Civil Dimensions

Consulting Engineers

CONCEPTUAL SITE BASED STORMWATER MANAGEMENT PLAN

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2015/727

Date: 14 October 2016

Queensland Government

Project: **Proposed Industrial Subdivision**
820 Greenbank Road, North Maclean

Prepared for:
Anna Property Group

Civil Dimensions Pty Ltd
A.B.N. 66 103 198 527

Unit 8/51 Freda St
Upper Mt Gravatt

Tel (07) 3422 2020
Fax (07) 3422 2021

www.civildimensions.com.au
mail@civildimensions.com.au

Contact: Ben Byrnes

Date: 8 September 2015

Document Distribution Register

Civil Dimensions Pty Ltd

Unit 8/51 Freda Street
Upper Mt Gravatt Qld 4122

Telephone: (07) 3422 2020
Facsimile: (07) 3422 2021
Email: mail@civildimensions.com.au

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Contents

1. Executive Summary

This report addresses the Development Application's stormwater design for the proposed subdivision creating 12 industrial lots from one rural allotment.

This report has been created as part of a Development Application lodged with Department of Infrastructure, Local Government and Planning (DILGP) following a pre-lodgement meeting hosted with this department earlier this year and on-going discussions with Marcus Bonotto of DILGP.

This report will demonstrate that it is feasible to develop the land whilst still maintaining Water Sensitive Urban Design (WSUD) principals and illustrates the development complies with the Logan City Council Policies and Guidelines for stormwater, the Queensland Urban Drainage Manual (QUDM) Vol. 1 Third Edition 2013 and the DERM State Planning Policy Guidelines 4/10 for Healthy Waters.

Key personnel associated with this work include:

- Tim Evans, Director
- Jason Bond, Civil Designer
- Ben Byrnes, Senior Engineer
- Denis Ogle, Reviewing Engineer

The management proposed, for both quantity and quality is through the use of a detention basin with a bio-retention filter system incorporated in the floor of the basin.

Subject to Council's acceptance of this proposal, this report can be utilised as the concept for detailed design. Notwithstanding the concept presented herewith, we note further detailing of the outlet configuration may be required and this will need to accommodate additional runoff generated from external catchments.

The software used for the stormwater quantity and quality analysis have been included on a disk in Appendix F for checking by the user.

2. Introduction

Anna Property Group Pty Ltd has engaged Civil Dimensions Pty Ltd to prepare a Conceptual Stormwater Management Plan for a proposed residential subdivision located at 820 Greenbank Road, North Maclean (Lot 2 on RP868726). This study concerns the proposed Development area making allowance for future contributing catchment areas.

The overall lot area is 20.25 hectares including 6.63 hectares which will remain as vegetated open space (approximately). It is also proposed to use the existing road reserve along the southern boundary for the entrance road. The existing road reserve area is excluded from the overall lot area.

The proposed development reconfigures one existing lot into 12 new industrial lots. The industrial lots range in area, from 5,831 m^2 to 15,580 m^2.

The proposed development layout (subdivision plan) was provided by O'Reilly Nunn Favier (refer Appendix A).

3. Proposed Development

3.1 Title Description & Address

The site's real property description is: Lot 2 on RP868726

Address: 820 Greenbank Road, North Maclean.

3.2 Existing Site Conditions and Improvements

An environmental report has been prepared by JWA Pty Ltd Ecological Consultants. The proposed development area of the site is currently vegetated with areas of open grass and forest. There are no known structures on the site other than an existing dam that is proposed to be removed. Refer to the before mentioned report for detailed information.

3.3 Topography, Catchments and Site Drainage

3.3.1 Topography

The site falls generally away from a north-south ridge to both the east and west with the eastern catchment being the far larger of the two. The site levels range from RL 40.5 on the northern boundary to RL 27.5m AHD on the eastern boundary at an average slope of 4-5%. A review of Logan City Council's Planning Overlay confirms the site does not have any effects from regional flooding.

3.3.2 Catchments

The area surrounding the development has been assessed to determine any external catchments likely to have an impact on the proposed site.

The extent of these catchments can be seen on Drg. CD14-053-SW1 in Appendix B. Their impact and how they are treated will be addressed during detailed design.

3.3.3 Existing Discharge

The stormwater runoff from the site currently discharges via sheet flow, continuing to fall into natural rills and gullies discharging from the site to the east and west of the development.

3.4 Soils and Erosion

3.4.1 Erosion and Sediment

Preliminary soil testing has been undertaken on the site by SGS Civil, the results of this investigation are currently unknown.

A Concept Erosion and Sediment Control (ESC) Plan and typical details plan have been prepared for the site, refer to Drg's CD14-053-ESC1 & ESC2 in Appendix C. This plan illustrates the proposed measures that will be implemented to manage the erosion risks associated with this development. Upon the soil testing being conducted, a revised plan will be submitted as part of the Operational Works application.

3.4.2 Acid Sulphate Soils

Acid Sulphate soils are naturally occurring soils, generally present in areas below RL 5.0m AHD. The lowest portion of the development site is approximately RL 28m. However those areas will be filled to create benched lots. The site appears to be well outside the area of concern indicated on Logan Planning Scheme

Acid Sulphate Soils overlay map OM-01.01 indicates that the site is not acid sulphate affected and as such no detailed soil testing is proposed to be undertaken prior to any works being conducted on site. Refer to Appendix C for a copy of Councils Acid Sulphate Soils overlay plan.

3.5 Vegetation

Significant vegetation exists over the site and JWA Pty Ltd have been commissioned by the developer to provide input into the proposed development. The lot layout has been prepared in accordance with the recommendations provided. Compensatory planting along with a monetary contribution is proposed to offset the vegetation losses.

Vegetation management hasn't been addressed in this report other than where required for stormwater quality management measures.

4. Stormwater Quantity Management

4.1 Procedure

The procedure used to determine the increase in stormwater runoff from the pre to the post developed site is based on comparing the peak discharge flow rates for each ARI storm event including the 1yr, 2yr, 5yr, 10yr, 20yr, 50yr and 100yr events and proposing an appropriate treatment to ensure the site achieves a no-net worsening outcome across all storms.

The rational method was used to estimate pre and post development flows for the above events and the computer modelling program WBNM (Watershed Bounded Network Model) was calibrated against these post-development events to size a proposed detention basin to mitigate post-development flows back to the pre-development equivalent.

The solutions provided for these events are sufficient to define the basin footprint, configuration and storage volumes.

Final Inlet and outlet sizing will be undertaken during the Operational Works phase. This will also need to consider contributing flows from external sources.

4.2 Local Authority Standards and Guidelines

The stormwater analysis will be undertaken in accordance with the Logan City Council standards and guidelines, the Queensland Urban Drainage Manual (QUDM) Volume 1, Third Edition 2013.

The following level of serviceability shown in Table 4.2-1 will be provided within the stormwater drainage system as per the Logan City Council guidelines.

Table 4.2-1 Stormwater Network Design Storms

Landuse	Design Parameter	Design Standard
Industrial	Minor Drainage System	Minimum 2yr ARI
	Major Drainage System	Minimum 100yr ARI

4.3 Hydraulic Model Development

4.3.1 Existing Catchment Description

The pre and post development catchments are shown in Table 4.3-1**Error! Reference source not found.** below and appear on Drg. CD14-053-SW1 and SW2 respectively and are included in Appendix B.

Currently the pre-development Catchments Eastern and Western (E & W) (including the proposed detention basin area), and overland flows from adjacent land to the west and north, discharge stormwater, as sheet flow, across the site to the existing defined gullies which traverses east and west from the site.

The post-development Catchment E will discharge to the same location however the post-development Catchment W will be predominately redirected to the East. This is to enable all flows to be treated at one common point.

Table 4.3-1 Pre and Post Development Catchments

Catchment	Area (ha)
Catchment E (Pre-Development)	10.950
Catchment E (Post-Development)	13.803
Difference	2.853
Catchment	Area (ha)
Catchment W (Pre Development)	3.002
Catchment W (Post Development)	0.149
Difference	-2.853

4.3.2 Lawful Point of Discharge

Both Council's Planning Policy and QUDM dictate that all developments must have a lawful point of discharge. The intended lawful point of discharge for the post development Catchment E is to the existing natural gully that flows in an easterly direction. Catchment W will be reduced significantly to approximately 5% of the original area. We would expect that the post-development peak flow from the relatively small road catchment (approximately 1,500m^2) would be no greater than the pre-developed flow equivalent. A flow spreader is proposed along the western boundary road reserve to avoid any flow concentration that may occur from the kerb outfall. We therefore expect that this addresses the lawful point of discharge for catchment W from a stormwater quantity perspective and the remainder of the stormwater quantity analysis will only focus on Catchment E.

4.3.3 Pre-Development Peak Stormwater Flows

Rainfall intensities used in the stormwater calculations have been taken from the Local Council IFD tables, for reference these have been included in Appendix D. The 1hr rainfall intensity for a 10yr ARI ($^1I_{10}$) for this site is 67mm/hr.

By reviewing aerial photography and from a site visit, the existing pre-developed condition can be generally categorised as undeveloped, with very little built form and extensive vegetation covering the site. Grass covers the majority of the site especially in the current flow paths which are being defined by animal routes. The exception is in the highly vegetated zone along the eastern boundary where leaf litter is more prevalent.

Utilising the above information the percentage of existing impervious area was established for the sites catchment, from this the site's pre-development f_i and C_{10} values have been calculated from QUDM Table 4.5.4. assuming **medium** soil permeability and **medium density** bush. Refer Table 4.3-1 4.2-2 below.

Table 4.3-1 Catchment Pre-development Controls

Catchment	Development Category	Fraction Impervious (f_i)	Coefficient of Discharge (C_{10})
Catchment E	Undeveloped	0.00	0.66

The coefficient of runoff (C_y) for the various ARI events has been evaluated using the frequency factor and C_{10} values calculated above.

QUDM Section 4 has been used to calculate the time of concentration (t_c) for the pre-development Catchment E. Due to the undeveloped nature of the site the time of concentration will be made up of a combination of overland sheet flow and channel flow.

Overland Flow has been initially calculated using the Friend's equation:

Figure 4.3-1 Friend's Equation (Section 4.6.6 QUDM)

Friend's equation:

$$t = (107n\,L^{0.333})/S^{0.2} \qquad (4.5)$$

where:

t = overland sheet flow travel time (min)
L = overland sheet flow path length (m)
n = Horton's surface roughness factor
S = slope of surface (%)

Using Friends Equation with an average natural slope of 2.5% for the initial flow path the recommended assumed maximum flow length is between 100-200m. We have adopted 150m and based on the above equation and using the following values, t_c for the overland component has been calculated as a total of **23.7 mins** as shown in the calculation tables below:

Upper grassed ridge (flat) progressing to rolling hill :

n	0.045	horton
L	150	m
S	2.5	%
tc	**21.3**	min

Concentrated channel flow occurs from this point. QUDM Figure 4.8 has been used to calculate channel flow time. Based on the values below the t_c for the concentrated channel component has been calculated as 2.4min:

L	60m
Fall	1.7m
t	0.8min
delta	3
tc	**2.4min**

Therefore the total time of concentration for Catchment E has been calculated as **23.7** mins.

Utilising the Rational Method calculation outined in QUDM, the pre-development Peak Stormwater Flows for Catchment E have been provided in Table below.

Table 4.3-3 Catchment 'E' Pre-development Peak Stormwater Flows

ARI (yr) (AEP - %)	Runoff Coefficient (C_y)	Catchment Area (ha)	Rainfall Intensity (mm/hr)	Peak Stormwater Flow (m^3/s)
1 (63%)	0.528	10.950	60	0.964
2 (39%)	0.561	10.950	77	1.314
5 (18%)	0.627	10.950	97	1.850
10 (10%)	0.660	10.950	108	2.168
20 (5%)	0.693	10.950	124	2.614
50 (2%)	0.759	10.950	145	3.348
100 (1%)	0.792	10.950	160	3.854

4.3.4 Post-development Peak Stormwater Flows

In accordance with Council's design standards, the proposed development is categorised as Industrial.

Catchment E

QUDM Section 4 has been used to calculate the time of concentration (t_c) for the post-development Catchment E. Based on the proposed development type, the time of concentration will be a combination of the standard inlet time and pipe flow time.

Based on Council's guidelines and QUDM Section 4.06.4, the t_c inlet has been established as t_c = 5 mins. Using QUDM guidelines the t_c in the pipe has been established as t_c = 3.6 mins based on an average flow velocity of 1.5m/s based on the fact that the road and associated drainage will be relatively flat and this should restrict pipe and kerb velocities.

Based on the above, the post-development total time of concentration for Catchment E has been calculated as **8.6 mins**.

Utilising the Rational Method calculation outined in QUDM, the post-development Peak Stormwater Flows for Catchment B have been provided in Table 4.3-4 below.

Table 4.3-4 Catchment 'E' Un-detained Post-Development Peak Stormwater Flows

ARI (yr) (AEP - %)	Runoff Coefficient (C_y)	Catchment Area (ha)	Rainfall Intensity (mm/hr)	Peak Stormwater Flow (m^3/s)
1	0.704	13.803	97	2.618
2	0.748	13.803	123	3.528
5	0.836	13.803	153	4.904

10	0.880	13.803	171	5.770
20	0.924	13.803	195	6.908
50	1.000	13.803	226	8.665
100	1.000	13.803	251	9.624

To ensure a non-worsening discharge is achieved from the post-development catchment, a detention basin is required to mitigate peak stormwater flows from the site prior to discharging to the neighbouring property to the east.

4.4 Flow to be detained

Based on the results shown in Table 4.3-3 and Table 4.3-4 above, the increase of runoff from Catchment B for each ARI event is shown below.

Table 4.4-1 Peak Flows - Pre-development (Catchment E) and Post-development (Catchment E)

ARI (yr) (AEP - %)	Pre-development Flow (m^3/s)	Un-detained Post Development Flow (m^3/s)	Flow Increase (m^3/s)	Percentage Increase (%)
1 (63%)	0.964	2.618	1.655	171.7%
2 (39%)	1.314	3.528	2.214	168.5%
5 (18%)	1.850	4.904	3.054	165.1%
10 (10%)	2.168	5.770	3.602	166.1%
20 (5%)	2.614	6.908	4.295	164.3%
50 (2%)	3.348	8.665	5.318	158.9%
100 (1%)	3.854	9.624	5.769	149.7%

To calculate the detention storage volumes required and to ensure a non-worsening post development result is achieved, a dynamic analysis using Watershed Bounded Network Model (WBNM) was undertaken. The Eastern catchment was split into 4 sub-catchments (labelled SUB1-4) plus an area for detention basin storage (labelled DET_BAS). The detention basin is modelled as an outlet structure on DET_BAS. WBNM requires a sub-catchment downstream of an outlet structure to function, hence a small" catchment labelled "Dummy" has been included simply to run the analysis. Storm duration times of 10, 15, 20, 25, 30, 60 & 90mins were run to ensure the critical storm events were obtained.

Generally the 25min storm produced the peak inflow into the detention basin with the exception of the 50 and 100yr ARI events that had peaks for both the 15 and 25min storm durations.

4.4.1 Flow Calibration – Post Development

In accordance with QUDM Section 4.1.4, un-detained post development flows were calibrated against the peak discharges derived using the Rational Method.

Tabl below provides the settings used for calibrating the flows.

Table 4.4-2 Calibration Settings

ARI (yr) (AEP - %)	Lag Parameters		Flowpaths	Rainfall Losses Continuing Loss Rate		
	C	Imp Lag	R	Pervious IL mm	CLR mm/hr	Imp IL and continuing loss
1 (63%)	0.8	0.45	0.3	5	1	0
2 (39%)	0.8	0.40	0.3	5	1	0
5 (18%)	0.8	0.32	0.3	5	1	0
10 (10%)	0.8	0.28	0.3	5	1	0
20 (5%)	0.8	0.24	0.3	5	1	0
50 (2%)	0.8	0.11	0.3	0	0	0
100 (1%)	0.8	0.11	0.3	0	0	0

These parameters reflect the expected values for a relatively small catchment that is highly urbanised with little pervious area.

4.4.2 Detention Basin Results

The calculated peak inflows and outflows for the 1yr ARI to 100yr ARI events for a range of critical durations (10, 15, 20, 25, 30, 60 & 90mins) are provided in Table 4.4-3 below.

