OSKA CONSULTING GROUP

CONCEPTUAL STORMWATER MANAGEMENT PLAN

Proposed Residential Subdivision

12, 18 & 26 Cloverdale Road, Doolandella

Lots 101-103 on RP90234

For QLD International Investment Pty Ltd

20 June 2022

File No: OSK3426-0014-A

DOCUMENT CONTROL SHEET

Title:	Conceptual Stormwater Management Plan
Document No:	OSK3426-0014-A
Original Date of Issue:	4 May 2022
Project Manager:	Jason Webster
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Client:	QLD International Investment Pty Ltd
Client Contact:	Stewart Somers
Client Reference:	12, 18 & 26 Cloverdale Road, Doolandella
Synopsis:	This *Conceptual Stormwater Management Plan* 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
Aaron Pianta	10423		20 June 2022

Revision/Checking History			
Revision No	**Date**	**Checked By**	**Issued By**
Draft	4 May 2022	Jason Webster	Ben Grant
A	20 June 2022	Aaron Pianta	Ben Grant

Distribution		
Recipient	**No of Copies**	**Method**
QLD International Investment Pty Ltd – Alex Wu	1	PDF
Nexus Urban Consulting Pty Ltd – Stewart Somers	1	PDF

The information contained within this report is provided in good faith in the belief that no information, opinions or recommendations made are misleading. All comments and opinions given in this report are based on information supplied by the client, their agent and third parties.

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1.0 INTRODUCTION

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.

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.*

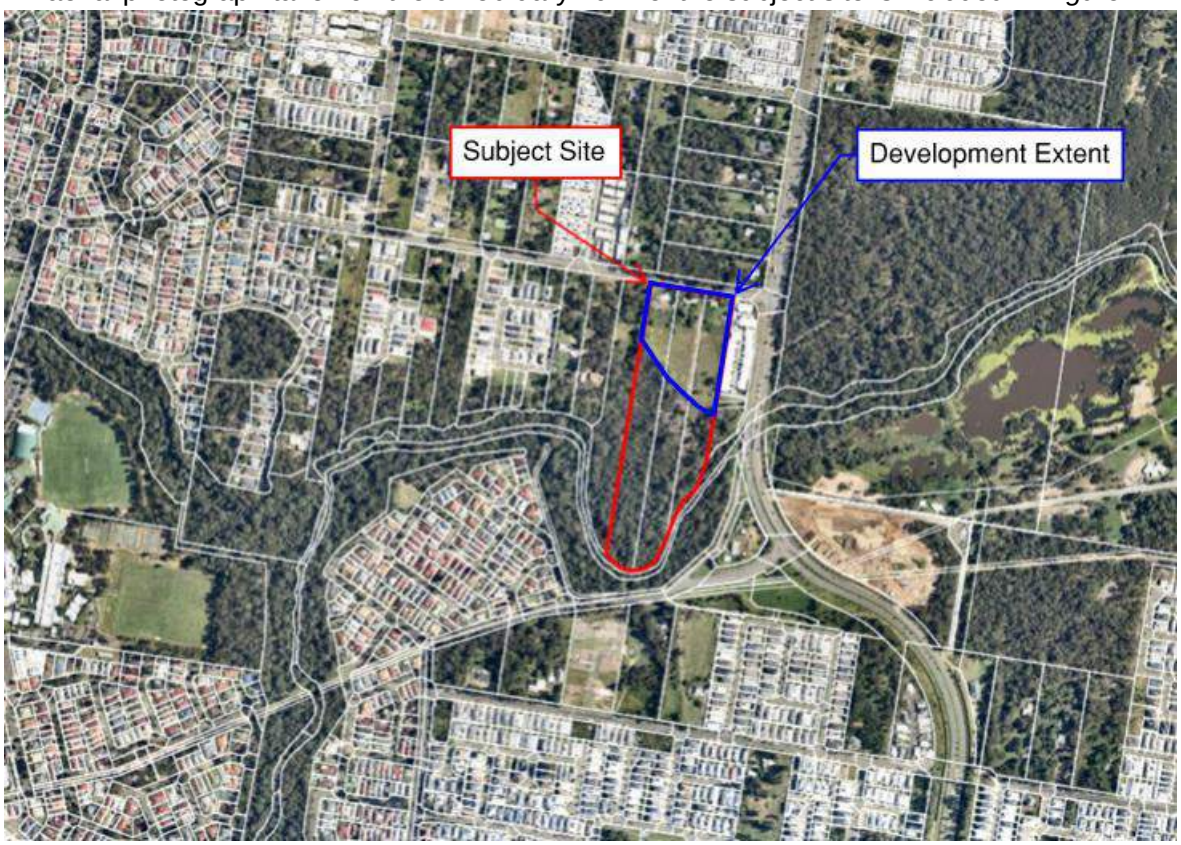


Figure 2: Aerial Image of the Site (Source: Nearmap – Image taken 9 February 2022)

2.4 Proposed Development

The proposed development is to subdivide into forty (40) residential lots. The site will have an internal 14m wide road reserve which will provide access to all 40 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 Consulting Group, Proposed Reconfiguration (Ref: S152485 Rev C).

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 the 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 Consulting Group, Proposed Reconfiguration (Ref: S152485 Rev C);
- 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

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. 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/A) 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 ($^1I_{10}$) 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 ($^1I_{10}$) 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_2	C_{10}	C_{20}	C_{100}
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_c
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^3/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	**AEP**	39%	10%	5%	1%
Coefficient of Runoff	**C**	0.57	0.67	0.71	0.81
Area of Catchment (ha)	**A**	1.061	1.061	1.061	1.061
Average Rainfall Intensity (mm/h)	**I**	70	114	131	169
Peak Flow Rate (m^3/s)	**Q**	**0.118**	**0.225**	**0.272**	**0.403**

4.3 Post Development

4.3.1 Catchment Definition and Lawful Point of Discharge

The post-development scenario has been analysed as two internal catchments (A and B) similar to the pre-development scenario and has a total contributing area of 2.379ha. The post-development Catchment A has a contributing area of 2.000ha and Catchment B has a contributing area of 0.379ha.

Stormwater collected from the roof, road and ground areas of Catchment A 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. The captured flows within the basin are then piped to the existing natural drainage channel (the catchment's LPOD) located to the south of the development footprint. Stormwater collected from the roof, road and ground areas of Catchment B 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 street pods. The captured flows within the pods are then piped to the drainage infrastructure within the existing cul-de-sac (the catchment's LPOD) located to the east of the development footprint.

The post development catchment area and LPOD are detailed on OSKA Consulting Group, Post Development Catchment Plan (Ref: OSK3426/P004/A) 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 A has approximately 1.152ha of impervious surfaces which equates to a fraction impervious (fi) of 0.58. Using a one-hour, ten-year rainfall intensity ($^1I_{10}$) of 61.7 mm/hr, a C10 value of 0.77 has been adopted for the post-development Catchment A. Based on the supplied subdivision plan, the post-development Catchment B has approximately 0.250ha of impervious surfaces which equates to a fraction impervious (fi) of 0.66. Using a one-hour, ten-year rainfall intensity ($^1I_{10}$) of 61.7 mm/hr, a C10 value of 0.80 has been adopted for the post-development Catchment B.

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	C_2	C_{10}	C_{20}	C_{100}
POST A	0.66	0.77	0.81	0.93
POST B	0.68	0.80	0.84	0.96

4.3.3 Time of Concentration

The Time Of Concentration for both post developed catchments 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 A 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. Post-development Catchment B will have a time of concentration that will incorporate 5 minutes of the roof to downpipes time plus 1 minute of pipe flow. This equates to a total travel time of six (6) 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 for both catchments are presented in *Tables 7* and *8*.

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

POST A					
Annual Exceedance Probability	AEP	39%	10%	5%	1%
Coefficient of Runoff	**C**	0.66	0.77	0.81	0.93
Area of Catchment (ha)	**A**	2.000	2.000	2.000	2.000
Average Rainfall Intensity (mm/h)	**I**	100	162	186	240
Peak Flow Rate (m^3/s)	**Q**	**0.364**	**0.695**	**0.837**	**1.238**

Table 8: Post Development Catchment B Peak Flow Estimation – Rational Method

POST B					
Annual Exceedance Probability	AEP	39%	10%	5%	1%
Coefficient of Runoff	**C**	0.68	0.80	0.84	0.96
Area of Catchment (ha)	**A**	0.379	0.379	0.379	0.379
Average Rainfall Intensity (mm/h)	**I**	116	190	218	285
Peak Flow Rate (m^3/s)	**Q**	**0.083**	**0.159**	**0.193**	**0.287**

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 *Tables 9* and *10*.

