16) Appendix O

Civil Plans and Stormwater Report
Prepared by
CHRISP Consulting

Planning Proposal Stormwater Assessment

Dural Health Hub

Client: Healing ONR

Document No: 21067_Dural Health Hub_Stormwater

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1 Introduction

1.1 Project Background

CHRISP Consulting has been engaged to assess civil and stormwater engineering options for a proposed health services facility at 679-685 Old Northern Road, Dural. To support this planning proposal application, CHRISP Consulting have assessed the existing stormwater and proposed stormwater requirements as outlined within Hornsby Shire Council's DCP 2013 standards and best engineering practices.

The combined lot area is 3,471m2 with a retainment of approximately 10% pervious surfaces in post-development end state. There is no inground surface stormwater infrastructure along the property frontage on Old Northern Road and the site falls towards the east (rear boundary) at an approximate grade of 8%.

Figure 01 – Site Plan

1.2 Review of Council's Planning Proposal Pre-Lodgement Meeting Comments

It is understood that Council requires a stormwater concept plan to show proposed method of drainage for the proposed development to Council's drainage system by gravity, including detailed calculations.

CHRISP Consulting Response:

The site was assessed against 3 possible Stormwater Management Options using DRAINS software against Hornsby Shire Council Stormwater Drainage (Design) Specification 0074 which states:

(a) Post-development flow Q20 to not exceed pre-development Q5
(b) Pre-development (Q5) 100% pervious = 67 litres/sec
(c) Post-development (Q20) 10% pervious and 90% impervious = 152 litres/sec

Specification 0074 also states that OSD requirements are under review and Q100 may be required to be detained to meet Pre-development Q5

(a) Post-development (Q100) 10% pervious and 90% impervious = 197 litres/sec

<u>Stormwater Management Option 1</u>

1. OSD tank for Q20 requirements are:
(a) Volume: 48.2 m3
(b) Tank size: 35m2 x 138m deep with 190mm outlet orifice (flows to be detained to Q5 pre-development)

2. OSD tank for Q100 requirements are: 55m2 x 1.6m deep with 180mm outlet orifice
(a) Volume: 70.0 m3
(b) Tank size: 55m2 x1.3m deep with 190mm outlet orifice (flows to be detained to Q5 pre-development)

3. OSD to discharge along rear boundary via level spreader with suitable scour protection

<u>Stormwater Management Option 2</u>

4. OSD on grade basin to be as per tank volume but restricted to 1200mm deep

5. OSD to discharge along rear boundary via level spreader with suitable scour protection

<u>Stormwater Management Option 3</u>

6. Drainage easement be obtained through neighbouring property to allow direct stormwater discharge into existing basin

7. Typical swale dimensions to be: 500mm base width, 1400mm top width & 150mm depth
(a) Swale can provide 87 litres/sec capacity at 1.0% channel slope. This capacity is suitable to cater for OSD outlet discharge

(b) Swale can provide 245 litres/sec capacity at 8.0% channel slope (assumed slope based on available adjacent survey). This capacity is suitable to cater for zero OSD capacity which shall require the increase in storage volume of the existing downstream basin

This calculation summary are shown on CHRISP Consulting drawing 21067-C201–Revision D

