIDIAN:	RP 90234

**Contour and Detail Survey**  
 Lots 99-103 on RP 90234  
 18-32 Cloverdale Road, Doolandella  
 Sheet 3 of 3



DRAWN:	20.01.2016
CHECKED:	20.01.2016
APPROVED:	20.01.2016
DRAWING NUMBER:	3814/002-3
REV	2



100  
RP 90234

101  
RP 90234

102  
RP 90234

103  
RP 90234

105  
SP 235699

BLUNDER

CREEK

Contours in this area are indicative only

Contours in this area are indicative only

Contours in this area are indicative only

LEGEND	
EDGE OF KERB	
OVERHEAD ELECTRICITY	
BUILDING WALL	
CROWN OF BITUMEN	
FENCE LINES	
PROPERTY BOUNDARY	
STORMWATER	
SEWER MAIN	
WATER VALVE/METER	
FIRE HYDRANT	
TELSTRA PIT	
ELECTRICITY PIT/POLE	
SURVEY MARKS	
STORMWATER MH/GRATE	
SEWER MH	

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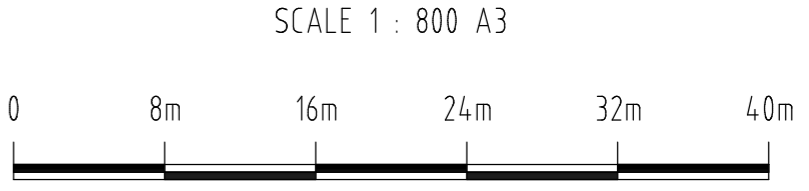


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Ph 32451611 Fax 32451944  
reception@terramap.com.au

SURVEYOR:	RS & NM
DATE OF SURVEY:	20.01.2016
CONTOUR INTERVAL:	0.25m
LEVEL DATUM:	AHD DERIVED
ORIGIN:	PSM 186215 RL20.590
MERIDIAN:	RP 90234

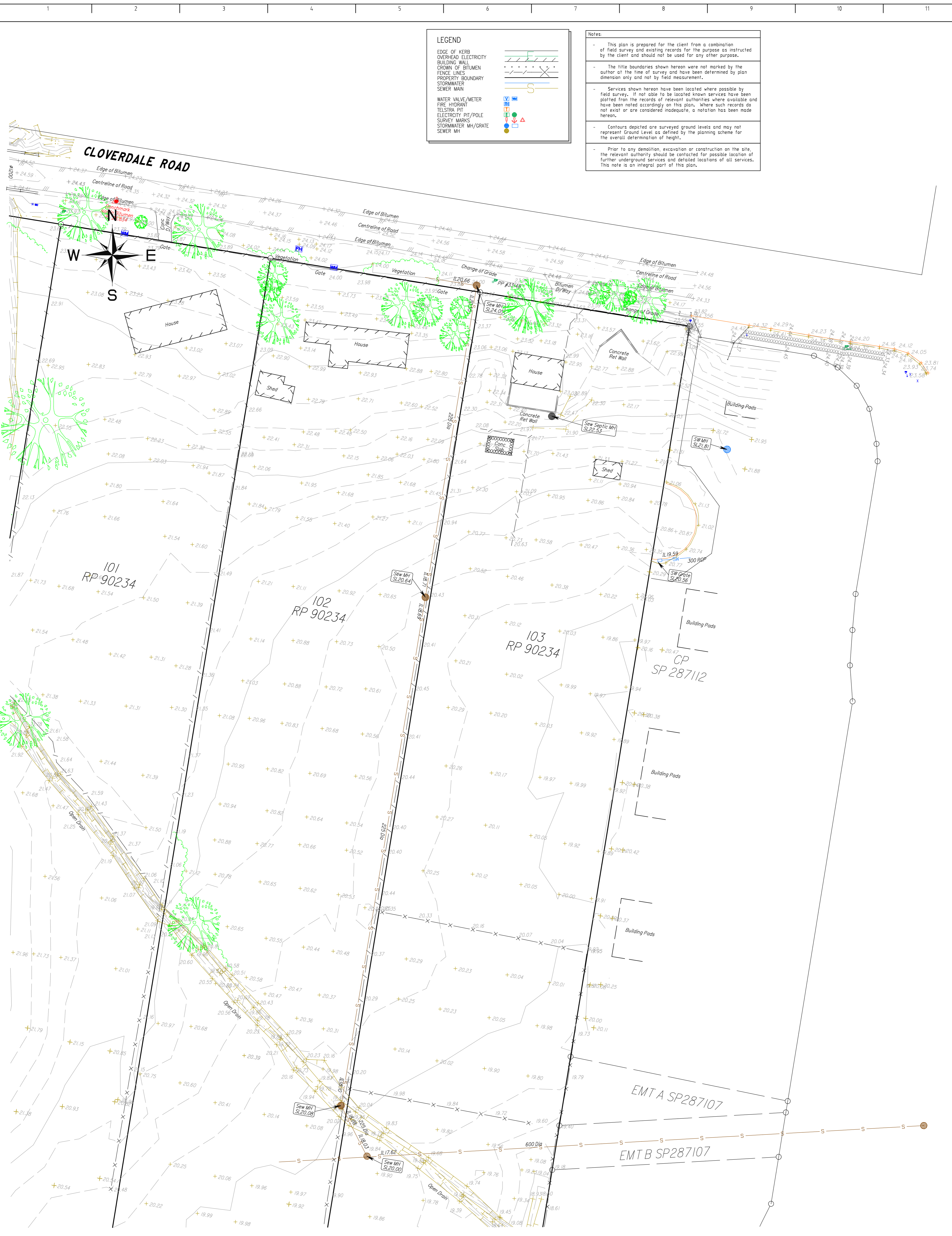
Alex Wu

Contour and Detail Survey  
Lots 99-103 on RP 90234  
18-32 Cloverdale Road, Doolandella  
Sheet 2 of 3



DRAWN:	20.01.2016
CHECKED:	20.01.2016
APPROVED:	20.01.2016
DRAWING NUMBER:	3814/002-2
REV:	2

Rev	DATE	By	AMENDMENT
2	31/03/22	MP	Updated Boundary
1	20/12/21	RK	Datum changed to MGA2020
0	20.01.16	G/JW	ORIGINAL ISSUE



**LEGEND**

EDGE OF KERB	
OVERHEAD ELECTRICITY	
BUILDING WALL	
CROWN OF BITUMEN	
FENCE LINES	
PROPERTY BOUNDARY	
STORMWATER	
SEWER MAIN	
WATER VALVE/METER	
FIRE HYDRANT	
TELSTRA PIT	
ELECTRICITY PIT/POLE	
SURVEY MARKS	
STORMWATER MH/GRATE	
SEWER MH	

- Notes**
- This plan is prepared for the client from a combination of field survey and existing records for the purpose as instructed by the client and should not be used for any other purpose.
  - The title boundaries shown herein were not marked by the author at the time of survey and have been determined by plan dimension only and not by field measurement.
  - Services shown hereon have been located where possible by field survey. If not able to be located known services have been plotted from the records of relevant authorities where available and have been noted accordingly on this plan. Where such records do not exist or are considered inadequate, a notation has been made hereon.
  - Contours depicted are surveyed ground levels and may not represent Ground Level as defined by the planning scheme for the overall determination of height.
  - Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services. This note is an integral part of this plan.

**terra map**  
CONSULTING CADASTRAL & ENGINEERING SURVEYORS

Unit 12, 178-182 Redland Bay Road  
Capalaba, QLD 4157  
www.terra-map.com.au

Ph 32451611 Fax 32451944  
reception@terra-map.com.au

SURVEYOR:	RS & NM
DATE OF SURVEY:	04.09.15 & 20.01.2016
CONTOUR INTERVAL:	0.25m
LEVEL DATUM:	AHD DERIVED
ORIGIN:	PSM 186215 RL20.590
MERIDIAN:	RP 90234

**Alex Wu**

**Contour and Detail Survey**  
Lots 99-103 on RP 90234  
18-32 Cloverdale Road, Doolandella  
Sheet 1 of 3

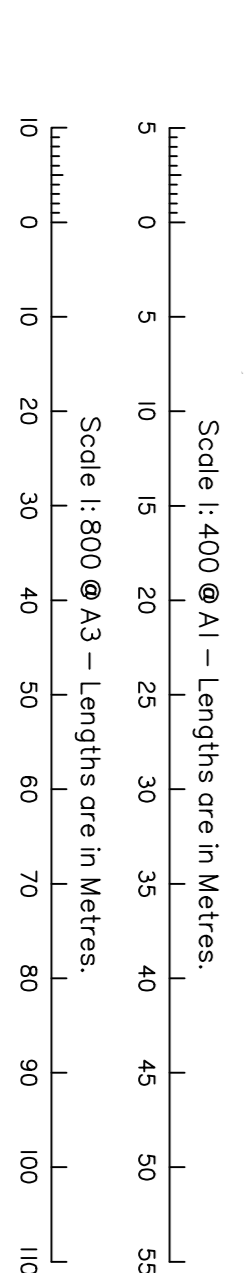
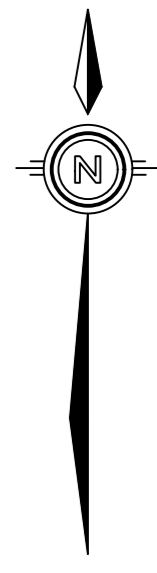
SCALE 1 : 800 A3

