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CSR Hebel Line 2 Extension, Somersby

Civil Engineering Report

Prepared for: **CSR Hebel**

Project no: **NE160073**

Date: **1/11/2016**

Revisions

Date	Revision/ Issue No.	Revision Description	Prepared By	Reviewed By	Approved By
13/04/2016	1	DRAFT	J.Rhodes	R.Staniland	R. Staniland
28/04/16	2	For Approval	J.Rhodes	R.Staniland	R. Staniland
24/10/16	3	For Client Review	J.Rhodes	R.Staniland	R. Staniland
31/10/2016	4	For Approval	J.Rhodes	R.Staniland	R. Staniland
1/11/2016	5	For Approval	J.Rhodes	R.Staniland	R. Staniland

It is the responsibility of the reader to verify the currency of the version number of this report. All subsequent releases will be made directly to CSR Hebel.

Table of Contents

1 Introduction

ACOR Consultants (NNSW) were engaged by CSR Hebel to undertake a civil engineering design including site grading and stormwater management for a proposed additional facility located at 98 Wisemans Ferry Road, Somersby.

The objective of this report is to address the site grading and water cycle management for the site to meet the requirements of Gosford City Council's DCP Section 6.7 Water Cycle Management. The elements to be addressed include:

1. Site grading
2. Stormwater Conveyance;
3. Water Cycle Management including On Site Detention (OSD) and retention/reuse;
4. Stormwater Quality;
5. Erosion and Sediment Control.

2 Site

The site is located at Lot 22 D.P. 873845, 98 Wisemans Ferry Road, Somersby, New South Wales. CSR Hebel currently operate a facility on the neighbouring north property. The total usable site area of both the existing site and the new site is approximately 7.68 hectares. Figure 1 shows the location of the site.

The site generally drains to the south east to a tributary of Piles Creek.

Figure 2 shows a survey of the site in its existing condition.

The proposed expansion will consist of a factory building, hardstand area and a car park extension. The area of the proposed new development is approximately 3.24 ha. The new development will result in an increase to the impervious area of the site. The total impervious area of the site will be approximately 76%. Figure 3 shows the total site, including the proposed development.

3 Site Grading

The proposed development involves significant site grading to enable the levels of the new works to be a continuation of the existing site to the north. As the proposed development site falls to the south east, significant retaining is required to enable the continuation of the hardstand and circulation road from the existing northern site. By filling the site, general site grades will range between 3 and 5%.

Figure 4 shows the proposed grading of the new site. Figures 5 and 6 show the proposed levels and retaining at the southern extent of the site. Figures 7 to 12 show sections through the site. Figure 13 shows the cut and fill proposed for the site.

4 Stormwater Management

4.1 Stormwater Conveyance

Runoff from the new development will be directed to a stormwater reuse/detention tank to the east of the new development. Minor stormwater flows will be conveyed through a pit and pipe network to the

basin. Major flows will drain via an overland flow path to the basin. The existing stormwater drainage from the west of the site will be directed to the stormwater pipe system for the new development which will convey flows to the east to the proposed stormwater detention/reuse tank.

Figure 14 shows the proposed stormwater management plan for the site, including the new stormwater reuse/detention tank.

4.2 Water Cycle Management

The proposed water cycle management for the site, consists of water quantity (detention and retention) as well as water quality which will consist of a tank for both detention as well as reuse in the manufacturing processes on the site. Figure 14 shows the stormwater management plan for the proposed development.

4.3 STORMWATER RETENTION

4.3.1 Stormwater Retention

In accordance with section 6.7.7.2.4 Deemed to Comply of Gosford Council's DCP, the total volume of retention required is calculated using the following formula:

$V = 0.01A\ (0.02F)^2$

Where V =stormwater retention volume (m^3), A = Total site area (m^2) and F = fraction impervious (%).

The area of the new development site is 37,290 m^2(including the south western environmentally protected area). The fraction impervious of the site is approximately 73%. From the above information, a stormwater retention volume of 795 m^3 is required for the development. A volume of 800 m^3 has been adopted for retention for the site.

4.3.2 Stormwater Reuse

The stormwater retention will be utilised for reuse in the new factory in the manufacturing process in the ball mill and/or the slurry wash. It is estimated that 75 kL of water per day will be reused in the manufacturing process. This volume has been adopted for the modelling. When the required volume is not available in the tank, mains water will be used in the ball mill and slurry wash.

A water balance was undertaken using the MUSIC (Model of Urban Stormwater Improvement Conceptualisation) Model adopting the retention volume for the site of 800 m^3. Runoff from the new development as well as the existing development will be directed to the storage tank.

Modelling of the reuse with 800 m^3 of storage indicates that, on average, the reuse demand of 75 kL/day for the ball mill and/or slurry wash will be met 71% of the time throughout the year. This equates to an average annual reduction in potable water usage of 19.0 ML. Details of the MUSIC model including the water balance can be found in Appendix A.

4.4 On-Site Detention

4.4.1 General

Detention is required to limit the developed peak flows from the site to the predeveloped peak flows. To size the detention requirements, a hydrologic/hydraulic model was developed using the DRAINS program to determine the volume of detention required for the site.

4.4.2 Drains Modelling

DRAINS modelling was undertaken to determine the predeveloped and developed peak flows for a range of ARI's from 1 to 100 years, for storm durations ranging from 5 minutes to 4.5 hours. The predeveloped vs development peak flows for the total site with no detention are shown in Table 1. Predeveloped flows assume the southern site is in an undeveloped state, while the existing northern site is in its current developed state. Details of the DRAINS modelling are shown in Appendix B.

Table 1: Predeveloped vs Developed (no detention) Total Peak Flows from the Total Site

ARI (Years)	Pre-Developed Peak Flow (m^3/s)	Developed Peak Flow (no detention) (m^3/s)	Increase (%)
1	1.11	1.56	41
2	1.66	2.09	26
5	2.29	2.72	19
10	2.69	3.08	14
20	3.17	3.56	12
50	3.38	3.76	11
100	3.77	4.17	11

From Table 1 it can be seen that the proposed development increases the peak flows from the total site when compared to the existing peak flows. To mitigate the peak flows from the site and restrict them to the predeveloped peak flows, detention is required.

A detention tank configuration consisting of a volume of 1100 m^3 (peak detention volume), a low-level outlet of 4 x 525 mm diameter pipes and a 6 m wide weir was modelled in DRAINS. The detention volume is required above the reuse volume (total tank volume 1900 m^3). Table 2 shows the predeveloped peak flows vs the developed peak flows with the above detention configuration for the total site. Figure 15 shows the reuse/detention tank details. DRAINS inputs and results for the detention modelling can be found in Appendix B.

Table 2: Predeveloped vs Developed (with detention) Total Peak Flows from the Site

ARI (Years)	Pre-Developed Peak Flow (m^3/s)	Developed Peak Flow (with detention) (m^3/s)	Reduction (%)
1	1.11	1.13	2
2	1.66	1.49	-10
5	2.29	1.87	-18
10	2.69	2.07	-23
20	3.17	2.62	-17
50	3.38	3.03	-10
100	3.77	3.30	-12

As can be seen from Table 2, the detention configuration modelled reduces the peak flows from the total site for all ARIs to equal to or below the predeveloped peak flows except for the 1 year ARI storm event. To simulate the worst case scenario, the model was run assuming the reuse volume of the tank was full. It is expected that some additional volume from the reuse portion of the tank would be available in most storm events which would reduce the developed peak flows to below those in the Table 2.

4.5 WATER QUALITY

4.5.1 General

The water quality treatment for the site will be by reuse in the manufacturing process and a gross pollutant trap (Ecosol GPT or equivalent) to reduce the volume of pollution entering the retention/detention tank. As discussed in section 4.3, a reuse volume of 800 m^3 is proposed for the facility. Water use for the new facility has been estimated at 75 kL per day.

4.5.2 Objectives

Section 6.7.7.3.2 of Gosford Council's DCP states the water quality objectives for the site is:

- Total Suspended Solids: 80%
- Total Phosphorus: 45%
- Total Nitrogen: 45%

4.5.3 Water Quality Modelling

4.5.3.1 General

Water quality modelling was undertaken in the MUSIC (Version 6.1.0) program. The inputs for the model are described below. The catchment entering the tank includes the existing hardstand area and the existing factory roof area.

4.5.3.2 Rainfall and Evapotranspiration

The rainfall and evapotranspiration data was adopted for the Sydney Observatory Hill Rainfall Station with a 6-minute time step.

4.5.3.3 Rainfall/Runoff Catchment Parameters

The rainfall and runoff catchment parameters were adopted from the default values from the NSW MUSIC Modelling Guidelines. Details of the MUSIC modelling inputs are shown in Appendix A.

The water quality parameters adopted for the site were for general urban.

4.5.3.4 Stormwater Treatment Measures

The main treatment measure for the site will be reuse via retention/detention tank. The volume of the tank for retention/reuse is 800 m^3. An Ecosol GPT (or equivalent) will be constructed upstream of the reuse tank to reduce the volume of pollutants entering the tank.

The Ecosol GPT unit is an inline system, that removes 99% of pollutants larger than 2 mm as well as 80% of TSS and 45% of the nutrients TP and TN from the incoming stormwater flows.

4.5.4 Results

The pollutant reductions from the water quality infrastructure for the total site from the MUSIC modelling are shown in Table 3.

Table 3: Total Site Pollutant Reduction

Pollutant	MUSIC Model Reduction	GCC Water Quality Reduction Objectives
TSS	81%	80%
TP	62%	45%
TN	49%	45%

As can be seen from Table 3, the pollutant reductions from the total site including the existing development exceed the GCC requirements for TSS, TP and TN.

4.6 Erosion and Sediment Control

During construction of the development, erosion and sediment control will be required to limit the pollutant runoff from the site into the existing downstream stormwater drainage system. Erosion and sediment controls such as sediment fencing, pit inlet filters and stabilized site access will be adopted to control the sediment runoff from the site until the development is sufficiently stabilized, and the new stormwater management and drainage system is constructed.

The water reuse tank will be able to be used as a sediment basin during the construction process, prior to the site being sealed.

The erosion and sediment controls will be in accordance with Landcom's Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, March 2004 (The Blue Book) and the requirements of Gosford City Council.

Figure 16 shows a concept erosion and sediment control plan for the development.

5 Conclusion

This civil engineering and stormwater management plan was undertaken for the proposed CSR Hebel Line 2 development located at 98 Wisemans Ferry Road, Somersby.

Significant site grading is required for the development including large retaining structures around the site boundary as well as between the existing factory and the proposed factory. General grading of the hardstand areas will be in the range of 3 to 5%.

Stormwater runoff from the site will be conveyed via a pit and pipe system to the detention/reuse tank.

Stormwater quantity for the site will be addressed by a tank that will act as both a detention and a reuse tank. Overflows from the tank will be directed to the existing site stormwater outlet to the creek tributary. The peak flows from the site have been reduced to below the current peak flows leaving the site.

Water quality for the site will be treated by the reuse tank as well as an Ecosol GPT (or equivalent) upstream of the tank to reduce the volume of pollutants entering the tank. The combination of the reuse tank and GPT reduce the pollutants in the runoff to the requirement of Gosford City Council.

Erosion and sediment controls will be implemented during the construction process to the requirements of Gosford City Council.

Figures

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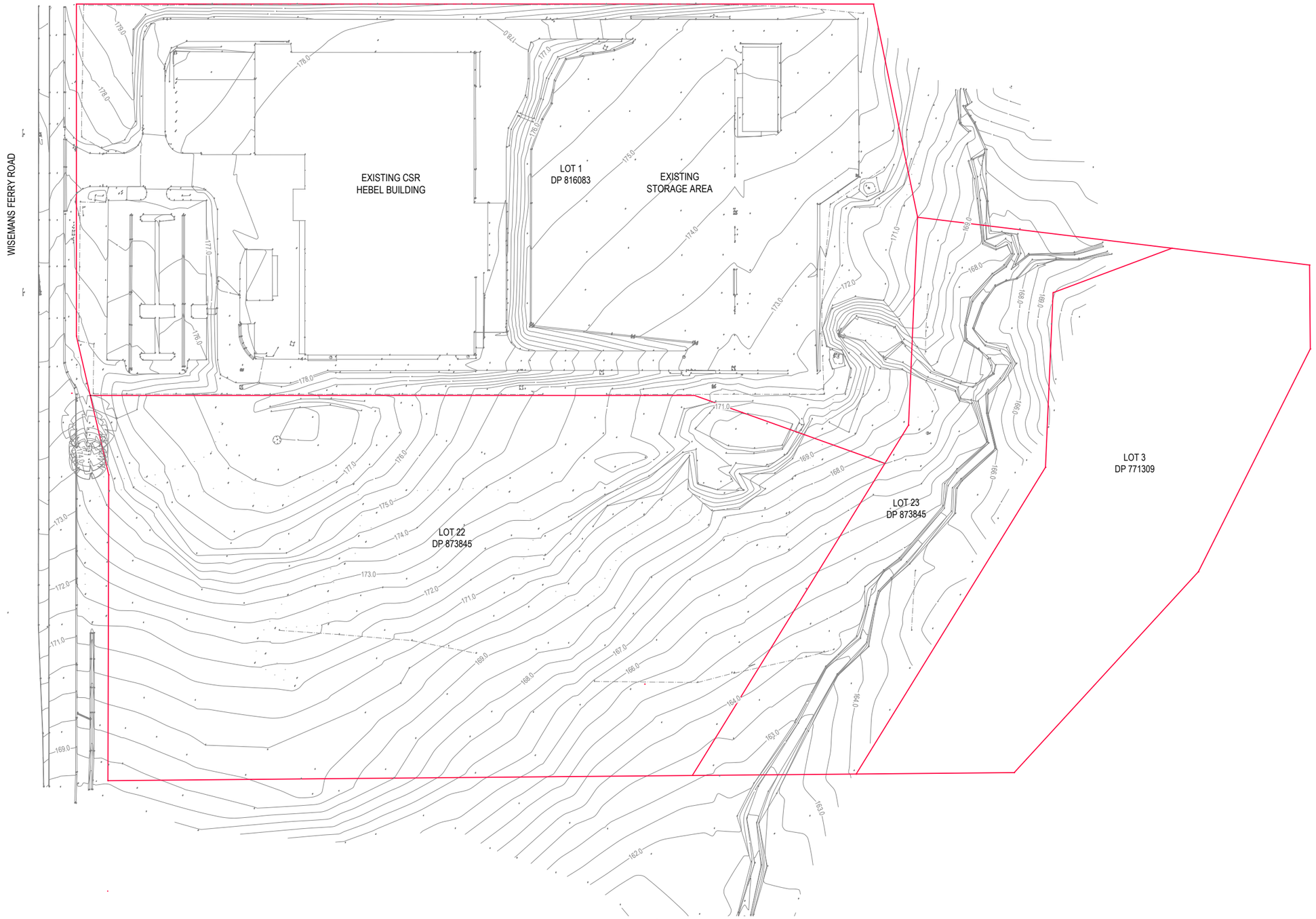
Drawing Title
LOCALITY PLAN

Project No.	Scale	Figure No.	Issue
NE160073	N.T.S. @ A3	FIGURE 01	B



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Drawing Title
EXISTING SITE SURVEY

Project No.	Scale	Figure No.	Issue
NE160073	1:1500 @ A3	FIGURE 02	B

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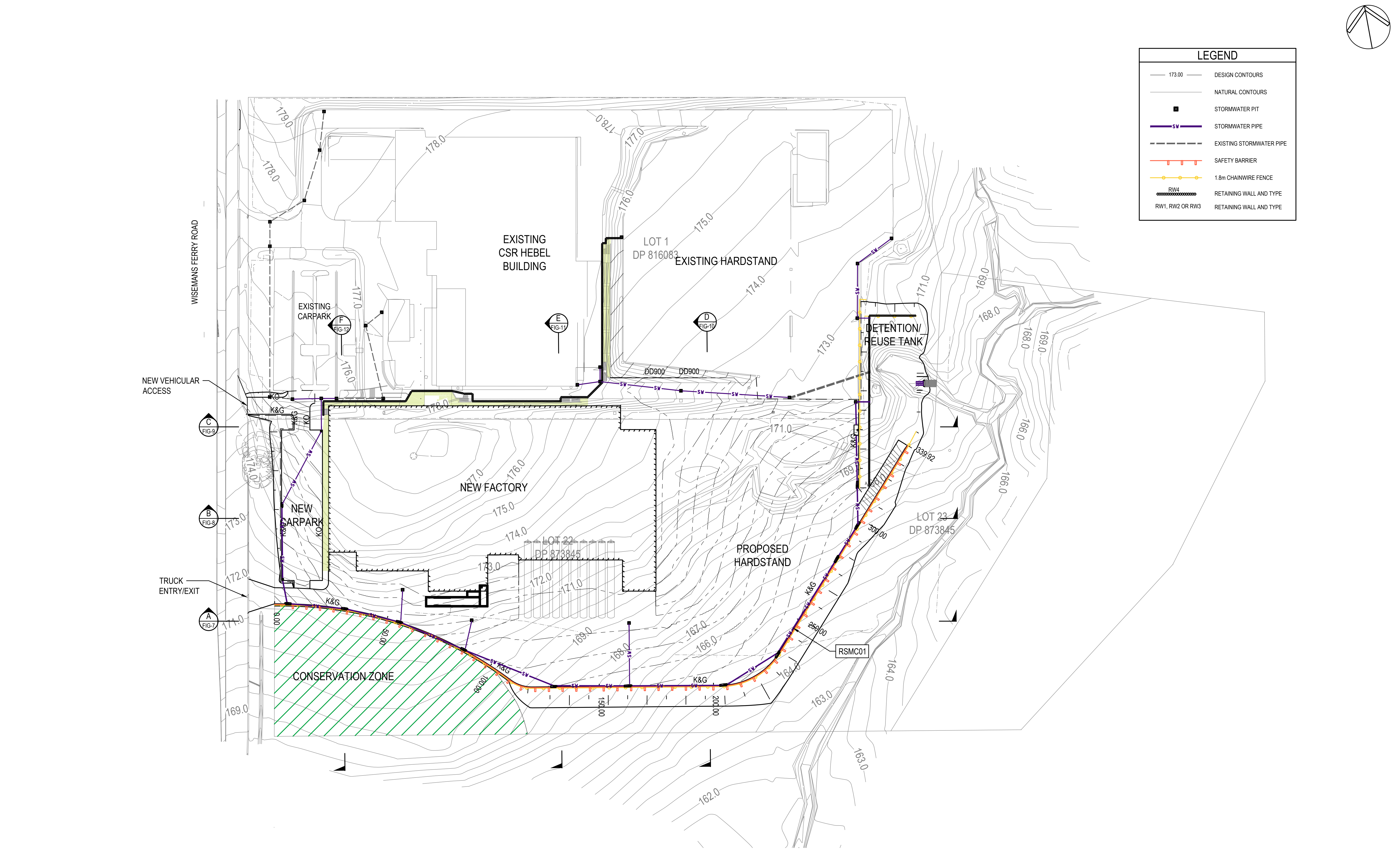

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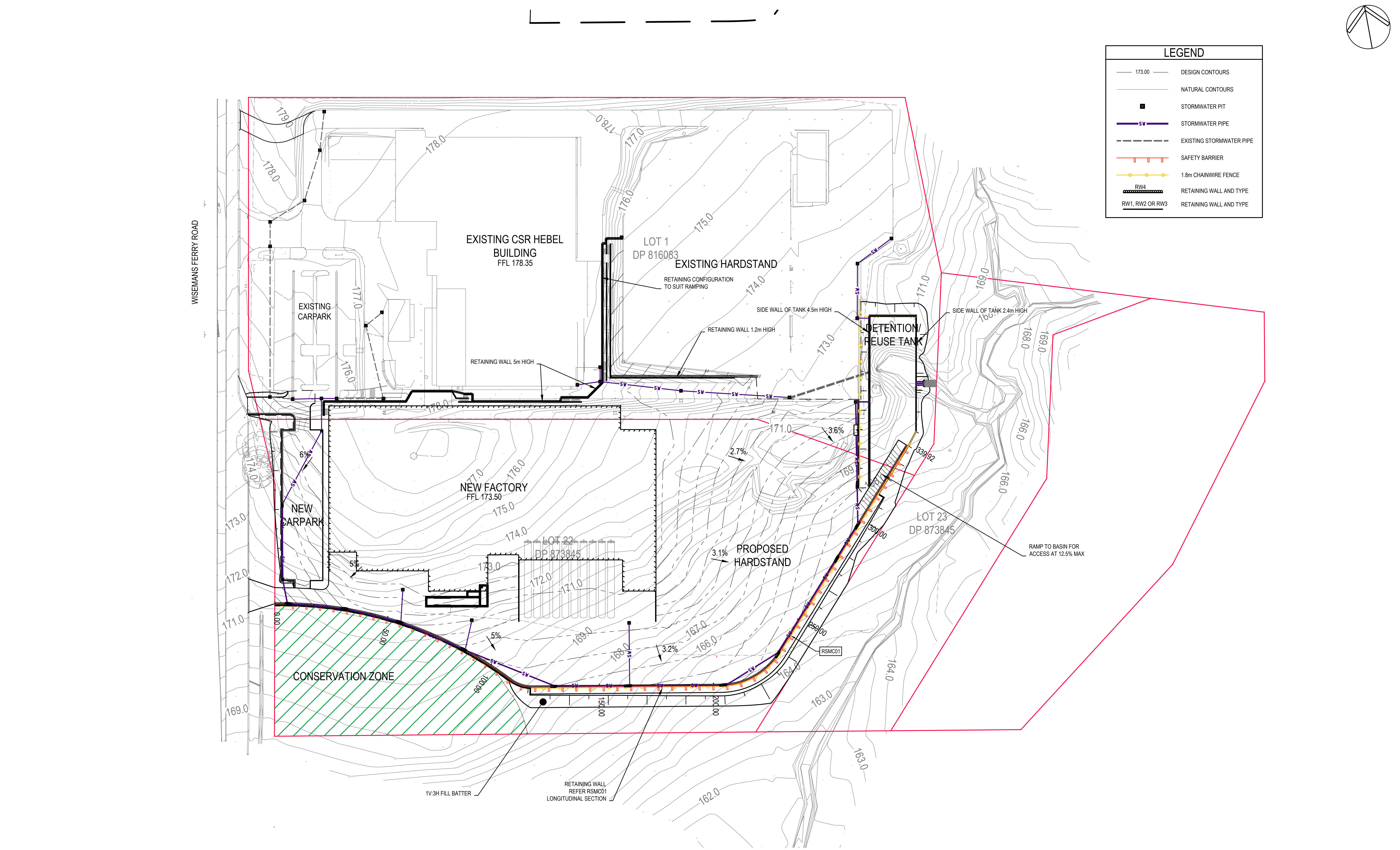
Drawing Title				
PROPOSED DEVELOPMENT				
Project No.	Scale		Figure No.	Issue
NE160073	1:1500	@ A3	FIGURE 03	C



LEGEND
DESIGN CONTOURS
NATURAL CONTOURS
STORMWATER PIT
STORMWATER PIPE
EXISTING STORMWATER PIPE
SAFETY BARRIER
1.8m CHAINWIRE FENCE
RETAINING WALL AND TYPE
RW1, RW2 OR RW3
RETAINING WALL AND TYPE
WISEMANS FERRY ROAD
EXISTING CSR HEBEL BUILDING
FFL 178.35
LOT 1
DP 816083
EXISTING HARDSTAND
RETAINING CONFIGURATION TO SUIT RAMPING
EXISTING CARPARK
RETAINING WALL 5m HIGH
RETAINING WALL 1.2m HIGH
SIDE WALL OF TANK 4.5m HIGH
SIDE WALL OF TANK 2.4m HIGH
DETENTION/ REUSE TANK
NEW FACTORY
FFL 173.50
NEW CARPARK
LOT 22
DP 873845
PROPOSED HARDSTAND
LOT 23
DP 873845
RAMP TO BASIN FOR ACCESS AT 12.5% MAX
CONSERVATION ZONE
RSMC01
1V:3H FILL BATTER
RETAINING WALL REFER RSMC01 LONGITUDINAL SECTION
SCALE 1:1500 @ A3

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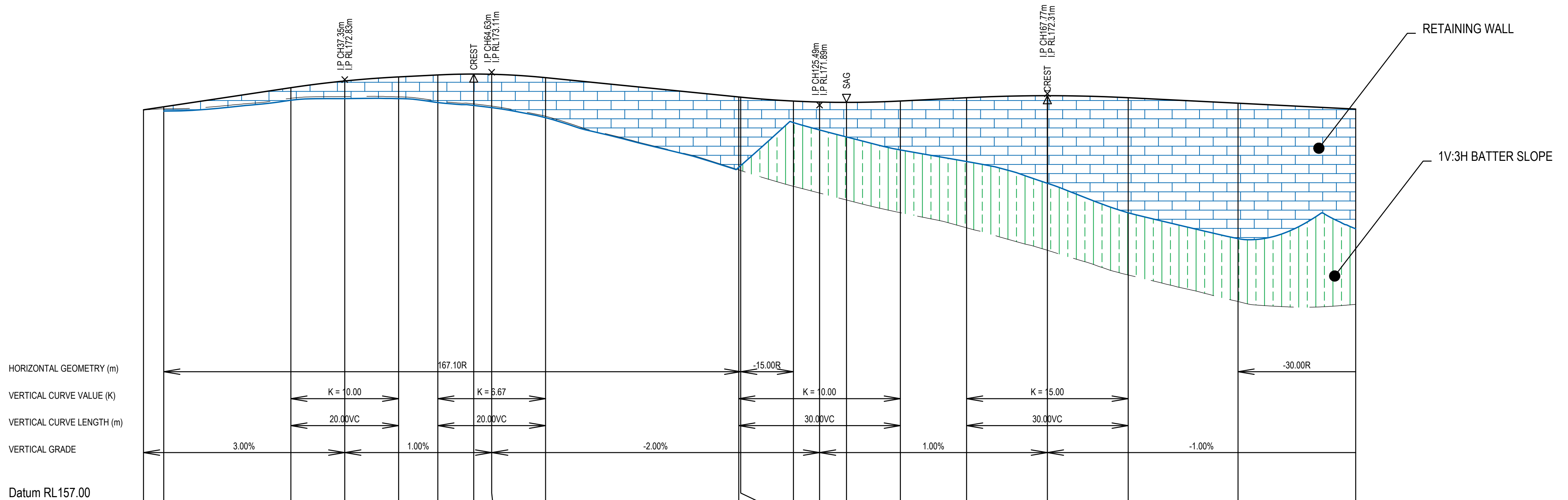
Drawing Title: PROPOSED SITE GRADING