Table 4.4-1 Detention Basin Results from WBNM

Outlet Structure modelled as a detention basin								Rational Method Peaks	Change from Rational to WBNM
1 Yr ARI	**10**	**15**	**20**	**25**	**30**	**60**	**90**		
Inflow Peak (m3/s)	2.00	2.27	2.45	**2.63**	2.50	2.47	2.04	2.62	0%
Outflow Peak (m3/s)	0.50	0.59	0.67	0.74	0.78	**0.94**	0.91	0.96	-2%
Inflow Volume (m3)	1954	2467	2880	3229	3531	4854	5455		
Max Vol. Stored (m3)	1273	1599	1862	2063	2198	**2672**	2582		
Max Water Elevation (m)	30.405	30.484	30.548	30.597	30.623	**30.713**	30.696		
2 Yr ARI	**10**	**15**	**20**	**25**	**30**	**60**	**90**		
Inflow Peak (m3/s)	2.72	3.10	3.29	**3.55**	3.37	3.26	2.66	3.53	1%
Outflow Peak (m3/s)	0.62	0.75	0.86	0.95	1.01	**1.21**	1.17	1.31	-8%
Inflow Volume (m3)	2504	3153	3674	4114	4494	6155	6931		
Max Vol. Stored (m3)	1677	2109	2444	2698	2862	**3432**	3316		
Max Water Elevation (m)	30.503	30.606	30.67	30.718	30.749	**30.852**	30.832		
5 Yr ARI	**10**	**15**	**20**	**25**	**30**	**60**	**90**		
Inflow Peak (m3/s)	3.80	4.33	4.48	**4.91**	4.65	4.44	3.56	4.90	0%
Outflow Peak (m3/s)	0.79	0.98	1.13	1.25	1.32	**1.59**	1.53	1.85	-14%
Inflow Volume (m3)	3147	3969	4630	5191	5677	7807	8829		
Max Vol. Stored (m3)	2216	2780	3216	3532	3724	**4411**	4259		
Max Water Elevation (m)	30.626	30.733	30.814	30.869	30.902	**31.02**	30.995		
10 Yr ARI	**10**	**15**	**20**	**25**	**30**	**60**	**90**		
Inflow Peak (m3/s)	4.49	5.18	5.22	**5.77**	5.46	5.18	4.12	5.77	0%
Outflow Peak (m3/s)	0.90	1.12	1.31	1.44	1.52	**1.82**	1.75	2.17	-16%
Inflow Volume (m3)	3526	4451	5197	5829	6379	8793	9963		
Max Vol. Stored (m3)	2546	3192	3682	4031	4232	**4990**	4817		
Max Water Elevation (m)	30.689	30.81	30.895	30.956	30.991	**31.113**	31.086		
20 Yr ARI	**10**	**15**	**20**	**25**	**30**	**60**	**90**		
Inflow Peak (m3/s)	5.43	6.33	6.28	**6.93**	6.55	6.19	4.89	6.91	0%
Outflow Peak (m3/s)	1.05	1.33	1.55	1.71	1.79	**2.27**	2.10	3.83	-41%
Inflow Volume (m3)	4045	5109	5969	6698	7332	10128	11492		
Max Vol. Stored (m3)	2998	3746	4312	4700	4908	**5714**	5544		
Max Water Elevation (m)	30.774	30.906	31.004	31.067	31.1	**31.228**	31.202		
50 Yr ARI	**10**	**15**	**20**	**25**	**30**	**60**	**90**		
Inflow Peak (m3/s)	7.45	**8.65**	8.41	8.63	8.19	7.76	5.87	8.67	0%
Outflow Peak (m3/s)	1.37	1.71	1.99	2.21	2.36	**3.09**	2.72	4.88	-37%
Inflow Volume (m3)	4771	6020	7033	7892	8641	11951	13582		
Max Vol. Stored (m3)	3838	4716	5351	5661	5809	**6441**	6192		
Max Water Elevation (m)	30.922	31.069	31.171	31.22	31.242	**31.336**	31.299		
100 Yr ARI	**10**	**15**	**20**	**25**	**30**	**60**	**90**		
Inflow Peak (m3/s)	8.29	**9.64**	9.38	9.62	9.13	8.68	6.57	9.62	0%
Outflow Peak (m3/s)	1.53	1.93	2.44	2.71	2.88	**3.79**	3.46	3.85	-2%
Inflow Volume (m3)	5302	6695	7826	8786	9623	13330	15164		
Max Vol. Stored (m3)	4267	5242	5902	6180	6300	**6906**	6693		
Max Water Elevation (m)	30.997	31.154	31.256	31.297	31.315	**31.406**	31.374		

Top of basin bank RL 31.5
Freeboard to top of basin bank: 94 mm

It can be seen from the % change column that the outflow's have been mitigated in proportion back to pre-development flows.

The calculated inflow and outflow hydrographs for the 1, 2, 5, 10, 20, 50 and 100yr ARI critical duration events can be seen in the Figures below:

Figure 4.4-1 Post-development Peak Inflow / Outflow Hydrograph, 1yr ARI, Critical Durations

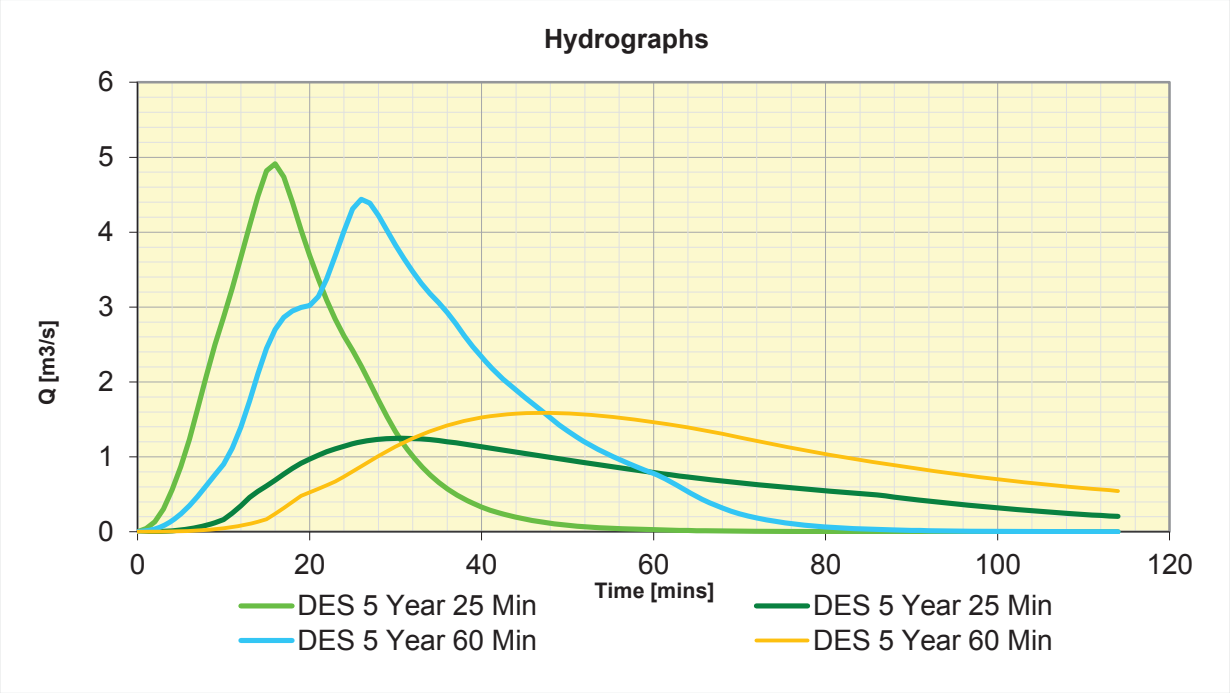


Figure 4.4-2 Post-development Peak Inflow / Outflow Hydrograph, 2yr ARI, Critical Durations

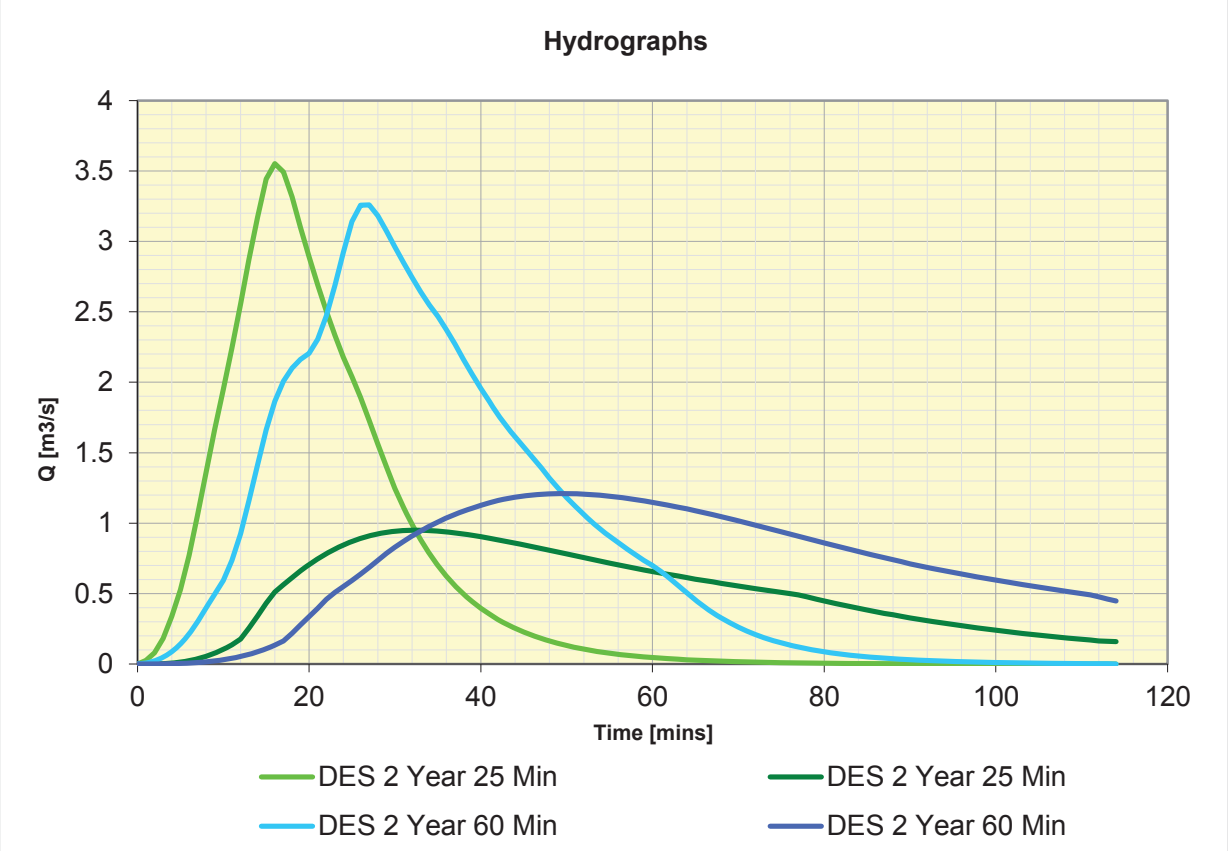


Figure 4.4-3 Post-development Peak Inflow / Outflow Hydrograph, 5yr ARI, Critical Durations

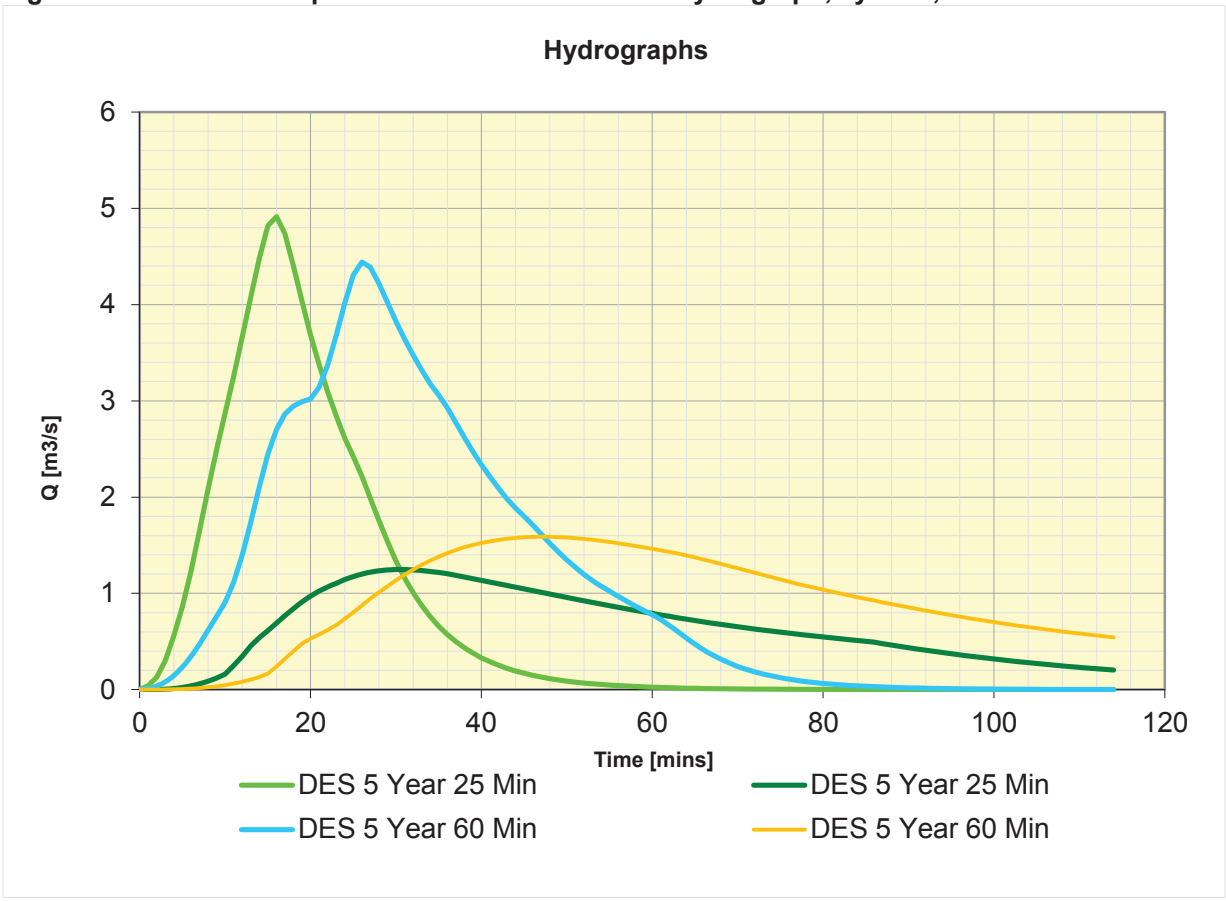


Figure 4.4-4 Post-development Peak Inflow / Outflow Hydrograph, 10yr ARI, Critical Durations