7	22/04/22	MP	Updated Boundary	DRAWN:	20.01.2016
6	31/03/22	MP	Updated Boundary	CHECKED:	20.01.2016
5	17/03/22	JD	Survey Extended	APPROVED:	20.01.2016
4	20/12/21	RK	Datum changed to MGA2020	DRAWING NUMBER:	3814/002-1
3	15/07/17	AS	Survey Extended	REV	7
2	21/10/16	AS	Sewer IL added		
1	20.01.16	GJW	ORIGINAL ISSUE		
0	14.09.15	BG	ORIGINAL ISSUE		
Rev	DATE	By	AMENDMENT		

APPENDIX

**B**

Intrax, Proposed  
Reconfiguration (Ref: S152485)



- LEGEND**
- PP Denotes Power Pole
  - Denotes Development Boundary
  - Denotes Existing Lot Boundaries
  - Denotes Option for Future Bikeway
  - Denotes Watercourse
  - Denotes Drainage Easement
  - Denotes Access Easement
  - Denotes Overland Flow Flooding Easement
  - Denotes Creek Flooding Easement
  - Denotes Covenant
  - Denotes Building Envelope
  - Denotes Garage Built to Boundary
  - Denotes New Road
  - Denotes Existing Road
  - Denotes Drainage Reserve
  - Denotes Bio-retention Basin
  - Denotes Detached House Lots (35 Dwellings)
  - Denotes Environmental Protection Zone (1 Dwelling)
  - (36 Dwellings Total)

REV	AMENDMENT	DATE	APPROVED
C-3	ATTENTION OF BENTON FRONZAGE	05/02/2022	Shortficks
C-2	REALIGNMENT OF FOOTPATH	08/02/2022	
D-1	REVISION	08/02/2023	

VERTICAL DATUM:	MGA, Zone 56
ORIGIN:	AHD
CONTOUR INTERVAL:	0.25 m

SCALE:	1:400
DATE:	5/6/2023
SHEET NO.:	2 OF 2
PROJECT NO.:	S152485
REVISION:	D
DATE:	0-1

**PROPOSED RECONFIGURATION OF LOT APPLICATION OVER**  
**LOTS 101-103 ON RP90234**  
**12, 18 & 26 CLOVERDALE ROAD**  
**LOCAL AUTHORITY OF BRISBANE C.C.**

This plan was prepared as a proposed subdivision and should not be used for any other purpose. The dimensions and area of lots shown herein are subject to field survey and are to the requirements of relevant legislation. In particular no reliance should be placed on the information on this plan for any financial dealings involving the land. This plan is an integral part of the plan.

REV	DATE	DESCRIPTION
C-3	15/02/2022	WIDENING OF EASEMENT
C-4	05/05/2022	ALTERATION OF BUSH LOT FRONTAGE
C-5	06/07/2022	REALIGNMENT OF POTENTIAL ACTIVE TRANSPORT ROUTE
D-1	05/08/2023	REVISION

**Intrax**  
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 Brisbane QLD 4001  
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 Fax: 1300 766 670  
 www.intrax.com.au  
 VICT. NSW. QLD

**PROPOSED RECONFIGURATION OF LOT APPLICATION OVER**  
 LOTS 101-103 ON RP90234  
 12, 18 & 26 CLOVERDALE ROAD  
 LOCALITY OF DOOLANDELLA LOCAL AUTHORITY OF BRISBANE C.C.

This plan was prepared as a proposed subdivision and should not be used for any other purpose. The plan is subject to the requirements of the Council and any other authority which may have requirements under any relevant legislation. In particular, no reliance should be placed on the plan for any purpose other than that for which it was prepared. This note is an integral part of this plan.

HORIZONTAL DATUM:	MGA, Zone 56
VERTICAL DATUM:	AHD
ORIGIN:	3814002.1
CONTOUR INTERVAL:	0.25 m

SCALE:	1:750
DATE:	5/08/2023
SHEET NO.:	1 OF 2
PROJECT NO.:	S152485

DESIGNED:	DRAWN:	CHECKED:	APPROVED:

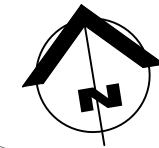
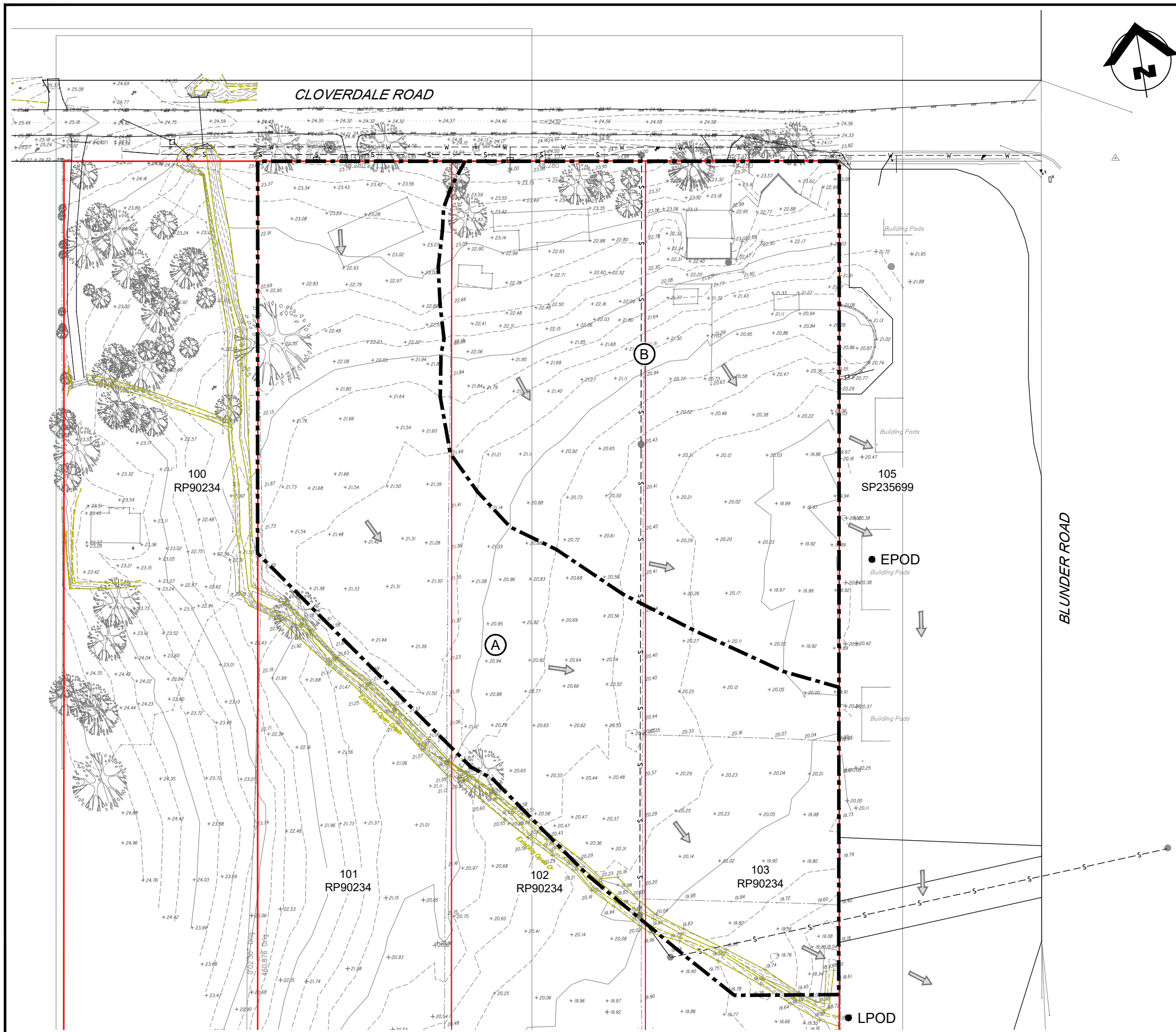




APPENDIX

**C**

OSKA Consulting Group,  
Pre Development Catchment Plan  
(Ref: OSK3426/P003/B)



PRE-DEVELOPMENT CATCHMENT PLAN

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- STORMWATER CATCHMENT I.D.
- EXISTING SURFACE CONTOURS
- LPOD LAWFUL POINT OF DISCHARGE
- EPOD EXISTING POINT OF DISCHARGE
- FLOW DIRECTION