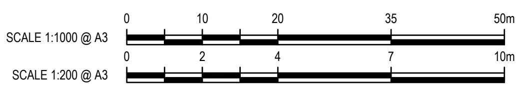
Project No.	Scale	Figure No.	Issue
NE160073	1:1500 @ A3	FIGURE 04	C



DESIGN SURFACE	171.71	171.83	172.53	172.78	172.93	173.01	173.04	173.03	172.91	172.19	172.18	172.04	172.00	171.99	172.04	172.16	172.24	172.16	171.96	171.74
TOP OF RETAINING WALL		171.94	172.64	172.89	173.04	173.12	173.15	173.14	173.02	172.30	172.29	172.15	172.11	172.10	172.15	172.27	172.35	172.27	172.07	171.85
BOTTOM OF RETAINING WALL		171.67	172.07	172.13	172.13	171.98	171.88	171.80	171.42	169.58	169.64	171.24	170.97	170.71	170.22	169.80	168.99	167.89	166.94	167.30
APPROX RETAINING WALL HEIGHT		0.27	0.57	0.76	0.91	1.14	1.27	1.34	1.60	2.72	2.65	0.91	1.14	1.39	1.93	2.47	3.36	4.38	5.13	4.55
NATURAL SURFACE	171.71	171.75	172.14	172.20	172.19	172.04	171.94	171.85	171.48	169.49	169.46	168.88	168.63	168.37	167.90	167.34	166.50	165.59	164.60	164.50
CUT/FILL DEPTH (-ve/+ve)	0.00	0.08	0.39	0.58	0.74	0.97	1.11	1.18	1.43	2.70	2.72	3.16	3.38	3.62	4.14	4.83	5.73	6.58	7.35	7.24
ROAD CHAINAGE	0.00	3.76	27.35	37.35	47.35	54.63	61.30	64.63	74.63	110.49	110.85	120.64	125.49	130.49	140.49	152.77	167.77	182.77	203.16	225.00

RSMC01 LONGITUDINAL SECTION

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200



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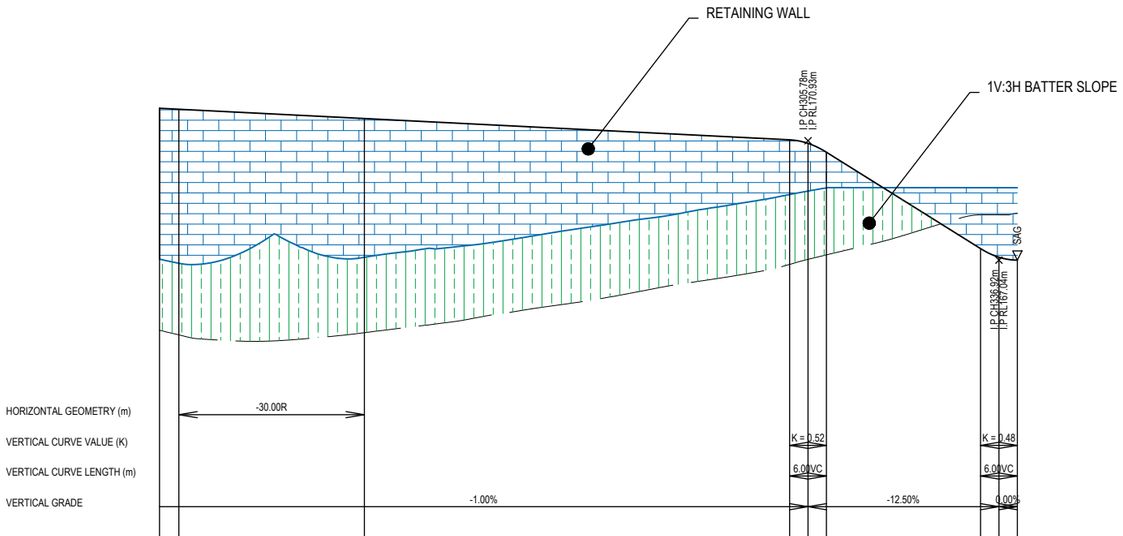
Drawing Title
SOUTHERN RETAINING WALL
LONGITUDINAL SECTION SHEET 1

Project No.	Scale	Figure No.	Issue
NE160073	AS SHOWN @ A3	FIGURE 05	B



DESIGN SURFACE	171.99	171.96	171.66	170.96	170.85	170.56	167.42	167.13	167.04		
TOP OF RETAINING WALL	172.10	172.07	171.77	171.07	170.96	170.67	169.40	169.40	169.40		
BOTTOM OF RETAINING WALL	167.07	166.94	167.13	169.18	169.29	169.40	167.53	167.24	167.04		
APPROX RETAINING WALL HEIGHT	5.03	5.13	4.64	1.89	1.67	1.27	1.87	2.16	2.36		
NATURAL SURFACE	164.75	164.60	164.67	166.90	167.07	167.21	168.52	168.52	168.58		
CUT/FILL DEPTH (-ve/+ve)	7.24	7.35	6.98	4.06	3.78	3.35	-1.10	-1.38	-1.54		
ROAD CHAINAGE	200.00	203.16	233.42	302.78	305.78	308.78	333.92	336.92	339.92		

RSMC01 LONGITUDINAL SECTION

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200

SCALE 1:1000 @ A3 — 0 10 20 35 50m
SCALE 1:200 @ A3 — 0 2 4 7 10m

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Drawing Title
SOUTHERN RETAINING WALL
LONGITUDINAL SECTION SHEET 2

Project No.	Scale	Figure No.	Issue
NE160073	AS SHOWN @ A3	FIGURE 06	B

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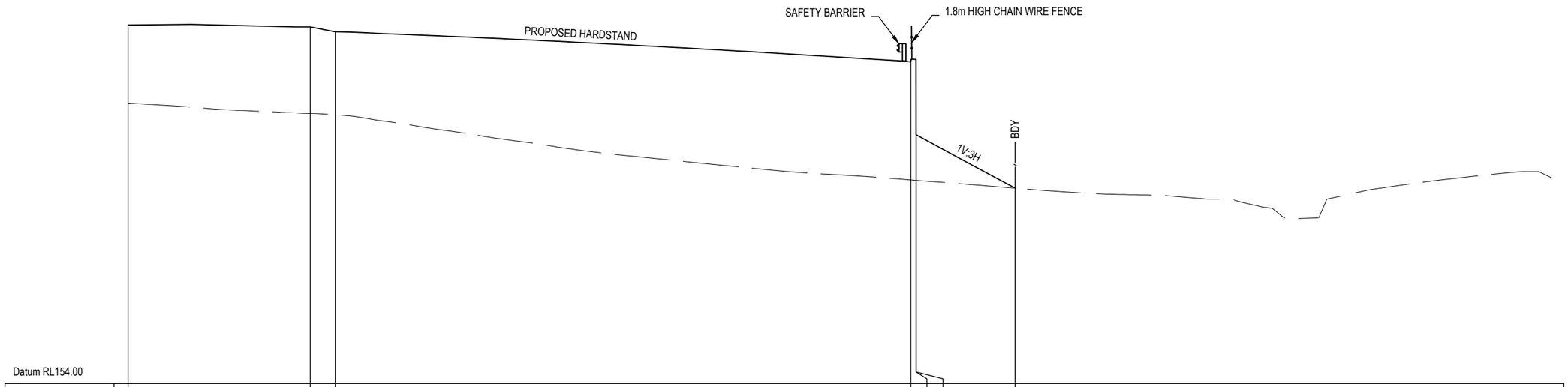

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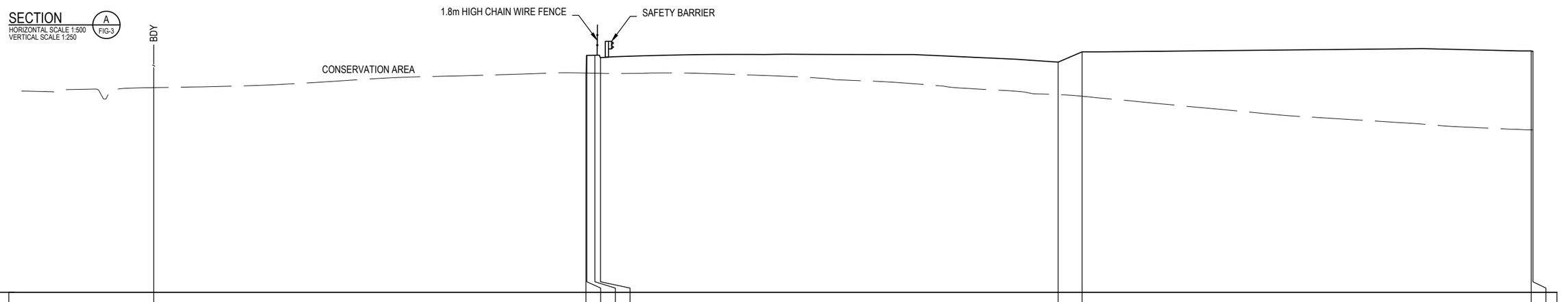
DESIGN SURFACE	173.34		173.36	173.10		171.46	171.60	167.50	164.60
NATURAL SURFACE	169.23		168.66	168.59		165.05	165.02	165.02	164.60
CUT/FILL DEPTH (-ve/+ve)	4.12		4.70	4.51		6.41	6.58	2.48	-0.00
OFFSET FROM EASTERN BOUNDARY	144.27		164.06	166.78		229.31	229.88	229.89	240.64

SECTION A
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250
FIG-3



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DESIGN SURFACE			172.05	173.10	173.11	172.96	172.70	173.31	173.36	173.34
NATURAL SURFACE	171.18		172.05	172.05	172.04	172.03	170.76	170.67	168.66	168.66
CUT/FILL DEPTH (-ve/+ve)			0.00	1.05	1.07	0.93	1.93	2.64	4.70	4.68
OFFSET FROM EASTERN BOUNDARY	0.00		51.48	51.58	52.54	53.21	107.71	110.56	164.06	164.27

SECTION A
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250
FIG-3

SCALE 1:500 @ A3 — 0, 5, 10, 17.5, 25m
SCALE 1:250 @ A3 — 0, 2.5, 5, 8.75, 12.5m

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Drawing Title: SITE SECTION A

Project No.	Scale	Figure No.	Issue
NE160073	AS SHOWN @ A3	FIGURE 07	B

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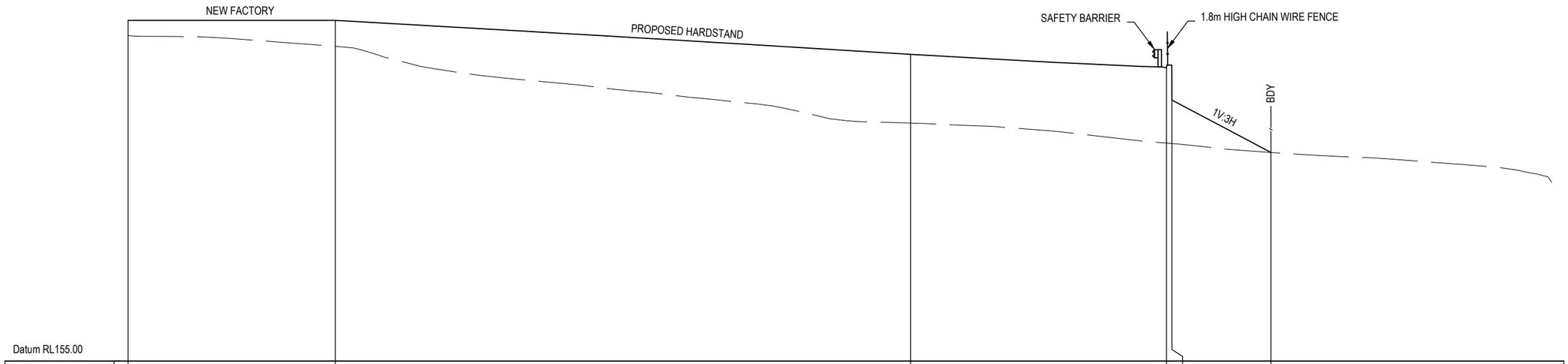

DESIGN SURFACE	173.50	173.50	171.65	170.93	169.17	166.33
NATURAL SURFACE	172.67	172.09	167.92	166.84	166.81	166.33
CUT/FILL DEPTH (-ve/+ve)	0.83	1.41	3.73	4.09	2.36	-0.00
OFFSET FROM EASTERN BOUNDARY	144.15	166.66	229.17	256.98	257.56	268.32

SECTION B FIG-3
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250

DESIGN SURFACE	173.84	173.08	172.93	173.08	173.37	173.44	173.50	173.50
NATURAL SURFACE	173.84	173.96	173.98	174.35	174.79	175.55	175.97	172.19
CUT/FILL DEPTH (-ve/+ve)	0.00	-0.87	-1.06	-1.28	-1.42	-2.11	-2.47	1.31
OFFSET FROM EASTERN BOUNDARY	0.00	2.41	2.94	8.89	14.89	20.84	23.46	164.15

SECTION B FIG-3
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250

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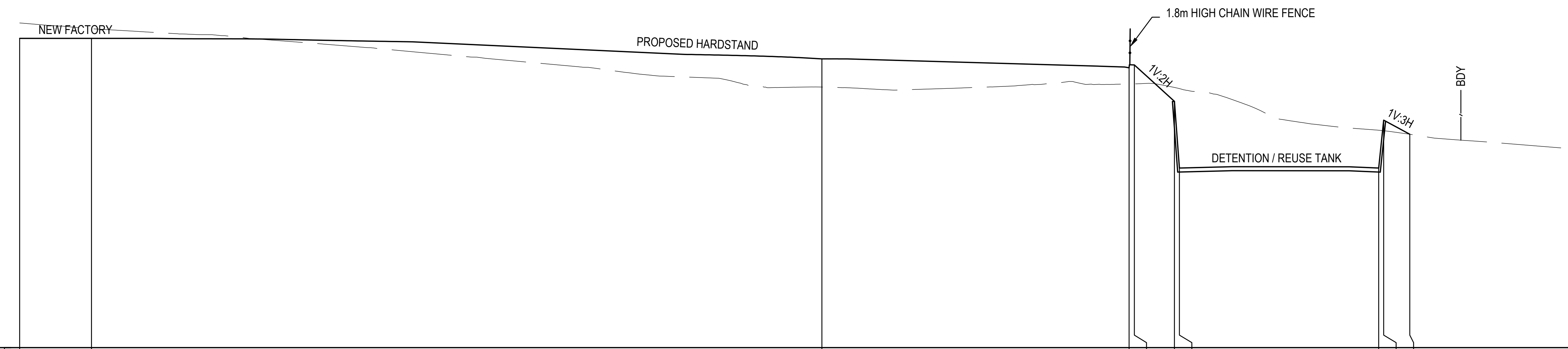
Drawing Title
SITE SECTION B

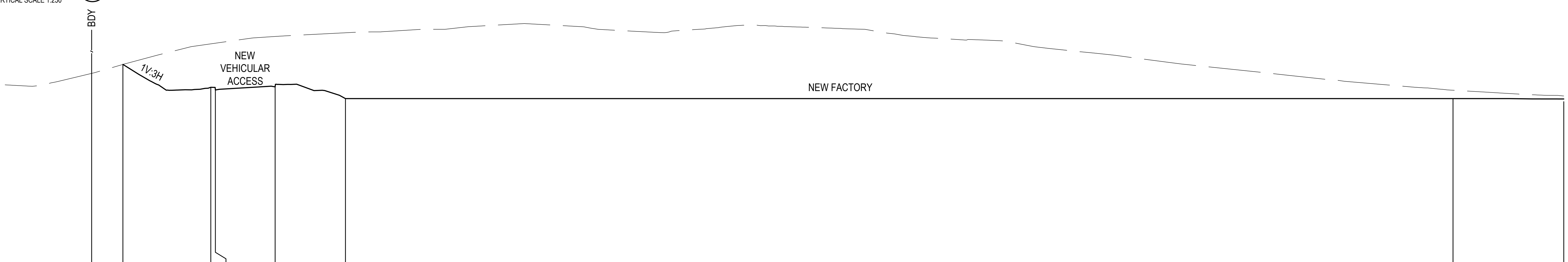
Project No.	Scale	Figure No.	Issue
NE160073	AS SHOWN @ A3	FIGURE 08	B



Datum RL158.00

DESIGN SURFACE	173.50	173.50	172.47	172.02	172.17	170.34	167.00	167.00	169.40	168.69
NATURAL SURFACE	174.27	173.98	171.06	171.21	171.22	171.04	170.98	168.90	168.87	168.69
CUT/FILL DEPTH (-ve/+ve)	-0.77	-0.48	1.41	0.81	0.95	-0.70	-3.98	-1.90	0.53	0.00
OFFSET FROM EASTERN BOUNDARY	150.00	157.21	230.51	261.34	261.87	265.89	266.39	286.39	286.89	289.51

SECTION C (FIG-3)
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250



Datum RL164.00

DESIGN SURFACE		175.47	174.15	174.00	174.18	173.50	173.50	173.32
NATURAL SURFACE	174.96	175.47	176.66	176.70	177.09	177.30	173.98	173.65
CUT/FILL DEPTH (-ve/+ve)		0.00	-2.51	-2.70	-2.91	-3.80	-0.48	-0.33
OFFSET FROM EASTERN BOUNDARY	0.00	3.61	13.76	14.29	21.19	29.31	157.21	170.00

SECTION C (FIG-3)
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250

SCALE 1:500 @ A3 — 0, 5, 10, 17.5, 25m
SCALE 1:250 @ A3 — 0, 2.5, 5, 8.75, 12.5m

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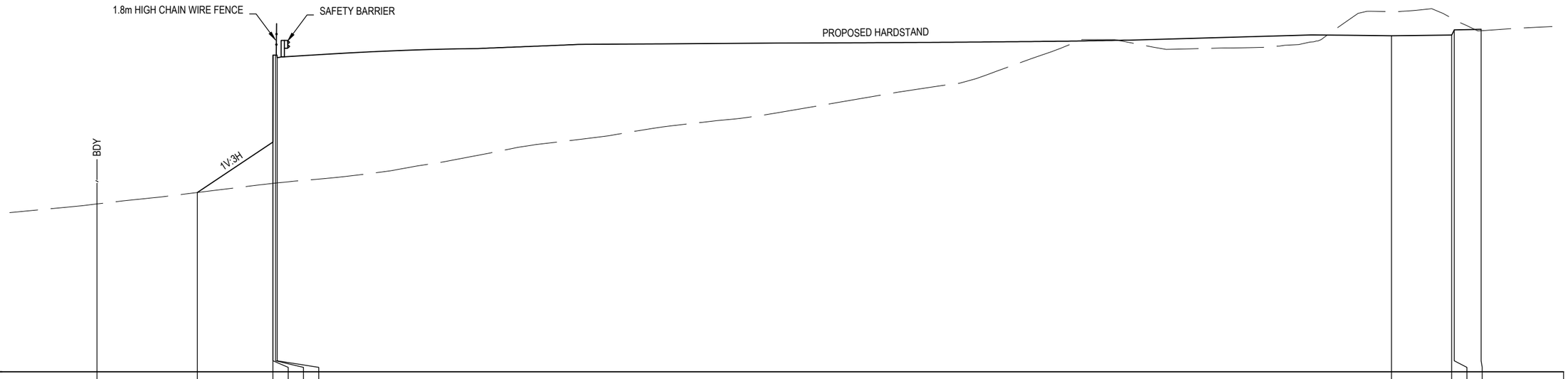
Drawing Title	Project No.	Scale	Figure No.	Issue
SITE SECTION C	NE160073	AS SHOWN @ A3	FIGURE 09	B



Datum RL154.00

DESIGN SURFACE		164.25	167.14	172.12	172.12	171.97	173.22	173.26	173.56	173.59	
NATURAL SURFACE	163.60	164.25	164.78	164.78	164.80	164.81	174.61	174.23	174.15	173.51	
CUT/FILL DEPTH (-ve/+ve)		0.00	2.36	7.34	7.32	7.16	-1.39	-0.97	-0.59	0.08	
OFFSET FROM SOUTHERN BDY	0.00	11.50	20.16	20.17	20.47	20.65	148.33	155.22	155.52	158.59	

SECTION D (FIG-3)
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250

SCALE 1:500 @ A3 — 0 5 10 17.5 25m
SCALE 1:250 @ A3 — 0 2.5 5 8.75 12.5m

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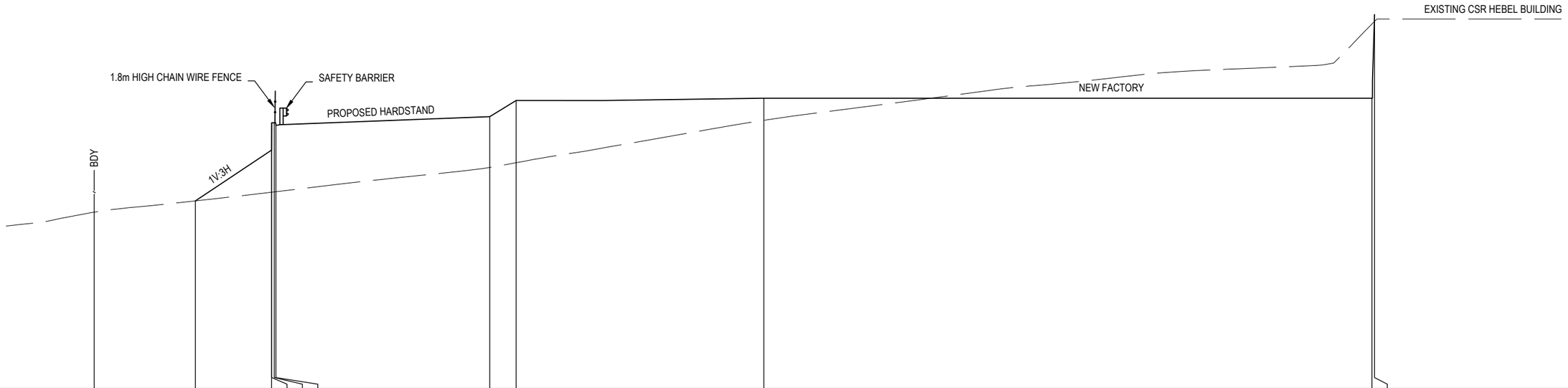
Drawing Title: SITE SECTION D

Project No.	Scale	Figure No.	Issue
NE160073	AS SHOWN @ A3	FIGURE 10	B



Datum RL157.00

DESIGN SURFACE		167.66	170.55	172.10	172.10	171.95	172.45	173.37	173.50		173.50	178.25
NATURAL SURFACE	167.02	167.67	168.16	168.16	168.18	168.19	169.57	169.83	172.24		177.72	177.87
CUT/FILL DEPTH (-ve/+ve)		-0.00	2.39	3.95	3.93	3.77	2.88	3.54	1.26		-4.22	0.38
OFFSET FROM SOUTHERN BDY	0.00	11.50	20.16	20.17	20.47	20.65	44.95	47.95	76.10		145.20	145.50

SECTION E
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250
FIG-3

SCALE 1:500 @ A3 — 0 5 10 17.5 25m
SCALE 1:250 @ A3 — 0 2.5 5 8.75 12.5m

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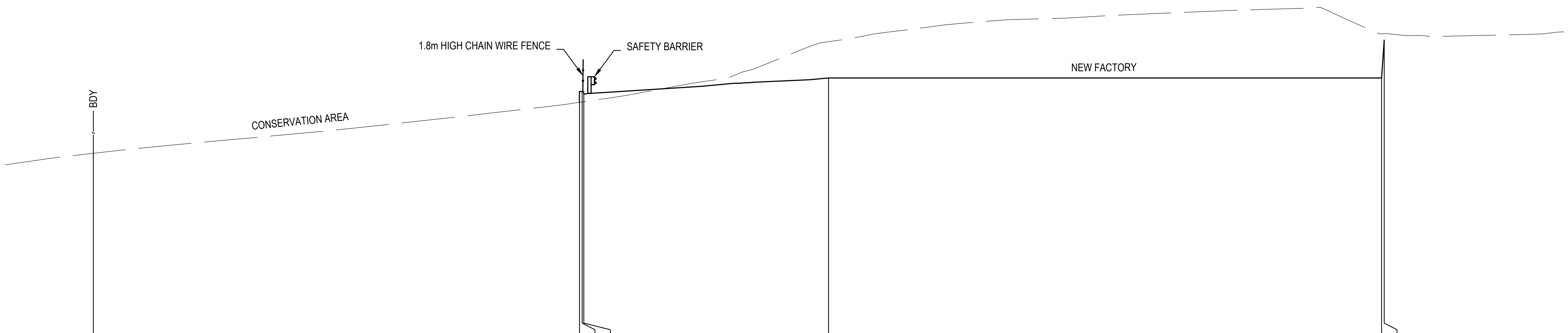
Drawing Title
SITE SECTION E

Project No.	Scale	Figure No.	Issue
NE160073	AS SHOWN @ A3	FIGURE 11	B

Apr 28, 2016 - 3:25pm P:\NE\NE160073\Drawings\CIVil\grams\NE160073_FIG-11_B.dwg



Datum RL159.00

	BDY						
DESIGN SURFACE		172.74	172.73	172.58	173.50	173.50	175.64
NATURAL SURFACE	169.24	172.12	172.14	172.16	175.56	176.00	176.01
CUT/FILL DEPTH (-ve/+ve)		0.61	0.59	0.43	-2.06	-2.50	-0.36
OFFSET FROM SOUTHERN BDY	0.00	55.12	55.42	55.60	83.34	146.05	146.35

