10.ii Appendix B – Engineering Calculations

MAVEN ASSOCIATES	Job Number	Sheet	Rev	147007 Development of Riverhead Forest For Rangitoopuni Developments Limited	Author	Date	Checked
	147007	1	A	Calc Title: Catchment and Swale 10-yr Capacity check for Stage 1-5	WY	13/02/2025	KH

Rainfall Depth	ARI 10YR (mm)
TP108 rainfall data	130
Climate Increase 2.1°	152.1

	CN Number
Impervious area	98
Pervious	74

Swale has 0.3m bottom width with the side slope 1:4 and 1:3

Maximum Capacity based on the Minmum Slope

Swale	Catchment	Catchment Area	CN	rate -	Flow	Top Width	Bottom Width	Depth	A	P	R	N	Minimum S	Capacity	Percent Capacity
number	*letter*	*m2*		*l/s*	*cms*	*m*	*m*	*m*	*m2*	*m*	*m/m*	*Grass*	*m/m*	*cms*	*%*
SW1	1	11691	80.4	222.9	0.22	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	32.2%
SW2	2	8728	81.0	168.9	0.17	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	24.4%
SW3	3	12864	79.6	240.6	0.24	2.400	0.300	0.300	0.405	2.486	0.163	0.018	0.018	0.880	27.3%
SW4	4A	3810	81.0	73.8	0.07	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	13.7%
	4B	13581	82.0	269.4	0.27	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	50.2%
	4	17391	80.0	328.6	0.33	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	61.2%
SW5	5	20539	85.0	435.1	0.44	2.400	0.300	0.300	0.405	2.486	0.163	0.018	0.018	0.880	49.4%
SW6	6	17549	85.0	371.7	0.37	2.400	0.300	0.300	0.405	2.486	0.163	0.018	0.018	0.880	42.2%
SW7	7	6017	85.0	127.5	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.018	0.018	0.880	14.5%
SW8	8	2409	79.2	44.6	0.04	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	8.6%
SW9	9	2839	83.7	58.5	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	11.3%
SW10	10	1530	98.0	38.5	0.04	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	7.4%
SW11	11	2342	98.0	59.0	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	11.3%
SW12	12	2769	98.0	69.7	0.07	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	13.4%
SW13	13	3924	98.0	98.8	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	19.0%
SW14	14	2315	98.0	58.3	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	11.2%
SW15	15	4820	98.0	121.4	0.12	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	23.3%
SW16	16	9318	98.0	234.7	0.23	2.400	0.300	0.300	0.405	2.486	0.163	0.040	0.030	0.520	45.1%

MAVEN ASSOCIATES	Job Number	Sheet	Rev	147007 Development of Riverhead Forest For Rangitoopuni Developments Limited	Author	Date	Checked
	147007	1	A	Calc Title: Catchment and Swale 100-yr Capacity check for Stage 1-5	WY	13/02/2025	KH

Rainfall Depth	ARI 100YR (mm)
TP108 rainfall data	190
Climate Increase 3.8°	252.1

	CN Number
Impervious area	98
Pervious	74

Swale has 0.3m bottom width with the side slope 1:4 and 1:3

Swale	Catchment	Catchment Area	CN	rate -	Flow	Top Width	Bottom Width	Depth	A	P	R	N	Minimum S	Capacity	Percent Capacity
number	*letter*	*m2*		*l/s*	*cms*	*m*	*m*	*m*	*m2*	*m*	*m/m*	*Grass*	*m/m*	*cms*	*%*
SW1	1	11691	85.0	451.8	0.45	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	65.2%
SW2	2	8728	85.0	337.3	0.34	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	48.6%
SW3	3	12864	85.0	497.1	0.50	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	71.7%
SW4	4A	3810	81.0	140.6	0.14	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	26.2%
	4B	13581	82.0	507.6	0.51	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.018	0.537	94.5%
	4	17391	80.0	633.7	0.63	Refer to Culvert 3-2 Calculation									
SW5	5	20539	80.0	748.4	0.75	Refer to Culvert 3-3 Calculation									
SW6	6	17549	80.0	639.5	0.64	Refer to Culvert 3-4 Calculation									
SW7	7	6017	85.0	232.5	0.23	Refer to Culvert 3-5 Calculation									
SW8	8	2409	95.0	100.0	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	14.4%
SW9	9	2839	95.0	117.8	0.12	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	17.0%
SW10	10	1530	95.0	63.5	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	9.2%
SW11	11	2342	95.0	97.2	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	14.0%
SW12	12	2769	95.0	114.9	0.11	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	16.6%
SW13	13	3924	95.0	162.9	0.16	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	23.5%
SW14	14	2315	95.0	96.1	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	13.9%
SW15	15	4820	95.0	200.1	0.20	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	28.9%
SW16	16	9318	95.0	386.8	0.39	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	55.8%

MAVEN ASSOCIATES	Job Number	Sheet	Rev	147007 Development of Riverhead Forest For Rangitoopuni Developments Limited	Author	Date	Checked
	147007	1	A	Calc Title: Catchment and Swale 10-yr Capacity check for Stage 6-14	WY	13/02/2025	KH

Rainfall Depth	ARI 10YR (mm)
TP108 rainfall data	130
Climate Increase 2.1°	152.1

	CN Number
Impervious area	98
Pervious	74

All proposed road Swale have 0.3m bottom width with the side slope 1:4 and 1:3

Maximum Capacity based on the Minmum Slope

Swale	Catchment	Catchment Area	CN	rate -	Flow	Top Width	Bottom Width	Depth	A	P	R	N	Minimum S	Capacity	Percent Capacity
number	*letter*	*m2*		*l/s*	*cms*	*m*	*m*	*m*	*m2*	*m*	*m/m*	*Grass*	*m/m*	*cms*	*%*
SW17	17	5461	95.0	134.7	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	19.4%
SW18	18	7934	95.0	195.7	0.20	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	28.2%
SW19	19	679	95.0	16.8	0.02	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	2.4%
SW20	20	3947	95.0	97.4	0.10	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	14.0%
SW21	21	28845	85.0	611.0	0.61	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	88.1%
SW22	22	3189	95.0	78.7	0.08	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	11.3%
SW23	23	4421	95.0	109.1	0.11	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	15.7%
SW24	24	3550	95.0	87.6	0.09	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	12.6%
SW25	25	3381	95.0	83.4	0.08	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	12.0%
SW26	26	4629	95.0	114.2	0.11	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	16.5%
SW27	27	4443	95.0	109.6	0.11	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	15.8%
SW28	28	1571	95.0	38.8	0.04	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	5.6%
SW29	29	955	95.0	23.6	0.02	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	3.4%
SW30	30	4763	95.0	117.5	0.12	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	16.9%
SW31	31	812	95.0	20.0	0.02	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	2.9%
SW32	32	1826	95.0	45.0	0.05	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	6.5%
SW33	33	1141	95.0	28.2	0.03	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	4.1%
SW34	34	2561	95.0	63.2	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	9.1%
SW35	35	1831	95.0	45.2	0.05	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	6.5%
SW36	36	3043	95.0	75.1	0.08	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	10.8%
SW37	37	5137	95.0	126.7	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	18.3%
SW38	38	570	95.0	14.1	0.01	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	2.0%
SW39	39	1520	95.0	37.5	0.04	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	5.4%
SW40	40	9197	95.0	226.9	0.23	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	32.7%
SW41	41	4935	95.0	121.8	0.12	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	17.6%
SW42	42	9323	95.0	230.0	0.23	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	33.2%
SW43	43	2067	95.0	51.0	0.05	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	7.4%
SW44	44	2298	95.0	56.7	0.06	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	8.2%
SW45	45	15672	95.0	386.7	0.39	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	55.8%
SW46	46	2636	95.0	65.0	0.07	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	9.4%
SW47	47	3071	95.0	75.8	0.08	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	10.9%
SW48	48	17142	95.0	422.9	0.42	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	61.0%
SW49	49	19455	95.0	480.0	0.48	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	69.2%
SW50	50	5252	95.0	129.6	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	18.7%
SW51	51	3003	95.0	74.1	0.07	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	10.7%
SW52	52	6017	95.0	148.5	0.15	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	21.4%
SW53	53	5565	95.0	137.3	0.14	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	19.8%
SW54	54	5182	95.0	127.8	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	18.4%
SW55	55	5389	96.0	134.1	0.13	2.400	0.300	0.300	0.405	2.486	0.163	0.030	0.030	0.693	19.3%

MAVEN ASSOCIATES	Job Number	Sheet	Rev	147007 Development of Riverhead Forest For Rangitoopuni Developments Limited	Author	Date	Checked
	147007	1	A	Calc Title: Catchment and Swale 100-yr Capacity check for Stage 6-14	WY	13/02/2025	KH

Rainfall Depth	ARI 100YR (mm)
TP108 rainfall data	190
Climate Increase 3.8°	252.1

	CN Number
Impervious area	98
Pervious	74

Swale has 0.3m bottom width with the side slope 1:4 and 1:3

Swale	Catchment	Catchment Area	CN	rate -	Flow	Top Width	Bottom Width	Depth	A	P	R	N	Minimum S	Capacity	Percent Capacity
number	*letter*	*m2*		*l/s*	*cms*	*m*	*m*	*m*	*m2*	*m*	*m/m*	*Grass*	*m/m*	*cms*	*%*
SW17	17	5461	95.0	226.7	0.23	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	31.9%
SW18	18	7934	95.0	329.4	0.33	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	46.4%
SW19	19	679	95.0	28.2	0.03	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	4.0%
SW20	20	3947	95.0	163.8	0.16	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	23.1%
SW21	21	28845	96.0	1201.7	1.26	100 year Q=1.26 cms from Culvert 6-6 HY-8 Report									
SW22	22	3189	95.0	132.4	0.13	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	18.7%
SW23	23	4421	95.0	183.5	0.18	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	25.9%
SW24	24	3550	95.0	147.3	0.15	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	20.8%
SW25	25	3381	95.0	140.3	0.14	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	19.8%
SW26	26	4629	95.0	192.2	0.19	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	27.1%
SW27	27	4443	95.0	184.4	0.18	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	26.0%
SW28	28	1571	95.0	65.2	0.07	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	9.2%
SW29	29	955	95.0	39.6	0.04	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	5.6%
SW30	30	4763	95.0	197.7	0.20	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	27.9%
SW31	31	812	95.0	33.7	0.03	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	4.7%
SW32	32	1826	95.0	75.8	0.08	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	10.7%
SW33	33	1141	95.0	47.4	0.05	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	6.7%
SW34	34	2561	95.0	106.3	0.11	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	15.0%
SW35	35	1831	95.0	76.0	0.08	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	10.7%
SW36	36	3043	95.0	126.3	0.13	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	17.8%
SW37	37	5137	95.0	213.3	0.21	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	30.0%
SW38	38	570	95.0	23.7	0.02	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	3.3%
SW39	39	1520	95.0	63.1	0.06	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	8.9%
SW40	40	9197	95.0	381.8	0.38	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	53.8%
SW41	41	4935	95.0	204.9	0.20	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	28.9%
SW42	42	9323	95.0	387.0	0.39	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	54.5%
SW43	43	2067	95.0	85.8	0.09	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	12.1%
SW44	44	2298	95.0	95.4	0.10	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	13.4%
SW45	45	15672	95.0	650.6	0.65	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	91.7%
SW46	46	2636	95.0	109.4	0.11	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	15.4%
SW47	47	3071	95.0	127.5	0.13	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	18.0%
SW48	48	17142	85.0	662.5	0.66	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	93.3%
SW49	49	19455	80.0	708.9	0.71	100 year Q=1.56 cms from Culvert 13-4 HY-8 Report									
SW50	50	5252	95.0	218.0	0.22	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	30.7%
SW51	51	3003	95.0	124.7	0.12	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	17.6%
SW52	52	6017	95.0	249.8	0.25	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	35.2%
SW53	53	5565	95.0	231.0	0.23	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	32.5%
SW54	54	5182	95.0	215.1	0.22	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	30.3%
SW55	55	5389	96.0	224.5	0.22	2.400	0.300	0.300	0.405	2.486	0.169	0.030	0.030	0.710	31.6%

MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title / Title: Development of Riverhead Forest — SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

