

NOTE:  
ALL RESIDENTIAL AREAS ASSUMED TO BE 50% IMPERVIOUS

**CONCEPT DESIGN**  
**NOT FOR CONSTRUCTION**

No.	Revision	SOB	COB	Appd	Date
-	FOR INFORMATION				10.01.19

Drawing Originator:	<b>Beca</b>	Original Scale (A1)	COB	10.01.20	Approved For Construction*
		AS SHOWN	SOB	10.01.20	
		Reduced Scale (A3)	Design Verifier		Date
		1/2 SHOWN	COB	10.01.20	

\* Refer to Revision 1 for Original Signature

Client:	Project:
	<b>KOHIMARAMA RETIREMENT VILLAGE</b>

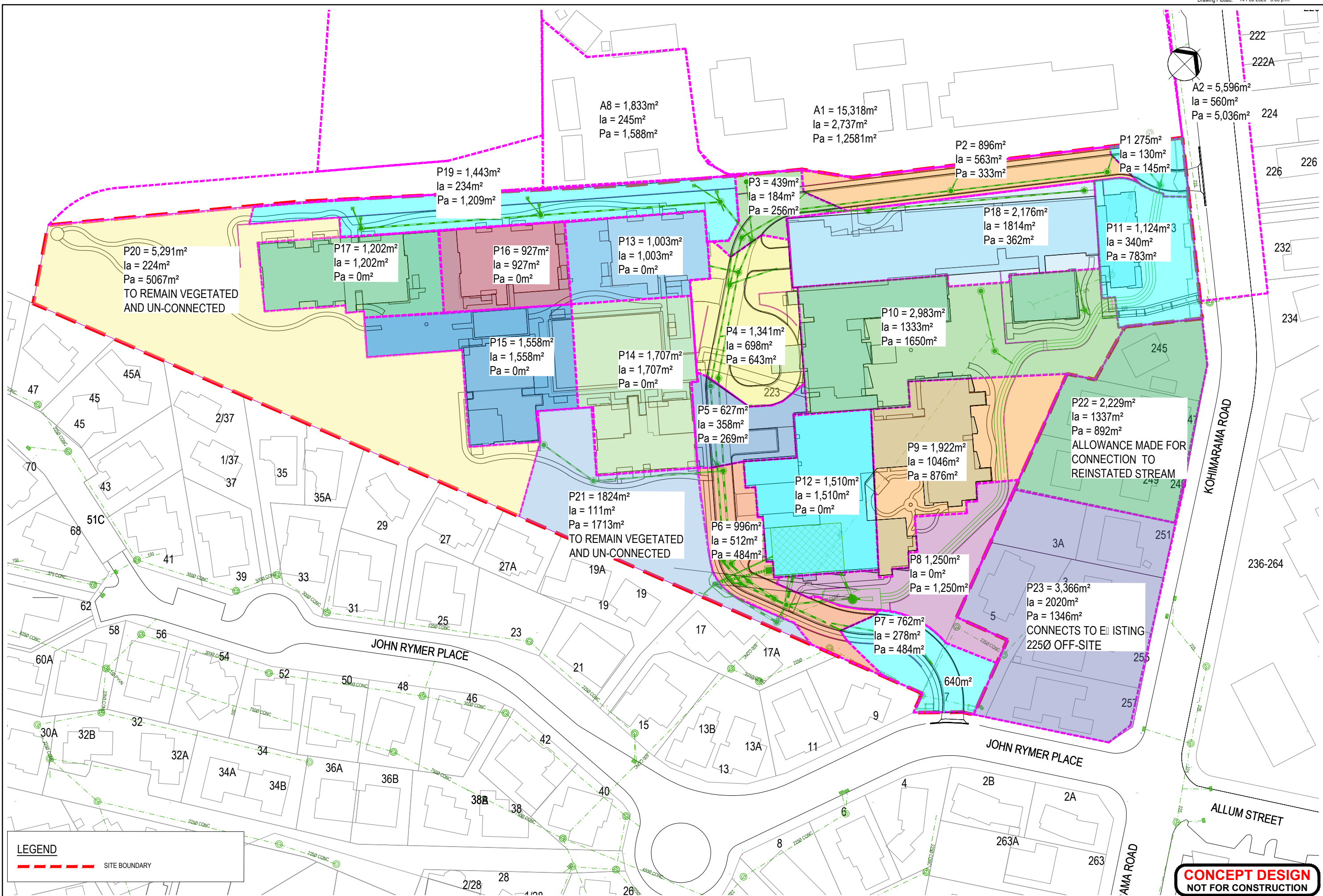
Title:	Discipline:
<b>EXISTING SECONDARY STORMWATER CATCHMENT PLAN</b>	<b>CIVIL ENGINEERING</b>

Drawing No.:	Rev.:
<b>044-RCT_401_CO-SK082</b>	-

DO NOT SCALE

IF IN DOUBT ASK



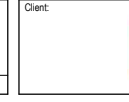


No.	Revision	SOB	COB	Appd	Date
-	FOR INFORMATION				10.01.20



Original Scale (A1)	Design	COB	Date	Approved For Construction*
1:500 <td>SOB <td> <td>10/01/20 <td></td> </td></td></td>	SOB <td> <td>10/01/20 <td></td> </td></td>	<td>10/01/20 <td></td> </td>	10/01/20 <td></td>	
Reduced Scale (A3)	Design	COB	Date	
1:1000 <td>SOB <td> <td>10/01/20 <td></td> </td></td></td>	SOB <td> <td>10/01/20 <td></td> </td></td>	<td>10/01/20 <td></td> </td>	10/01/20 <td></td>	

\* Refer to Revision 1 for Original Signature



Client: KOHIMARAMA RETIREMENT VILLAGE

Title: PROPOSED PRIMARY STORMWATER CATCHMENT PLAN

Discipline: CIVIL ENGINEERING  
 Drawing No: 044-RCT\_401\_CO-SK085

FRENCH DRAIN ASSUMED TO HAVE CAPACITY TO ACCOMMODATE Q10.