SECTION F (FIG-3)
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250

SCALE 1:500 @ A3: 0 5 10 17.5 25m
SCALE 1:250 @ A3: 0 2.5 5 8.75 12.5m

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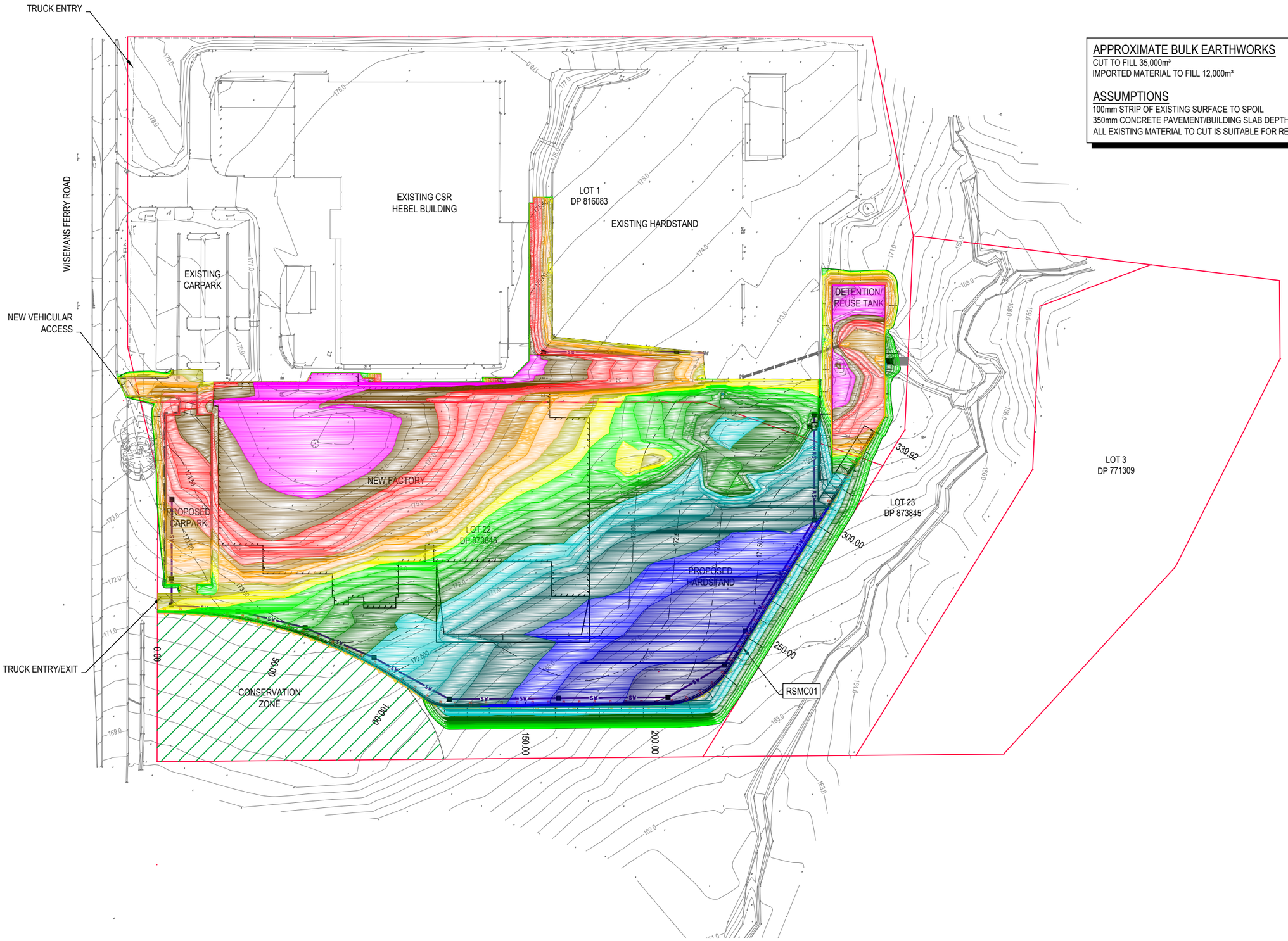
Drawing Title			
SITE SECTION F			
Project No. NE160073	Scale AS SHOWN @ A3	Figure No. FIGURE 12	Issue B



APPROXIMATE BULK EARTHWORKS

CUT TO FILL 35,000m³
IMPORTED MATERIAL TO FILL 12,000m³

ASSUMPTIONS

100mm STRIP OF EXISTING SURFACE TO SPOIL
350mm CONCRETE PAVEMENT/BUILDING SLAB DEPTH
ALL EXISTING MATERIAL TO CUT IS SUITABLE FOR REUSE

NOTE: CUT (-ve) FILL (+ve)

-8	to	-6.5	m
-6.5	to	-5	m
-5.00	to	-4.00	m
-4.00	to	-3.00	m
-3.00	to	-2.50	m
-2.50	to	-2.00	m
-2.00	to	-1.50	m
-1.50	to	-1.00	m
-1.00	to	-0.75	m
-0.75	to	-0.50	m
-0.50	to	-0.25	m
-0.25	to	0.00	m
0.00	to	0.25	m
0.25	to	0.5	m
0.50	to	0.75	m
0.75	to	1.00	m
1.00	to	1.50	m
1.50	to	2.00	m
2.00	to	2.50	m
2.50	to	3.00	m
3.00	to	4.00	m
4.00	to	5.00	m
5.00	to	6.5	m
6.5	to	8	m

SCALE 1:1500 @ A3

0 15 30 52.5 75m

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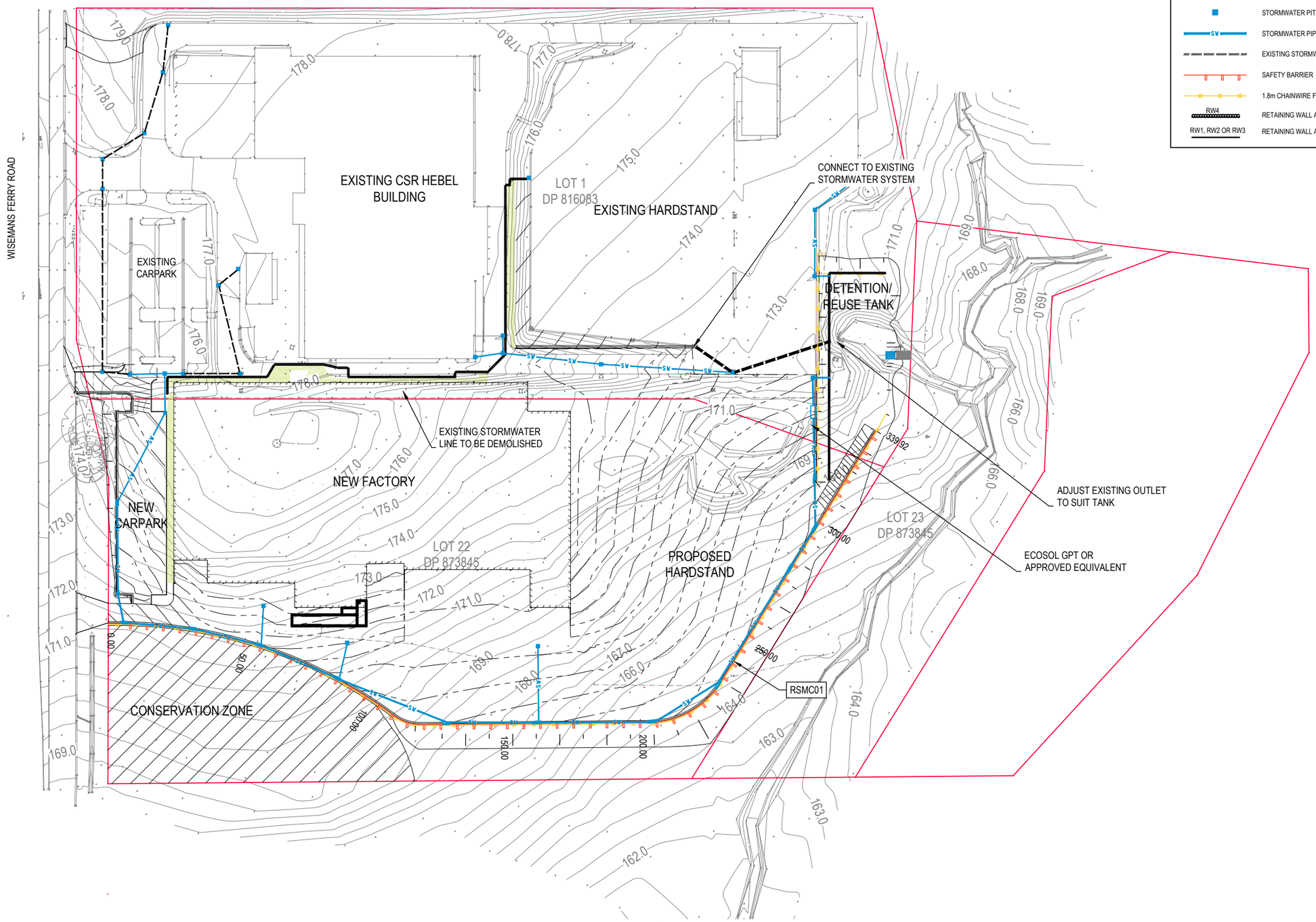
Drawing Title: CUT/FILL PLAN

Project No.	Scale	Figure No.	Issue
NE160073	1:1500 @ A3	FIGURE 13	B

Apr 28, 2016 - 2:29pm P:\NE160073\Drawing\CIVIL\Figures\NE160073_FIG 13 B.dwg



LEGEND

- 173.00 — DESIGN CONTOURS
- NATURAL CONTOURS
- STORMWATER PIT
- SW — STORMWATER PIPE
- EXISTING STORMWATER PIPE
- SAFETY BARRIER
- 1.8m CHAINWIRE FENCE
- RW4 — RETAINING WALL AND TYPE
- RW1, RW2 OR RW3 — RETAINING WALL AND TYPE

SCALE 1:1500 @ A3

0 15 30 52.5 75m

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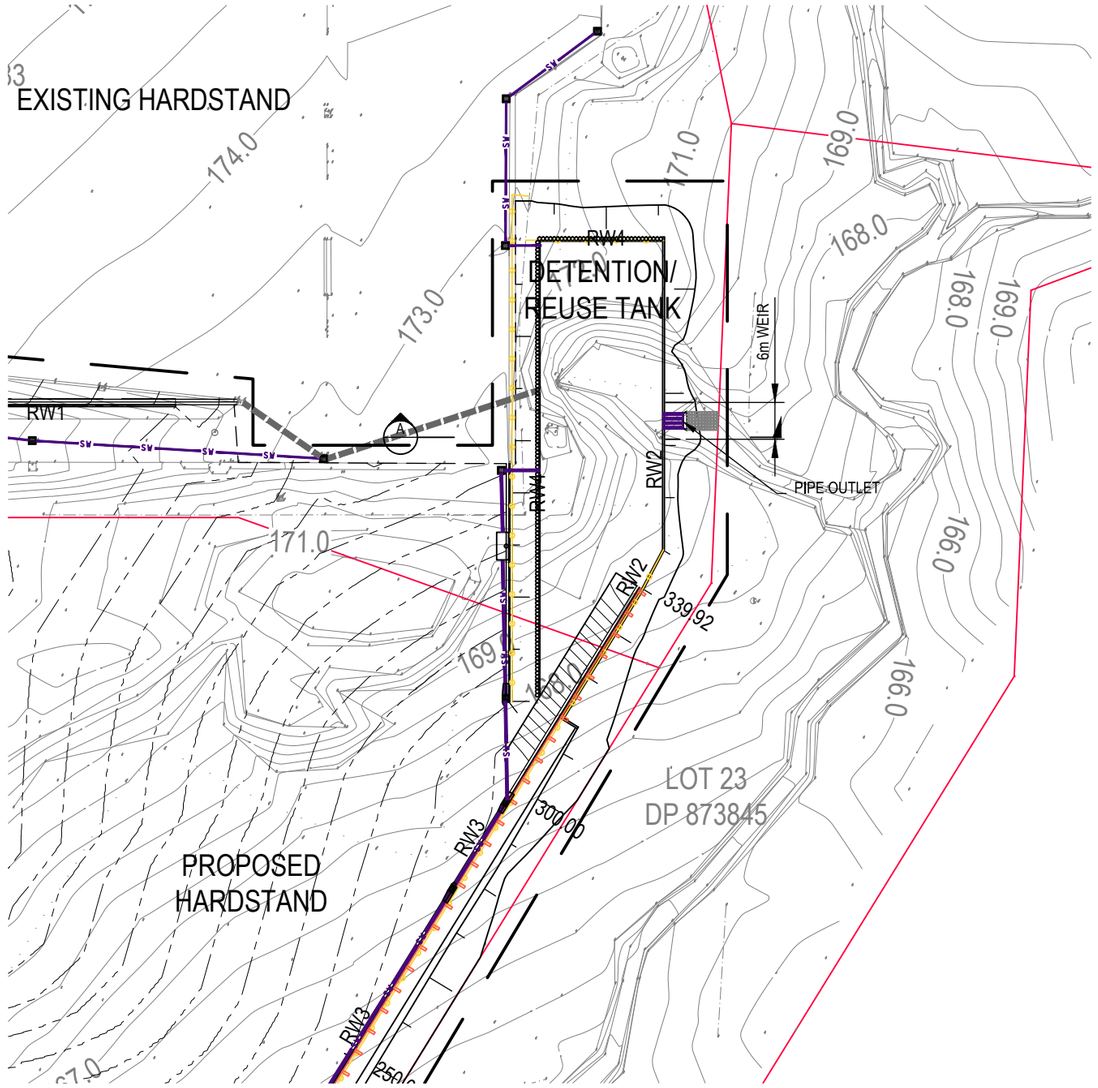
Drawing Title
STORMWATER MANAGEMENT PLAN

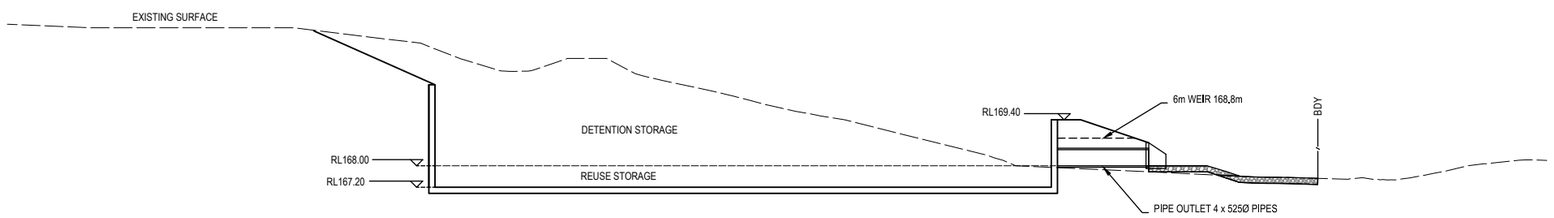
Project No.	Scale	Figure No.	Issue
NE160073	1:1500 @ A3	FIGURE 14	C

Oct 26, 2016 - 4:19pm P:\NE\NE160073 - CSR HEBEL\Drawings\CAD\Figures\NE160073_FIG14_C.dwg



LEGEND

- 173.00 — DESIGN CONTOURS
- NATURAL CONTOURS
- STORMWATER PIT
- SW — STORMWATER PIPE
- EXISTING STORMWATER PIPE
- SAFETY BARRIER
- 1.8m CHAINWIRE FENCE
- RW4 — RETAINING WALL AND TYPE
- RW1, RW2 OR RW3 — RETAINING WALL AND TYPE



SECTION A
SCALE = 1:200

SCALE 1:1000 @ A3 — 0 10 20 35 50m

SCALE 1:200 @ A3 — 0 2 4 7 10m

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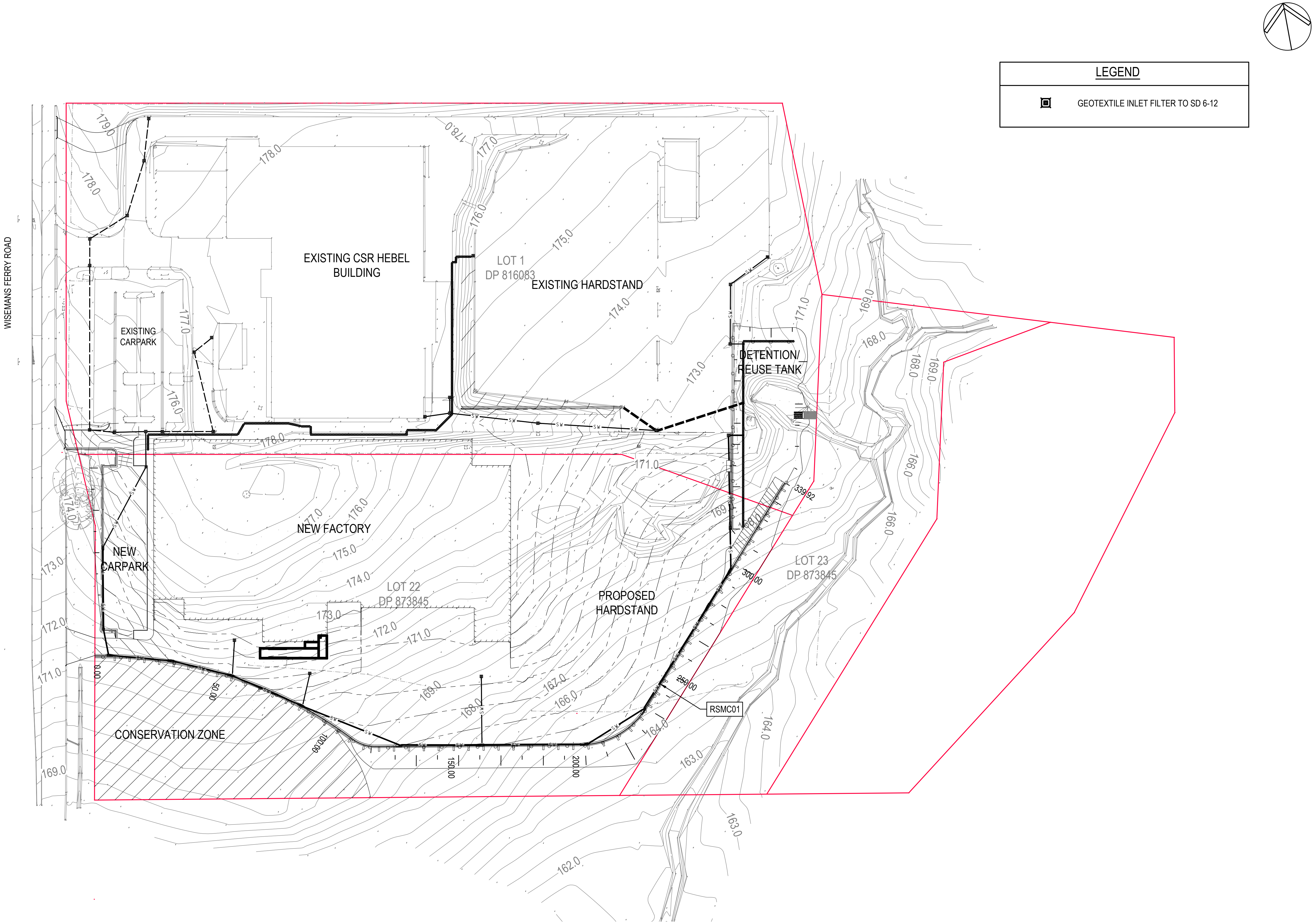
Drawing Title
REUSE/DETENTION TANK DETAILS

Project No.	Scale	Figure No.	Issue
NE160073	AS SHOWN @ A3	FIGURE 15	C

Oct 28, 2016 - 1:56pm P:\NE\NE160073 - CSR THEBE\Drawings\CAD\Figures\NE160073 FIG 15_C.dwg



LEGEND

GEOTEXTILE INLET FILTER TO SD 6-12

SCALE 1:1500 @ A3

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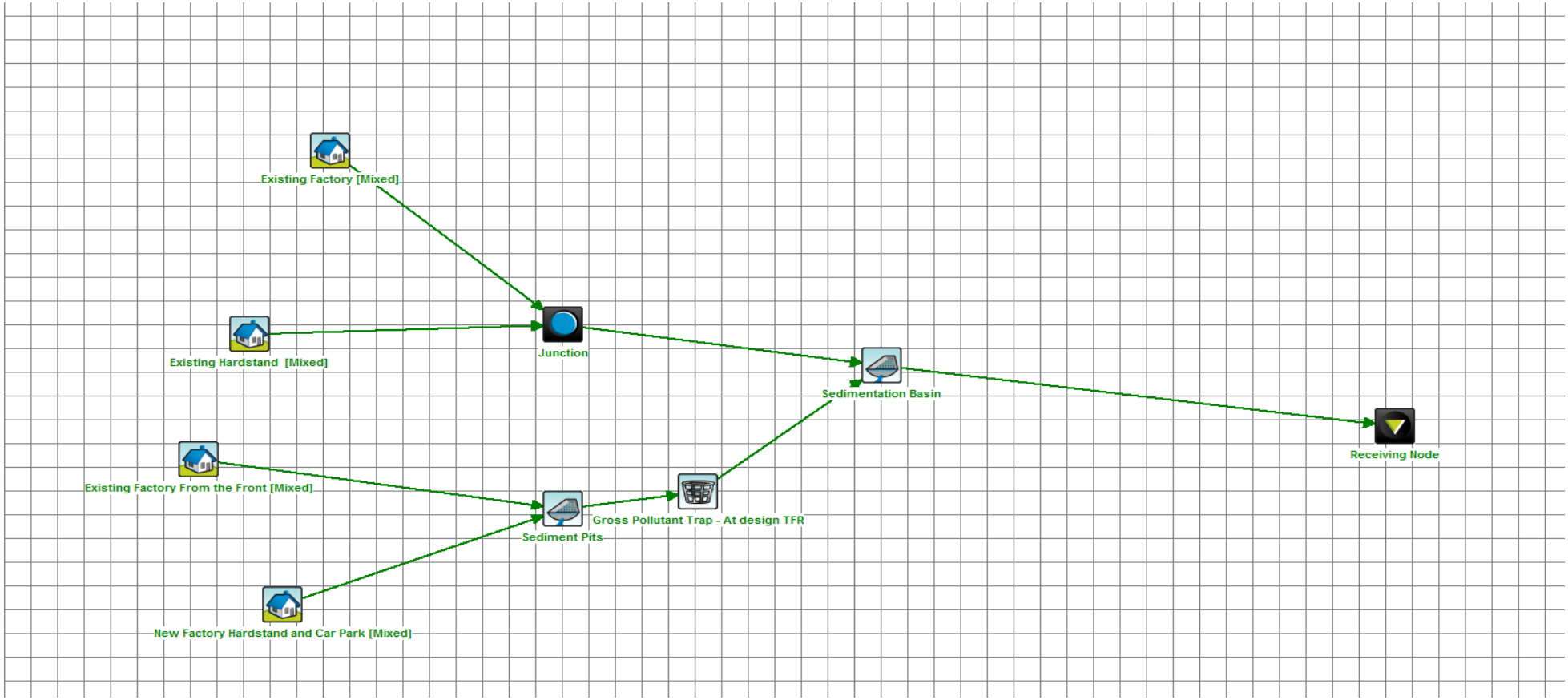
Drawing Title
EROSION AND SEDIMENT CONTROL PLAN

Project No.	Scale	Figure No.	Issue
NE160073	1:1500 @ A3	FIGURE 16	C

Appendix A – MUSIC Modelling Inputs and Results

CSR Hebel Line 2 MUSIC Model Schematic



CSR Hebel Line 2 MUSIC Model Input and Results Summary

Source nodes

Location	New Factory Hardstand and Car Park	Existing Hardstand	Existing Factory	Existing Factory From the Front
ID	1	3	4	8
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode
Zoning Surface Type	Mixed	Mixed	Mixed	Mixed
Total Area (ha)	3.24	1.688	0.84	1.132
Area Impervious (ha)	3.073043284	1.607379104	0.84	0.85183
Area Pervious (ha)	0.166956716	0.080620896	0	0.28017
Field Capacity (mm)	80	80	80	80
Pervious Area Infiltration Capacity coefficient - a	200	200	200	200
Pervious Area Infiltration Capacity exponent - b	1	1	1	1
Impervious Area Rainfall Threshold (mm/day)	1	1	1	1
Pervious Area Soil Storage Capacity (mm)	200	200	200	200
Pervious Area Soil Initial Storage (% of Capacity)	30	30	30	30
Groundwater Initial Depth (mm)	10	10	10	10
Groundwater Daily Recharge Rate (%)	0.5	0.5	0.5	0.5
Groundwater Daily Baseflow Rate (%)	0.16	0.16	0.16	0.16
Groundwater Daily Deep Seepage Rate (%)	2	2	2	2
Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15	2.15
Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.32	0.32
Stormflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Suspended Solids Serial Correlation	0	0	0	0
Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6	-0.6
Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.25	0.25
Stormflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Phosphorus Serial Correlation	0	0	0	0
Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3	0.3
Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19
Stormflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Nitrogen Serial Correlation	0	0	0	0
Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2	1.2
Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.17	0.17
Baseflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic
Baseflow Total Suspended Solids Serial Correlation	0	0	0	0
Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85	-0.85
Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19
Baseflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic
Baseflow Total Phosphorus Serial Correlation	0	0	0	0
Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11	0.11
Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.12	0.12
Baseflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic
Baseflow Total Nitrogen Serial Correlation	0	0	0	0
Flow based constituent generation - enabled	Off	Off	Off	Off
Flow based constituent generation - flow file				
Flow based constituent generation - base flow column				
Flow based constituent generation - pervious flow column				
Flow based constituent generation - impervious flow column				
Flow based constituent generation - unit				
OUT - Mean Annual Flow (ML/yr)	3.67E+01	1.91E+01	9.88E+00	10.8
OUT - TSS Mean Annual Load (kg/yr)	6.76E+03	3.52E+03	1.83E+03	1.99E+03
OUT - TP Mean Annual Load (kg/yr)	10.9	5.67	2.92	3.17
OUT - TN Mean Annual Load (kg/yr)	80.2	42.1	21.6	23.8
OUT - Gross Pollutant Mean Annual Load (kg/yr)	906	472	240	283
Rain In (ML/yr)	41.8611	21.8091	10.8529	14.6255
ET Loss (ML/yr)	5.09994	2.65696	0.97703	3.64235
Deep Seepage Loss (ML/yr)	0.099493	0.0518348	0	0.173806
Baseflow Out (ML/yr)	0.00780025	0.00406385	0	0.013626
Imp. Stormflow Out (ML/yr)	36.1879	18.8534	9.87586	9.98167
Perv. Stormflow Out (ML/yr)	0.466761	0.243177	0	0.815392
Total Stormflow Out (ML/yr)	36.6546	19.0966	9.87586	10.7971
Total Outflow (ML/yr)	36.6624	19.1007	9.87586	10.8107
Change in Soil Storage (ML/yr)	-0.00075745	-0.0003946	0	-0.00132
TSS Baseflow Out (kg/yr)	0.133485	0.069498	0	0.233033
TSS Total Stormflow Out (kg/yr)	6758.34	3522.02	1829.9	1988.96
TSS Total Outflow (kg/yr)	6758.47	3522.09	1829.9	1989.19
TP Baseflow Out (kg/yr)	0.0012129	0.00063165	0	0.002116
TP Total Stormflow Out (kg/yr)	10.8632	5.66921	2.91517	3.16598
TP Total Outflow (kg/yr)	10.8644	5.66984	2.91517	3.16809
TN Baseflow Out (kg/yr)	0.010441	0.00543915	0	0.018243
TN Total Stormflow Out (kg/yr)	80.1827	42.1317	21.5891	23.8013
TN Total Outflow (kg/yr)	80.1931	42.1371	21.5891	23.8195
GP Total Outflow (kg/yr)	906.306	472.174	240.483	283.009