Detailed Calculations

DRAINS MODEL INPUT DATA

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)			
N1	Node							0			
N366	Node					8.6		0			
DETENTION BASIN DETAILS											
Name	**Elev**	**Surf. Area**	**Not Used**	**Outlet Type**	**K**	**Dia(mm)**	**Centre RL**				
OSD	8	0		Orifice		190	8.2				
	8.2	1									
	8.21	55									
	8.31	55									
	8.41	55									
	8.51	55									
	8.61	55									
	8.71	55									
	8.81	55									
	8.91	55									
	9.01	55									
	9.11	55									
	9.21	55									
	9.31	55									
	9.41	55									
	9.51	55									
	9.61	55									
SUB-CATCHMENT DETAILS											
Name	**Pit or Node**	**Total Area (ha)**	**EIA %**	**Perv Area %**	**RIA %**	**EIA Time (min)**	**Perv Time (min)**	**RIA Time (min)**			
Pre-Dev	N1	0.3471	0	100	0	5	5	2			
Post-Dev	OSD	0.3471	90	10	0	5	5	2			
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**
Pipe1	OSD	N366	10	8.075	7.975	1	uPVC	225	242	0.012	NewFixed
OVERFLOW ROUTE DETAILS											
Name	**From**	**To**	**Travel Time (min)**	**Spill Level (m)**	**Crest Length (m)**	**Weir Coeff. C**	**Cross Section**	**Safe Depth Major Storms (m)**	**SafeDepth Minor Storms (m)**	**Safe DxV (sq.m/sec)**	**Bed Slope (%)**
OF1	OSD	N366	0.3	9.6	1	1.7	Swale	0.15	0.1	1	1
This model has no pipes with non-return valves											

DRAINS results 20% AEP (1 in 5yr ARI)

PIT / NODE DETAILS				Version 8			
Name	**Max HGL**	**Max Pond HGL**	**Max Surface Flow Arriving (cu.m/s)**	**Max Pond Volume (cu.m)**	**Min Freeboard (m)**	**Overflow (cu.m/s)**	**Constraint**
N366	8.16		0				
SUB-CATCHMENT DETAILS							
Name	**Max Flow Q (cu.m/s)**	**EIA Max Q (cu.m/s)**	**Remaining Max Q (cu.m/s)**	**EIA Tc (cu.m/s)**	**RIA Tc (min)**	**PA Tc (min)**	**Due to Storm (min)**
Pre-Dev	0.067	0	0.067	5	2	5	20% AEP, 1 hour burst, Storm 5
Post-Dev	0.114	0.114	0	5	2	5	20% AEP, 5 min burst, Storm 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	0.055	1.44	8.591	8.161	20% AEP, 20 min burst, Storm 4		
OVERFLOW ROUTE DETAILS							
Name	**Max Q U/S**	**Max Q D/S**	**Safe Q**	**Max D**	**Max DxV**	**Max Width**	**Max V**
OF1	0	0	0.054	0	0	0	0
DETENTION BASIN DETAILS							
Name	**Max WL**	**MaxVol**	**Max Q Total**	**Max Q Low Level**	**Max Q High Level**		
OSD	8.77	31.2	0.055	0.055	0		
Run Log for DRAINS MODEL Rev 01.drn run at 15:58:43 on 10/2/2022 using version 2020.061							
Flows were safe in all overflow routes.							

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DRAINS results 5% AEP (1 in 20 yr ARI)

PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N366	8.18		0				
SUB-CATCHMENT DETAILS							
Name	Max Flow Q (cu.m/s)	EIA Max Q (cu.m/s)	Remaining Max Q (cu.m/s)	EIA Tc (cu.m/s)	RIA Tc (min)	PA Tc (min)	Due to Storm (min)
Pre-Dev	0.101	0	0.101	5	2	5	5% AEP, 1 hour burst, Storm 6
Post-Dev	0.152	0.152	0	5	2	5	5% AEP, 5 min burst, Storm 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	0.067	1.59	8.816	8.185	5% AEP, 20 min burst, Storm 8		
OVERFLOW ROUTE DETAILS							
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V
OF1	0	0	0.054	0	0	0	0
DETENTION BASIN DETAILS							
Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level		
OSD	9.08	48.2	0.067	0.067	0		
Run Log for DRAINS MODEL Rev 01.drn run at 15:59:08 on 10/2/2022 using version 2020.061							
Flows were safe in all overflow routes.							