Table 9: Change in Peak Flow Rates Estimation – Rational Method (Catchment A)

Annual Exceedance Probability	**AEP**	39%	10%	5%	1%
Pre Developed Peak Flow Rate (m^3/s)	**Q**	0.143	0.274	0.331	0.491
Post Developed Peak Flow Rate (m^3/s)	**Q**	0.364	0.695	0.837	1.238
Change in Peak Flow Rate (m^3/s)	**Q**	**+0.221**	**+0.421**	**+0.506**	**+0.747**

The proposed development has demonstrated via the Rational Method Assessment, that an increase in peak flow rates discharging from Catchment A to the existing natural drainage channel is anticipated. Therefore, 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-C), 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.

Table 10: Change in Peak Flow Rates Estimation – Rational Method (Catchment B)

Annual Exceedance Probability	**AEP**	39%	10%	5%	1%
Pre Developed Peak Flow Rate (m^3/s)	**Q**	0.118	0.225	0.272	0.403
Post Developed Peak Flow Rate (m^3/s)	**Q**	0.083	0.159	0.193	0.287
Change in Peak Flow Rate (m^3/s)	**Q**	**-0.035**	**-0.066**	**-0.079**	**-0.116**

The proposed development has demonstrated via the Rational Method Assessment, that a decrease in peak flow rates discharging from Catchment B to Lot 105 on SP235699 is anticipated, therefore, no On-Site Detention (OSD) will be required.

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 an internal 12m wide drainage channel. The catchment and channel have been analysed and designed previously through a Hydraulic Impact Assessment by Knobel Engineers 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 Knobel Engineers (Ref: K3426-0008-C).

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 11: 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/A); 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 and MS2 shown on OSKA Consulting Group, *Sediment and Erosion Control Plan* (Ref: OSK3426/P007/A).

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

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/A); OSKA Consulting Group, Conceptual Stormwater Management Details (Ref: OSK3426/P006/A) 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)
- 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 SQID'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 SQID 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 12: Adopted MUSIC Catchment Areas

Catchment	Area (m^2)	% Impervious
Roof - A (Residential)	6 880	100
Roof – B North (Residential)	860	100
Roof – B South (Residential)	860	100
Road - A (Residential)	5 043	60
Road – B North (Residential)	453	60
Road – B South (Residential)	453	60
Ground – A (Residential)	8 084	20
Ground – B North (Residential)	580	20
Ground – B South (Residential)	581	20
TOTAL Site	**23 794**	

Stormwater runoff captured from the roof from Catchment A will be directly conveyed to the proposed pit and pipe network to the proposed bio-retention basin. Runoff generated from the remaining road and ground areas will be conveyed to the proposed bio-retention basin. Stormwater runoff captured from the roof from Catchment B will be directly conveyed to the proposed pit and pipe network to the proposed bio-retention street pods. Runoff generated from the remaining road and ground areas will be conveyed to the proposed bio-retention street pods.

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

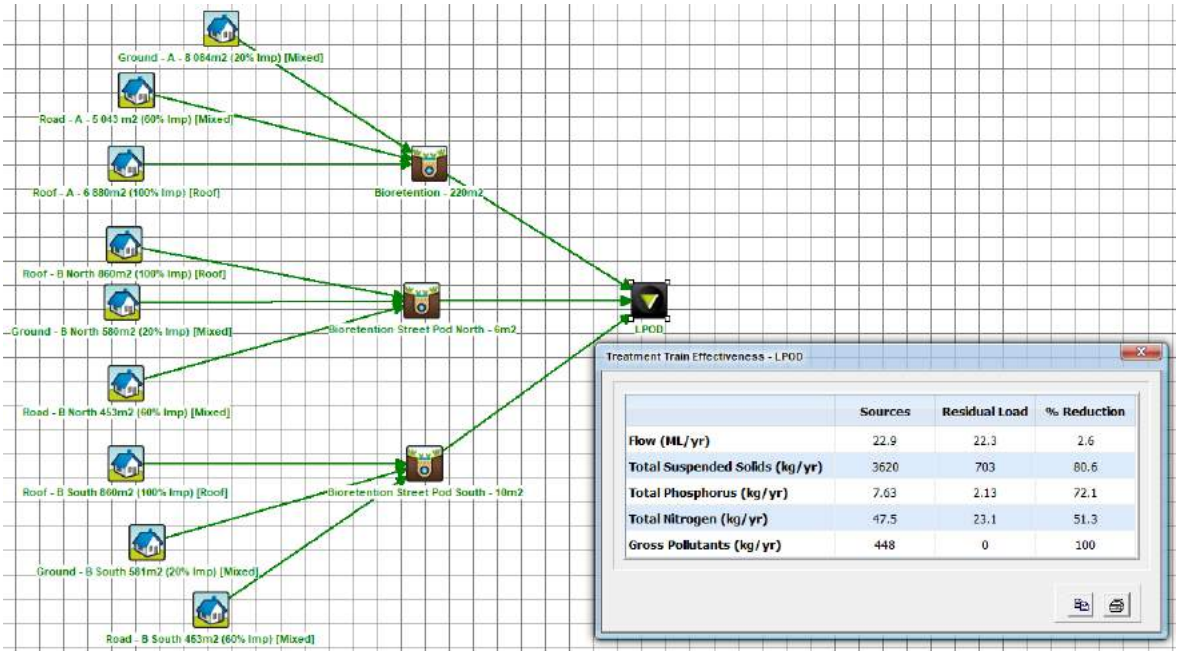


Figure 3: Operational Phase Treatment Train (Source: MUSIC)

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 BASINS

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 — 0.40 m;
- Drainage layer — 0.20 m;
- Extended detention depth — 0.30 m;
- Seepage — 0 mm/hr;
- Filter Area — 220 m^2;
- Surface Area — 250 m^2.

BIO-RETENTION STREET PODS

A bio-retention street pod 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 street pod shall be located to treat all stormwater from the development area.

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 — 0.30 m;
- Drainage layer — 0.20 m;
- Extended detention depth — 0.30 m;
- Seepage — 0 mm/hr;
- Filter Area — 6 and 10m^2;
- Surface Area — same as filter area.

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 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/A) and OSKA Consulting Group, *Conceptual Stormwater Management Details* (Ref: OSK3426/P006/A) included at Appendix E.

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 13* illustrates the effectiveness of the SQID's in the treatment train for the development.

Table 13: Treatment Train Effectiveness at Receiving Node

Parameter	Post	Post Mitigated	Reduction	Water Quality Objectives
Flow (ML/yr)	22.9	22.3	2.6 %	-
TSS (kg/yr)	3 620	703	80.6 %	80 %
TP (kg/yr)	7.63	2.13	72.1 %	60 %
TN (kg/yr)	47.5	23.1	51.3 %	45 %
Gross Pollutants (kg/yr)	448	0	100 %	90 %

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

6.0 OPERATIONAL PHASE MAINTENANCE REQUIREMENTS

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 14: Bio-retention Basin and Pod Maintenance Schedule

Bio-retention Basin Maintenance Checklist			
Inspection Frequency: 3 Monthly	**Date of Visit:**		
Location:			
Description:			
Site Visibility:			
Inspection Items	**Yes**	**No**	**Action Required (Details)**
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?			
Comments:			

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 15* as a guideline for the necessary steps to be taken prior to the end of the maintenance period.

Table 15: Asset Handover Checklist

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

8.0 CONCLUSIONS

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 from Catchment A 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. A hydrological analysis demonstrated that the anticipated post-development peak flow rates discharging from Catchment B is lower than the pre-development flow rates and no detention system will be required.

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 220 m^2 of bio filter area and 2 bio-retention street pods with 6m^2 and 10m^2 of bio filter area. The SQID's utilised within the MUSIC model have been adopted to demonstrate a potential treatment system, pending council approval.

