

APPENDIX G
ATTENUATION PONDS CALCULATIONS



Project

ATTENUATION
PONDS

Job No.

Date

02-04-13

Page No.

Rev.

Member/Location

Engineer

CP

Checked

NORTHERN POND (16 1/5)

YEAR	MAX Q (1/s)	MAX Depth (mm)
2	6.8	138
10	9.4	189
30	11.4	233
100	13.8	295
100+30%	16	382

SOUTHERN POND (12 1/5)

YEAR	MAX Q (1/s)	MAX Depth (mm)
2	8.5	189
10	9.1	262
30	9.4	327
100	10.6	414
100+30%	12	533



Project

ATTENUATION
PONDS

Job No.

Date

02 04 13

Page No.

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Engineer

CP

Checked

NORTHERN POND

IMP A = 1.81 ha

MAX Q = 16 l/s

MAX V REQUIRED = 1112 m³

MAX WL = 0.382 m

VOLUME

BASE	-	0 m ³
+ 100 mm	-	277 m ³
200 mm	-	556 m ³
300 mm	-	856 m ³
400 mm	-	1169 m ³
500 mm	-	1495 m ³
600 mm	-	1838 m ³
700 mm	-	2194 m ³

SOUTHERN POND

IMP A = 2.64 ha

MAX Q = 12 l/s

MAX V REQUIRED = 1916 m³

MAX WL = 0.533 m

VOLUME

BASE	-	0 m ³
+ 100 mm	-	307 m ³
200 mm	-	639 m ³
300 mm	-	994 m ³
400 mm	-	1374 m ³
500 mm	-	1778 m ³
600 mm	-	2207 m ³
700 mm	-	2661 m ³

Michael A Jennings Associates				Page 1	
58-62 Ock Street Abingdon Oxon OX14 5BZ		Northern Attenuation Pond 1:2 year Max Discharge =16 l/s			
Date 19.03.13 File Northern Attenuation Pond - ...		Designed by C.Pendle Checked by			
Micro Drainage		Source Control 2013.1			
Summary of Results for 2 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.346	0.046	2.0	124.3	O K
30 min Summer	99.361	0.061	2.7	163.3	O K
60 min Summer	99.376	0.076	3.5	205.5	O K
120 min Summer	99.392	0.092	4.4	249.8	O K
180 min Summer	99.401	0.101	4.9	275.2	O K
240 min Summer	99.407	0.107	5.2	291.9	O K
360 min Summer	99.414	0.114	5.5	310.1	O K
480 min Summer	99.417	0.117	5.7	320.1	O K
600 min Summer	99.420	0.120	5.9	327.9	O K
720 min Summer	99.422	0.122	6.0	333.9	O K
960 min Summer	99.425	0.125	6.1	342.2	O K
1440 min Summer	99.428	0.128	6.3	348.6	O K
2160 min Summer	99.427	0.127	6.2	346.1	O K
2880 min Summer	99.424	0.124	6.1	338.0	O K
4320 min Summer	99.417	0.117	5.7	317.6	O K
5760 min Summer	99.409	0.109	5.3	297.9	O K
7200 min Summer	99.403	0.103	5.0	280.3	O K
8640 min Summer	99.398	0.098	4.7	264.6	O K
10080 min Summer	99.393	0.093	4.4	250.9	O K
15 min Winter	99.352	0.052	2.2	139.2	O K
30 min Winter	99.368	0.068	3.1	182.9	O K
60 min Winter	99.385	0.085	4.0	230.3	O K
120 min Winter	99.403	0.103	5.0	280.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	37.154	0.0	87.9	30	
30 min Summer	24.581	0.0	119.1	44	
60 min Summer	15.691	0.0	192.3	72	
120 min Summer	9.821	0.0	242.3	130	
180 min Summer	7.430	0.0	275.6	186	
240 min Summer	6.089	0.0	301.4	244	
360 min Summer	4.578	0.0	339.9	360	
480 min Summer	3.735	0.0	369.1	414	
600 min Summer	3.190	0.0	393.0	474	
720 min Summer	2.803	0.0	413.0	534	
960 min Summer	2.286	0.0	445.4	666	
1440 min Summer	1.716	0.0	489.5	940	
2160 min Summer	1.287	0.0	615.3	1348	
2880 min Summer	1.049	0.0	665.2	1744	
4320 min Summer	0.787	0.0	731.9	2516	
5760 min Summer	0.642	0.0	833.6	3288	
7200 min Summer	0.548	0.0	888.0	4040	
8640 min Summer	0.481	0.0	931.5	4760	
10080 min Summer	0.431	0.0	964.1	5544	
15 min Winter	37.154	0.0	99.5	30	
30 min Winter	24.581	0.0	134.6	43	
60 min Winter	15.691	0.0	216.3	72	
120 min Winter	9.821	0.0	272.5	128	
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58-62 Ock Street Abingdon Oxon OX14 5BZ	Northern Attenuation Pond 1:2 year Max Discharge =16 l/s				
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Micro Drainage		Source Control 2013.1			
Summary of Results for 2 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	99.413	0.113	5.5	309.0	O K
240 min Winter	99.420	0.120	5.9	328.1	O K
360 min Winter	99.428	0.128	6.3	349.5	O K
480 min Winter	99.431	0.131	6.5	359.8	O K
600 min Winter	99.434	0.134	6.6	366.9	O K
720 min Winter	99.436	0.136	6.7	372.7	O K
960 min Winter	99.438	0.138	6.8	378.7	O K
1440 min Winter	99.438	0.138	6.8	378.5	O K
2160 min Winter	99.434	0.134	6.6	365.9	O K
2880 min Winter	99.428	0.128	6.3	349.1	O K
4320 min Winter	99.416	0.116	5.6	316.0	O K
5760 min Winter	99.406	0.106	5.1	287.7	O K
7200 min Winter	99.397	0.097	4.6	264.4	O K
8640 min Winter	99.390	0.090	4.3	244.6	O K
10080 min Winter	99.384	0.084	3.9	228.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
180 min Winter	7.430	0.0	309.9	184	
240 min Winter	6.089	0.0	338.9	240	
360 min Winter	4.578	0.0	382.1	350	
480 min Winter	3.735	0.0	414.9	452	
600 min Winter	3.190	0.0	441.7	484	
720 min Winter	2.803	0.0	464.2	558	
960 min Winter	2.286	0.0	500.6	712	
1440 min Winter	1.716	0.0	550.3	1010	
2160 min Winter	1.287	0.0	690.0	1440	
2880 min Winter	1.049	0.0	746.0	1852	
4320 min Winter	0.787	0.0	821.3	2648	
5760 min Winter	0.642	0.0	933.9	3416	
7200 min Winter	0.548	0.0	995.0	4184	
8640 min Winter	0.481	0.0	1044.0	4936	
10080 min Winter	0.431	0.0	1081.5	5664	
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.400</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.810 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.500</td> <td>4 8</td> <td>0.500</td> <td>8 12</td> <td>0.500</td> <td>12 16</td> <td>0.310</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	2	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.400	Shortest Storm (mins)	15	Ratio R	0.350	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	0 4	0.500	4 8	0.500	8 12	0.500	12 16	0.310
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Micro Drainage	Source Control 2013.1	