EXISTING SERVICES LEGEND

- EXISTING SEWER MAIN
- EXISTING WATER MAIN
- EXISTING STORMWATER PIPE

STORMWATER CATCHMENT TABLE

STORMWATER CATCHMENT I.D.	AREA (m <sup>2</sup> )
A	1.318
B	1.061
TOTAL	2.379

**REPORT ISSUE**  
NOT FOR CONSTRUCTION

**BCC DS**  
Plans/Documents RECEIVED  
08/06/2023  
APPLICATION REF  
A006067610.

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS

ISSUE No.	DATE	AMENDMENT
B	18-05-23	ISSUED FOR REPORT
A	10-05-22	ISSUED FOR REPORT



CLIENT  
QLD INTERNATIONAL INVESTMENT PTY LTD

PROJECT  
PROPOSED RESIDENTIAL SUBDIVISION  
12, 18 & 26 CLOVERDALE ROAD  
DOOLANDELLA

DESIGN  
BG

DRAWN  
ES

APPROVED  
AP

TITLE  
PRE DEVELOPMENT CATCHMENT PLAN

SCALE  
1:500 AT A1  
1:1000 AT A3

PROJECT NO.  
**OSK3426**

DWG NO.  
P003

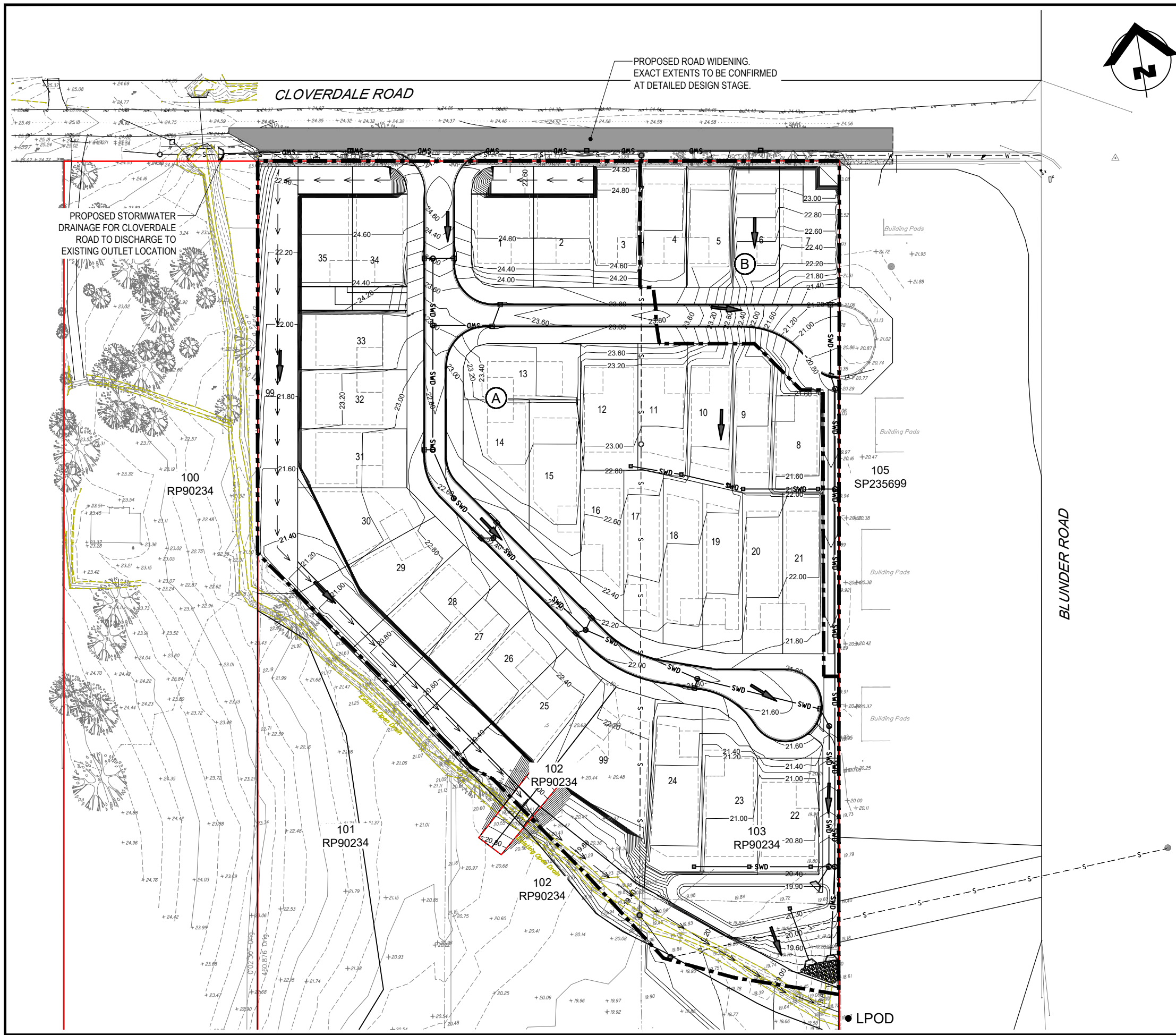
ISSUE  
B



APPENDIX

**D**

OSKA Consulting Group,  
Post Development Catchment Plan  
(Ref: OSK3426/P004/B)



POST-DEVELOPMENT CATCHMENT PLAN

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- STORMWATER CATCHMENT I.D.
- EXISTING SURFACE CONTOURS
- LPOD
- PROPOSED FLOW DIRECTION
- EXTERNAL DRAINAGE CHANNEL
- EXTERNAL CATCHMENT FLOW
- PROPOSED ROAD WIDENING

EXISTING SERVICES LEGEND

- EXISTING SEWER MAIN
- EXISTING WATER MAIN
- EXISTING STORMWATER PIPE

STORMWATER QUALITY CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (m <sup>2</sup> )
A	2.1136
B	0.2654
TOTAL	2.379

NOTE

FOR STORMWATER QUANTITY, ALL FLOWS WILL DISCHARGE TO THE EXISTING NATURAL DRAINAGE CHANNEL TO THE SOUTH.

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A006067610,

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ISSUE No.	DATE	AMENDMENT
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A	10-05-22	ISSUED FOR REPORT



CLIENT  
QLD INTERNATIONAL INVESTMENT PTY LTD

PROJECT  
PROPOSED RESIDENTIAL SUBDIVISION  
12, 18 & 26 CLOVERDALE ROAD  
DOOLANDELLA

DESIGN  
BG

DRAWN  
ES

APPROVED  
AP

TITLE  
POST DEVELOPMENT CATCHMENT PLAN

SCALE  
1:500 AT A1  
1:1000 AT A3

PROJECT NO.  
**OSK3426**

DWG NO.  
P004

ISSUE  
B

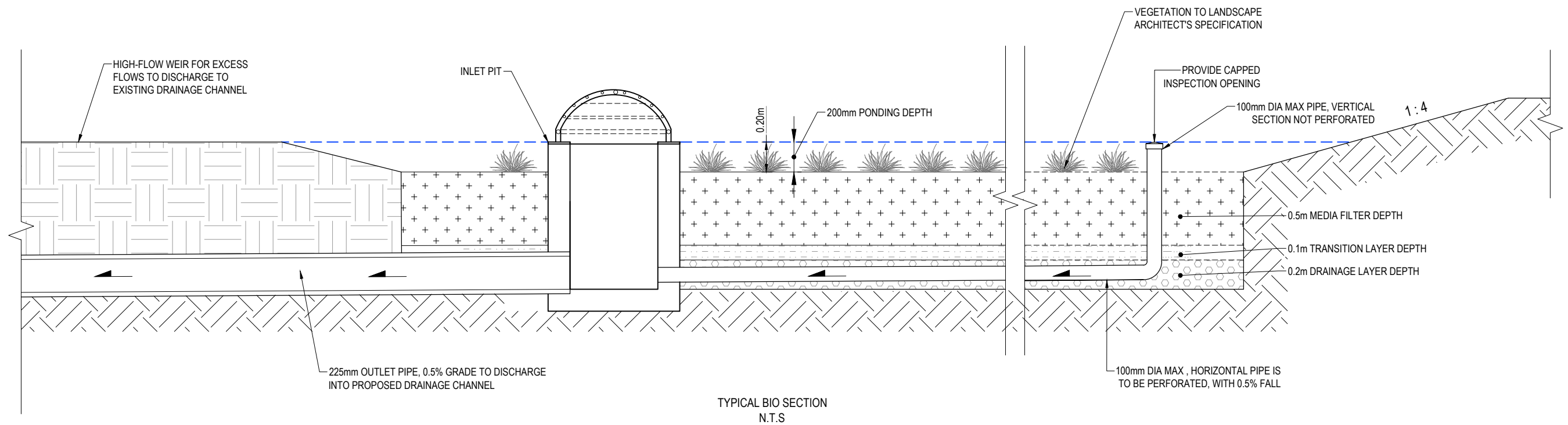
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Plans/Documents  
RECEIVED  
08/06/2023  
APPLICATION REF  
A006067610,

APPENDIX

**E**

OSKA Consulting Group,  
Conceptual Stormwater Management Plan  
(Ref: OSK3426/P005/B);  
OSKA Consulting Group,  
Conceptual Stormwater Management Details  
(Ref: OSK3426/P006/B)





**BIORETENSION NOTES:**

- DO NOT SCALE THIS DRAWING TAKE FIGURED DIMENSIONS ONLY
- ALL DIMENSIONS IN METERS UNLESS NOTED OTHERWISE

**FILTRATION LAYER:**

1. MATERIAL TO CONSIST OF SANDY LOAM OR EQUIVALENT MATERIAL.
2. MATERIAL TO HAVE 5% - 10% ORGANIC CONTENT IN ACCORDANCE WITH AS12894.1.1
3. MATERIAL TO HAVE AN AVERAGE PARTICLE SIZE (D50) OF 0.45mm.
4. SATURATED HYDRAULIC CONDUCTIVITY BETWEEN 50 - 200mm/hr DETERMINED IN ACCORDANCE WITH AS 4419 -1998 APPENDIX H SOIL PERMEABILITY.
5. pH BETWEEN 6 & 7.
6. DEPTH TO BE 400mm OR GREATER FOR TREE PLANTING.

**TRANSITION LAYER:**

1. MATERIAL TO CONSIST OF SAND/COURSE SAND MATERIAL.
  2. TYPICAL PARTICLE SIZE DISTRIBUTION
- % PASSING: 1.4mm 100%  
 1.0mm 80%  
 0.7mm 44%  
 0.5mm 08%

**DRAINAGE LAYER:**

1. MATERIAL TO CONSIST OF 2 - 5mm GRAVEL.

**PERFORATED PIPE:**

1. MINIMUM GRADE OF 0.5%
2. MAXIMUM SPACING \* 1.5m CENTRE FOR BASINS < 100m²  
 \* 2.5m CENTRE FOR BASINS > 100m²

**CONSTRUCTION PHASE:**

1. COVER FILTRATION LAYER WITH GEOTEXTILE, 50mm TOPSOIL & TURF STRIPS PERPENDICULAR TO FLOW.
2. GEOTEXTILE TO BE REMOVED ONLY WHEN UPSTREAM SEDIMENT LOADS ARE CONTROLLED.