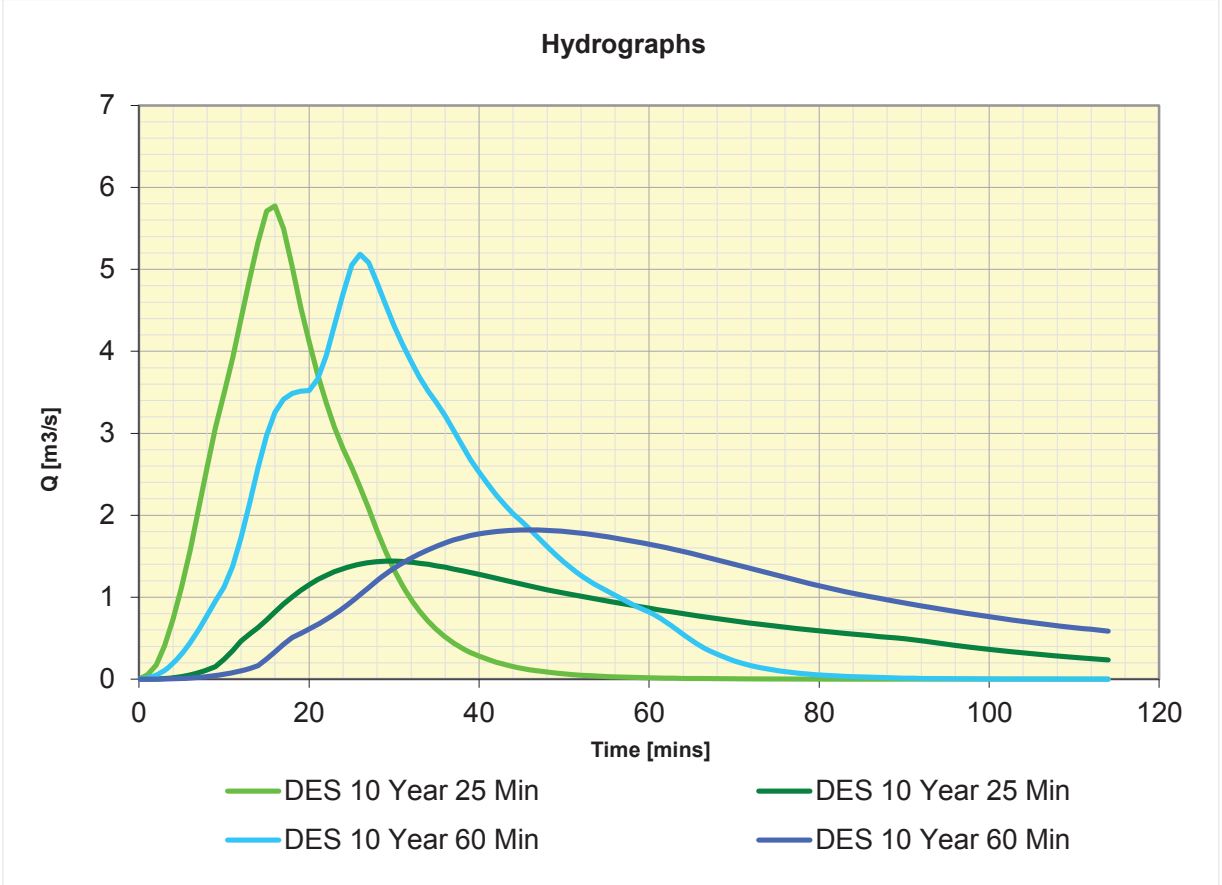


Figure 4.4-5 Post-development Peak Inflow / Outflow Hydrograph, 20yr ARI, Critical Durations

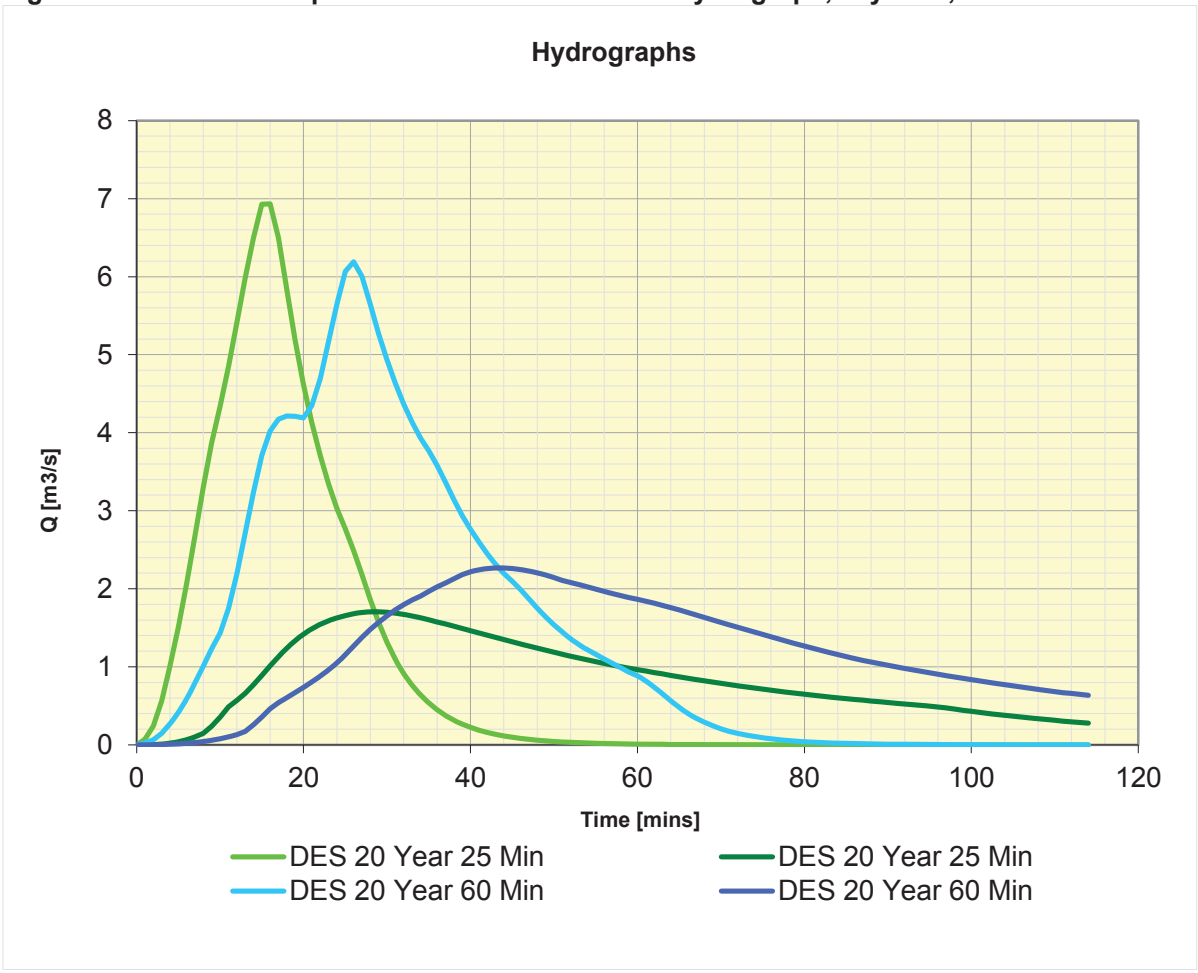


Figure 4.4-6 Post-development Peak Inflow / Outflow Hydrograph, 50yr ARI, Critical Durations

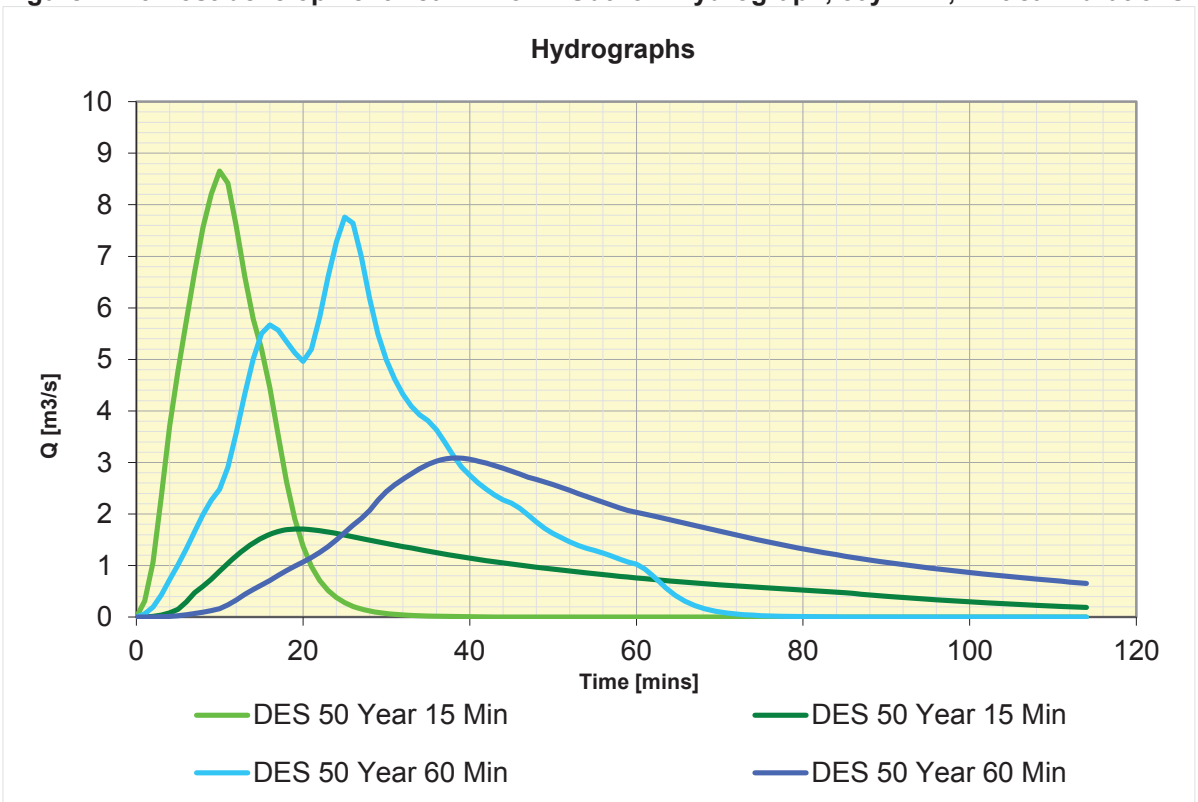
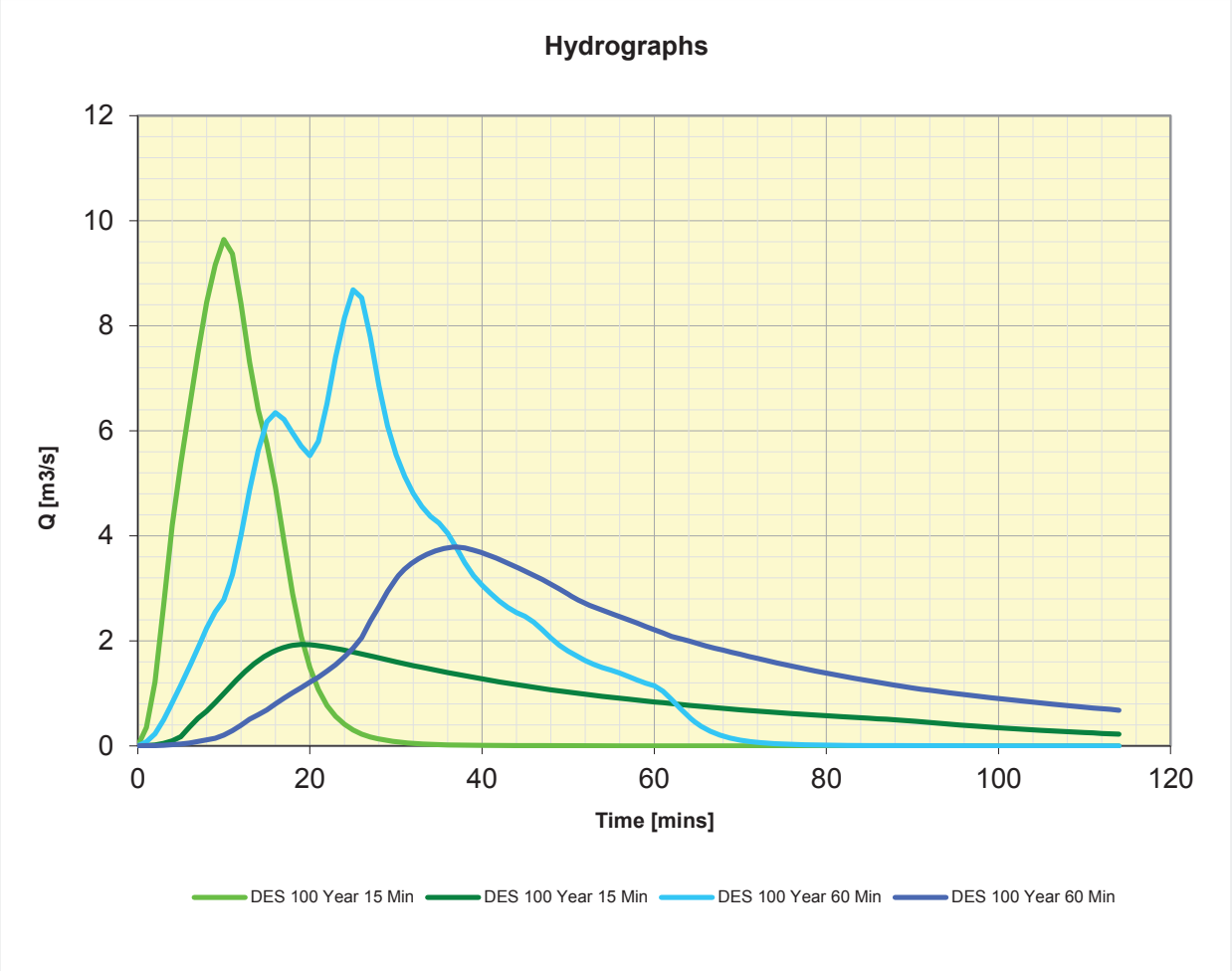


Figure 4.4-7 Post-development Peak Inflow / Outflow Hydrograph, 100yr ARI, Critical Durations



The outflow arrangement from the basin is 4/375mm dia pipes at RL30, 2/600mm dia pipes at RL30.55 and a 3-stage weir from RL31.15 to RL31.3 with a total width of 8m. Refer Drg CD14-053 – SW4 located in Appendix B. As discussed in previous sections of this report, the final details of the outlet configuration will need to be addressed at during detail design as part of the Operational Works. During the detailed design additional flows received from external catchments will influence basin inlet and outlet configurations, though not the basin height-storage relationship as these flows are not required to be mitigated.

This outflow arrangement and detention basin for Catchment E has been modelled with a Storage Volume vs Height Profile, shown Table 4.4-2 below.

Table 4.4-2 Basin Elevation vs Area

Elevation (m)	Area (m^2)
30	0
30.2	656
30.4	1296
30.6	2132
30.8	3193
31	4344
31.2	5584
31.4	6918
31.5	7621

* Depth of water excludes initial 300mm allowance for bio-detention, refer Section 6.

The proposed stormwater detention device to be used will be a landscaped basin, incorporating an end of line proprietary sediment forebay and bio-retention measures in the base. The location of the basin will be at the lowest point of the catchment to allow all flows to be treated by the device. Details of this device can be seen on the concept plans located in Appendix B.

4.5 Freeboard and Safety

The level of the proposed bund is RL31.5m resulting in a freeboard of approximately 94mm to the highest predicted water level (RL31.406) within the detention basin. In order to achieve minimum freeboard requirements within adjoining lots, the following levels are proposed:

- Minimum ground level within lot – RL 31.7m;
- Minimum road level – RL 31.7m;
- Top of retaining wall along eastern edge of basin RL 31.7m; and
- Minimum Floor Level – RL 31.9m.

The internal basin sides are proposed to be 1 in 4 to eliminate steps etc. in accordance with QUDM 2013 section 5.11. The external eastern side is designed with a 1m wide berm against a retaining wall to minimise impact on the existing vegetation. We would recommend a control fence around the perimeter of the basin to aid safety with a minimum of a fence along the top of this wall. Final Basin safety requirements to be confirmed at the detail design phase for Operational Works.

The results presented in this report demonstrate the proposed detention device sufficiently accommodates the catchment's runoff, and ensures a non-worsening post-development stormwater discharge is achieved.

5. Stormwater Quality Management

5.1 Stormwater Management Strategy

The Stormwater Management Strategy for the site has considered a wide variety of water sensitive urban design practices incorporated into a conventional drainage network as end of pipe solutions. This allows for a cost effective management strategy that minimises maintenance in comparison with streetscape devices whilst achieving the stormwater quality objectives outlined in Table 5.2-1.

The key treatment methodology employed for the development area is noted in the following section.

5.1.1 Bio Retention Basin

The Bio-retention basin has been selected to treat the development area, and it is proposed to provide two basins one collecting the northern Catchment A and the other collecting the southern Catchment B. The basins will be located on either side of the detention basin along the new internal road.

The basins have been designed taking the existing and developed topography into consideration.

In particular, for both Basins A & B:

- The underdrainage's outlet pipe's invert level will discharge at the existing ground level.
- An overflow weir between the bio-basin and detention basin will be designed during detailed design.

The bio retention basin acts to treat stormwater by accepting stormwater flows into a shallow planted depression where water ponds above a sandy-loam filter media. This maximises the volume of runoff that passes through the filter media. Water then percolates through the filter media at an infiltration rate of approximately 200mm per hour and out through an underdrainage system where water is discharged into the receiving drainage system or waterway.

The treatment system operates by firstly filtering surface flows through surface vegetation and then percolating runoff through prescribed filtration media that provides treatment through fine filtration, extended detention and some biological uptake. They also provide flow retardation for smaller events and are particularly efficient in removing nutrients.