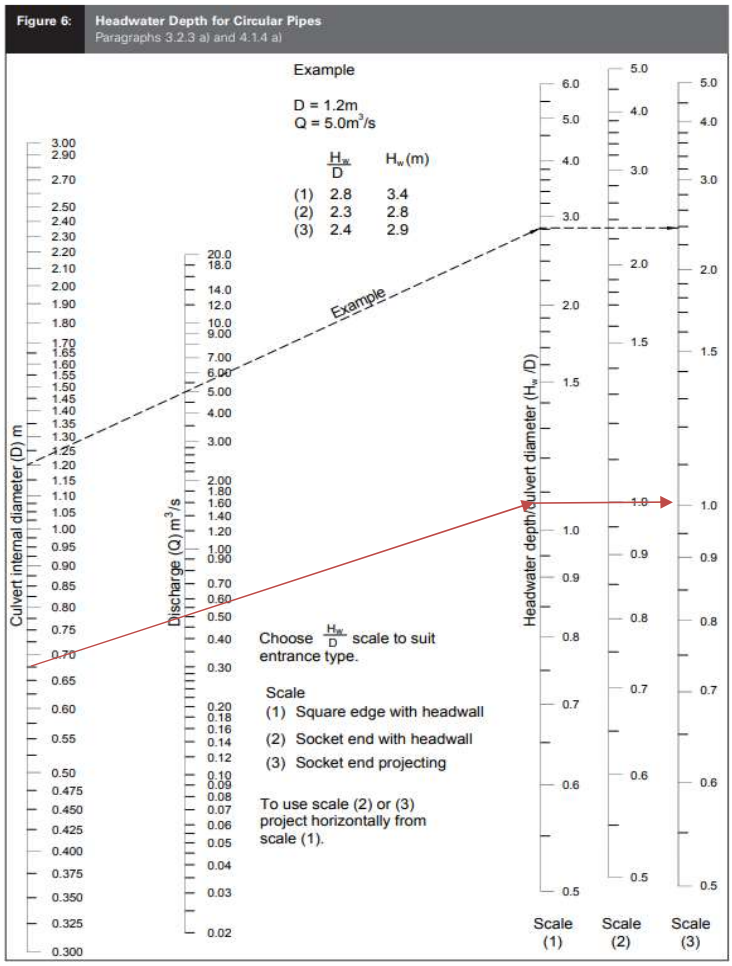
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-1

Q	0.5	m^3/s	Catchment 3
D	0.675	m	*Pipe Diameter*

	Hw/D	*Hw*
(1)	1.08	0.73
(2)	1	0.68
(3)	1.02	0.69

Circular Pipe with 675 mm diamter would have a headwater of 0.73 m depth



MAVEN ASSOCIATES		Job Number 147007	Sheet 1	Rev A
Job Title Title	Development of Riverhead Forest SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

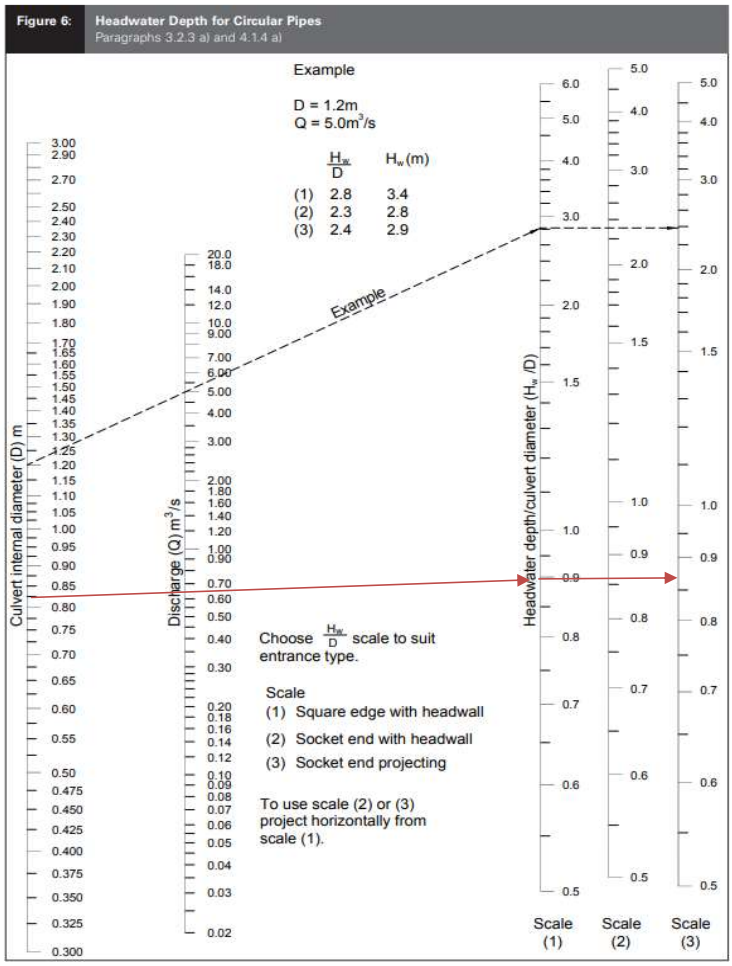
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-2

Q	0.63	m^3/s	Catchment 4
D	0.825	m	*Pipe Diameter*

	Hw/D	*Hw*
(1)	0.9	0.74
(2)	0.86	0.71
(3)	0.87	0.72

Circular Pipe with 825 mm diamter would have a headwater of 0.7 m depth



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title / Title: Development of Riverhead Forest — SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

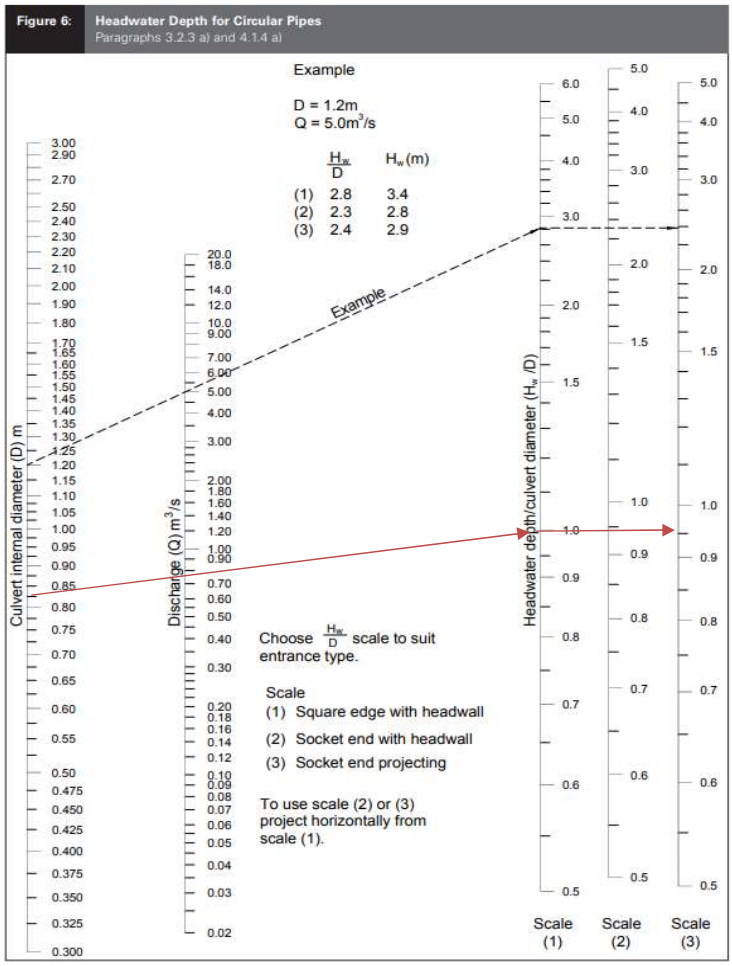
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-3

Q	0.75	m^3/s	Catchment 5
D	0.825	m	*Pipe Diameter*
(1)	1	0.83	
(2)	0.94	0.78	
(3)	0.96	0.79	

Circular Pipe with 0.825m Diameter would have a headwater of 0.83m depth

Circular Pipe with 825 mm diamter would have a headwater of 0.83 m depth



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title / Title: Development of Riverhead Forest — SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

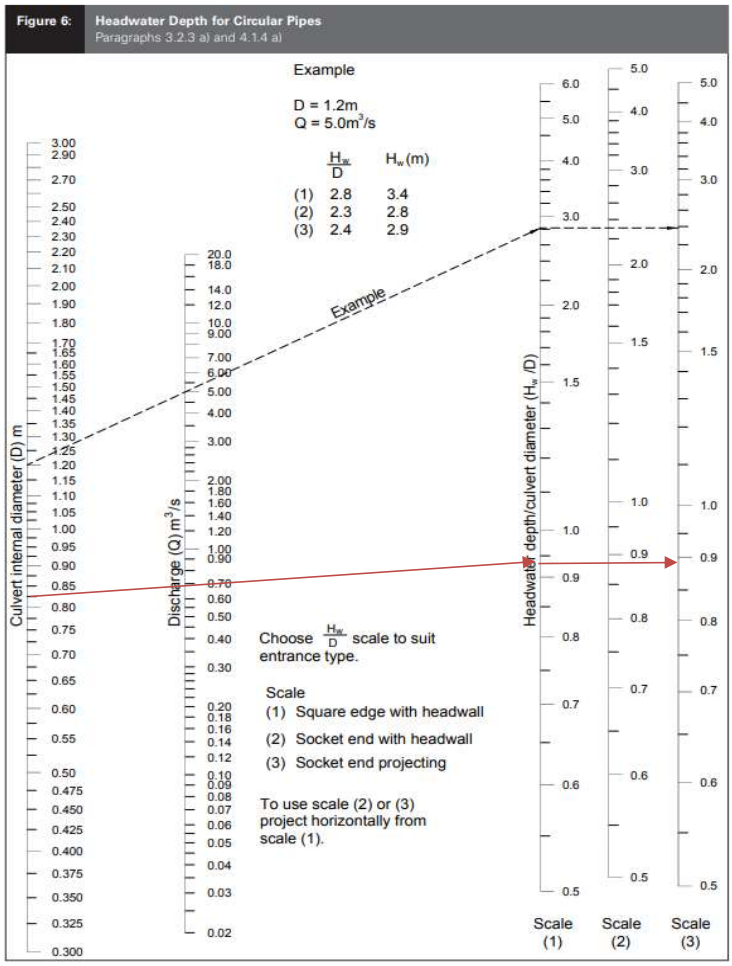
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-4

Q	0.68	m^3/s	Catchment 6
D	0.825	m	*Pipe Diameter*

	Hw/D	*Hw*
(1)	0.93	0.77
(2)	0.88	0.73
(3)	0.89	0.73

Circular Pipe with 825 mm diamter would have a headwater of 0.8 m depth



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title: Development of Riverhead Forest For Rangitoopuni Developments Limited Title: SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

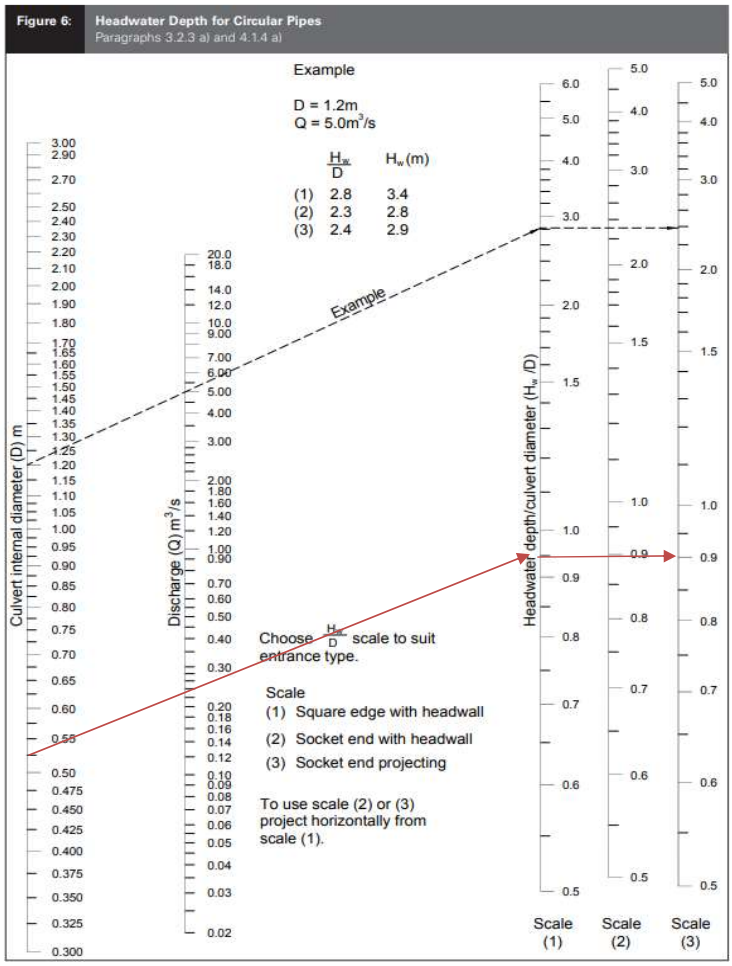
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 3-5