**REPORT ISSUE**  
 NOT FOR CONSTRUCTION

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS

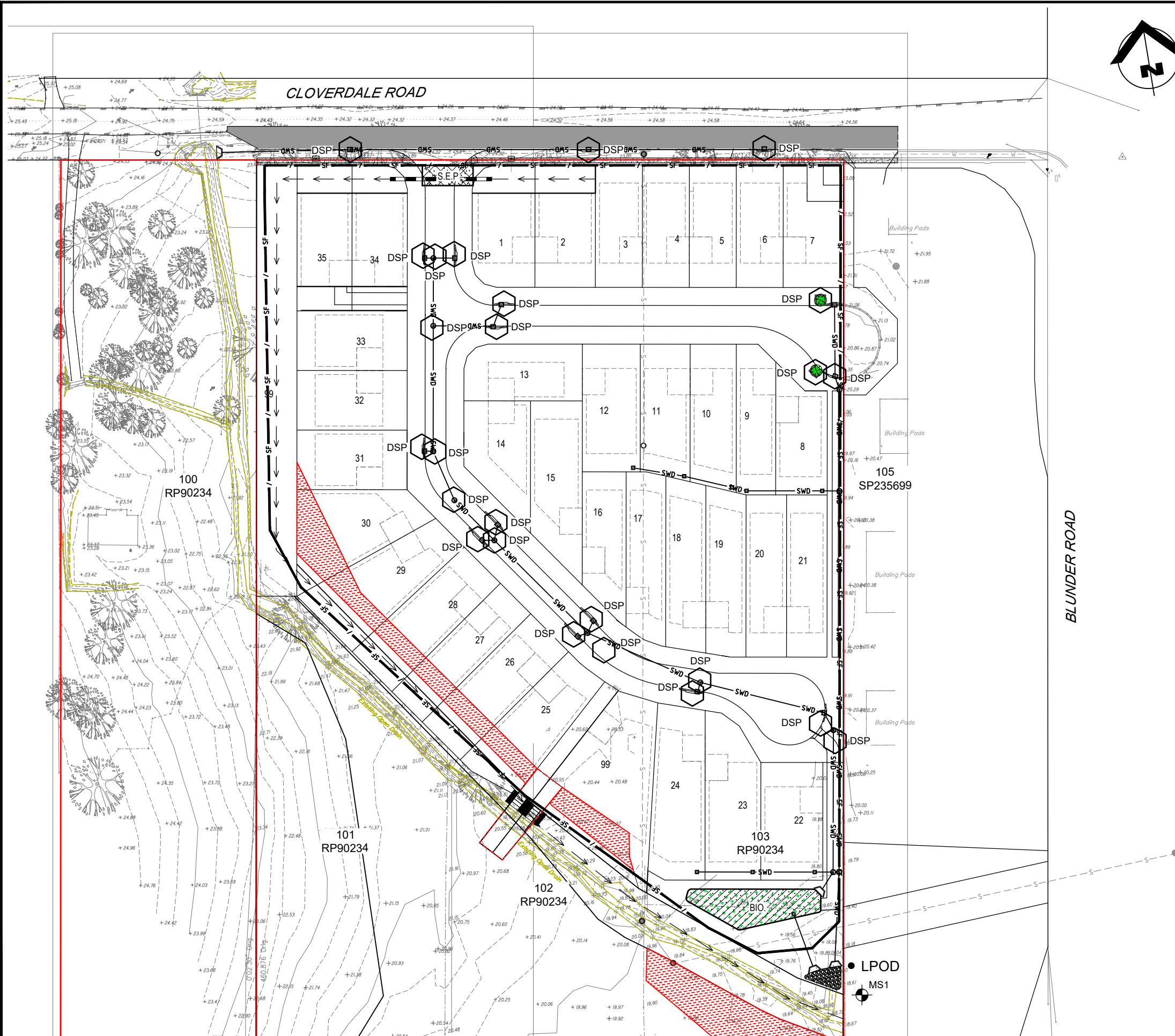
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 Plans/Documents RECEIVED  
 08/06/2023  
 APPLICATION REF  
 A006067610,

			CLIENT QLD INTERNATIONAL INVESTMENT PTY LTD	DESIGN BG	DRAWN ES	APPROVED AP	TITLE CONCEPTUAL STORMWATER MANAGEMENT DETAILS	PROJECT NO. OSK3426	
			PROJECT PROPOSED RESIDENTIAL SUBDIVISION 12, 18 & 26 CLOVERDALE ROAD DOOLANDELLA				SCALE	DWG NO. P006	ISSUE B
B	18-05-23		ISSUED FOR REPORT						
A	10-05-22		ISSUED FOR REPORT						
ISSUE No.	DATE	AMENDMENT							

APPENDIX

**F**

OSKA Consulting Group,  
Sediment and Erosion Control Plan  
(Ref: OSK3426/P007/B);  
OSKA Consulting Group,  
Sediment and Erosion Control Details  
(Ref: OSK3426/P008/A)



**SEDIMENT & EROSION CONTROL LEGEND**

- SEDIMENT FENCE
- TEMPORARY DIVERSION DRAIN
- TEMPORARY SEDIMENT PONDS WITHIN FUTURE BIO RETENTION BASINS
- LOCATION OF STABILISED ENTRY/EXIT POINT
- DRAINAGE STRUCTURE PROTECTION
- WATER QUALITY MONITORING STATION
- FLOW ARROW
- EXTERNAL DRAINAGE CHANNEL
- LAWFUL POINT OF DISCHARGE
- FINISHED SURFACE CONTOURS
- EXISTING SURFACE CONTOURS

**EXISTING SERVICES LEGEND**

- EXISTING SEWER MAIN
- EXISTING WATER MAIN
- EXISTING STORMWATER PIPE

**REPORT ISSUE**  
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**BCC DS**  
Plans/Documents  
RECEIVED  
08/06/2023  
APPLICATION REF  
A006067610.

CONTRACTOR TO DETERMINE AND LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS

ISSUE No.	DATE	AMENDMENT
B	18-05-23	ISSUED FOR REPORT
A	10-05-22	ISSUED FOR REPORT



CLIENT  
QLD INTERNATIONAL INVESTMENT PTY LTD

PROJECT  
PROPOSED RESIDENTIAL SUBDIVISION  
12, 18 & 26 CLOVERDALE ROAD  
DOOLANDELLA

DESIGN  
BG

DRAWN  
ES

APPROVED  
AP

TITLE  
SEDIMENT AND EROSION CONTROL PLAN

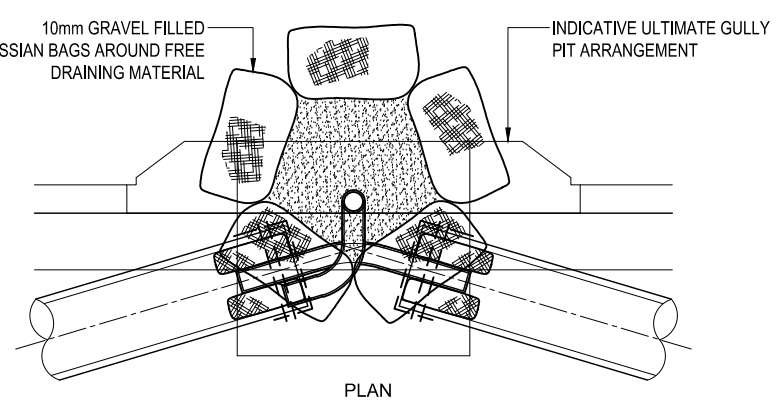
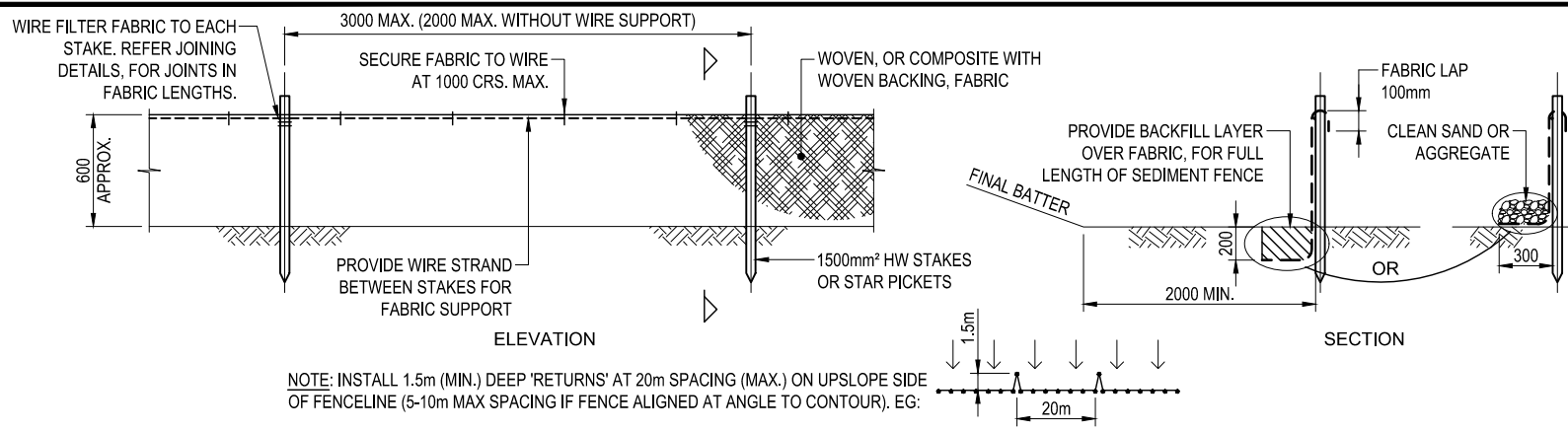
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PROJECT NO.  
**OSK3426**