DRAINS results 1% AEP (1 in 100yr ARI)

PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
N366	8.2		0.027				
SUB-CATCHMENT DETAILS							
Name	Max Flow Q (cu.m/s)	EIA Max Q (cu.m/s)	Remaining Max Q (cu.m/s)	EIA Tc (cu.m/s)	RIA Tc (min)	PA Tc (min)	Due to Storm (min)
Pre-Dev	0.147	0	0.147	5	2	5	1% AEP, 20 min burst, Storm 10
Post-Dev	0.197	0.197	0	5	2	5	1% AEP, 5 min burst, Storm 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	0.08	1.81	9.099	8.197	1% AEP, 25 min burst, Storm 1		
OVERFLOW ROUTE DETAILS							
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V
OF1	0	0	0.159	0	0	0	0
DETENTION BASIN DETAILS							
Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level		
OSD	9.48	70	0.08	0.08	0		
Run Log for DRAINS MODEL Rev 01.drn run at 15:59:21 on 10/2/2022 using version 2020.061							
Flows were safe in all overflow routes.							

Trapezoidal Open Channel Flow

Q100 discharge from OSD Tank = 80 l/s

1.0 Trapezoidal Channel Data

base width at invert =	B =	0.500	m
depth =	D =	0.150	m
LHS bank slope =	1 Vertical in	3.000	Horizontal [= H.l]
RHS bank slope =	1 Vertical in	3.000	Horizontal [= H.r]
Manning's roughness coefficient =	n =	0.035	
slope of invert =	So =	1.000	%
	=	1 in	100.0
	=	0.010	m / m

2.0 Flow Rating Table

depth of flow d (m)	area of flow A (m^2)	wetted perimeter Wp (m)	hydraulic radius R (m)	velocity of flow v (m/s)	flow rate Q (m^3/s)	surface width of flow T (m)	Froude Number Fr	V x D
1	2	3	4	5	6	7	8	
0.000	0.000	0.500	0.000	0.000	0.000	0.500	0.000	0.000
0.008	0.004	0.547	0.007	0.106	0.000	0.545	0.399	0.001
0.015	0.008	0.595	0.014	0.164	0.001	0.590	0.444	0.002
0.023	0.013	0.642	0.020	0.209	0.003	0.635	0.471	0.005
0.030	0.018	0.690	0.026	0.248	0.004	0.680	0.491	0.007
0.038	0.023	0.737	0.031	0.283	0.006	0.725	0.507	0.011
0.045	0.029	0.785	0.036	0.314	0.009	0.770	0.520	0.014
0.053	0.035	0.832	0.041	0.342	0.012	0.815	0.531	0.018
0.060	0.041	0.879	0.046	0.369	0.015	0.860	0.540	0.022
0.068	0.047	0.927	0.051	0.393	0.019	0.905	0.549	0.027
0.075	0.054	0.974	0.056	0.417	0.023	0.950	0.556	0.031
0.083	0.062	1.022	0.060	0.439	0.027	0.995	0.563	0.036
0.090	0.069	1.069	0.065	0.461	0.032	1.040	0.570	0.041
0.098	0.077	1.117	0.069	0.481	0.037	1.085	0.576	0.047
0.105	0.086	1.164	0.074	0.501	0.043	1.130	0.581	0.053
0.113	0.094	1.212	0.078	0.520	0.049	1.175	0.586	0.059
0.120	0.103	1.259	0.082	0.539	0.056	1.220	0.591	0.065
0.128	0.113	1.306	0.086	0.557	0.063	1.265	0.596	0.071
0.135	0.122	1.354	0.090	0.574	0.070	1.310	0.600	0.078
0.143	0.132	1.401	0.094	0.592	0.078	1.355	0.605	0.084
0.150	0.143	1.449	0.098	0.608	0.087	1.400	0.609	0.091

3.0 Notes

1. depth of flow d at D/20 increments
2. area of flow, A = [d * B] + [0.5 * d * d * H.l] + [0.5 * d * d * H.r]
3. wetted perimeter, Wp = B + [d * sqrt(1 + H.l^2)] + [d * sqrt(1 + H.r^2)]
4. hydraulic radius, R = A / Wp
5. velocity of flow, v = [1 / n] * [R^0.667] * [So^0.5] ===> Manning's equation of flow
6. flow rate, Q = A * v
7. surface width of flow, T = B + [d * H.l] + [d * H.r]
8. Froude number, Fr = v / [(g * A / T)^0.5] ===> when Fr < 1 ===> flow is sub-critical
   when Fr = 1 ===> flow is critical
   when Fr > 1 ===> flow is super-critical