5.2 MUSIC Model Development

The pollutant export loads from the catchment and treatment train effectiveness were assessed using the Cooperative Research Centre for Catchment Hydrology's (CRCCH) Model for Urban Stormwater Improvement Conceptualisation (MUSIC). MUSIC is a decision support tool, used to plan and design appropriate urban stormwater management systems at the conceptual level. MUSIC Version 6.1 (Build 0.767) was used in this assessment. Model parameters including rainfall runoff and pollutant export parameters were adopted based on the recommendations from the Water by Design 'MUSIC Modelling Guidelines for South East Queensland'.

5.2.1 Water Quality Objectives

State Planning Policy (SPP) 4/10 and the Urban Stormwater Quality Planning Guidelines 2010 (DERM 2010) provide the development criteria intended to ensure development is carried out in a way that will achieve the relevant water quality objectives of Logan City Council's Stormwater Quality and Flow Management Guidelines, July 2013. This policy outlines best practice stormwater quality management to protect the environmental values of receiving waters.

The SPP 4/10 guidelines references the Urban Stormwater Quality Planning Guidelines 2010 (DERM, 2010) to provide details of the required management of the site. These guidelines identify pollutant load reductions for urban stormwater. Load based objectives compare loads produced by an unmitigated catchment to the loads coming from the developed catchment where Water Sensitive Urban Design has been implemented.

The percentage removal efficiency or the 'treatment train effectiveness' required to be achieved is outlined in Table 5.2-1 below.

Table 5.2-1 Adopted Stormwater Quality Objectives

Pollutant Type	Objective	Urban Stormwater Quality Planning Guidelines 2010
Total Suspended Solids	Reduction in average annual load of pollutants leaving the developed unmitigated scenario compared to the developed mitigated scenario	80%
Total Phosphorous	Reduction in average annual load of pollutants leaving the developed scenario compared to the developed mitigated scenario	60%
Total Nitrogen	Reduction in average annual load of pollutants leaving the developed unmitigated scenario compared to the developed mitigated scenario	45%
Gross Pollutant	Reduction in average annual load of pollutants leaving the developed unmitigated scenario compared to the developed mitigated scenario	90%

5.2.2 Music Model Parameters

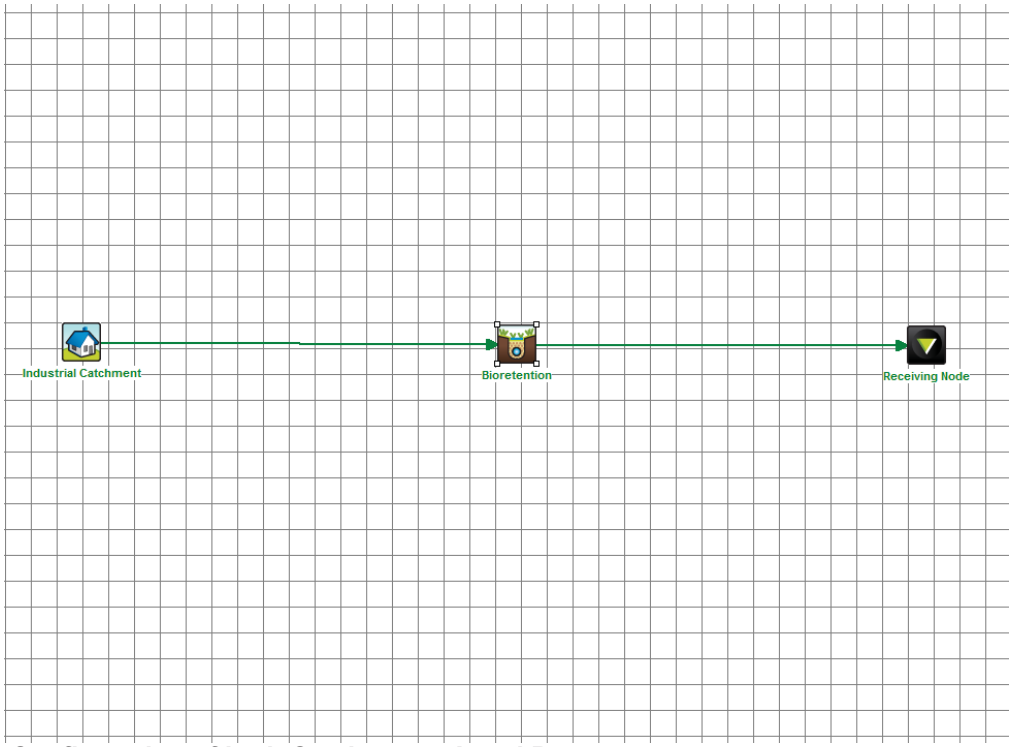
Parameters used within MUSIC have been sourced from the Water by Design MUSIC Modelling Guidelines for South East Queensland.

5.2.3 Climate Data

Climate data for the catchment was sourced from the Bureau of Meteorology (BOM). Rainfall data was obtained from the Glenlogan Station (040454) for the 11 years between 1971 and 1982 at six (6) minute intervals.

5.2.4 Catchment Properties

Catchment areas are based on the proposed industrial development's layout as shown in Appendix B. Rainfall-runoff and pollutant export parameters were adopted from the recommended values found in Water by Design "MUSIC Modelling Guidelines, Version 1.0 – 2010 - Tables 3.7 & 3.9 for Industrial land use. Table 5.2-2 to 5.2-4 provide a summary of the MUSIC Model parameters adopted for the catchment.



Configuration of both Catchments A and B

Table 5.2-2 MUSIC Catchment Parameters

Catchment Label	Area (ha)	Impervious Area (%)	MUSIC Land Use
A	7.737 (North)	90	Industrial
B	5.264 (South)	90	Industrial

Table 5.2-3 Rainfall-runoff parameters

(ex. Table 3.7 MUSIC Modelling Guidelines, Version 1.0 – 2010)

Parameter	Urban Residential
Rainfall Threshold (mm)	1
Soil storage capacity (mm)	18
Initial Storage (% capacity)	10
Field Capacity (mm)	80
Infiltration capacity – coefficient a	243
Infiltration capacity – coefficient b	0.60
Initial depth (mm)	50
Daily recharge rate (%)	0
Daily base-flow rate (%)	31
Daily deep seepage rate (%)	0

Table 5.2-4 Pollutant export parameters for both Industrial Catchments

(ex. Table 3.9 MUSIC Modelling Guidelines, Version 1.0 – 2010)

Landuse	Flow Type	TSS $\log^{10}$ values		TP $\log^{10}$ values		TN $\log^{10}$ values	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Urban Residential	Base-flow	0.78	0.45	-1.11	0.48	0.14	0.20
	Storm-flow	1.92	0.44	-0.59	0.36	0.25	0.32

5.2.5 Treatment Node Parameters

Best management practices in WSUD were considered in the adoption of the 'end of line controls' at the outlet of the catchment. A bio-retention system was selected to treat the stormwater.

The bio-retention basin was chosen due to their high pollutant removal efficiency and providing a positive visual amenity to the estate.

A plan showing the location and size of the proposed bio-retention basin is provided in Appendix B.

The proposed bio-retention basins will have the following MUSIC modelling properties:

Figure 5.2-2 Catchment A - Bio-retention Properties for MUSIC Modelling

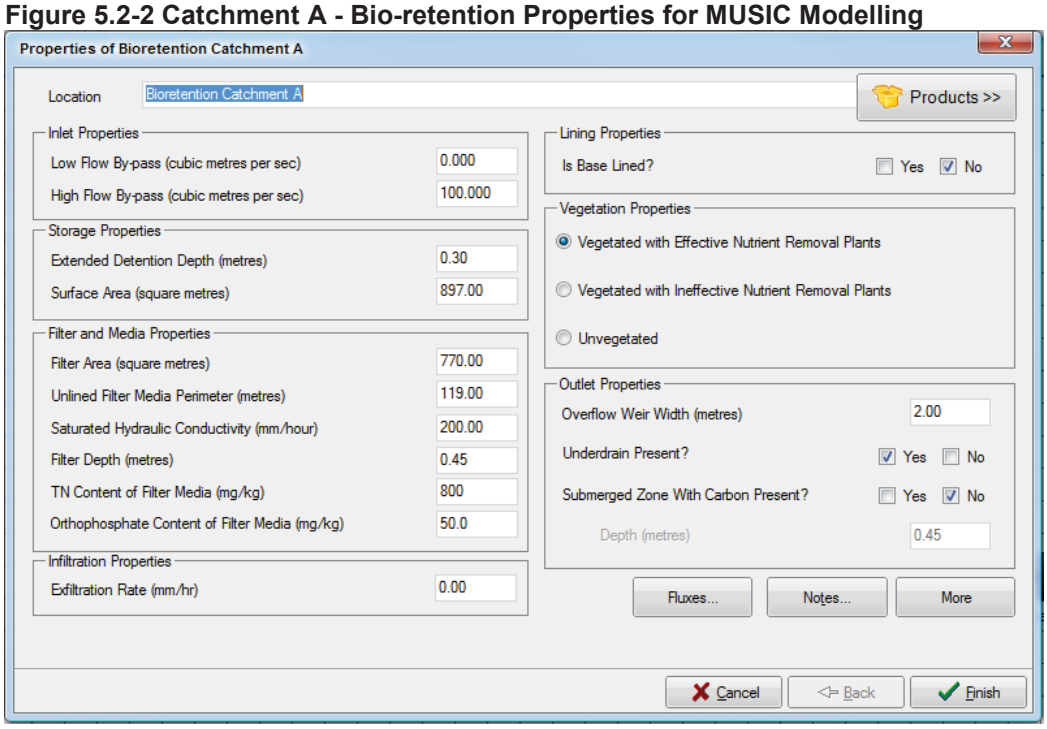
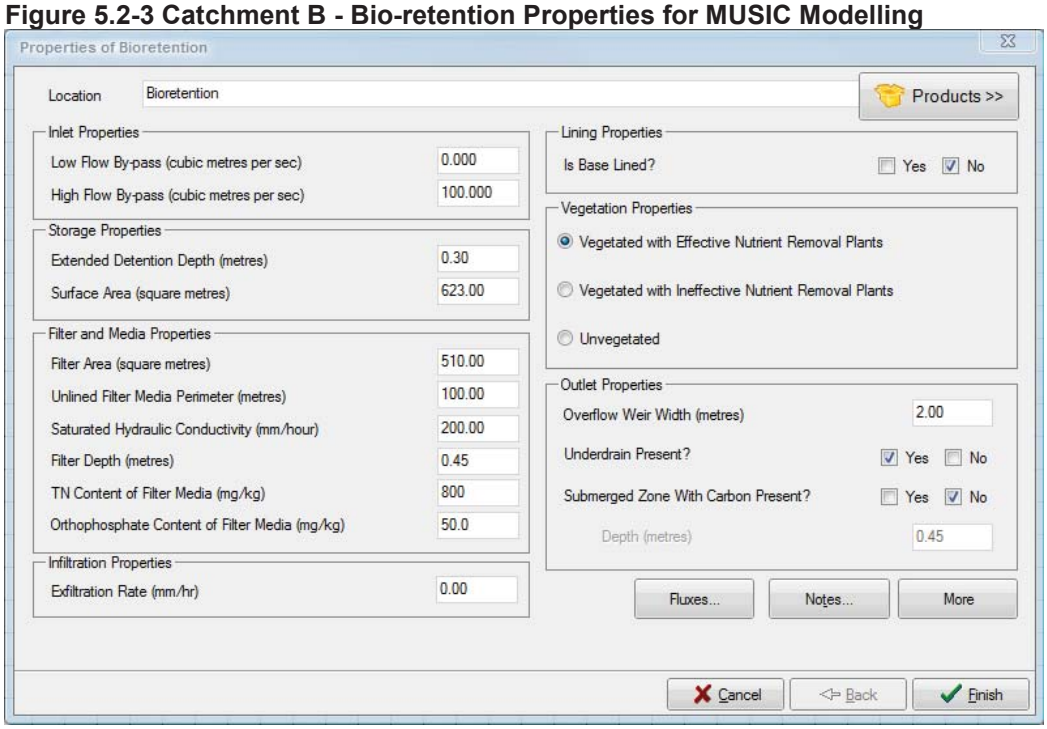


Figure 5.2-3 Catchment B - Bio-retention Properties for MUSIC Modelling



Water Quality Results

The effectiveness of the treatment device proposed in the above section has been modelled using MUSIC with the overall efficiency results shown in Table 5.2.1 and 5.2.2 below.

Table 5.2.1 Catchment A - Water Quality Results (North)

Indicator	Total Site reduction	Target	Target Achieved
Total Suspended Solids (TSS)	83.8%	80%	Yes
Total Phosphorus (TP)	60.9%	60%	Yes
Total Nitrogen (TN)	51.0%	45%	Yes
Total Gross Pollutants (GP)	100.0%	90%	Yes

Table 5.2.2 Catchment B - Water Quality Results (South)

Indicator	Total Site reduction	Target	Target Achieved
Total Suspended Solids (TSS)	84.0%	80%	Yes
Total Phosphorus (TP)	60.1%	60%	Yes
Total Nitrogen (TN)	51.1%	45%	Yes
Total Gross Pollutants (GP)	100.0%	90%	Yes

From the results presented in Table 5.2.1 & 5.2.2 it can be seen that the proposed Treatment Devices mitigate the water quality impacts of the development and meet the required Water Quality Objectives.

Though not required to achieve water quality targets, we propose a concrete sediment forebay be located at the stormwater inlet into the basin. This will further improve sediment capture, ease of maintenance and prolong the design life of the basin (refer Drg. CD14-053-SW5, located in Appendix B).

5.3 Maintenance of Treatment Devices

5.3.1 Maintenance Task and Responsibility

The following maintenance schedules are proposed for the various Stormwater Quality Improvement Devices to ensure they continue to operate as planned.

Stormwater Quality Improvement Device	On Maintenance Period	Off Maintenance Period
Sediment Basin/Forebay	Developer	Local Authority
Bio Retention System	Developer	Local Authority

5.3.2 Sediment Basin/Forebay Maintenance Plan

The following long term maintenance plan is taken from the Healthy Waterways Technical Design Guide for Sediment Basins.

Sediment basins treat runoff by slowing flow velocities and promoting settlement of coarse to medium sized sediments. Maintenance revolves around ensuring erosion protection is operating as designed, monitoring sediment accumulation and ensuring the outlet is not blocked with debris. The outlets from sedimentation basins are to be designed such that access to the outlet does not require a water vessel. Maintenance of the littoral vegetation including watering and weeding is also required, particularly during the plant establishment period (first two years).

Inspections of the inlet configuration following storm events should be made after construction to check for erosion. In addition, regular checks of sediment build up will be required as sediment loads from developing catchments vary significantly. During the operational phase of the basin, the sediment forebay must be cleaned out if more than half full of accumulated sediment.

Similar to other types of WSUD elements, debris removal is an ongoing maintenance requirement. Debris, if not removed, can block inlets and can be unsightly if deposited in a visible location. Inspection and removal of debris should be done regularly and debris removed whenever it is observed on the site.

Typical Maintenance of Sediment Basins will involve:

- Routine inspection of the sediment basin to identify depth of sediment accumulation, damage to vegetation, scouring or litter and debris build up (after first 3 significant storm events and at least every 3 months);
- Routine inspection of inlet and outlet points to identify any areas of scour, litter build up and blockages;
- Removal of litter and debris;
- Removal and management of invasive weeds (both terrestrial and aquatic);
- Periodic (usually every 5 years) draining and de-silting, which will require excavation and dewatering of removed sediment (and disposal to an approved location);
- Regular watering of littoral vegetation during plant establishment;
- Replacement of plants that have died (from any cause) with plants of equivalent size and species as detailed in the planting schedule.

Inspections are also recommended following large storm events to check for scour and damage.

5.3.3 Bio Retention Construction and Establishment

In the context of development sites and associated construction and building works, constructing bio-retention systems and establishing vegetation can be very challenging. As this is the case, bio-retention basins require a careful construction and establishment approach to ensure the basin establishes in accordance with design intent. The following outlines a recommended staged construction and establishment methodology for bio-retention basins as outlined within Healthy Waterways Technical Design Guidelines.

5.3.4 Construction and Establishment

The following is a proposed construction and establishment methodology;

Functional Installation;
Construction of the functional elements of the bio-retention basin at the end of civil works construction and the installation of temporary protective measures; for example, using a temporary arrangement of a suitable geofabric covered with shallow topsoil (e.g. 25mm) and instant turf, in lieu of the final basin planting.