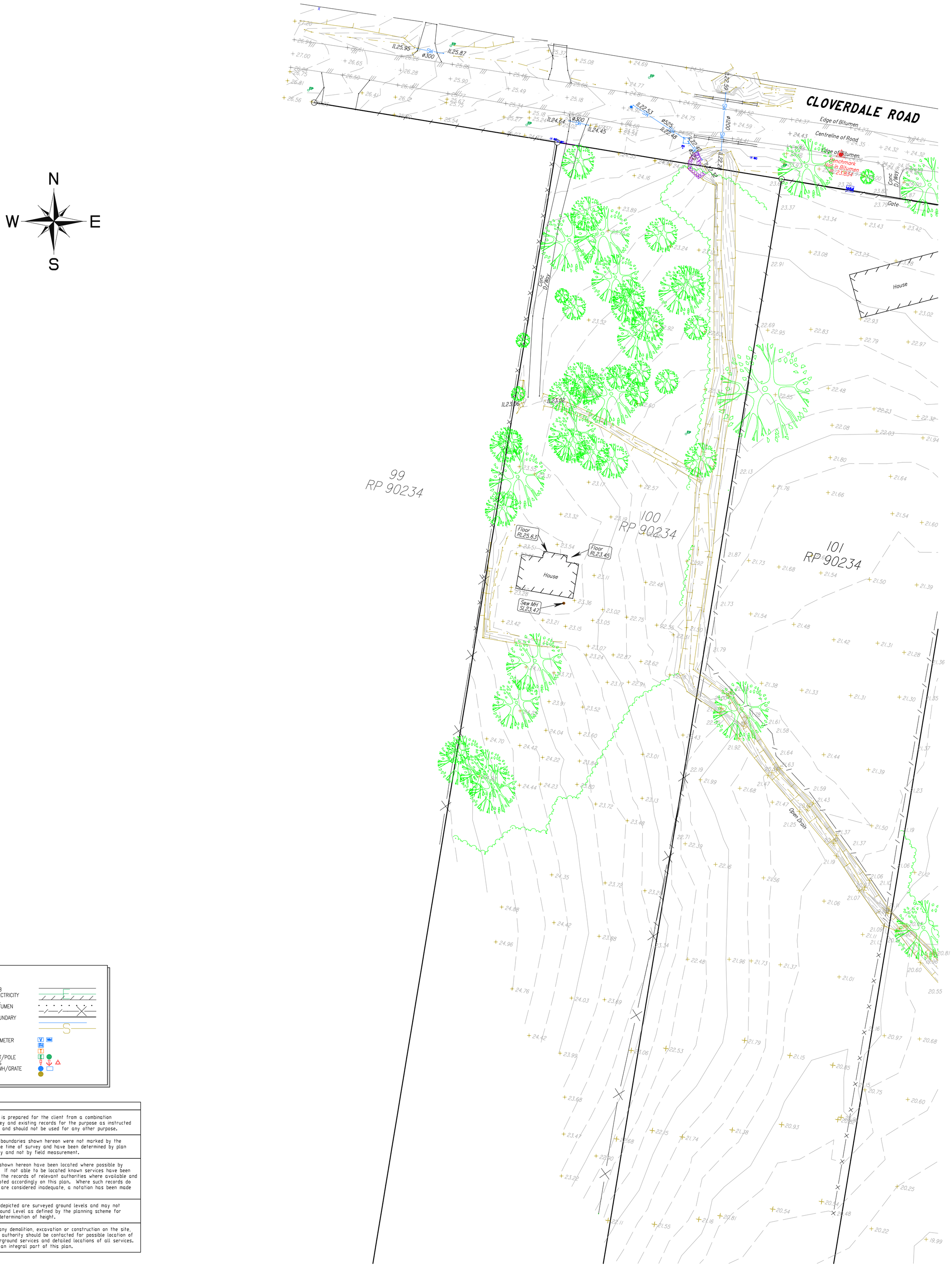
A monitoring and maintenance plan for the proposed infrastructure has been included. A sediment and erosion control plan is provided for the construction phase of the development and shall be implemented by the contractor and developer.

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)



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
- ELECTRCITY 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 fron 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.

terramap
CONSULTING CADASTRAL & ENGINEERING SURVEYORS

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

Ph 32451611 Fax 32451944
reception@terramap.com.au

Alex Wu

SCALE 1 : 800 A3

0 8m 16m 24m 32m 40m

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

Rev	DATE	By	AMENDMENT
2	31/03/22	MP	Updated Boundary
1	20/12/21	RK	Datum changed to MGA2020
0	15/5/17	AS	ORIGINAL ISSUE

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

N

W E

S

100
RP 90234

101
RP 90234

102
RP 90234

103
RP 90234

105
SP 235699

Contours in this area are indicative only

Contours in this area are indicative only

Contours in this area are indicative only

General Location of high bank

General Location of high bank

General Location of high bank

BLUNDER CREEK

LEGEND

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

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Alex Wu

SCALE 1 : 800 A3

0 8m 16m 24m 32m 40m

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

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

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

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

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
ELECTRCITY PIT/POLE
SURVEY MARKS
STORMWATER MH/GRATE
SEWER MH

Notes:

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CLOVERDALE ROAD
Edge of Bitumen
Centreline of Road
Edge of Bitumen
Benchmark Nail in Bitumen RL24.834
Conc D/Way
Gate
Vegetation
Gate
Vegetation
Change of Grade
IL20.66
PP #33148
Bitumen D/Way
Edge of Bitumen
Centreline of Road
Edge of Bitumen
Change of Grade
Sew MH SL24.05
225 Dia
Ø1200
N
W
E
S
House
Shed
House
Concrete Ret Wall
Sew Septic MH SL22.53
Conc Slab
Shed
Concrete Ret Wall
SW MH SL21.81
Building Pads
IL19.59
SW
300 RCP
SW Grate SL20.56
Building Pads
Building Pads
Sew MH SL20.64
IL18.71
IL18.69
225 Dia
101 RP 90234
102 RP 90234
103 RP 90234
CP SP 287112
Open Drain
Open Drain
Sew MH SL20.08
IL18.06
225 Dia
IL18.03
IL17.62
Sew MH SL20.00
600 Dia
EMT A SP287107
EMT B SP287107

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Alex Wu

SCALE 1 : 800 A3

0 8m 16m 24m 32m 40m

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

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

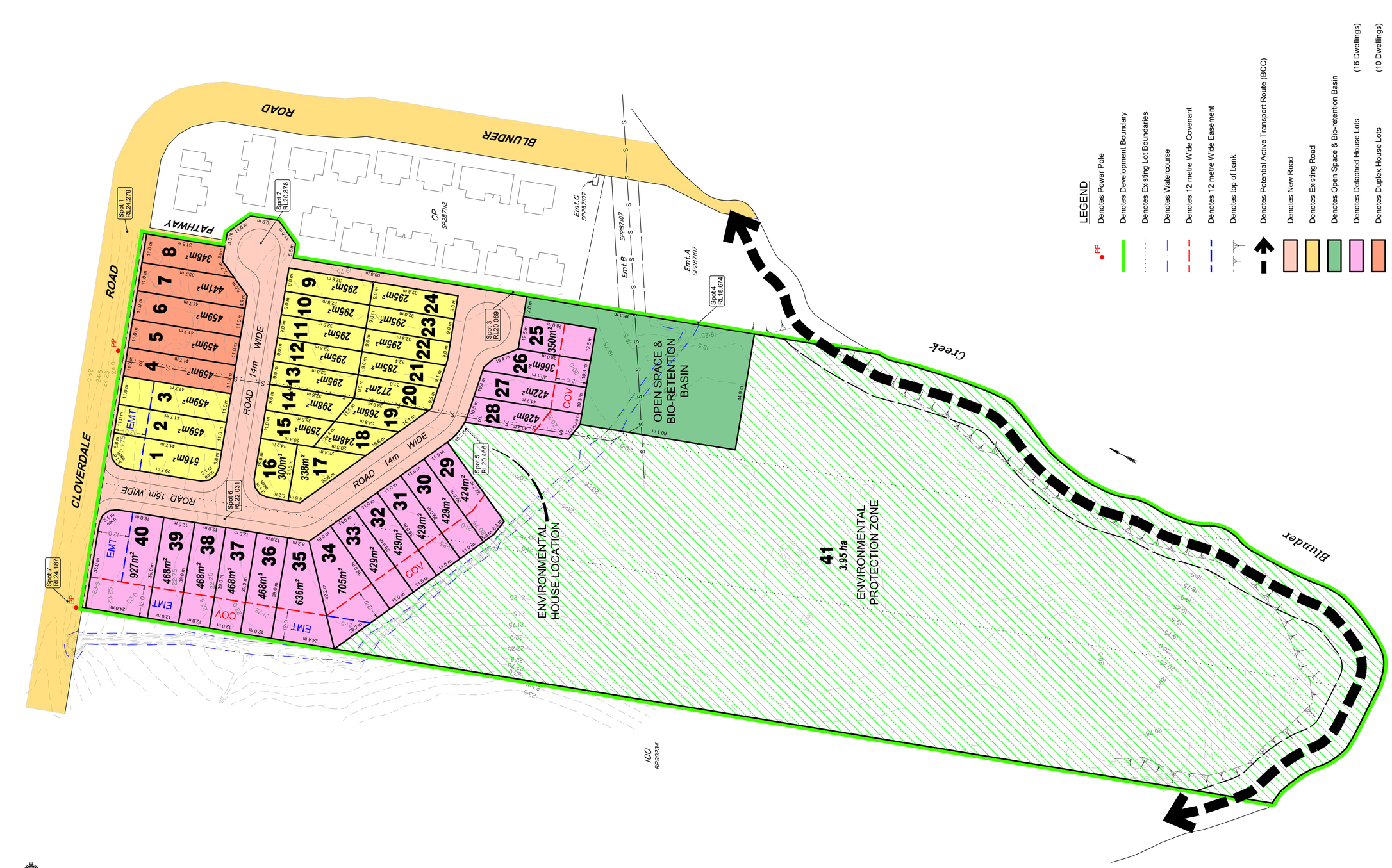
Rev	DATE	By	AMENDMENT
7	22/04/22	MP	Updated Boundary
6	31/03/22	MP	Updated Boundary
5	17/03/22	JO	Survey Extended
4	20/12/21	RK	Datum changed to MGA2020
3	15/5/17	AS	Survey Extended
2	21/10/16	AS	Sewer IL added
1	20.01.16	GJW	ORIGINAL ISSUE
0	14.09.15	BG	ORIGINAL ISSUE