No Imported Data Source nodes

USTM treatment nodes

Location	Sedimentation Basin	Sediment Pits
ID	7	9
Node Type	SedimentationBasinNode	SedimentationBasinNode
Lo-flow bypass rate (cum/sec)	0	0
Hi-flow bypass rate (cum/sec)	100	100
Inlet pond volume	0	0
Area (sqm)	1000	50
Initial Volume (m^3)	0	3
Extended detention depth (m)	1.5	1.8
Number of Rainwater tanks		
Permanent Pool Volume (cubic metres)	800	3
Proportion vegetated	0	0
Equivalent Pipe Diameter (mm)	1050	600
Overflow weir width (m)	6	2
Notional Detention Time (hrs)	0.132	2.22E-02
Orifice Discharge Coefficient	0.6	0.6
Weir Coefficient	1.7	1.7
Number of CSTR Cells	1	1

Total Suspended Solids - k (m/yr)		8000	8000
Total Suspended Solids - C* (mg/L)		20	20
Total Suspended Solids - C** (mg/L)		20	20
Total Phosphorus - k (m/yr)		6000	6000
Total Phosphorus - C* (mg/L)		0.13	0.13
Total Phosphorus - C** (mg/L)		0.13	0.13
Total Nitrogen - k (m/yr)		500	500
Total Nitrogen - C* (mg/L)		1.4	1.4
Total Nitrogen - C** (mg/L)		1.4	1.4
Threshold Hydraulic Loading for C** (m/yr)		3500	3500
Horizontal Flow Coefficient			
Reuse Enabled	On	Off	
Max drawdown height (m)		0.8	
Annual Demand Enabled	Off	Off	
Annual Demand Value (ML/year)			
Annual Demand Distribution			
Annual Demand Monthly Distribution: Jan			
Annual Demand Monthly Distribution: Feb			
Annual Demand Monthly Distribution: Mar			
Annual Demand Monthly Distribution: Apr			
Annual Demand Monthly Distribution: May			
Annual Demand Monthly Distribution: Jun			
Annual Demand Monthly Distribution: Jul			
Annual Demand Monthly Distribution: Aug			
Annual Demand Monthly Distribution: Sep			
Annual Demand Monthly Distribution: Oct			
Annual Demand Monthly Distribution: Nov			
Annual Demand Monthly Distribution: Dec			
Daily Demand Enabled	On	Off	
Daily Demand Value (ML/day)		0.075	
Custom Demand Enabled	Off	Off	
Custom Demand Time Series File			
Custom Demand Time Series Units			
Filter area (sqm)			
Filter perimeter (m)			
Filter depth (m)			
Filter Median Particle Diameter (mm)			
Saturated Hydraulic Conductivity (mm/hr)			
Infiltration Media Porosity			
Length (m)			
Bed slope			
Base Width (m)			
Top width (m)			
Vegetation height (m)			
Vegetation Type			
Total Nitrogen Content in Filter (mg/kg)			
Orthophosphate Content in Filter (mg/kg)			
Is Base Lined?			
Is Underdrain Present?			
Is Submerged Zone Present?			
Submerged Zone Depth (m)			
B for Media Soil Texture		-9999	-9999
Proportion of upstream impervious area treated			
Exfiltration Rate (mm/hr)		0	0
Evaporative Loss as % of PET		100	75
Depth in metres below the drain pipe			
TSS A Coefficient			
TSS B Coefficient			
TP A Coefficient			
TP B Coefficient			
TN A Coefficient			
TN B Coefficient			
Sfc			
S*			
Sw			
Sh			
Emax (m/day)			
Ew (m/day)			
IN - Mean Annual Flow (ML/yr)		7.64E+01	47.5
IN - TSS Mean Annual Load (kg/yr)		8.27E+03	8.75E+03
IN - TP Mean Annual Load (kg/yr)		15.2	14
IN - TN Mean Annual Load (kg/yr)		120	104
IN - Gross Pollutant Mean Annual Load (kg/yr)		713	1.19E+03
OUT - Mean Annual Flow (ML/yr)		5.62E+01	47.4
OUT - TSS Mean Annual Load (kg/yr)		2.60E+03	6.43E+03
OUT - TP Mean Annual Load (kg/yr)		8.67	12
OUT - TN Mean Annual Load (kg/yr)		85.5	102
OUT - Gross Pollutant Mean Annual Load (kg/yr)		0	0
Flow In (ML/yr)		76.3985	47.449
ET Loss (ML/yr)		0.908535	0.0468066
Infiltration Loss (ML/yr)		0	0
Low Flow Bypass Out (ML/yr)		0	0
High Flow Bypass Out (ML/yr)		0	0
Orifice / Filter Out (ML/yr)		56.161	47.247
Weir Out (ML/yr)		0.02949	0.179161
Transfer Function Out (ML/yr)		0	0
Reuse Supplied (ML/yr)		18.9993	0
Reuse Requested (ML/yr)		26.9074	0
% Reuse Demand Met		70.6103	0
% Load Reduction		26.4508	0.0481348
TSS Flow In (kg/yr)		8266.45	8747.65
TSS ET Loss (kg/yr)		0	0
TSS Infiltration Loss (kg/yr)		0	0
TSS Low Flow Bypass Out (kg/yr)		0	0
TSS High Flow Bypass Out (kg/yr)		0	0
TSS Orifice / Filter Out (kg/yr)		2596.8	6401.15
TSS Weir Out (kg/yr)		3.92014	31.0444

TSS Transfer Function Out (kg/yr)		0	0
TSS Reuse Supplied (kg/yr)		401.821	0
TSS Reuse Requested (kg/yr)		0	0
TSS % Reuse Demand Met		0	0
TSS % Load Reduction		68.5389	26.4695
TP Flow In (kg/yr)		15.2262	14.0325
TP ET Loss (kg/yr)		0	0
TP Infiltration Loss (kg/yr)		0	0
TP Low Flow Bypass Out (kg/yr)		0	0
TP High Flow Bypass Out (kg/yr)		0	0
TP Orifice / Filter Out (kg/yr)		8.6671	11.9778
TP Weir Out (kg/yr)		0.00619185	0.0495412
TP Transfer Function Out (kg/yr)		0	0
TP Reuse Supplied (kg/yr)		2.52737	0
TP Reuse Requested (kg/yr)		0	0
TP % Reuse Demand Met		0	0
TP % Load Reduction		43.0369	14.2891
TN Flow In (kg/yr)		119.941	104.013
TN ET Loss (kg/yr)		0	0
TN Infiltration Loss (kg/yr)		0	0
TN Low Flow Bypass Out (kg/yr)		0	0
TN High Flow Bypass Out (kg/yr)		0	0
TN Orifice / Filter Out (kg/yr)		85.424	101.532
TN Weir Out (kg/yr)		0.0523925	0.344896
TN Transfer Function Out (kg/yr)		0	0
TN Reuse Supplied (kg/yr)		27.4207	0
TN Reuse Requested (kg/yr)		0	0
TN % Reuse Demand Met		0	0
TN % Load Reduction		28.7346	2.0537
GP Flow In (kg/yr)		712.65	1189.27
GP ET Loss (kg/yr)		0	0
GP Infiltration Loss (kg/yr)		0	0
GP Low Flow Bypass Out (kg/yr)		0	0
GP High Flow Bypass Out (kg/yr)		0	0
GP Orifice / Filter Out (kg/yr)		0	0
GP Weir Out (kg/yr)		0	0
GP Transfer Function Out (kg/yr)		0	0
GP Reuse Supplied (kg/yr)		0	0
GP Reuse Requested (kg/yr)		0	0
GP % Reuse Demand Met		0	0
GP % Load Reduction		100	100
PET Scaling Factor			

Generic treatment nodes		
Location	Gross Pollutant Trap - At design TFR	
ID		6
Node Type	GPTNode	
Lo-flow bypass rate (cum/sec)		0
Hi-flow bypass rate (cum/sec)		1
Flow Transfer Function		
Input (cum/sec)		0
Output (cum/sec)		0
Input (cum/sec)		10
Output (cum/sec)		10
Input (cum/sec)		
Output (cum/sec)		
Input (cum/sec)		
Output (cum/sec)		
Input (cum/sec)		
Output (cum/sec)		
Input (cum/sec)		
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Input (cum/sec)		
Output (cum/sec)		
Input (cum/sec)		
Output (cum/sec)		
Input (cum/sec)		
Output (cum/sec)		
Input (cum/sec)		
Output (cum/sec)		
Gross Pollutant Transfer Function		
Enabled	TRUE	
Input (kg/ML)		0
Output (kg/ML)		0
Input (kg/ML)		1000
Output (kg/ML)		0
Input (kg/ML)		
Output (kg/ML)		
Input (kg/ML)		
Output (kg/ML)		
Input (kg/ML)		
Output (kg/ML)		
Input (kg/ML)		
Output (kg/ML)		
Input (kg/ML)		
Output (kg/ML)		
Input (kg/ML)		
Output (kg/ML)		
Input (kg/ML)		
Output (kg/ML)		
Input (kg/ML)		
Output (kg/ML)		
Total Nitrogen Transfer Function		
Enabled	TRUE	
Input (mg/L)		0
Output (mg/L)		0
Input (mg/L)		1000

Output (mg/L)			550
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Total Phosphorus Transfer Function			
Enabled		TRUE	
Input (mg/L)			0
Output (mg/L)			0
Input (mg/L)			1000
Output (mg/L)			550
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
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Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Total Suspended Solids Transfer Function			
Enabled		TRUE	
Input (mg/L)			0
Output (mg/L)			0
Input (mg/L)			1000
Output (mg/L)			450
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
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Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
Input (mg/L)			
Output (mg/L)			
TSS Flow based Efficiency Enabled	Off		
TSS Flow based Efficiency			
TP Flow based Efficiency Enabled	Off		
TP Flow based Efficiency			
TN Flow based Efficiency Enabled	Off		
TN Flow based Efficiency			
GP Flow based Efficiency Enabled	Off		
GP Flow based Efficiency			
IN - Mean Annual Flow (ML/yr)			4.74E+01
IN - TSS Mean Annual Load (kg/yr)			6.43E+03
IN - TP Mean Annual Load (kg/yr)			12
IN - TN Mean Annual Load (kg/yr)			102
IN - Gross Pollutant Mean Annual Load (kg/yr)			0
OUT - Mean Annual Flow (ML/yr)			4.74E+01
OUT - TSS Mean Annual Load (kg/yr)			2.91E+03
OUT - TP Mean Annual Load (kg/yr)			6.64
OUT - TN Mean Annual Load (kg/yr)			56.2
OUT - Gross Pollutant Mean Annual Load (kg/yr)			0
Flow In (ML/yr)			47.4261
ET Loss (ML/yr)			0
Infiltration Loss (ML/yr)			0
Low Flow Bypass Out (ML/yr)			0
High Flow Bypass Out (ML/yr)			0.209621
Orifice / Filter Out (ML/yr)			0
Weir Out (ML/yr)			0
Transfer Function Out (ML/yr)			47.2165
Reuse Supplied (ML/yr)			0
Reuse Requested (ML/yr)			0
% Reuse Demand Met			0
% Load Reduction			-4.89E-05
TSS Flow In (kg/yr)			6431.75
TSS ET Loss (kg/yr)			0
TSS Infiltration Loss (kg/yr)			0
TSS Low Flow Bypass Out (kg/yr)			0
TSS High Flow Bypass Out (kg/yr)			36.2796
TSS Orifice / Filter Out (kg/yr)			0

TSS Weir Out (kg/yr)		0
TSS Transfer Function Out (kg/yr)		2878
TSS Reuse Supplied (kg/yr)		0
TSS Reuse Requested (kg/yr)		0
TSS % Reuse Demand Met		0
TSS % Load Reduction		54.6892
TP Flow In (kg/yr)		12.0265
TP ET Loss (kg/yr)		0
TP Infiltration Loss (kg/yr)		0
TP Low Flow Bypass Out (kg/yr)		0
TP High Flow Bypass Out (kg/yr)		0.0579905
TP Orifice / Filter Out (kg/yr)		0
TP Weir Out (kg/yr)		0
TP Transfer Function Out (kg/yr)		6.58272
TP Reuse Supplied (kg/yr)		0
TP Reuse Requested (kg/yr)		0
TP % Reuse Demand Met		0
TP % Load Reduction		44.7825
TN Flow In (kg/yr)		101.866
TN ET Loss (kg/yr)		0
TN Infiltration Loss (kg/yr)		0
TN Low Flow Bypass Out (kg/yr)		0
TN High Flow Bypass Out (kg/yr)		0.406928
TN Orifice / Filter Out (kg/yr)		0
TN Weir Out (kg/yr)		0
TN Transfer Function Out (kg/yr)		55.8062
TN Reuse Supplied (kg/yr)		0
TN Reuse Requested (kg/yr)		0
TN % Reuse Demand Met		0
TN % Load Reduction		44.8168
GP Flow In (kg/yr)		0
GP ET Loss (kg/yr)		0
GP Infiltration Loss (kg/yr)		0
GP Low Flow Bypass Out (kg/yr)		0
GP High Flow Bypass Out (kg/yr)		0
GP Orifice / Filter Out (kg/yr)		0
GP Weir Out (kg/yr)		0
GP Transfer Function Out (kg/yr)		0
GP Reuse Supplied (kg/yr)		0
GP Reuse Requested (kg/yr)		0
GP % Reuse Demand Met		0
GP % Load Reduction		100

Other nodes

Location	Receiving Node	Junction	
ID		2	5
Node Type	ReceivingNode	JunctionNode	
IN - Mean Annual Flow (ML/yr)		5.62E+01	29
IN - TSS Mean Annual Load (kg/yr)		2.60E+03	5.35E+03
IN - TP Mean Annual Load (kg/yr)		8.67	8.58
IN - TN Mean Annual Load (kg/yr)		85.5	63.7
IN - Gross Pollutant Mean Annual Load (kg/yr)		0	713
OUT - Mean Annual Flow (ML/yr)		56.2	29
OUT - TSS Mean Annual Load (kg/yr)		2.60E+03	5.35E+03
OUT - TP Mean Annual Load (kg/yr)		8.67	8.58
OUT - TN Mean Annual Load (kg/yr)		85.5	63.7
OUT - Gross Pollutant Mean Annual Load (kg/yr)		0	713
% Load Reduction		26.5	-9.55E-11
TSS % Load Reduction		81.6	1.92E-12
TN % Load Reduction		49	7.14E-13
TP % Load Reduction		61.7	-5.38E-13
GP % Load Reduction		100	1.16E-11

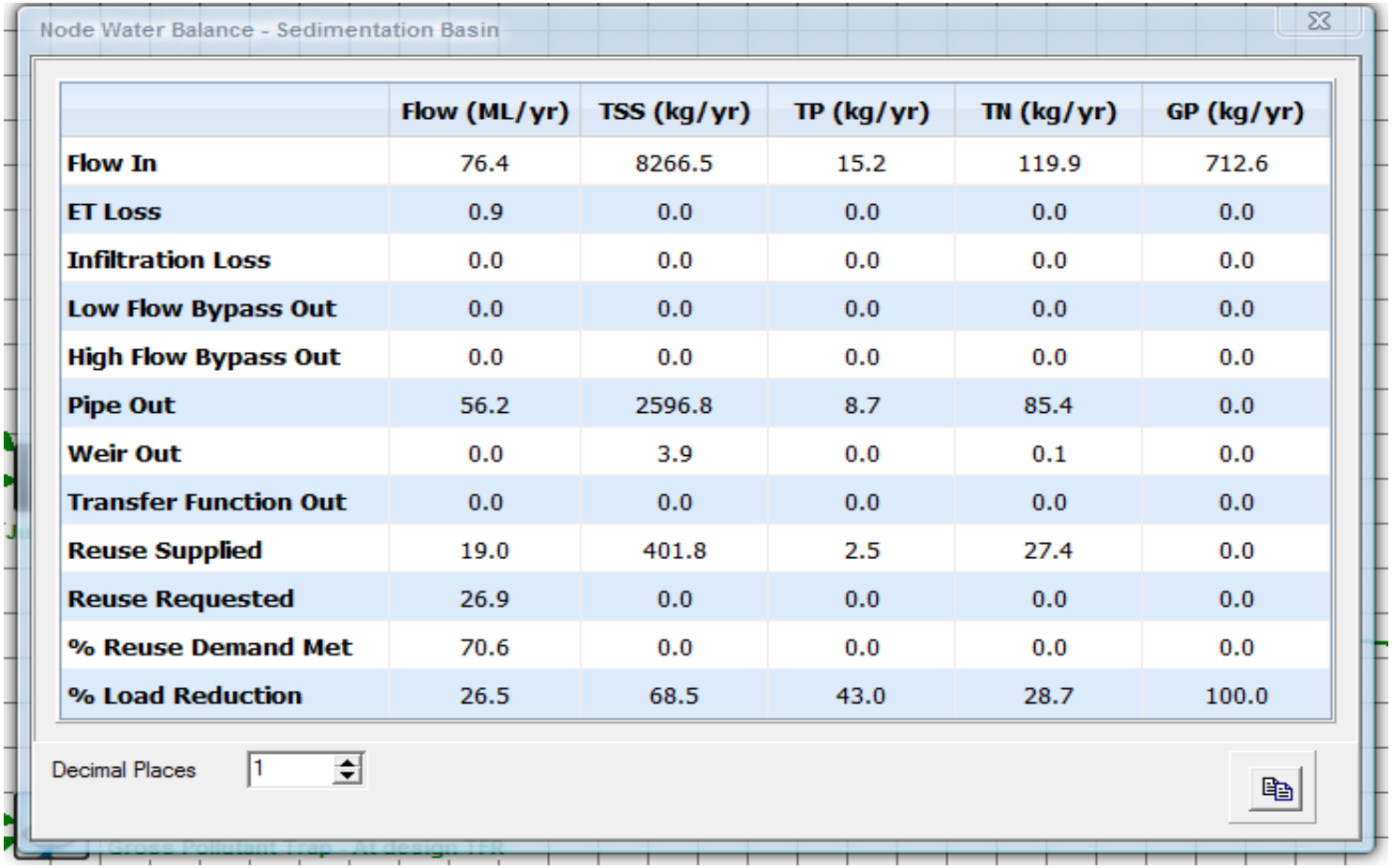
Links

Location	Drainage Link	Drainage Link	Drainage Link	Drainage Li	Drainage Li	Drainage Li	Drainage Li	Drainage Li	Drainage Link
Source node ID	4	3	6	7	8	1	9	5	
Target node ID	5	5	7	2	9	9	6	7	
Muskingum-Cunge Routing	Not Routed	Not Routed	Not Routed	Not Routec	Not Routec	Not Routec	Not Routec	Not Routed	
Muskingum K									
Muskingum theta									
IN - Mean Annual Flow (ML/yr)	9.88E+00	1.91E+01	4.74E+01	5.62E+01	1.08E+01	36.7	47.4	29	
IN - TSS Mean Annual Load (kg/yr)	1.83E+03	3.52E+03	2.91E+03	2.60E+03	1.99E+03	6.76E+03	6.43E+03	5.35E+03	
IN - TP Mean Annual Load (kg/yr)	2.92	5.67	6.64	8.67	3.17	10.9	12	8.58	
IN - TN Mean Annual Load (kg/yr)	21.6	42.1	56.2	85.5	23.8	80.2	102	63.7	
IN - Gross Pollutant Mean Annual Load (kg/yr)	240	472	0	0	283	906	0	713	
OUT - Mean Annual Flow (ML/yr)	9.88E+00	1.91E+01	4.74E+01	5.62E+01	1.08E+01	36.7	47.4	29	
OUT - TSS Mean Annual Load (kg/yr)	1.83E+03	3.52E+03	2.91E+03	2.60E+03	1.99E+03	6.76E+03	6.43E+03	5.35E+03	
OUT - TP Mean Annual Load (kg/yr)	2.92	5.67	6.64	8.67	3.17	10.9	12	8.58	
OUT - TN Mean Annual Load (kg/yr)	21.6	42.1	56.2	85.5	23.8	80.2	102	63.7	
OUT - Gross Pollutant Mean Annual Load (kg/yr)	240	472	0	0	283	906	0	713	

Catchment Details

Catchment Name	Hebal MUSIC Modelling Toilet only reusel 1000 m3 Ecosol sed basin 1 x Ecosol GPT	
Timestep	6 Minutes	
Start Date		1/01/1974 0:00
End Date		31/12/1993 23:54
Rainfall Station	66062 SYDNEY	
ET Station	User-defined monthly PET	
Mean Annual Rainfall (mm)		1297
Mean Annual ET (mm)		1261
MUSIC-link Area	Upland	
MUSIC-link Scenario	Wyong Development	
MUSIC-link Scenario	Wyong Development	

CSR Hebel Line 2 MUSIC Model Water balance Results for Detention/Reuse Tank



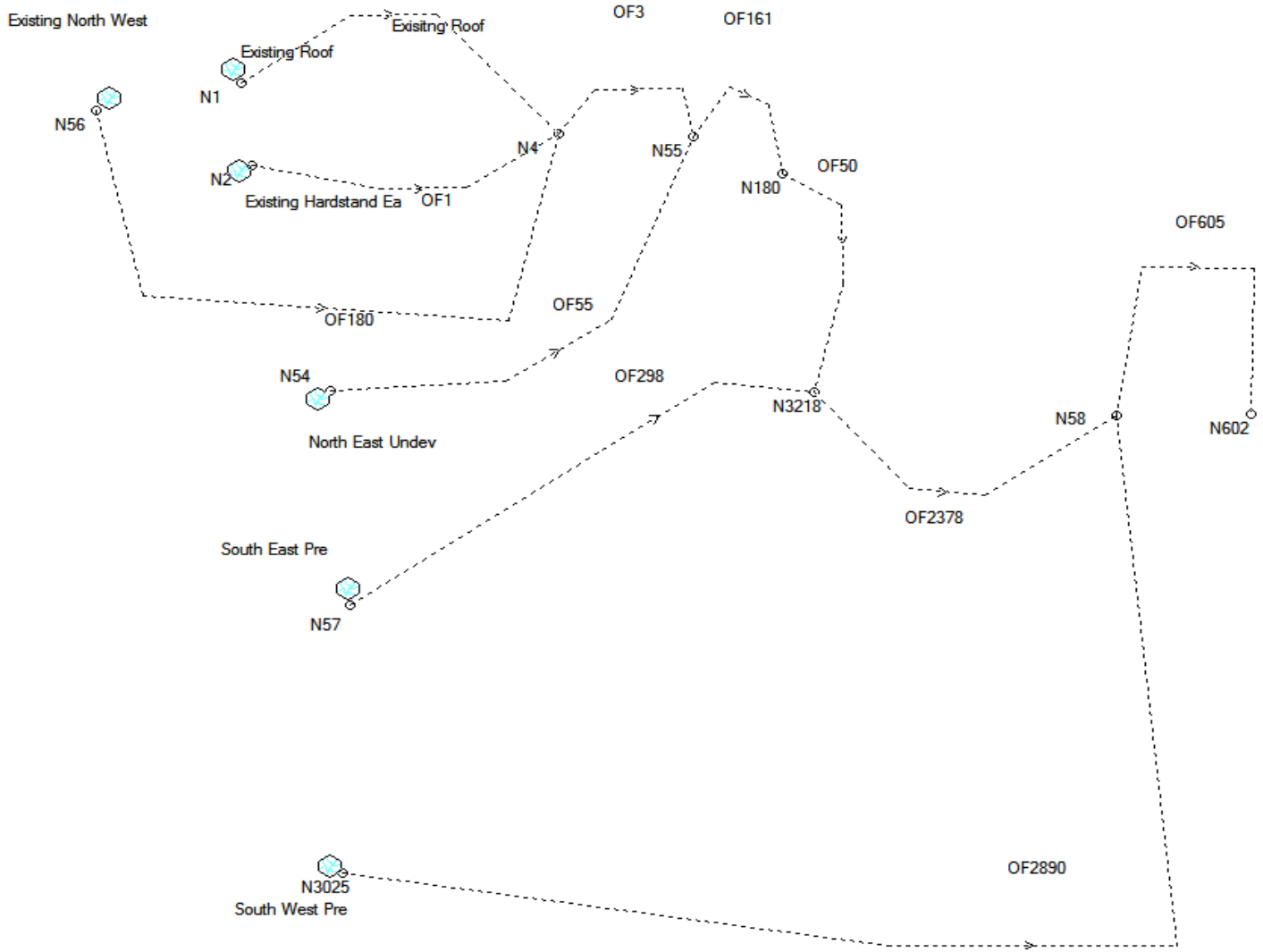
	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	GP (kg/yr)
Flow In	76.4	8266.5	15.2	119.9	712.6
ET Loss	0.9	0.0	0.0	0.0	0.0
Infiltration Loss	0.0	0.0	0.0	0.0	0.0
Low Flow Bypass Out	0.0	0.0	0.0	0.0	0.0
High Flow Bypass Out	0.0	0.0	0.0	0.0	0.0
Pipe Out	56.2	2596.8	8.7	85.4	0.0
Weir Out	0.0	3.9	0.0	0.1	0.0
Transfer Function Out	0.0	0.0	0.0	0.0	0.0
Reuse Supplied	19.0	401.8	2.5	27.4	0.0
Reuse Requested	26.9	0.0	0.0	0.0	0.0
% Reuse Demand Met	70.6	0.0	0.0	0.0	0.0
% Load Reduction	26.5	68.5	43.0	28.7	100.0

CSR Hebel Line 2 Pollutant Reduction Summary

Pollutant	Total Pollutant Runoff	Total Runoff	Total Reduction %
	(kg/yr)	(kg/yr)	
TSS	14,200	2,640	81
TP	22.7	8.69	62
TN	168	49	49

