



Ibrahim Stormwater Consultants



REF : C9015-13539

REV. A

STORMWATER DESIGN CALCULATIONS

AT 4 CRETE STREET

NARRAWEENA

Contents

1.0 Detention System Requirements

- 1.1 Storage-Area calcs.
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Files On Disk

C9015-13539 -DRAINS.DRN

2.0 Infiltration System Requirements

Borehole Report suggests rock within close proximity so Level Spreader design proposed

1.0 Detention System Requirements

1.1 Storage-Area calcs.

DATA:

Site Area Assessed due to easements

Site Area = **0.0549** ha **549** sq.m

Impervious Area Pre Development = **284.9** sqm

Percentage Impervious Pre Development = **0%** assumed

Impervious Area POST Development = **278** sqm

Percentage Impervious POST Development = **51%**

Catchment directed through OSD A = **223** sqm **80.2 %**

OSD Bypass Areas :	Impervious	55 sqm	42.0 %
	Pervious	76 sqm	58.0 %
	Total	131 sqm	

Area bypassing OSD B = **195** sqm

Slope of Site =	4.3 %	Time of Concentration tc =	
Effective Flow Length =	36.3 m	1 min.	1:5
Hortons n=	0.1	1 min.	1:100

FFL of house =	66.21 m
Roof Gutter Level =	68.82 m
Invert of Outlet =	64.9 m
Raintank Pad Level =	65.43 m
Freeboard to Roof Gutter=	1.530 m

Detention A

Volume Required **5.58** cu.m

Total Area **5.01** sq.m

Stage Storage-Discharge Relationship

Stage	Storage Area	Avg. Depth	Storage
(m)	(sq.m)	(m)	(cu.m)
66.06	0	0	0.000
67.06	5.0	1.000	5.010
67.17	5.0	1.11	5.579

Invert of pit = **66.06** m

Orifice Dia. = **68** mm

Max. Water Level achieved = **67.140** m

Storage achieved **5.43** cu.m

Basix Allowance

Raintank Basix = **1700** L

Raintank Provided = **3130** L

Water Level in Tank RL for Basix = **66.06** m = orifice IL. Depth=0.625m

0% OSD Compensation = **2715** L

Net OSD required **2715** L -RL. **67.14** m

Nominal tank Volume used = **9310** L

Total Tank Height = **1.860** m TOP OF TANK.=67.29m

Overflow to ---> **OSD**, then Level Spreader

Trench Length = **5** m x **1** rows x **0.25** m wide

Detention B

Volume Required **6.07** cu.m

Total Area **19.70** sq.m

Stage Storage-Discharge Relationship

Stage	Storage Area	Avg. Depth	Storage
(m)	(sq.m)	(m)	(cu.m)
65.40	0.36	0.3	0.108
65.50	19.7	0.100	1.147
65.60	19.7	0.100	3.117
65.75	19.7	0.15	6.072