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Trapezoidal Open Channel Flow

Q100 discharge from Site (No OSD) = 197 l/s

1.0 Trapezoidal Channel Data

base width at invert =	B =	0.500	m
depth =	D =	0.150	m
LHS bank slope =	1 Vertical in	3.000	Horizontal [= H.l]
RHS bank slope =	1 Vertical in	3.000	Horizontal [= H.r]
Manning's roughness coefficient =	n =	0.035	
slope of invert =	So =	8.000	%
	=	1 in	12.5
	=	0.080	m / m

2.0 Flow Rating Table

depth of flow d (m)	area of flow A (m^2)	wetted perimeter Wp (m)	hydraulic radius R (m)	velocity of flow v (m/s)	flow rate Q (m^3/s)	surface width of flow T (m)	Froude Number Fr	V x D
1	2	3	4	5	6	7	8	
0.000	0.000	0.500	0.000	0.000	0.000	0.500	0.000	0.000
0.008	0.004	0.547	0.007	0.300	0.001	0.545	1.128	0.002
0.015	0.008	0.595	0.014	0.463	0.004	0.590	1.256	0.007
0.023	0.013	0.642	0.020	0.592	0.008	0.635	1.334	0.013
0.030	0.018	0.690	0.026	0.702	0.012	0.680	1.390	0.021
0.038	0.023	0.737	0.031	0.799	0.018	0.725	1.434	0.030
0.045	0.029	0.785	0.036	0.887	0.025	0.770	1.470	0.040
0.053	0.035	0.832	0.041	0.967	0.033	0.815	1.501	0.051
0.060	0.041	0.879	0.046	1.042	0.043	0.860	1.528	0.063
0.068	0.047	0.927	0.051	1.113	0.053	0.905	1.552	0.075
0.075	0.054	0.974	0.056	1.179	0.064	0.950	1.573	0.088
0.083	0.062	1.022	0.060	1.242	0.077	0.995	1.593	0.102
0.090	0.069	1.069	0.065	1.303	0.090	1.040	1.611	0.117
0.098	0.077	1.117	0.069	1.361	0.105	1.085	1.628	0.133
0.105	0.086	1.164	0.074	1.417	0.121	1.130	1.644	0.149
0.113	0.094	1.212	0.078	1.471	0.139	1.175	1.659	0.166
0.120	0.103	1.259	0.082	1.524	0.157	1.220	1.673	0.183
0.128	0.113	1.306	0.086	1.575	0.177	1.265	1.686	0.201
0.135	0.122	1.354	0.090	1.625	0.198	1.310	1.698	0.219
0.143	0.132	1.401	0.094	1.673	0.221	1.355	1.710	0.238
0.150	0.143	1.449	0.098	1.721	0.245	1.400	1.722	0.258

3.0 Notes

1. depth of flow d at D/20 increments
2. area of flow, A = [d * B] + [0.5 * d * d * H.l] + [0.5 * d * d * H.r]
3. wetted perimeter, Wp = B + [d * sqrt(1 + H.l^2)] + [d * sqrt(1 + H.r^2)]
4. hydraulic radius, R = A / Wp
5. velocity of flow, v = [1 / n] * [R^0.667] * [So^0.5] ===> Manning's equation of flow
6. flow rate, Q = A * v
7. surface width of flow, T = B + [d * H.l] + [d * H.r]
8. Froude number, Fr = v / [(g * A / T)^0.5] ===> when Fr < 1 ===> flow is sub-critical
   when Fr = 1 ===> flow is critical
   when Fr > 1 ===> flow is super-critical

2 Conclusion

We believe that either of the 3 available Stormwater Management Options are viable and can be reviewed in detail during the Development Application design development stage. We understand that should an easement through the downstream neighbouring land be unattainable, then the options for a on site detention tank or basin (or composite of both) can be achieved to restrict the outgoing flows to pre-development conditions via a level spreader network along the rear boundary.