A12 = 4685m<sup>2</sup>  
la = 0m<sup>2</sup>  
Pa = 4685m<sup>2</sup>

A1 = 15,318m<sup>2</sup>  
la = 12,581m<sup>2</sup>  
Pa = 2,737m<sup>2</sup>

A11 = 1,833m<sup>2</sup>  
la = 1,588m<sup>2</sup>  
Pa = 245m<sup>2</sup>

A13 = 735m<sup>2</sup>  
la = 0m<sup>2</sup>  
Pa = 735m<sup>2</sup>

A14 = 645m<sup>2</sup>  
la = 0m<sup>2</sup>  
Pa = 645m<sup>2</sup>

A15 = 3,101m<sup>2</sup>  
la = 282m<sup>2</sup>  
Pa = 2,819m<sup>2</sup>

A10 = 2,731m<sup>2</sup>  
la = 1,331m<sup>2</sup>  
Pa = 1,400m<sup>2</sup>

A2 = 5,596m<sup>2</sup>  
la = 5,036m<sup>2</sup>  
Pa = 560m<sup>2</sup>

A6 = 6,625m<sup>2</sup>  
la = 4,913m<sup>2</sup>  
Pa = 1,712m<sup>2</sup>

A3 = 8,297m<sup>2</sup>  
la = 4,151m<sup>2</sup>  
Pa = 4,146m<sup>2</sup>

A4 = 733m<sup>2</sup>  
la = 440m<sup>2</sup>  
Pa = 293m<sup>2</sup>

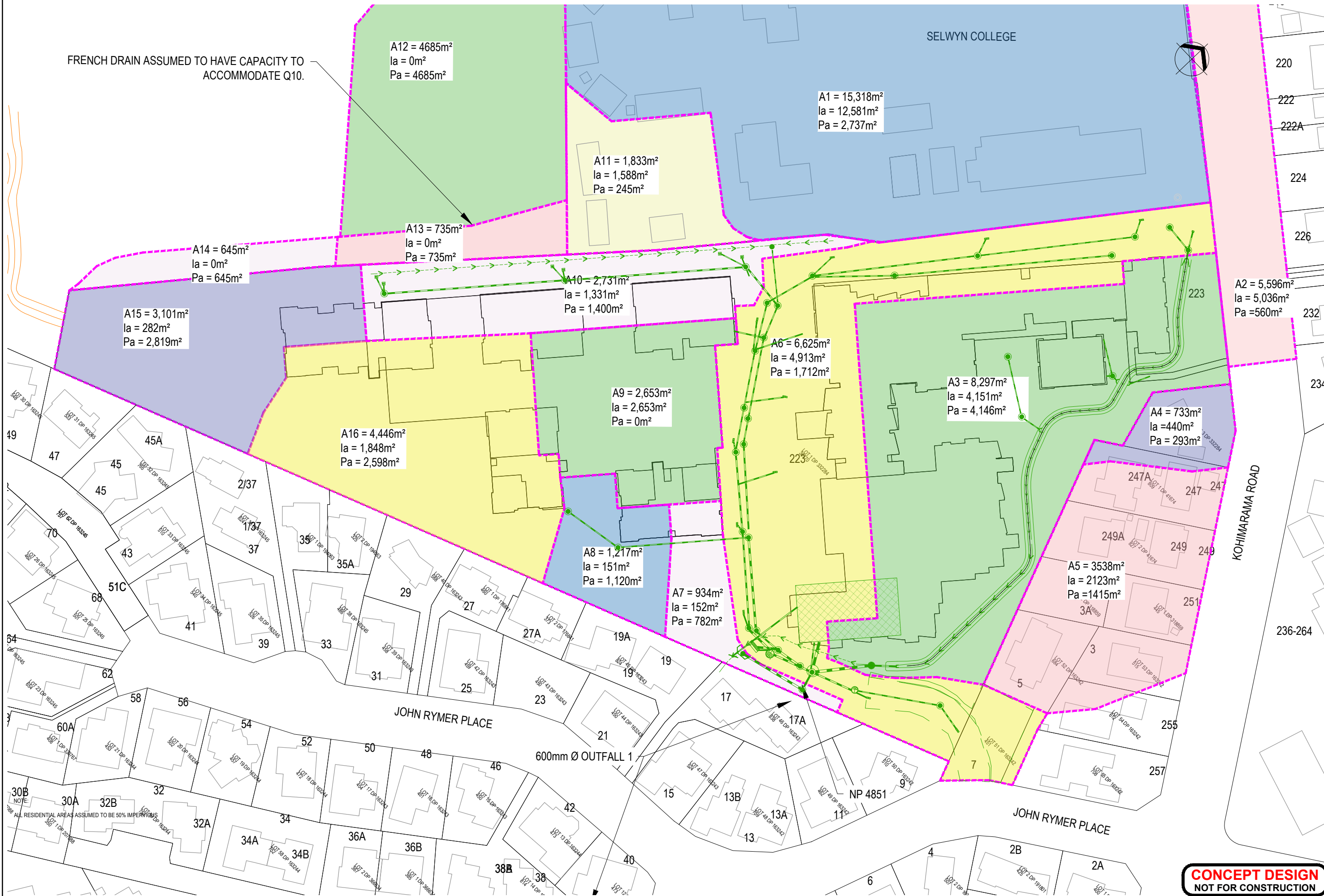
A16 = 4,446m<sup>2</sup>  
la = 1,848m<sup>2</sup>  
Pa = 2,598m<sup>2</sup>

A9 = 2,653m<sup>2</sup>  
la = 2,653m<sup>2</sup>  
Pa = 0m<sup>2</sup>

A8 = 1,217m<sup>2</sup>  
la = 151m<sup>2</sup>  
Pa = 1,120m<sup>2</sup>

A7 = 934m<sup>2</sup>  
la = 152m<sup>2</sup>  
Pa = 782m<sup>2</sup>

A5 = 3538m<sup>2</sup>  
la = 2123m<sup>2</sup>  
Pa = 1415m<sup>2</sup>



**CONCEPT DESIGN**  
NOT FOR CONSTRUCTION

No.	Revision	SOB	COB	Appd	Date
A	FOR RESOURCE CONSENT				09.01.20



Original Scale (A1)	Design	COB	09.01.20	Approved For Construction*
1:500	Drawn	SOB	09.01.20	
Reduced Scale (A3)	Design Verifier			
1:1000	Design Check	COB	09.01.20	Date

\* Refer to Revision 1 for Original Signature



Client: KOHIMARAMA RETIREMENT VILLAGE

Title: PROPOSED SECONDARY STORMWATER CATCHMENT PLAN

Discipline	CIVIL ENGINEERING
Document No.	044-RCT_401_CO-086
Rev.	A

# C

Appendix C – Detailed stormwater calculations

DRAFT

**EXISTING Q10  
CALCULATIONS WITHOUT  
CLIMATE CHANGE  
ALLOWANCE**

---





Job Number 3124460 Date 13.02.20  
 Job Name Kohimarama Retirement Village  
 Subject Existing Stormwater Calc for a 10% AEP with No Climate Change  
 By Conor O'Boyle Page No of

# Calculation Sheet

Beca Ltd



JOB NO: 3124460/221

## Hydrographs- SCS Method:

Project Description SCS Calc for 1ha Catchment Areas

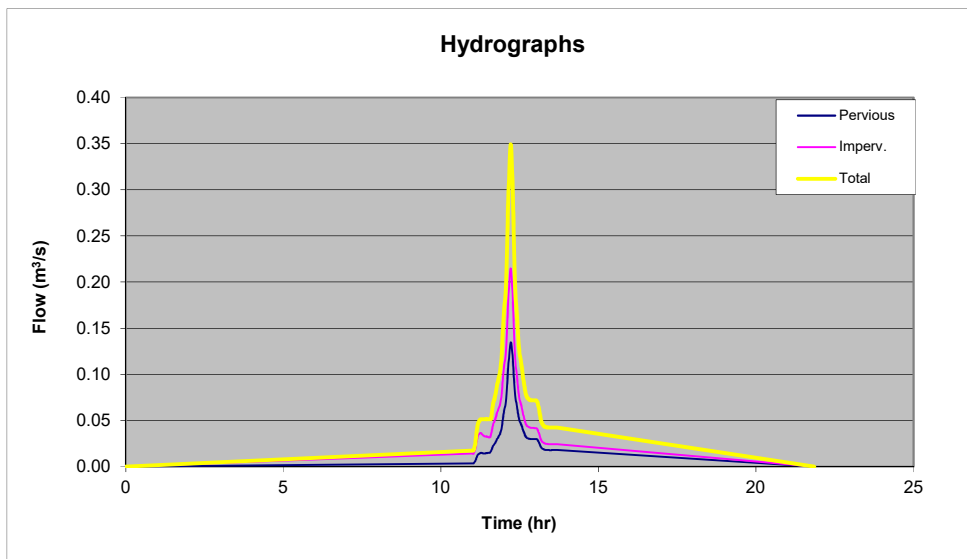
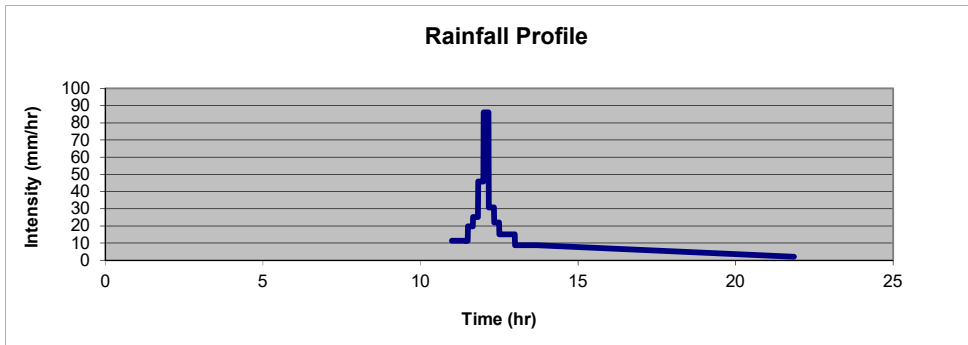
Rainfall Depth (mm) 124

**Notes:**

1. Inputs
2. Typical inputs for CN 20000 are in 'Typical CN Values' Sheet
3. Method based on ARC TP108

Catchment Data	Pervious Area	Impervious Area
Area (ha)	1	1
Runoff No (CN)	74	98
Initial Loss (Ia-mm)	5	0
Time of Concentration (tc-min)	10.0	10.0
Soil storage (S-mm)	89.2	5.2

Outputs	1	1	Total
Area (ha)	1	1	2
Runoff (mm)	68.0	119.0	93.5
Peak Flow (m <sup>3</sup> /s)	0.135	0.215	0.349
Time (hr) at Peak Flow	12.22	12.21	12.21
Rainfall (mm/h) over tc	86.03	86.03	86.03
Runoff Coefficient - Peak	0.56	0.90	0.73
Runoff Coefficient - Volume	0.55	0.96	0.75





# Calculation Sheet

## Existing Stormwater Catchment Area & Flow Allocation

Peak flow from 1ha ignoring CN values		
Impermeable	0.215	m <sup>3</sup> /s
Permeable	0.135	m <sup>3</sup> /s
CN <sub>impermeable</sub>	0.98	
CN <sub>permeable</sub>	0.74	
Factor of Safety	1	
Design Rainfall	124	mm
Time of Concentration	10	mins

On-Site & Upstream Catchments	Total Area	Pervious Area	Impervious Area	% Impervious	Design Runoff (m <sup>3</sup> /s)	Notes
A1	15318	2737	12581	0.82	0.307	
A2	5596	560	5036	0.90	0.132	Limited to the Q10
A3	6843	6843	0	0.00	0.092	
A4	733	293	440	0.60	0.013	
A5 - Primary Catchment	1480	592	888	0.60	0.027	
A5 - Overland Flow	3538	1415	2123	0.60	0.065	
A6	5322	5322	0	0.00	0.072	
A7	9879	9879	0	0.00	0.133	
A8	1833	245	1588	0.87	0.037	
A9 - Primary Catchment	741	741	0	0.00	0.010	
A9 - Overland Flow	5543	5543	0	0.00	0.075	
A10	5779	5779	0	0.00	0.078	
A11	3329	3329	0	0.00	0.045	
A12	640	640	0	0	0.009	