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.300

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2646.0	0.700	3632.0	1.400	0.0	2.100	0.0
0.100	2784.0	0.701	0.0	1.500	0.0	2.200	0.0
0.200	2923.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	3063.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	3204.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	3346.0	1.200	0.0	1.900	0.0		
0.600	3488.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Outflow Control

Design Head (m) 0.380 Hydro-Brake® Type Md8 Invert Level (m) 99.300
Design Flow (l/s) 16.0 Diameter (mm) 200

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8	1.200	27.0	3.000	42.4	7.000	64.8
0.200	9.9	1.400	29.0	3.500	45.8	7.500	67.1
0.300	14.0	1.600	31.0	4.000	49.0	8.000	69.3
0.400	16.4	1.800	32.9	4.500	52.0	8.500	71.4
0.500	18.1	2.000	34.6	5.000	54.8	9.000	73.5
0.600	19.7	2.200	36.3	5.500	57.4	9.500	75.5
0.800	22.3	2.400	37.9	6.000	60.0		
1.000	24.7	2.600	39.5	6.500	62.4		

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K</td></tr><tr><td>600 min Summer</td><td>99.467</td><td>0.167</td><td>8.3</td><td>460.1</td><td>O K</td></tr><tr><td>720 min Summer</td><td>99.469</td><td>0.169</td><td>8.4</td><td>466.4</td><td>O K</td></tr><tr><td>960 min Summer</td><td>99.471</td><td>0.171</td><td>8.5</td><td>474.0</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>99.472</td><td>0.172</td><td>8.6</td><td>476.9</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>99.469</td><td>0.169</td><td>8.4</td><td>467.2</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>99.464</td><td>0.164</td><td>8.2</td><td>451.4</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>99.452</td><td>0.152</td><td>7.5</td><td>417.5</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>99.441</td><td>0.141</td><td>7.0</td><td>386.7</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>99.432</td><td>0.132</td><td>6.5</td><td>360.4</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>99.424</td><td>0.124</td><td>6.1</td><td>338.0</td><td>O 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Summer</td><td>14.404</td><td>0.0</td><td>360.0</td><td>130</td></tr><tr><td>180 min Summer</td><td>10.791</td><td>0.0</td><td>405.1</td><td>186</td></tr><tr><td>240 min Summer</td><td>8.764</td><td>0.0</td><td>438.8</td><td>244</td></tr><tr><td>360 min Summer</td><td>6.528</td><td>0.0</td><td>489.8</td><td>360</td></tr><tr><td>480 min Summer</td><td>5.292</td><td>0.0</td><td>528.3</td><td>414</td></tr><tr><td>600 min Summer</td><td>4.495</td><td>0.0</td><td>559.3</td><td>474</td></tr><tr><td>720 min Summer</td><td>3.932</td><td>0.0</td><td>585.1</td><td>534</td></tr><tr><td>960 min Summer</td><td>3.183</td><td>0.0</td><td>626.1</td><td>668</td></tr><tr><td>1440 min Summer</td><td>2.361</td><td>0.0</td><td>680.1</td><td>940</td></tr><tr><td>2160 min Summer</td><td>1.750</td><td>0.0</td><td>839.4</td><td>1348</td></tr><tr><td>2880 min Summer</td><td>1.414</td><td>0.0</td><td>899.9</td><td>1744</td></tr><tr><td>4320 min Summer</td><td>1.047</td><td>0.0</td><td>978.4</td><td>2520</td></tr><tr><td>5760 min Summer</td><td>0.846</td><td>0.0</td><td>1098.5</td><td>3288</td></tr><tr><td>7200 min Summer</td><td>0.716</td><td>0.0</td><td>1161.2</td><td>4040</td></tr><tr><td>8640 min Summer</td><td>0.626</td><td>0.0</td><td>1212.6</td><td>4760</td></tr><tr><td>10080 min Summer</td><td>0.558</td><td>0.0</td><td>1250.6</td><td>5544</td></tr><tr><td>15 min Winter</td><td>55.614</td><td>0.0</td><td>154.2</td><td>30</td></tr><tr><td>30 min Winter</td><td>36.694</td><td>0.0</td><td>207.3</td><td>43</td></tr><tr><td>60 min Winter</td><td>23.276</td><td>0.0</td><td>325.3</td><td>72</td></tr><tr><td>120 min Winter</td><td>14.404</td><td>0.0</td><td>404.5</td><td>126</td></tr></tbody></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	99.369	0.069	3.1	185.9	O K	30 min Summer	99.390	0.090	4.2	243.5	O K	60 min Summer	99.412	0.112	5.4	304.3	O K	120 min Summer	99.434	0.134	6.6	365.5	O K	180 min Summer	99.445	0.145	7.2	398.5	O K	240 min Summer	99.452	0.152	7.6	418.7	O K	360 min Summer	99.460	0.160	7.9	440.5	O K	480 min Summer	99.464	0.164	8.2	451.7	O K	600 min Summer	99.467	0.167	8.3	460.1	O K	720 min Summer	99.469	0.169	8.4	466.4	O K	960 min Summer	99.471	0.171	8.5	474.0	O K	1440 min Summer	99.472	0.172	8.6	476.9	O K	2160 min Summer	99.469	0.169	8.4	467.2	O K	2880 min Summer	99.464	0.164	8.2	451.4	O K	4320 min Summer	99.452	0.152	7.5	417.5	O K	5760 min Summer	99.441	0.141	7.0	386.7	O K	7200 min Summer	99.432	0.132	6.5	360.4	O K	8640 min Summer	99.424	0.124	6.1	338.0	O K	10080 min Summer	99.417	0.117	5.7	318.8	O K	15 min Winter	99.377	0.077	3.6	208.2	O K	30 min Winter	99.400	0.100	4.8	272.8	O K	60 min Winter	99.425	0.125	6.1	341.0	O K	120 min Winter	99.449	0.149	7.4	410.1	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	55.614	0.0	136.4	30	30 min Summer	36.694	0.0	183.6	44	60 min Summer	23.276	0.0	289.4	72	120 min Summer	14.404	0.0	360.0	130	180 min Summer	10.791	0.0	405.1	186	240 min Summer	8.764	0.0	438.8	244	360 min Summer	6.528	0.0	489.8	360	480 min Summer	5.292	0.0	528.3	414	600 min Summer	4.495	0.0	559.3	474	720 min Summer	3.932	0.0	585.1	534	960 min Summer	3.183	0.0	626.1	668	1440 min Summer	2.361	0.0	680.1	940	2160 min Summer	1.750	0.0	839.4	1348	2880 min Summer	1.414	0.0	899.9	1744	4320 min Summer	1.047	0.0	978.4	2520	5760 min Summer	0.846	0.0	1098.5	3288	7200 min Summer	0.716	0.0	1161.2	4040	8640 min Summer	0.626	0.0	1212.6	4760	10080 min Summer	0.558	0.0	1250.6	5544	15 min Winter	55.614	0.0	154.2	30	30 min Winter	36.694	0.0	207.3	43	60 min Winter	23.276	0.0	325.3	72	120 min Winter	14.404	0.0	404.5	126
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																																																																									
15 min Summer	99.369	0.069	3.1	185.9	O K																																																																																																																																																																																																																																																																									
30 min Summer	99.390	0.090	4.2	243.5	O K																																																																																																																																																																																																																																																																									
60 min Summer	99.412	0.112	5.4	304.3	O K																																																																																																																																																																																																																																																																									
120 min Summer	99.434	0.134	6.6	365.5	O K																																																																																																																																																																																																																																																																									
180 min Summer	99.445	0.145	7.2	398.5	O K																																																																																																																																																																																																																																																																									
240 min Summer	99.452	0.152	7.6	418.7	O K																																																																																																																																																																																																																																																																									
360 min Summer	99.460	0.160	7.9	440.5	O K																																																																																																																																																																																																																																																																									
480 min Summer	99.464	0.164	8.2	451.7	O K																																																																																																																																																																																																																																																																									
600 min Summer	99.467	0.167	8.3	460.1	O K																																																																																																																																																																																																																																																																									