Q	0.23	m^3/s	Catchment 7
D	0.525	m	*Pipe Diameter*
(1)	0.95	0.50	
(2)	0.9	0.47	
(3)	0.9	0.47	

Circular Pipe with 0.525m Diameter would have a headwater of 0.49m depth

Circular Pipe with 525 mm diamter would have a headwater of 0.5 m depth



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title: Development of Riverhead Forest For Rangitoopuni Developments Limited Title: SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

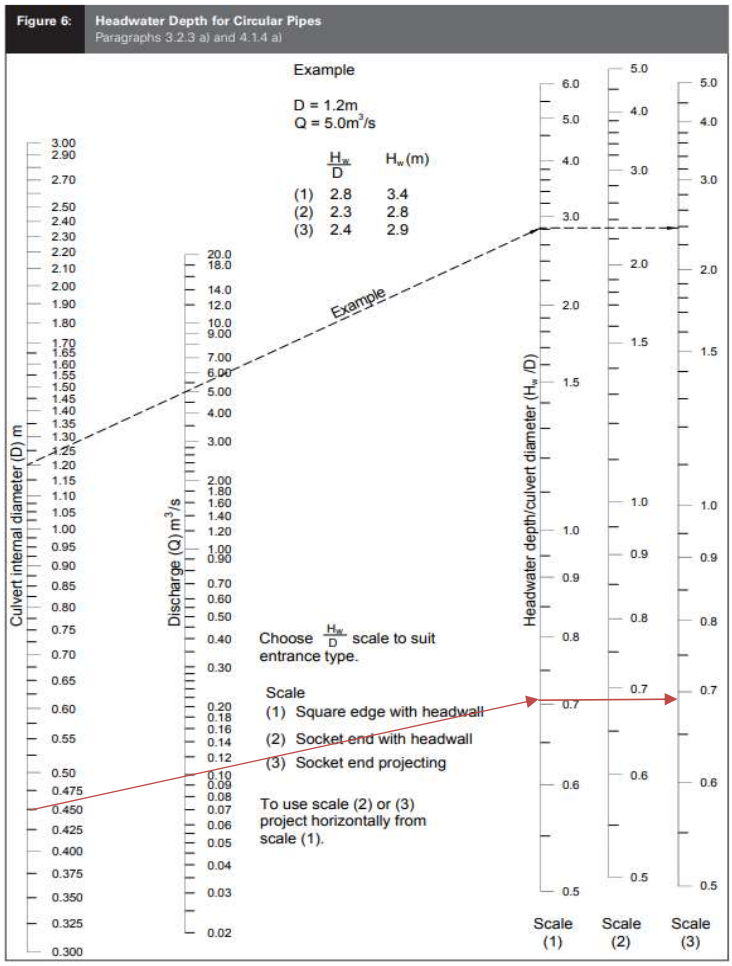
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 4-1

Q	0.1	m^3/s	Catchment 14
D	0.45	m	*Pipe Diameter*

	Hw/D	*Hw*
(1)	0.71	0.32
(2)	0.68	0.31
(3)	0.69	0.31

Circular Pipe with 450 mm diamter would have a headwater of 0.3 m depth



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title: Development of Riverhead Forest For Rangitoopuni Developments Limited Title: SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

Verification Method E1/VM1. Based on Figure 6

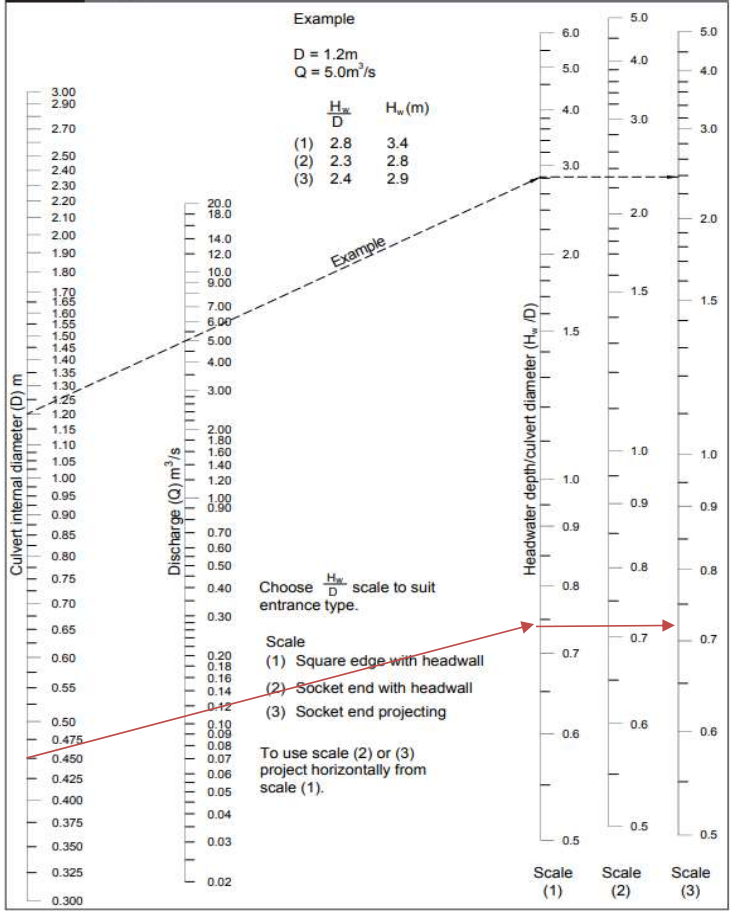
For Proposed Culvert 5-1

Q	0.11	m^3/s	Catchment 12
D	0.45	m	*Pipe Diameter*

	Hw/D	*Hw*
(1)	0.74	0.33
(2)	0.72	0.32
(3)	0.73	0.33

Circular Pipe with 450 mm diamter would have a headwater of 0.3 m depth

Figure 6: Headwater Depth for Circular Pipes
Paragraphs 3.2.3 a) and 4.1.4 a)



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title: Development of Riverhead Forest For Rangitoopuni Developments Limited Title: SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

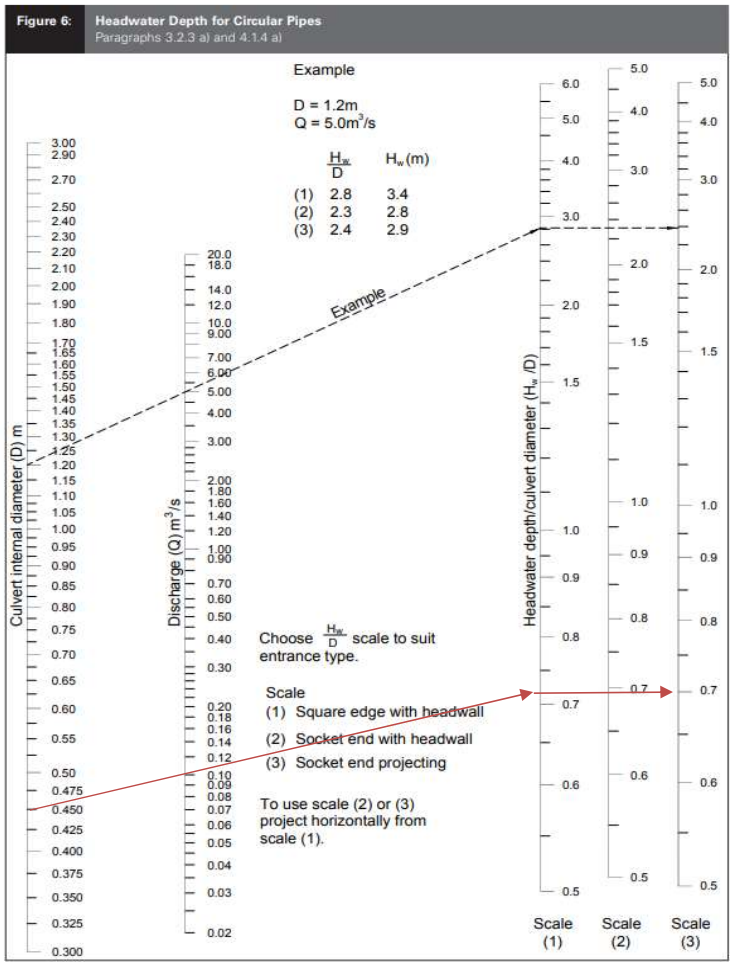
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 5-2

Q	0.1	m^3/s	Catchment 8
D	0.45	m	*Pipe Diameter*

	Hw/D	*Hw*
(1)	0.72	0.32
(2)	0.69	0.31
(3)	0.7	0.32

Circular Pipe with 450 mm diamter would have a headwater of 0.3 m depth



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title: Development of Riverhead Forest For Rangitoopuni Developments Limited Title: SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

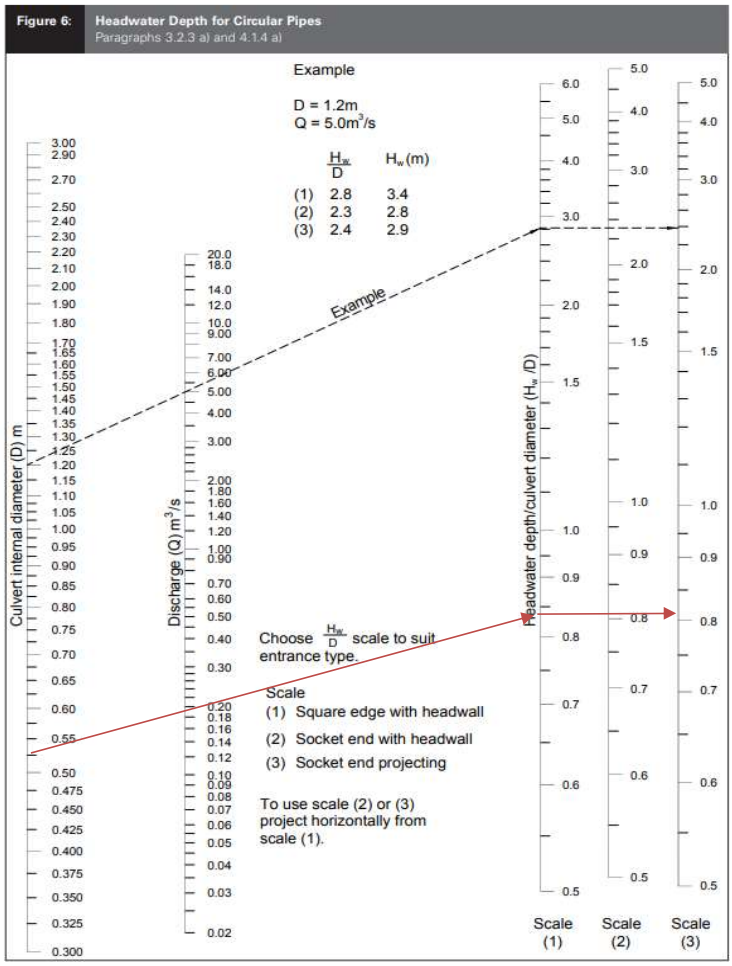
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 9-1

Q	0.19	m^3/s	Catchment 25
D	0.525	m	*Pipe Diameter*

	Hw/D	*Hw*
(1)	0.84	0.44
(2)	0.81	0.43
(3)	0.81	0.43

Circular Pipe with 525 mm diamter would have a headwater of 0.4 m depth



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title: Development of Riverhead Forest For Rangitoopuni Developments Limited Title: SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