DRAWN: 20.01.2016
CHECKED: 20.01.2016
APPROVED: 20.01.2016
DRAWING NUMBER: 3814/002-1
REV: 7

APPENDIX

B

Intrax Consulting Group, Proposed Reconfiguration (Ref: S152485 Rev C)



Scale 1: 750 @ A1 – Lengths are in Metres.

5 0 5 10 20 30 40 50 60 70 80 90 100 110

Scale 1: 1500 @ A3 – Lengths are in Metres.

10 0 20 40 60 80 100 120 140 160 180 200 220

REV.	AMENDMENT	DATE

Intrax
www.intrax.com.au
Intrax Consulting Group
VIC | NSW | SA | QLD

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Ground Floor D2, 643 Kessels Rd,
Upper MT. Gravatt QLD 4122
Ph 1300 INTRAX (1300 468 729)
receptionqld@intrax.com.au

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 dimensions,areas and total number of lots shown hereon are subject to field survey and also to the requirements of Council and any other authority which may have requirements under any relevant legislation. In particular,no reliance should be placed on the information on this plan for any financial dealings involving the land. 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:	26/10/2021
SHEET NO.	1 OF 1

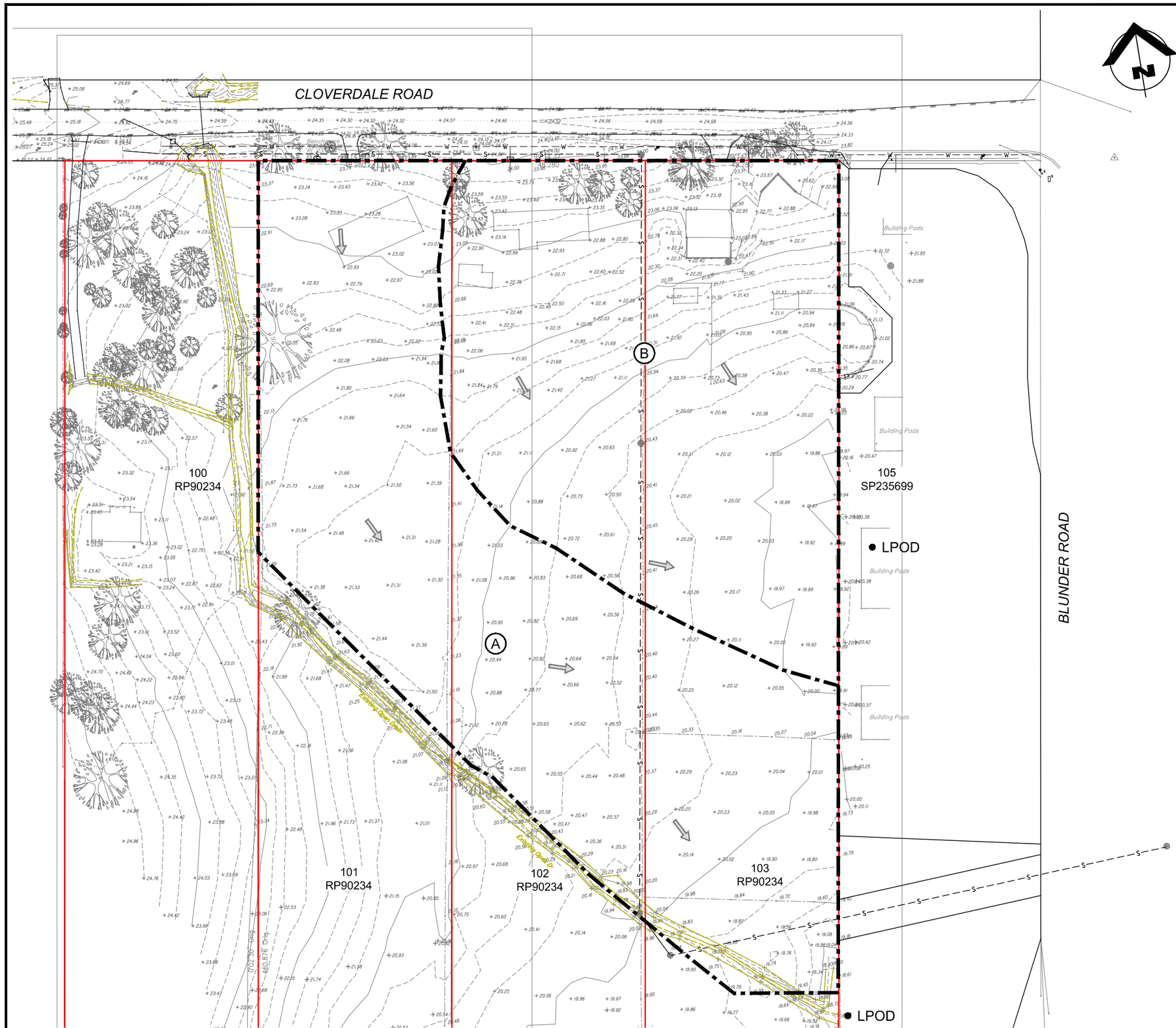
SURVEYED:	
DRAWN:	Stanfield's
CHECKED:	
APPROVED:	
REVISION:	(C-2)

S152485 | C | A1

APPENDIX

C

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



PRE-DEVELOPMENT CATCHMENT PLAN

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- (A) STORMWATER CATCHMENT I.D.
- 80.0 EXISTING SURFACE CONTOURS
- ● LPOD LAWFUL POINT OF DISCHARGE
- FLOW DIRECTION

EXISTING SERVICES LEGEND

- S EXISTING SEWER MAIN
- W EXISTING WATER MAIN
- SWD EXISTING STORMWATER PIPE

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (m²)
A	1.318
B	1.061
TOTAL	2.379

REPORT ISSUE
NOT FOR CONSTRUCTION

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

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

OSKA CONSULTING GROUP

CLIENT: QLD INTERNATIONAL INVESTMENT PTY LTD

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

DESIGN	DRAWN	APPROVED
BG	ES	AP

TITLE: PRE DEVELOPMENT CATCHMENT PLAN

SCALE: 1:500 AT A1, 1:1000 AT A3 (0 10 20 30 40 50m)