Appendix B – DRAINS Modelling Inputs and Results

CSR Hebel DRAINS Exisitng (Predeveloped) Model Schematic



CSR Hebel DRAINS Exisitng (Predeveloped) DRAINS Inputs

PIT / NODE DETAILS Version 13

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is
N1	Node							0		417	-168		3		No	
N2	Node							0		426	-246		6		No	
N4	Node							0		690	-216		8		No	
N54	Node							0		494	-459		127		No	
N55	Node							0		806	-218		132		No	
N56	Node							0		291	-194		150		No	
N57	Node							0		510	-663		154		No	
N58	Node							0		1171	-483		155		No	
N180	Node							0		883	-253		447		No	
N602	Node							0		1287	-482		1532		No	
N3025	Node							0		504.4	-916		7505		No	
N3218	Node							0		909.703	-461.194		7983		No	

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length	id

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor	Rainfall Multiplier
Existing Ro	N1	0.836	100	0	0	5	0	0										0				1
Existing Ha	N2	1.69	95	5	0	5	10	0										0				1
North East	N54	0.319	0	100	0	5	10	0										0				1
Existing No	N56	1.132	75	25	0	5	10	0										0				1
South East	N57	2.757	0	100	0	5	3	0	-1	50	-1	-1	8	-1	-1	0.1	-1	0				1
South Wes	N3025	0.9717	0	100	0	5	10	0										0				1

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	etc	etc

CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Stor (m)	Safe Depth Minor Stor (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id
Exisitng Ro	N1	N4	0.1				Swale with	0.15	0.1	1	1	0	10
OF1	N2	N4	0.1				Swale with	0.15	0.1	1	1	0	9
OF3	N4	N55	0.1				Swale with	0.15	0.1	1	1	0	12
OF55	N54	N55	0.1				Swale with	0.15	0.1	1	1	0	139
OF161	N55	N180	0.1				Swale with	0.15	0.1	1	1	0	448

60
1
1
1
1
1

OF180	N56	N4	1	4 m wide p	0.3	0.15	0.4	1	0	468	
OF298	N57	N3218	0.1	Swale with	0.15	0.1	1	1	0	790	0.1
OF605	N58	N602	0.1	Swale with	0.15	0.1	1	1	0	1533	
OF50	N180	N3218	0.1	Swale with	0.15	0.1	1	1	0	134	1
OF2890	N3025	N58	0.1	Swale with	0.15	0.1	1	1	0	7506	1
OF2378	N3218	N58	0.1	Swale with	0.15	0.1	1	1	0	6189	0.1

PIPE COVER DETAILS

Name	Type	Dia (mm)	Safe Cover	Cover (m)

CSR Hebel DRAINS Exisitng (Predeveloped) DRAINS 1 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.205	0.205	0	5	0	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
Existing Hardstand Ea	0.4	0.395	0.006	5	10	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
North East Undev	0.034	0	0.034	5	10	0	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
Existing North West	0.229	0.202	0.029	5	10	0	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
South East Pre	0.215	0	0.215	5	14.17	0	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
South West Pre	0.103	0	0.103	5	10	0	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1

Outflow Volumes for Total Catchment (3.29 impervious + 4.42 pervious = 7.71 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 1 year, 5 minutes storm, average 90.9 mm/h, Zone 1	584.03	216.49 (37.1%)	216.49 (86.8%)	0.00 (0.0%)
AR&R 1 year, 10 minutes storm, average 70.1 mm/h, Zone 1	899.77	379.12 (42.1%)	351.32 (91.4%)	27.80 (5.4%)
AR&R 1 year, 15 minutes storm, average 58.3 mm/h, Zone 1	1123.49	535.89 (47.7%)	446.85 (93.1%)	89.04 (13.8%)
AR&R 1 year, 20 minutes storm, average 50.8 mm/h, Zone 1	1303.55	657.30 (50.4%)	523.74 (94.1%)	133.57 (17.9%)
AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1	1456.83	754.86 (51.8%)	589.19 (94.7%)	165.67 (19.8%)
AR&R 1 year, 30 minutes storm, average 41.3 mm/h, Zone 1	1591.48	816.05 (51.3%)	646.69 (95.2%)	169.35 (18.6%)
AR&R 1 year, 45 minutes storm, average 33.3 mm/h, Zone 1	1924.11	1026.49 (53.3%)	788.73 (96.0%)	237.75 (21.6%)
AR&R 1 year, 1 hour storm, average 28.4 mm/h, Zone 1	2190.22	1198.83 (54.7%)	902.37 (96.5%)	296.46 (23.6%)
AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1	2613.71	1431.01 (54.8%)	1083.20 (97.1%)	347.81 (23.2%)
AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1	2953.66	1636.81 (55.4%)	1228.37 (97.4%)	408.44 (24.1%)
AR&R 1 year, 3 hours storm, average 15.1 mm/h, Zone 1	3499.35	1944.60 (55.6%)	1461.40 (97.8%)	483.20 (24.1%)
AR&R 1 year, 4.5 hours storm, average 12.0 mm/h, Zone 1	4145.86	2276.86 (54.9%)	1737.47 (98.1%)	539.39 (22.7%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.205	0.205	0	0.165	0.1	3.96	0.63	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF1	0.4	0.4	0	0.167	0.2	4	1.2	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF3	0.818	0.818	0	0.167	0.41	4	2.45	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF55	0.034	0.034	0	0.084	0.03	2.01	0.4	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1

CSR Hebel DRAINS Exisitng (Predeveloped) DRAINS 2 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.263	0.263	0	5	0	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
Existing Hardstand Ea	0.517	0.505	0.012	5	10	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
North East Undev	0.063	0	0.063	5	10	0	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
Existing North West	0.308	0.259	0.049	5	10	0	AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1
South East Pre	0.434	0	0.434	5	13.8	0	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
South West Pre	0.191	0	0.191	5	10	0	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1

Outflow Volumes for Total Catchment (3.29 impervious + 4.42 pervious = 7.71 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 2 year, 5 minutes storm, average 116 mm/h, Zone 1	744.43	312.58 (42.0%)	284.98 (89.6%)	27.60 (6.5%)
AR&R 2 year, 10 minutes storm, average 89.4 mm/h, Zone 1	1148.53	618.40 (53.8%)	457.54 (93.3%)	160.86 (24.4%)
AR&R 2 year, 15 minutes storm, average 74.5 mm/h, Zone 1	1435.96	840.10 (58.5%)	580.28 (94.6%)	259.82 (31.6%)
AR&R 2 year, 20 minutes storm, average 64.9 mm/h, Zone 1	1667.06	1013.46 (60.8%)	678.97 (95.4%)	334.50 (35.0%)
AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1	1863.75	1146.16 (61.5%)	762.96 (95.9%)	383.21 (35.9%)
AR&R 2 year, 30 minutes storm, average 52.9 mm/h, Zone 1	2036.55	1250.81 (61.4%)	836.75 (96.2%)	414.07 (35.5%)
AR&R 2 year, 45 minutes storm, average 42.6 mm/h, Zone 1	2463.77	1549.97 (62.9%)	1019.18 (96.9%)	530.79 (37.6%)
AR&R 2 year, 1 hour storm, average 36.4 mm/h, Zone 1	2806.16	1781.73 (63.5%)	1165.39 (97.3%)	616.34 (38.3%)
AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1	3352.36	2137.89 (63.8%)	1398.63 (97.7%)	739.27 (38.5%)
AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1	3792.3	2431.99 (64.1%)	1586.49 (98.0%)	845.50 (38.9%)
AR&R 2 year, 3 hours storm, average 19.5 mm/h, Zone 1	4502.25	2916.43 (64.8%)	1889.65 (98.3%)	1026.78 (39.8%)
AR&R 2 year, 4.5 hours storm, average 15.4 mm/h, Zone 1	5345.25	3419.21 (64.0%)	2249.64 (98.6%)	1169.57 (38.2%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.263	0.263	0	0.167	0.13	4	0.79	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF1	0.517	0.517	0	0.167	0.26	4	1.55	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF3	1.066	1.066	0	0.167	0.53	4	3.19	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF55	0.063	0.063	0	0.106	0.05	2.54	0.47	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1

OF161	1.11	1.11	0	0.167	0.56	4	3.33	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF180	0.308	0.308	0	0.084	0.09	4	1.11	AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1
OF298	0.434	0.434	0	0.167	0.22	4	1.3	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
OF605	1.657	1.657	0	0.167	0.83	4	4.97	AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1
OF50	1.11	1.11	0	0.167	0.56	4	3.33	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF2890	0.191	0.191	0	0.161	0.1	3.85	0.62	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
OF2378	1.492	1.492	0	0.167	0.75	4	4.47	AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	403.07	403.07	0	0
N2	790.29	790.29	0	0
N4	1656.98	1656.98	0	0
N54	61.19	61.19	0	0
N55	1718.17	1718.18	0	0
N56	463.63	463.63	0	0
N57	527.41	527.41	0	0
N58	2431.98	2431.98	0	0
N180	1718.18	1718.18	0	0
N602	2431.98	2431.98	0	0
N3025	186.4	186.4	0	0
N3218	2245.59	2245.59	0	0

Run Log for Drains Model Existing Updated Exisitng SW Layout.drn run at 10:16:42 on 31/10/2016
The maximum flow in the following overflow routes is unsafe: OF2890, OF2378, OF605, OF298, OF161, OF55, OF50, OF3, Exisitng Roof, OF1

OF161	0.838	0.838	0	0.167	0.42	4	2.51	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF180	0.229	0.229	0	0.073	0.07	4	0.98	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
OF298	0.215	0.215	0	0.167	0.11	4	0.64	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
OF605	1.112	1.112	0	0.167	0.56	4	3.33	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
OF50	0.838	0.838	0	0.167	0.42	4	2.51	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF2890	0.103	0.103	0	0.127	0.07	3.05	0.53	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
OF2378	1.016	1.016	0	0.167	0.51	4	3.04	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	275.2	275.2	0	0
N2	535.18	535.18	0	0
N4	1112.2	1112.2	0	0
N54	25.17	25.17	0	0
N55	1137.36	1137.36	0	0
N56	301.81	301.81	0	0
N57	216.99	216.99	0	0
N58	1431.01	1431.01	0	0
N180	1137.36	1137.36	0	0
N602	1431.01	1431.01	0	0
N3025	76.66	76.66	0	0
N3218	1354.35	1354.35	0	0

Run Log for Drains Model Existing Updated Exisitng SW Layout.drn run at 10:16:23 on 31/10/2016
The maximum flow in the following overflow routes is unsafe: OF2890, OF2378, OF605, OF298, OF161, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Exisitng (Predeveloped) DRAINS 5 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.331	0.331	0	5	0	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
Existing Hardstand Ea	0.655	0.636	0.02	5	10	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
North East Undev	0.088	0	0.088	5	10	0	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
Existing North West	0.401	0.336	0.066	5	10	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
South East Pre	0.643	0	0.643	5	9.98	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
South West Pre	0.267	0	0.267	5	10	0	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1

Outflow Volumes for Total Catchment (3.29 impervious + 4.42 pervious = 7.71 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 5 year, 5 minutes storm, average 145 mm/h, Zone 1	932.39	488.73 (52.4%)	365.25 (91.7%)	123.49 (23.1%)
AR&R 5 year, 10 minutes storm, average 112 mm/h, Zone 1	1441.99	908.53 (63.0%)	582.86 (94.7%)	325.67 (39.4%)
AR&R 5 year, 15 minutes storm, average 93.8 mm/h, Zone 1	1806.22	1202.61 (66.6%)	738.39 (95.7%)	464.23 (44.9%)
AR&R 5 year, 20 minutes storm, average 81.7 mm/h, Zone 1	2099.23	1439.50 (68.6%)	863.51 (96.3%)	575.99 (47.9%)
AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1	2348.63	1619.66 (69.0%)	970.01 (96.7%)	649.65 (48.3%)
AR&R 5 year, 30 minutes storm, average 66.7 mm/h, Zone 1	2568.12	1775.04 (69.1%)	1063.74 (97.0%)	711.31 (48.3%)
AR&R 5 year, 45 minutes storm, average 53.9 mm/h, Zone 1	3112.4	2184.49 (70.2%)	1296.15 (97.5%)	888.33 (49.8%)
AR&R 5 year, 1 hour storm, average 46.1 mm/h, Zone 1	3552.01	2512.37 (70.7%)	1483.88 (97.8%)	1028.49 (50.5%)
AR&R 5 year, 1.5 hours storm, average 36.9 mm/h, Zone 1	4260.16	3031.99 (71.2%)	1786.27 (98.2%)	1245.72 (51.0%)
AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1	4837.06	3456.80 (71.5%)	2032.62 (98.4%)	1424.18 (51.4%)
AR&R 5 year, 3 hours storm, average 25.0 mm/h, Zone 1	5778.7	4166.31 (72.1%)	2434.73 (98.7%)	1731.58 (52.3%)
AR&R 5 year, 4.5 hours storm, average 19.9 mm/h, Zone 1	6904.88	4938.20 (71.5%)	2915.63 (98.9%)	2022.57 (51.1%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.331	0.331	0	0.167	0.17	4	0.99	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF1	0.655	0.655	0	0.167	0.33	4	1.96	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF3	1.362	1.362	0	0.167	0.68	4	4.08	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF55	0.088	0.088	0	0.12	0.06	2.87	0.51	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
OF161	1.435	1.435	0	0.167	0.72	4	4.3	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF180	0.401	0.401	0	0.097	0.12	4	1.22	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF298	0.643	0.643	0	0.167	0.32	4	1.93	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1

OF605	2.289	2.289	0	0.167	1.15	4	6.86	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF50	1.435	1.435	0	0.167	0.72	4	4.3	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF2890	0.267	0.267	0	0.167	0.13	4	0.8	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
OF2378	2.066	2.066	0	0.167	1.03	4	6.19	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	516.42	516.42	0	0
N2	1019.04	1019.04	0	0
N4	2151.27	2151.27	0	0
N54	102.99	102.99	0	0
N55	2254.25	2254.26	0	0
N56	615.81	615.81	0	0
N57	888.84	888.84	0	0
N58	3456.8	3456.8	0	0
N180	2254.26	2254.26	0	0
N602	3456.8	3456.8	0	0
N3025	313.7	313.7	0	0
N3218	3143.1	3143.1	0	0

Run Log for Drains Model Existing Updated Exisitng SW Layout.drn run at 10:17:00 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2378, OF605, OF298, OF161, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Exisitng (Predeveloped) DRAINS 10 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.37	0.37	0	5	0	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
Existing Hardstand Ea	0.734	0.711	0.024	5	10	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
North East Undev	0.101	0	0.101	5	10	0	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
Existing North West	0.454	0.376	0.08	5	10	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
South East Pre	0.799	0	0.799	5	9.68	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
South West Pre	0.306	0	0.306	5	10	0	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1

Outflow Volumes for Total Catchment (3.29 impervious + 4.42 pervious = 7.71 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 10 year, 5 minutes storm, average 162 mm/h, Zone 1	1038.92	595.02 (57.3%)	410.74 (92.6%)	184.29 (31.0%)
AR&R 10 year, 10 minutes storm, average 125 mm/h, Zone 1	1607.73	1072.91 (66.7%)	653.63 (95.2%)	419.28 (45.5%)
AR&R 10 year, 15 minutes storm, average 105 mm/h, Zone 1	2015.55	1409.16 (69.9%)	827.78 (96.2%)	581.38 (50.3%)
AR&R 10 year, 20 minutes storm, average 91.3 mm/h, Zone 1	2343.82	1681.06 (71.7%)	967.96 (96.7%)	713.10 (53.1%)
AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1	2623.6	1890.37 (72.1%)	1087.43 (97.1%)	802.94 (53.4%)
AR&R 10 year, 30 minutes storm, average 74.5 mm/h, Zone 1	2869.92	2073.76 (72.3%)	1192.62 (97.3%)	881.14 (53.6%)
AR&R 10 year, 45 minutes storm, average 60.3 mm/h, Zone 1	3482.4	2547.56 (73.2%)	1454.16 (97.8%)	1093.40 (54.8%)
AR&R 10 year, 1 hour storm, average 51.6 mm/h, Zone 1	3978.58	2932.41 (73.7%)	1666.03 (98.1%)	1266.38 (55.6%)
AR&R 10 year, 1.5 hours storm, average 41.4 mm/h, Zone 1	4782.22	3549.08 (74.2%)	2009.21 (98.4%)	1539.87 (56.2%)
AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1	5440.16	4053.80 (74.5%)	2290.16 (98.6%)	1763.64 (56.6%)
AR&R 10 year, 3 hours storm, average 28.2 mm/h, Zone 1	6518.44	4894.37 (75.1%)	2750.59 (98.8%)	2143.77 (57.4%)
AR&R 10 year, 4.5 hours storm, average 22.5 mm/h, Zone 1	7812.42	5824.68 (74.6%)	3303.17 (99.0%)	2521.51 (56.3%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.37	0.37	0	0.167	0.19	4	1.11	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF1	0.734	0.734	0	0.167	0.37	4	2.2	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF3	1.53	1.53	0	0.167	0.77	4	4.58	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF55	0.101	0.101	0	0.126	0.07	3.02	0.53	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
OF161	1.618	1.618	0	0.167	0.81	4	4.85	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF180	0.454	0.454	0	0.103	0.13	4	1.29	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF298	0.799	0.799	0	0.167	0.4	4	2.39	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF605	2.686	2.686	0	0.167	1.34	4	8.05	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1

OF50	1.618	1.618	0	0.167	0.81	4	4.85	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF2890	0.306	0.306	0	0.167	0.15	4	0.92	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
OF2378	2.413	2.413	0	0.167	1.21	4	7.23	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	581.85	581.85	0	0
N2	1151.19	1151.19	0	0
N4	2437.07	2437.08	0	0
N54	127.53	127.53	0	0
N55	2564.6	2564.6	0	0
N56	704.03	704.03	0	0
N57	1100.75	1100.75	0	0
N58	4053.8	4053.8	0	0
N180	2564.6	2564.6	0	0
N602	4053.8	4053.8	0	0
N3025	388.45	388.45	0	0
N3218	3665.35	3665.34	0	0

Run Log for Drains Model Existing Updated Exisitng SW Layout.drn run at 10:17:20 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2378, OF605, OF298, OF161, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Exisitng (Predeveloped) DRAINS 20 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.422	0.422	0	5	0	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
Existing Hardstand Ea	0.84	0.811	0.029	5	10	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
North East Undev	0.117	0	0.117	5	10	0	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
Existing North West	0.527	0.429	0.099	5	10	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
South East Pre	1.011	0	1.011	5	9.34	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
South West Pre	0.358	0	0.358	5	10	0	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1

Outflow Volumes for Total Catchment (3.29 impervious + 4.42 pervious = 7.71 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, average 184 mm/h, Zone 1	1182.89	738.21 (62.4%)	472.21 (93.5%)	265.99 (39.2%)
AR&R 20 year, 10 minutes storm, average 143 mm/h, Zone 1	1832.03	1296.23 (70.8%)	749.41 (95.8%)	546.82 (52.1%)
AR&R 20 year, 15 minutes storm, average 119 mm/h, Zone 1	2298.87	1689.68 (73.5%)	948.76 (96.6%)	740.92 (56.2%)
AR&R 20 year, 20 minutes storm, average 104 mm/h, Zone 1	2674.71	2008.01 (75.1%)	1109.26 (97.1%)	898.76 (58.6%)
AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1	2995.08	2257.39 (75.4%)	1246.06 (97.4%)	1011.33 (58.9%)
AR&R 20 year, 30 minutes storm, average 85.1 mm/h, Zone 1	3277.23	2477.66 (75.6%)	1366.54 (97.6%)	1111.12 (59.2%)
AR&R 20 year, 45 minutes storm, average 68.9 mm/h, Zone 1	3979.48	3036.16 (76.3%)	1666.42 (98.1%)	1369.74 (60.1%)
AR&R 20 year, 1 hour storm, average 59.0 mm/h, Zone 1	4550.15	3496.40 (76.8%)	1910.11 (98.3%)	1586.29 (60.8%)
AR&R 20 year, 1.5 hours storm, average 47.4 mm/h, Zone 1	5478.63	4239.76 (77.4%)	2306.59 (98.6%)	1933.16 (61.6%)
AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1	6241.68	4851.27 (77.7%)	2632.43 (98.8%)	2218.85 (62.0%)
AR&R 20 year, 3 hours storm, average 32.4 mm/h, Zone 1	7498.22	5860.74 (78.2%)	3169.00 (99.0%)	2691.74 (62.7%)
AR&R 20 year, 4.5 hours storm, average 26.0 mm/h, Zone 1	9012.2	7008.04 (77.8%)	3815.49 (99.1%)	3192.54 (61.8%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.422	0.422	0	0.167	0.21	4	1.27	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF1	0.84	0.84	0	0.167	0.42	4	2.52	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF3	1.756	1.756	0	0.167	0.88	4	5.26	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF55	0.117	0.117	0	0.134	0.07	3.21	0.55	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1

OF161	1.867	1.867	0	0.167	0.93	4	5.59	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF180	0.527	0.527	0	0.112	0.15	4	1.36	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF298	1.011	1.011	0	0.167	0.51	4	3.03	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF605	3.172	3.172	0	0.167	1.59	4	9.5	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF50	1.867	1.867	0	0.167	0.93	4	5.59	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF2890	0.358	0.358	0	0.167	0.18	4	1.07	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
OF2378	2.838	2.838	0	0.167	1.42	4	8.5	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	668.81	668.81	0	0
N2	1326.91	1326.91	0	0
N4	2817.23	2817.24	0	0
N54	160.42	160.42	0	0
N55	2977.65	2977.65	0	0
N56	821.52	821.52	0	0
N57	1384.99	1384.99	0	0
N58	4851.28	4851.27	0	0
N180	2977.65	2977.65	0	0
N602	4851.27	4851.27	0	0
N3025	488.64	488.64	0	0
N3218	4362.63	4362.64	0	0

Run Log for Drains Model Existing Updated Exisitng SW Layout.drn run at 10:17:39 on 31/10/2016
The maximum flow in the following overflow routes is unsafe: OF2890, OF2378, OF605, OF298, OF161, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Exisitng (Predeveloped) DRAINS 50 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.467	0.467	0	5	0	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
Existing Hardstand Ea	0.911	0.897	0.014	5	10	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
North East Undev	0.131	0	0.131	5	10	0	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
Existing North West	0.558	0.457	0.101	5	10	0	AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
South East Pre	1.12	0	1.12	5	8.71	0	AR&R 50 year, 20 minutes storm, average 121 mm/h, Zone 1
South West Pre	0.398	0	0.398	5	10	0	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1

Outflow Volumes for Total Catchment (3.29 impervious + 4.42 pervious = 7.71 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1	1368.85	924.01 (67.5%)	551.62 (94.4%)	372.39 (47.5%)
AR&R 50 year, 10 minutes storm, average 165 mm/h, Zone 1	2122.73	1585.24 (74.7%)	873.55 (96.4%)	711.70 (58.5%)
AR&R 50 year, 15 minutes storm, average 138 mm/h, Zone 1	2667.14	2053.33 (77.0%)	1106.02 (97.1%)	947.31 (62.0%)
AR&R 50 year, 20 minutes storm, average 121 mm/h, Zone 1	3105.4	2426.74 (78.1%)	1293.17 (97.5%)	1133.58 (63.7%)
AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1	3478.42	2728.04 (78.4%)	1452.45 (97.8%)	1275.59 (64.0%)
AR&R 50 year, 30 minutes storm, average 98.8 mm/h, Zone 1	3807.07	2997.77 (78.7%)	1592.79 (98.0%)	1404.98 (64.4%)
AR&R 50 year, 45 minutes storm, average 80.0 mm/h, Zone 1	4625.6	3673.11 (79.4%)	1942.33 (98.3%)	1730.79 (65.3%)
AR&R 50 year, 1 hour storm, average 68.7 mm/h, Zone 1	5292.72	4227.42 (79.9%)	2227.20 (98.5%)	2000.21 (66.0%)
AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1	6382.44	5135.23 (80.5%)	2692.53 (98.8%)	2442.69 (66.8%)
AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1	7283.68	5887.25 (80.8%)	3077.39 (98.9%)	2809.86 (67.3%)
AR&R 50 year, 3 hours storm, average 38.0 mm/h, Zone 1	8775.44	7114.73 (81.1%)	3714.37 (99.1%)	3400.36 (67.6%)
AR&R 50 year, 4.5 hours storm, average 30.5 mm/h, Zone 1	10580.89	8562.38 (80.9%)	4485.35 (99.3%)	4077.03 (67.2%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.467	0.467	0	0.167	0.23	4	1.4	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
OF1	0.911	0.911	0	0.167	0.46	4	2.73	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
OF3	1.856	1.856	0	0.167	0.93	4	5.56	AR&R 50 year, 15 minutes storm, average 138 mm/h, Zone 1
OF55	0.131	0.131	0	0.139	0.08	3.33	0.56	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
OF161	1.967	1.967	0	0.167	0.98	4	5.89	AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF180	0.558	0.558	0	0.115	0.16	4	1.4	AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1

OF298	1.12	1.12	0	0.167	0.56	4	3.35	AR&R 50 year, 20 minutes storm, average 121 mm/h, Zone 1
OF605	3.378	3.378	0	0.167	1.69	4	10.12	AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1
OF50	1.967	1.967	0	0.167	0.98	4	5.89	AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF2890	0.398	0.398	0	0.167	0.2	4	1.19	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
OF2378	3.018	3.018	0	0.167	1.51	4	9.04	AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	781.86	781.86	0	0
N2	1555.32	1555.32	0	0
N4	3311.36	3311.37	0	0
N54	203.1	203.1	0	0
N55	3514.47	3514.47	0	0
N56	974.19	974.19	0	0
N57	1754.11	1754.11	0	0
N58	5887.24	5887.24	0	0
N180	3514.47	3514.47	0	0
N602	5887.24	5887.24	0	0
N3025	618.66	618.66	0	0
N3218	5268.58	5268.58	0	0

Run Log for Drains Model Existing Updated Exisitng SW Layout.drn run at 10:17:57 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2378, OF605, OF298, OF161, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Exisitng (Predeveloped) DRAINS 100 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.518	0.518	0	5	0	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
Existing Hardstand Ea	1.011	0.994	0.017	5	10	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
North East Undev	0.146	0	0.146	5	10	0	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
Existing North West	0.619	0.506	0.113	5	10	0	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
South East Pre	1.264	0	1.264	5	8.49	0	AR&R 100 year, 20 minutes storm, average 133 mm/h, Zone 1
South West Pre	0.446	0	0.446	5	10	0	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1