Sediment and Erosion Control;
The temporary protective measures preserve the functional infrastructure of the bio-retention basins whilst providing a temporary erosion and sediment facility through the building phase.

Operational Establishment;
At the completion of the building phase, remove all the temporary protective measures along with accumulated sediment, and install plants in accordance with the design planting schedule.

Weed Control;
Adopting high planting densities and if necessary, applying a suitable biodegradable erosion control matting to the basin's batters will help to combat weed invasion and reduce labour intensive maintenance requirements. A heavy application of seedless hydro-mulch can also provide short term erosion and weed control. No matting or hydro-mulch is to be applied to the surface of the bio-retention basin following the construction phase, as this will hinder filtration of stormwater through the filter media.

5.3.5 Bio Retention Basins Maintenance Plan

Vegetation plays a key role in maintaining the porosity of the filter media of a bio-retention basin and a strong healthy growth of vegetation is critical to its performance. Therefore the most intensive period of maintenance is during the plant establishment period (first two years) when weed removal and replanting may be required.

Inflow systems and overflow pits require careful monitoring, as these can be prone to scour and litter build up. Debris can block inlets or outlets and can be unsightly, particularly in high visibility areas. Inspection and removal of debris should be done regularly, and debris should be removed whenever it is observed on a site.

For larger bio-retention basins, it is essential that a maintenance access point is designed and maintained in the bio-retention basin. The size and complexity of the system will guide its design and may involve provision of a reinforced concrete ramp/pad for truck or machinery access.

Typical Maintenance of Sediment Basins will involve:

- Routine inspection of the bio-retention basin profile to identify any areas of obvious increased sediment deposition, scouring and storm flows, rill erosion of the batters from lateral inflows, damage to the profile from vehicles and clogging of the bio-retention basin (evident by a 'boggy' filter media surface);
- Routine inspection of inflows systems, overflow pits and under-drains to identify and clean any areas of scour, litter build up and blockages;
- Removal of sediment where it is smothering the bio-retention basin's vegetation;
- Where a sediment forebay is adopted, removal of accumulated sediment. The course sediment forebay has been sized on 1 yearly clean out intervals;
- Repairing any damage to the profile resulting from scour, rill erosion or vehicle damage by replacement of appropriate fill (to match onsite soils) and revegetating;
- Tilling of the bio-retention basin surface, or removal of the surface layer, if there is evidence of clogging;
- Regular watering/irrigation of vegetation until plants are established and actively growing;
- Removal and management of invasive weeds (herbicides should not be used);
- Removal of plants that have died and replacement with plants of equivalent size and species as detailed in the plant schedule;
- Pruning to remove dead or diseased vegetation material and to stimulate growth;
- Vegetation pest monitoring and control.

Resetting (i.e. complete reconstruction) of the bio-retention basin will be required if the system fails to drain adequately after tilling of the surface. Maintenance should only occur after a reasonably rain free period when the soil in the bio-retention system is dry.

Inspections are also recommended following large storm events to check for scour and other damage.

6. Conclusion

This Conceptual Site Based Stormwater Management Plan has been prepared for the proposed development of 12 Industrial Allotments, located at 820 Greenbank Road, North Maclean. If the development was to go ahead in an unmitigated scenario, the proposed development would increase stormwater runoff volumes from the site due to the new impervious surfaces. Furthermore, the development would have an effect on water quality runoff from the site. The findings and recommendations of this report will need to be checked and amended as necessary during detailed design.

Stormwater management and treatment devices have been proposed within this report to lessen the impact of the development on the surrounding areas.

This report demonstrates that the proposed devices exceed the required Water Quality Objectives outlined by Logan City Council for Total Suspended Solids, Total Phosphorus, Total Nitrogen and Gross Pollutants. The report also shows that the proposed detention measures ensure a non-worsening effect on the downstream receiving waters in all runoff volumes up to and including the Q100 storm event.

The report has demonstrated that with the implementation of the Detention Basin, no net worsening of peak discharge will occur from the site. The proposed Bio-Retention Basins, proposed to be incorporated into both ends the base of the detention basin, will achieve the desired Water Quality Objectives targets.

DISCLAIMER

This report has been prepared specifically for Anna Properties Pty Ltd in accordance with an agreed scope of works to support their development application to DILGP. This report is not to be used by other third parties unless written permission from Civil Dimensions Pty Ltd is provided. Civil Dimensions Pty Ltd accepts no liability or responsibility whatsoever for the use or reliance of this report by others.

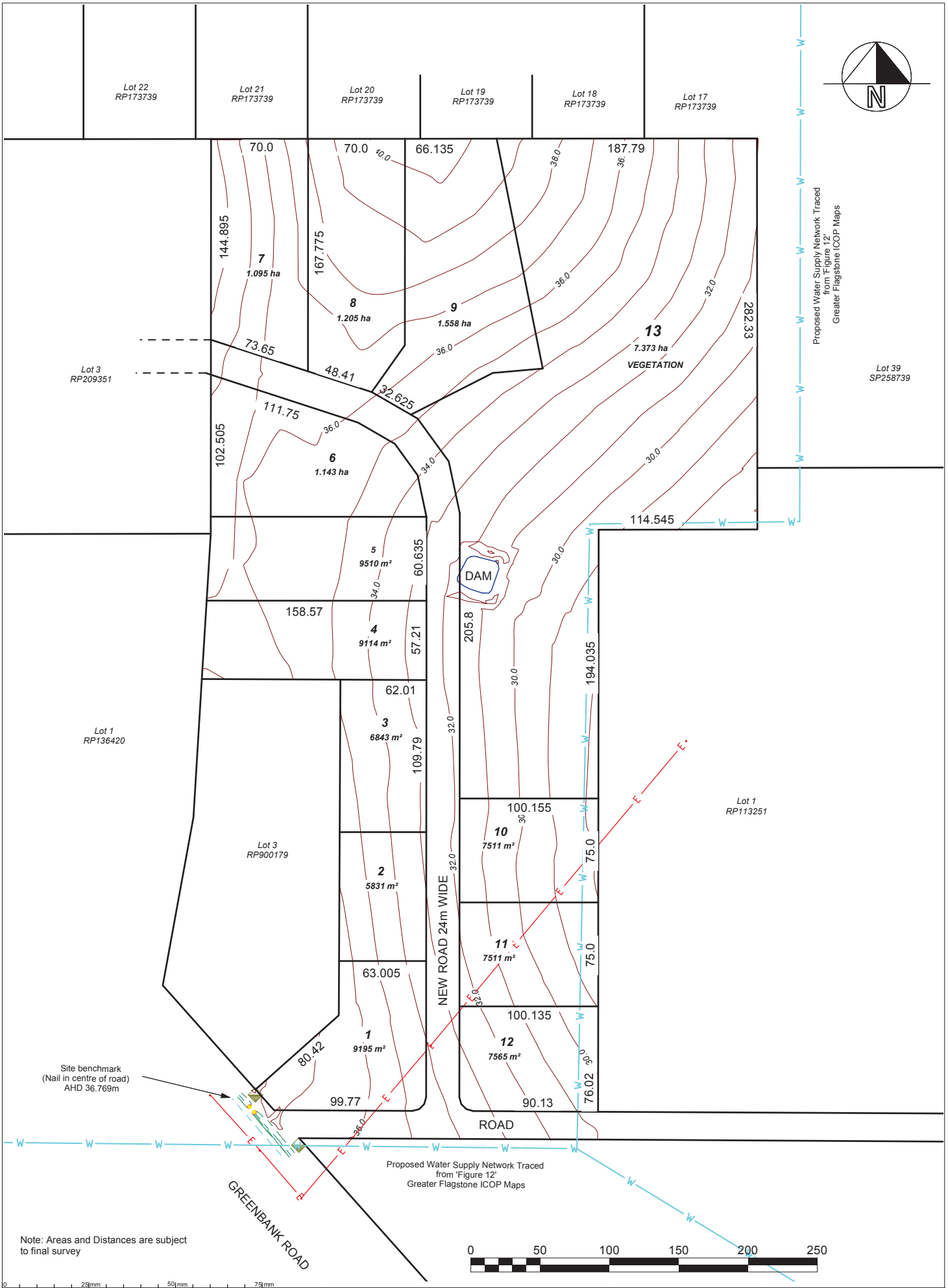
This report has relied on information provided by others and Civil Dimensions Pty Ltd accepts no responsibility whatsoever for the accuracy of this information. This report relies on the assumptions and software modelling described in the report. The accuracy and completeness of these assumptions and modelling should be checked for adequacy and relevance before being used.

7. References

These following references were utilised in the preparation of this report:

- Logan City Council's Planning Scheme Policies
  - Logan Planning Scheme 2015
  - Stormwater Quality and Flow Management Guidelines, July 2013
- South East Queensland Water Partnership 2010, Water by Design, Music Modelling Guidelines Version 1.0 – 2010
- Queensland Urban Drainage Manual, Third edition, 2013 (Department of Energy and Water Supply)
- State Planning Policy, July 2014 (Department of State Development, Infrastructure and Planning)
- Best Practice Erosion and Sediment Control, 2008 (International Erosion Control Association)
- WBNM theory behind Model – June 2012
- WBNM Userguide – June 2012

Appendix A – Proposed Plan of Development



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Horizontal Co-Ord Origin		Level Origin PM28008	Value 27.192m		
Easting	Northing	Surveyed P.V	Date 20-10-2014		
Azimuth RP868726	Field Book TSC3-5	Drawn HC	Date 17-7-2015		

O'REILLY NUNN FAVIER surveyors
Ph. (07) 4162 2647, Fax (07) 4162 5599 Email: onf@sbsurveys.com.au

Client: Anna Property Pty Ltd

Project: PROPOSED SUBDIVISION
LOT 2 ON RP868726
- 820 Greenbank rd, North McLean -

Computer File	Scale (A3)	Job No.	Locality	Drawing Number	Rev	Sheet
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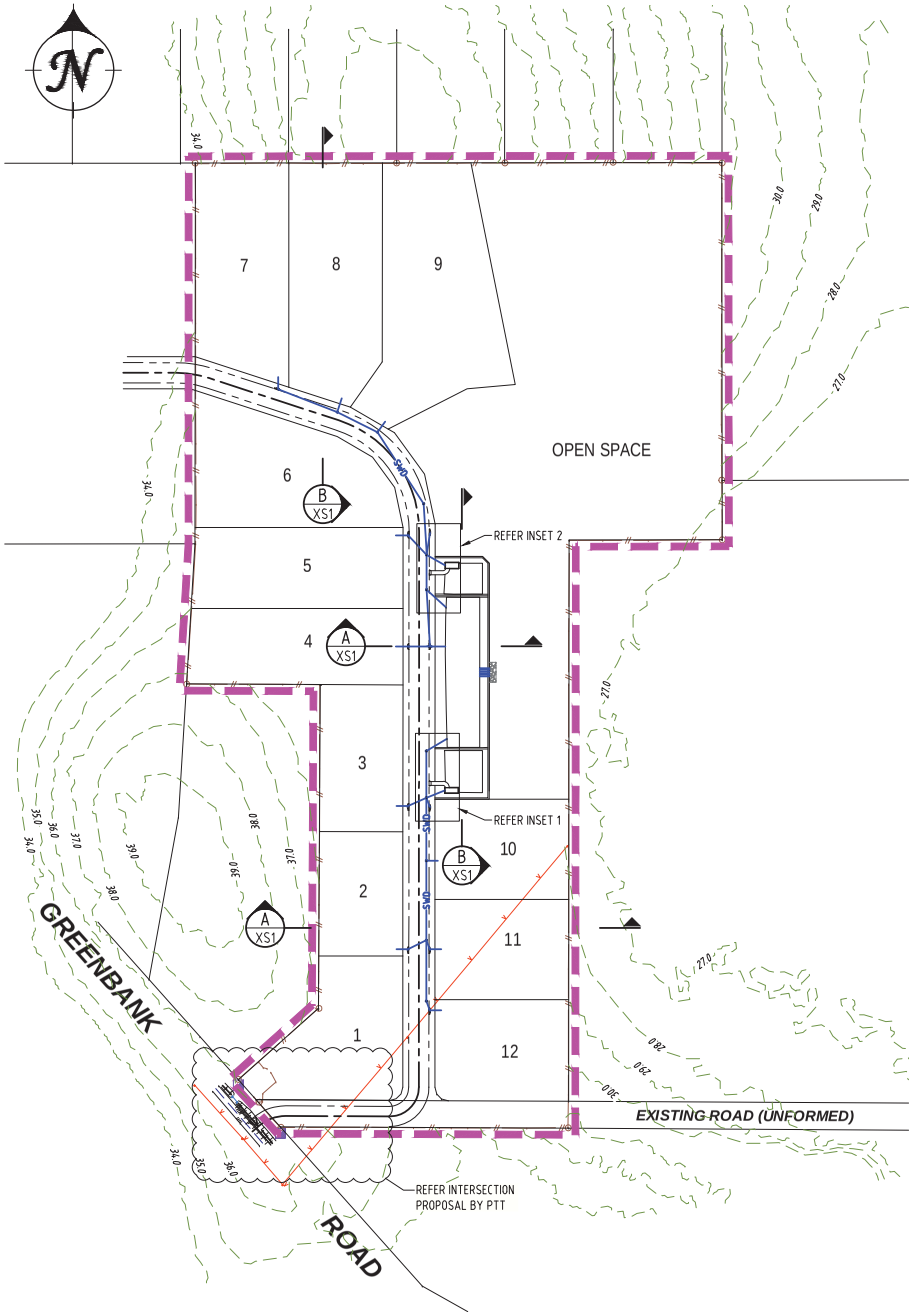
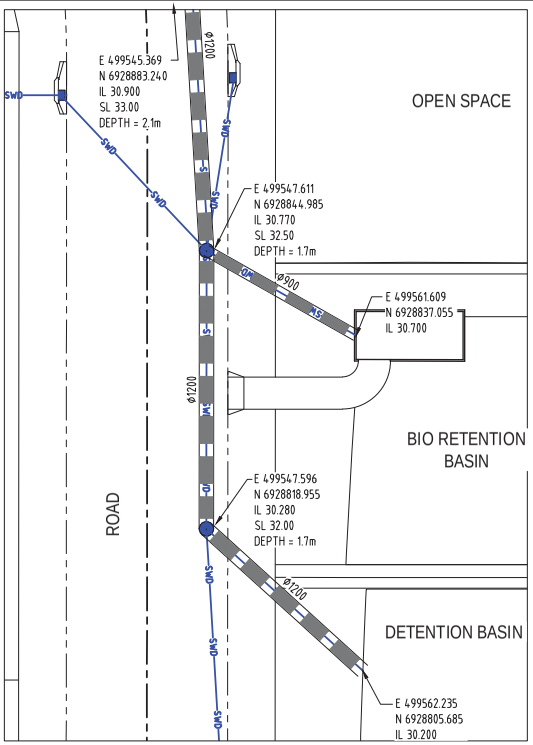
Appendix B – Concept Engineering Plans





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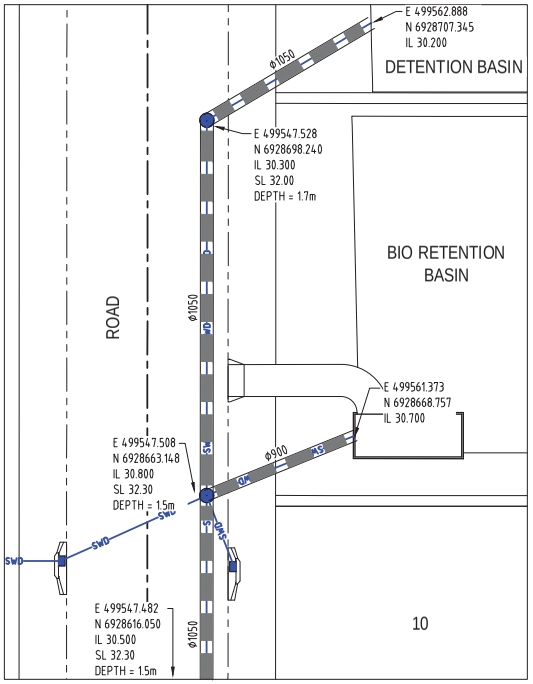

INSET 1 SCALE 1:250 (A1)