PROJECT NO.: OSK3426

DWG NO.: P003

ISSUE: A

APPENDIX

D

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

POST-DEVELOPMENT CATCHMENT PLAN

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- (A) STORMWATER CATCHMENT I.D.
- 22.75 EXISTING SURFACE CONTOURS
- ● LPOD — LAWFUL POINT OF DISCHARGE
- PROPOSED FLOW DIRECTION
- EXTERNAL DRAINAGE CHANNEL
- EXTERNAL CATCHMENT FLOW

EXISTING SERVICES LEGEND

- S — EXISTING SEWER MAIN
- W — EXISTING WATER MAIN
- SWD — EXISTING STORMWATER PIPE

STORMWATER CATCHMENT TABLE	
STORMWATER CATCHMENT I.D.	AREA (m²)
A	2.000
B	0.379
TOTAL	2.379

CLOVERDALE ROAD

BLUNDER ROAD

100 RP90234

101 RP90234

102 RP90234

102 RP90234

103 RP90234

105 SP235699

LPOD

LPOD

Building Pods

Existing Quail Drain

Existing Quail Drain

REPORT ISSUE
NOT FOR CONSTRUCTION

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

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

OSKA CONSULTING GROUP

CLIENT: QLD INTERNATIONAL INVESTMENT PTY LTD

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

DESIGN	DRAWN	APPROVED
BG	ES	AP

TITLE: POST DEVELOPMENT CATCHMENT PLAN

SCALE: 1:500 AT A1, 1:1000 AT A3 (0 10 20 30 40 50m)

PROJECT NO.: OSK3426

DWG NO.: P004

ISSUE: A

APPENDIX

E

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

CLOVERDALE ROAD

4 x 1800(W) x 900(H) CULVERTS

EXTERNAL CATCHMENT DRAINAGE CHANNEL 12m WIDE

BIO-RETENTION STREET TREE POD
FILTER AREA - 6m²
SURFACE AREA - 6m²
TO BE DESIGNED IN ACCORDANCE WITH BSD-8331 AND BSD-8332.
BIO POD TO DISCHARGE INTO EXISTING DRAINAGE WITHIN CUL-DE-SAC

BIO-RETENTION STREET TREE POD
FILTER AREA - 10m²
SURFACE AREA - 10m²
TO BE DESIGNED IN ACCORDANCE WITH BSD-8331 AND BSD-8332.
BIO POD TO DISCHARGE INTO EXISTING DRAINAGE WITHIN CUL-DE-SAC

BIO-RETENTION BASIN
FILTER AREA - 220m²
SURFACE AREA - 250m²
BIO TO DISCHARGE TO EXISTING DRAINAGE CHANNEL

BLUNDER ROAD

100 RP90234

101 RP90234

102 RP90234

103 RP90234

105 SP235699

UNDEVELOPED AREA

LEGEND

- STORMWATER CATCHMENT BOUNDARY
- EXISTING SURFACE CONTOURS
- LPOD — LAWFUL POINT OF DISCHARGE
- SWD — PROPOSED STORMWATER PIPE
- PROPOSED FIELD INLET
- PROPOSED FLOW DIRECTION
- SITE BOUNDARY
- EXTERNAL DRAINAGE CHANNEL
- BIO — PROPOSED BIO-RETENTION BASIN
- PROPOSED STORMWATER MANHOLE
- PROPOSED GULLY PIT

EXISTING SERVICES LEGEND

- S — EXISTING SEWER MAIN
- W — EXISTING WATER MAIN
- SWD — EXISTING STORMWATER PIPE

REPORT ISSUE
NOT FOR CONSTRUCTION

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

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

OSKA CONSULTING GROUP

CLIENT: QLD INTERNATIONAL INVESTMENT PTY LTD

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

DESIGN	DRAWN	APPROVED
BG	BG	AP

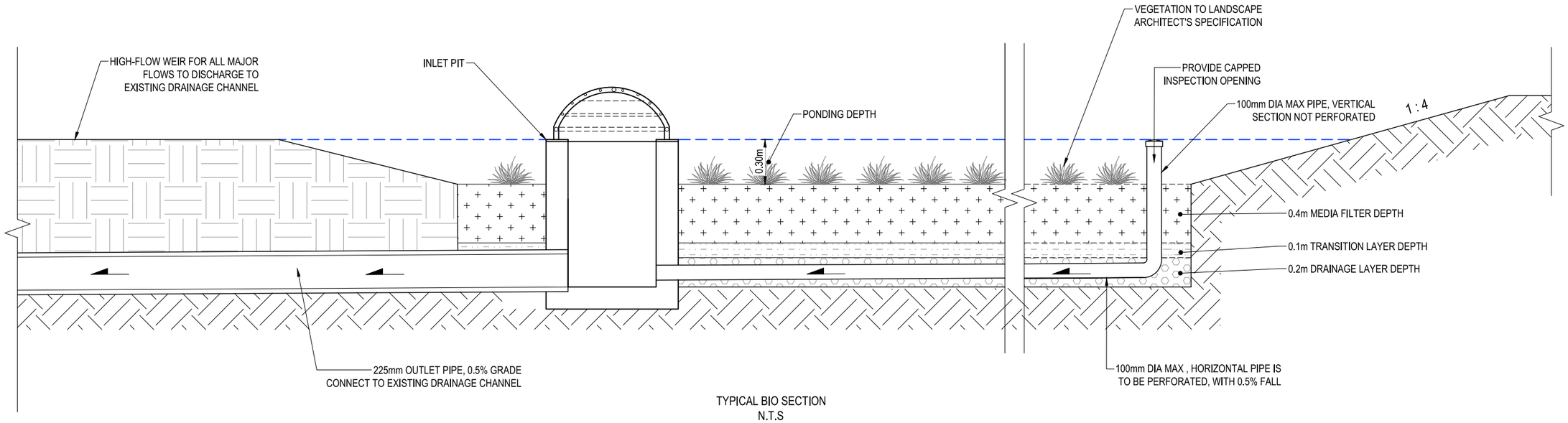
TITLE: CONCEPTUAL STORMWATER MANAGEMENT PLAN

SCALE: 1:500 AT A1, 1:1000 AT A3 (0 10 20 30 40 50m)