Off-Site Catchments	Total Area	Pervious Area	Impervious Area	% Impervious	Notes
B1	4173	1669.2	2503.8	0.6	
B2	11737	4694.8	7042.2	0.6	
B3	12964	5185.6	7778.4	0.6	
B4	16845	6738	10107	0.6	
B5	929	371.6	557.4	0.6	
B6	1622	648.8	973.2	0.6	
B7	2216	886.4	1329.6	0.6	
B8	2539	1015.6	1523.4	0.6	
B9	1499	599.6	899.4	0.6	
B10	5976	2390.4	3585.6	0.6	
B11	23122	9248.8	13873.2	0.6	
B12	2593	1037	1556	0.6	
B13	1707	682.8	1024.2	0.6	
C1	4262	1704.8	2557.2	0.6	
C2	11750	4700	7050	0.6	
C3	9328	3731.2	5596.8	0.6	
C4	12843	5137.2	7705.8	0.6	
C5	6034	2413.6	3620.4	0.6	
C6	5910	2364	3546	0.6	

	Catchment Area			Permeable Cumulative Catchment area (m <sup>2</sup> )	Impermeable Cumulative Catchment Area (m <sup>2</sup> )	Design FLOW (m <sup>3</sup> /s)	Notes
	Permeable	Impermeable	Total				
<b>Ashwell Street</b>							
SWMH NP4954	0	0	0	20051	30076	0.916	-
SWMH NP5167	1705	2557	4262	20051	30076	0.916	C1
SWMH NP7810	0	0	0	18346	27519	0.838	-
SWMH NP5693	4700	7050	11750	18346	27519	0.838	C2
SWMH 11519	3731	5597	9328	13646	20469	0.624	C3
SWMH NP5690	5137	7706	12843	9915	14872	0.453	C4
SWMH NP5672	2414	3620	6034	4778	7166	0.218	C5
SWMH NP5668	2364	3546	5910	2364	3546	0.108	C6

<b>SW John Rymer</b>							
EX. SW Outfall (Pourewa Creek)	0	0	0	83106	105485	3.003	none
SWMH NP4983	8407	12611	21018	83106	105485	3.003	B1, B4
SWMH NP4996	9880	14821	24701	74698	92875	2.618	B2, B3
SWMH NP4965	0	0	0	64818	78054	2.167	none
SWMH NP4954	35212	52818	88030	64818	78054	2.167	B5-B11, C1-C6
SWMH NP4849	1720	2580	4300	29606	25236	0.558	B12, B13
SWMH NP4851	27886	22656	50542	27886	22656	0.479	(A1-A8) Attenuated Flows

<b>Kohi Road</b>							
SWMH NP4954	0	0	0	15161	22742	0.693	none
SWMH NP4952	1387	2081	3468	15161	22742	0.693	B5, B8
SWMH NP5466	1535	2303	3838	13774	20661	0.629	B6, B7
SWMH NP5468	2390	3586	5976	12239	18358	0.559	B10
SWMH NP5470	600	899	1499	9848	14773	0.450	B9
SWMH NP5456	0	0	0	9249	13873	0.423	none
SWMH NP5459	9249	13873	23122	9249	13873	0.423	B11



Job Number 3124460 Date 13.02.20  
 Job Name Kohimarama Retirement Village  
 Subject Existing Stormwater Calc for a 10% AEP with No Climate Change  
 By Conor O'Boyle Page No of

# Calculation Sheet

Beca Ltd



JOB NO: 3124460

## Hydrographs- SCS Method:

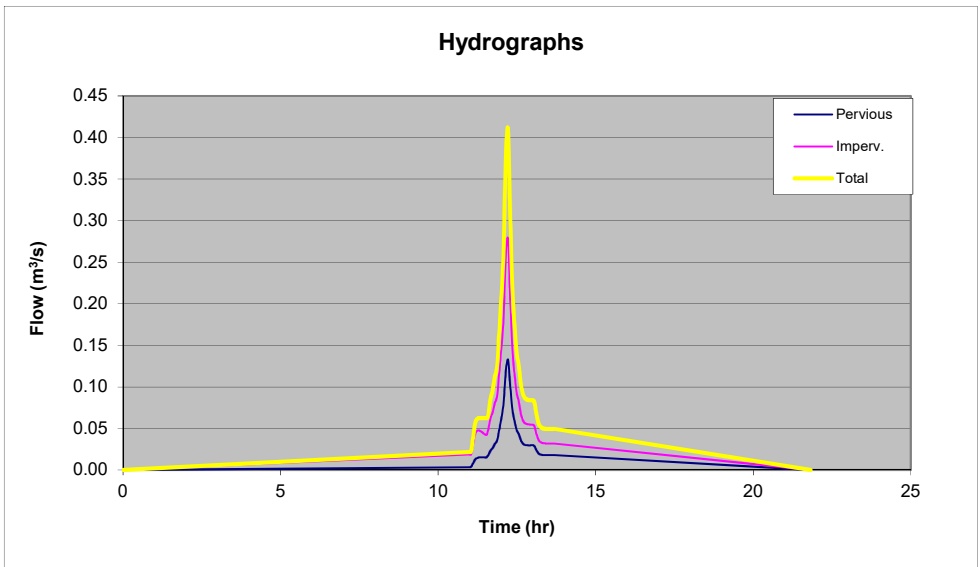
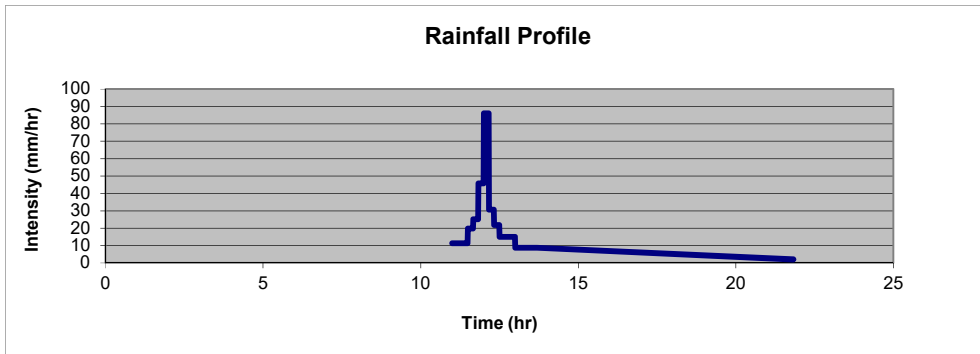
**Project Description** Kohi - Storage Volume 1 Catchment (A1, A3, A4)

Rainfall Depth (mm) 124

- Notes:**
1. Inputs
  2. Typical inputs for CN are in 'Typical CN Values' Sheet
  3. Method based on ARC TP108

Catchment Data	Pervious Area	Impervious Area
Area (ha)	0.9873	1.3021
Runoff No (CN)	74	98
Initial Loss (Ia-mm)	5	0
Time of Concentration (tc-min)	10.0	10.0
Soil storage (S-mm)	89.2	5.2

Outputs			Total
Area (ha)	0.98732	1.30208	2.2894
Runoff (mm)	68.0	119.0	97.0
Peak Flow (m <sup>3</sup> /s)	0.133	0.280	0.412
Time (hr) at Peak Flow	12.21	12.20	12.20
Rainfall (mm/h) over tc	86.03	86.03	86.03
Runoff Coefficient - Peak	0.56	0.90	0.75
Runoff Coefficient - Volume	0.55	0.96	0.78







Job Number 3124460 Date 13.02.20  
 Job Name Kohimarama Retirement Village  
 Subject Existing Stormwater Calc for a 10% AEP with No Climate Change  
 By Conor O'Boyle Page No \_\_\_\_\_ of \_\_\_\_\_

# Calculation Sheet

Beca Ltd



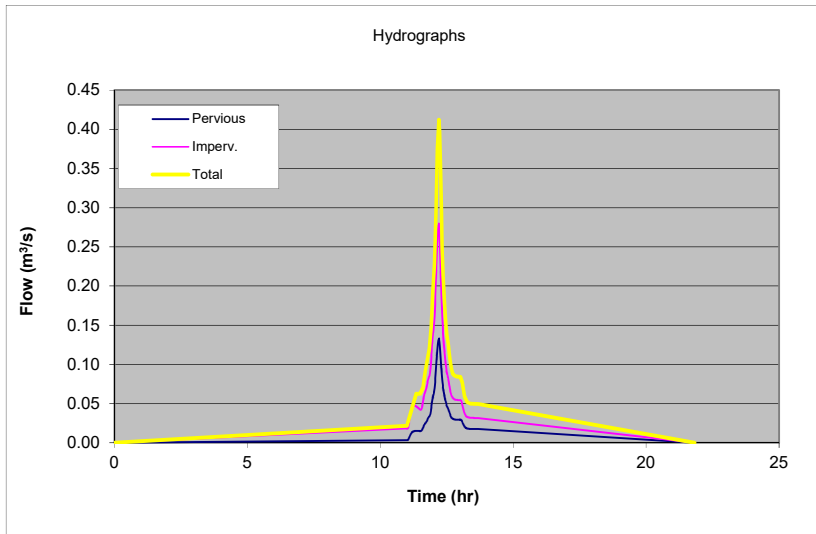
JOB NO: 3124460

## Hydrographs- SCS Method:

Project Description Kohi - Storage Volume 1 Catchment (A1, A3, A4)