DISCLAIMER
THE INFORMATION SHOWN ON THIS DRAWING IS PRELIMINARY IN NATURE AND SUBJECT TO DETAIL DESIGN

LEGEND

Existing
- 31.0 — Surface Contours (1m)

Proposed
- Development Boundary
- 31.0 — Surface Contours (0.5m)
- Kerbing (Nominal)
- Road Centerline
- SWD — Stormwater Drainage (Plan)
- Stormwater Drainage (Inset)

NOT FOR CONSTRUCTION

PROJECT NAME
Industrial Subdivision
820 Greenbank Road, North Maclean
12 Lot Subdivision (20.25 ha)
Lot 2 on RP 868726

CLIENT
Anna Properties Pty Ltd

ASSOCIATED CONSULTANTS

PURPOSE
Preliminary

SCALE (U.N.O.)
0 10 20 30 40 80 120m
1:2000 (A1) 1:4000 (A3)
SCALE

ABN 66 103 198 527
Postal:
Unit 8, 51 Freda St
Upper Mt Gravatt,
Qld 4122
Brisbane:
Tel 3422 2020
Fax 3422 2021
Civil Dimensions Pty Ltd
Consulting Engineers
mail@civildimensions.com.au

DESIGNED	DRAWN	CHECKED
CH	JB	BB

APPROVED RPEQ 6328

FOR AND ON BEHALF OF CIVIL DIMENSIONS PTY LTD

Rev	Amendment Details	Date
	Preliminary Information Only	31/08/15

DRAWING TITLE
Stormwater Layout Plan

PROJECT NUMBER	DRG	REV
CD14-053	SW	-

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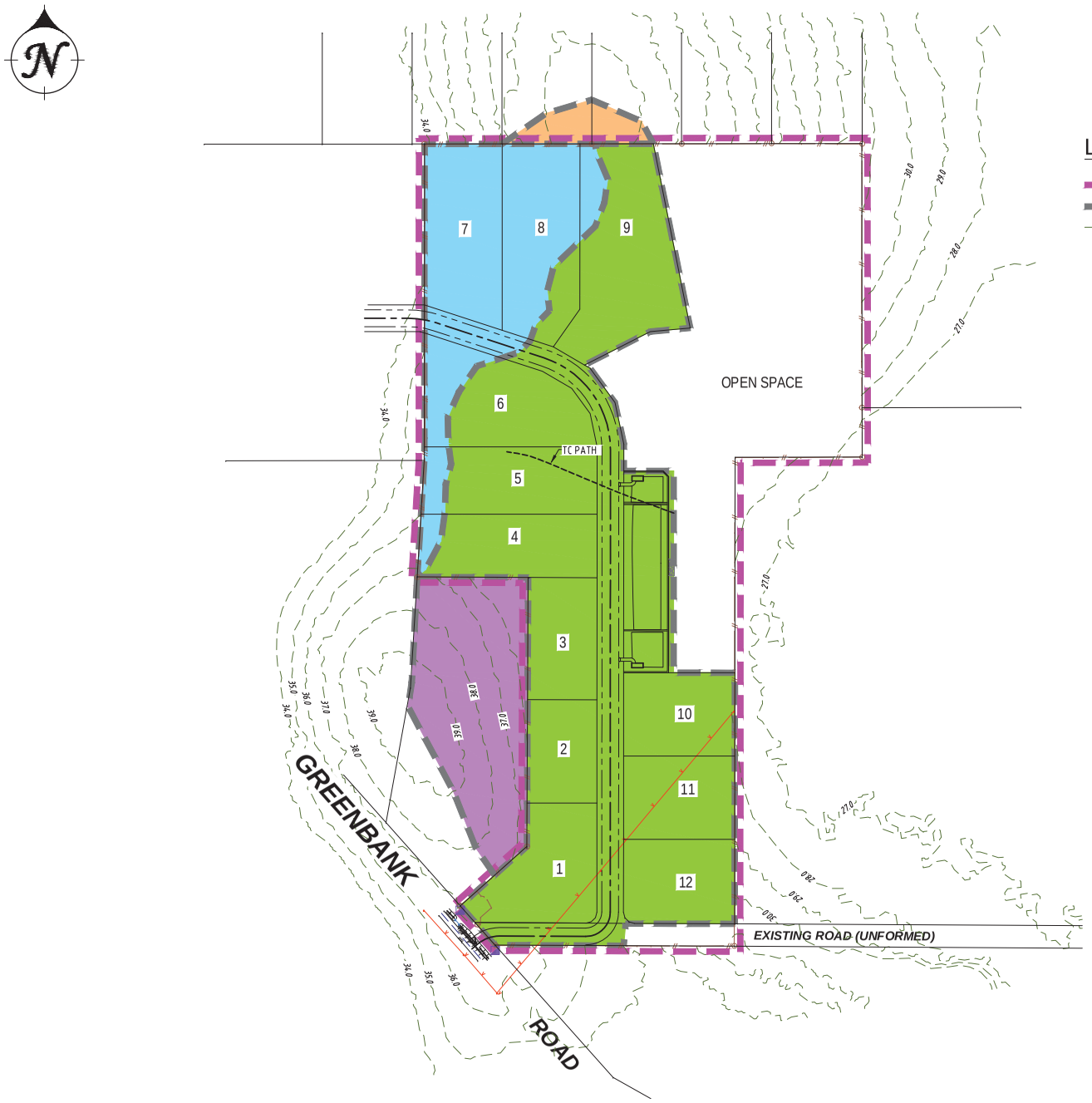

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Industrial Subdivision

820 Greenbank Road, North Maclean

12 Lot Subdivision (20.25 ha)

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Rev	Amendment Details	Date
	Preliminary Information Only	26/08/15

DRAWING TITLE

Pre Development Catchment Plan

PROJECT NUMBER	DRG	REV
CD14-053	SW1	-

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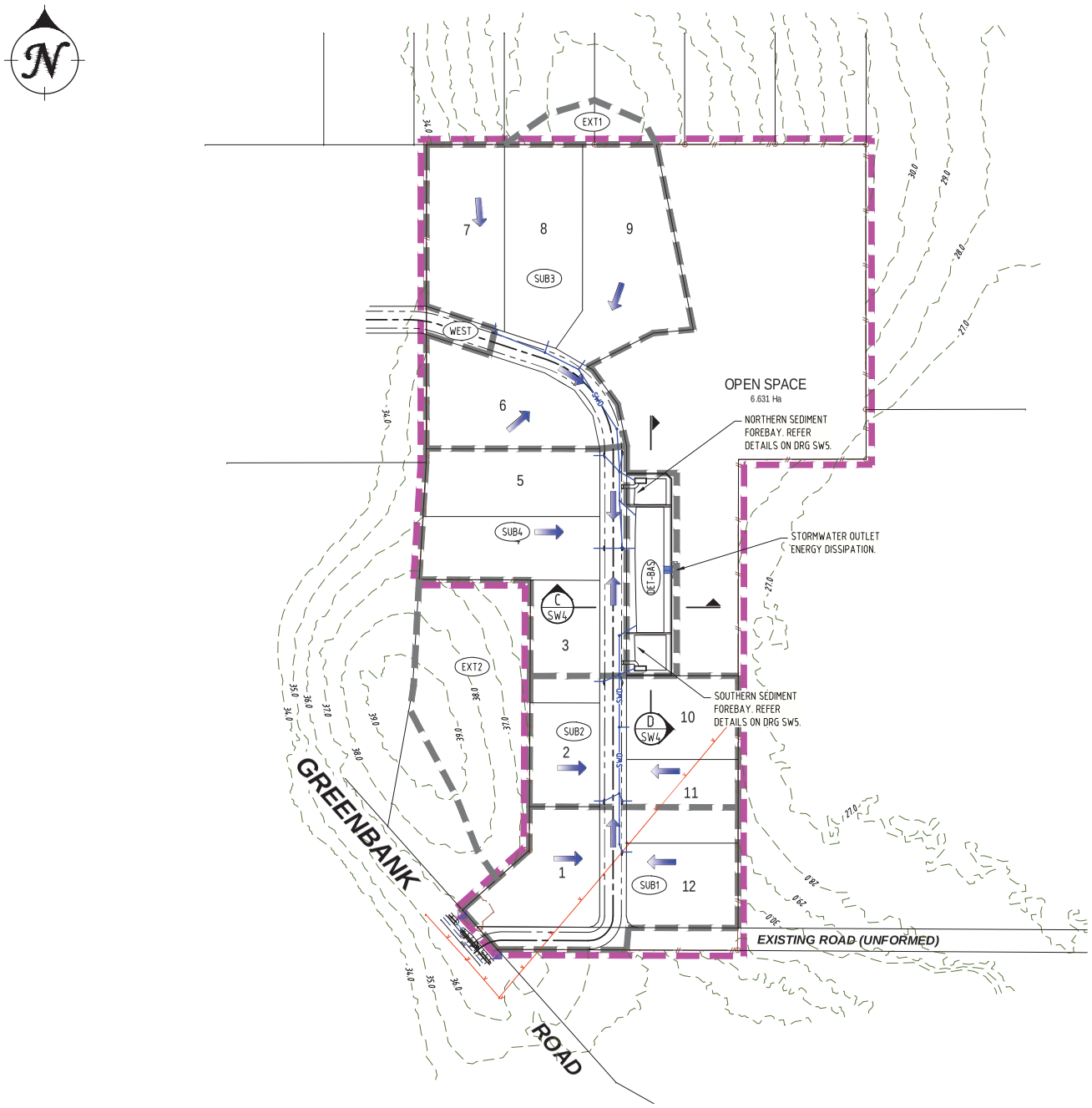

LEGEND

- Development Boundary
- Proposed Catchment Area.
- 31.0 Existing Contours
- Nominal Kerb Line
- SWD Proposed Stormwater Drainage
- Flow Direction

CATCHMENT TABLES

CATCHMENT NAME	CATCHMENT AREA (ha)
SUB1	2.518
SUB2	2.196
SUB3	5.380
SUB4	2.909
DET-BASIN	0.798
TOTAL	13.803

EXTERNAL

CATCHMENT NAME	CATCHMENT AREA (ha)
EXT1	0.3
EXT2	2.2
TOTAL	2.5

WESTERN

CATCHMENT NAME	CATCHMENT AREA (ha)
WEST	0.149

NOT FOR CONSTRUCTION

PROJECT NAME

Industrial Subdivision

820 Greenbank Road, North Maclean

12 Lot Subdivision (20.25 ha)

Lot 2 on RP 868726

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ASSOCIATED CONSULTANTS

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CH	JB	BB

APPROVED RPEQ 6328

FOR AND ON BEHALF OF CIVIL DIMENSIONS PTY LTD

Rev	Amendment Details	Date
	Preliminary Information Only	26/08/15

DRAWING TITLE

Post Development Catchment Plan

PROJECT NUMBER	DRG	REV
CD14-053	SW2	-

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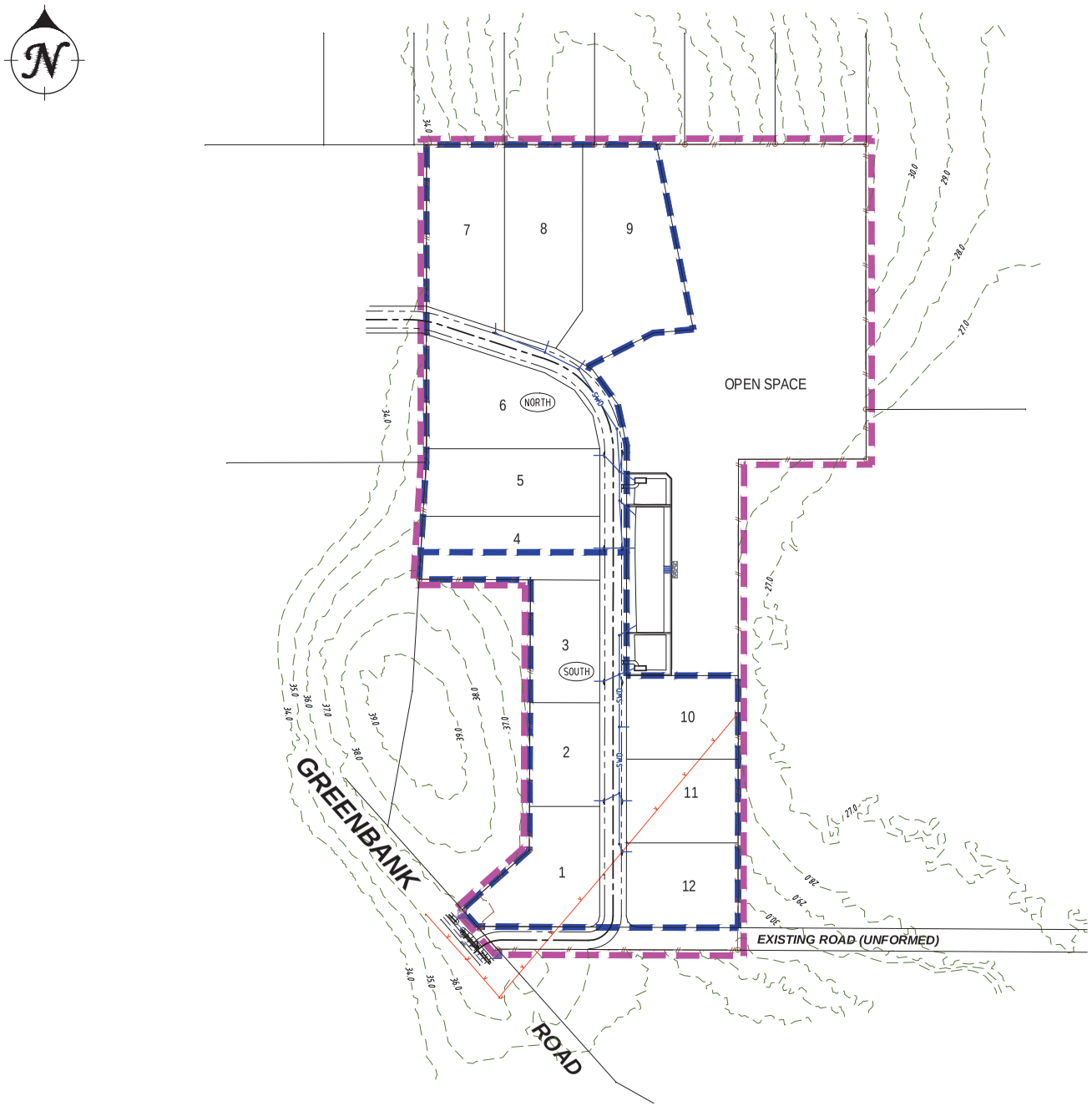

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DESIGNED	DRAWN	CHECKED
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APPROVED RPEQ 6328

FOR AND ON BEHALF OF CIVIL DIMENSIONS PTY LTD

Rev	Amendment Details	Date
	Preliminary Information Only	26/08/15

DRAWING TITLE

Stormwater Quality Catchment Plan

PROJECT NUMBER	DRG	REV
CD14-053	SW3	-

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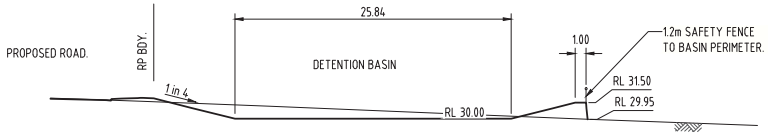
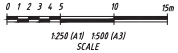
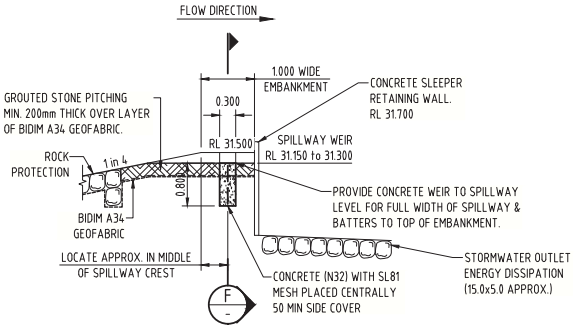
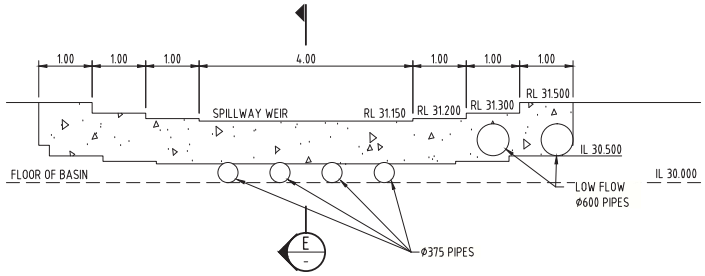


SECTION C SW1





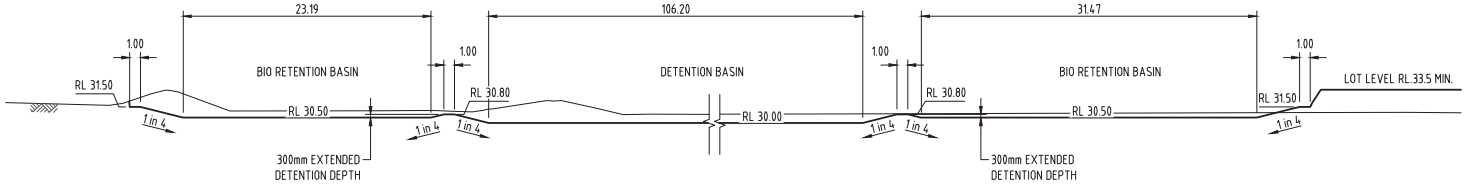
E Weir Spillway Longitudinal Section



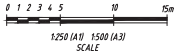
F Weir Spillway Cross Section

TYPICAL SECTIONS - WEIR SPILLWAY TREATMENT

SPILLWAY NOTES :
SPILLWAY DIMENSIONS SUBJECT TO VARY IN DETAIL DESIGN FOR OPERATIONAL WORKS.
SPILLWAY FOR THE BASIN TO BE PROTECTED WITH GROUTED STONE PITCHING FOR FULL WIDTH OF SPILLWAY. REFER ALSO IPWEAQ STD DRG WSUD-006.