720 min Summer	99.469	0.169	8.4	466.4	O K																																																																																																																																																																																																																																																																									
960 min Summer	99.471	0.171	8.5	474.0	O K																																																																																																																																																																																																																																																																									
1440 min Summer	99.472	0.172	8.6	476.9	O K																																																																																																																																																																																																																																																																									
2160 min Summer	99.469	0.169	8.4	467.2	O K																																																																																																																																																																																																																																																																									
2880 min Summer	99.464	0.164	8.2	451.4	O K																																																																																																																																																																																																																																																																									
4320 min Summer	99.452	0.152	7.5	417.5	O K																																																																																																																																																																																																																																																																									
5760 min Summer	99.441	0.141	7.0	386.7	O K																																																																																																																																																																																																																																																																									
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60 min Summer	23.276	0.0	289.4	72																																																																																																																																																																																																																																																																										
120 min Summer	14.404	0.0	360.0	130																																																																																																																																																																																																																																																																										
180 min Summer	10.791	0.0	405.1	186																																																																																																																																																																																																																																																																										
240 min Summer	8.764	0.0	438.8	244																																																																																																																																																																																																																																																																										
360 min Summer	6.528	0.0	489.8	360																																																																																																																																																																																																																																																																										
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600 min Summer	4.495	0.0	559.3	474																																																																																																																																																																																																																																																																										
720 min Summer	3.932	0.0	585.1	534																																																																																																																																																																																																																																																																										
960 min Summer	3.183	0.0	626.1	668																																																																																																																																																																																																																																																																										
1440 min Summer	2.361	0.0	680.1	940																																																																																																																																																																																																																																																																										
2160 min Summer	1.750	0.0	839.4	1348																																																																																																																																																																																																																																																																										
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7200 min Summer	0.716	0.0	1161.2	4040																																																																																																																																																																																																																																																																										
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Michael A Jennings Associates			Page 2		
58-62 Ock Street Abingdon Oxon OX14 5BZ	Northern Attenuation Pond 1:10 year Max Discharge =16 l/s				
Date 19.03.13 File Northern Attenuation Pond - ...	Designed by C.Pendle Checked by				
Micro Drainage	Source Control 2013.1				
Summary of Results for 10 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	99.462	0.162	8.1	447.7	O K
240 min Winter	99.470	0.170	8.5	471.0	O K
360 min Winter	99.479	0.179	8.9	497.0	O K
480 min Winter	99.483	0.183	9.1	508.5	O K
600 min Winter	99.486	0.186	9.2	515.4	O K
720 min Winter	99.488	0.188	9.3	521.1	O K
960 min Winter	99.489	0.189	9.4	525.2	O K
1440 min Winter	99.487	0.187	9.3	518.3	O K
2160 min Winter	99.478	0.178	8.9	494.2	O K
2880 min Winter	99.469	0.169	8.4	466.4	O K
4320 min Winter	99.451	0.151	7.5	415.0	O K
5760 min Winter	99.436	0.136	6.7	372.9	O K
7200 min Winter	99.424	0.124	6.1	339.0	O K
8640 min Winter	99.414	0.114	5.6	311.4	O K
10080 min Winter	99.406	0.106	5.1	288.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
180 min Winter	10.791	0.0	455.1	184	
240 min Winter	8.764	0.0	493.0	240	
360 min Winter	6.528	0.0	550.1	350	
480 min Winter	5.292	0.0	593.3	452	
600 min Winter	4.495	0.0	628.0	486	
720 min Winter	3.932	0.0	657.0	560	
960 min Winter	3.183	0.0	703.0	712	
1440 min Winter	2.361	0.0	763.5	1012	
2160 min Winter	1.750	0.0	941.0	1444	
2880 min Winter	1.414	0.0	1008.9	1856	
4320 min Winter	1.047	0.0	1097.4	2648	
5760 min Winter	0.846	0.0	1230.6	3416	
7200 min Winter	0.716	0.0	1301.0	4184	
8640 min Winter	0.626	0.0	1359.0	4936	
10080 min Winter	0.558	0.0	1402.8	5656	
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58-62 Ock Street Abingdon Oxon OX14 5BZ	Northern Attenuation Pond 1:10 year Max Discharge =16 l/s	
Date 19.03.13 File Northern Attenuation Pond - ...	Designed by C.Pendle Checked by	
Micro Drainage Source Control 2013.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	10	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.810

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)
0 4	0.500	4 8	0.500	8 12	0.500	12 16	0.310

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58-62 Ock Street Abingdon Oxon OX14 5BZ	Northern Attenuation Pond 1:10 year Max Discharge =16 l/s	
Date 19.03.13 File Northern Attenuation Pond - ...	Designed by C.Pendle Checked by	
Micro Drainage	Source Control 2013.1	

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.300

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2646.0	0.700	3632.0	1.400	0.0	2.100	0.0
0.100	2784.0	0.701	0.0	1.500	0.0	2.200	0.0
0.200	2923.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	3063.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	3204.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	3346.0	1.200	0.0	1.900	0.0		
0.600	3488.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Outflow Control

Design Head (m) 0.380 Hydro-Brake® Type Md8 Invert Level (m) 99.300
Design Flow (l/s) 16.0 Diameter (mm) 200