Invert of pit = **65.10** m

Orifice Dia. = **103** mm

Max. Water Level achieved = **65.750** m

Storage achieved **6.07** cu.m

1.2 DRAINS Data File for Pre & Post Developed Conditions

PIT / NODE DETAILS										Version 9											
Name	Type	Family	Size	Ponding	Pressure	Surface	Max Pond	Base	Blocking	x	y	Bolt-down	id	Part Full							
				Volume	Change	Elev (m)	Depth (m)	Inflow	Factor				lid	Shock Loss							
			(cu.m)		Coeff. Ku			(cu.m/s)													
Pre	Node					10		0			256	-139		2							
Ground	Node					66		0			444	-153		8							
Level Spreader	OnGrade	Sutherland grat	Grated pit with 0.9 m x 0.		1.5	65.7		0	0	618.441	-210.487	No	566686	1 x Ku							
Dummy Node	Node					65.2		0		664.978	-235.87			45							
Roof	Node					68.82		0			440	-74		9							
DETENTION BASIN DETAILS																					
Name	Elev	Surf. Area	Init Vol. (cu	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Leng	id						
OSD -2	65.40	0.36	0.3	Orifice		103	65.4515				571.865	-185.735	No		36990						
	65.50	19.70																			
	65.60	19.70																			
	65.75	19.70																			
OSD -1	66.06	5.0	0	Orifice		68	66.089341				558	-103	No		5						
	67.06	5.0																			
	67.17	5.0																			
SUB-CATCHMENT DETAILS																					
Name	Pit or Node	Total Area	Paved Area	Grass Area	Supp Area	Paved Time	Grass Time	Supp Time	Paved Length	Grass Length	Supp Length	Paved Slope(%)	Grass Slope	Supp Slope	Paved Rough	Grass Rough	Supp Rough	Lag Time	Gutter Length	Gutter Slope	Gutter FlowFactor
		(ha)	(%)	(%)	(%)	(min)	(min)	(min)	(m)	(m)	(m)	(%)	(%)	(%)				or Factor	(m)	(%)	
Pre Site	Pre	0.0549	0	100	0	0	0	0	0	36.3	36.3	0	4.3	4.3	0	0.01	0.33	0	0		
Ground -2	Ground	0.0131	42.0	58.0	0	0	0	0	0	25	25	0	4.3	4.3	0	0.01	0.33	0	0		
bypass-2	Level Spre	0.0195	0	100	0	0	0	0	0	36.3	36.3	0	1.3	1.3	0	0.01	0.33	0	0		
Roof Area	Roof	0.0223	100	0	0	0	0	0	0	21	0	0	20	0	0	0.01	0	0	0		
PIPE DETAILS																					
Name	From	To	Length	U/S IL	D/S IL	Slope	Type	Dia	I.D.	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg	RI	Chg	RL	etc		
			(m)	(m)	(m)	(%)		(mm)	(mm)						(m)	(m)	(m)	(m)	(m)		
Pipe2	Ground	OSD -2	45	65.7	65.4	1.44	uPVC, not un	150	154	0.03	NewFixed	1	Ground		0						
Pipe4	OSD -2	Level Spreader	5	65.4	65.3	2	uPVC, not un	150	154	0.03	NewFixed	1	OSD -2		0						
Pipe5	Level Spre	Dummy Node	5	65.3	65.2	2	uPVC, not un	225	230	0.03	New	1	Level Sprn		0						
Pipe1	Roof	OSD -1	20	68.32	66.21	1	uPVC, not un	150	154	0.03	NewFixed	1	Roof		0						
Pipe3	OSD -1	OSD -2	10	66.06	65.5	9.8	uPVC, not un	150	154	0.03	NewFixed	1	OSD -1		0						
DETAILS of SERVICES CROSSING PIPES																					
Pipe	Chg	Bottom	Height of S	Bottom	Height of	Chg	Bottom	Height of	etc												
(m)	(m)	Elev (m)	(m)	Elev (m)	(m)	(m)	Elev (m)	(m)	etc												
CHANNEL DETAILS																					
Name	From	To	Type	Length	U/S IL	D/S IL	Slope	Base Width	L.B. Slope	R.B. Slope	Manning	Depth	Roofed								
				(m)	(m)	(m)	(%)	(m)	(%)	(%)		(m)									
OVERFLOW ROUTE DETAILS																					
Name	From	To	Travel Time	Spill Level	Crest Length	Weir Coeff. C	Cross Section	Safe Depth Major Storm	SafeDepth Minor Stor	Safe DxV	Bed Slope	D/S Area Contributing	id								
			(min)	(m)	(m)			(m)	(m)	(sq.m/sec)	(%)	%									
OSD Overflow	OSD -2	Level Spreader	1	65.75	5	1.7	Pathway 6 m	0.1	0.05	0.4	1	0	37044								