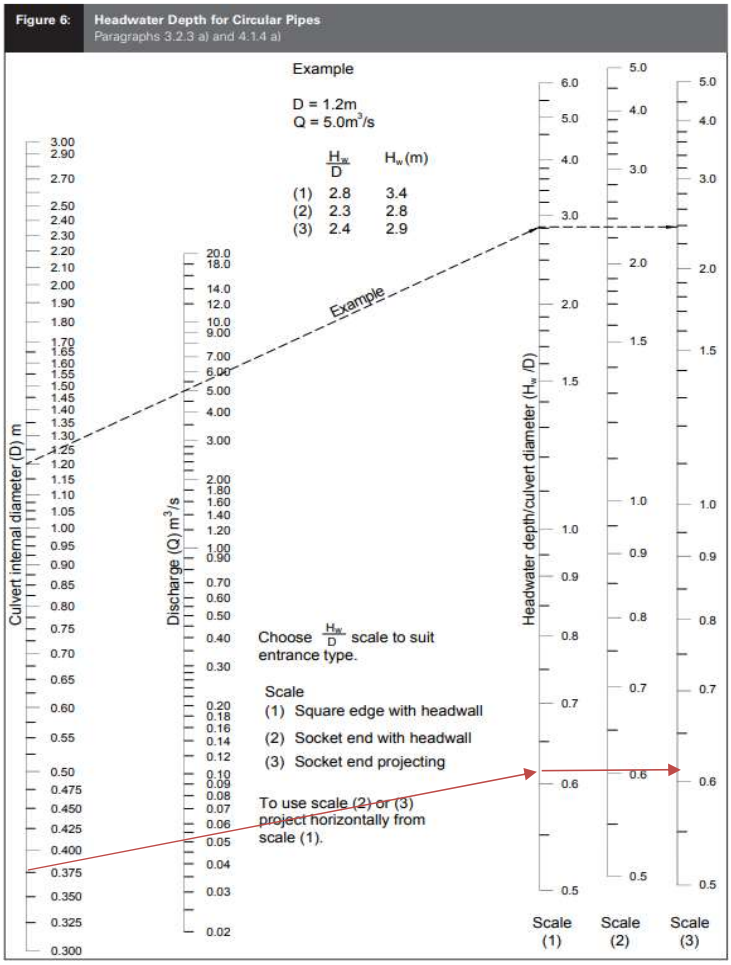
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 12-1

Q	0.05	m^3/s	Catchment 33
D	0.375	m	*Pipe Diameter*

	Hw/D	*Hw*
(1)	0.62	0.23
(2)	0.61	0.23
(3)	0.62	0.23

Circular Pipe with 375 mm diamter would have a headwater of 0.2 m depth



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title: Development of Riverhead Forest For Rangitoopuni Developments Limited Title: SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

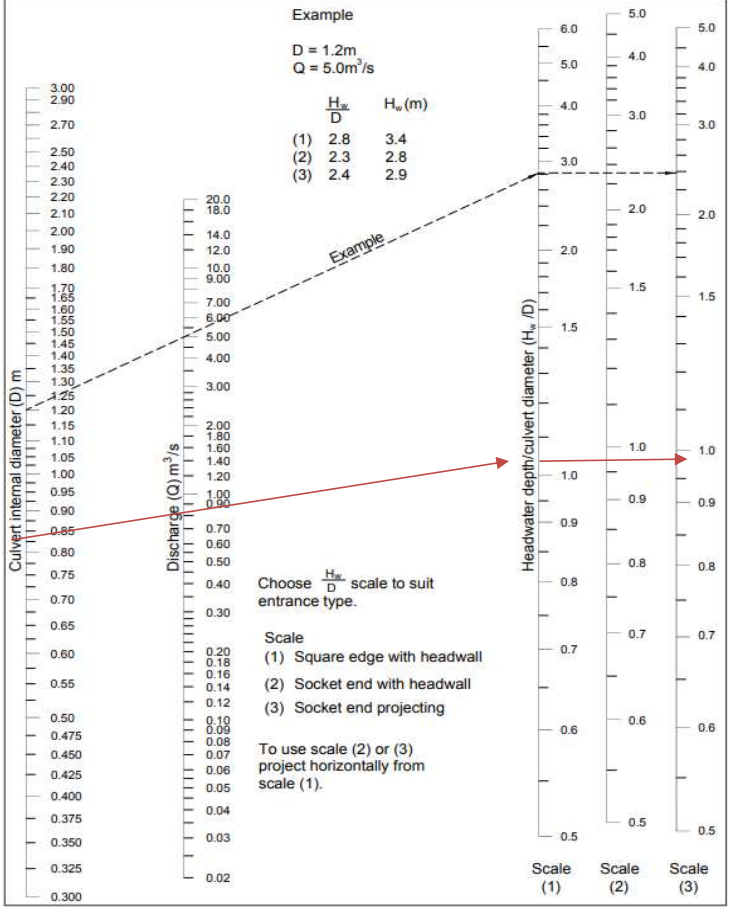
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 14-2

Q	0.83	m^3/s	Catchment 45
D	0.825	m	*Pipe Diameter*
	Hw/D	*Hw*	
(1)	1.05	0.87	
(2)	0.98	0.81	
(3)	0.99	0.82	

Circular Pipe with 825 mm diamter would have a headwater of 0.81 m depth

Figure 6: Headwater Depth for Circular Pipes
Paragraphs 3.2.3 a) and 4.1.4 a)



MAVEN ASSOCIATES	Job Number 147007	Sheet 1	Rev A
Job Title: Development of Riverhead Forest For Rangitoopuni Developments Limited Title: SW 100-year Circular Culvert Size Calculation	Author WY	Date 13/05/2024	Checked KH

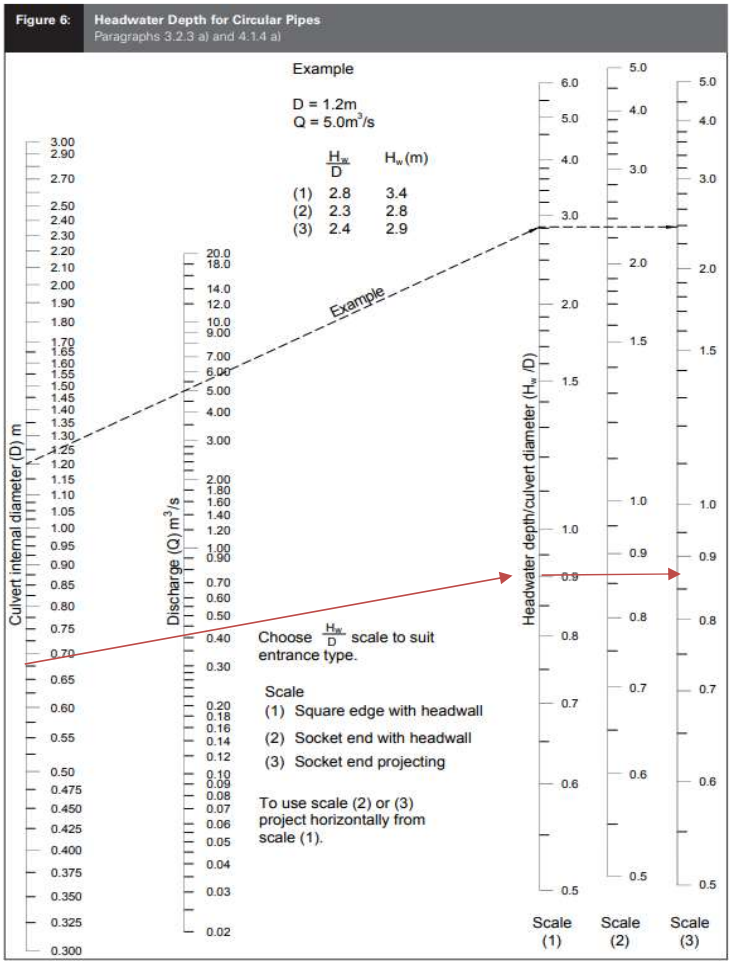
Verification Method E1/VM1. Based on Figure 6

For Proposed Culvert 14-4

Q	0.39	m^3/s	Catchment 42
D	0.675	m	*Pipe Diameter*

	Hw/D	*Hw*
(1)	0.9	0.61
(2)	0.86	0.58
(3)	0.87	0.59

Circular Pipe with 675 mm diamter would have a headwater of 0.58 m depth



MAVEN ASSOCIATES		Job Number 147016	Sheet 1	Rev A
Job Title	Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Calc Title	Outlet Structure Riprap Calculations	AO	19-Mar	KH

ROCK RIPRAP DIMENSION SUMMARY

TABLE OF RIPRAP DIMENSIONS			
OUTFALL NUMBER	L (m)	W (m)	D_A (m)
1-0	6.4	1.8	0.44
2-0	5.8	1.4	0.44
3-0	3.5	0.7	0.30
4-0	3.3	0.7	0.28
5-0	7.3	2.1	0.50
6-0	3.0	0.8	0.20
6-P-0	11.8	2.5	0.98
7-0	4.2	0.9	0.34
8-0	6.3	1.6	0.46
9-0	8.1	2.3	0.56
10-0	3	0.9	0.20
15-0	2.3	0.9	0.14
16-0	2.3	0.9	0.14
17-0	2.3	0.9	0.14
18-0	2.3	0.9	0.14
19-0	2.3	0.9	0.14
20-0	2.3	0.9	0.14
21-0	2.3	0.9	0.14
22-0	2.3	0.9	0.14
23-0	2.3	0.9	0.14
24-0	3	0.9	0.20
25-0	2.9	1.2	0.18

MAVEN ASSOCIATES	Job Number 147016	Sheet 2	Rev A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author: AO	Date: 19-Mar	Checked: KH
Calc Title: Outlet Structure Riprap Calculations			

OUTLET STRUCTURE 1-0 - ROCK RIPRAP

Pipe diameter =	0.600	m		ks=	0.6
Pipe gradient =	0.020	m/m			
Velocity =	3.45	m/s			
Froude Number Fo =	1.42				
Rock diameter =	213	mm	=> Use	**440**	mm (min 2x Dia)
Outfall width =	1.8	m	=> Use	**1.80**	m (min)
Outfall length =	6.36	m	=> Use	**6.40**	m (min)

OUTLET STRUCTURE 2-0 - ROCK RIPRAP

Pipe diameter =	0.450	m		ks=	0.6
Pipe gradient =	0.040	m/m			
Velocity =	4.08	m/s			
Froude Number Fo =	1.94				
Rock diameter =	218	mm	=> Use	**440**	mm (min 2x Dia)
Outfall width =	1.35	m	=> Use	**1.40**	m
Outfall length =	5.80	m	=> Use	**5.80**	m

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	147016	3	A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Calc Title: Outlet Structure Riprap Calculations	AO	19-Mar	KH

OUTLET STRUCTURE 3-0 - ROCK RIPRAP

Pipe diameter =	0.225	m		ks=	0.6
Pipe gradient =	0.090	m/m			
Velocity =	3.95	m/s			
Froude Number Fo =	2.66				
Rock diameter =	149	mm	=> Use	**300**	mm (min 2x Dia)
Outfall width =	0.675	m	=> Use	**0.70**	m (min)
Outfall length =	3.42	m	=> Use	**3.50**	m (min)

OUTLET STRUCTURE 4-0 - ROCK RIPRAP

Pipe diameter =	0.225	m		ks=	0.6
Pipe gradient =	0.070	m/m			
Velocity =	3.48	m/s			
Froude Number Fo =	2.34				
Rock diameter =	132	mm	=> Use	**280**	mm (min 2x Dia)
Outfall width =	0.675	m	=> Use	**0.70**	m
Outfall length =	3.21	m	=> Use	**3.30**	m

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	147016	4	A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Calc Title: Outlet Structure Riprap Calculations	AO	19-Mar	KH

OUTLET STRUCTURE 5-0 - ROCK RIPRAP

Pipe diameter =	0.675	m	ks=	0.6	
Pipe gradient =	0.020	m/m			
Velocity =	3.71	m/s			
Froude Number Fo =	1.44				
Rock diameter =	243	mm	=> Use	**500**	mm (min 2x Dia)
Outfall width =	2.025	m	=> Use	**2.10**	m (min)
Outfall length =	7.23	m	=> Use	**7.30**	m (min)

OUTLET STRUCTURE 6-0 - ROCK RIPRAP

Pipe diameter =	0.300	m	ks=	0.6	
Pipe gradient =	0.020	m/m			
Velocity =	2.23	m/s			
Froude Number Fo =	1.30				
Rock diameter =	97	mm	=> Use	**200**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m
Outfall length =	2.98	m	=> Use	**3.00**	m

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	147016	5	A

Job Title	Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Calc Title	Outlet Structure Riprap Calculations	AO	19-Mar	KH