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8	1.200	27.0	3.000	42.4	7.000	64.8
0.200	9.9	1.400	29.0	3.500	45.8	7.500	67.1
0.300	14.0	1.600	31.0	4.000	49.0	8.000	69.3
0.400	16.4	1.800	32.9	4.500	52.0	8.500	71.4
0.500	18.1	2.000	34.6	5.000	54.8	9.000	73.5
0.600	19.7	2.200	36.3	5.500	57.4	9.500	75.5
0.800	22.3	2.400	37.9	6.000	60.0		
1.000	24.7	2.600	39.5	6.500	62.4		

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58-62 Ock Street Abingdon Oxon OX14 5BZ		Northern Attenuation Pond 1:30year Max Discharge =16 l/s																																																																																																																																																																																																																																																																												
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Summary of Results for 30 year Return Period																																																																																																																																																																																																																																																																														
<table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>99.387</td><td>0.087</td><td>4.1</td><td>235.1</td><td>O K</td></tr><tr><td>30 min Summer</td><td>99.414</td><td>0.114</td><td>5.6</td><td>310.6</td><td>O K</td></tr><tr><td>60 min Summer</td><td>99.442</td><td>0.142</td><td>7.0</td><td>390.2</td><td>O K</td></tr><tr><td>120 min Summer</td><td>99.470</td><td>0.170</td><td>8.5</td><td>468.7</td><td>O K</td></tr><tr><td>180 min Summer</td><td>99.484</td><td>0.184</td><td>9.1</td><td>509.3</td><td>O K</td></tr><tr><td>240 min Summer</td><td>99.492</td><td>0.192</td><td>9.5</td><td>532.9</td><td>O K</td></tr><tr><td>360 min Summer</td><td>99.500</td><td>0.200</td><td>9.9</td><td>557.6</td><td>O K</td></tr><tr><td>480 min Summer</td><td>99.504</td><td>0.204</td><td>10.1</td><td>569.3</td><td>O K</td></tr><tr><td>600 min Summer</td><td>99.507</td><td>0.207</td><td>10.3</td><td>577.9</td><td>O K</td></tr><tr><td>720 min Summer</td><td>99.509</td><td>0.209</td><td>10.4</td><td>583.8</td><td>O K</td></tr><tr><td>960 min Summer</td><td>99.511</td><td>0.211</td><td>10.5</td><td>590.3</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>99.511</td><td>0.211</td><td>10.5</td><td>589.2</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>99.505</td><td>0.205</td><td>10.2</td><td>572.1</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>99.497</td><td>0.197</td><td>9.8</td><td>549.0</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>99.481</td><td>0.181</td><td>9.0</td><td>501.9</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>99.467</td><td>0.167</td><td>8.3</td><td>460.9</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>99.455</td><td>0.155</td><td>7.7</td><td>426.6</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>99.445</td><td>0.145</td><td>7.2</td><td>397.9</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>99.436</td><td>0.136</td><td>6.7</td><td>373.5</td><td>O K</td></tr><tr><td>15 min Winter</td><td>99.397</td><td>0.097</td><td>4.6</td><td>263.3</td><td>O K</td></tr><tr><td>30 min Winter</td><td>99.427</td><td>0.127</td><td>6.2</td><td>348.0</td><td>O K</td></tr><tr><td>60 min Winter</td><td>99.459</td><td>0.159</td><td>7.9</td><td>437.4</td><td>O K</td></tr><tr><td>120 min Winter</td><td>99.489</td><td>0.189</td><td>9.4</td><td>526.1</td><td>O K</td></tr><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>70.373</td><td>0.0</td><td>175.9</td><td>30</td></tr><tr><td>30 min Summer</td><td>46.843</td><td>0.0</td><td>238.3</td><td>44</td></tr><tr><td>60 min Summer</td><td>29.868</td><td>0.0</td><td>374.3</td><td>72</td></tr><tr><td>120 min Summer</td><td>18.484</td><td>0.0</td><td>465.2</td><td>130</td></tr><tr><td>180 min Summer</td><td>13.799</td><td>0.0</td><td>521.4</td><td>186</td></tr><tr><td>240 min Summer</td><td>11.157</td><td>0.0</td><td>562.1</td><td>244</td></tr><tr><td>360 min Summer</td><td>8.261</td><td>0.0</td><td>623.3</td><td>360</td></tr><tr><td>480 min Summer</td><td>6.668</td><td>0.0</td><td>669.2</td><td>416</td></tr><tr><td>600 min Summer</td><td>5.644</td><td>0.0</td><td>705.8</td><td>476</td></tr><tr><td>720 min Summer</td><td>4.923</td><td>0.0</td><td>736.0</td><td>538</td></tr><tr><td>960 min Summer</td><td>3.965</td><td>0.0</td><td>783.5</td><td>670</td></tr><tr><td>1440 min Summer</td><td>2.919</td><td>0.0</td><td>844.4</td><td>944</td></tr><tr><td>2160 min Summer</td><td>2.146</td><td>0.0</td><td>1031.0</td><td>1352</td></tr><tr><td>2880 min Summer</td><td>1.724</td><td>0.0</td><td>1098.7</td><td>1756</td></tr><tr><td>4320 min Summer</td><td>1.264</td><td>0.0</td><td>1184.3</td><td>2520</td></tr><tr><td>5760 min Summer</td><td>1.014</td><td>0.0</td><td>1317.3</td><td>3288</td></tr><tr><td>7200 min Summer</td><td>0.854</td><td>0.0</td><td>1384.9</td><td>4040</td></tr><tr><td>8640 min Summer</td><td>0.743</td><td>0.0</td><td>1440.5</td><td>4760</td></tr><tr><td>10080 min Summer</td><td>0.660</td><td>0.0</td><td>1480.9</td><td>5544</td></tr><tr><td>15 min Winter</td><td>70.373</td><td>0.0</td><td>198.6</td><td>30</td></tr><tr><td>30 min Winter</td><td>46.843</td><td>0.0</td><td>268.8</td><td>43</td></tr><tr><td>60 min Winter</td><td>29.868</td><td>0.0</td><td>420.6</td><td>70</td></tr><tr><td>120 min Winter</td><td>18.484</td><td>0.0</td><td>522.4</td><td>128</td></tr></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	99.387	0.087	4.1	235.1	O K	30 min Summer	99.414	0.114	5.6	310.6	O K	60 min Summer	99.442	0.142	7.0	390.2	O K	120 min Summer	99.470	0.170	8.5	468.7	O K	180 min Summer	99.484	0.184	9.1	509.3	O K	240 min Summer	99.492	0.192	9.5	532.9	O K	360 min Summer	99.500	0.200	9.9	557.6	O K	480 min Summer	99.504	0.204	10.1	569.3	O K	600 min Summer	99.507	0.207	10.3	577.9	O K	720 min Summer	99.509	0.209	10.4	583.8	O K	960 min Summer	99.511	0.211	10.5	590.3	O K	1440 min Summer	99.511	0.211	10.5	589.2	O K	2160 min Summer	99.505	0.205	10.2	572.1	O K	2880 min Summer	99.497	0.197	9.8	549.0	O K	4320 min Summer	99.481	0.181	9.0	501.9	O K	5760 min Summer	99.467	0.167	8.3	460.9	O K	7200 min Summer	99.455	0.155	7.7	426.6	O K	8640 min Summer	99.445	0.145	7.2	397.9	O K	10080 min Summer	99.436	0.136	6.7	373.5	O K	15 min Winter	99.397	0.097	4.6	263.3	O K	30 min Winter	99.427	0.127	6.2	348.0	O K	60 min Winter	99.459	0.159	7.9	437.4	O K	120 min Winter	99.489	0.189	9.4	526.1	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	70.373	0.0	175.9	30	30 min Summer	46.843	0.0	238.3	44	60 min Summer	29.868	0.0	374.3	72	120 min Summer	18.484	0.0	465.2	130	180 min Summer	13.799	0.0	521.4	186	240 min Summer	11.157	0.0	562.1	244	360 min Summer	8.261	0.0	623.3	360	480 min Summer	6.668	0.0	669.2	416	600 min Summer	5.644	0.0	705.8	476	720 min Summer	4.923	0.0	736.0	538	960 min Summer	3.965	0.0	783.5	670	1440 min Summer	2.919	0.0	844.4	944	2160 min Summer	2.146	0.0	1031.0	1352	2880 min Summer	1.724	0.0	1098.7	1756	4320 min Summer	1.264	0.0	1184.3	2520	5760 min Summer	1.014	0.0	1317.3	3288	7200 min Summer	0.854	0.0	1384.9	4040	8640 min Summer	0.743	0.0	1440.5	4760	10080 min Summer	0.660	0.0	1480.9	5544	15 min Winter	70.373	0.0	198.6	30	30 min Winter	46.843	0.0	268.8	43	60 min Winter	29.868	0.0	420.6	70	120 min Winter	18.484	0.0	522.4	128
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																																																																									
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960 min Summer	3.965	0.0	783.5	670																																																																																																																																																																																																																																																																										
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Michael A Jennings Associates			Page 2		
58-62 Ock Street Abingdon Oxon OX14 5BZ	Northern Attenuation Pond 1:30year Max Discharge =16 l/s				
Date 19.03.13 File Northern Attenuation Pond - ...	Designed by C.Pendle Checked by				
Micro Drainage	Source Control 2013.1				
Summary of Results for 30 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	99.505	0.205	10.2	572.5	O K
240 min Winter	99.515	0.215	10.6	599.9	O K
360 min Winter	99.525	0.225	11.1	629.8	O K
480 min Winter	99.529	0.229	11.3	642.2	O K
600 min Winter	99.531	0.231	11.3	648.1	O K
720 min Winter	99.533	0.233	11.4	653.2	O K
960 min Winter	99.533	0.233	11.4	655.4	O K
1440 min Winter	99.529	0.229	11.2	641.9	O K
2160 min Winter	99.517	0.217	10.7	606.4	O K
2880 min Winter	99.504	0.204	10.1	568.0	O K
4320 min Winter	99.480	0.180	9.0	499.3	O K
5760 min Winter	99.461	0.161	8.0	444.2	O K
7200 min Winter	99.446	0.146	7.2	400.7	O K
8640 min Winter	99.434	0.134	6.6	365.9	O K
10080 min Winter	99.424	0.124	6.1	337.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
180 min Winter	13.799	0.0	585.5	184	
240 min Winter	11.157	0.0	631.0	240	
360 min Winter	8.261	0.0	699.7	350	
480 min Winter	6.668	0.0	751.1	454	
600 min Winter	5.644	0.0	792.0	490	
720 min Winter	4.923	0.0	825.9	562	
960 min Winter	3.965	0.0	879.0	716	
1440 min Winter	2.919	0.0	947.0	1016	
2160 min Winter	2.146	0.0	1155.6	1452	
2880 min Winter	1.724	0.0	1231.7	1860	
4320 min Winter	1.264	0.0	1328.1	2652	
5760 min Winter	1.014	0.0	1475.7	3456	
7200 min Winter	0.854	0.0	1551.6	4184	
8640 min Winter	0.743	0.0	1614.4	4936	
10080 min Winter	0.660	0.0	1661.1	5656	
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58-62 Ock Street Abingdon Oxon OX14 5BZ	Northern Attenuation Pond 1:30year Max Discharge =16 l/s	
Date 19.03.13 File Northern Attenuation Pond - ...	Designed by C.Pendle Checked by	
Micro Drainage Source Control 2013.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.810