DWG NO.  
P007

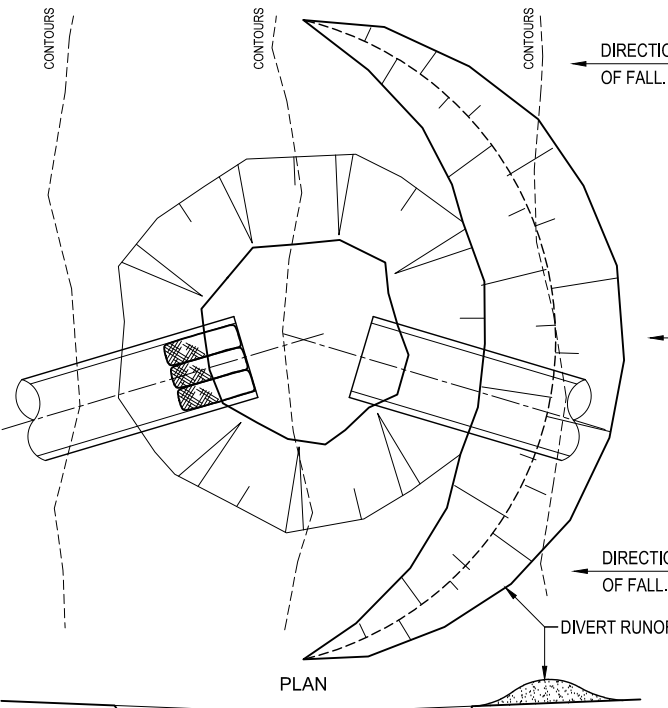
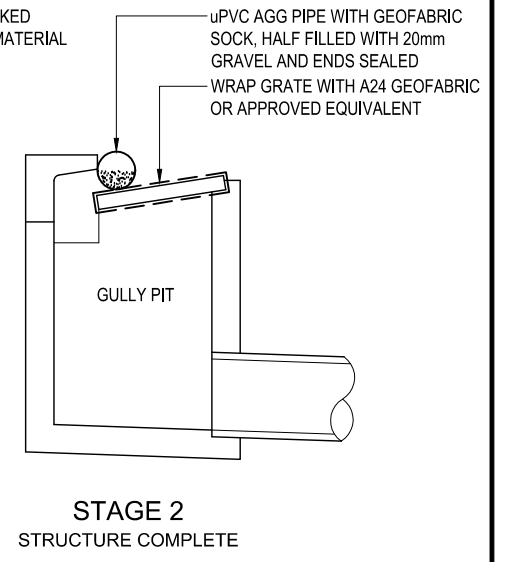
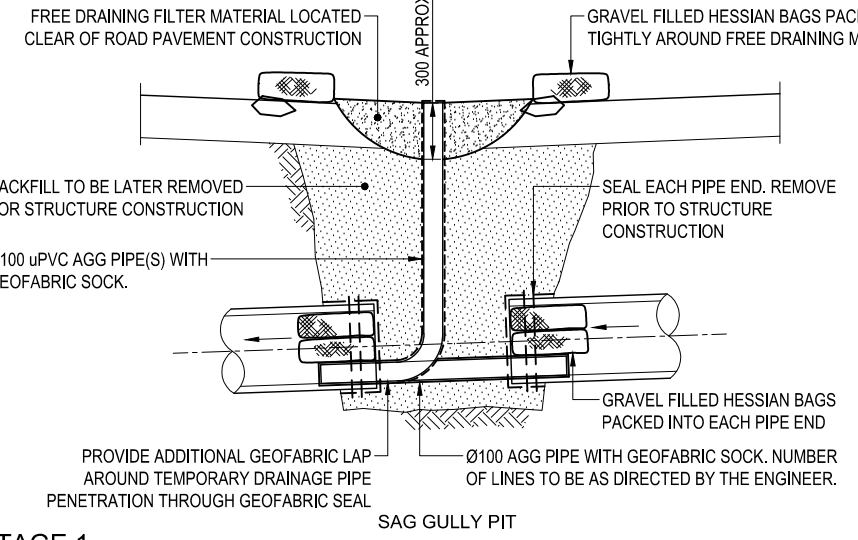
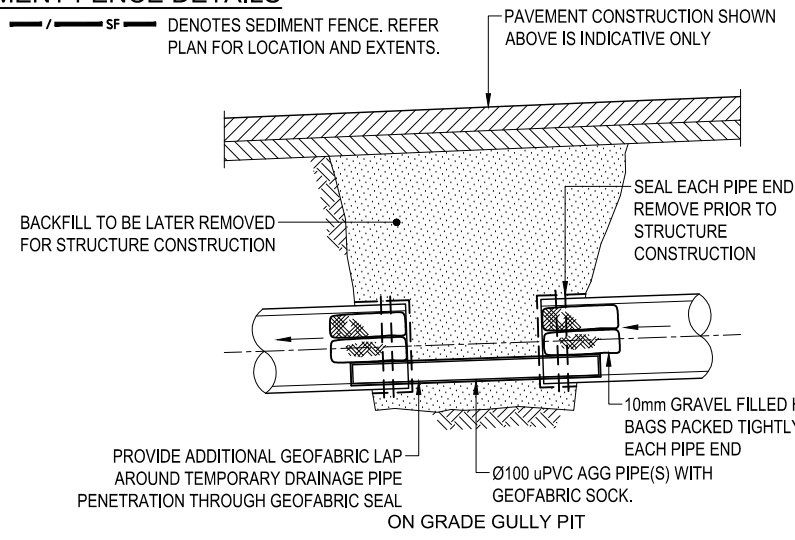
ISSUE  
B

**REPORT ISSUE**  
**NOT FOR CONSTRUCTION**



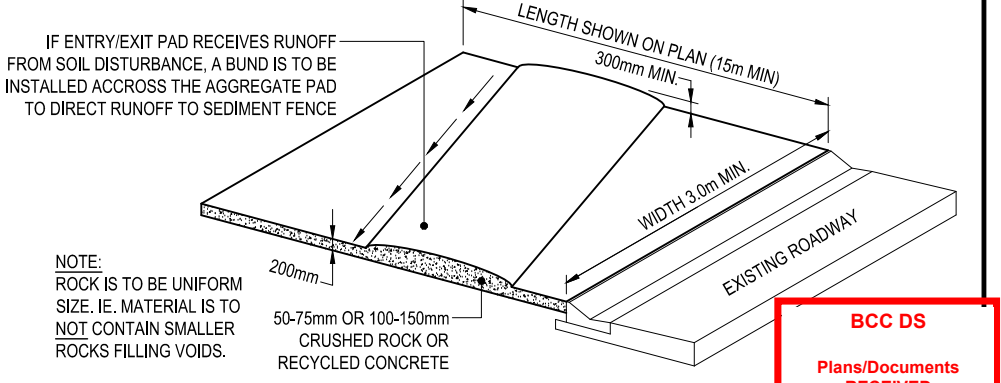
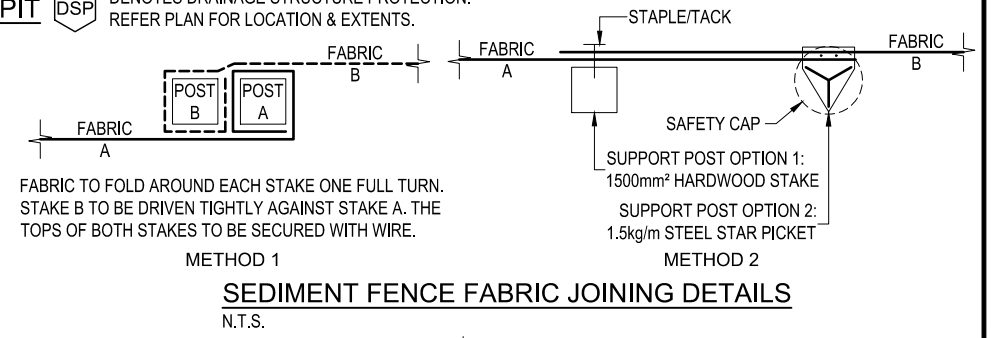
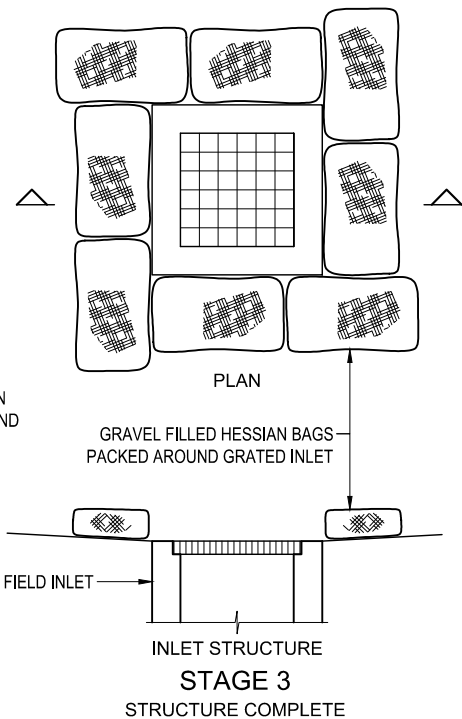
**SEDIMENT FENCE DETAILS**

N.T.S. — / — SF DENOTES SEDIMENT FENCE. REFER PLAN FOR LOCATION AND EXTENTS.  
PAVEMENT CONSTRUCTION SHOWN ABOVE IS INDICATIVE ONLY