Total Hydrograph in tabular form: (based on simulation from above)

Volumetric error in scaling 0.01%



Time (hr)	Flow (m <sup>3</sup> /s)
0.000	0.000
11.001	0.022
11.347	0.063
11.491	0.063
11.601	0.070
11.694	0.090
11.776	0.106
11.850	0.120
11.918	0.149
11.981	0.194
12.040	0.227
12.096	0.297
12.150	0.375
12.201	0.412
12.232	0.399
12.264	0.352
12.297	0.295
12.331	0.246
12.365	0.214
12.400	0.190
12.437	0.167
12.474	0.149
12.513	0.136
12.553	0.127
12.594	0.114
12.637	0.102
12.682	0.093
12.729	0.088
12.778	0.086
12.830	0.085
12.886	0.084
12.945	0.084
13.010	0.084
13.082	0.077
13.163	0.059
13.260	0.052
13.386	0.050
13.690	0.050
21.822	0.000
-1.000	0.000



Job Number 3124460 Date 13.02.20  
 Job Name Kohimarama Retirement Village  
 Subject Existing Stormwater Calc for a 10% AEP with No Climate Change  
 By Conor O'Boyle Page No of

# Calculation Sheet

Beca Ltd



JOB NO: 3124460

## Hydrographs- SCS Method:

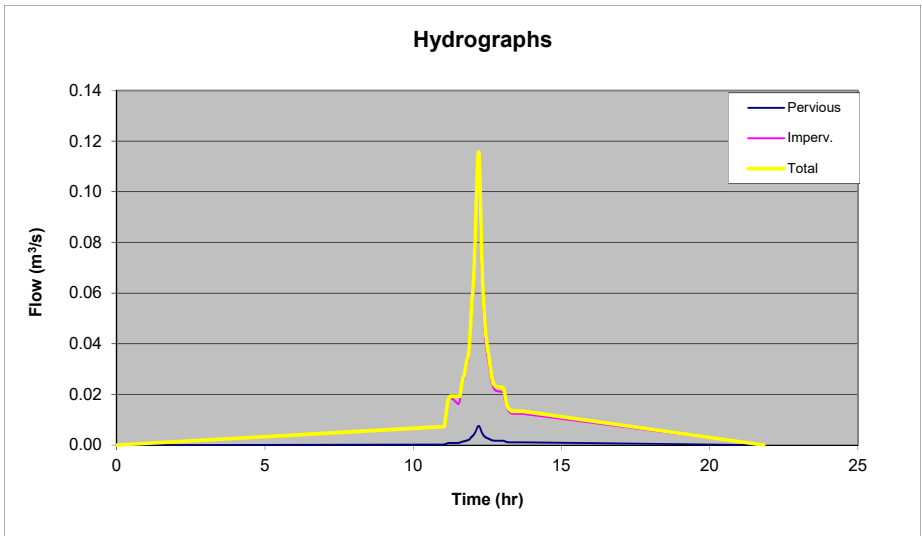
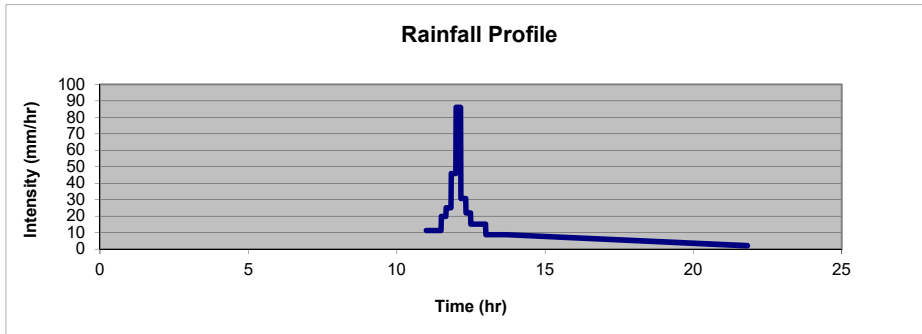
Project Description **Kohi -Existing Storage Volume 1 Catchment (A2 limited to Q10)**

Rainfall Depth (mm) **124**

Catchment Data	Pervious Area	Impervious Area
Area (ha)	0.0560	0.5036
Runoff No (CN)	74	98
Initial Loss (Ia-mm)	5	0
Time of Concentration (tc-min)	10.0	10.0
Soil storage (S-mm)	89.2	5.2

- Notes:**
- Inputs
  - Typical inputs for CN are in 'Typical CN Values' Sheet
  - Method based on ARC TP108

Outputs	Total		
Area (ha)	0.05596	0.50364	0.5596
Runoff (mm)	68.0	119.0	113.9
Peak Flow (m <sup>3</sup> /s)	0.008	0.108	0.116
Time (hr) at Peak Flow	12.21	12.20	12.20
Rainfall (mm/h) over tc	86.03	86.03	86.03
Runoff Coefficient - Peak	0.56	0.90	0.87
Runoff Coefficient - Volume	0.55	0.96	0.92





Job Number 3124460 Date 13.02.20  
 Job Name Kohimarama Retirement Village  
 Subject Existing Stormwater Calc for a 10% AEP with No Climate Change  
 By Conor O'Boyle Page No of

# Calculation Sheet

Beca Ltd



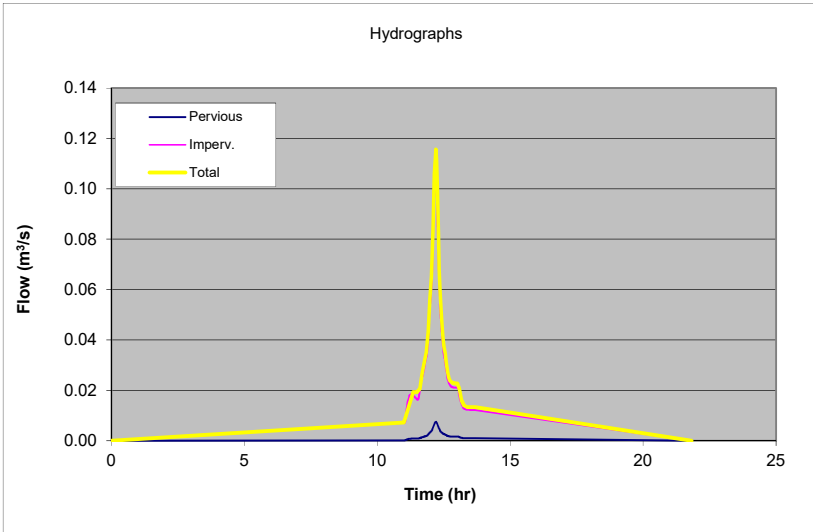
JOB NO: 3124460

## Hydrographs- SCS Method:

Project Description Kohi -Existing Storage Volume 1 Catchment (A2 limited to Q10)

Total Hydrograph in tabular form: (based on simulation from above)

Volumetric error in scaling 0.01%



Time (hr)	Flow (m³/s)
0.000	0.000
11.001	0.007
11.347	0.019
11.491	0.019
11.601	0.021
11.694	0.027
11.776	0.031
11.850	0.035
11.918	0.043
11.981	0.056
12.040	0.065
12.096	0.085
12.150	0.106
12.201	0.116
12.232	0.112
12.264	0.098
12.297	0.082
12.331	0.068
12.365	0.059
12.400	0.052
12.437	0.046
12.474	0.041
12.513	0.037
12.553	0.035
12.594	0.031
12.637	0.028
12.682	0.025
12.729	0.024
12.778	0.023
12.830	0.023
12.886	0.023
12.945	0.023
13.010	0.023
13.082	0.021
13.163	0.016
13.260	0.014
13.386	0.013
13.690	0.013
21.822	0.000
-1.000	0.000



# Calculation Sheet

## Hydrograph Routing - Storage Volume 1

Project Description **Kohi - Storage Volume 1 Catchment (A1, A3, A4 & A2)**

Stability Coefficient (0.5-1.0) **0.50**  
Start time (hr) **0**

Inflow Hydrograph (A1, A3, A4 & A2)