OUTLET STRUCTURE 6-P-0 - ROCK RIPRAP

Pipe diameter =	0.825	m	ks=	0.6	
Pipe gradient =	0.050	m/m			
Velocity =	6.66	m/s			
Froude Number Fo =	2.34				
Rock diameter =	483	mm	=> Use	**980**	mm (min 2x Dia)
Outfall width =	2.475	m	=> Use	**2.50**	m (min)
Outfall length =	11.78	m	=> Use	**11.80**	m (min)

MAVEN ASSOCIATES	Job Number 147016	Sheet 6	Rev A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author: AO	Date: 19-Mar	Checked: KH
Calc Title: Outlet Structure Riprap Calculations			

OUTLET STRUCTURE 7-0 - ROCK RIPRAP

Pipe diameter =	0.300	m		ks=	0.6
Pipe gradient =	0.060	m/m			
Velocity =	3.87	m/s			
Froude Number Fo =	2.26				
Rock diameter =	169	mm	=> Use	**340**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m (min)
Outfall length =	4.20	m	=> Use	**4.20**	m (min)

OUTLET STRUCTURE 8-0 - ROCK RIPRAP

Pipe diameter =	0.525	m		ks=	0.6
Pipe gradient =	0.030	m/m			
Velocity =	3.89	m/s			
Froude Number Fo =	1.71				
Rock diameter =	225	mm	=> Use	**460**	mm (min 2x Dia)
Outfall width =	1.575	m	=> Use	**1.60**	m
Outfall length =	6.29	m	=> Use	**6.30**	m

MAVEN ASSOCIATES	Job Number 147016	Sheet 7	Rev A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited Calc Title: Outlet Structure Riprap Calculations	Author AO	Date 19-Mar	Checked KH

OUTLET STRUCTURE 9-0 - ROCK RIPRAP

Pipe diameter =	0.750	m	ks=	0.6	
Pipe gradient =	0.020	m/m			
Velocity =	3.96	m/s			
Froude Number Fo =	1.46				
Rock diameter =	274	mm	=> Use	**560**	mm (min 2x Dia)
Outfall width =	2.25	m	=> Use	**2.30**	m (min)
Outfall length =	8.10	m	=> Use	**8.10**	m (min)

OUTLET STRUCTURE 10-0 - ROCK RIPRAP

Pipe diameter =	0.300	m	ks=	0.6	
Pipe gradient =	0.020	m/m			
Velocity =	2.23	m/s			
Froude Number Fo =	1.30				
Rock diameter =	97	mm	=> Use	**200**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m
Outfall length =	2.98	m	=> Use	**3.00**	m

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	147016	8	A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Calc Title: Outlet Structure Riprap Calculations	AO	19-Mar	KH

OUTLET STRUCTURE 15-0 - ROCK RIPRAP

Pipe diameter =	0.300	m		ks=	0.6
Pipe gradient =	0.010	m/m			
Velocity =	1.57	m/s			
Froude Number Fo =	0.92				
Rock diameter =	69	mm	=> Use	**140**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m (min)
Outfall length =	2.21	m	=> Use	**2.30**	m (min)

OUTLET STRUCTURE 16-0 - ROCK RIPRAP

Pipe diameter =	0.300	m		ks=	0.6
Pipe gradient =	0.010	m/m			
Velocity =	1.57	m/s			
Froude Number Fo =	0.92				
Rock diameter =	69	mm	=> Use	**140**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m
Outfall length =	2.21	m	=> Use	**2.30**	m

MAVEN ASSOCIATES	Job Number 147016	Sheet 9	Rev A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author: AO	Date: 19-Mar	Checked: KH
Calc Title: Outlet Structure Riprap Calculations			

OUTLET STRUCTURE 17-0 - ROCK RIPRAP

Pipe diameter =	0.300	m		ks=	0.6
Pipe gradient =	0.010	m/m			
Velocity =	1.57	m/s			
Froude Number Fo =	0.92				
Rock diameter =	69	mm	=> Use	**140**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m (min)
Outfall length =	2.21	m	=> Use	**2.30**	m (min)

OUTLET STRUCTURE 18-0 - ROCK RIPRAP

Pipe diameter =	0.300	m		ks=	0.6
Pipe gradient =	0.010	m/m			
Velocity =	1.57	m/s			
Froude Number Fo =	0.92				
Rock diameter =	69	mm	=> Use	**140**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m
Outfall length =	2.21	m	=> Use	**2.30**	m

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	147016	10	A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Calc Title: Outlet Structure Riprap Calculations	AO	19-Mar	KH

OUTLET STRUCTURE 19-0 - ROCK RIPRAP

Pipe diameter =	0.300	m		ks=	0.6
Pipe gradient =	0.010	m/m			
Velocity =	1.57	m/s			
Froude Number Fo =	0.92				
Rock diameter =	69	mm	=> Use	**140**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m (min)
Outfall length =	2.21	m	=> Use	**2.30**	m (min)

OUTLET STRUCTURE 20-0 - ROCK RIPRAP

Pipe diameter =	0.300	m		ks=	0.6
Pipe gradient =	0.010	m/m			
Velocity =	1.57	m/s			
Froude Number Fo =	0.92				
Rock diameter =	69	mm	=> Use	**140**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m
Outfall length =	2.21	m	=> Use	**2.30**	m

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	147016	11	A

Job Title	Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Calc Title	Outlet Structure Riprap Calculations	AO	19-Mar	KH

OUTLET STRUCTURE 21-0 - ROCK RIPRAP

Pipe diameter =	0.300	m	ks=	0.6	
Pipe gradient =	0.010	m/m			
Velocity =	1.57	m/s			
Froude Number Fo =	0.92				
Rock diameter =	69	mm	=> Use	**140**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m (min)
Outfall length =	2.21	m	=> Use	**2.30**	m (min)

OUTLET STRUCTURE 22-0 - ROCK RIPRAP

Pipe diameter =	0.300	m	ks=	0.6	
Pipe gradient =	0.010	m/m			
Velocity =	1.57	m/s			
Froude Number Fo =	0.92				
Rock diameter =	69	mm	=> Use	**140**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m
Outfall length =	2.21	m	=> Use	**2.30**	m

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	147016	12	A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited		Author	Date	Checked
Calc Title: Outlet Structure Riprap Calculations		AO	19-Mar	KH

OUTLET STRUCTURE 23-0 - ROCK RIPRAP

Pipe diameter =	0.300	m		ks=	0.6
Pipe gradient =	0.010	m/m			
Velocity =	1.57	m/s			
Froude Number Fo =	0.92				
Rock diameter =	69	mm	=> Use	**140**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m (min)
Outfall length =	2.21	m	=> Use	**2.30**	m (min)

OUTLET STRUCTURE 24-0 - ROCK RIPRAP

Pipe diameter =	0.300	m		ks=	0.6
Pipe gradient =	0.020	m/m			
Velocity =	2.23	m/s			
Froude Number Fo =	1.30				
Rock diameter =	97	mm	=> Use	**200**	mm (min 2x Dia)
Outfall width =	0.9	m	=> Use	**0.90**	m
Outfall length =	2.98	m	=> Use	**3.00**	m

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	147016	13	A

Job Title	Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Calc Title	Outlet Structure Riprap Calculations	AO	19-Mar	KH

OUTLET STRUCTURE 25-0 - ROCK RIPRAP

Pipe diameter =	0.375	m	ks=	0.6	
Pipe gradient =	0.010	m/m			
Velocity =	1.81	m/s			
Froude Number Fo =	0.94				
Rock diameter =	89	mm	=> Use	**180**	mm (min 2x Dia)
Outfall width =	1.125	m	=> Use	**1.20**	m (min)
Outfall length =	2.84	m	=> Use	**2.90**	m (min)

	Maven Associates	Job Number 147016	Sheet 1	Rev A
Job Title	Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Title	Retirement Village-Raingarden Sizing Calculations	AO	Mar-25	KH

Outfall/ RG	Catchment	Proposed Raingarden Footprint area m^2		Treatment Type	Number of Cartridges Required	StormFilter Drawing	
						Online	Peak Diversion
1-0	1+50	113.0		Storm Filter	12	Storm Filter Vault	2800W X 3650L X 2150 D
2-0	2	34.0		Storm Filter	4	SF-MH-69-1500-T-20	SF-MHPD-69-1800-T-20
3-0	3	11.0		no treatment proposed, less than 10 lots.			
4-0	7	7.0		no treatment proposed, less than 10 lots.			
5-0	6	100.0		Communal RG			
6-0	5	89.0		JELLYFISH	3	JF-MH-54-1200-T-OFF-20	
7-0	4	13.0		no treatment proposed, less than 10 lots.			
8-0	8	54.0		Communal RG			
9-0	9	140.0		Communal RG			
10-0	10+51	17.0		no treatment proposed , serving less than 10 carparks, if required stormfilter			

	Maven Associates	Job Number 147016	Sheet 2	Rev A
Job Title	Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Title	Forest Road-Raingarden Sizing Calculations	AO	Mar-25	KH

Outfall/ RG	Catchment	Proposed Raingarden Footprint area m^2		Treatment Type	Number of Cartridges Required	Drawing	
						Online	Peak Diversion
15	1254.92	44.0		Public Raingarden			
16	294.07	11.0		Public Raingarden			
17	913.11	32.00		Public Raingarden			
18	794.77	28.00		Public Raingarden			
19	658.65	24.00		Public Raingarden			
20	379.49	14.00		Public Raingarden			
21	1061.14	38.00		Public Raingarden			
22	944.38	34.00		Public Raingarden			
23	1172.16	42.0		Public Raingarden			
24	2224.46	78.0		Jelly Fish	5	JF-MH-54-1800-T-OFF-20	

Maven Associates	**Job Number** 147016	**Sheet** 3	**Rev** A	
Job Title Development of Riverhead Retirement Village For Rangitoopuni Developments Limited **Title** Preliminary Raingarden Sizing Calculations	**Author** AO	**Date** Mar-25	**Checked** KH	

GD01 Bioretention Device Sizing Criteria for WQV :		Design parameters
Device footprint	2%	water quality treatment only
Ponding depth	0.1	The volume of water stored in the ponding area (100% @ Void space)
Media depth	0.5	The volume of water stored in the void space of the bioretention media Media Depth (@ 30% Void space)
Transition layer	0.1	The volume of water stored in the void space of 50mm Transition Layer (@ 30% Void space)
Drainage layer	0.3	The volume of water stored in the void space of the drainage layer, above the underdrain invert. (@ 35% Void Space)

1

					Alternative Solutions				
RG No	**Road Catchment Area**	**Min Ponding Footprint Required (m2)**	**Proposed Raingarden Footprint area m^2**		**Notes**	**Number of Cartridges Required**	**StormFilter Drawing**		
Rain Gardens							Online	Peak Diversion	
1	5643.3	112.87	113.00		Storm Filter	12	Storm Filter Vault	2800W X 3650L X 2150 D	
2	1698.1	33.962	34		Storm Filter	4	SF-MH-69-1500-T-20	SF-MHPD-69-1800-T-20	
3	502	10.04	11.00		no treatment proposed, less than 10 lots.				
4	311.2	6.22	7.00		no treatment proposed, less than 10 lots.				
5	4975	99.50	100.00		Communal RG				
6	4401.3	88.03	89.00		JELLYFISH	3	JF-MH-54-1200-T-OFF-20		
7	612.2	12.24	13.00		no treatment proposed, less than 10 lots.				
8	2655.9	53.12	54.00		Communal RG				
9	6970.3	139.41	140.00		Communal RG				
10	810.2	16.20	17.00		no treatment proposed , serving less than 10 carparks, if required stormfilter				

Proprietary device due to proposed location constraints

Maven Associates	Job Number 147016	Sheet 4	Rev A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited Title: Raingarden Sizing Calculations	Author AO	Date Mar-25	Checked KH

GD01 Bioretention Device Sizing Criteria for SMAF 2 :	
Device footprint	3.5%
Ponding depth	0.15
Media depth	0.5
Transition layer	0.1
Drainage layer	0.3
Storage layer	0.45
	1.5

Design parameters

water quality treatment only

The volume of water stored in the ponding area (100% @ Void space)

The volume of water stored in the void space of the bioretention media Media Depth (@ 30% Void space)

The volume of water stored in the void space of 50mm Transition Layer (@ 30% Void space)

The volume of water stored in the void space of the drainage layer, above the underdrain invert. (@ 35% Void Space)