Outflow Volumes for Total Catchment (3.29 impervious + 4.42 pervious = 7.71 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1	1508.45	1063.69 (70.5%)	611.24 (94.9%)	452.45 (52.3%)
AR&R 100 year, 10 minutes storm, average 182 mm/h, Zone 1	2340.93	1803.22 (77.0%)	966.72 (96.7%)	836.50 (62.4%)
AR&R 100 year, 15 minutes storm, average 153 mm/h, Zone 1	2942.68	2327.84 (79.1%)	1223.68 (97.4%)	1104.16 (65.5%)
AR&R 100 year, 20 minutes storm, average 133 mm/h, Zone 1	3427.11	2746.67 (80.1%)	1430.55 (97.8%)	1316.13 (67.0%)
AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1	3839.81	3088.16 (80.4%)	1606.78 (98.0%)	1481.39 (67.3%)
AR&R 100 year, 30 minutes storm, average 109 mm/h, Zone 1	4203.4	3392.88 (80.7%)	1762.04 (98.2%)	1630.85 (67.7%)
AR&R 100 year, 45 minutes storm, average 88.4 mm/h, Zone 1	5110.74	4156.96 (81.3%)	2149.49 (98.5%)	2007.46 (68.6%)
AR&R 100 year, 1 hour storm, average 75.9 mm/h, Zone 1	5852.03	4785.29 (81.8%)	2466.04 (98.7%)	2319.25 (69.2%)
AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1	7066.83	5818.52 (82.3%)	2984.78 (98.9%)	2833.74 (70.0%)
AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1	8075.19	6675.72 (82.7%)	3415.36 (99.0%)	3260.36 (70.5%)
AR&R 100 year, 3 hours storm, average 42.2 mm/h, Zone 1	9748.67	8082.29 (82.9%)	4130.00 (99.2%)	3952.29 (70.8%)
AR&R 100 year, 4.5 hours storm, average 34.0 mm/h, Zone 1	11778.36	9756.05 (82.8%)	4996.64 (99.3%)	4759.42 (70.5%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.518	0.518	0	0.167	0.26	4	1.55	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
OF1	1.011	1.011	0	0.167	0.51	4	3.03	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
OF3	2.055	2.055	0	0.167	1.03	4	6.16	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF55	0.146	0.146	0	0.145	0.08	3.47	0.58	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1

OF161	2.182	2.182	0	0.167	1.09	4	6.54	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF180	0.619	0.619	0	0.122	0.18	4	1.45	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF298	1.264	1.264	0	0.167	0.63	4	3.79	AR&R 100 year, 20 minutes storm, average 133 mm/h, Zone 1
OF605	3.769	3.769	0	0.167	1.88	4	11.29	AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1
OF50	2.182	2.182	0	0.167	1.09	4	6.54	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF2890	0.446	0.446	0	0.167	0.22	4	1.33	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
OF2378	3.365	3.365	0	0.167	1.68	4	10.08	AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1

DETENTION BASIN DETAILS

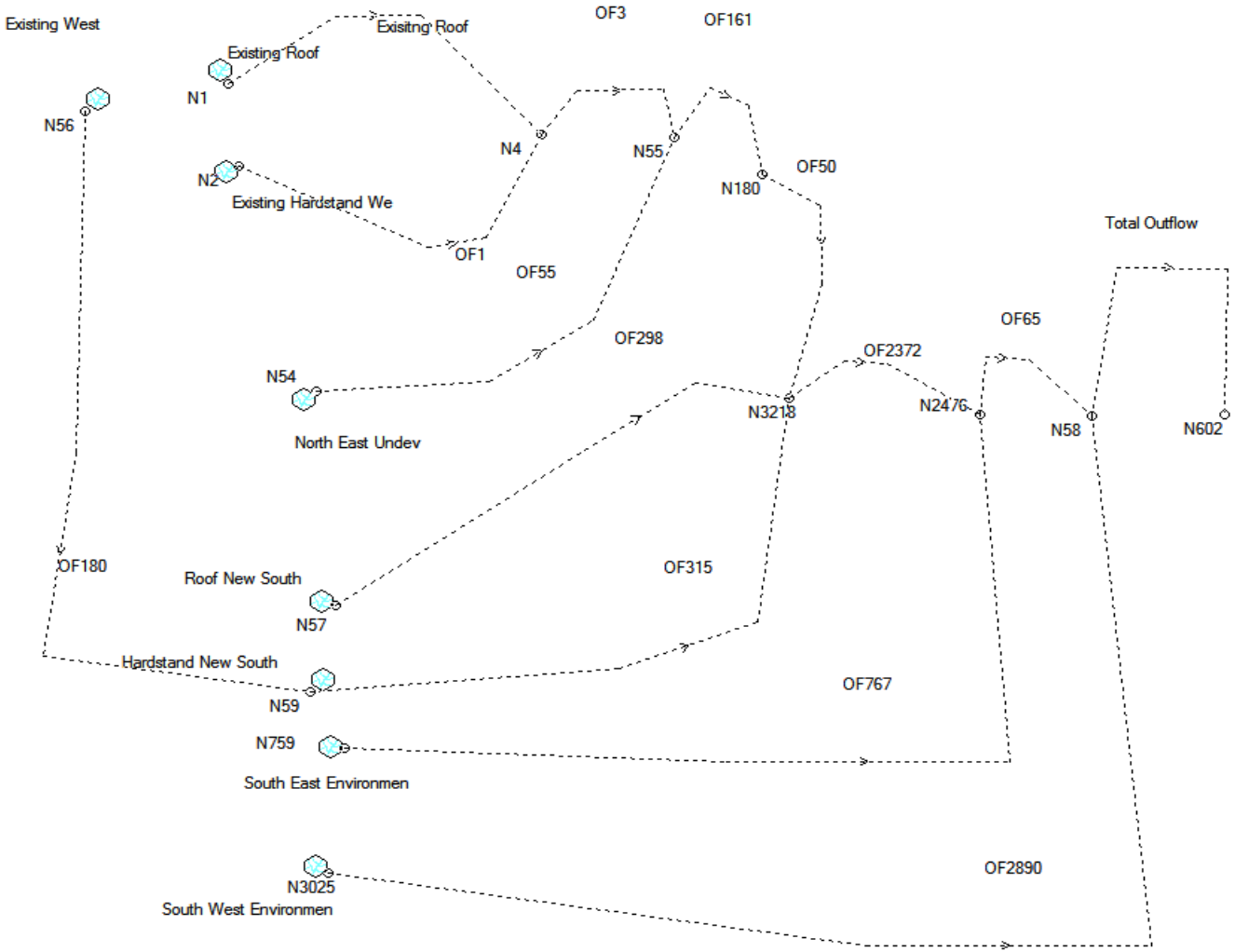
Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	867.73	867.73	0	0
N2	1728.84	1728.84	0	0
N4	3686.82	3686.83	0	0
N54	235.63	235.63	0	0
N55	3922.46	3922.46	0	0
N56	1090.26	1090.26	0	0
N57	2035.53	2035.53	0	0
N58	6675.74	6675.73	0	0
N180	3922.46	3922.46	0	0
N602	6675.73	6675.73	0	0
N3025	717.75	717.75	0	0
N3218	5957.99	5957.99	0	0

Run Log for Drains Model Existing Updated Exisitng SW Layout.drn run at 10:18:08 on 31/10/2016
The maximum flow in the following overflow routes is unsafe: OF2890, OF2378, OF605, OF298, OF161, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed No Detention Model Schematic



CSR Hebel DRAINS Developed No Detention Model DRAINS Inputs

PIT / NODE DETAILS Version 13

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is
N1	Node							0		417	-168		3		No	
N2	Node							0		426	-246		6		No	
N4	Node							0		690	-216		8		No	
N54	Node							0		494	-459		127		No	
N55	Node							0		806	-218		132		No	
N56	Node							0		291	-194		150		No	
N57	Node							0		510	-663		154		No	
N58	Node							0		1171	-483		155		No	
N59	Node							0		488	-745		160		No	
N180	Node							0		883	-253		447		No	
N602	Node							0		1287	-482		1532		No	
N759	Node							0		518	-798		1930		No	
N2476	Node							0		1073	-482		6162		No	
N3025	Node							0		504.4	-916		7505		No	
N3218	Node							0		905.795	-465.102		7979		No	

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length	id

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor	Rainfall Multiplier
Existing Ro	N1	0.836	100	0	0	5	0	0										0				1
Existing Ha	N2	1.69	95	5	0	5	10	0										0				1
North East	N54	0.319	0	100	0	5	10	0										0				1
Existing We	N56	1.132	75	25	0	5	10	0										0				1
Roof New S	N57	1.028	100	0	0	5	0	0										0				1
Hardstand	N59	1.77	95	5	0	5	10	0										0				1
South East	N759	0.4447	0	100	0	5	10	0										0				1
South Wes	N3025	0.4823	0	100	0	5	10	0										0				1

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	etc etc

CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Stor (m)	SafeDepth Minor Stor (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id

Exisitng Ro	N1	N4	0.1	Swale with	0.15	0.1	1	1	0	10	60
OF1	N2	N4	0.1	Swale with	0.15	0.1	1	1	0	9	1
OF3	N4	N55	0.1	Swale with	0.15	0.1	1	1	0	12	1
OF55	N54	N55	0.1	Swale with	0.15	0.1	1	1	0	139	1
OF161	N55	N180	0.1	Swale with	0.15	0.1	1	1	0	448	1
OF180	N56	N59	0.1	4 m wide p	0.3	0.15	0.4	1	0	468	
OF298	N57	N3218	0.1	Swale with	0.15	0.1	1	1	0	790	1
Total Outfl	N58	N602	0.1	Swale with	0.15	0.1	1	1	0	1533	1
OF315	N59	N3218	0.1	Swale with	0.15	0.1	1	1	0	807	1
OF50	N180	N3218	0.1	Swale with	0.15	0.1	1	1	0	134	1
OF767	N759	N2476	0.1	Swale with	0.15	0.1	1	1	0	1932	1
OF65	N2476	N58	0.1	Swale with	0.15	0.1	1	1	0	156	1
OF2890	N3025	N58	0.1	Swale with	0.15	0.1	1	1	0	7506	1
OF2372	N3218	N2476	0.1	Swale with	0.15	0.1	1	1	0	6184	0.1

PIPE COVER DETAILS

Name	Type	Dia (mm)	Safe Cover	Cover (m)

CSR Hebel DRAINS Developed No Detention Model DRAINS 1 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.205	0.205	0	5	0	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
Existing Hardstand We	0.4	0.395	0.006	5	10	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
North East Undev	0.034	0	0.034	5	10	0	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
Existing West	0.229	0.202	0.029	5	10	0	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
Roof New South	0.253	0.253	0	5	0	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
Hardstand New South	0.419	0.413	0.006	5	10	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
South East Environmen	0.047	0	0.047	5	10	0	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
South West Environmen	0.051	0	0.051	5	10	0	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 1 year, 5 minutes storm, average 90.9 mm/h, Zone 1	583.75	394.75 (67.6%)	394.75 (86.8%)	0.00 (0.0%)
AR&R 1 year, 10 minutes storm, average 70.1 mm/h, Zone 1	899.34	651.45 (72.4%)	640.60 (91.4%)	10.85 (5.5%)
AR&R 1 year, 15 minutes storm, average 58.3 mm/h, Zone 1	1122.95	849.83 (75.7%)	814.80 (93.1%)	35.03 (14.1%)
AR&R 1 year, 20 minutes storm, average 50.8 mm/h, Zone 1	1302.92	1007.49 (77.3%)	955.00 (94.1%)	52.49 (18.2%)
AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1	1456.13	1138.66 (78.2%)	1074.35 (94.7%)	64.31 (20.0%)
AR&R 1 year, 30 minutes storm, average 41.3 mm/h, Zone 1	1590.72	1245.13 (78.3%)	1179.20 (95.2%)	65.93 (18.8%)
AR&R 1 year, 45 minutes storm, average 33.3 mm/h, Zone 1	1923.19	1530.36 (79.6%)	1438.20 (96.0%)	92.16 (21.7%)
AR&R 1 year, 1 hour storm, average 28.4 mm/h, Zone 1	2189.17	1760.03 (80.4%)	1645.40 (96.5%)	114.63 (23.7%)
AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1	2612.45	2109.42 (80.7%)	1975.15 (97.1%)	134.27 (23.3%)
AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1	2952.24	2398.38 (81.2%)	2239.85 (97.4%)	158.53 (24.3%)
AR&R 1 year, 3 hours storm, average 15.1 mm/h, Zone 1	3497.67	2851.03 (81.5%)	2664.75 (97.8%)	186.28 (24.1%)
AR&R 1 year, 4.5 hours storm, average 12.0 mm/h, Zone 1	4143.87	3377.09 (81.5%)	3168.16 (98.1%)	208.93 (22.8%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.205	0.205	0	0.165	0.1	3.96	0.63	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF1	0.4	0.4	0	0.167	0.2	4	1.2	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF3	0.606	0.606	0	0.167	0.3	4	1.81	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF55	0.034	0.034	0	0.084	0.03	2.01	0.4	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
OF161	0.626	0.626	0	0.167	0.31	4	1.88	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1

OF180	0.229	0.229	0	0.073	0.07	4	0.98	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
OF298	0.253	0.253	0	0.167	0.13	4	0.76	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
Total Outflow	1.559	1.559	0	0.167	0.78	4	4.67	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF315	0.643	0.643	0	0.167	0.32	4	1.93	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF50	0.626	0.626	0	0.167	0.31	4	1.88	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF767	0.047	0.047	0	0.095	0.04	2.27	0.44	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
OF65	1.527	1.527	0	0.167	0.76	4	4.58	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF2890	0.051	0.051	0	0.098	0.04	2.35	0.44	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
OF2372	1.498	1.498	0	0.167	0.75	4	4.49	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	312.09	312.09	0	0
N2	607.22	607.22	0	0
N4	919.3	919.3	0	0
N54	29.71	29.71	0	0
N55	949.02	949.01	0	0
N56	343.3	343.3	0	0
N57	383.76	383.76	0	0
N58	2398.38	2398.38	0	0
N59	979.26	979.26	0	0
N180	949.01	949.01	0	0
N602	2398.38	2398.38	0	0
N759	41.42	41.42	0	0
N2476	2353.46	2353.46	0	0
N3025	44.92	44.92	0	0
N3218	2312.03	2312.04	0	0

Run Log for Drains Model Dev no detention Updated Existing SW Layout .drn run at 10:30:42 on 31/10/2016
The maximum flow in the following overflow routes is unsafe: OF2372, Total Outflow, OF315, OF298, OF161, OF65, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed No Detention Model DRAINS 2 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.263	0.263	0	5	0	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
Existing Hardstand We	0.517	0.505	0.012	5	10	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
North East Undev	0.063	0	0.063	5	10	0	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
Existing West	0.308	0.259	0.049	5	10	0	AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1
Roof New South	0.323	0.323	0	5	0	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
Hardstand New South	0.541	0.529	0.013	5	10	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
South East Environmen	0.088	0	0.088	5	10	0	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
South West Environmen	0.095	0	0.095	5	10	0	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 2 year, 5 minutes storm, average 116 mm/h, Zone 1	744.08	529.53 (71.2%)	519.65 (89.6%)	9.88 (6.0%)
AR&R 2 year, 10 minutes storm, average 89.4 mm/h, Zone 1	1147.98	895.61 (78.0%)	834.30 (93.3%)	61.31 (24.2%)
AR&R 2 year, 15 minutes storm, average 74.5 mm/h, Zone 1	1435.27	1158.26 (80.7%)	1058.10 (94.6%)	100.16 (31.6%)
AR&R 2 year, 20 minutes storm, average 64.9 mm/h, Zone 1	1666.26	1367.38 (82.1%)	1238.05 (95.4%)	129.33 (35.1%)
AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1	1862.86	1539.11 (82.6%)	1391.20 (95.9%)	147.91 (35.9%)
AR&R 2 year, 30 minutes storm, average 52.9 mm/h, Zone 1	2035.57	1685.91 (82.8%)	1525.75 (96.2%)	160.16 (35.6%)
AR&R 2 year, 45 minutes storm, average 42.6 mm/h, Zone 1	2462.59	2063.62 (83.8%)	1858.40 (96.9%)	205.22 (37.7%)
AR&R 2 year, 1 hour storm, average 36.4 mm/h, Zone 1	2804.81	2362.73 (84.2%)	2125.00 (97.3%)	237.73 (38.4%)
AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1	3350.76	2835.42 (84.6%)	2550.30 (97.7%)	285.11 (38.5%)
AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1	3790.47	3219.34 (84.9%)	2892.85 (98.0%)	326.48 (39.0%)
AR&R 2 year, 3 hours storm, average 19.5 mm/h, Zone 1	4500.09	3841.68 (85.4%)	3445.68 (98.3%)	396.00 (39.8%)
AR&R 2 year, 4.5 hours storm, average 15.4 mm/h, Zone 1	5342.69	4553.16 (85.2%)	4102.05 (98.6%)	451.11 (38.2%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.263	0.263	0	0.167	0.13	4	0.79	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF1	0.517	0.517	0	0.167	0.26	4	1.55	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1

OF3	0.779	0.779	0	0.167	0.39	4	2.33 AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF55	0.063	0.063	0	0.106	0.05	2.54	0.47 AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
OF161	0.824	0.824	0	0.167	0.41	4	2.47 AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF180	0.308	0.308	0	0.084	0.09	4	1.11 AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1
OF298	0.323	0.323	0	0.167	0.16	4	0.97 AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
Total Outflow	2.089	2.089	0	0.167	1.04	4	6.26 AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF315	0.843	0.843	0	0.167	0.42	4	2.53 AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF50	0.824	0.824	0	0.167	0.41	4	2.47 AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF767	0.088	0.088	0	0.12	0.06	2.87	0.51 AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
OF65	2.022	2.022	0	0.167	1.01	4	6.06 AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF2890	0.095	0.095	0	0.124	0.06	2.96	0.52 AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
OF2372	1.96	1.96	0	0.167	0.98	4	5.87 AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	403.07	403.07	0	0
N2	790.29	790.29	0	0
N4	1193.36	1193.36	0	0
N54	61.19	61.19	0	0
N55	1254.55	1254.55	0	0
N56	463.63	463.63	0	0
N57	495.64	495.64	0	0
N58	3219.34	3219.34	0	0
N59	1291.32	1291.32	0	0
N180	1254.55	1254.55	0	0
N602	3219.34	3219.34	0	0
N759	85.3	85.3	0	0
N2476	3126.82	3126.82	0	0
N3025	92.52	92.52	0	0
N3218	3041.52	3041.51	0	0

Run Log for Drains Model Dev no detention Updated Existing SW Layout .drn run at 10:31:16 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed No Detention Model DRAINS 5 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.331	0.331	0	5	0	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
Existing Hardstand We	0.655	0.636	0.02	5	10	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
North East Undev	0.088	0	0.088	5	10	0	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
Existing West	0.401	0.336	0.066	5	10	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
Roof New South	0.407	0.407	0	5	0	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
Hardstand New South	0.686	0.666	0.021	5	10	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
South East Environmen	0.122	0	0.122	5	10	0	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
South West Environmen	0.133	0	0.133	5	10	0	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 5 year, 5 minutes storm, average 145 mm/h, Zone 1	931.94	710.61 (76.3%)	666.00 (91.7%)	44.61 (21.7%)
AR&R 5 year, 10 minutes storm, average 112 mm/h, Zone 1	1441.3	1186.65 (82.3%)	1062.80 (94.7%)	123.85 (38.9%)
AR&R 5 year, 15 minutes storm, average 93.8 mm/h, Zone 1	1805.35	1524.74 (84.5%)	1346.40 (95.7%)	178.34 (44.7%)
AR&R 5 year, 20 minutes storm, average 81.7 mm/h, Zone 1	2098.22	1796.31 (85.6%)	1574.55 (96.3%)	221.76 (47.8%)
AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1	2347.51	2019.18 (86.0%)	1768.75 (96.7%)	250.43 (48.3%)
AR&R 5 year, 30 minutes storm, average 66.7 mm/h, Zone 1	2566.88	2214.04 (86.3%)	1939.65 (97.0%)	274.39 (48.4%)
AR&R 5 year, 45 minutes storm, average 53.9 mm/h, Zone 1	3110.9	2706.30 (87.0%)	2363.45 (97.5%)	342.85 (49.9%)
AR&R 5 year, 1 hour storm, average 46.1 mm/h, Zone 1	3550.3	3102.48 (87.4%)	2705.75 (97.8%)	396.73 (50.6%)
AR&R 5 year, 1.5 hours storm, average 36.9 mm/h, Zone 1	4258.12	3737.64 (87.8%)	3257.15 (98.2%)	480.49 (51.1%)
AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1	4834.74	4255.82 (88.0%)	3706.34 (98.4%)	549.47 (51.4%)
AR&R 5 year, 3 hours storm, average 25.0 mm/h, Zone 1	5775.92	5107.25 (88.4%)	4439.55 (98.7%)	667.70 (52.3%)
AR&R 5 year, 4.5 hours storm, average 19.9 mm/h, Zone 1	6901.57	6096.34 (88.3%)	5316.45 (98.9%)	779.89 (51.1%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.331	0.331	0	0.167	0.17	4	0.99	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF1	0.655	0.655	0	0.167	0.33	4	1.96	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF3	0.987	0.987	0	0.167	0.49	4	2.96	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1

OF55	0.088	0.088	0	0.12	0.06	2.87	0.51 AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
OF161	1.059	1.059	0	0.167	0.53	4	3.17 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF180	0.401	0.401	0	0.097	0.12	4	1.22 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF298	0.407	0.407	0	0.167	0.2	4	1.22 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
Total Outflow	2.721	2.721	0	0.167	1.36	4	8.15 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF315	1.081	1.081	0	0.167	0.54	4	3.24 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF50	1.059	1.059	0	0.167	0.53	4	3.17 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF767	0.122	0.122	0	0.136	0.08	3.26	0.55 AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
OF65	2.611	2.611	0	0.167	1.31	4	7.82 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF2890	0.133	0.133	0	0.14	0.08	3.35	0.57 AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
OF2372	2.509	2.509	0	0.167	1.25	4	7.52 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	516.42	516.42	0	0
N2	1019.04	1019.04	0	0
N4	1535.46	1535.46	0	0
N54	102.99	102.99	0	0
N55	1638.44	1638.44	0	0
N56	615.81	615.81	0	0
N57	635.02	635.02	0	0
N58	4255.82	4255.83	0	0
N59	1683.09	1683.09	0	0
N180	1638.44	1638.44	0	0
N602	4255.83	4255.83	0	0
N759	143.57	143.57	0	0
N2476	4100.12	4100.12	0	0
N3025	155.71	155.71	0	0
N3218	3956.55	3956.55	0	0

Run Log for Drains Model Dev no detention Updated Existing SW Layout .drn run at 10:31:31 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed No Detention Model DRAINS 10 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.37	0.37	0	5	0	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
Existing Hardstand We	0.734	0.711	0.024	5	10	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
North East Undev	0.101	0	0.101	5	10	0	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
Existing West	0.454	0.376	0.08	5	10	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
Roof New South	0.455	0.455	0	5	0	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
Hardstand New South	0.769	0.744	0.025	5	10	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
South East Environmen	0.14	0	0.14	5	10	0	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
South West Environmen	0.152	0	0.152	5	10	0	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 10 year, 5 minutes storm, average 162 mm/h, Zone 1	1038.42	816.35 (78.6%)	748.95 (92.6%)	67.40 (29.4%)
AR&R 10 year, 10 minutes storm, average 125 mm/h, Zone 1	1606.96	1351.42 (84.1%)	1191.85 (95.2%)	159.57 (44.9%)
AR&R 10 year, 15 minutes storm, average 105 mm/h, Zone 1	2014.59	1732.51 (86.0%)	1509.40 (96.2%)	223.11 (50.1%)
AR&R 10 year, 20 minutes storm, average 91.3 mm/h, Zone 1	2342.69	2039.35 (87.1%)	1765.00 (96.7%)	274.35 (53.0%)
AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1	2622.34	2292.19 (87.4%)	1982.85 (97.1%)	309.34 (53.4%)
AR&R 10 year, 30 minutes storm, average 74.5 mm/h, Zone 1	2868.55	2514.32 (87.7%)	2174.65 (97.3%)	339.67 (53.6%)
AR&R 10 year, 45 minutes storm, average 60.3 mm/h, Zone 1	3480.73	3073.33 (88.3%)	2651.55 (97.8%)	421.78 (54.8%)
AR&R 10 year, 1 hour storm, average 51.6 mm/h, Zone 1	3976.67	3526.34 (88.7%)	3037.90 (98.1%)	488.44 (55.6%)
AR&R 10 year, 1.5 hours storm, average 41.4 mm/h, Zone 1	4779.93	4257.58 (89.1%)	3663.65 (98.4%)	593.93 (56.2%)
AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1	5437.55	4856.35 (89.3%)	4175.95 (98.6%)	680.40 (56.6%)
AR&R 10 year, 3 hours storm, average 28.2 mm/h, Zone 1	6515.31	5842.14 (89.7%)	5015.55 (98.8%)	826.59 (57.4%)
AR&R 10 year, 4.5 hours storm, average 22.5 mm/h, Zone 1	7808.67	6995.19 (89.6%)	6023.15 (99.0%)	972.03 (56.3%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.37	0.37	0	0.167	0.19	4	1.11	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF1	0.734	0.734	0	0.167	0.37	4	2.2	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF3	1.104	1.104	0	0.167	0.55	4	3.31	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1

OF55	0.101	0.101	0	0.126	0.07	3.02	0.53	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
OF161	1.193	1.193	0	0.167	0.6	4	3.57	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF180	0.454	0.454	0	0.103	0.13	4	1.29	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF298	0.455	0.455	0	0.167	0.23	4	1.36	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
Total Outflow	3.079	3.079	0	0.167	1.54	4	9.22	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF315	1.217	1.217	0	0.167	0.61	4	3.64	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF50	1.193	1.193	0	0.167	0.6	4	3.57	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF767	0.14	0.14	0	0.143	0.08	3.43	0.57	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
OF65	2.945	2.945	0	0.167	1.47	4	8.82	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF2890	0.152	0.152	0	0.148	0.09	3.54	0.58	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
OF2372	2.821	2.821	0	0.167	1.41	4	8.45	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	581.85	581.85	0	0
N2	1151.19	1151.19	0	0
N4	1733.04	1733.04	0	0
N54	127.53	127.53	0	0
N55	1860.57	1860.57	0	0
N56	704.03	704.03	0	0
N57	715.48	715.48	0	0
N58	4856.35	4856.35	0	0
N59	1909.72	1909.72	0	0
N180	1860.57	1860.57	0	0
N602	4856.35	4856.35	0	0
N759	177.78	177.78	0	0
N2476	4663.54	4663.55	0	0
N3025	192.81	192.81	0	0
N3218	4485.77	4485.77	0	0