**STAGE 1**  
EXCAVATION, PIPE INSTALLATION AND INTERIM BACKFILLING

**ROADWAY GULLY PIT** DSP DENOTES DRAINAGE STRUCTURE PROTECTION. REFER PLAN FOR LOCATION & EXTENTS.  
N.T.S.



**BCC DS**  
Plans/Documents RECEIVED  
08/06/2023  
APPLICATION REF  
A006067610,

ISSUE No.	DATE	AMENDMENT
A	10-05-22	ISSUED FOR REPORT



CLIENT	QLD INTERNATIONAL INVESTMENT PTY LTD
PROJECT	PROPOSED RESIDENTIAL SUBDIVISION 12, 18 & 26 CLOVERDALE ROAD DOOLANDELLA

DESIGN	BG
DRAWN	ES
APPROVED	AP

TITLE	SEDIMENT AND EROSION CONTROL DETAILS
SCALE	1:500 AT A1 1:1000 AT A3

PROJECT NO.	OSK3426
DWG NO.	P008
ISSUE	A



APPENDIX

**G**

OSKA Consulting Group,  
Response to Stormwater Code  
(Ref: OSK3426-0016)



**9.4.9 Stormwater code**

**9.4.9.3 Performance outcomes and acceptable outcomes**

**Table 9.4.9.3.A—Performance outcomes and acceptable outcomes**

Performance outcomes	Acceptable outcomes	Comments
<p><b>Section A—If for a material change of use, reconfiguring a lot, operational work or building work</b>  Note—Compliance with the performance outcomes and acceptable outcomes in this section should be demonstrated by the submission of a site-based stormwater management plan for high risk development only.</p>		
<p><b>PO1</b>  Development provides a stormwater management system which achieves the integrated management of stormwater to:</p> <ul style="list-style-type: none"> <li>• minimise flooding;</li> <li>• protect environmental values of receiving waters;</li> <li>• maximise the use of water sensitive urban design;</li> <li>• minimise safety risk to all persons;</li> <li>• maximise the use of natural waterway corridors and natural channel design principles.</li> </ul> <p>Editor’s note—The stormwater management system to be developed to address PO1 is not intended to require management of stormwater quality.</p>	<p><b>AO1</b>  Development provides a stormwater management system designed in compliance with the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>A Conceptual Stormwater Management Plan (CSWMP) has been prepared for the proposed development. The CSWMP details the proposed treatment measures to be implemented to ensure compliance with Infrastructure design planning scheme policy.</p> <p>For further information on the proposed stormwater management system, refer to OSKA Consulting Group, <i>Conceptual Stormwater Management Plan</i> (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.</p>

<p><b>PO2</b>  Development ensures that the stormwater management system and site work does not adversely impact flooding or drainage characteristics of premises which are up slope, down slope or adjacent to the site.</p>	<p><b>AO2.1</b>  Development does not result in an increase in flood level or flood hazard on up slope, down slope or adjacent premises.</p>	<p>In accordance with Brisbane City Council City Plan Section 6.16, Chapter 7 <i>Stormwater Drainage</i>, Section 7.5.2, it is proposed to not provide any detention as the development complies with 3a, 3c and 3h. The proposed development is not anticipated to cause any nuisance to downstream receiving waters, upstream of the site and the site's surrounding areas.</p> <p>For further information on the proposed stormwater management system, refer to OSKA Consulting Group, <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.</i></p>
	<p><b>AO2.2</b>  Development provides a stormwater management system which is designed in compliance with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>The proposed drainage network shall be designed in accordance with the BCC Infrastructure Planning Scheme Policy.</p>
<p><b>PO3</b>  Development ensures that the stormwater management system does not direct stormwater run-off through existing or proposed lots and property where it is likely to adversely affect the safety of, or cause nuisance to properties.</p>	<p><b>AO3.1</b>  Development ensures that the location of the stormwater drainage system is contained within a road reserve, drainage reserve, public pathway, park or waterway corridor.</p>	<p>A Conceptual Stormwater Management Plan (CSWMP) has been prepared for the proposed development. The CSWMP details the proposed treatment measures to be implemented to ensure compliance with Infrastructure design planning scheme policy.</p> <p>For further information on the proposed stormwater management system, refer to OSKA Consulting Group, <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.</i></p>
	<p><b>AO3.2</b>  Development provides a stormwater management system which is designed in compliance with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>A Conceptual Stormwater Management Plan (CSWMP) has been prepared for the proposed development. The CSWMP details the proposed treatment measures to be implemented to ensure compliance with Infrastructure design planning scheme policy.</p>

		<p>For further information on the proposed stormwater management system, refer to OSKA Consulting Group, <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.</i></p>
	<p><b>AO3.3</b>  Development obtains a lawful point of discharge in compliance with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>A Lawful Point of Discharge (LPOD) has been demonstrated in accordance with BCC's Infrastructure Design Planning Scheme Policy (ID PSP), Section 7.6.</p> <p>Refer to OSKA Consulting Group, <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.</i></p>
	<p><b>AO3.4</b>  Where on private land, all underground stormwater infrastructure is secured by a drainage easement.</p>	<p>NA</p>
<p><b>PO4</b>  Development provides a stormwater management system which has sufficient capacity to safely convey run-off taking into account increased run-off from impervious surfaces and flooding in local catchments.</p>	<p><b>AO4.1</b>  Development provides a stormwater conveyance system which is designed to safely convey flows in compliance with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>Refer Response to PO1</p>
	<p><b>AO4.2</b>  Development provides sufficient area to convey run-off which will comply with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>Refer Response to PO1</p>

<p><b>PO5</b>  Development designs stormwater channels, creek modification works, bridges, culverts and major drains to protect and enhance the value of the waterway corridor or drainage path for fauna movement.</p>	<p><b>AO5</b>  Development ensures the design of stormwater channels, creek modifications or other infrastructure, permits terrestrial and aquatic fauna movement.</p>	<p>NA</p>
<p><b>PO6</b>  Development ensures that location and design of stormwater detention and water quality treatment:</p> <ul style="list-style-type: none"> <li>• minimises risk to people and property;</li> <li>• provides for safe access and maintenance;</li> <li>• (c) minimises ecological impacts to creeks and waterways.</li> </ul>	<p><b>AO6.1</b>  Development locates stormwater detention and water quality treatment:  outside of a waterway corridor;  offline to any catchment not contained within the development.</p>	<p>NA</p>
	<p><b>AO6.2</b>  Development providing for stormwater detention and water quality treatment devices are designed in compliance with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>In accordance with Brisbane City Council City Plan Section 6.16, Chapter 7 <i>Stormwater Drainage</i>, Section 7.5.2, it is proposed to not provide any detention as the development complies with 3a, 3c and 3h. The proposed development is not anticipated to cause any nuisance to downstream receiving waters, upstream of the site and the site's surrounding areas.</p> <p>In accordance with Brisbane City Council City Plan Section 9.4.9 <i>Stormwater Code</i>, the development does trigger the design of permanent stormwater improvement devices as the developed site area is greater than 2,500 m<sup>2</sup>.</p> <p>Refer to OSKA Consulting Group, <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella</i>.</p>

<p><b>PO7</b>  Development is designed, including any car parking areas and channel works to:</p> <ul style="list-style-type: none"> <li>• reduce property damage;</li> <li>• (b) provide safe access to the site during the <a href="#">defined flood event</a>.</li> </ul>	<p><b>AO7.1</b>  Development (including any ancillary structures and car parking areas) is located above minimum flood immunity levels in <a href="#">Table 9.4.9.3.B</a>, <a href="#">Table 9.4.9.3.C</a>, <a href="#">Table 9.4.9.3.D</a>, <a href="#">Table 9.4.9.3.E</a> and <a href="#">Table 9.4.9.3.F</a>.  Note—Compliance with this acceptable outcome can be demonstrated by the submission of a hydraulic and hydrology report identifying flood levels and development design levels (as part of a site-based stormwater management plan).</p>	NA
	<p><b>AO7.2</b>  Development including the road network provides a stormwater management system that provides safe pedestrian and vehicle access in accordance with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	The proposed stormwater infrastructure will ensure compliance with this performance outcome.
<p><b>PO8</b>  Development designs stormwater channels, creek modification works and the drainage network to protect and enhance the environmental values of the waterway corridor or drainage path.</p>	<p><b>AO8.1</b>  Development ensures natural waterway corridors and drainage paths are retained.</p>	NA
	<p><b>AO8.2</b>  Development provides the required hydraulic conveyance of the drainage channel and floodway, while maximising its potential to maximise environmental benefits and minimise scour.  Editor's note—Guidance on natural channel design principles can be found in the Council's publication <a href="#">Natural channel design guidelines</a>.</p>	NA
	<p><b>AO8.3</b>  Development provides stormwater outlets into waterways, creeks, wetlands and overland flow paths with energy dissipation to minimise scour in compliance with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	NA