The volume of water stored in the void space of the storage layer

Alternative Solutions

Catchment No	Road Catchment Area	Imp %	Min Ponding Footprint Required (m2)	Proposed Raingarden Footprint area m^2	Notes
Rain Gardens		0.9			
300	835.063	751.56	26.30	27.00	Existing Road no Proposed Treatment
301	900.923	810.83	28.38	29.00	Existing Road no Proposed Treatment
302	877.686	789.92	27.65	28.00	Existing Road no Proposed Treatment
303	243.834	219.45	7.68	8.00	Existing Road no Proposed Treatment
304	414.518	373.07	13.06	14.00	Existing Road no Proposed Treatment
305	670.222	603.20	21.11	22.00	Existing Road no Proposed Treatment
306	610.3	549.27	19.22	20.00	Existing Road no Proposed Treatment
307	578.996	521.10	18.24	19.00	Existing Road no Proposed Treatment
308	579.907	521.92			
309	536.527	482.87			
310	533.283	479.95			
311	324.544	292.09			
Outlet 15		1254.92	43.92	44.00	Public Raingarden
312	326.741	294.07	10.29	11.00	
Outlet 16					
313	1014.57	913.11	31.96	32.00	
Outlet 17					Public Raingarden

314	883.08	794.77	27.82	28.00	Public Raingarden
Outlet 18					
315	480.953	432.86			
Outlet 19					
316	250.882	225.79			
Outlet 19		658.65	23.05	24.00	Public Raingarden
317	421.656	379.49	13.28	14.00	
Outlet 20					Public Raingarden
318	489	440.10			
319	281.767	253.59			
320	408.275	367.45			
outlet 21		1061.14	37.14	38.00	
321	605.679	545.11			
322	443.635	399.27			
outlet 22		944.38	33.05	34.00	Public Raingarden
323	309.93	278.94			
324	992.465	893.22			
outlet 23		1172.16	41.03	42.00	Public Raingarden
325	1192.701	1073.43			
335	375.672	338.10			
336	419.038	377.13			
337	484.208	435.79			
outlet 24		2224.46	77.86	78.00	Private Road to be Proprietary device

MAVEN ASSOCIATES	Job Number	Sheet	Rev	Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author		Date	Checked
	147016	1	A	Calc Title: Pipe Capacity Check	AYC		1/04/2025	KH

Rainfall Depth	ARI 10YR (mm)	
TP108 rainfall data	130.2	(from TP108 Maps)
Climate change Increase	152.334	

Pipe ks factor = 0.6 mm (pipes up to 1.0m dia)
0.6 mm (pipes over 1.0m dia)

	CN Number		CN Number	
Impervious area	98	Proposed Roads	96.8	Equivalent CN - (95% impervious coverage, 10% pervious coverage)
Pervious	74	Residential Lots	90.8	Equivalent CN - (70% impervious coverage, 30% pervious coverage)

Line *number*		MH to MH	Catchment *letter*	Catchment Area *m2*	CN	Peak Flow rate - 10YR ARI *l/s*	Cum. Flow *l/s*	Pipe dia *m*	Gradient *%*	Capacity *l/s*	Percent Capacity *%*	Remaining *l/s*	Velocity *m/s*	Check OK
OUTLET 1														
S1	ROAD	1-4-2-4 to 1-4	24,25	531	96.8	13.3	13.3							
	LOTS		26,27	4686	90.8	110.1	123.4	0.300	1.60	141.6	87.2%	18.2	2.00	OK
S2	ROAD	1-4-1-11 to 1-4-1-9	32	526	96.8	13.2	13.2							
	LOTS		43,38	3774	90.8	88.7	101.9	0.300	2.00	158.4	64.3%	56.5	2.24	OK
	ROAD	1-4-1-9 to 1-4-1-7	31	368	96.8	9.2	9.2							
	LOTS		37	1562	90.8	36.7	147.8	0.375	2.00	284.9	51.9%	137.1	2.58	OK
	ROAD	1-4-1-7 to 1-4-1-5	30	410	96.8	10.3	10.3							
	LOTS		36	1785	90.8	41.9	200.0	0.375	2.00	284.9	70.2%	84.8	2.58	OK
	ROAD	1-4-1-5 to 1-4-1-3	29	426	96.8	10.7	10.7							
	LOTS		35,40	2972	90.8	69.8	280.5	0.450	2.00	459.9	61.0%	179.4	2.89	OK
	ROAD	1-4-1-3 to 1-4-1-1			96.8	0.0	0.0							
	LOTS		33,34,39	4609	90.8	108.3	388.9	0.450	2.00	459.9	84.5%	71.1	2.89	OK
	ROAD	1-4-1-1 to 1-4	28	389	96.8	9.7	9.7							
	LOTS			0	90.8	0.0	398.6	0.525	1.00	487.4	81.8%	88.8	2.25	OK
S3	ROAD	1-6-1 to 1-6			96.8	0.0	0.0							
	LOTS		41,44,408	4382	90.8	103.0	103.0	0.300	1.10	117.4	87.7%	14.4	1.66	OK
S4	ROAD	1-9 to 1-8	6	524	96.8	13.1	13.1							
	LOTS				90.8	0.0	13.1	0.225	2.00	74.2	17.7%	61.0	1.87	OK
	ROAD	1-8 to 1-7	5	395	96.8	9.9	9.9							
	LOTS				90.8	0.0	23.0	0.225	2.00	74.2	31.0%	51.1	1.87	OK
	ROAD	1-7 to 1-6	4	1217	96.8	30.5	30.5							
	LOTS				90.8	0.0	53.5	0.225	2.00	74.2	72.2%	20.6	1.87	OK
	ROAD	1-6 to 1-5	42 + S3	417	96.8	10.5	10.5							
	LOTS		S3		90.8	0.0	167.0	0.375	2.00	284.9	58.6%	117.9	2.58	OK
	ROAD	1-5 to 1-4	2	1698	96.8	42.6	42.6							
	LOTS				90.8	0.0	209.5	0.375	2.00	284.9	73.6%	75.3	2.58	OK
TOTAL	ROAD	1-4 to 1-0	1 + S1&2	570	96.8	14.3	14.3							
	LOTS		S1&2		90.8	0.0	745.8	0.600	1.50	847.4	88.0%	101.5	3.00	OK

OUTLET 2														
S1	ROAD	2-8 to 2-6	48	405	96.8	10.2	10.2							
	LOTS		55,56	5398	90.8	126.9	137.0	0.300	4.00	224.0	61.2%	87.0	3.17	OK
	ROAD	2-6 to 2-2	49,47	827	96.8	20.7	20.7							
	LOTS		53,52	3434	90.8	80.7	238.4	0.375	2.00	284.9	83.7%	46.4	2.58	OK
S2	ROAD	2-2-1 to 2-2			96.8	0.0	0.0							
	LOTS		387,54	4690	90.8	110.2	110.2	0.300	2.00	158.4	69.6%	48.1	2.24	OK
TOTAL	ROAD	2-2 to 2-1	45,46 + S1&2	711	96.8	17.8	17.8							
	LOTS		S1&2		90.8	0.0	366.5	0.450	1.60	411.4	89.1%	44.9	2.59	OK
OUTLET 3	ROAD	3-2 to 3-1	407,398,396	576	96.8	14.4	14.4							
	LOTS		406	2178	90.8	51.2	65.6	0.225	8.98	157.2	41.7%	91.6	3.95	OK
OUTLET 4	ROAD	4-2 to 4-1	93	397	96.8	9.9	9.9							
	LOTS		94	968	90.8	22.7	32.7	0.225	2.00	74.2	44.1%	41.5	1.87	OK
OUTLET 5														
S1	ROAD	5-13 to 5-12			96.8	0.0	0.0							
	LOTS		97,102	4599	90.8	108.1	108.1	0.300	1.20	122.6	88.1%	14.6	1.73	OK
	ROAD	5-12 to 5-10	92	454	96.8	11.4	11.4							
	LOTS		415,414,96	3379	90.8	79.4	198.9	0.375	2.00	284.9	69.8%	86.0	2.58	OK
	ROAD	5-10 to 5-9	91	511	96.8	12.8	12.8							
	LOTS		95	2062	90.8	48.5	260.1	0.450	2.00	459.9	56.6%	199.8	2.89	OK
	ROAD	5-9 to 5-5	90,89	1232	96.8	30.9	30.9							
	LOTS		393,99,98	6939	90.8	163.1	454.1	0.525	1.10	511.2	88.8%	57.1	2.36	OK
S2	ROAD	5-5-3 to 5-5-2	370	602	96.8	15.1	15.1							
	LOTS		100,101	6077	90.8	142.8	157.9	0.375	1.00	201.4	78.4%	43.5	1.82	OK
	ROAD	5-5-2 to 5-5	10,11	1500	96.8	37.6	37.6							
	LOTS				90.8	0.0	195.5	0.375	2.00	284.9	68.6%	89.4	2.58	OK
S3	ROAD	5-5 to 5-4	9, S1&2	1227	96.8	30.8	30.8							
	LOTS		S1&2		90.8	0.0	680.3	0.600	2.00	978.5	69.5%	298.2	3.46	OK
	ROAD	5-4 to 5-1	8	1993	96.8	49.9	49.9							
	LOTS		88,87	3256	90.8	76.5	806.8	0.600	1.80	928.3	86.9%	121.5	3.28	OK
FLOW DIVERSION	ROAD	5-1 to 6-2-2-1	7	1585	96.8	39.7	846.5	0.675	1.50	1153.8	73.4%	307.4	3.22	OK
WATER QUALITY	ROAD	5-1 to RG5 to 5-0	10 mm/hr for water quality	9104	96.8	24.480	24.5							
	LOTS		flow	26312	90.8	66.365	90.8	0.300	1.00	111.9	81.2%	21.1	1.58	OK

OUTLET 6-P														
S1	ROAD	8-1 to 6-14 to 6-11	OUTLET 8		96.8	0.0	0.0							
	LOTS		86,74 + OUTLET 8	3869	90.8	90.9	618.6	0.525	2.50	770.8	80.3%	152.2	3.56	OK
	ROAD	6-11 to 6-10	65	400	96.8	10.0	10.0							
	LOTS		416	1733	90.8	40.7	669.3	0.600	2.00	978.5	68.4%	309.2	3.46	OK
	ROAD	6-10 to 6-7	64	508	96.8	12.7	12.7							
	LOTS		73	1699	90.8	39.9	722.0	0.600	2.00	978.5	73.8%	256.5	3.46	OK
	ROAD	6-7 to 6-6	63	628	96.8	15.7	15.7							
	LOTS		85,72	9340	90.8	219.5	957.2	0.675	2.00	1332.4	71.8%	375.2	3.72	OK
	ROAD	6-6 to 6-4	62	454	96.8	11.4	11.4							
	LOTS		71,80,70,79	6963	90.8	163.6	1132.2	0.750	2.00	1755.9	64.5%	623.7	3.97	OK
	ROAD	6-4 to 6-2	61,60	638	96.8	16.0	16.0							
	LOTS		78	1405	90.8	33.0	1181.2	0.750	1.49	1515.5	77.9%	334.3	3.43	OK
S2	ROAD	6-2-5 to 6-2-3	76,84	1056	96.8	26.5	26.5							
	LOTS		82,81,83	7188	90.8	168.9	195.4	0.375	1.50	246.7	79.2%	51.3	2.23	OK
	ROAD	6-2-3 to 6-2-2	75	857	96.8	21.5	21.5							
	LOTS		77	1233	90.8	29.0	245.8	0.450	1.00	325.2	75.6%	79.3	2.04	OK
S3	ROAD	6-2-2 to 6-2	57 +S2	395	96.8	9.9	9.9							
	LOTS		311,327 +S2 + OUTLET 5	3522	90.8	82.8	1185.0	0.750	1.50	1520.6	77.9%	335.6	3.44	OK
TOTAL	ROAD	6-2 to 6-P-1	58,59 +S1+S3	815	96.8	20.4	20.4							
	LOTS		S1+ S3		90.8	0.0	2386.6	0.825	4.50	3380.7	70.6%	994.1	6.32	OK

OUTLET 6-0														
WATER	ROAD	6-2 to 6-0	10 mm/hr for water quality	5751	96.8	15.464	15.5							
QUALITY	LOTS		flow	36952	90.8	93.201	108.7	0.300	1.33	129.1	84.2%	20.4	1.83	OK