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:	From:	To:
0	4	4	8	8	12	12	16
	0.500		0.500		0.500		0.310

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58-62 Ock Street Abingdon Oxon OX14 5BZ	Northern Attenuation Pond 1:30year Max Discharge =16 l/s	
Date 19.03.13 File Northern Attenuation Pond - ...	Designed by C.Pendle Checked by	
Micro Drainage	Source Control 2013.1	

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.300

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2646.0	0.700	3632.0	1.400	0.0	2.100	0.0
0.100	2784.0	0.701	0.0	1.500	0.0	2.200	0.0
0.200	2923.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	3063.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	3204.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	3346.0	1.200	0.0	1.900	0.0		
0.600	3488.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Outflow Control

Design Head (m) 0.380 Hydro-Brake® Type Md8 Invert Level (m) 99.300
Design Flow (l/s) 16.0 Diameter (mm) 200

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.8	1.200	27.0	3.000	42.4	7.000	64.8
0.200	9.9	1.400	29.0	3.500	45.8	7.500	67.1
0.300	14.0	1.600	31.0	4.000	49.0	8.000	69.3
0.400	16.4	1.800	32.9	4.500	52.0	8.500	71.4
0.500	18.1	2.000	34.6	5.000	54.8	9.000	73.5
0.600	19.7	2.200	36.3	5.500	57.4	9.500	75.5
0.800	22.3	2.400	37.9	6.000	60.0		
1.000	24.7	2.600	39.5	6.500	62.4		