	<p><b>AO8.4</b>  Development ensures that the design of modifications to the existing design of new stormwater channels, creeks and major drains is in compliance with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>The proposed stormwater infrastructure will ensure compliance with this performance outcome.</p>
<p><b>PO9</b>  Development is designed to manage run-off and peak flows by minimising large areas of impervious material and maximising opportunities for capture and re-use.</p>	<p><b>AO9</b>  No acceptable outcome is prescribed.</p>	<p>The proposed stormwater infrastructure will ensure compliance with this performance outcome.</p>
<p><b>PO10</b>  Development ensures that there is sufficient site area to accommodate an effective stormwater management system.  Note—Compliance with the performance outcome should be demonstrated by the submission of a site-based stormwater management plan for high-risk development only.</p>	<p><b>AO10</b>  No acceptable outcome is prescribed.</p>	<p>The proposed stormwater infrastructure has been sized and designed in accordance with the infrastructure design planning scheme.</p> <p>Refer to OSKA Consulting Group, <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella</i>.</p>
<p><b>PO11</b>  Development provides for the orderly development of stormwater infrastructure within a catchment, having regard to the:</p> <ul style="list-style-type: none"> <li>existing capacity of stormwater infrastructure within and external to the site, and any planned stormwater infrastructure upgrades;</li> <li>safe management of stormwater discharge from existing and future up-slope development;</li> <li>(c) implication for adjacent and down-slope development.</li> </ul>	<p><b>AO11.1</b>  Development with up-slope external catchment areas provides a drainage connection sized for ultimate catchment conditions that is directed to a lawful point of discharge.</p>	<p>NA</p>
	<p><b>AO11.2</b>  Development ensures that existing stormwater infrastructure that is undersized is upgraded in compliance with the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>The proposed stormwater infrastructure has been sized and designed in accordance with the infrastructure design planning scheme.</p> <p>Refer to OSKA Consulting Group <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella</i>.</p>

<p><b>PO12</b>  Development provides stormwater infrastructure which:</p> <ul style="list-style-type: none"> <li>remains fit for purpose for the life of the development and maintains full functionality in the design flood event;</li> <li>can be safely accessed and maintained cost effectively;</li> <li>(c) ensures no structural damage to existing stormwater infrastructure.</li> </ul>	<p><b>AO12.1</b>  The stormwater management system is designed in compliance with the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>The proposed stormwater infrastructure has been designed in accordance with the infrastructure design planning scheme.</p> <p>Refer to OSKA Consulting Group, <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella</i>.</p>
<p><b>PO13</b>  Development ensures that all reasonable and practicable measures are taken to manage the impacts of erosion, turbidity and sedimentation, both within and external to the development site from construction activities, including vegetation clearing, earthworks, civil construction, installation of services, rehabilitation, revegetation and landscaping to protect:</p> <ul style="list-style-type: none"> <li>the environmental values and water quality objectives of waters;</li> <li>waterway hydrology;</li> <li>the maintenance and serviceability of stormwater infrastructure.</li> </ul> <p>Note—The <a href="#">Infrastructure design planning scheme policy</a> outlines the appropriate measures to be taken into account to achieve the performance outcome.</p>	<p><b>AO13</b>  No acceptable outcome is prescribed.</p>	<p>A sediment and erosion control plan is included in OSKA Consulting Group, <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella</i>.</p> <p>The plan addresses devices and management measures to control erosion and sediment for the pre-construction, construction and post-construction phases of the development, in accordance with the Best Practice Erosion and Sediment Control: International Erosion Control Association, (IECA) 2008.</p>
<p><b>PO14</b>  Development ensures that:</p> <ul style="list-style-type: none"> <li>unnecessary disturbance to soil, waterways or drainage channels is avoided;</li> <li>all soil surfaces remain effectively stabilised against erosion in the short and long term.</li> </ul>	<p><b>AO14</b>  No acceptable outcome is prescribed.</p>	<p>Refer Response PO13.</p>

<p><b>PO15</b>  Development does not increase:</p> <ul style="list-style-type: none"> <li>the concentration of total suspended solids or other contaminants in stormwater flows during site construction;</li> <li>run-off which causes erosion either on site or off site.</li> </ul>	<p><b>AO15</b>  No acceptable outcome is prescribed.</p>	<p>Refer Response PO13.</p>
<p><b>Section B—Additional performance outcomes and acceptable outcomes which apply to high-risk development, being one or more of the following:</b></p> <ul style="list-style-type: none"> <li>a material change of use for an urban purpose which involves greater than 2,500m<sup>2</sup> of land that: <ul style="list-style-type: none"> <li>will result in an impervious area greater than 25% of the net developable area; or</li> <li>will result in 6 or more dwellings.</li> </ul> </li> <li>reconfiguring a lot for an urban purpose that involves greater than 2,500m<sup>2</sup> of land and will result in 6 or more lots; <ul style="list-style-type: none"> <li>operational work for an urban purpose which involves disturbing greater than 2,500m<sup>2</sup> of land.</li> </ul> </li> </ul>		
<p><b>PO16</b>  Development ensures that the entry and transport of contaminants into stormwater is avoided or minimised to protect receiving water environmental values.  Note—Prescribed water contaminants are defined in the <a href="#">Environmental Protection Act 1994</a>.  Note—Compliance with the performance outcome should be demonstrated by the submission of a site-based stormwater management plan for high-risk development only.</p>	<p><b>AO16</b>  Development provides a stormwater management system which is designed in compliance with the standards in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>NA.</p>
<p><b>PO17</b>  Development ensures that:</p> <ul style="list-style-type: none"> <li>the discharge of wastewater to a waterway or external to the site is avoided; or</li> <li>if the discharge cannot practicably be avoided, the development minimises wastewater discharge through re-use, recycling, recovery and treatment.</li> </ul> <p>Note—The preparation of a wastewater management plan can assist in demonstrating</p>	<p><b>AO17</b>  No acceptable outcome is prescribed.</p>	<p>NA.</p>

<p>achievement of this performance outcome. Editor's note—This code does not deal with sewerage which is the subject of the <a href="#">Wastewater code</a>.</p>		
<p><b>Section C—Additional performance outcomes and acceptable outcomes for assessable development for a material change of use or reconfiguring a lot</b></p>		
<p><b>PO18</b>  Development protects stormwater infrastructure to ensure the following are not compromised:</p> <ul style="list-style-type: none"> <li>the <a href="#">long term infrastructure</a> for the stormwater network in the <a href="#">Long term infrastructure plans</a>;</li> <li>the existing and planned infrastructure for the stormwater network in the <a href="#">Local government infrastructure plan</a>;</li> <li>the provision of long term, existing and planned infrastructure for the stormwater network which:</li> <li>is required to service the development or an existing and future urban development in the planning scheme area; or</li> <li>is in the interests of rational development or the efficient and orderly planning of the general area in which the site is situated.</li> </ul> <p>Editor's note—A condition which requires a proposed development to keep permanent improvements and structures associated with the approved development clear of the area of long term infrastructure, may be imposed.</p>	<p><b>AO18</b>  Development protects stormwater infrastructure in compliance with the following:</p> <ul style="list-style-type: none"> <li>for <a href="#">long term infrastructure</a> for the stormwater network, the <a href="#">Long term infrastructure plans</a>;</li> <li>for existing and planned infrastructure for the stormwater network, the <a href="#">Local government infrastructure plan</a>;</li> </ul> <p>the standards for stormwater drainage in the <a href="#">Infrastructure design planning scheme policy</a>.</p>	<p>The proposed stormwater management strategy does not propose to discharge site runoff to existing trunk infrastructure.</p> <p>Refer to OSKA Consulting Group, <i>Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella</i>.</p>

<p><b>PO19</b>  Development provides for the payment of extra trunk infrastructure costs for the following:</p> <ul style="list-style-type: none"> <li>• for development completely or partly outside the priority infrastructure area in the <a href="#">Local government infrastructure plan</a>;</li> <li>• for development completely inside the priority infrastructure area in the <a href="#">Local government infrastructure plan</a> involving:</li> <li>• trunk infrastructure that is to be provided earlier than planned in the <a href="#">Local government infrastructure plan</a>;</li> <li>• <a href="#">long term infrastructure</a> for the stormwater network which is made necessary by development that is not assumed future urban development;</li> <li>• other infrastructure for the stormwater network associated with development that is not assumed future urban development which is made necessary by the development.</li> </ul> <p>Editor's note—The payment of extra trunk infrastructure costs for development completely inside the priority infrastructure area in the <a href="#">Local government infrastructure plan</a> is to be worked out in accordance with the Charges Resolution.</p> <p>Editor's note—See section 130 Imposing Development conditions (Conditions for extra trunk infrastructure costs) of the <a href="#">Planning Act 2016</a>.</p>	<p><b>AO19</b>  No acceptable outcome is prescribed.</p>	<p>There is no trunk council infrastructure proposed as part of the development works.</p>
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APPLICATION REF

A006067610.



# ENGINEERING INFRASTRUCTURE REPORT

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## Proposed Residential Subdivision 12, 18 & 26 Cloverdale Road, Doolandella

### Lots 101-103 on RP90234


For QLD International Investment Pty Ltd

5 June 2023

File No: OSK3426-0015-B

## DOCUMENT CONTROL SHEET

<b>Title:</b>	Engineering Infrastructure Report
<b>Document No:</b>	OSK3426-0015-B
<b>Original Date of Issue:</b>	10 May 2022
<b>Project Manager:</b>	Aaron Pianta
<b>Author:</b>	Ben Grant
<b>Client:</b>	QLD International Investment Pty Ltd
<b>Client Contact:</b>	Stewart Somers
<b>Client Reference:</b>	12, 18 & 26 Cloverdale Road, Doolandella
<b>Synopsis:</b>	This report examines the existing infrastructure and future engineering impacts for the proposed development of the site, including the availability of services and the provision of water and sewerage servicing the development site and determines the demand on these systems from the proposed development.

Reviewed by RPEQ	Reg. No.	Signed	Date
Daley Curran	26353		5 June 2023

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Revision No	Date	Checked By	Issued By
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Appendix H:	OSKA Consulting Group, Filling and Excavation Code (Ref: OSK3426-0018);
Appendix I:	Erosion Hazard Assessment Form
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## 1.0 INTRODUCTION

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### 1.1 Background

OSKA Civil Consultants has been commissioned by QLD International Investment Pty Ltd to prepare an Engineering Infrastructure Report (EIR) to support a Development Application (DA) to the Brisbane City Council (BCC) for the proposed Residential Subdivision situated at 12, 18 & 26 Cloverdale Road, Doolandella. The subject site is described as Lots 101-103 on RP90234.