Time (hr)	Flow (m <sup>3</sup> /s)
0.000	0.000
11.001	0.029
11.347	0.082
11.491	0.082
11.601	0.091
11.694	0.117
11.776	0.138
11.850	0.155
11.918	0.193
11.981	0.251
12.040	0.293
12.096	0.381
12.150	0.481
12.201	0.528
12.232	0.511
12.264	0.451
12.297	0.377
12.331	0.314
12.365	0.273
12.400	0.242
12.437	0.213
12.474	0.190
12.513	0.174
12.553	0.162
12.594	0.146
12.637	0.129
12.682	0.118
12.729	0.112
12.778	0.109
12.830	0.108
12.886	0.107
12.945	0.107
13.010	0.107
13.082	0.097
13.163	0.075
13.260	0.066
13.386	0.063
13.690	0.063
21.822	0.000
-1.000	0.000

Depth/ Volume Relationship

RL (m)	Volume (m <sup>3</sup> )
31.610	0
31.710	1.1
31.810	3.9
31.910	9.4
32.010	18.9
32.110	32.8
32.210	50.5
32.310	73.0
32.410	103.5
32.510	149.4
32.610	234.6
32.635	271.0
32.660	307.3
32.685	343.7
32.710	380.0
32.735	421.6
32.760	463.2
32.785	504.8
32.810	546.4
32.835	588.0
-1.000	

Flow Rating Curve

RL (m)	Flow (m <sup>3</sup> /s)		
	Pipe	Overland	Total
31.610	0.000		0.000
31.710	0.149		0.149
31.810	0.211		0.211
31.910	0.259		0.259
32.010	0.299		0.299
32.110	0.334		0.334
32.210	0.366		0.366
32.310	0.395		0.395
32.410	0.422		0.422
32.510	0.448		0.448
32.610	0.472	0.000	0.472
32.635	0.478	0.036	0.514
32.660	0.484	0.125	0.609
32.685	0.489	0.269	0.758
32.710	0.495	0.466	0.961
32.735	0.501	0.730	1.231
32.760	0.506	1.113	1.619
32.785	0.512	1.626	2.138
32.810	0.517	2.214	2.731
32.835	0.522	2.873	3.395
-1.000			

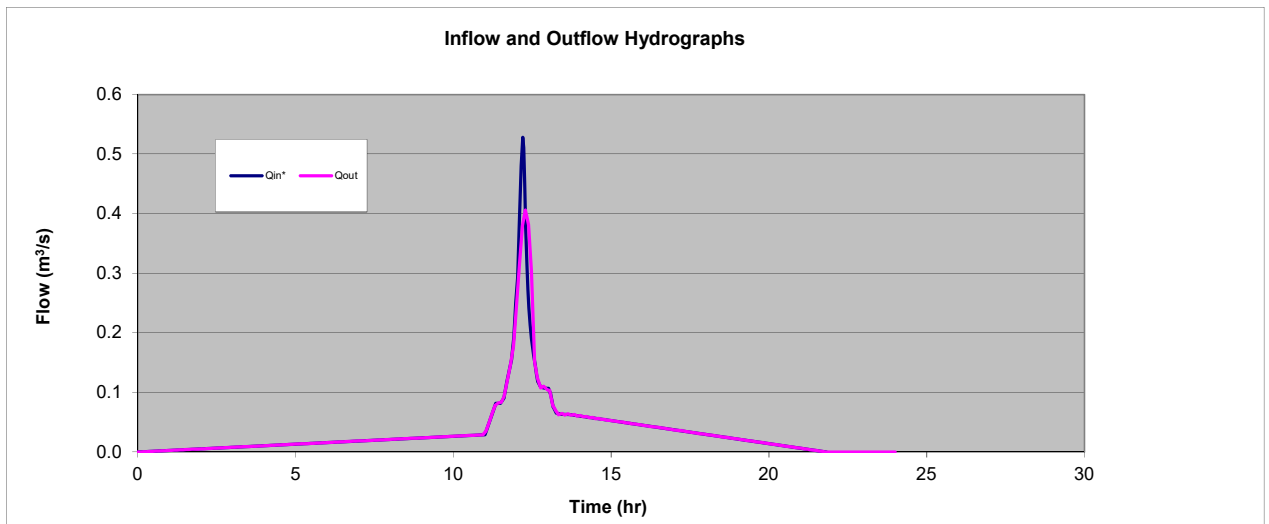
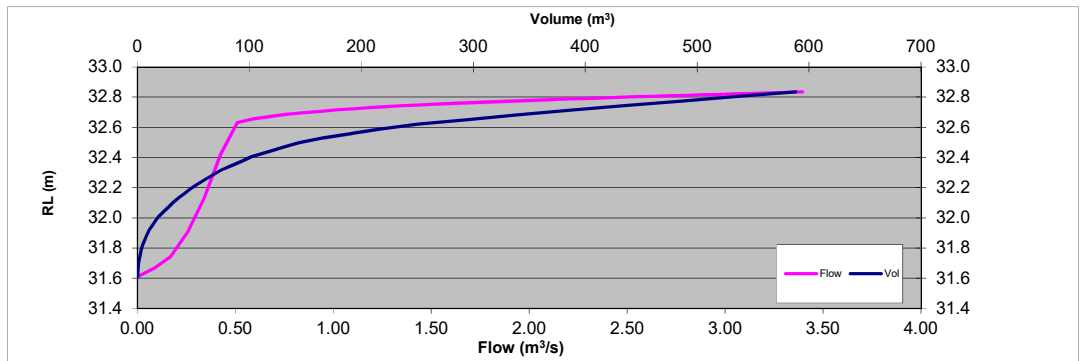
Finish time (hr) **24**  
Extraction rate (m<sup>3</sup>/s) **0.00**

- Input data should be in ascending order in the boxes provided. The maximum no. of values is 40, 20 & 20. If a lesser no. of values is needed then terminate as a -1 for the x value.
- If there is instability in the results then check that the depth/ vol. and/or the flow rating covers the flow range. Otherwise increase the stability coeff. towards 1.0. A value close to 0.5 has better accuracy.
- Initial pond level will be taken as the RL corresponding to the initial flow on the inflow hydrograph.
- Extraction rate applies to external pumping or infiltration.

**Results:**

Max. Inflow (m<sup>3</sup>/s) 0.528  
Time at Max. Inflow (hr) 12.19  
Max. Outflow (m<sup>3</sup>/s) **0.406**  
Time at Max. Outflow (hr) 12.29  
Initial RL (m) 31.610  
Max. RL (m) 32.351  
Max. Volume (m<sup>3</sup>) 85.5  
Inflow Volume (m<sup>3</sup>) 2896.2  
Volumetric error 0.00%  
Extraction Volume (m<sup>3</sup>) 0.0

Cd 0.670  
Pipe Diameter 0.450 m





Job Number 3124460 Date 13.02.20  
 Job Name Kohimarama Retirement Village  
 Subject Existing Stormwater Calc for a 10% AEP with No Climate Change  
 By Conor O'Boyle Page No of

# Calculation Sheet

**Beca Infrastructure Ltd** JOB NO: .....

## Hydrograph Routing

**Project Description** Kohi - Storage Volume 1 Catchment (A1, A3, A4 & A2)

**Total Hydrograph in tabular form:** (based on simulation from above)

Volumetric error in scaling 1.84%

Time (hr)	Flow (m <sup>3</sup> /s)
0.000	0.000
3.547	0.009
5.017	0.013
6.144	0.016
7.094	0.019
7.932	0.021
8.689	0.023
9.385	0.025
10.033	0.027
10.642	0.028
11.217	0.062
11.765	0.134
12.288	0.406
12.515	0.247
12.747	0.111
12.984	0.104
13.227	0.070
13.474	0.063
13.728	0.062
13.988	0.061
14.255	0.059
14.530	0.056
14.812	0.054
15.104	0.052
15.406	0.050
15.718	0.047
16.043	0.045
16.382	0.042
16.737	0.039
17.109	0.037
17.503	0.033
17.923	0.030
18.374	0.027
18.864	0.023
19.406	0.019
20.022	0.014
20.752	0.008
21.703	0.001
24.000	0.000
-1.000	0.000