SECTION D SW1



NOT FOR CONSTRUCTION

PROJECT NAME

Industrial Subdivision

820 Greenbank Road, North Maclean

12 Lot Subdivision (20.25 ha)

Lot 2 on RP 868726

CLIENT

Anna Properties Pty Ltd

ASSOCIATED CONSULTANTS

PURPOSE

Preliminary

SCALE (U.N.O.)

As Shown

ABN 66 103 198 527
Postal:
Unit 8, 51 Freda St
Upper Mt Gravatt,
Qld 4122
Brisbane:
Tel 3422 2020
Fax 3422 2021
Civil Dimensions Pty Ltd
Consulting Engineers
mail@civildimensions.com.au

DESIGNED	DRAWN	CHECKED
CH	JB	BB

APPROVED RPEQ 6328

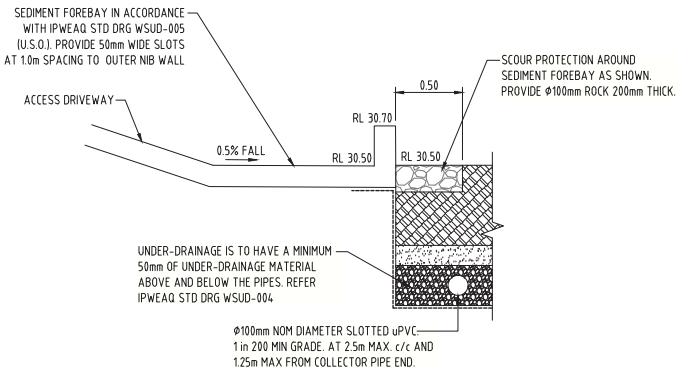
FOR AND ON BEHALF OF CIVIL DIMENSIONS PTY LTD

Rev	Amendment Details	Date
	Preliminary Information Only	26/08/15

DRAWING TITLE

Bio Retention Basin and Detention Basin Section and Details

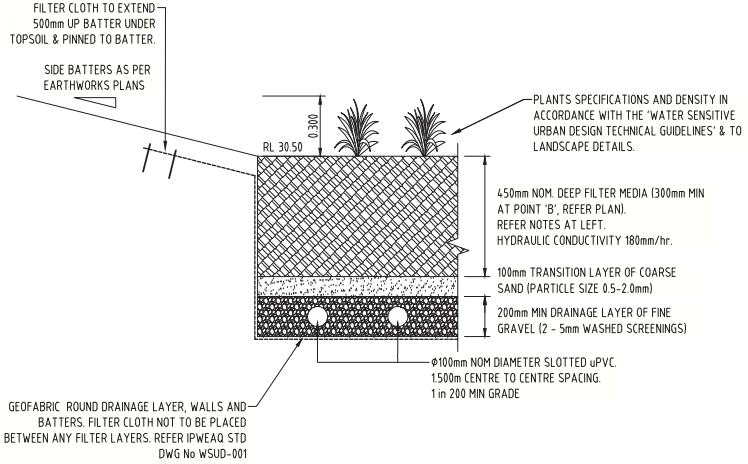
PROJECT NUMBER	DRG	REV
CD14-053	SW4	-



SEDIMENT FOREBAY TYPICAL DETAIL NTS

REFER IPWEAQ STD DRG WSUD-001

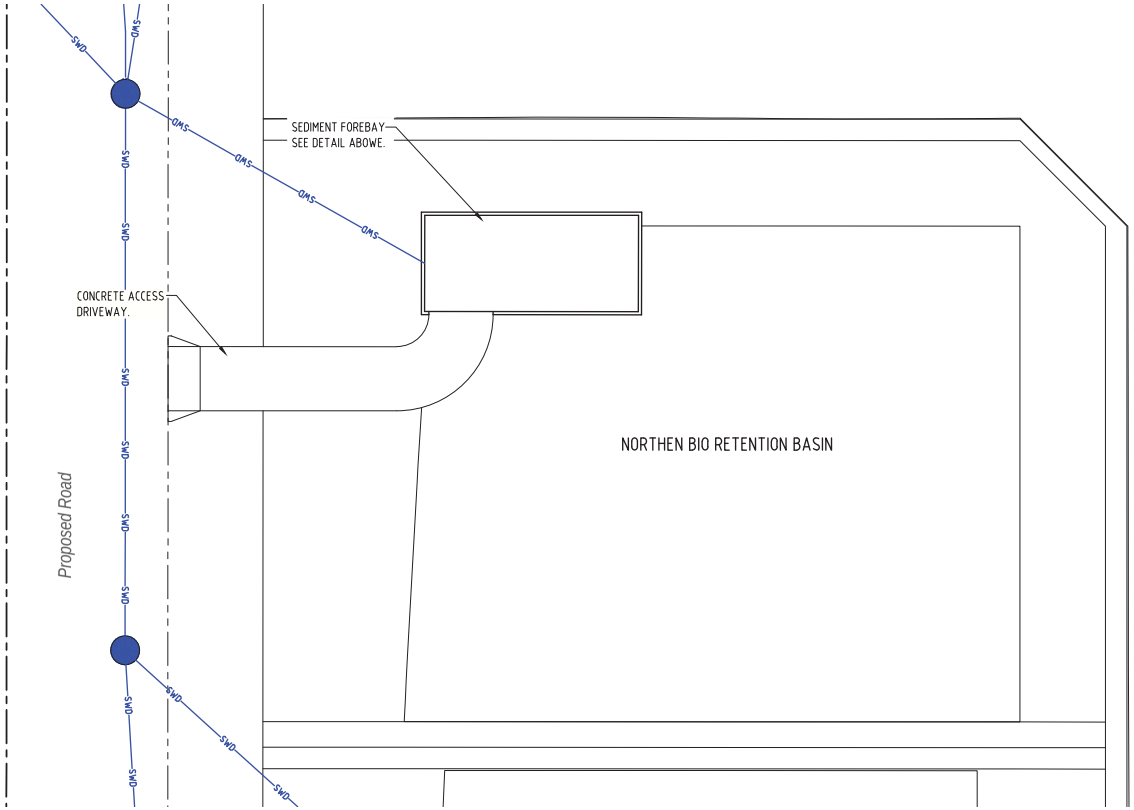
FOR ALL OTHER DETAILS REFER TO WATER BY DESIGN "CONSTRUCTION AND ESTABLISHMENT GUIDELINES: SWALES, BIORETENTION SYSTEMS AND WETLANDS VERSION 1.1 APRIL 2010"



BIORETENTION BASIN SECTION DETAIL

NTS

REFER IPWEAQ STD DRG WSUD-001



SEDIMENT FOREBAY MINIMUM SIZE BASED ON ANNUAL CLEAN-OUT
NORTH 45m²
SOUTH 40m²

NORTHERN SEDIMENT FOREBAY PLAN VIEW

SOUTHERN SEDIMENT FOREBAY SIMILAR CONFIGURATION

0 2.5 5 7.5m

1:125 (A1) 1:250 (A3) SCALE

NOT FOR CONSTRUCTION

PROJECT NAME

Industrial Subdivision

820 Greenbank Road, North Maclean

12 Lot Subdivision (20.25 ha)

Lot 2 on RP 868726

CLIENT

Anna Properties Pty Ltd

ASSOCIATED CONSULTANTS

PURPOSE

Preliminary

SCALE (U.N.O.)

0 2.5 5 7.5m

1:125 (A1) 1:250 (A3) SCALE

ABN 66 103 198 527
Postal:
Unit 8, 51 Freda St
Upper Mt Gravatt,
Qld 4122
Brisbane:
Tel 3422 2020
Fax 3422 2021
Civil Dimensions Pty Ltd
Consulting Engineers
mail@civildimensions.com.au

DESIGNED	DRAWN	CHECKED
CH	JB	BB

APPROVED RPEQ 6328

FOR AND ON BEHALF OF CIVIL DIMENSIONS PTY LTD

Rev	Amendment Details	Date
	Preliminary Information Only	26/08/15

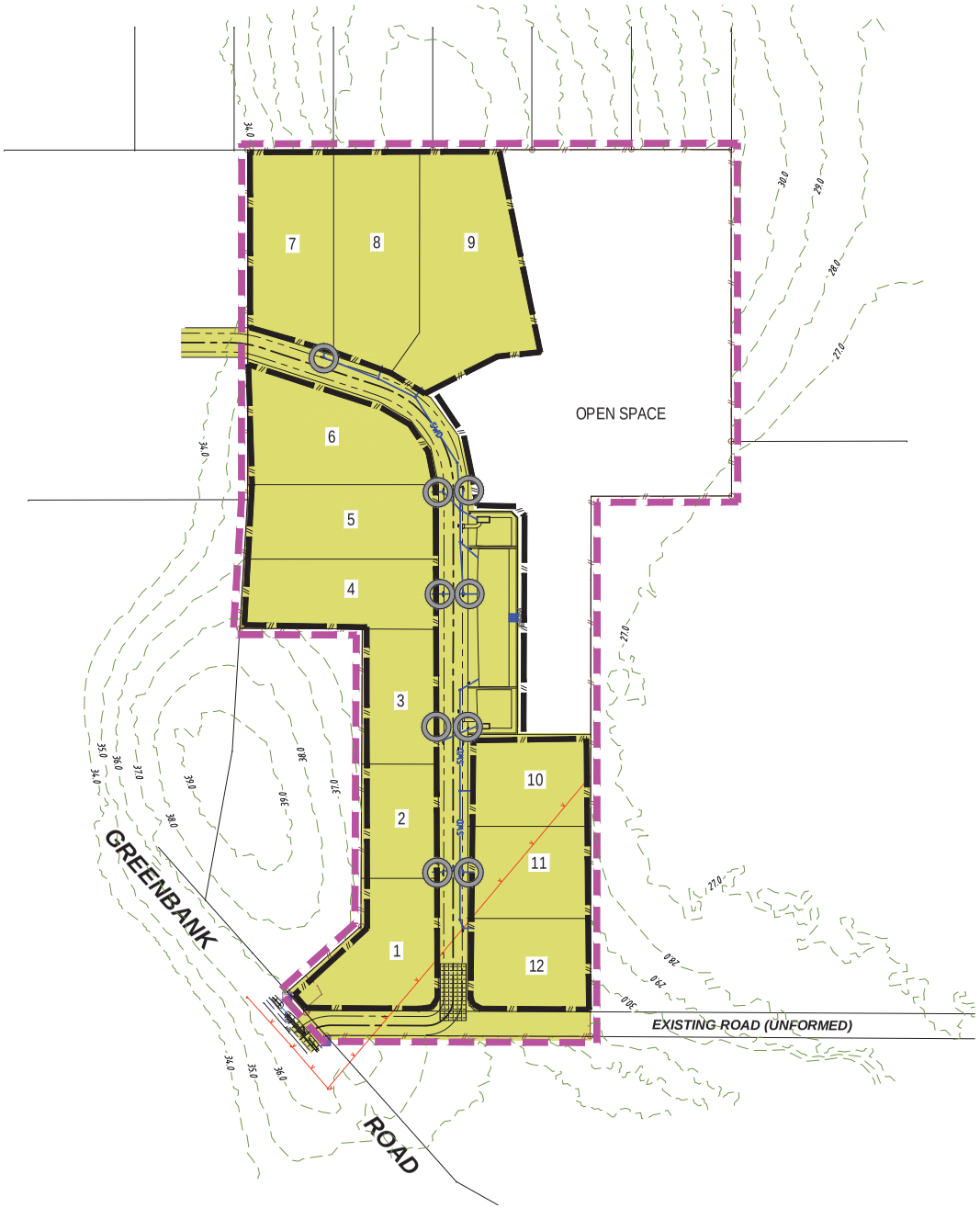
DRAWING TITLE

Bio Retention Basin Details

PROJECT NUMBER	DRG	REV
CD14-053	SW5	-

P:\CD14-053 Greenbank Road, North Maclean\Acad\Miscellaneous\GREENBANK SW CATCHMENT PLAN.dwg, 9/09/2015 4:33:14 PM, DWG To PDF.pc3

Appendix C – Soils and Erosion



NOTE:
SEDIMENT BASIN SIZING, TYPE AND DISCHARGE TO BE CONFIRMED IN OPERATIONAL WORKS PHASE.

DISCLAIMER
THE INFORMATION SHOWN ON THIS DRAWING IS PRELIMINARY IN NATURE AND SUBJECT TO DETAIL DESIGN

E.S.C LEGEND

- Sediment Fence
- Turf Filter Strips
- Straw Bale Filter
- SB — Temporary Sediment Basin
- Gully Inlet Treatments
- Shake Down Device

FEATURES LEGEND

Existing
- 30.0 — Surface Contours (0.5m)

Proposed
- Development Boundary
- 33.0 — Surface Contours (0.5m)
- Kerbing (Nominal)
- Area of Disturbance

PLANS SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AND STAMPED "FOR CONSTRUCTION"

NOT FOR CONSTRUCTION

PROJECT NAME
Industrial Subdivision
820 Greenbank Road, North Maclean
12 Lot Subdivision (20.25 ha)
Lot 2 on RP 868726

CLIENT
Anna Properties Pty Ltd

ASSOCIATED CONSULTANTS

PURPOSE
Preliminary

SCALE (U.N.O.)
0 10 20 30 40 80 120m
1:2000 (A1) 1:4000 (A3)
SCALE

ABN 66 103 198 527
Postal:
Unit 8, 51 Freda St
Upper Mt Gravatt,
Qld 4122
Brisbane:
Tel 3422 2020
Fax 3422 2021
Civil Dimensions Pty Ltd
Consulting Engineers
mail@civildimensions.com.au

DESIGNED	DRAWN	CHECKED
CH	JB	BB

APPROVED RPEQ 6328

FOR AND ON BEHALF OF CIVIL DIMENSIONS PTY LTD

Rev	Amendment Details	Date
	Preliminary Information Only	26/08/15

DRAWING TITLE
Erosion and Sediment Control Management Plan

PROJECT NUMBER	DRG	REV
CD14-053	ESC1	-

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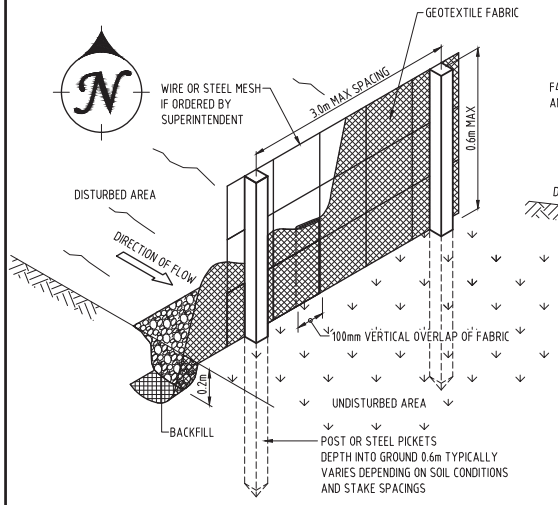
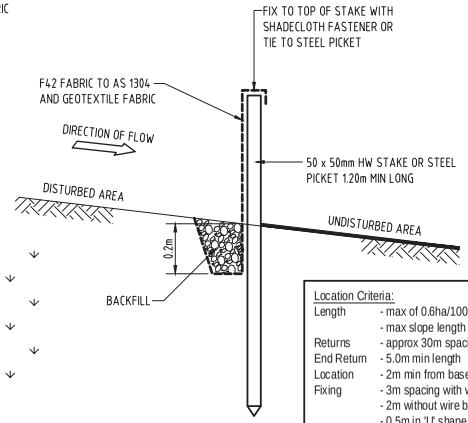
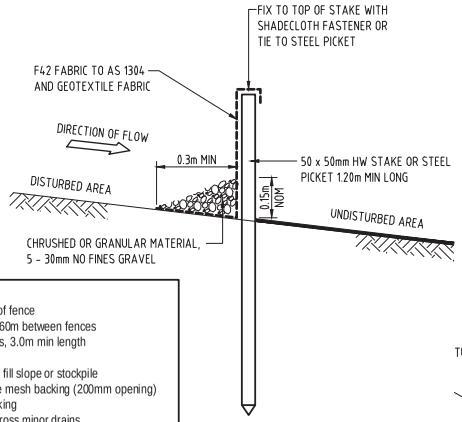




ALTERNATIVE 1



ALTERNATIVE 2

Location Criteria:	
Length	- max of 0.6ha/100m of fence - max slope length of 60m between fences
Returns	- approx 30m spacings, 3.0m min length
End Return	- 5.0m min length
Location	- 2m min from base of fill slope or stockpile
Fixing	- 3m spacing with wire mesh backing (200mm opening) - 2m without wire backing - 0.5m in 'U' shape across minor drains

300mm high spill through weir provided at low points and 20m spacings for fences installed along contours to control overflow, unless directed otherwise by superintendent.