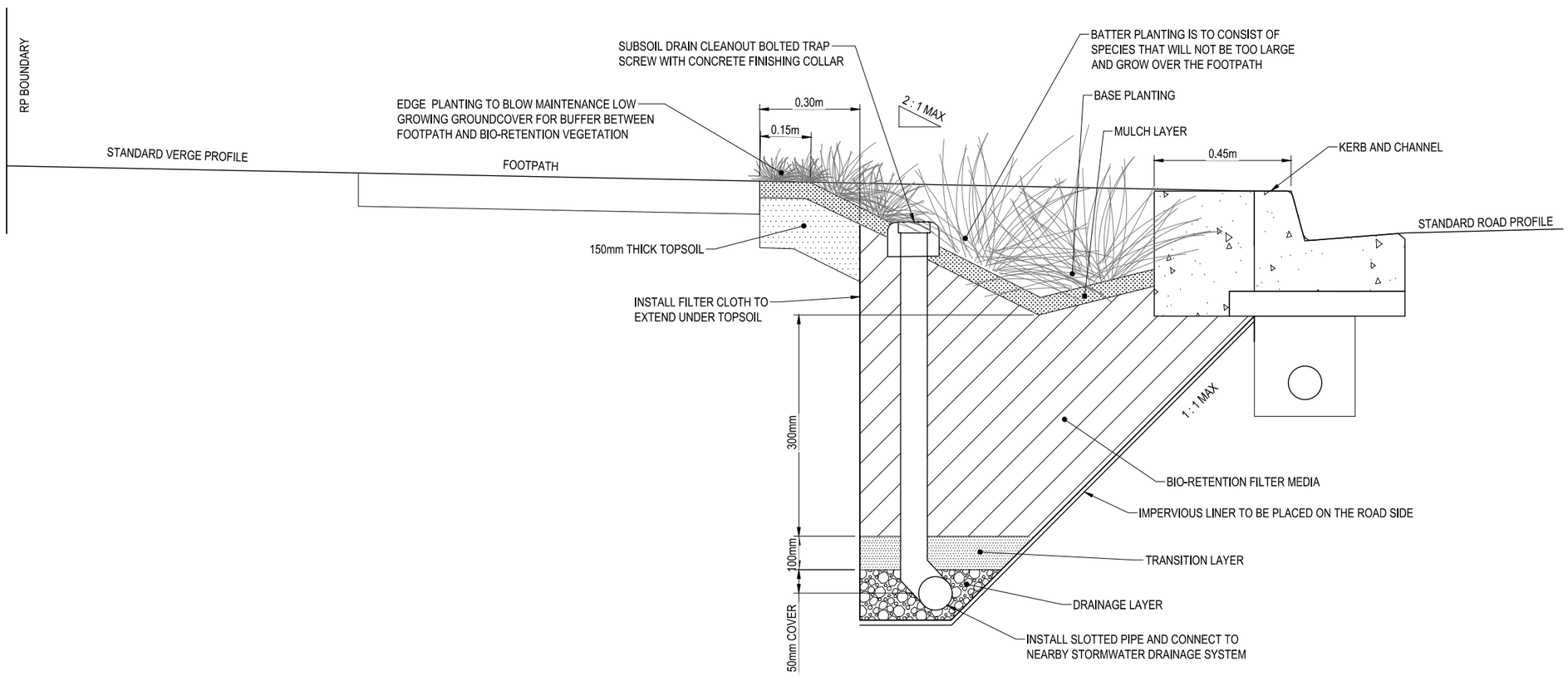
PROJECT NO. OSK3426

DWG NO. P005

ISSUE A



TYPICAL BIO SECTION
N.T.S



TYPICAL BIO-RETENTION STREET POD SECTION
N.T.S

REPORT ISSUE
NOT FOR CONSTRUCTION

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

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

OSKA CONSULTING GROUP

CLIENT: QLD INTERNATIONAL INVESTMENT PTY LTD

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

DESIGN	DRAWN	APPROVED
BG	ES	AP

TITLE: CONCEPTUAL STORMWATER MANAGEMENT DETAILS

SCALE: 1:20 AT A1, 1:40 AT A3 (0, 500, 1000, 1500, 2000mm)

PROJECT NO. OSK3426

DWG NO. P006

ISSUE A

APPENDIX

F

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

CLOVERDALE ROAD

BLUNDER ROAD

100
RP90234

101
RP90234

102
RP90234

103
RP90234

105
SP235699

S.E.P

DSP

LPOD

MS1

MS2

BIO.

SF

SWD

JS

Existing Open Drain

Building Pods

460.876 Orig.

0°02'36" Orig.

SEDIMENT & EROSION CONTROL LEGEND

- SEDIMENT FENCE
- TEMPORARY DIVERSION DRAIN
- TEMPORARY SEDIMENT PONDS WITHIN FUTURE BIO RETENTION BASINS
- S.E.P — LOCATION OF STABILISED ENTRY/EXIT POINT
- DSP — DRAINAGE STRUCTURE PROTECTION
- MS1 — WATER QUALITY MONITORING STATION
- FLOW ARROW
- EXTERNAL DRAINAGE CHANNEL
- LPOD — LAWFUL POINT OF DISCHARGE
- 80.0 — FINISHED SURFACE CONTOURS
- 80.0 — EXISTING SURFACE CONTOURS

EXISTING SERVICES LEGEND

- S — EXISTING SEWER MAIN
- W — EXISTING WATER MAIN
- SWD — EXISTING STORMWATER PIPE

REPORT ISSUE
NOT FOR CONSTRUCTION

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

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

OSKA CONSULTING GROUP

CLIENT: QLD INTERNATIONAL INVESTMENT PTY LTD

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

DESIGN	DRAWN	APPROVED
BG	ES	AP

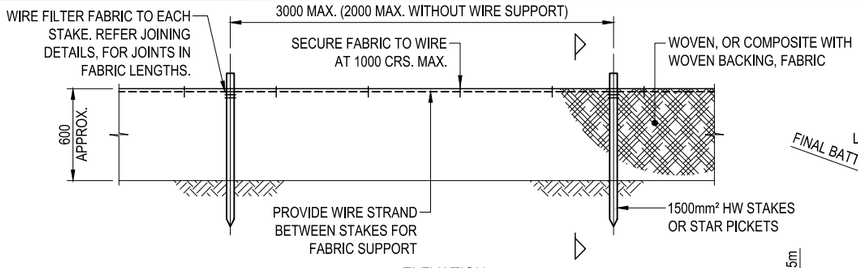
TITLE: SEDIMENT AND EROSION CONTROL PLAN

SCALE: 1:500 AT A1, 1:1000 AT A3 (0 10 20 30 40 50m)

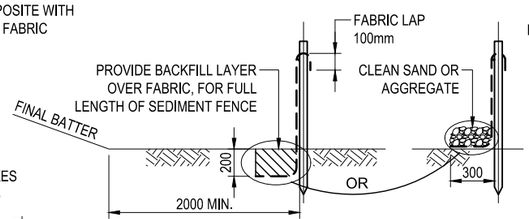
PROJECT NO.: OSK3426

DWG NO.: P007

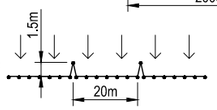
ISSUE: A



ELEVATION



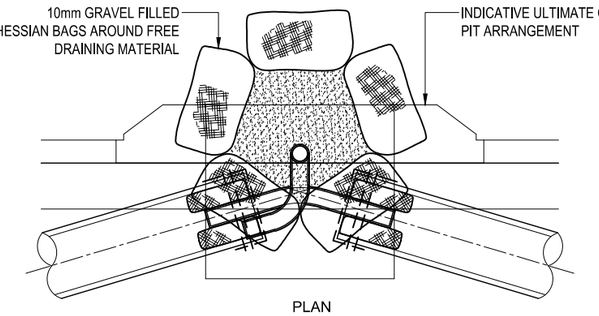
SECTION



NOTE: INSTALL 1.5m (MIN.) DEEP 'RETURNS' AT 20m SPACING (MAX.) ON UPSLOPE SIDE OF FENCELINE (5-10m MAX SPACING IF FENCE ALIGNED AT ANGLE TO CONTOUR). EG:

SEDIMENT FENCE DETAILS

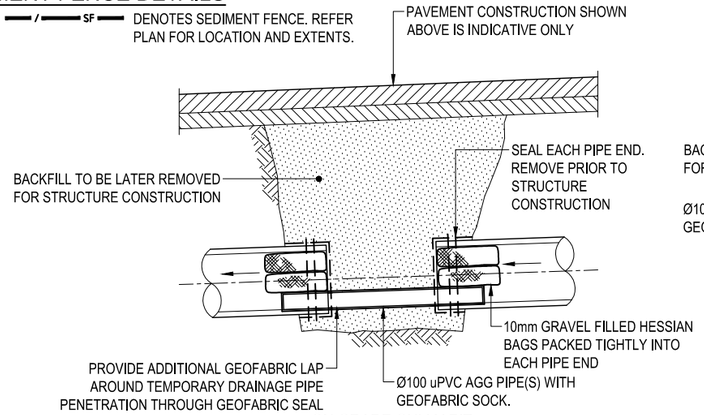
N.T.S.



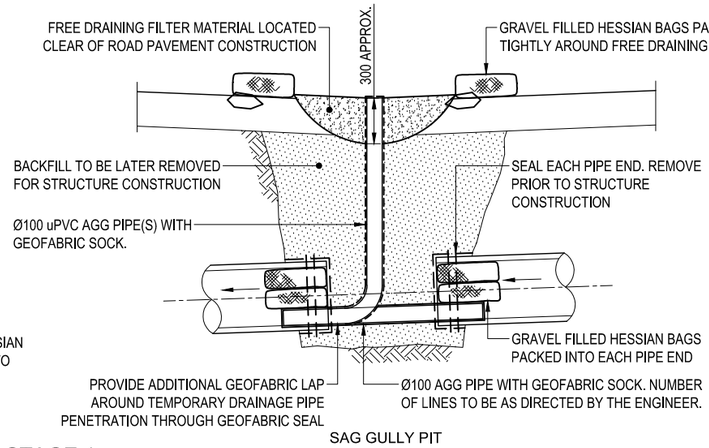
PLAN

REPORT ISSUE
NOT FOR CONSTRUCTION

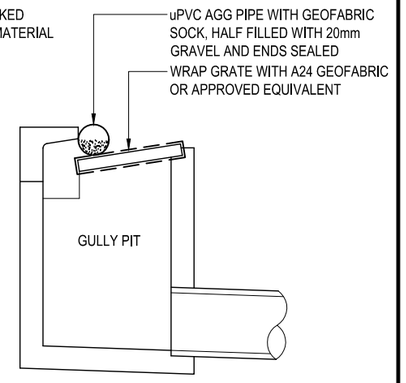
SF DENOTES SEDIMENT FENCE. REFER PLAN FOR LOCATION AND EXTENTS.