# Calculation Sheet

Beca Ltd



JOB NO: 3124460

## Hydrographs- SCS Method:

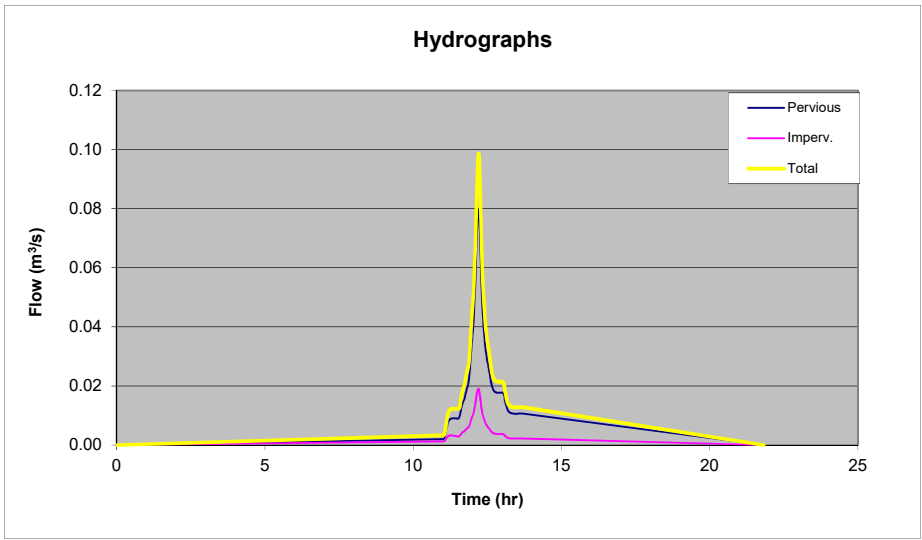
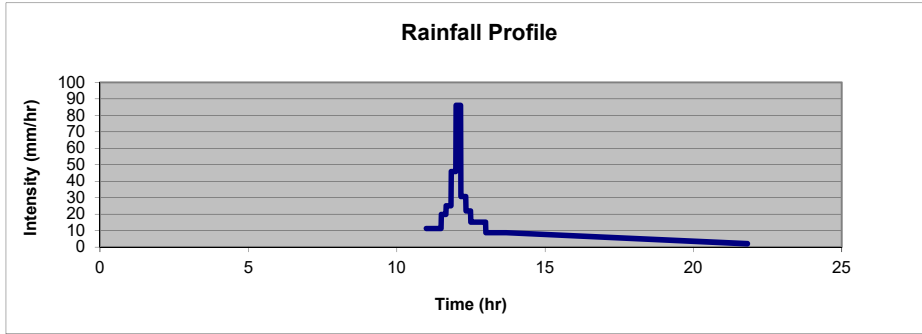
Project Description Kohi - Existing Storage Volume 2 Catchment (A5&A6)

Rainfall Depth (mm) 124

- Notes:**
- Inputs
  - Typical inputs for CN are in 'Typical CN Values' Sheet
  - Method based on ARC TP108

Catchment Data	Pervious Area	Impervious Area
Area (ha)	0.5914	0.0888
Runoff No (CN)	74	98
Initial Loss (Ia-mm)	5	0
Time of Concentration (tc-min)	10.0	10.0
Soil storage (S-mm)	89.2	5.2

Outputs	Total		
Area (ha)	0.5914	0.0888	0.6802
Runoff (mm)	68.0	119.0	74.7
Peak Flow (m <sup>3</sup> /s)	0.080	0.019	0.099
Time (hr) at Peak Flow	12.21	12.20	12.21
Rainfall (mm/h) over tc	86.03	86.03	86.03
Runoff Coefficient - Peak	0.56	0.90	0.61
Runoff Coefficient - Volume	0.55	0.96	0.60







Job Number 3124460 Date 13.02.20  
 Job Name Kohimarama Retirement Village  
 Subject Existing Stormwater Calc for a 10% AEP with No Climate Change  
 By Conor O'Boyle Page No \_\_\_\_\_ of \_\_\_\_\_

# Calculation Sheet

Beca Ltd



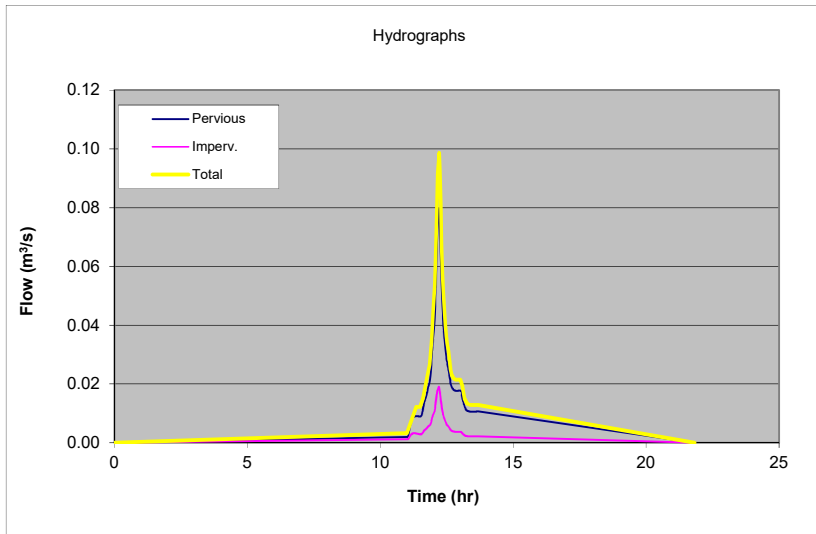
JOB NO: 3124460

## Hydrographs- SCS Method:

Project Description Kohi - Existing Storage Volume 2 Catchment (A5&A6)

Total Hydrograph in tabular form: (based on simulation from above)

Volumetric error in scaling 0.01%



Time (hr)	Flow (m <sup>3</sup> /s)
0.000	0.000
11.001	0.003
11.351	0.012
11.495	0.012
11.607	0.015
11.700	0.020
11.783	0.023
11.857	0.027
11.926	0.035
11.990	0.045
12.050	0.054
12.107	0.073
12.161	0.092
12.212	0.099
12.243	0.093
12.275	0.081
12.308	0.068
12.341	0.057
12.375	0.051
12.410	0.045
12.446	0.040
12.483	0.036
12.522	0.034
12.561	0.031
12.602	0.028
12.645	0.025
12.689	0.023
12.736	0.022
12.785	0.022
12.837	0.022
12.892	0.021
12.951	0.021
13.015	0.021
13.087	0.019
13.167	0.015
13.263	0.013
13.388	0.013
13.690	0.013
21.822	0.000
-1.000	0.000

# Calculation Sheet



JOB NO: 3124460

## Hydrograph Routing - Storage Volume 2

Project Description **Kohi - Existing Storage Volume 2 Catchment (A5 & A6)**

Stability Coefficient (0.5-1.0) 0.60  
 Start time (hr) 0  
 Finish time (hr) 24  
 Extraction rate (m<sup>3</sup>/s) 0.00

### Inflow Hydrograph (A + B)

Time (hr)	Flow (m <sup>3</sup> /s)
0.001	0.000
3.547	0.001
6.274	0.002
7.145	0.002
7.779	0.002
8.295	0.002
8.738	0.003
9.131	0.003
9.486	0.003
9.812	0.003
10.114	0.003
10.397	0.003
10.663	0.003
10.915	0.003
11.155	0.007
11.383	0.012
11.603	0.015
11.813	0.025
12.016	0.049
12.212	0.099
12.427	0.043
12.649	0.025
12.880	0.021
13.120	0.018
13.371	0.013
13.633	0.013
13.909	0.012
14.201	0.012
14.510	0.012
14.841	0.011
15.198	0.010
15.587	0.010
16.017	0.009
16.503	0.008
17.068	0.008
17.762	0.006
18.716	0.005
21.703	0.000
24.000	0.000
-1.000	0.000

### Depth/ Volume Relationship

RL (m)	Volume (m <sup>3</sup> )
26.110	0
26.360	1
26.610	3
26.860	7
27.110	14
27.360	24
27.610	39
27.860	58
28.110	83
28.360	115
28.610	155
28.641	161.8
28.673	168.7
28.704	175.7
28.735	182.7
28.766	189.6
28.798	196.6
28.829	203.5
28.860	210.5
-1.000	

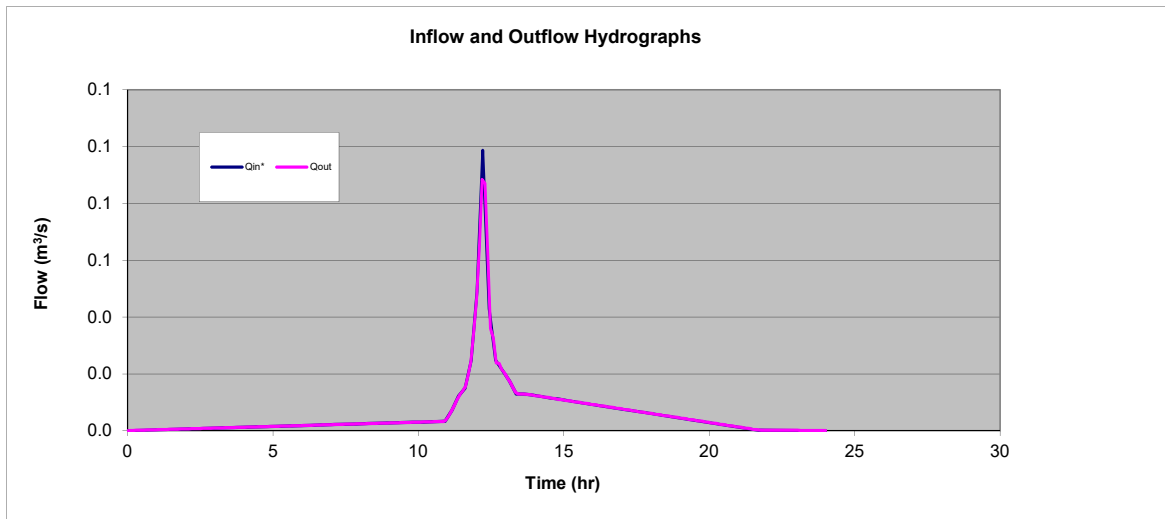
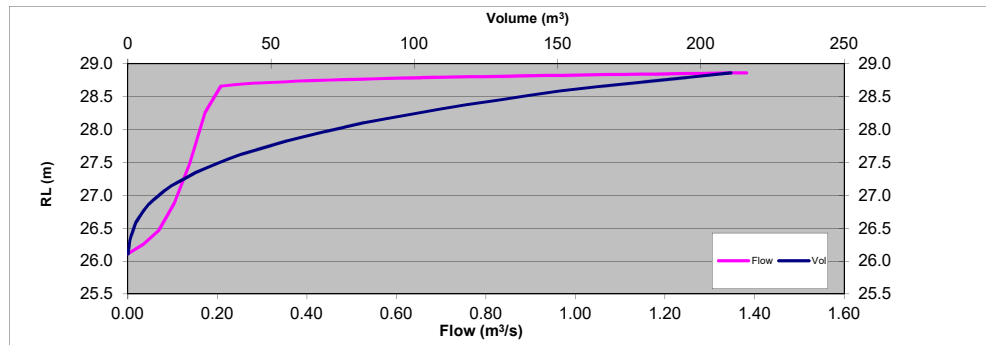
### Flow Rating Curve