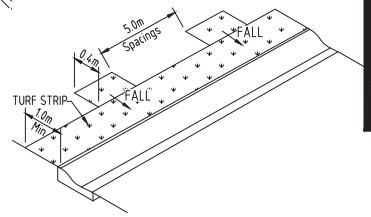
NOTE: 300MM HIGH SPILL THROUGH WEIR PROVIDED AT 20M SPACINGS FOR FENCES INSTALLED ALONG CONTOURS TO CONTROL OVERFLOW.

GEOTEXTILE SEDIMENT FENCE

SCALE N.T.S.

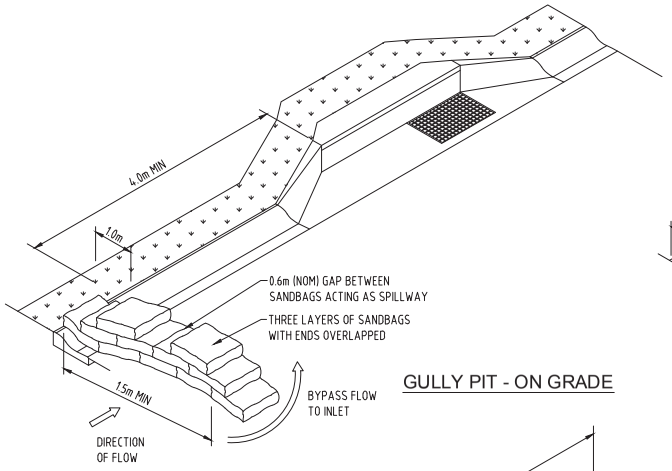
Reference Document: IECA 2008, *Best Practice Erosion and Sediment Control* . International Erosion Control Association (Australasia), Picton, NSW.

NOTE:
Variations/Alternatives (eg IPWEA standards) may be used with the Superintendent's permission.

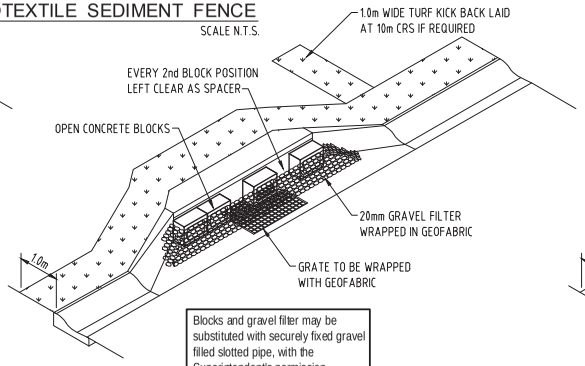


TURF FILTER STRIP

SCALE N.T.S.

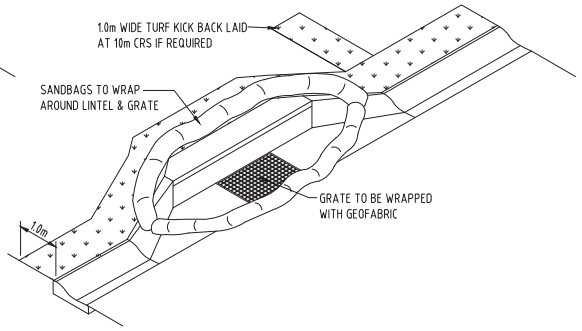


GULLY PIT - ON GRADE



ALTERNATIVE 1

Blocks and gravel filter may be substituted with securely fixed gravel filled slotted pipe, with the Superintendent's permission.

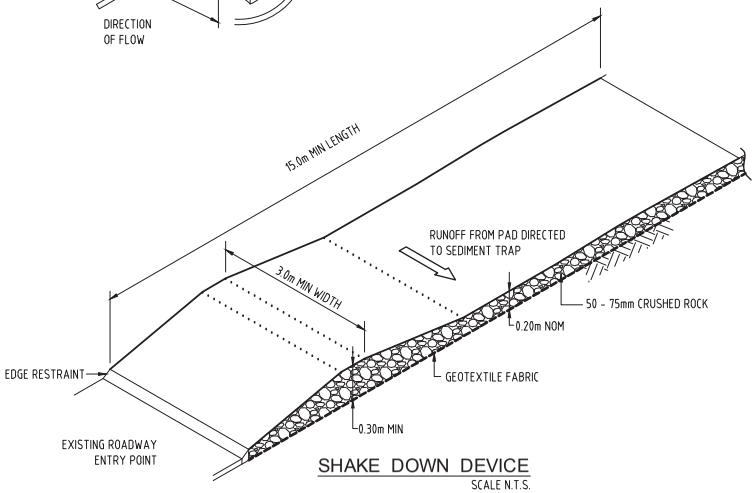


ALTERNATIVE 2

GULLY PIT - SAG TYPE

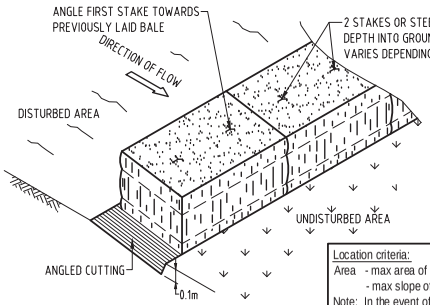
STORMWATER GULLY TREATMENTS

SCALE N.T.S.



SHAKE DOWN DEVICE

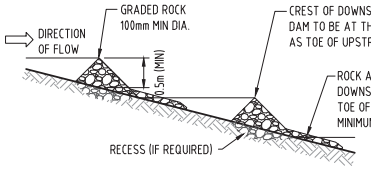
SCALE N.T.S.



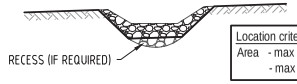
Location criteria:	
Area	- max area of 0.4ha - max slope of 1(v) : 2 (h)
Note:	In the event of imminent rainfall, straw bales may be temporarily used to direct flows around excavated areas, slopes & trenches.

STRAW BALE FILTER

SCALE N.T.S.



LONGITUDINAL SECTION



CROSS SECTION

Location criteria:	
Area	- max area of 1.0ha - max slope of 2 (H) : 1 (V)

NOTES
1. Where slope of channels exceeds 5%, provide rock check dams at 3m spacing.
   - <500mm deep use sand/gravel filled bags
   - >500mm deep use rock check dams
   - for slopes >1:10 use recessed rock check dams.

CHECK DAM

SCALE N.T.S.

PLANS SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AND STAMPED "FOR CONSTRUCTION"

NOT FOR CONSTRUCTION

PROJECT NAME

Industrial Subdivision

820 Greenbank Road, North Maclean

12 Lot Subdivision (20.25 ha)

Lot 2 on RP 868726

CLIENT

Anna Properties Pty Ltd

ASSOCIATED CONSULTANTS

PURPOSE

Preliminary

SCALE (U.N.O.)

0 10 20 30 40 80 120m

1:2000 (A1) 1:4000 (A3) SCALE

ABN 66 103 198 527
Postal:
Unit 8, 51 Freda St
Upper Mt Gravatt,
Qld 4122
Brisbane:
Tel 3422 2020
Fax 3422 2021
Civil Dimensions Pty Ltd
Consulting Engineers
mail@civildimensions.com.au

DESIGNED	DRAWN	CHECKED
CH	JB	BB

APPROVED RPEQ 6328

FOR AND ON BEHALF OF CIVIL DIMENSIONS PTY LTD

Rev	Amendment Details	Date
	Preliminary Information Only	26/08/15

DRAWING TITLE

Erosion and Sediment Control (Typical Details)

PROJECT NUMBER	DRG	REV
CD14-053	ESC2	-

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Appendix D – IFD Table

Extract from Logan City Council's Planning Scheme Policy Number 5.

Table 2.9.1B Rainfall intensity values

Column 1 Time of concentration (minutes)	Column 2 Rainfall intensity for the specified ARI statistical flood (millimetres/hour)[1]						
	1 year	2 year	5 year	10 year	20 year	50 year	100 year
6.0	111	142	176	195	223	258	286
6.2	110	140	174	193	220	255	282
6.4	108	138	172	191	217	252	279
6.6	107	137	170	189	215	250	276
6.8	106	135	168	187	213	247	273
7.0	105	134	166	185	210	244	270
7.2	104	132	164	183	208	242	268
7.4	102	131	162	181	206	239	265
7.6	101	129	161	179	204	237	262
7.8	100	128	159	177	202	235	260
8.0	99	127	158	176	200	233	257
8.2	98	126	156	174	198	230	255
8.4	97	124	155	172	196	228	253
8.6	97	123	153	171	195	226	251
8.8	96	122	152	169	193	224	248
9.0	95	121	151	168	191	222	246
9.2	94	120	149	166	190	221	244
9.4	93	119	148	165	188	219	242
9.6	92	118	147	164	187	217	240
9.8	92	117	146	162	185	215	238

Column 1 Time of concentration (minutes)	Column 2 Rainfall intensity for the specified ARI statistical flood (millimetres/hour)[1]						
	1 year	2 year	5 year	10 year	20 year	50 year	100 year
10.0	91	116	144	161	184	214	236
10.5	89	114	142	158	180	209	232
11.0	87	111	139	155	177	206	228
11.5	86	109	136	152	174	202	224
12.0	84	107	134	149	171	198	220
12.5	83	106	132	147	168	195	216
13.0	81	104	130	144	165	192	213
13.5	80	102	127	142	162	189	209
14.0	79	100	125	140	160	186	206
14.5	77	99	124	138	157	183	203
15.0	76	97	122	136	155	181	200
15.5	75	96	120	134	153	178	198
16.0	74	95	118	132	151	176	195
16.5	73	93	117	130	149	173	192
17.0	72	92	115	129	147	171	190
17.5	71	91	114	127	145	169	187
18.0	70	90	112	125	143	167	185
18.5	69	89	111	124	141	165	183
19.0	68	87	109	122	140	163	181
19.5	68	86	108	121	138	161	178
20.0	67	85	107	119	136	159	176
20.5	66	84	106	118	135	157	174
21.0	65	83	104	117	133	156	173
21.5	64	82	103	115	132	154	171
22.0	64	81	102	114	130	152	169
22.5	63	81	101	113	129	151	167
23.0	62	80	100	112	128	149	165
23.5	62	79	99	111	126	147	164
24.0	61	78	98	109	125	146	162
24.5	60	77	97	108	124	145	160
25.0	60	76	96	107	123	143	159
26.0	59	75	94	105	120	140	156
27.0	57	73	92	103	118	138	153
28.0	56	72	91	101	116	135	150
29.0	55	71	89	100	114	133	148
30.0	54	70	87	98	112	131	145
31.0	53	68	86	96	110	129	143

Column 1 Time of concentration (minutes)	Column 2 Rainfall intensity for the specified ARI statistical flood (millimetres/hour)[1]						
	1 year	2 year	5 year	10 year	20 year	50 year	100 year
32.0	53	67	84	95	108	127	141
33.0	52	66	83	93	107	125	138
34.0	51	65	82	92	105	123	136
35.0	50	64	81	90	103	121	134
36.0	49	63	79	89	102	119	132
37.0	49	62	78	88	100	117	130
38.0	48	61	77	86	99	116	129
39.0	47	60	76	85	98	114	127
40.0	46	59	75	84	96	113	125
45.0	43	56	70	79	90	106	117
50.0	41	52	66	74	85	100	111
55.0	39	49	63	70	81	94	105
60.0	37	47	59	67	77	90	100

Appendix E – Stormwater Flow Calculations

Rational Method Calculations

Existing (Pre-Developed) Eastern Catchment

Catchment Data:
Description: **Proposed Development Footprint**
Status: **Pre Developed**

Time of Concentration 23.7 (min)

Intensity (1hr-10Yr) 67 (mm/hr)
Fraction Impervious 0.000 (*fi*)
Coefficient of discharge for 10 Yr aRI 0.6600 (C_{10})
Area 10.95000 ha

Discharge Calculations - Pre Developed

	ARI	*fy*	fy.C10	Intensity	Discharge
Units				(mm/hr)	Q (m^3/sec)
	1	0.800	0.528	60	0.964
	2	0.850	0.561	77	1.314
	5	0.950	0.627	97	1.850
	10	1.000	0.660	108	2.168
	20	1.050	0.693	124	2.614
	50	1.150	0.759	145	3.348
	100	1.200	0.792	160	3.854

Check with Friends Equation for sheet flow:

t	**21.3**	min
n	0.045	horton
L	150	m
S	2.5	%

(Average Grass)

t		min
n	0.035	horton
L	0	m
S		%

Then channel flow from QUDM figure 4.8:

L	60 m
Fall	1.7 m
t	0.8 min
delta	3
t=	**2.4** min

TOTAL tc = 23.7 mins

Design (Post-Developed)

Catchment Data:
Description: **Proposed Development Footprint**
Status: **Post Development**

Developed (subdivision) catchment
Time of Concentration 8.6 (min)

Intensity (1hr-10Yr) 67 (mm/hr)
Fraction Impervious not in use (*fi*)
Coefficient of discharge for 10 Yr aRI 0.88 (C_{10})
Area 13.803 ha

Pervious catchment
inlet time 5
concentrated
flow time 3.6
Total time 8.6

7.269

Discharge Calculations - Post Developed

ARI	*fy.C* $_{10}$	Intensity	*fy.C* $_{10}$	Discharge		Existing	Design	Increase	Increase
		(mm/hr)		Q (m^3/sec)		(m^3/sec)	(m^3/sec)	(m^3/sec)	(%)
1	0.704	97		2.618	>>	0.964	**2.618**	1.655	171.7%
2	0.748	123		3.528	>>	1.314	**3.528**	2.214	168.5%
5	0.836	153		4.904	>>	1.850	**4.904**	3.054	165.1%
10	0.880	171		5.770	>>	2.168	**5.770**	3.602	166.1%
20	0.924	195		6.908	>>	2.614	**6.908**	4.295	164.3%
50	1.000	226		8.665	>>	3.348	**8.665**	5.318	158.9%
100	1.000	251		**9.624**	>>	3.854	**9.624**	5.769	149.7%

Discharge Comparison

Land Summary

East (Pre-Development)	10.950
East (Post-Development)	13.803
Difference	2.853

West (Pre-Development)	3.002
West (Post-Development)	0.149
Difference	-2.853

Total Pre-Development Area 13.952
Total Post-Development Area 13.952 0.000
(Both numbers should be the same)

2.853 Change in catchment area

Appendix F – Stormwater Quantity and Quality Software Output on disk