ON GRADE GULLY PIT

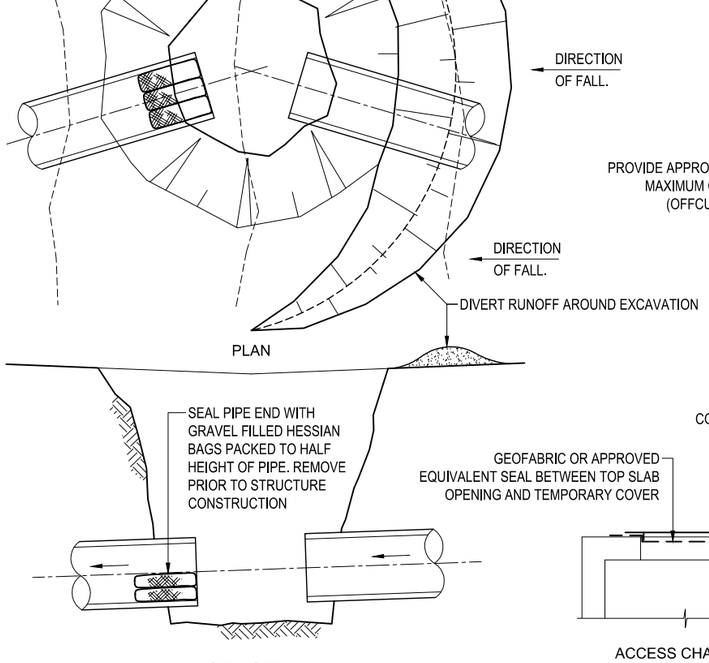


SAG GULLY PIT



STAGE 2
STRUCTURE COMPLETE

STAGE 1
EXCAVATION, PIPE INSTALLATION AND INTERIM BACKFILLING



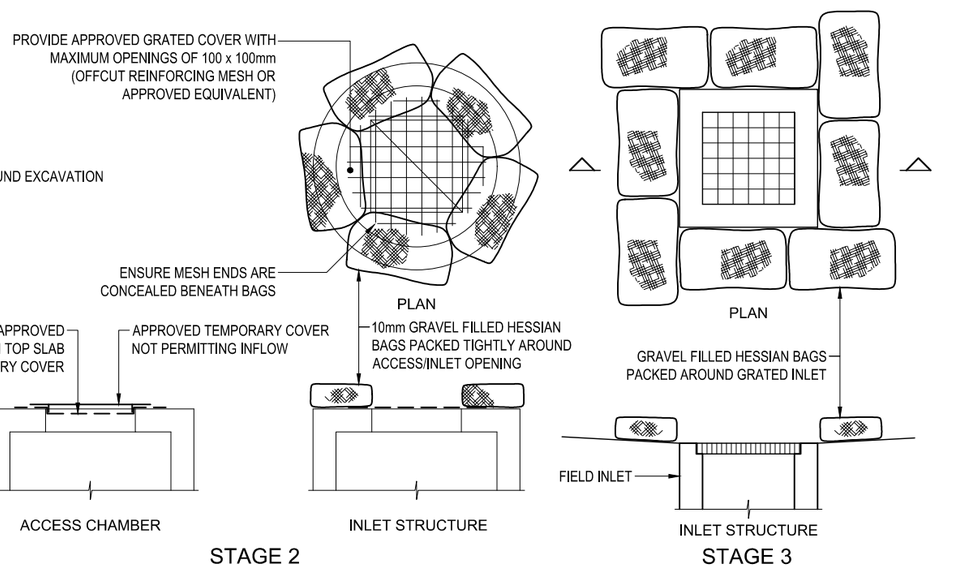
PLAN

STAGE 1
EXCAVATION AND PIPE INSTALLATION

ROADWAY GULLY PIT

N.T.S.

DSP DENOTES DRAINAGE STRUCTURE PROTECTION. REFER PLAN FOR LOCATION & EXTENTS.



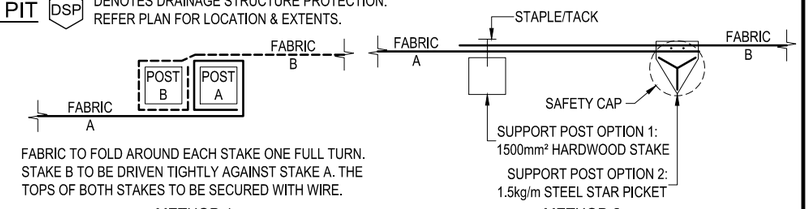
STAGE 2
STRUCTURE COMPLETE UP TO TOP SLAB

STAGE 3
STRUCTURE COMPLETE

ACCESS CHAMBER / INLET STRUCTURE

N.T.S.

DSP DENOTES DRAINAGE STRUCTURE PROTECTION, REFER PLAN FOR LOCATION & EXTENTS.



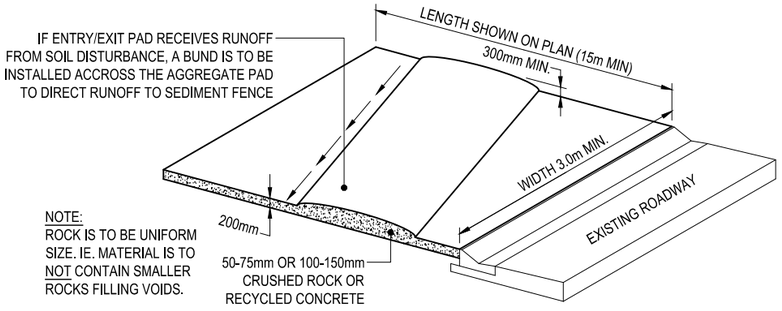
FABRIC TO FOLD AROUND EACH STAKE ONE FULL TURN. STAKE B TO BE DRIVEN TIGHTLY AGAINST STAKE A. THE TOPS OF BOTH STAKES TO BE SECURED WITH WIRE.

METHOD 1

METHOD 2

SEDIMENT FENCE FABRIC JOINING DETAILS

N.T.S.



NOTE:
ROCK IS TO BE UNIFORM SIZE. IE. MATERIAL IS TO NOT CONTAIN SMALLER ROCKS FILLING VOIDS.

STABILISED ENTRY/EXIT POINT

N.T.S. OR APPROVED EQUIVALENT

SEP DENOTES STABILISED ENTRY/EXIT POINT, REFER PLAN FOR LOCATIONS.

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

OSKA CONSULTING GROUP

CLIENT: QLD INTERNATIONAL INVESTMENT PTY LTD

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

DESIGN	DRAWN	APPROVED
BG	ES	AP

TITLE: SEDIMENT AND EROSION CONTROL DETAILS

SCALE: 1:500 AT A1, 1:1000 AT A3 (0 10 20 30 40 50m)

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
Section A—If for a material change of use, reconfiguring a lot, operational work or building work 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.		
PO1 Development provides a stormwater management system which achieves the integrated management of stormwater to: • minimise flooding; • protect environmental values of receiving waters; • maximise the use of water sensitive urban design; • minimise safety risk to all persons; • maximise the use of natural waterway corridors and natural channel design principles. Editor's note—The stormwater management system to be developed to address PO1 is not intended to require management of stormwater quality.	**AO1** Development provides a stormwater management system designed in compliance with the Infrastructure design planning scheme policy.	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. For further information on the proposed stormwater management system, refer to OSKA Consulting Group, *Conceptual Stormwater Management Plan* (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.