For any further queries regarding this report, please feel free to contact our office on 0408 696 526 or info@chrispconsulting.com.au

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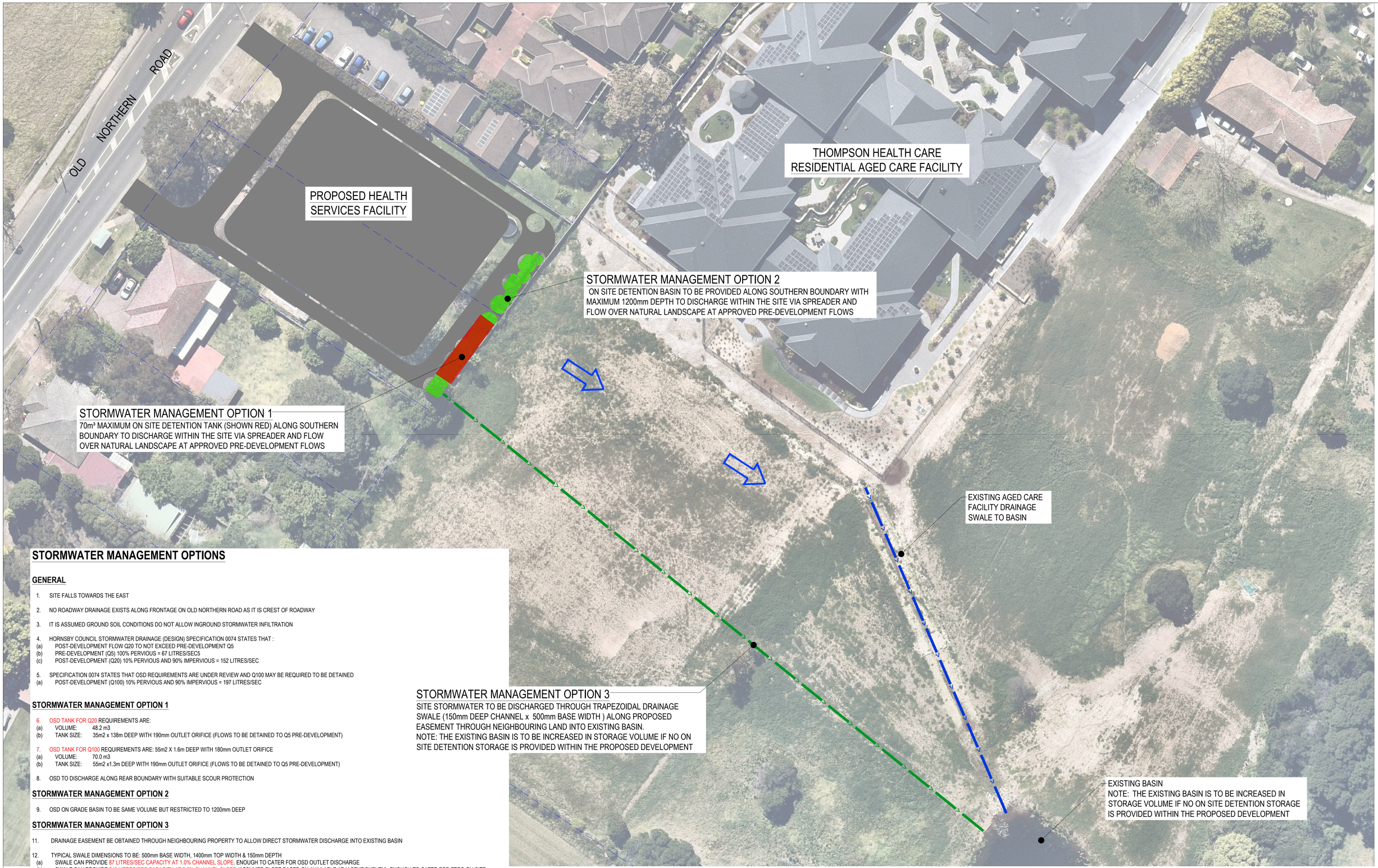