OUTLET 7	ROAD	7-4 to 7-0	68,390,392	820	96.8	20.6	20.6							
	LOTS		66,67,69	4521	90.8	106.2	126.8	0.300	2.00	158.4	80.1%	31.6	2.24	OK

OUTLET 8	ROAD	8-8 to 8-7	374	546	96.8	13.7	13.7							
	LOTS		114,115,124	5488	90.8	129.0	142.7	0.300	3.55	211.0	67.6%	68.4	2.99	OK
	ROAD	8-7 to 8-6	106	510	96.8	12.8	12.8							
	LOTS		113,119	3962	90.8	93.1	248.5	0.450	2.00	459.9	54.0%	211.4	2.89	OK
	ROAD	8-6 to 8-4	105	545	96.8	13.7	13.7							
	LOTS		111,112,118	5614	90.8	131.9	394.1	0.450	2.28	491.1	80.3%	97.0	3.09	OK
	ROAD	8-4 to 8-3	104	486	96.8	12.2	12.2							
	LOTS		110,117	2829	90.8	66.5	472.8	0.525	2.00	689.4	68.6%	216.6	3.18	OK
	ROAD	8-3 to 8-2		0	96.8	0.0	0.0							
	LOTS		109,116	1820	90.8	42.8	515.6	0.525	2.00	689.4	74.8%	173.8	3.18	OK
FLOW	ROAD	8-2 to 8-1 to 6-14	103,12	482	96.8	12.1	12.1							
DIVERSION	LOTS				90.8	0.0	527.6	0.525	2.00	689.4	76.5%	161.7	3.18	OK
WATER	ROAD	8-1 to RG8 to 8-0	10 mm/hr for water quality	2569	96.8	6.908	6.9							
QUALITY	LOTS		flow	19713	90.8	49.721	56.6	0.300	1.00	111.9	50.6%	55.3	1.58	OK

OUTLET 9														
S1	ROAD	9-2-10 to 9-2-8			96.8	0.0	0.0							
	LOTS		154,153	3279	90.8	77.1	77.1	0.300	2.00	158.4	48.7%	81.3	2.24	OK
	ROAD	9-2-8 to 9-2-7	142	595	96.8	14.9	14.9							
	LOTS		134,152	6065	90.8	142.5	234.5	0.375	2.00	284.9	82.3%	50.4	2.58	OK
	ROAD	9-2-7 to 9-2-6	141,	548	96.8	13.7	13.7							
	LOTS		133,394	1134	90.8	26.6	274.9	0.450	2.00	459.9	59.8%	185.1	2.89	OK
	ROAD	9-2-6 to 9-2-4		1208	96.8	30.3	30.3							
	LOTS		132,395,131	3395	90.8	79.8	384.9	0.525	1.00	487.4	79.0%	102.4	2.25	OK
	ROAD	9-2-4 to 9-2-3	140	1208	96.8	30.3	30.3							
	LOTS		130	1203	90.8	28.3	443.5	0.600	1.00	691.8	64.1%	248.3	2.45	OK
	ROAD	9-2-3 to 9-2	139	635	96.8	15.9	15.9							
	LOTS		409,129	1605	90.8	37.7	497.1	0.600	1.00	691.8	71.9%	194.7	2.45	OK
S2	ROAD	9-13 to 9-12	23,159	686	96.8	17.2	17.2							
	LOTS		158,157	3460	90.8	81.3	98.5	0.300	2.00	158.4	62.2%	59.8	2.24	OK
	ROAD	9-12 to 9-11	22	383	96.8	9.6	9.6							
	LOTS		156	1889	90.8	44.4	152.5	0.375	2.00	284.9	53.5%	132.4	2.58	OK
	ROAD	9-11 to 9-9	21	419	96.8	10.5	10.5							
	LOTS		155,150	1655	90.8	38.9	201.9	0.375	2.00	284.9	70.9%	83.0	2.58	OK
	ROAD	9-9 to 9-8	358	441	96.8	11.1	11.1							
	LOTS		135,149	3686	90.8	86.6	299.6	0.450	1.26	365.0	82.1%	65.5	2.30	OK
	ROAD	9-8 to 9-6	19	424	96.8	10.6	10.6							
	LOTS		148,138	2747	90.8	64.6	374.7	0.450	2.00	459.9	81.5%	85.2	2.89	OK
	ROAD	9-6 to 9-5	18	433	96.8	10.9	10.9							
	LOTS		147,137	3056	90.8	71.8	457.4	0.525	1.67	629.9	72.6%	172.5	2.91	OK
	ROAD	9-5 to 9-3	17	338	96.8	8.5	8.5							
	LOTS		136,146	3709	90.8	87.2	553.0	0.525	2.00	689.4	80.2%	136.3	3.18	OK
S3	ROAD	9-3-3 to 9-3-2		0	96.8	0.0	0.0							
	LOTS		128,126	3079	90.8	72.4	72.4	0.300	1.00	111.9	64.6%	39.6	1.58	OK
	ROAD	9-3-2 to 9-3	271	383	96.8	9.6	9.6							
	LOTS		411,412	2179	90.8	51.2	133.2	0.300	2.10	162.3	82.1%	29.1	2.30	OK
S4	ROAD	9-1-6 to 9-1-5		0	96.8	0.0	0.0							
	LOTS		120,121,125	3931	90.8	92.4	92.4	0.300	1.45	134.8	68.5%	42.4	1.91	OK
	ROAD	9-1-5 to 9-1-4	108	540	96.8	13.5	13.5							
	LOTS		122	1443	90.8	33.9	139.8	0.375	2.00	284.9	49.1%	145.0	2.58	OK
	ROAD	9-1-4 to 9-1-1	410	396	96.8	9.9	9.9							
	LOTS		123	1978	90.8	46.5	196.2	0.375	2.00	284.9	68.9%	88.6	2.58	OK
	ROAD	9-1-1 to 9-1	273	347	96.8	8.7	8.7							
	LOTS			0	90.8	0.0	204.9	0.375	2.00	284.9	71.9%	79.9	2.58	OK
S5	ROAD	9-3 to 9-2	16,161 +S2&3	793	96.8	19.9	19.9							
	LOTS		S2&3		90.8	0.0	706.1	0.600	2.00	978.5	72.2%	272.4	3.46	OK
	ROAD	9-2 to 9-1	15 + S1&2&3	932	96.8	23.4	23.4							
	LOTS		S1&2&3		90.8	0.0	1206.7	0.750	2.00	1755.9	68.7%	549.2	3.97	OK
	ROAD	9-1 to 9-0	14,15,16,161 + S1&2&3&4	2588	96.8	64.9	64.9							
	LOTS		S1&2&3&4		90.8	0.0	1453.1	0.750	2.00	1755.9	82.8%	302.8	3.97	OK

OUTLET 10	ROAD	10-1 to 10-0	144,143	885	96.8	22.2	22.2							
	LOTS		145,151	2826	90.8	66.4	88.6	0.300	1.78	149.4	59.3%	60.8	2.11	OK
OUTLET 11	ROAD	11-3 to PR	300	835	96.8	20.9	20.9							
	LOTS	CULVERT 1			90.8	0.0	20.9	0.225	1.00	52.4	39.9%	31.5	1.32	OK
OUTLET 12	ROAD	EX CULVERT 12	301,302	1777	96.8	44.5	44.5							
	LOTS				90.8	0.0	44.5	0.300	5.18	254.9	17.5%	210.4	3.61	OK
OUTLET 13	ROAD	EX CULVERT 13	303	243	96.8	6.1	6.1							
	LOTS				90.8	0.0	6.1	0.300	5.41	260.5	2.3%	254.4	3.69	OK
OUTLET 14	ROAD	14-6 to PR	307,306,305,304	2272	96.8	56.9	56.9							
	LOTS	CULVERT 2			90.8	0.0	56.9	0.300	0.60	86.7	65.7%	29.7	1.23	OK
OUTLET 15														
S1	ROAD	15-1-4 TO RG15	309,310,311	1393	96.8	34.9	34.9							
	LOTS				90.8	0.0	34.9	0.300	0.50	79.1	44.1%	44.2	1.12	OK
								0.225	1.00	52.4	66.6%	52.4	1.32	OK
S2	ROAD	15-2-1 TO RG15	308	579	96.8	14.5	14.5							
	LOTS				90.8	0.0	14.5	0.225	1.00	52.4	27.7%	37.9	1.32	OK
	ROAD	RG15 TO 15-0	S1+S2	1972	96.8	49.4	49.4							
	LOTS				90.8	0.0	49.4	0.300	1.00	111.9	44.1%	62.5	1.58	OK
OUTLET 16	ROAD	16-1 TO 16-0	312	326	96.8	8.2	8.2							
	LOTS				90.8	0.0	8.2	0.225	1.00	52.4	15.6%	44.3	1.32	OK
OUTLET 17	ROAD	17-1 TO 17-0	313	1014	96.8	25.4	25.4							
	LOTS				90.8	0.0	25.4	0.225	1.00	52.4	48.5%	27.0	1.32	OK
OUTLET 18	ROAD	18-1 TO 18-0	314	883	96.8	22.1	22.1							
	LOTS				90.8	0.0	22.1	0.225	1.00	52.4	42.2%	30.3	1.32	OK
OUTLET 19	ROAD	19-2 TO 19-0	315,316	730	96.8	18.3	18.3							
	LOTS				90.8	0.0	18.3	0.225	1.00	52.4	34.9%	34.1	1.32	OK
OUTLET 20	ROAD	20-1 TO 20-0	317	421	96.8	10.6	10.6							
	LOTS				90.8	0.0	10.6	0.225	1.00	52.4	20.1%	41.9	1.32	OK
OUTLET 21	ROAD	21-3 TO 21-0	318,319,320	1178	96.8	29.5	29.5							
	LOTS				90.8	0.0	29.5	0.225	0.90	49.7	59.3%	20.2	1.25	OK

OUTLET 22	ROAD	22-2 TO 22-0	321,322	1048	96.8	26.3	26.3							
	LOTS				90.8	0.0	26.3	0.225	1.00	52.4	50.1%	26.2	1.32	OK
OUTLET 23	ROAD	RG23 TO 23-0	323,324	1301	96.8	32.6	32.6							
	LOTS				90.8	0.0	32.6	0.225	0.80	46.9	69.5%	14.3	1.18	OK
OUTLET 24														
	ROAD	24-5 TO 24-3	337,336,335	1278	96.8	32.0	32.0							
	LOTS				90.8	0.0	32.0	0.225	1.00	52.4	61.1%	20.4	1.32	OK
	ROAD	24-2 TO 24-0	325	1192	96.8	29.9	29.9							
	LOTS				90.8	0.0	61.9	0.300	1.00	111.9	55.3%	50.0	1.58	OK

MAVEN ASSOCIATES	Job Number 147016	Sheet 1	Rev A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited Title: Roof Run off pipe sizing	Author AO	Date 18/03/2025	Checked KH

For the roof stormwater pipe calculation the following assumption are made based on what's available:

Proposed total tank storage for drinking water, 600 cubic m (target)
Assumed 150 sq m of roof per unit
Total of 296 units

600 m3 = 150 sq m of roof x 296 units x required rainfall depth to fill tanks
600 / (150 x 296) = 0.013m required rainfall depth to fill tanks = 13mm

Based on this, it is assumed the 95th rainfall event (35mm over 24 hours) would be used to size the roof stormwater pipes

Run-off from one unit *0.82 l/s* *colebrook white, ks 0.6 and CN 98*

DN	Assumed Grade (%)	Pipe Capacity (m^3/s)	Max no of Units
150	2	0.0254	30
225	2	0.0742	90
300	2	0.1584	193
375	2	0.2849	347

assumed pipes are to be uPVC SN16

MAVEN ASSOCIATES	Job Number	Sheet	Rev
	147016	1	A
Job Title: Development of Riverhead Retirement Village For Rangitoopuni Developments Limited	Author	Date	Checked
Calc Title: Wastewater Capacity Check	AYC	1-Apr	KH

As per Watercare standards: 3 people per dwelling
PWWF = 1206 l/person/day
ks for uPVC = 0.6

Section Letter	Pipe size	Persons no	Units no	PWW Flow l/s	Pipe dia m	Gradient %	Capacity l/s	Velocity m/s	Check OK
	150	-	296	12.40	0.15	1.00	17.96	1.02	OK
	260 VILLAS AND 36 CARE UNITS								

Downstream pipe network has adequate capacity to accommodate the development.