RL (m)	Flow (m <sup>3</sup> /s)		
	Pipe	Overland	Total (m <sup>3</sup> /s)
26.110	0.000	0.000	0.000
26.360	0.059	0.000	0.059
26.610	0.083	0.000	0.083
26.860	0.102	0.000	0.102
27.110	0.118	0.000	0.118
27.360	0.132	0.000	0.132
27.610	0.145	0.000	0.145
27.860	0.156	0.000	0.156
28.110	0.167	0.000	0.167
28.360	0.177	0.000	0.177
28.610	0.187	0.000	0.187
28.641	0.188	0.005	0.193
28.673	0.189	0.030	0.219
28.704	0.190	0.087	0.277
28.735	0.191	0.187	0.378
28.766	0.192	0.337	0.529
28.798	0.193	0.555	0.748
28.829	0.195	0.835	1.030
28.860	0.196	1.188	1.384
-1.000			

- Input data should be in ascending order in the boxes provided. The maximum no. of values is 40, 20 & 20. If a lesser no. of values is needed then terminate as a -1 for the x value.
- If there is instability in the results then check that the depth/ vol. and/or the flow rating covers the flow range. Otherwise increase the stability coeff. towards 1.0. A value close to 0.5 has better accuracy.
- Initial pond level will be taken as the RL corresponding to the initial flow on the inflow hydrograph.
- Extraction rate applies to external pumping or infiltration.

**Results:**  
 Max. Inflow (m<sup>3</sup>/s) 0.099  
 Time at Max. Inflow (hr) 12.19  
 Max. Outflow (m<sup>3</sup>/s) 0.088  
 Time at Max. Outflow (hr) 12.19  
 Initial RL (m) 26.110  
 Max. RL (m) 26.676  
 Max. Volume (m<sup>3</sup>) 4.1  
 Inflow Volume (m<sup>3</sup>) 516.2  
 Volumetric error 0.00%  
 Extraction Volume (m<sup>3</sup>) 0.0

Cd 0.670  
 Pipe Diameter 0.225 m





Job Number 3124460 Date 13.02.20  
 Job Name Kohimarama Retirement Village  
 Subject Existing Stormwater Calc for a 10% AEP with No Climate Change  
 By Conor O'Boyle Page No of

# Calculation Sheet

**Beca Infrastructure Ltd**  JOB NO: .....

**Hydrograph Routing**

**Project Description** Kohi - Existing Storage Volume 2 Catchment (A5 & A6)

**Total Hydrograph in tabular form:** (based on simulation from above)

Volumetric error in scaling 3.76%

**Inflow and Outflow Hydrographs**

The graph plots Flow (m³/s) on the y-axis (0.0 to 0.1) against Time (hr) on the x-axis (0 to 30). Two lines are shown: a blue line for Inflow (Qin\*) and a magenta line for Outflow (Qout). Both lines show a sharp peak at approximately 12 hours, with the outflow peak being slightly lower than the inflow peak. The outflow lags behind the inflow, peaking at approximately 13 hours.

Time (hr)	Flow (m³/s)
0.001	0.000
3.520	0.001
4.978	0.001
6.097	0.002
7.040	0.002
7.871	0.002
8.622	0.003
9.312	0.003
9.955	0.003
10.559	0.003
11.130	0.007
11.673	0.018
12.192	0.088
12.422	0.052
12.656	0.025
12.895	0.021
13.139	0.017
13.388	0.013
13.644	0.013
13.906	0.013
14.176	0.012
14.452	0.012
14.737	0.011
15.032	0.011
15.336	0.010
15.651	0.010
15.978	0.009
16.320	0.009
16.677	0.008
17.053	0.008
17.450	0.007
17.873	0.006
18.328	0.006
18.822	0.005
19.369	0.004
19.989	0.003
20.725	0.002
21.684	0.000
24.000	0.000
-1.000	0.000





# Calculation Sheet

Beca Ltd



JOB NO: 3124460-221

## Hydrograph Combination - Existing Combined Piped Flow

Project Description Combined Pipe Flow from SV1 & SV2

Time Lag (min)  Time Lag (min)

### Hydrograph SV1 Piped Outflow

### Hydrograph SV2 Piped Outflow

### Hydrograph Total Pipe Outflow

Time (hr)	Flow (m <sup>3</sup> /s)
0.000	0.000
3.547	0.009
5.017	0.013
6.144	0.016
7.094	0.019
7.932	0.021
8.689	0.023
9.385	0.025
10.033	0.027
10.642	0.028
11.217	0.029
11.765	0.030
12.288	0.031
12.515	0.032
12.747	0.033
12.984	0.034
13.227	0.035
13.474	0.036
13.728	0.037
13.988	0.038
14.255	0.039
14.530	0.040
14.812	0.041
15.104	0.042
15.406	0.043
15.718	0.044
16.043	0.045
16.382	0.046
16.737	0.047
17.109	0.048
17.503	0.049
17.923	0.050
18.374	0.051
18.864	0.052
19.406	0.053
20.022	0.054
20.752	0.055
21.703	0.056
24.000	0.000
-1.000	0.000

Time (hr)	Flow (m <sup>3</sup> /s)
0.001	0.000
3.520	0.001
4.978	0.001
6.097	0.002
7.040	0.002
7.871	0.002
8.622	0.003
9.312	0.003
9.955	0.003
10.559	0.003
11.130	0.007
11.673	0.018
12.192	0.088
12.422	0.052
12.656	0.025
12.895	0.021
13.139	0.017
13.388	0.013
13.644	0.013
13.906	0.013
14.176	0.012
14.452	0.012
14.737	0.011
15.032	0.011
15.336	0.010
15.651	0.010
15.978	0.009
16.320	0.009
16.677	0.008
17.053	0.008
17.450	0.007
17.873	0.006
18.328	0.006
18.822	0.005
19.369	0.004
19.989	0.003
20.725	0.002
21.684	0.000
24.000	0.000
-1.000	0.000

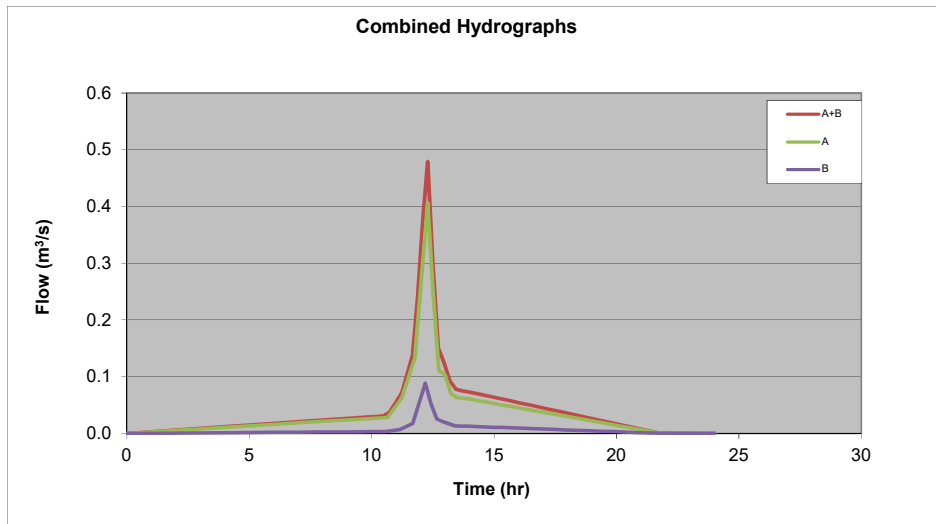
Time (hr)	Flow (m <sup>3</sup> /s)
0.002	0.000
3.520	0.010
6.280	0.018
7.161	0.021
7.802	0.023
8.324	0.024
8.773	0.026
9.170	0.027
9.530	0.028
9.859	0.029
10.165	0.030
10.451	0.031
10.720	0.037
10.975	0.053
11.218	0.071
11.449	0.106
11.671	0.140
11.885	0.243
12.090	0.378
12.288	0.479
12.501	0.300
12.721	0.150
12.950	0.126
13.188	0.092
13.437	0.078
13.698	0.075
13.971	0.073
14.261	0.070
14.568	0.067
14.896	0.065
15.250	0.061
15.636	0.058
16.063	0.054
16.544	0.049
17.105	0.044
17.794	0.038
18.740	0.029
21.703	0.001
24.000	0.000
-1.000	0.000

**Notes:**

- Input data should be in ascending order with time in the boxes provided. The maximum no. of values is 40. If a lesser no. of values is needed then terminate as a -1 for the x value.
- The Time Lag is relative to the hydrograph times.
- Volumetric error is generally due to the interpolation and reassignment of time values.