STORMWATER MANAGEMENT OPTIONS

GENERAL

1. SITE FALLS TOWARDS THE EAST

2. NO ROADWAY DRAINAGE EXISTS ALONG FRONTAGE ON OLD NORTHERN ROAD AS IT IS CREST OF ROADWAY

3. IT IS ASSUMED GROUND SOIL CONDITIONS DO NOT ALLOW INGROUND STORMWATER INFILTRATION

4. HORNSBY COUNCIL STORMWATER DRAINAGE (DESIGN) SPECIFICATION 0074 STATES THAT :
(a) POST-DEVELOPMENT FLOW Q20 TO NOT EXCEED PRE-DEVELOPMENT Q5
(b) PRE-DEVELOPMENT (Q5) 100% PERVIOUS = 67 LITRES/SEC5
(c) POST-DEVELOPMENT (Q20) 10% PERVIOUS AND 90% IMPERVIOUS = 152 LITRES/SEC

5. SPECIFICATION 0074 STATES THAT OSD REQUIREMENTS ARE UNDER REVIEW AND Q100 MAY BE REQUIRED TO BE DETAINED
(a) POST-DEVELOPMENT (Q100) 10% PERVIOUS AND 90% IMPERVIOUS = 197 LITRES/SEC

STORMWATER MANAGEMENT OPTION 1

6. OSD TANK FOR Q20 REQUIREMENTS ARE:
(a) VOLUME: 48.2 m3
(b) TANK SIZE: 35m2 x 138m DEEP WITH 190mm OUTLET ORIFICE (FLOWS TO BE DETAINED TO Q5 PRE-DEVELOPMENT)

7. OSD TANK FOR Q100 REQUIREMENTS ARE: 55m2 X 1.6m DEEP WITH 180mm OUTLET ORIFICE
(a) VOLUME: 70.0 m3
(b) TANK SIZE: 55m2 x1.3m DEEP WITH 190mm OUTLET ORIFICE (FLOWS TO BE DETAINED TO Q5 PRE-DEVELOPMENT)

8. OSD TO DISCHARGE ALONG REAR BOUNDARY WITH SUITABLE SCOUR PROTECTION

STORMWATER MANAGEMENT OPTION 2

9. OSD ON GRADE BASIN TO BE SAME VOLUME BUT RESTRICTED TO 1200mm DEEP

STORMWATER MANAGEMENT OPTION 3

11. DRAINAGE EASEMENT BE OBTAINED THROUGH NEIGHBOURING PROPERTY TO ALLOW DIRECT STORMWATER DISCHARGE INTO EXISTING BASIN

12. TYPICAL SWALE DIMENSIONS TO BE: 500mm BASE WIDTH, 1400mm TOP WIDTH & 150mm DEPTH
(a) SWALE CAN PROVIDE 87 LITRES/SEC CAPACITY AT 1.0% CHANNEL SLOPE. ENOUGH TO CATER FOR OSD OUTLET DISCHARGE
(b) SWALE CAN PROVIDE 245 LITRES/SEC CAPACITY AT 8.0% CHANNEL SLOPE (ASSUMED SLOPE BASED ON AVAILABLE ADJACENT SURVEY). ENOUGH TO CATER FOR ZERO ON-SITE DETENTION CAPACITY WHICH SHALL REQUIRE THE INCREASE IN STORAGE VOLUME OF THE EXISTING DOWNSTREAM BASIN

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FOR INFORMATION ONLY

REV	DATE	REVISION DESCRIPTION
A	11.11.2021	ISSUE FOR REVIEW
B	12.11.2021	ISSUE FOR REVIEW
C	17.11.2021	ISSUE FOR INFORMATION FOR PLANNING PROPOSAL
D	12.02.2022	ISSUE FOR INFORMATION
E	14.02.2022	ISSUE FOR INFORMATION

TITLE	NAME
DRAWN	CP
DESIGNED	
DRG CHECK	
DESIGN CHECK	
APPROVED	CP

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STORMWATER MANAGEMENT PLAN

JOB NUMBER:	SCALE @ A1	SHEET No	REV
21067	N.T.S.	C201	E