1.3 DRAINS Summary of Pre & Post Developed Discharges

5 YEAR

DRAINS results prepared from Version 2019.07

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Version 8		Min Freeboard (m)	Overflow (cu.m/s)	Constraint
			Max Surface Flow Arriving	Max Pond Volume			
			(cu.m/s)	(cu.m)			
Ground	65.75		0.004				
Level Spreader	65.4		0.003		0.3		None
Dummy Node	65.25		0				
Roof	68.36		0.011				

SUB-CATCHMENT DETAILS

Name	Max	Paved	Grassed	Paved	Grassed	Supp.	Due to Storm
	Flow Q	Max Q	Max Q	Tc	Tc	Tc	
	(cu.m/s)	(cu.m/s)	(cu.m/s)	(min)	(min)	(min)	
Pre Site	0.011	0	0.011	1.63	13.26	0	AR&R 5 year, 25 minute storm, average 87 mm/h, Zone 1
Ground -2	0.004	0.003	0.002	1.3	10.6	0	AR&R 5 year, 25 minute storm, average 87 mm/h, Zone 1
bypass-2	0.003	0	0.003	2.8	22.81	0	AR&R 5 year, 60 minute storm, average 55 mm/h, Zone 1
Roof Area	0.011	0.011	0	0.74	0	0	AR&R 5 year, 25 minute storm, average 87 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.03 impervious + 0.08 pervious = 0.11 total ha)

Storm	Total Rainfa	Total Runoff	Impervious R		Pervious Runoff	
	cu.m	cu.m (Runoff %)	cu.m (Runoff	cu.m (Runoff %)	cu.m (Runoff	cu.m (Runoff %)
AR&R 5 year, 10 min	11.9	3.00 (25.2%)	2.73 (90.8%)	0.27 (3.0%)		
AR&R 5 year, 15 min	30.2	15.96 (52.9%)	7.37 (96.4%)	8.59 (38.1%)		
AR&R 5 year, 20 min	35.5	19.63 (55.3%)	8.71 (96.9%)	10.91 (41.2%)		
AR&R 5 year, 25 min	39.8	22.35 (56.2%)	9.80 (97.2%)	12.55 (42.2%)		
AR&R 5 year, 30 min	43.92	24.47 (55.7%)	10.84 (97.5%)	13.63 (41.6%)		
AR&R 5 year, 45 min	53.53	30.50 (57.0%)	13.28 (97.9%)	17.23 (43.1%)		
AR&R 5 year, 60 min	60.39	34.44 (57.0%)	15.01 (98.2%)	19.42 (43.1%)		
AR&R 5 year, 90 min	72.47	41.11 (56.7%)	18.07 (98.5%)	23.04 (42.6%)		
AR&R 5 year, 120 mi	81.25	45.64 (56.2%)	20.30 (98.6%)	25.34 (41.8%)		
AR&R 5 year, 180 mi	95.86	53.75 (56.1%)	23.99 (98.9%)	29.75 (41.6%)		

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
Pipe2	0.004		0.86	65.748	65.573 AR&R 5 year, 25 minute storm, average 87 mm/h, Zone 1
Pipe4	0.008		1.54	65.449	65.403 AR&R 5 year, 25 minute storm, average 87 mm/h, Zone 1
Pipe5	0.011		1.59	65.378	65.25 AR&R 5 year, 60 minute storm, average 55 mm/h, Zone 1
Pipe1	0.011		3.12	68.356	66.622 AR&R 5 year, 25 minute storm, average 87 mm/h, Zone 1
Pipe3	0.007		2.2	66.095	65.573 AR&R 5 year, 25 minute storm, average 87 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm
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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
OSD Overflow		0	0	0	0	0	0	0

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD -2	65.57		2.2	0.008	0.008
OSD -1	66.62		2.8	0.007	0.007

CONTINUITY CHECK for AR&R 5 year, 60 minute storm, average 55 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
Pre	13.03	13.03	0	0
Ground	4.78	4.78	0	-0.1
OSD -2	16.8	16.8	0	0
Level Spreader	21.39	21.37	0	0.1
Dummy Node	21.37	21.37	0	0
Roof	12.04	12.02	0	0.2
OSD -1	12.02	12.01	0.01	0

Run Log for C9015 run at 23:57:21 on 27/8/2019

No water upwelling from any pit. Freeboard was adequate at all pits.