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58-62 Ock Street Abingdon Oxon OX14 5BZ		Northern Attenuation Pond 1:100 year Max Discharge =16l/s																																																																																																																																																																																																																																																																												
Date 19.03.13 File NORTHERN ATTENUATION PO...		Designed by C.Pendle Checked by																																																																																																																																																																																																																																																																												
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Summary of Results for 100 year Return Period <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>99.412</td><td>0.112</td><td>5.4</td><td>304.2</td><td>O K</td></tr><tr><td>30 min Summer</td><td>99.448</td><td>0.148</td><td>7.3</td><td>405.7</td><td>O K</td></tr><tr><td>60 min Summer</td><td>99.485</td><td>0.185</td><td>9.2</td><td>512.7</td><td>O K</td></tr><tr><td>120 min Summer</td><td>99.520</td><td>0.220</td><td>10.9</td><td>616.2</td><td>O K</td></tr><tr><td>180 min Summer</td><td>99.538</td><td>0.238</td><td>11.6</td><td>667.7</td><td>O K</td></tr><tr><td>240 min Summer</td><td>99.547</td><td>0.247</td><td>12.0</td><td>695.8</td><td>O K</td></tr><tr><td>360 min Summer</td><td>99.557</td><td>0.257</td><td>12.4</td><td>725.0</td><td>O K</td></tr><tr><td>480 min Summer</td><td>99.561</td><td>0.261</td><td>12.6</td><td>736.7</td><td>O 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Summer	99.448	0.148	7.3	405.7	O K	60 min Summer	99.485	0.185	9.2	512.7	O K	120 min Summer	99.520	0.220	10.9	616.2	O K	180 min Summer	99.538	0.238	11.6	667.7	O K	240 min Summer	99.547	0.247	12.0	695.8	O K	360 min Summer	99.557	0.257	12.4	725.0	O K	480 min Summer	99.561	0.261	12.6	736.7	O K	600 min Summer	99.563	0.263	12.7	744.7	O K	720 min Summer	99.565	0.265	12.7	749.8	O K	960 min Summer	99.566	0.266	12.8	753.9	O K	1440 min Summer	99.564	0.264	12.7	746.3	O K	2160 min Summer	99.554	0.254	12.3	717.9	O K	2880 min Summer	99.543	0.243	11.8	683.7	O K	4320 min Summer	99.521	0.221	10.9	617.4	O K	5760 min Summer	99.502	0.202	10.0	561.3	O K	7200 min Summer	99.486	0.186	9.2	515.2	O K	8640 min Summer	99.473	0.173	8.6	477.6	O K	10080 min Summer	99.462	0.162	8.0	446.0	O K	15 min Winter	99.425	0.125	6.1	340.7	O K	30 min Winter	99.465	0.165	8.2	454.6	O K	60 min Winter	99.506	0.206	10.2	574.8	O K	120 min Winter	99.546	0.246	12.0	692.0	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume 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Michael A Jennings Associates			Page 2		
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<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	99.565	0.265	12.7	751.2	O K
240 min Winter	99.576	0.276	13.1	784.1	O K
360 min Winter	99.588	0.288	13.6	820.1	O K
480 min Winter	99.593	0.293	13.7	834.1	O K
600 min Winter	99.594	0.294	13.7	837.3	O K
720 min Winter	99.595	0.295	13.8	841.3	O K
960 min Winter	99.595	0.295	13.8	840.1	O K
1440 min Winter	99.587	0.287	13.5	816.8	O K
2160 min Winter	99.570	0.270	12.9	764.5	O K
2880 min Winter	99.552	0.252	12.2	710.3	O K
4320 min Winter	99.520	0.220	10.9	615.6	O K
5760 min Winter	99.495	0.195	9.7	541.5	O K
7200 min Winter	99.475	0.175	8.7	483.9	O K
8640 min Winter	99.459	0.159	7.9	438.7	O K
10080 min Winter	99.446	0.146	7.2	402.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
180 min Winter	18.068	0.0	770.3	184	
240 min Winter	14.537	0.0	825.7	240	
360 min Winter	10.694	0.0	909.0	352	
480 min Winter	8.592	0.0	970.6	458	
600 min Winter	7.244	0.0	1019.1	506	
720 min Winter	6.298	0.0	1058.8	570	
960 min Winter	5.045	0.0	1119.9	724	
1440 min Winter	3.684	0.0	1195.0	1024	
2160 min Winter	2.684	0.0	1446.9	1456	
2880 min Winter	2.141	0.0	1531.9	1876	
4320 min Winter	1.554	0.0	1636.0	2684	
5760 min Winter	1.237	0.0	1800.8	3456	
7200 min Winter	1.035	0.0	1882.0	4192	
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Michael A Jennings Associates		Page 4																																																																																																																																								
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Model Details Storage is Online Cover Level (m) 100.000 Tank or Pond Structure Invert Level (m) 99.300 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>2646.0</td><td>0.700</td><td>3632.0</td><td>1.400</td><td>0.0</td><td>2.100</td><td>0.0</td></tr><tr><td>0.100</td><td>2784.0</td><td>0.701</td><td>0.0</td><td>1.500</td><td>0.0</td><td>2.200</td><td>0.0</td></tr><tr><td>0.200</td><td>2923.0</td><td>0.900</td><td>0.0</td><td>1.600</td><td>0.0</td><td>2.300</td><td>0.0</td></tr><tr><td>0.300</td><td>3063.0</td><td>1.000</td><td>0.0</td><td>1.700</td><td>0.0</td><td>2.400</td><td>0.0</td></tr><tr><td>0.400</td><td>3204.0</td><td>1.100</td><td>0.0</td><td>1.800</td><td>0.0</td><td>2.500</td><td>0.0</td></tr><tr><td>0.500</td><td>3346.0</td><td>1.200</td><td>0.0</td><td>1.900</td><td>0.0</td><td></td><td></td></tr><tr><td>0.600</td><td>3488.0</td><td>1.300</td><td>0.0</td><td>2.000</td><td>0.0</td><td></td><td></td></tr></tbody></table> Hydro-Brake® Outflow Control Design Head (m) 0.380 Hydro-Brake® Type Md8 Invert Level (m) 99.300 Design Flow (l/s) 16.0 Diameter (mm) 200 <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>4.8</td><td>1.200</td><td>27.0</td><td>3.000</td><td>42.4</td><td>7.000</td><td>64.8</td></tr><tr><td>0.200</td><td>9.9</td><td>1.400</td><td>29.0</td><td>3.500</td><td>45.8</td><td>7.500</td><td>67.1</td></tr><tr><td>0.300</td><td>14.0</td><td>1.600</td><td>31.0</td><td>4.000</td><td>49.0</td><td>8.000</td><td>69.3</td></tr><tr><td>0.400</td><td>16.4</td><td>1.800</td><td>32.9</td><td>4.500</td><td>52.0</td><td>8.500</td><td>71.4</td></tr><tr><td>0.500</td><td>18.1</td><td>2.000</td><td>34.6</td><td>5.000</td><td>54.8</td><td>9.000</td><td>73.5</td></tr><tr><td>0.600</td><td>19.7</td><td>2.200</td><td>36.3</td><td>5.500</td><td>57.4</td><td>9.500</td><td>75.5</td></tr><tr><td>0.800</td><td>22.3</td><td>2.400</td><td>37.9</td><td>6.000</td><td>60.0</td><td></td><td></td></tr><tr><td>1.000</td><td>24.7</td><td>2.600</td><td>39.5</td><td>6.500</td><td>62.4</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	2646.0	0.700	3632.0	1.400	0.0	2.100	0.0	0.100	2784.0	0.701	0.0	1.500	0.0	2.200	0.0	0.200	2923.0	0.900	0.0	1.600	0.0	2.300	0.0	0.300	3063.0	1.000	0.0	1.700	0.0	2.400	0.0	0.400	3204.0	1.100	0.0	1.800	0.0	2.500	0.0	0.500	3346.0	1.200	0.0	1.900	0.0			0.600	3488.0	1.300	0.0	2.000	0.0			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.8	1.200	27.0	3.000	42.4	7.000	64.8	0.200	9.9	1.400	29.0	3.500	45.8	7.500	67.1	0.300	14.0	1.600	31.0	4.000	49.0	8.000	69.3	0.400	16.4	1.800	32.9	4.500	52.0	8.500	71.4	0.500	18.1	2.000	34.6	5.000	54.8	9.000	73.5	0.600	19.7	2.200	36.3	5.500	57.4	9.500	75.5	0.800	22.3	2.400	37.9	6.000	60.0			1.000	24.7	2.600	39.5	6.500	62.4		
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Summer</td><td>99.637</td><td>0.337</td><td>15.0</td><td>969.4</td><td>O K</td></tr><tr><td>600 min Summer</td><td>99.640</td><td>0.340</td><td>15.1</td><td>979.6</td><td>O K</td></tr><tr><td>720 min Summer</td><td>99.642</td><td>0.342</td><td>15.1</td><td>986.2</td><td>O K</td></tr><tr><td>960 min Summer</td><td>99.644</td><td>0.344</td><td>15.2</td><td>991.9</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>99.641</td><td>0.341</td><td>15.1</td><td>983.1</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>99.629</td><td>0.329</td><td>14.8</td><td>946.8</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>99.615</td><td>0.315</td><td>14.4</td><td>901.5</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>99.586</td><td>0.286</td><td>13.5</td><td>812.6</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>99.560</td><td>0.260</td><td>12.5</td><td>735.9</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>99.539</td><td>0.239</td><td>11.7</td><td>673.1</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>99.522</td><td>0.222</td><td>10.9</td><td>621.9</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>99.508</td><td>0.208</td><td>10.3</td><td>579.5</td><td>O K</td></tr><tr><td>15 min Winter</td><td>99.461</td><td>0.161</td><td>8.0</td><td>442.8</td><td>O K</td></tr><tr><td>30 min Winter</td><td>99.512</td><td>0.212</td><td>10.5</td><td>591.0</td><td>O K</td></tr><tr><td>60 min Winter</td><td>99.564</td><td>0.264</td><td>12.7</td><td>747.9</td><td>O K</td></tr><tr><td>120 min Winter</td><td>99.615</td><td>0.315</td><td>14.4</td><td>902.1</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>118.408</td><td>0.0</td><td>306.1</td><td>30</td></tr><tr><td>30 min Summer</td><td>79.579</td><td>0.0</td><td>416.0</td><td>44</td></tr><tr><td>60 min Summer</td><td>51.031</td><td>0.0</td><td>647.8</td><td>72</td></tr><tr><td>120 min Summer</td><td>31.581</td><td>0.0</td><td>803.2</td><td>130</td></tr><tr><td>180 min Summer</td><td>23.488</td><td>0.0</td><td>895.7</td><td>188</td></tr><tr><td>240 min Summer</td><td>18.897</td><td>0.0</td><td>959.8</td><td>246</td></tr><tr><td>360 min Summer</td><td>13.902</td><td>0.0</td><td>1055.9</td><td>362</td></tr><tr><td>480 min Summer</td><td>11.169</td><td>0.0</td><td>1127.0</td><td>452</td></tr><tr><td>600 min Summer</td><td>9.417</td><td>0.0</td><td>1182.7</td><td>506</td></tr><tr><td>720 min Summer</td><td>8.187</td><td>0.0</td><td>1228.2</td><td>566</td></tr><tr><td>960 min Summer</td><td>6.558</td><td>0.0</td><td>1297.9</td><td>692</td></tr><tr><td>1440 min Summer</td><td>4.789</td><td>0.0</td><td>1382.2</td><td>966</td></tr><tr><td>2160 min Summer</td><td>3.489</td><td>0.0</td><td>1680.3</td><td>1372</td></tr><tr><td>2880 min 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Summer	99.490	0.190	9.4	527.4	O K	60 min Summer	99.537	0.237	11.6	666.9	O K	120 min Summer	99.583	0.283	13.4	802.8	O K	180 min Summer	99.605	0.305	14.1	871.5	O K	240 min Summer	99.618	0.318	14.5	910.1	O K	360 min Summer	99.631	0.331	14.9	952.6	O K	480 min Summer	99.637	0.337	15.0	969.4	O K	600 min Summer	99.640	0.340	15.1	979.6	O K	720 min Summer	99.642	0.342	15.1	986.2	O K	960 min Summer	99.644	0.344	15.2	991.9	O K	1440 min Summer	99.641	0.341	15.1	983.1	O K	2160 min Summer	99.629	0.329	14.8	946.8	O K	2880 min Summer	99.615	0.315	14.4	901.5	O K	4320 min Summer	99.586	0.286	13.5	812.6	O K	5760 min Summer	99.560	0.260	12.5	735.9	O K	7200 min Summer	99.539	0.239	11.7	673.1	O K	8640 min Summer	99.522	0.222	10.9	621.9	O K	10080 min Summer	99.508	0.208	10.3	579.5	O K	15 min Winter	99.461	0.161	8.0	442.8	O K	30 min Winter	99.512	0.212	10.5	591.0	O K	60 min Winter	99.564	0.264	12.7	747.9	O K	120 min Winter	99.615	0.315	14.4	902.1	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	118.408	0.0	306.1	30	30 min Summer	79.579	0.0	416.0	44	60 min Summer	51.031	0.0	647.8	72	120 min Summer	31.581	0.0	803.2	130	180 min Summer	23.488	0.0	895.7	188	240 min Summer	18.897	0.0	959.8	246	360 min Summer	13.902	0.0	1055.9	362	480 min Summer	11.169	0.0	1127.0	452	600 min Summer	9.417	0.0	1182.7	506	720 min Summer	8.187	0.0	1228.2	566	960 min Summer	6.558	0.0	1297.9	692	1440 min Summer	4.789	0.0	1382.2	966	2160 min Summer	3.489	0.0	1680.3	1372	2880 min Summer	2.783	0.0	1779.2	1772	4320 min Summer	2.020	0.0	1900.4	2556	5760 min Summer	1.607	0.0	2090.5	3336	7200 min Summer	1.346	0.0	2184.9	4048	8640 min Summer	1.165	0.0	2263.4	4832	10080 min Summer	1.032	0.0	2320.2	5552	15 min Winter	118.408	0.0	344.8	30	30 min Winter	79.579	0.0	467.6	43	60 min Winter	51.031	0.0	726.9	72	120 min Winter	31.581	0.0	900.7	128