This revision of the report (Revision B) was issued in response to Council Information Request (A006067610) dated 6 September 2022.

The purpose of this report is to demonstrate that the proposed development can be connected to Council's existing stormwater drainage, sewerage, water systems and other utility services.

## 2.0 SITE DESCRIPTION

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### 2.1 Location

The subject site is located on 12, 18 & 26 Cloverdale Road, Doolandella. The site fronts Cloverdale Road to the north, Blunder Creek to the south, a residential lot to the west and an existing residential townhouse development to the east. The site covers a total combined area of 6.34ha, however the proposed development footprint covers an area of 2.379ha, with details as summarised in Table 1 and as located in Figure 1.

**Table 1: Site Description**

Client	Lot and Property Description	Street Address
<i>QLD International Investment Pty Ltd</i>	Lots 101-103 on RP90234	12, 18 & 26 Cloverdale Road, Doolandella



Figure 1: Locality Plan (Source: Nearmap)

## 2.2 Site Topography

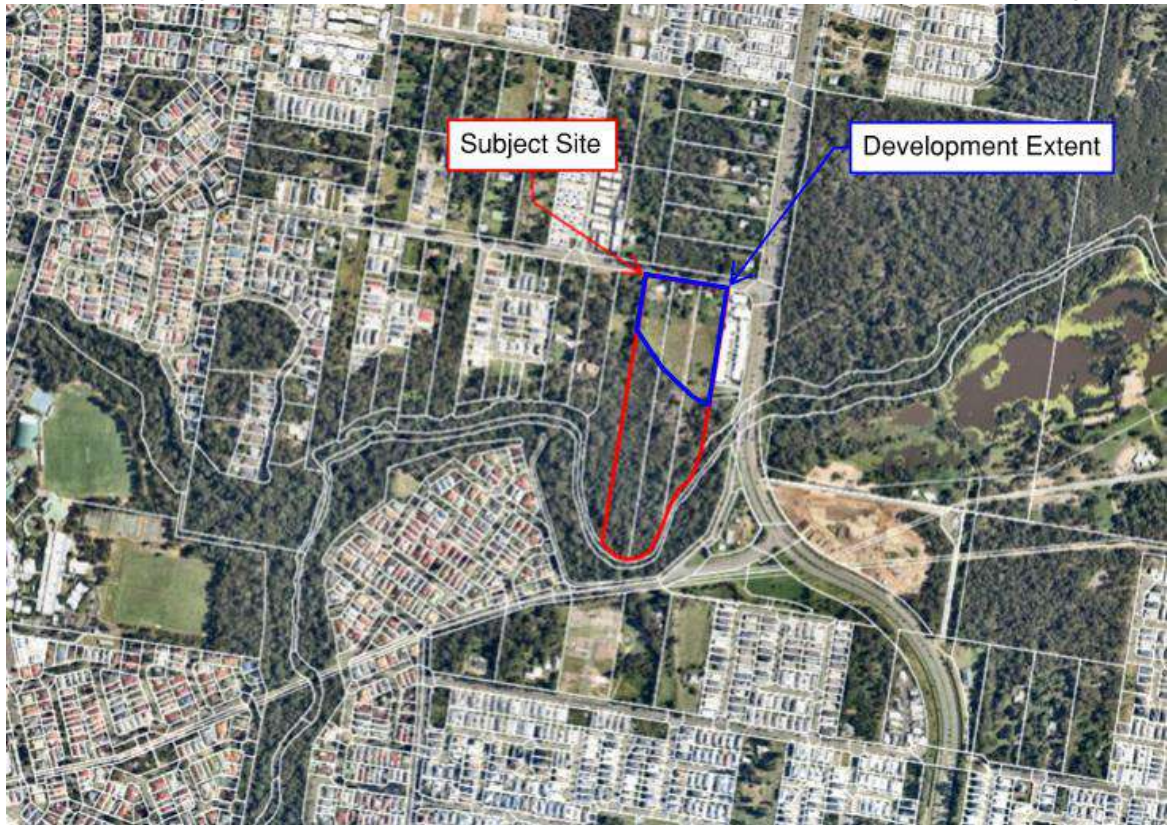
The existing site is generally slopes towards Blunders Creek to the south-east with spot heights ranging from approximately RL 24.00m AHD along the northern boundary to 18.41 m AHD at the top of the bank of Blunders Creek. The levels drop off further into Blunders Creek to the south, however the survey didn't pick up the corresponding levels. Based on the provided survey and aerial information, any stormwater runoff from roof and ground surfaces drains towards Blunders Creek to the south of the site.

Further information of the site survey has been provided by Terramap, Contour & Detail Survey (Ref: 3814/002) included as Appendix A.

## 2.3 Vegetation and Land Use

The subject site currently consists of 3 residential dwellings with landscaped/grassed areas to the front half of the lot with dense vegetation at the rear of the lot. The site is enclosed by a fence to the front along Cloverdale Road with the southern end of the site is situated on Blunders Creek. Access to the site is gained from the north via Cloverdale Road.

An aerial photograph taken on the 9 February 2022 of the subject site is included in *Figure 2*.



**Figure 2: Aerial Image of the Site (Source: Nearmap – Image taken 9 February 2022)**

## 2.4 Proposed Development

The proposed development is to subdivide into thirty-six (36) residential lots. The site will have an internal 14m wide road reserve which will provide access to all 36 lots. Access to the site will be gained from the north via Cloverdale Road which will provide access to the internal road reserve.

Refer to Appendix B for the proposed architectural details prepared by Intrax, Proposed Reconfiguration (Ref: S152485).

## 3.0 ROADWORKS

The proposed site access strategy includes a new priority intersection with Cloverdale Road and a new public road from Cloverdale Road connecting to the existing cul-de-sac head to the east within Lot 105 on SP235699. The proposed intersection will also service the existing residential development to the east (the existing access driveway will be closed) ensuring that access impacts on Cloverdale Road are minimised as illustrated in the OSKA Consulting Group, Cloverdale Road Upgrade Works – Overall Plan and Typical Sections (Ref: OSK3426/P014/C) included in Appendix F.

For further details, see OSKA Consulting Group, Traffic Impact Assessment Report (TIA) (Ref: K3426-TIA-01), and Intrax, Proposed Reconfiguration (Ref: S152485).

## 4.0 EARTHWORKS

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Earthworks will be required for the proposed development to set the building pad levels and grade the driveway and internal roads. The earthworks will involve the minimum cut and fill to achieve the required building pad levels. The earthworks should be undertaken in accordance with Level 1 compaction within the AS3798 – Guidelines on earthworks for commercial and residential developments.

The proposed earthworks for the development are illustrated on the OSKA Consulting Group, Earthworks Concept Plan (Ref: OSK3426/P012/C) and OSKA Consulting Group, Typical Bio Section (Ref: OSK3426/P013/C) included in Appendix E.

Included within Appendix I is the Erosion Hazard Assessment Form. Included within Appendices G and H is the Brisbane City Council Code Responses; Filling and Excavation and Infrastructure Codes.

## 5.0 STORMWATER

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It is proposed that the site's captured stormwater from the roof and ground areas shall be conveyed via an internal network of pits and pipes, sized to capture the minor AEP events, and conveyed to the proposed bio-retention basin or bio-retention tree pits. The captured flows within the basin and pits are then piped to the existing natural drainage channel (the site's LPOD) located to the south of the development footprint.

For further details, see OSKA Consulting Group, Conceptual Stormwater Management Plan (Ref: OSK3426-0014-CSWMP).

## 6.0 SEWERAGE

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The subject site will be serviced by the existing Ø225mm reticulation sewer main located at Cloverdale Road. For further details, see schematic drawings showing the existing sewer infrastructure and the proposed modifications to the existing network as illustrated in the OSKA Consulting Group, Sewer Concept Plan (Ref: OSK3426/P011/B) included in Appendix D.

A Service Advice Notice (SAN) shall be requested by Urban Utilities prior to detail design.

## 7.0 WATER

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There is an existing 150mm water main along Cloverdale Road to the north of the site. It is proposed to connect into this main and run a new water line down to connect into the additional properties.

The existing water infrastructure and available water connections are illustrated in OSKA Consulting Group, Civil Services Concept Plan (Ref: OSK3426/P010/B), included in Appendix C.

## 8.0 ELECTRICAL AND TELSTRA

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Telecommunications and Electrical services are available along Cloverdale Road. Load requirements and any necessary upgrades will need to be investigated by an electrical consultant as part of the detailed design for the proposed development.

A pad mount transfer has been considered for the proposed development on the northeastern corner on Cloverdale Road.

The Dial Before You Dig searches for the existing services are included as Appendix J.

## 9.0 CONCLUSIONS

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OSKA Civil Consultants has been commissioned by QLD International Investment Pty Ltd to prepare an Engineering Infrastructure Report (EIR) to support a Development Application (DA) to the Brisbane City Council (BCC) for the proposed Residential Development situated at 12, 18 & 26 Cloverdale Road, Doolandella.

This Engineering Infrastructure Report has detailed the existing infrastructure and the provision of services to the proposed development and determined the proposed demand on the existing water and sewerage infrastructure. The location of the existing water and sewerage reticulation infrastructure as well as the proposed connection points for the development have been shown on the servicing plans in addition to the proposed earthworks.

APPENDIX

**A**

*Terramap, Contour & Detail  
Survey (Ref: 3814/002)*