PO2 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.	**AO2.1** Development does not result in an increase in flood level or flood hazard on up slope, down slope or adjacent premises.	In accordance with Brisbane City Council City Plan Section 6.16, Chapter 7 *Stormwater Drainage*, 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. For further information on the proposed stormwater management system, refer to OSKA Consulting Group, *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.*
	AO2.2 Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	The proposed drainage network shall be designed in accordance with the BCC Infrastructure Planning Scheme Policy.
PO3 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.	**AO3.1** Development ensures that the location of the stormwater drainage system is contained within a road reserve, drainage reserve, public pathway, park or waterway corridor.	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. For further information on the proposed stormwater management system, refer to OSKA Consulting Group, *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.*
	AO3.2 Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	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. For further information on the proposed stormwater management system, refer to OSKA Consulting Group, *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.*
	AO3.3 Development obtains a lawful point of discharge in compliance with the standards in the Infrastructure design planning scheme policy.	A Lawful Point of Discharge (LPOD) has been demonstrated in accordance with BCC's Infrastructure Design Planning Scheme Policy (ID PSP), Section 7.6. Refer to OSKA Consulting Group, *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.*
	AO3.4 Where on private land, all underground stormwater infrastructure is secured by a drainage easement.	NA
PO4 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.	**AO4.1** Development provides a stormwater conveyance system which is designed to safely convey flows in compliance with the standards in the Infrastructure design planning scheme policy.	Refer Response to PO1
	AO4.2 Development provides sufficient area to convey run-off which will comply with the standards in the Infrastructure design planning scheme policy.	Refer Response to PO1

PO5 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.	**AO5** Development ensures the design of stormwater channels, creek modifications or other infrastructure, permits terrestrial and aquatic fauna movement.	NA
PO6 Development ensures that location and design of stormwater detention and water quality treatment: • minimises risk to people and property; • provides for safe access and maintenance; • (c) minimises ecological impacts to creeks and waterways.	**AO6.1** Development locates stormwater detention and water quality treatment:) outside of a waterway corridor;) offline to any catchment not contained within the development.	NA
	AO6.2 Development providing for stormwater detention and water quality treatment devices are designed in compliance with the standards in the Infrastructure design planning scheme policy.	In accordance with Brisbane City Council City Plan Section 6.16, Chapter 7 *Stormwater Drainage*, 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. In accordance with Brisbane City Council City Plan Section 9.4.9 *Stormwater Code*, the development does trigger the design of permanent stormwater improvement devices as the developed site area is greater than 2,500 m². Refer to OSKA Consulting Group, *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.*

PO7 Development is designed, including any car parking areas and channel works to: • reduce property damage; • (b) provide safe access to the site during the defined flood event.	**AO7.1** Development (including any ancillary structures and car parking areas) is located above minimum flood immunity levels in Table 9.4.9.3.B, Table 9.4.9.3.C, Table 9.4.9.3.D, Table 9.4.9.3.E and Table 9.4.9.3.F. 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).	NA
	AO7.2 Development including the road network provides a stormwater management system that provides safe pedestrian and vehicle access in accordance with the standards in the Infrastructure design planning scheme policy.	The proposed stormwater infrastructure will ensure compliance with this performance outcome.
PO8 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.	**AO8.1** Development ensures natural waterway corridors and drainage paths are retained.	NA
	AO8.2 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 Natural channel design guidelines.	NA
	AO8.3 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 Infrastructure design planning scheme policy.	NA

	AO8.4 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 Infrastructure design planning scheme policy.	The proposed stormwater infrastructure will ensure compliance with this performance outcome.
PO9 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.	**AO9** No acceptable outcome is prescribed.	The proposed stormwater infrastructure will ensure compliance with this performance outcome.
PO10 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.	**AO10** No acceptable outcome is prescribed.	The proposed stormwater infrastructure has been sized and designed in accordance with the infrastructure design planning scheme. Refer to OSKA Consulting Group, *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.*
PO11 Development provides for the orderly development of stormwater infrastructure within a catchment, having regard to the: • existing capacity of stormwater infrastructure within and external to the site, and any planned stormwater infrastructure upgrades; • safe management of stormwater discharge from existing and future up-slope development; • (c) implication for adjacent and down-slope development.	**AO11.1** 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.	NA
	AO11.2 Development ensures that existing stormwater infrastructure that is undersized is upgraded in compliance with the Infrastructure design planning scheme policy.	The proposed stormwater infrastructure has been sized and designed in accordance with the infrastructure design planning scheme. Refer to OSKA Consulting Group *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.*

PO12 Development provides stormwater infrastructure which: • remains fit for purpose for the life of the development and maintains full functionality in the design flood event; • can be safely accessed and maintained cost effectively; • (c) ensures no structural damage to existing stormwater infrastructure.	**AO12.1** The stormwater management system is designed in compliance with the Infrastructure design planning scheme policy.	The proposed stormwater infrastructure has been designed in accordance with the infrastructure design planning scheme. Refer to OSKA Consulting Group, *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.*
	AO12.2 Development provides a clear area with a minimum of 2m radius from the centre of an existing manhole cover and with a minimum height clearance of 2.5m.	NA
PO13 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: • the environmental values and water quality objectives of waters; • waterway hydrology; • the maintenance and serviceability of stormwater infrastructure. Note—The Infrastructure design planning scheme policy outlines the appropriate measures to be taken into account to achieve the performance outcome.	**AO13** No acceptable outcome is prescribed.	A sediment and erosion control plan is included in OSKA Consulting Group, *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.* 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.
PO14 Development ensures that: • unnecessary disturbance to soil, waterways or drainage channels is avoided; • all soil surfaces remain effectively stabilised against erosion in the short and long term.	**AO14** No acceptable outcome is prescribed.	Refer Response PO13.

PO15 Development does not increase: • the concentration of total suspended solids or other contaminants in stormwater flows during site construction; • run-off which causes erosion either on site or off site.	**AO15** No acceptable outcome is prescribed.	Refer Response PO13.
Section B—Additional performance outcomes and acceptable outcomes which apply to high-risk development, being one or more of the following: - a material change of use for an urban purpose which involves greater than 2,500m^2 of land that: • will result in an impervious area greater than 25% of the net developable area; or • will result in 6 or more dwellings. - reconfiguring a lot for an urban purpose that involves greater than 2,500m^2 of land and will result in 6 or more lots; • operational work for an urban purpose which involves disturbing greater than 2,500m^2 of land.		
PO16 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 *Environmental Protection Act 1994*. Note—Compliance with the performance outcome should be demonstrated by the submission of a site-based stormwater management plan for high-risk development only.	**AO16** Development provides a stormwater management system which is designed in compliance with the standards in the Infrastructure design planning scheme policy.	NA.
PO17 Development ensures that: • the discharge of wastewater to a waterway or external to the site is avoided; or • if the discharge cannot practicably be avoided, the development minimises wastewater discharge through re-use, recycling, recovery and treatment. Note—The preparation of a wastewater management plan can assist in demonstrating	**AO17** No acceptable outcome is prescribed.	NA.

achievement of this performance outcome. Editor's note—This code does not deal with sewerage which is the subject of the Wastewater code.		
Section C—Additional performance outcomes and acceptable outcomes for assessable development for a material change of use or reconfiguring a lot		
PO18 Development protects stormwater infrastructure to ensure the following are not compromised: • the long term infrastructure for the stormwater network in the Long term infrastructure plans; • the existing and planned infrastructure for the stormwater network in the Local government infrastructure plan; • the provision of long term, existing and planned infrastructure for the stormwater network which: • is required to service the development or an existing and future urban development in the planning scheme area; or • is in the interests of rational development or the efficient and orderly planning of the general area in which the site is situated. 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.	**AO18** Development protects stormwater infrastructure in compliance with the following:) for long term infrastructure for the stormwater network, the Long term infrastructure plans;) for existing and planned infrastructure for the stormwater network, the Local government infrastructure plan;) the standards for stormwater drainage in the Infrastructure design planning scheme policy.	The proposed stormwater management strategy does not propose to discharge site runoff to existing trunk infrastructure. Refer to OSKA Consulting Group, *Conceptual Stormwater Management Plan (Ref: OSK3426-0014) prepared for 12-26 Cloverdale Road, Doolandella.*

PO19 Development provides for the payment of extra trunk infrastructure costs for the following: • for development completely or partly outside the priority infrastructure area in the Local government infrastructure plan; • for development completely inside the priority infrastructure area in the Local government infrastructure plan involving: • trunk infrastructure that is to be provided earlier than planned in the Local government infrastructure plan; • long term infrastructure for the stormwater network which is made necessary by development that is not assumed future urban development; • other infrastructure for the stormwater network associated with development that is not assumed future urban development which is made necessary by the development. Editor's note—The payment of extra trunk infrastructure costs for development completely inside the priority infrastructure area in the Local government infrastructure plan is to be worked out in accordance with the Charges Resolution. Editor's note—See section 130 Imposing Development conditions (Conditions for extra trunk infrastructure costs) of the *Planning Act 2016*.	**AO19** No acceptable outcome is prescribed.	There is no trunk council infrastructure proposed as part of the development works.