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 1	Rev A
Job Title Rangitoopuni Calc Title Decant Sizing Calculation	Author HN	Date 1/04/2025	Checked KH

Max Catchment Area	3000	m^2
Decant Volume 3% of Area	90	m^3
Dead Storage 30% of volume	27	m^3
Live Storage 70% of volume	63	m^3
Decant Dewatering (3l/s/ha)	0.9	l/s

Size Decant

Standard decant	4.5	l/s	=	200 holes
Therefore	0.90	l/s	=	40 holes

Use 1 decants

Pond Dimensions

v = 90 m^3

d = 1 m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	3	x^2+	8.5	x+	-80
x	=	3.94	width of pond base			
or	=	-6.77				

Check = 90 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	5	x^2+	12.5	x+	-80
x	=	2.94	width of pond base			
or	=	-5.44				

Check = 90 m^3

Width = 3.94 m

Length = 11.81 m

Dead Storage Depth

Pond Dimensions

x = 3.94 m

v = 27.0 m^3

d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	3.347391751	d^2+	4.652608	+d	-2.7
e	=		0.31				

f	=		2.56	
g	=		1.72	
h	=		-0.18	
d	**=**		**0.430**	depth of dead storage
Check v	=	27.00		m^3

Spillway Dimensions

Side Slope	horizontal	3	vertical	1	
Gradient		**1**	**%**		
Base Width		0.50	m		

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where C	=		0.85			
I	**=**		3.91667E-05	mm/s	141	100yr/10min mm/hr)
A	**=**		3000	m2		
Therefor **Q**	**=**		**0.10**	**m3/sec**		

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n	**=**	0.018	Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.15	1.49	0.143	0.01	0.095973154	1.164557	0.166532

Therefor **H**	**=**	**0.15**	**m**	Min 250mm
Therefore	=	**300**	mm	

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 2	Rev A
Job Title: Rangitoopuni Calc Title: SEDIMENT RETEENTION POND 1	Author: HN	Date: 1/04/2025	Checked: KH

Max Catchment Area	**10000**	m^2
Pond Volume 3% of Area	300	m^3
Dead Storage 30% of volume	90	m^3
Live Storage 70% of volume	210	m^3
Decant Dewatering (3l/s/ha)	3	l/s

Size Decant

Standard decent	4.5 l/s	=	200	holes
Therefore	3.00 l/s	=	133	holes
Use	**1**	**decants**		

Pond Dimensions

v = 300 m^3
d = 1.5 m
x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-266.25
x	=	5.86	width of pond base			
or	=	-10.11				

Check = 300 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-266.25
x	=	4.37	width of pond base			
or	=	-8.12				

Check = 300 m^3

Width = 5.86 m
Length = 17.57 m

Dead Storage Depth

Pond Dimensions
x = 5.86 m
v = 90.0 m^3
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	4.976850746	d^2+	10.28472	+d	-9

e	=	0.68		
f	=	8.47		
g	=	2.57		
h	=	-0.26		
d	**=**	**0.647**	**depth of dead storage**	

Check v = 90.00 m^3

Spillway Dimensions

Side Slope	horizontal	3	vertical	1
Gradient		**1**	**%**	
Base Width		2.00	m	

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	10000	m2		

Therefore **Q = 0.332916667 m3/sec**

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.15	2.948683	0.3675	0.01	0.124632	1.386161	0.5094141

Therefore **H = 0.15 m** Min 300mm

Therefore = **300** mm

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 3	Rev A
Job Title: Rangitoopuni Calc Title: SEDIMENT RETENTION POND 2	Author HN	Date 1/04/2025	Checked KH

Max Catchment Area	**15000**	**m^2**
Pond Volume 3% of Area	450	m^3
Dead Storage 30% of volume	135	m^3
Live Storage 70% of volume	315	m^3
Decant Dewatering (3l/s/ha)	4.5	l/s

Size Decant

Standard decent	4.5 l/s	=	200	holes
Therefore	4.50 l/s	=	200	holes

Use 1 decants

Pond Dimensions

v = 450 m^3

d = 1.5 m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-416.25
x	=	7.72	width of pond base			
or	=	-11.97				

Check = 450 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-416.25
x	=	5.81	width of pond base			
or	=	-9.56				

Check = 450 m^3

Width	**=**	**7.72**	**m**
Length	**=**	**23.17**	**m**

Dead Storage Depth

Pond Dimensions

x = 7.72 m

v = 135.0 m^3

d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=>	$v = 10d^3+8.5xd^2+3x^2d$	cubic equation to find "d"							
				a		b		c	
0	=		d^3+	6.565953358	d^2+	17.90107	+d	-13.5	
	e	=		1.18					
	f	=		15.86					
	g	=		3.17					
	h	=		-0.37					
	d	**=**		**0.607**	**depth of dead storage**				
Check	v	=	135.00		m^3				

Spillway Dimensions

Side Slope	horizontal	3	vertical	1	
Gradient		**1**	**%**		
Base Width		2.00	m		

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	15000	m2		
Therefore	**Q**	**=**	**0.499375**	**m3/sec**		

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.15	2.948683	0.3675	0.01	0.124632	1.386161	0.5094141

Therefore	**H**	**=**	**0.15**	**m**	Min 300mm
Therefore		=	**300**	mm	

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 4	Rev A
Job Title: Rangitoopuni Calc Title: SEDIMENT RETENTION POND 3	Author: HN	Date: 1/04/2025	Checked: KH

Max Catchment Area	**20000**	m^2
Pond Volume 3% of Area	600	m^3
Dead Storage 30% of volume	180	m^3
Live Storage 70% of volume	420	m^3
Decant Dewatering (3l/s/ha)	6	l/s

Size Decant

Standard decent	4.5	l/s	=	200	holes
Therefore	6.00	l/s	=	267	holes

Use 2 decants

Pond Dimensions

v = 600 m^3
d = 1.5 m
x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-566.25
x	=	9.29	width of pond base			
or	=	-13.54				

Check = 600 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-566.25
x	=	7.01	width of pond base			
or	=	-10.76				

Check = 600 m^3

Width = 9.29 m
Length = 27.88 m

Dead Storage Depth

Pond Dimensions
x = 9.29 m
v = 180.0 m^3
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=>	$v = 10d^3+8.5xd^2+3x^2d$	cubic equation to find "d"						
			a		b		c	
0	=	d^3+	7.898239806	d^2+	25.90264	+d	-18	
	e	=	1.70					
	f	=	24.85					
	g	=	3.68					
	h	=	-0.46					
	d	**=**	**0.583**	**depth of dead storage**				
Check	v	=	180.00	m^3				

Spillway Dimensions

Side Slope	horizontal	3	vertical	1	
Gradient		**1**	**%**		
Base Width		2.00	m		

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	20000	m2		
Therefore	**Q**	**=**	**0.665833333**	**m3/sec**		

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.18	3.13842	0.4572	0.01	0.145678	1.538122	0.7032296

Therefore	**H**	**=**	**0.18**	**m**	Min 300mm
Therefore		=	**300**	mm	

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 5	Rev A
Job Title Rangitoopuni Calc Title Sediment Retention Pond 4	Author HN	Date 1/04/2025	Checked KH

Max Catchment Area	**30000**	m^2
Pond Volume 3% of Area	900	m^3
Dead Storage 30% of volume	270	m^3
Live Storage 70% of volume	630	m^3
Decant Dewatering (3l/s/ha)	9	l/s

Size Decant

Standard decent	4.5 l/s	=	200	holes
Therefore	9.00 l/s	=	400	holes

Use 2 decants

Pond Dimensions

v = 900 m^3
d = 1.5 m
x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-866.25
x	=	11.91	width of pond base			
or	=	-16.16				

Check = 900 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-866.25
x	=	9.03	width of pond base			
or	=	-12.78				

Check = 900 m^3

Width	**=**	**11.91**	**m**
Length	**=**	**35.73**	**m**

Dead Storage Depth

Pond Dimensions

x = 11.91 m
v = 270.0 m^3
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=>	$v = 10d^3+8.5xd^2+3x^2d$	cubic equation to find "d"							
				a		b		c	
0	=		d^3+	10.12454164	d^2+	42.56319	+d	-27	
	e	=		2.80					
	f	=		46.88					
	g	=		4.55					
	h	=		-0.62					
	d	**=**		**0.557**	**depth of dead storage**				
Check	v	=	270.00		m^3				

Spillway Dimensions

Side Slope	horizontal	3	vertical	1	
Gradient		**1**	**%**		
Base Width		2.00	m		

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	30000	m2		
Therefore	**Q**	**=**	**0.99875**	**m3/sec**		

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n	=	0.018	Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.22	3.391402	0.5852	0.01	0.172554	1.721911	1.0076626

Therefore	**H**	**=**	**0.22**	**m**	Min 300mm
Therefore		=	**300**	mm	

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 6	Rev A
Job Title: Rangitoopuni Calc Title: Sediment Retention Pond 5	Author: KH	Date: 1/04/2025	Checked: KH

Max Catchment Area	**50000**	m^2
Pond Volume 3% of Area	1500	m^3
Dead Storage 30% of volume	450	m^3
Live Storage 70% of volume	1050	m^3
Decant Dewatering (3l/s/ha)	15	l/s

Size Decant

Standard decent	4.5	l/s	=	200	holes
Therefore	15.00	l/s	=	667	holes

Use 4 decants

Pond Dimensions

v = 1500 m^3

d = 1.5 m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-1466.25
x	=	16.05	width of pond base			
or	=	-20.30				

Check = 1500 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-1466.25
x	=	12.23	width of pond base			
or	=	-15.98				

Check = 1500 m^3

Width = 16.05 m

Length = 48.15 m

Dead Storage Depth

Pond calculations allow for the sides

Pond Dimensions

x = 16.05 m

v = 450.0 m^3

d = Dead storage depth

and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	13.6429287	d^2+	77.28561	+d	-45

e	=	5.08	
f	=	104.18	
g	=	5.93	
h	=	-0.86	
d	**=**	**0.531**	**depth of dead storage**

Check v = 450.00 m^3

Spillway Dimensions

Side Slope horizontal 3 vertical 1

Gradient **1 %**

Base Width 5.00 m

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	50000	m2		

Therefore **Q** **=** **1.664583333** **m3/sec**

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n **=** 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.2	6.264911	1.12	0.01	0.178773	1.763043	1.974608

Therefore **H** **=** **0.2** **m** Min 300mm

Therefore = **300** mm

HY-8 CULVERT RESULTS SUMMARY										
CULVERT No.	**TYPE**	**SIZE**	**CULVERT LENGTH (m)**	**Flow (m3/s)**	**VELOCITY (m/s)**	**RIP-RAP THICKNESS (m)**	**POOL LENGTH (m)**	**APRON LENGTH (m)**	**BASIN LENGTH(m)**	**BASIN WIDTH (m)**
1	BOX CULVERT	5m x 2m	13.57	15.67	3.65	0.30	15.00	5.00	20.00	18.30
2	BOX CULVERT	1.5m x 1.5m	12.43	1.56	3.46	0.45	4.50	1.50	6.00	5.50
3	BOX CULVERT	4m x 2m	14.84	9.33	3.17	0.45	12.00	4.00	16.00	14.67
4	BOX CULVERT	6m x 2m	14.16	16.69	4.15	0.45	18.00	6.00	24.00	22.00
5	BOX CULVERT	2m x 1m	15.82	1.68	2.65	0.15	6.00	2.00	8.00	7.33
6	BOX CULVERT	1.5m x 2m	14.99	7.52	3.66	0.45	12.32	6.16	18.49	13.82
7	PRIMARY-CIR-CULVERT	0.6mø	29.08	1.22	4.34	0.45	4.57	2.28	6.85	5.17
COUNTRYSIDE										
13-4	CIR-CULVERT	1.20mø	14.33	1.58	3.35	0.30	5.58	2.79	8.36	6.78
14-1	BOX CULVERT	1.5m x 1.5m	13.31	4.07	5.28	0.45	9.11	4.56	13.67	10.61
6-6	CIR-CULVERT	1.05mø	13.41	1.26	3.13	0.36	3.15	1.46	4.61	4.12
1-1	PRIMARY-CIR-CULVERT	1.20mø	15.09	3.41	3.89	0.36	3.60	1.20	4.80	4.40
1-1	SECONDARY-BOX CULVERT	4m x 1.5m	12.36	Specific energy dissipation arrangement to be confirmed for the secondary culvert						