Flows were safe in all overflow routes.

100 YEAR

DRAINS results prepared from Version 2019.07

PIT / NODE DETAILS

Version 8

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving Volume (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
Ground	65.77			0.008			
Level Spreader	65.44			0.008	0.26		None
Dummy Node	65.27			0			
Roof	68.37			0.017			

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
Pre Site	0.028	0	0	0.028	1.27	10.32	0 AR&R 100 year, 20 minute storm, average 163 mm/h, Zone 1
Ground -2	0.008	0.004	0.004	0.004	1.05	8.55	0 AR&R 100 year, 25 minute storm, average 149 mm/h, Zone 1
bypass-2	0.008	0	0.008	0.008	2.45	19.94	0 AR&R 100 year, 90 minute storm, average 77 mm/h, Zone 1
Roof Area	0.017	0.017	0	0	0.78	0	0 AR&R 100 year, 90 minute storm, average 77 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.03 impervious + 0.08 pervious = 0.11 total ha)

Storm	Total Rainfa cu.m	Total Runoff cu.m (Runoff %)	Impervious R cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 10 n	38.98	26.57 (68.2%)	9.59 (97.2%)	16.97 (58.3%)
AR&R 100 year, 15 n	50.51	35.98 (71.2%)	12.51 (97.8%)	23.47 (62.2%)
AR&R 100 year, 20 n	59.66	43.37 (72.7%)	14.83 (98.2%)	28.55 (64.1%)
AR&R 100 year, 25 n	68.17	49.82 (73.1%)	16.98 (98.4%)	32.83 (64.5%)
AR&R 100 year, 30 n	74.12	54.11 (73.0%)	18.49 (98.5%)	35.62 (64.4%)
AR&R 100 year, 45 n	92.23	68.22 (74.0%)	23.08 (98.8%)	45.15 (65.5%)
AR&R 100 year, 60 n	105.41	78.22 (74.2%)	26.41 (99.0%)	51.81 (65.8%)
AR&R 100 year, 90 n	126.82	94.42 (74.5%)	31.83 (99.1%)	62.59 (66.1%)
AR&R 100 year, 120	142.74	106.00 (74.3%)	35.86 (99.2%)	70.13 (65.8%)
AR&R 100 year, 180	171.29	127.04 (74.2%)	43.09 (99.4%)	83.95 (65.6%)

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
Pipe2	0.008		1.02	65.768	65.746 AR&R 100 year, 25 minute storm, average 149 mm/h, Zone 1
Pipe4	0.012		1.7	65.462	65.44 AR&R 100 year, 90 minute storm, average 77 mm/h, Zone 1
Pipe5	0.019		1.88	65.403	65.266 AR&R 100 year, 60 minute storm, average 96 mm/h, Zone 1
Pipe1	0.017		3.56	68.366	67.142 AR&R 100 year, 90 minute storm, average 77 mm/h, Zone 1
Pipe3	0.01		2.43	66.102	65.746 AR&R 100 year, 90 minute storm, average 77 mm/h, Zone 1

CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm
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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
OSD Overflow	0	0	0	0	0	0	0	0

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD -2	65.75		5.6	0.012	0.012
OSD -1	67.14		5.4	0.01	0.01

CONTINUITY CHECK for AR&R 100 year, 90 minute storm, average 77 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage (cu.m)	Chai Difference %
Pre	41.93	41.93	0	0
Ground	12.11	12.09	0	0.2
OSD -2	37.6	37.6	0	0
Level Spreader	52.44	52.43	0	0
Dummy Node	52.43	52.43	0	0
Roof	25.53	25.52	0	0.1
OSD -1	25.52	25.51	0	0

Run Log for C9015 run at 23:57:43 on 27/8/2019

No water upwelling from any pit. Freeboard was adequate at all pits.

Flows were safe in all overflow routes.