Run Log for Drains Model Dev no detention Updated Existing SW Layout .drn run at 10:31:51 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed No Detention Model DRAINS 20 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.422	0.422	0	5	0	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
Existing Hardstand We	0.84	0.811	0.029	5	10	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
North East Undev	0.117	0	0.117	5	10	0	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
Existing West	0.527	0.429	0.099	5	10	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
Roof New South	0.519	0.519	0	5	0	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
Hardstand New South	0.88	0.85	0.031	5	10	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
South East Environmen	0.164	0	0.164	5	10	0	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
South West Environmen	0.178	0	0.178	5	10	0	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, average 184 mm/h, Zone 1	1182.32	959.47 (81.2%)	861.05 (93.5%)	98.42 (37.7%)
AR&R 20 year, 10 minutes storm, average 143 mm/h, Zone 1	1831.15	1574.67 (86.0%)	1366.50 (95.8%)	208.17 (51.4%)
AR&R 20 year, 15 minutes storm, average 119 mm/h, Zone 1	2297.76	2014.16 (87.7%)	1730.00 (96.6%)	284.16 (56.0%)
AR&R 20 year, 20 minutes storm, average 104 mm/h, Zone 1	2673.43	2368.33 (88.6%)	2022.65 (97.1%)	345.69 (58.5%)
AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1	2993.64	2661.54 (88.9%)	2272.10 (97.4%)	389.44 (58.9%)
AR&R 20 year, 30 minutes storm, average 85.1 mm/h, Zone 1	3275.66	2919.86 (89.1%)	2491.80 (97.6%)	428.06 (59.1%)
AR&R 20 year, 45 minutes storm, average 68.9 mm/h, Zone 1	3977.57	3566.72 (89.7%)	3038.60 (98.1%)	528.12 (60.1%)
AR&R 20 year, 1 hour storm, average 59.0 mm/h, Zone 1	4547.97	4094.65 (90.0%)	3482.95 (98.3%)	611.71 (60.9%)
AR&R 20 year, 1.5 hours storm, average 47.4 mm/h, Zone 1	5475.99	4951.44 (90.4%)	4205.90 (98.6%)	745.54 (61.6%)
AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1	6238.68	5655.94 (90.7%)	4800.05 (98.8%)	855.89 (62.1%)
AR&R 20 year, 3 hours storm, average 32.4 mm/h, Zone 1	7494.62	6816.12 (90.9%)	5778.43 (99.0%)	1037.69 (62.7%)
AR&R 20 year, 4.5 hours storm, average 26.0 mm/h, Zone 1	9007.87	8188.12 (90.9%)	6957.27 (99.1%)	1230.85 (61.8%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.422	0.422	0	0.167	0.21	4	1.27	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF1	0.84	0.84	0	0.167	0.42	4	2.52	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1

OF3	1.263	1.263	0	0.167	0.63	4	3.78	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF55	0.117	0.117	0	0.134	0.07	3.21	0.55	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
OF161	1.373	1.373	0	0.167	0.69	4	4.11	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF180	0.527	0.527	0	0.112	0.15	4	1.36	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF298	0.519	0.519	0	0.167	0.26	4	1.56	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
Total Outflow	3.563	3.563	0	0.167	1.78	4	10.67	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF315	1.399	1.399	0	0.167	0.7	4	4.19	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF50	1.373	1.373	0	0.167	0.69	4	4.11	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF767	0.164	0.164	0	0.152	0.09	3.63	0.6	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
OF65	3.396	3.396	0	0.167	1.7	4	10.17	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF2890	0.178	0.178	0	0.156	0.09	3.74	0.61	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
OF2372	3.242	3.242	0	0.167	1.62	4	9.71	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	668.81	668.81	0	0
N2	1326.91	1326.91	0	0
N4	1995.71	1995.71	0	0
N54	160.42	160.42	0	0
N55	2156.13	2156.13	0	0
N56	821.52	821.52	0	0
N57	822.41	822.41	0	0
N58	5655.94	5655.94	0	0
N59	2211.24	2211.24	0	0
N180	2156.13	2156.13	0	0
N602	5655.94	5655.94	0	0
N759	223.63	223.63	0	0
N2476	5413.4	5413.41	0	0
N3025	242.54	242.54	0	0
N3218	5189.78	5189.78	0	0

Run Log for Drains Model Dev no detention Updated Existing SW Layout .drn run at 10:32:05 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed No Detention Model DRAINS 50 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.467	0.467	0	5	0	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
Existing Hardstand We	0.911	0.897	0.014	5	10	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
North East Undev	0.131	0	0.131	5	10	0	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
Existing West	0.558	0.457	0.101	5	10	0	AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
Roof New South	0.574	0.574	0	5	0	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
Hardstand New South	0.955	0.94	0.015	5	10	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
South East Environmen	0.182	0	0.182	5	10	0	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
South West Environmen	0.197	0	0.197	5	10	0	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1	1368.2	1144.59 (83.7%)	1005.85 (94.4%)	138.74 (45.9%)
AR&R 50 year, 10 minutes storm, average 165 mm/h, Zone 1	2121.71	1863.95 (87.9%)	1592.85 (96.4%)	271.10 (57.8%)
AR&R 50 year, 15 minutes storm, average 138 mm/h, Zone 1	2665.85	2379.90 (89.3%)	2016.75 (97.1%)	363.15 (61.6%)
AR&R 50 year, 20 minutes storm, average 121 mm/h, Zone 1	3103.91	2793.81 (90.0%)	2358.00 (97.5%)	435.81 (63.5%)
AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1	3476.75	3139.18 (90.3%)	2648.45 (97.8%)	490.73 (63.9%)
AR&R 50 year, 30 minutes storm, average 98.8 mm/h, Zone 1	3805.24	3445.24 (90.5%)	2904.35 (98.0%)	540.89 (64.3%)
AR&R 50 year, 45 minutes storm, average 80.0 mm/h, Zone 1	4623.38	4208.77 (91.0%)	3541.70 (98.3%)	667.08 (65.3%)
AR&R 50 year, 1 hour storm, average 68.7 mm/h, Zone 1	5290.18	4832.29 (91.3%)	4061.15 (98.5%)	771.14 (66.0%)
AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1	6379.37	5851.54 (91.7%)	4909.63 (98.8%)	941.91 (66.8%)
AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1	7280.19	6695.05 (92.0%)	5611.41 (98.9%)	1083.64 (67.4%)
AR&R 50 year, 3 hours storm, average 38.0 mm/h, Zone 1	8771.23	8084.06 (92.2%)	6772.93 (99.1%)	1311.13 (67.6%)
AR&R 50 year, 4.5 hours storm, average 30.5 mm/h, Zone 1	10575.81	9750.88 (92.2%)	8178.73 (99.3%)	1572.15 (67.3%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.467	0.467	0	0.167	0.23	4	1.4	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
OF1	0.911	0.911	0	0.167	0.46	4	2.73	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
OF3	1.379	1.379	0	0.167	0.69	4	4.13	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
OF55	0.131	0.131	0	0.139	0.08	3.33	0.56	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1

OF161	1.458	1.458	0	0.167	0.73	4	4.37 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF180	0.558	0.558	0	0.115	0.16	4	1.4 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF298	0.574	0.574	0	0.167	0.29	4	1.72 AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
Total Outflow	3.761	3.761	0	0.167	1.88	4	11.27 AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1
OF315	1.484	1.484	0	0.167	0.74	4	4.45 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF50	1.458	1.458	0	0.167	0.73	4	4.37 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF767	0.182	0.182	0	0.157	0.1	3.77	0.61 AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
OF65	3.579	3.579	0	0.167	1.79	4	10.72 AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1
OF2890	0.197	0.197	0	0.163	0.1	3.9	0.62 AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
OF2372	3.419	3.419	0	0.167	1.71	4	10.24 AR&R 50 year, 15 minutes storm, average 138 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	781.86	781.86	0	0
N2	1555.32	1555.32	0	0
N4	2337.18	2337.17	0	0
N54	203.1	203.1	0	0
N55	2540.27	2540.27	0	0
N56	974.19	974.19	0	0
N57	961.42	961.42	0	0
N58	6695.04	6695.04	0	0
N59	2603.14	2603.14	0	0
N180	2540.27	2540.27	0	0
N602	6695.04	6695.04	0	0
N759	283.13	283.13	0	0
N2476	6387.97	6387.96	0	0
N3025	307.07	307.07	0	0
N3218	6104.83	6104.83	0	0

Run Log for Drains Model Dev no detention Updated Existing SW Layout .drn run at 10:32:20 on 31/10/2016
The maximum flow in the following overflow routes is unsafe: OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed No Detention Model DRAINS 100 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.518	0.518	0	5	0	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
Existing Hardstand We	1.011	0.994	0.017	5	10	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
North East Undev	0.146	0	0.146	5	10	0	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
Existing West	0.619	0.506	0.113	5	10	0	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
Roof New South	0.637	0.637	0	5	0	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
Hardstand New South	1.059	1.041	0.018	5	10	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
South East Environmen	0.204	0	0.204	5	10	0	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
South West Environmen	0.221	0	0.221	5	10	0	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1	1507.73	1283.68 (85.1%)	1114.55 (94.9%)	169.13 (50.8%)
AR&R 100 year, 10 minutes storm, average 182 mm/h, Zone 1	2339.8	2081.55 (89.0%)	1762.75 (96.7%)	318.80 (61.7%)
AR&R 100 year, 15 minutes storm, average 153 mm/h, Zone 1	2941.27	2654.57 (90.3%)	2231.30 (97.4%)	423.27 (65.1%)
AR&R 100 year, 20 minutes storm, average 133 mm/h, Zone 1	3425.46	3114.29 (90.9%)	2608.50 (97.8%)	505.79 (66.8%)
AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1	3837.97	3499.66 (91.2%)	2929.85 (98.0%)	569.81 (67.2%)
AR&R 100 year, 30 minutes storm, average 109 mm/h, Zone 1	4201.38	3840.69 (91.4%)	3212.95 (98.2%)	627.74 (67.6%)
AR&R 100 year, 45 minutes storm, average 88.4 mm/h, Zone 1	5108.29	4692.99 (91.9%)	3919.45 (98.5%)	773.54 (68.5%)
AR&R 100 year, 1 hour storm, average 75.9 mm/h, Zone 1	5849.22	5390.65 (92.2%)	4496.65 (98.7%)	894.00 (69.2%)
AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1	7063.44	6535.11 (92.5%)	5442.53 (98.9%)	1092.58 (70.0%)
AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1	8071.31	7484.88 (92.7%)	6227.70 (99.0%)	1257.18 (70.5%)
AR&R 100 year, 3 hours storm, average 42.2 mm/h, Zone 1	9743.99	9054.58 (92.9%)	7530.67 (99.2%)	1523.91 (70.8%)
AR&R 100 year, 4.5 hours storm, average 34.0 mm/h, Zone 1	11772.7	10946.33 (93.0%)	9111.15 (99.3%)	1835.19 (70.5%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.518	0.518	0	0.167	0.26	4	1.55	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
OF1	1.011	1.011	0	0.167	0.51	4	3.03	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1

OF3	1.529	1.529	0	0.167	0.76	4	4.58	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
OF55	0.146	0.146	0	0.145	0.08	3.47	0.58	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
OF161	1.616	1.616	0	0.167	0.81	4	4.84	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF180	0.619	0.619	0	0.122	0.18	4	1.45	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF298	0.637	0.637	0	0.167	0.32	4	1.91	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
Total Outflow	4.165	4.165	0	0.167	2.08	4	12.48	AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1
OF315	1.645	1.645	0	0.167	0.82	4	4.93	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF50	1.616	1.616	0	0.167	0.81	4	4.84	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF767	0.204	0.204	0	0.165	0.1	3.94	0.63	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
OF65	3.961	3.961	0	0.167	1.98	4	11.87	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF2890	0.221	0.221	0	0.167	0.11	4	0.66	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
OF2372	3.785	3.785	0	0.167	1.89	4	11.34	AR&R 100 year, 15 minutes storm, average 153 mm/h, Zone 1

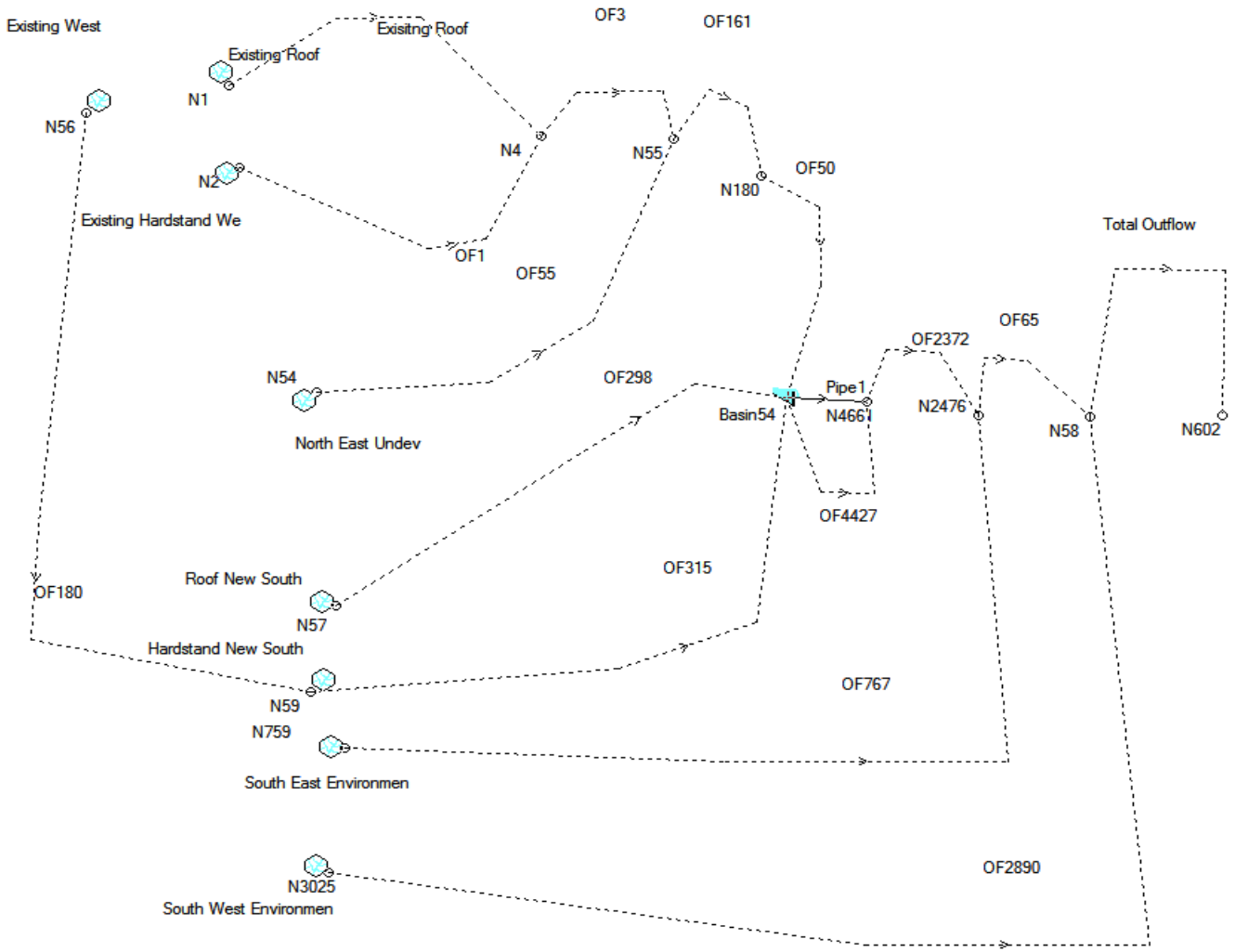
DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level

CONTINUITY CHECK for AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	867.73	867.73	0	0
N2	1728.84	1728.84	0	0
N4	2596.57	2596.57	0	0
N54	235.63	235.63	0	0
N55	2832.2	2832.2	0	0
N56	1090.26	1090.26	0	0
N57	1067.02	1067.02	0	0
N58	7484.88	7484.88	0	0
N59	2900.94	2900.94	0	0
N180	2832.2	2832.2	0	0
N602	7484.88	7484.88	0	0

CSR Hebel DRAINS Developed Detention Model Schematic



CSR Hebel DRAINS Developed Detention Model DRAINS Inputs

PIT / NODE DETAILS Version 13

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is
N1	Node							0		417	-168		3		No	
N2	Node							0		426	-246		6		No	
N4	Node							0		690	-216		8		No	
N54	Node							0		494	-459		127		No	
N55	Node							0		806	-218		132		No	
N56	Node							0		291	-194		150		No	
N57	Node							0		510	-663		154		No	
N58	Node							0		1171	-483		155		No	
N59	Node							0		488	-745		160		No	
N180	Node							0		883	-253		447		No	
N602	Node							0		1287	-482		1532		No	
N759	Node							0		518	-798		1930		No	
N2476	Node							0		1073	-482		6162		No	
N3025	Node							0		504.4	-916		7505		No	
N4661	Node					168		0		975.734	-467.888		11542		No	

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length	id
Basin54	167.2	1000		Culvert	0.5					904.879	-464.119	No			11540
	168	1000													
	180	1000													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor	Rainfall Multiplier
Existing Ro	N1	0.836	100	0	0	5	0	0										0				1
Existing Ha	N2	1.69	95	5	0	5	10	0										0				1
North East	N54	0.319	0	100	0	5	10	0										0				1
Existing We	N56	1.132	75	25	0	5	10	0										0				1
Roof New S	N57	1.028	100	0	0	5	0	0										0				1
Hardstand	N59	1.77	95	5	0	5	10	0										0				1
South East	N759	0.4447	0	100	0	5	10	0										0				1
South Wes	N3025	0.4823	0	100	0	5	10	0										0				1

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)
Pipe1	Basin54	N4661	20	168	167.8	1	RCP-2	525	525	0.013	NewFixed	4	Basin54	0					

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	etc etc

CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Stor (m)	Safe Depth Minor Stor (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %		id	
Exisitng Ro	N1	N4	0.1				Swale with	0.15	0.1	1	1	0		10	60
OF1	N2	N4	0.1				Swale with	0.15	0.1	1	1	0		9	1
OF3	N4	N55	0.1				Swale with	0.15	0.1	1	1	0		12	1
OF55	N54	N55	0.1				Swale with	0.15	0.1	1	1	0		139	1
OF161	N55	N180	0.1				Swale with	0.15	0.1	1	1	0		448	1
OF180	N56	N59	0.1				4 m wide p	0.3	0.15	0.4	1	0		468	
OF298	N57	Basin54	0.1				Swale with	0.15	0.1	1	1	0		790	1
Total Outfl	N58	N602	0.1				Swale with	0.15	0.1	1	1	0		1533	1
OF315	N59	Basin54	0.1				Swale with	0.15	0.1	1	1	0		807	1
OF50	N180	Basin54	0.1				Swale with	0.15	0.1	1	1	0		134	1
OF767	N759	N2476	0.1				Swale with	0.15	0.1	1	1	0		1932	1
OF65	N2476	N58	0.1				Swale with	0.15	0.1	1	1	0		156	1
OF2890	N3025	N58	0.1				Swale with	0.15	0.1	1	1	0		7506	1
OF4427	Basin54	N4661	0.1	168.8		6	1.7 Swale with	0.15	0.1	1	1	0		11543	0.1
OF2372	N4661	N2476	0.1				Swale with	0.15	0.1	1	1	0		6184	0.1

PIPE COVER DETAILS

Name	Type	Dia (mm)	Safe Cover	Cover (m)	
Pipe1	RCP-2	525	0.6	-1.37	Unsafe

CSR Hebel DRAINS Developed Detention Model DRAINS 1 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N4661	168.1			0			

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.205	0.205	0	5	0	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
Existing Hardstand We	0.4	0.395	0.006	5	10	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
North East Undev	0.034	0	0.034	5	10	0	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
Existing West	0.229	0.202	0.029	5	10	0	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
Roof New South	0.253	0.253	0	5	0	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
Hardstand New South	0.419	0.413	0.006	5	10	0	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
South East Environmen	0.047	0	0.047	5	10	0	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
South West Environmen	0.051	0	0.051	5	10	0	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 1 year, 5 minutes storm, average 90.9 mm/h, Zone 1	583.75	394.75 (67.6%)	394.75 (86.8%)	0.00 (0.0%)
AR&R 1 year, 10 minutes storm, average 70.1 mm/h, Zone 1	899.34	651.45 (72.4%)	640.60 (91.4%)	10.85 (5.5%)
AR&R 1 year, 15 minutes storm, average 58.3 mm/h, Zone 1	1122.95	849.83 (75.7%)	814.80 (93.1%)	35.03 (14.1%)
AR&R 1 year, 20 minutes storm, average 50.8 mm/h, Zone 1	1302.92	1007.49 (77.3%)	955.00 (94.1%)	52.49 (18.2%)
AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1	1456.13	1138.66 (78.2%)	1074.35 (94.7%)	64.31 (20.0%)
AR&R 1 year, 30 minutes storm, average 41.3 mm/h, Zone 1	1590.72	1245.13 (78.3%)	1179.20 (95.2%)	65.93 (18.8%)
AR&R 1 year, 45 minutes storm, average 33.3 mm/h, Zone 1	1923.19	1530.36 (79.6%)	1438.20 (96.0%)	92.16 (21.7%)
AR&R 1 year, 1 hour storm, average 28.4 mm/h, Zone 1	2189.17	1760.03 (80.4%)	1645.40 (96.5%)	114.63 (23.7%)
AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1	2612.45	2109.42 (80.7%)	1975.15 (97.1%)	134.27 (23.3%)
AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1	2952.24	2398.38 (81.2%)	2239.85 (97.4%)	158.53 (24.3%)
AR&R 1 year, 3 hours storm, average 15.1 mm/h, Zone 1	3497.67	2851.03 (81.5%)	2664.75 (97.8%)	186.28 (24.1%)
AR&R 1 year, 4.5 hours storm, average 12.0 mm/h, Zone 1	4143.87	3377.09 (81.5%)	3168.16 (98.1%)	208.93 (22.8%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	1.066	2.09	168.299	168.099	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm

Exisitng Roof	0.205	0.205	0	0.165	0.1	3.96	0.63	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF1	0.4	0.4	0	0.167	0.2	4	1.2	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF3	0.606	0.606	0	0.167	0.3	4	1.81	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF55	0.034	0.034	0	0.084	0.03	2.01	0.4	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
OF161	0.626	0.626	0	0.167	0.31	4	1.88	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF180	0.229	0.229	0	0.073	0.07	4	0.98	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
OF298	0.253	0.253	0	0.167	0.13	4	0.76	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
Total Outflow	1.13	1.13	0	0.167	0.56	4	3.38	AR&R 1 year, 1.5 hours storm, average 22.6 mm/h, Zone 1
OF315	0.643	0.643	0	0.167	0.32	4	1.93	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF50	0.626	0.626	0	0.167	0.31	4	1.88	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF767	0.047	0.047	0	0.095	0.04	2.27	0.44	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
OF65	1.095	1.095	0	0.167	0.55	4	3.28	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1
OF2890	0.051	0.051	0	0.098	0.04	2.35	0.44	AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1
OF4427	0	0	0	0	0	0	0	
OF2372	1.066	1.066	0	0.167	0.53	4	3.19	AR&R 1 year, 25 minutes storm, average 45.4 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin54	168.42	1215	1.066	1.066	0

CONTINUITY CHECK for AR&R 1 year, 2 hours storm, average 19.2 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	312.09	312.09	0	0
N2	607.22	607.22	0	0
N4	919.3	919.3	0	0
N54	29.71	29.71	0	0
N55	949.02	949.01	0	0
N56	343.3	343.3	0	0
N57	383.76	383.76	0	0
N58	2387.56	2387.56	0	0
N59	979.26	979.26	0	0
N180	949.01	949.01	0	0
N602	2387.55	2387.55	0	0
N759	41.42	41.42	0	0
N2476	2342.65	2342.65	0	0
N3025	44.92	44.92	0	0
Basin54	2312.03	2301.24	10.79	0
N4661	2301.24	2301.24	0	0

Run Log for Drains Dev with Detention Reuse Full Option 1 Updated for Existing SW Layout.drn run at 10:38:05 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2372, Total Outflow, OF315, OF298, OF161, OF65, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed Detention Model DRAINS 2 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N4661	168.15			0			

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.263	0.263	0	5	0	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
Existing Hardstand We	0.517	0.505	0.012	5	10	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
North East Undev	0.063	0	0.063	5	10	0	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
Existing West	0.308	0.259	0.049	5	10	0	AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1
Roof New South	0.323	0.323	0	5	0	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
Hardstand New South	0.541	0.529	0.013	5	10	0	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
South East Environmen	0.088	0	0.088	5	10	0	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
South West Environmen	0.095	0	0.095	5	10	0	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 2 year, 5 minutes storm, average 116 mm/h, Zone 1	744.08	529.53 (71.2%)	519.65 (89.6%)	9.88 (6.0%)
AR&R 2 year, 10 minutes storm, average 89.4 mm/h, Zone 1	1147.98	895.61 (78.0%)	834.30 (93.3%)	61.31 (24.2%)
AR&R 2 year, 15 minutes storm, average 74.5 mm/h, Zone 1	1435.27	1158.26 (80.7%)	1058.10 (94.6%)	100.16 (31.6%)
AR&R 2 year, 20 minutes storm, average 64.9 mm/h, Zone 1	1666.26	1367.38 (82.1%)	1238.05 (95.4%)	129.33 (35.1%)
AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1	1862.86	1539.11 (82.6%)	1391.20 (95.9%)	147.91 (35.9%)
AR&R 2 year, 30 minutes storm, average 52.9 mm/h, Zone 1	2035.57	1685.91 (82.8%)	1525.75 (96.2%)	160.16 (35.6%)
AR&R 2 year, 45 minutes storm, average 42.6 mm/h, Zone 1	2462.59	2063.62 (83.8%)	1858.40 (96.9%)	205.22 (37.7%)
AR&R 2 year, 1 hour storm, average 36.4 mm/h, Zone 1	2804.81	2362.73 (84.2%)	2125.00 (97.3%)	237.73 (38.4%)
AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1	3350.76	2835.42 (84.6%)	2550.30 (97.7%)	285.11 (38.5%)
AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1	3790.47	3219.34 (84.9%)	2892.85 (98.0%)	326.48 (39.0%)
AR&R 2 year, 3 hours storm, average 19.5 mm/h, Zone 1	4500.09	3841.68 (85.4%)	3445.68 (98.3%)	396.00 (39.8%)
AR&R 2 year, 4.5 hours storm, average 15.4 mm/h, Zone 1	5342.69	4553.16 (85.2%)	4102.05 (98.6%)	451.11 (38.2%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	1.359	2.2	168.352	168.153	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm

Exisitng Roof	0.263	0.263	0	0.167	0.13	4	0.79	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF1	0.517	0.517	0	0.167	0.26	4	1.55	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF3	0.779	0.779	0	0.167	0.39	4	2.33	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF55	0.063	0.063	0	0.106	0.05	2.54	0.47	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
OF161	0.824	0.824	0	0.167	0.41	4	2.47	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF180	0.308	0.308	0	0.084	0.09	4	1.11	AR&R 2 year, 1.5 hours storm, average 29.0 mm/h, Zone 1
OF298	0.323	0.323	0	0.167	0.16	4	0.97	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
Total Outflow	1.491	1.491	0	0.167	0.75	4	4.47	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF315	0.843	0.843	0	0.167	0.42	4	2.53	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF50	0.824	0.824	0	0.167	0.41	4	2.47	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF767	0.088	0.088	0	0.12	0.06	2.87	0.51	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
OF65	1.422	1.422	0	0.167	0.71	4	4.26	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1
OF2890	0.095	0.095	0	0.124	0.06	2.96	0.52	AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1
OF4427	0	0	0	0	0	0	0	
OF2372	1.359	1.359	0	0.167	0.68	4	4.07	AR&R 2 year, 25 minutes storm, average 58.0 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin54	168.54	1340.1	1.359	1.359	0

CONTINUITY CHECK for AR&R 2 year, 2 hours storm, average 24.6 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	403.07	403.07	0	0
N2	790.29	790.29	0	0
N4	1193.36	1193.36	0	0
N54	61.19	61.19	0	0
N55	1254.55	1254.55	0	0
N56	463.63	463.63	0	0
N57	495.64	495.64	0	0
N58	3208.41	3208.4	0	0
N59	1291.32	1291.32	0	0
N180	1254.55	1254.55	0	0
N602	3208.4	3208.4	0	0
N759	85.3	85.3	0	0
N2476	3115.91	3115.91	0	0
N3025	92.52	92.52	0	0
Basin54	3041.52	3030.62	10.9	0
N4661	3030.62	3030.61	0	0

Run Log for Drains Dev with Detention Reuse Full Option 1 Updated for Existing SW Layout.drn run at 10:38:33 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed Detention Model DRAINS 5 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N4661	168.22			0			

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.331	0.331	0	5	0	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
Existing Hardstand We	0.655	0.636	0.02	5	10	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
North East Undev	0.088	0	0.088	5	10	0	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
Existing West	0.401	0.336	0.066	5	10	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
Roof New South	0.407	0.407	0	5	0	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
Hardstand New South	0.686	0.666	0.021	5	10	0	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
South East Environmen	0.122	0	0.122	5	10	0	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
South West Environmen	0.133	0	0.133	5	10	0	AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 5 year, 5 minutes storm, average 145 mm/h, Zone 1	931.94	710.61 (76.3%)	666.00 (91.7%)	44.61 (21.7%)
AR&R 5 year, 10 minutes storm, average 112 mm/h, Zone 1	1441.3	1186.65 (82.3%)	1062.80 (94.7%)	123.85 (38.9%)
AR&R 5 year, 15 minutes storm, average 93.8 mm/h, Zone 1	1805.35	1524.74 (84.5%)	1346.40 (95.7%)	178.34 (44.7%)
AR&R 5 year, 20 minutes storm, average 81.7 mm/h, Zone 1	2098.22	1796.31 (85.6%)	1574.55 (96.3%)	221.76 (47.8%)
AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1	2347.51	2019.18 (86.0%)	1768.75 (96.7%)	250.43 (48.3%)
AR&R 5 year, 30 minutes storm, average 66.7 mm/h, Zone 1	2566.88	2214.04 (86.3%)	1939.65 (97.0%)	274.39 (48.4%)
AR&R 5 year, 45 minutes storm, average 53.9 mm/h, Zone 1	3110.9	2706.30 (87.0%)	2363.45 (97.5%)	342.85 (49.9%)
AR&R 5 year, 1 hour storm, average 46.1 mm/h, Zone 1	3550.3	3102.48 (87.4%)	2705.75 (97.8%)	396.73 (50.6%)
AR&R 5 year, 1.5 hours storm, average 36.9 mm/h, Zone 1	4258.12	3737.64 (87.8%)	3257.15 (98.2%)	480.49 (51.1%)
AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1	4834.74	4255.82 (88.0%)	3706.34 (98.4%)	549.47 (51.4%)
AR&R 5 year, 3 hours storm, average 25.0 mm/h, Zone 1	5775.92	5107.25 (88.4%)	4439.55 (98.7%)	667.70 (52.3%)
AR&R 5 year, 4.5 hours storm, average 19.9 mm/h, Zone 1	6901.57	6096.34 (88.3%)	5316.45 (98.9%)	779.89 (51.1%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	1.673	2.26	168.418	168.22	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.331	0.331	0	0.167	0.17	4	0.99	AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1

OF1	0.655	0.655	0	0.167	0.33	4	1.96 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF3	0.987	0.987	0	0.167	0.49	4	2.96 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF55	0.088	0.088	0	0.12	0.06	2.87	0.51 AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
OF161	1.059	1.059	0	0.167	0.53	4	3.17 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF180	0.401	0.401	0	0.097	0.12	4	1.22 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF298	0.407	0.407	0	0.167	0.2	4	1.22 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
Total Outflow	1.875	1.875	0	0.167	0.94	4	5.62 AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
OF315	1.081	1.081	0	0.167	0.54	4	3.24 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF50	1.059	1.059	0	0.167	0.53	4	3.17 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF767	0.122	0.122	0	0.136	0.08	3.26	0.55 AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
OF65	1.769	1.769	0	0.167	0.88	4	5.3 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1
OF2890	0.133	0.133	0	0.14	0.08	3.35	0.57 AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1
OF4427	0	0	0	0	0	0	0
OF2372	1.673	1.673	0	0.167	0.84	4	5.01 AR&R 5 year, 25 minutes storm, average 73.2 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin54	168.7	1503.1	1.673	1.673	0

CONTINUITY CHECK for AR&R 5 year, 2 hours storm, average 31.4 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	516.42	516.42	0	0
N2	1019.04	1019.04	0	0
N4	1535.46	1535.46	0	0
N54	102.99	102.99	0	0
N55	1638.44	1638.44	0	0
N56	615.81	615.81	0	0
N57	635.02	635.02	0	0
N58	4244.8	4244.79	0	0
N59	1683.09	1683.09	0	0
N180	1638.44	1638.44	0	0
N602	4244.78	4244.78	0	0
N759	143.57	143.57	0	0
N2476	4089.1	4089.1	0	0
N3025	155.71	155.71	0	0
Basin54	3956.55	3945.55	11	0
N4661	3945.55	3945.54	0	0

Run Log for Drains Dev with Detention Reuse Full Option 1 Updated for Existing SW Layout.drn run at 10:38:52 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed Detention Model DRAINS 10 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N4661	168.25		0.002				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.37	0.37	0	5	0	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
Existing Hardstand We	0.734	0.711	0.024	5	10	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
North East Undev	0.101	0	0.101	5	10	0	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
Existing West	0.454	0.376	0.08	5	10	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
Roof New South	0.455	0.455	0	5	0	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
Hardstand New South	0.769	0.744	0.025	5	10	0	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
South East Environmen	0.14	0	0.14	5	10	0	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
South West Environmen	0.152	0	0.152	5	10	0	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 10 year, 5 minutes storm, average 162 mm/h, Zone 1	1038.42	816.35 (78.6%)	748.95 (92.6%)	67.40 (29.4%)
AR&R 10 year, 10 minutes storm, average 125 mm/h, Zone 1	1606.96	1351.42 (84.1%)	1191.85 (95.2%)	159.57 (44.9%)
AR&R 10 year, 15 minutes storm, average 105 mm/h, Zone 1	2014.59	1732.51 (86.0%)	1509.40 (96.2%)	223.11 (50.1%)
AR&R 10 year, 20 minutes storm, average 91.3 mm/h, Zone 1	2342.69	2039.35 (87.1%)	1765.00 (96.7%)	274.35 (53.0%)
AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1	2622.34	2292.19 (87.4%)	1982.85 (97.1%)	309.34 (53.4%)
AR&R 10 year, 30 minutes storm, average 74.5 mm/h, Zone 1	2868.55	2514.32 (87.7%)	2174.65 (97.3%)	339.67 (53.6%)
AR&R 10 year, 45 minutes storm, average 60.3 mm/h, Zone 1	3480.73	3073.33 (88.3%)	2651.55 (97.8%)	421.78 (54.8%)
AR&R 10 year, 1 hour storm, average 51.6 mm/h, Zone 1	3976.67	3526.34 (88.7%)	3037.90 (98.1%)	488.44 (55.6%)
AR&R 10 year, 1.5 hours storm, average 41.4 mm/h, Zone 1	4779.93	4257.58 (89.1%)	3663.65 (98.4%)	593.93 (56.2%)
AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1	5437.55	4856.35 (89.3%)	4175.95 (98.6%)	680.40 (56.6%)
AR&R 10 year, 3 hours storm, average 28.2 mm/h, Zone 1	6515.31	5842.14 (89.7%)	5015.55 (98.8%)	826.59 (57.4%)
AR&R 10 year, 4.5 hours storm, average 22.5 mm/h, Zone 1	7808.67	6995.19 (89.6%)	6023.15 (99.0%)	972.03 (56.3%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	1.82	2.3	168.465	168.25	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.37	0.37	0	0.167	0.19	4	1.11	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1

OF1	0.734	0.734	0	0.167	0.37	4	2.2	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF3	1.104	1.104	0	0.167	0.55	4	3.31	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF55	0.101	0.101	0	0.126	0.07	3.02	0.53	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
OF161	1.193	1.193	0	0.167	0.6	4	3.57	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF180	0.454	0.454	0	0.103	0.13	4	1.29	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF298	0.455	0.455	0	0.167	0.23	4	1.36	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
Total Outflow	2.072	2.072	0	0.167	1.04	4	6.21	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
OF315	1.217	1.217	0	0.167	0.61	4	3.64	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF50	1.193	1.193	0	0.167	0.6	4	3.57	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF767	0.14	0.14	0	0.143	0.08	3.43	0.57	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
OF65	1.932	1.932	0	0.167	0.97	4	5.79	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF2890	0.152	0.152	0	0.148	0.09	3.54	0.58	AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1
OF4427	0.002	0.002	0	0.028	0.01	0.66	0.19	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1
OF2372	1.822	1.822	0	0.167	0.91	4	5.46	AR&R 10 year, 25 minutes storm, average 81.7 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin54	168.8	1603	1.822	1.82	0.002

CONTINUITY CHECK for AR&R 10 year, 2 hours storm, average 35.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	581.85	581.85	0	0
N2	1151.19	1151.19	0	0
N4	1733.04	1733.04	0	0
N54	127.53	127.53	0	0
N55	1860.57	1860.57	0	0
N56	704.03	704.03	0	0
N57	715.48	715.48	0	0
N58	4845.28	4845.28	0	0
N59	1909.72	1909.72	0	0
N180	1860.57	1860.57	0	0
N602	4845.27	4845.27	0	0
N759	177.78	177.78	0	0
N2476	4652.48	4652.48	0	0
N3025	192.81	192.81	0	0
Basin54	4485.77	4474.72	11.05	0
N4661	4474.72	4474.72	0	0

Run Log for Drains Dev with Detention Reuse Full Option 1 Updated for Existing SW Layout.drn run at 10:39:09 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed Detention Model DRAINS 20 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N4661	168.26		0.388				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.422	0.422	0	5	0	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
Existing Hardstand We	0.84	0.811	0.029	5	10	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
North East Undev	0.117	0	0.117	5	10	0	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
Existing West	0.527	0.429	0.099	5	10	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
Roof New South	0.519	0.519	0	5	0	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
Hardstand New South	0.88	0.85	0.031	5	10	0	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
South East Environmen	0.164	0	0.164	5	10	0	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
South West Environmen	0.178	0	0.178	5	10	0	AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 20 year, 5 minutes storm, average 184 mm/h, Zone 1	1182.32	959.47 (81.2%)	861.05 (93.5%)	98.42 (37.7%)
AR&R 20 year, 10 minutes storm, average 143 mm/h, Zone 1	1831.15	1574.67 (86.0%)	1366.50 (95.8%)	208.17 (51.4%)
AR&R 20 year, 15 minutes storm, average 119 mm/h, Zone 1	2297.76	2014.16 (87.7%)	1730.00 (96.6%)	284.16 (56.0%)
AR&R 20 year, 20 minutes storm, average 104 mm/h, Zone 1	2673.43	2368.33 (88.6%)	2022.65 (97.1%)	345.69 (58.5%)
AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1	2993.64	2661.54 (88.9%)	2272.10 (97.4%)	389.44 (58.9%)
AR&R 20 year, 30 minutes storm, average 85.1 mm/h, Zone 1	3275.66	2919.86 (89.1%)	2491.80 (97.6%)	428.06 (59.1%)
AR&R 20 year, 45 minutes storm, average 68.9 mm/h, Zone 1	3977.57	3566.72 (89.7%)	3038.60 (98.1%)	528.12 (60.1%)
AR&R 20 year, 1 hour storm, average 59.0 mm/h, Zone 1	4547.97	4094.65 (90.0%)	3482.95 (98.3%)	611.71 (60.9%)
AR&R 20 year, 1.5 hours storm, average 47.4 mm/h, Zone 1	5475.99	4951.44 (90.4%)	4205.90 (98.6%)	745.54 (61.6%)
AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1	6238.68	5655.94 (90.7%)	4800.05 (98.8%)	855.89 (62.1%)
AR&R 20 year, 3 hours storm, average 32.4 mm/h, Zone 1	7494.62	6816.12 (90.9%)	5778.43 (99.0%)	1037.69 (62.7%)
AR&R 20 year, 4.5 hours storm, average 26.0 mm/h, Zone 1	9007.87	8188.12 (90.9%)	6957.27 (99.1%)	1230.85 (61.8%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	1.948	2.41	168.536	168.262	AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm

Exisitng Roof	0.422	0.422	0	0.167	0.21	4	1.27 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF1	0.84	0.84	0	0.167	0.42	4	2.52 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF3	1.263	1.263	0	0.167	0.63	4	3.78 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF55	0.117	0.117	0	0.134	0.07	3.21	0.55 AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
OF161	1.373	1.373	0	0.167	0.69	4	4.11 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF180	0.527	0.527	0	0.112	0.15	4	1.36 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF298	0.519	0.519	0	0.167	0.26	4	1.56 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
Total Outflow	2.615	2.615	0	0.167	1.31	4	7.83 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF315	1.399	1.399	0	0.167	0.7	4	4.19 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF50	1.373	1.373	0	0.167	0.69	4	4.11 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF767	0.164	0.164	0	0.152	0.09	3.63	0.6 AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
OF65	2.47	2.47	0	0.167	1.24	4	7.4 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF2890	0.178	0.178	0	0.156	0.09	3.74	0.61 AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1
OF4427	0.388	0.388	0	0.167	0.19	4	1.16 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1
OF2372	2.336	2.336	0	0.167	1.17	4	7 AR&R 20 year, 25 minutes storm, average 93.3 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin54	168.91	1713	2.336	1.948	0.388

CONTINUITY CHECK for AR&R 20 year, 2 hours storm, average 40.5 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	668.81	668.81	0	0
N2	1326.91	1326.91	0	0
N4	1995.71	1995.71	0	0
N54	160.42	160.42	0	0
N55	2156.13	2156.13	0	0
N56	821.52	821.52	0	0
N57	822.41	822.41	0	0
N58	5644.8	5644.79	0	0
N59	2211.24	2211.24	0	0
N180	2156.13	2156.13	0	0
N602	5644.79	5644.79	0	0
N759	223.63	223.63	0	0
N2476	5402.28	5402.27	0	0
N3025	242.54	242.54	0	0
Basin54	5189.78	5178.66	11.11	0
N4661	5178.66	5178.66	0	0

Run Log for Drains Dev with Detention Reuse Full Option 1 Updated for Existing SW Layout.drn run at 10:39:30 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF4427, OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed Detention Model DRAINS 50 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N4661	168.27		0.695				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.467	0.467	0	5	0	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
Existing Hardstand We	0.911	0.897	0.014	5	10	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
North East Undev	0.131	0	0.131	5	10	0	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
Existing West	0.558	0.457	0.101	5	10	0	AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
Roof New South	0.574	0.574	0	5	0	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
Hardstand New South	0.955	0.94	0.015	5	10	0	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
South East Environmen	0.182	0	0.182	5	10	0	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
South West Environmen	0.197	0	0.197	5	10	0	AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1	1368.2	1144.59 (83.7%)	1005.85 (94.4%)	138.74 (45.9%)
AR&R 50 year, 10 minutes storm, average 165 mm/h, Zone 1	2121.71	1863.95 (87.9%)	1592.85 (96.4%)	271.10 (57.8%)
AR&R 50 year, 15 minutes storm, average 138 mm/h, Zone 1	2665.85	2379.90 (89.3%)	2016.75 (97.1%)	363.15 (61.6%)
AR&R 50 year, 20 minutes storm, average 121 mm/h, Zone 1	3103.91	2793.81 (90.0%)	2358.00 (97.5%)	435.81 (63.5%)
AR&R 50 year, 25 minutes storm, average 108 mm/h, Zone 1	3476.75	3139.18 (90.3%)	2648.45 (97.8%)	490.73 (63.9%)
AR&R 50 year, 30 minutes storm, average 98.8 mm/h, Zone 1	3805.24	3445.24 (90.5%)	2904.35 (98.0%)	540.89 (64.3%)
AR&R 50 year, 45 minutes storm, average 80.0 mm/h, Zone 1	4623.38	4208.77 (91.0%)	3541.70 (98.3%)	667.08 (65.3%)
AR&R 50 year, 1 hour storm, average 68.7 mm/h, Zone 1	5290.18	4832.29 (91.3%)	4061.15 (98.5%)	771.14 (66.0%)
AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1	6379.37	5851.54 (91.7%)	4909.63 (98.8%)	941.91 (66.8%)
AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1	7280.19	6695.05 (92.0%)	5611.41 (98.9%)	1083.64 (67.4%)
AR&R 50 year, 3 hours storm, average 38.0 mm/h, Zone 1	8771.23	8084.06 (92.2%)	6772.93 (99.1%)	1311.13 (67.6%)
AR&R 50 year, 4.5 hours storm, average 30.5 mm/h, Zone 1	10575.81	9750.88 (92.2%)	8178.73 (99.3%)	1572.15 (67.3%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	2.024	2.48	168.549	168.268	AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
Exisitng Roof	0.467	0.467	0	0.167	0.23	4	1.4	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
OF1	0.911	0.911	0	0.167	0.46	4	2.73	AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1

OF3	1.379	1.379	0	0.167	0.69	4	4.13 AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
OF55	0.131	0.131	0	0.139	0.08	3.33	0.56 AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
OF161	1.458	1.458	0	0.167	0.73	4	4.37 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF180	0.558	0.558	0	0.115	0.16	4	1.4 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF298	0.574	0.574	0	0.167	0.29	4	1.72 AR&R 50 year, 5 minutes storm, average 213 mm/h, Zone 1
Total Outflow	3.025	3.025	0	0.167	1.51	4	9.06 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF315	1.484	1.484	0	0.167	0.74	4	4.45 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF50	1.458	1.458	0	0.167	0.73	4	4.37 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF767	0.182	0.182	0	0.157	0.1	3.77	0.61 AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
OF65	2.866	2.866	0	0.167	1.43	4	8.59 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF2890	0.197	0.197	0	0.163	0.1	3.9	0.62 AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1
OF4427	0.695	0.695	0	0.167	0.35	4	2.08 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1
OF2372	2.719	2.719	0	0.167	1.36	4	8.14 AR&R 50 year, 1.5 hours storm, average 55.2 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin54	168.97	1766.8	2.719	2.024	0.695

CONTINUITY CHECK for AR&R 50 year, 2 hours storm, average 47.3 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	781.86	781.86	0	0
N2	1555.32	1555.32	0	0
N4	2337.18	2337.17	0	0
N54	203.1	203.1	0	0
N55	2540.27	2540.27	0	0
N56	974.19	974.19	0	0
N57	961.42	961.42	0	0
N58	6683.82	6683.81	0	0
N59	2603.14	2603.14	0	0
N180	2540.27	2540.27	0	0
N602	6683.8	6683.8	0	0
N759	283.13	283.13	0	0
N2476	6376.78	6376.75	0	0
N3025	307.07	307.07	0	0
Basin54	6104.83	6093.65	11.18	0
N4661	6093.65	6093.65	0	0

Run Log for Drains Dev with Detention Reuse Full Option 1 Updated for Existing SW Layout.drn run at 10:39:51 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF4427, OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF55, OF50, OF3, Exisitng Roof, OF1

CSR Hebel DRAINS Developed Detention Model DRAINS 100 Year ARI Results

DRAINS results prepared from Version 2016.14

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N4661	168.28		0.77				

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Existing Roof	0.518	0.518	0	5	0	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
Existing Hardstand We	1.011	0.994	0.017	5	10	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
North East Undev	0.146	0	0.146	5	10	0	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
Existing West	0.619	0.506	0.113	5	10	0	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
Roof New South	0.637	0.637	0	5	0	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
Hardstand New South	1.059	1.041	0.018	5	10	0	AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
South East Environmen	0.204	0	0.204	5	10	0	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
South West Environmen	0.221	0	0.221	5	10	0	AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1

Outflow Volumes for Total Catchment (6.00 impervious + 1.70 pervious = 7.70 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1	1507.73	1283.68 (85.1%)	1114.55 (94.9%)	169.13 (50.8%)
AR&R 100 year, 10 minutes storm, average 182 mm/h, Zone 1	2339.8	2081.55 (89.0%)	1762.75 (96.7%)	318.80 (61.7%)
AR&R 100 year, 15 minutes storm, average 153 mm/h, Zone 1	2941.27	2654.57 (90.3%)	2231.30 (97.4%)	423.27 (65.1%)
AR&R 100 year, 20 minutes storm, average 133 mm/h, Zone 1	3425.46	3114.29 (90.9%)	2608.50 (97.8%)	505.79 (66.8%)
AR&R 100 year, 25 minutes storm, average 120 mm/h, Zone 1	3837.97	3499.66 (91.2%)	2929.85 (98.0%)	569.81 (67.2%)
AR&R 100 year, 30 minutes storm, average 109 mm/h, Zone 1	4201.38	3840.69 (91.4%)	3212.95 (98.2%)	627.74 (67.6%)
AR&R 100 year, 45 minutes storm, average 88.4 mm/h, Zone 1	5108.29	4692.99 (91.9%)	3919.45 (98.5%)	773.54 (68.5%)
AR&R 100 year, 1 hour storm, average 75.9 mm/h, Zone 1	5849.22	5390.65 (92.2%)	4496.65 (98.7%)	894.00 (69.2%)
AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1	7063.44	6535.11 (92.5%)	5442.53 (98.9%)	1092.58 (70.0%)
AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1	8071.31	7484.88 (92.7%)	6227.70 (99.0%)	1257.18 (70.5%)
AR&R 100 year, 3 hours storm, average 42.2 mm/h, Zone 1	9743.99	9054.58 (92.9%)	7530.67 (99.2%)	1523.91 (70.8%)
AR&R 100 year, 4.5 hours storm, average 34.0 mm/h, Zone 1	11772.7	10946.33 (93.0%)	9111.15 (99.3%)	1835.19 (70.5%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	2.141	2.59	168.589	168.276	AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm

Exisitng Roof	0.518	0.518	0	0.167	0.26	4	1.55 AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
OF1	1.011	1.011	0	0.167	0.51	4	3.03 AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
OF3	1.529	1.529	0	0.167	0.76	4	4.58 AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
OF55	0.146	0.146	0	0.145	0.08	3.47	0.58 AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
OF161	1.616	1.616	0	0.167	0.81	4	4.84 AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF180	0.619	0.619	0	0.122	0.18	4	1.45 AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF298	0.637	0.637	0	0.167	0.32	4	1.91 AR&R 100 year, 5 minutes storm, average 235 mm/h, Zone 1
Total Outflow	3.296	3.296	0	0.167	1.65	4	9.87 AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
OF315	1.645	1.645	0	0.167	0.82	4	4.93 AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF50	1.616	1.616	0	0.167	0.81	4	4.84 AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF767	0.204	0.204	0	0.165	0.1	3.94	0.63 AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
OF65	3.079	3.079	0	0.167	1.54	4	9.22 AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
OF2890	0.221	0.221	0	0.167	0.11	4	0.66 AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1
OF4427	0.77	0.77	0	0.167	0.38	4	2.31 AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1
OF2372	2.91	2.91	0	0.167	1.46	4	8.72 AR&R 100 year, 1.5 hours storm, average 61.1 mm/h, Zone 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
Basin54	169.06	1855.6	2.91	2.141	0.77

CONTINUITY CHECK for AR&R 100 year, 2 hours storm, average 52.4 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
N1	867.73	867.73	0	0
N2	1728.84	1728.84	0	0
N4	2596.57	2596.57	0	0
N54	235.63	235.63	0	0
N55	2832.2	2832.2	0	0
N56	1090.26	1090.26	0	0
N57	1067.02	1067.02	0	0
N58	7473.64	7473.64	0	0
N59	2900.94	2900.94	0	0
N180	2832.2	2832.2	0	0
N602	7473.64	7473.64	0	0
N759	328.48	328.48	0	0
N2476	7117.4	7117.4	0	0
N3025	356.25	356.25	0	0
Basin54	6800.16	6788.94	11.22	0
N4661	6788.94	6788.93	0	0

Run Log for Drains Dev with Detention Reuse Full Option 1 Updated for Existing SW Layout.drn run at 10:40:07 on 31/10/2016

The maximum flow in the following overflow routes is unsafe: OF4427, OF2890, OF2372, OF767, Total Outflow, OF315, OF298, OF161, OF65, OF50, OF3, Exisitng Roof, OF1