**Results:**

Max. Flow (m <sup>3</sup> /s) -A	0.406
Time (hr) at Max Flow	12.29
Max. Flow (m <sup>3</sup> /s) -B	0.088
Time (hr) at Max Flow	12.19
Max. Flow (m <sup>3</sup> /s)	0.479
Time (hr) at Max Flow	12.29
Volumetric Error	0.0%



Beca Ltd



JOB NO: 3124460

## Hydrographs- SCS Method:

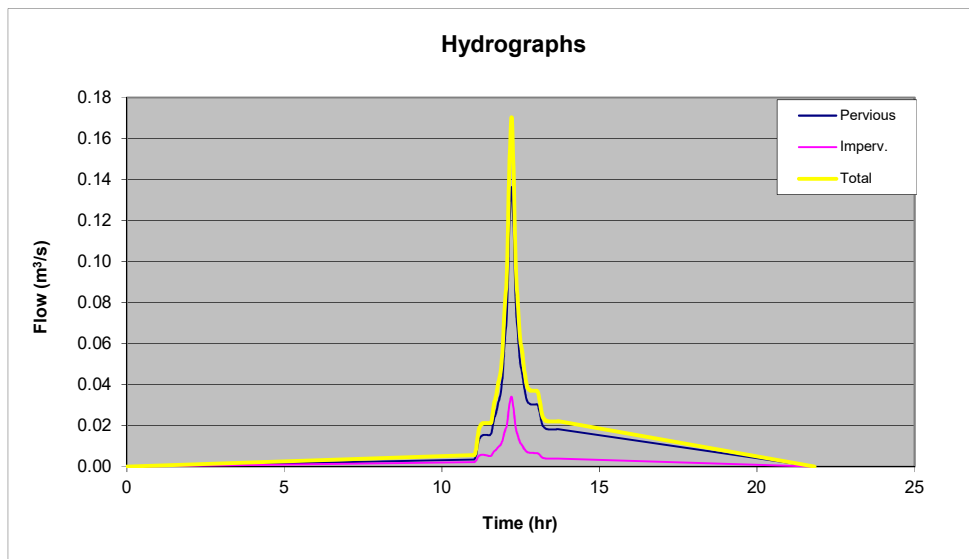
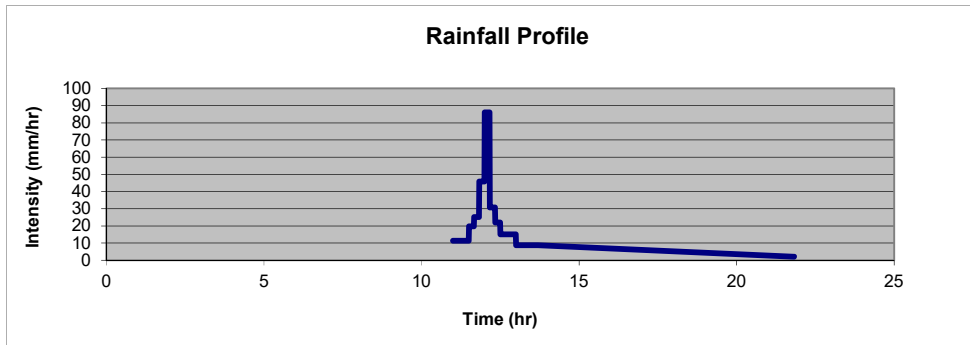
Project Description **Kohi - Catchment to No 17 John Rymer Place(A7 & A8)**

Rainfall Depth (mm) **124**

- Notes:**
- Inputs
  - Typical inputs for CN are in 'Typical CN Values' Sheet
  - Method based on ARC TP108

Catchment Data	Pervious Area	Impervious Area
Area (ha)	1.0124	0.1588
Runoff No (CN)	74	98
Initial Loss (Ia-mm)	5	0
Time of Concentration (tc-min)	10.0	10.0
Soil storage (S-mm)	89.2	5.2

Outputs	Pervious Area	Impervious Area	Total
Area (ha)	1.0124	0.1588	1.1712
Runoff (mm)	68.0	119.0	74.9
Peak Flow (m <sup>3</sup> /s)	0.136	0.034	0.170
Time (hr) at Peak Flow	12.21	12.20	12.21
Rainfall (mm/h) over tc	86.03	86.03	86.03
Runoff Coefficient - Peak	0.56	0.90	0.61
Runoff Coefficient - Volume	0.55	0.96	0.60



Beca Ltd



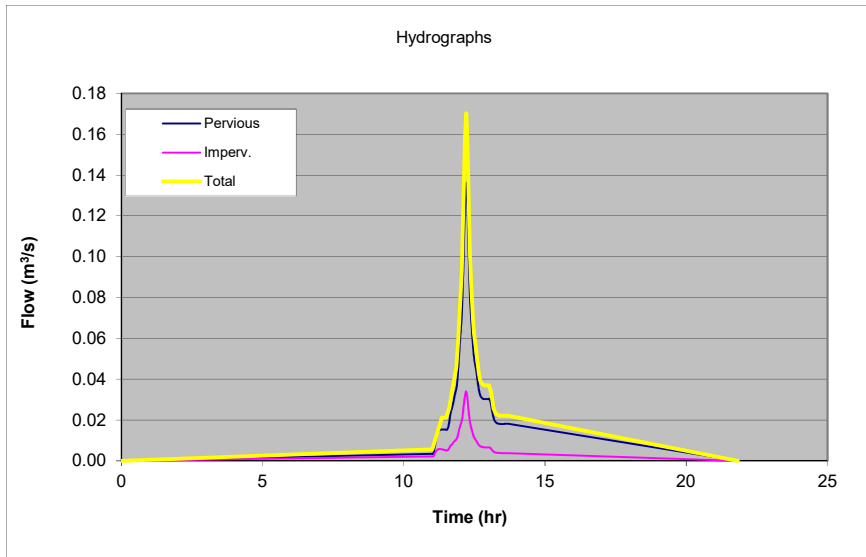
JOB NO: 3124460

## Hydrographs- SCS Method:

Project Description Kohi - Catchment to No 17 John Rymer Place(A7 & A8)

Total Hydrograph in tabular form: (based on simulation from above)

Volumetric error in scaling 0.01%



Time (hr)	Flow (m <sup>3</sup> /s)
0.000	0.000
11.001	0.006
11.351	0.021
11.495	0.021
11.607	0.026
11.700	0.034
11.783	0.040
11.857	0.046
11.926	0.060
11.990	0.078
12.050	0.093
12.107	0.126
12.161	0.158
12.212	0.170
12.243	0.161
12.275	0.140
12.308	0.117
12.341	0.099
12.375	0.088
12.410	0.078
12.446	0.069
12.483	0.063
12.522	0.058
12.561	0.054
12.602	0.048
12.645	0.043
12.689	0.040
12.736	0.038
12.785	0.037
12.837	0.037
12.892	0.037
12.951	0.037
13.015	0.037
13.087	0.033
13.167	0.026
13.263	0.023
13.388	0.022
13.690	0.022
21.822	0.000
-1.000	0.000

# Calculation Sheet

Beca Ltd



JOB NO: 3124460

## Hydrographs- SCS Method:

**Project Description** Kohi - Overland Catchment Catchment (A9, A10, A11 & A12)

**Rainfall Depth (mm)** 124

**Notes:**

1. Inputs
2. Typical inputs for CN are in 'Typical CN Values' Sheet
3. Method based on ARC TP108

Catchment Data	Pervious Area	Impervious Area
Area (ha)	1.0489	
Runoff No (CN)	74	98
Initial Loss (Ia-mm)	5	0
Time of Concentration (tc-min)	10.0	10.0
Soil storage (S-mm)	89.2	5.2

Outputs	Total		
Area (ha)	1.0489	0	1.0489
Runoff (mm)	68.0	119.0	68.0
Peak Flow (m <sup>3</sup> /s)	0.141	0.000	0.141
Time (hr) at Peak Flow	12.21	12.20	12.21
Rainfall (mm/h) over tc	86.03	86.03	86.03
Runoff Coefficient - Peak	0.56	0.00	0.56
Runoff Coefficient - Volume	0.55	0.96	0.55