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60 min Summer	51.031	0.0	647.8	72																																																																																																																																																																																																																																																																										
120 min Summer	31.581	0.0	803.2	130																																																																																																																																																																																																																																																																										
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Model Details Storage is Online Cover Level (m) 100.000 Tank or Pond Structure Invert Level (m) 99.300 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>2646.0</td><td>0.700</td><td>3632.0</td><td>1.400</td><td>0.0</td><td>2.100</td><td>0.0</td></tr><tr><td>0.100</td><td>2784.0</td><td>0.701</td><td>0.0</td><td>1.500</td><td>0.0</td><td>2.200</td><td>0.0</td></tr><tr><td>0.200</td><td>2923.0</td><td>0.900</td><td>0.0</td><td>1.600</td><td>0.0</td><td>2.300</td><td>0.0</td></tr><tr><td>0.300</td><td>3063.0</td><td>1.000</td><td>0.0</td><td>1.700</td><td>0.0</td><td>2.400</td><td>0.0</td></tr><tr><td>0.400</td><td>3204.0</td><td>1.100</td><td>0.0</td><td>1.800</td><td>0.0</td><td>2.500</td><td>0.0</td></tr><tr><td>0.500</td><td>3346.0</td><td>1.200</td><td>0.0</td><td>1.900</td><td>0.0</td><td></td><td></td></tr><tr><td>0.600</td><td>3488.0</td><td>1.300</td><td>0.0</td><td>2.000</td><td>0.0</td><td></td><td></td></tr></tbody></table> Hydro-Brake® Outflow Control Design Head (m) 0.380 Hydro-Brake® Type Md8 Invert Level (m) 99.300 Design Flow (l/s) 16.0 Diameter (mm) 200 <table><thead><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr></thead><tbody><tr><td>0.100</td><td>4.8</td><td>1.200</td><td>27.0</td><td>3.000</td><td>42.4</td><td>7.000</td><td>64.8</td></tr><tr><td>0.200</td><td>9.9</td><td>1.400</td><td>29.0</td><td>3.500</td><td>45.8</td><td>7.500</td><td>67.1</td></tr><tr><td>0.300</td><td>14.0</td><td>1.600</td><td>31.0</td><td>4.000</td><td>49.0</td><td>8.000</td><td>69.3</td></tr><tr><td>0.400</td><td>16.4</td><td>1.800</td><td>32.9</td><td>4.500</td><td>52.0</td><td>8.500</td><td>71.4</td></tr><tr><td>0.500</td><td>18.1</td><td>2.000</td><td>34.6</td><td>5.000</td><td>54.8</td><td>9.000</td><td>73.5</td></tr><tr><td>0.600</td><td>19.7</td><td>2.200</td><td>36.3</td><td>5.500</td><td>57.4</td><td>9.500</td><td>75.5</td></tr><tr><td>0.800</td><td>22.3</td><td>2.400</td><td>37.9</td><td>6.000</td><td>60.0</td><td></td><td></td></tr><tr><td>1.000</td><td>24.7</td><td>2.600</td><td>39.5</td><td>6.500</td><td>62.4</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	2646.0	0.700	3632.0	1.400	0.0	2.100	0.0	0.100	2784.0	0.701	0.0	1.500	0.0	2.200	0.0	0.200	2923.0	0.900	0.0	1.600	0.0	2.300	0.0	0.300	3063.0	1.000	0.0	1.700	0.0	2.400	0.0	0.400	3204.0	1.100	0.0	1.800	0.0	2.500	0.0	0.500	3346.0	1.200	0.0	1.900	0.0			0.600	3488.0	1.300	0.0	2.000	0.0			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.8	1.200	27.0	3.000	42.4	7.000	64.8	0.200	9.9	1.400	29.0	3.500	45.8	7.500	67.1	0.300	14.0	1.600	31.0	4.000	49.0	8.000	69.3	0.400	16.4	1.800	32.9	4.500	52.0	8.500	71.4	0.500	18.1	2.000	34.6	5.000	54.8	9.000	73.5	0.600	19.7	2.200	36.3	5.500	57.4	9.500	75.5	0.800	22.3	2.400	37.9	6.000	60.0			1.000	24.7	2.600	39.5	6.500	62.4		
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58-62 Ock Street Abingdon Oxon OX14 5BZ		Southern Attenuation Pond 1:2 year Max Discharge =12 l/s				
Date 19.03.13 File Southern Attenuation Pond - ...		Designed by C.Pendle Checked by				
Micro Drainage		Source Control 2013.1				
Summary of Results for 2 year Return Period						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		99.360	0.060	1.7	182.7	O K
30 min Summer		99.379	0.079	2.7	240.3	O K
60 min Summer		99.399	0.099	3.9	303.2	O K
120 min Summer		99.420	0.120	5.1	370.7	O K
180 min Summer		99.432	0.132	5.8	410.8	O K
240 min Summer		99.440	0.140	6.3	438.2	O K
360 min Summer		99.450	0.150	6.9	471.4	O K
480 min Summer		99.456	0.156	7.1	489.4	O K
600 min Summer		99.460	0.160	7.3	502.5	O K
720 min Summer		99.463	0.163	7.5	513.3	O K
960 min Summer		99.468	0.168	7.7	529.8	O K
1440 min Summer		99.473	0.173	7.9	548.0	O K
2160 min Summer		99.475	0.175	8.0	554.8	O K
2880 min Summer		99.474	0.174	7.9	550.0	O K
4320 min Summer		99.467	0.167	7.7	528.1	O K
5760 min Summer		99.460	0.160	7.3	502.3	O K
7200 min Summer		99.452	0.152	7.0	477.8	O K
8640 min Summer		99.445	0.145	6.6	455.3	O K
10080 min Summer		99.440	0.140	6.3	435.7	O K
15 min Winter		99.367	0.067	2.0	204.5	O K
30 min Winter		99.388	0.088	3.2	269.0	O K
60 min Winter		99.410	0.110	4.5	339.4	O K
120 min Winter		99.433	0.133	5.9	415.1	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		37.154	0.0	84.5	35	
30 min Summer		24.581	0.0	125.7	49	
60 min Summer		15.691	0.0	228.8	78	
120 min Summer		9.821	0.0	299.2	136	
180 min Summer		7.430	0.0	346.4	192	
240 min Summer		6.089	0.0	383.0	250	
360 min Summer		4.578	0.0	437.5	364	
480 min Summer		3.735	0.0	478.9	464	
600 min Summer		3.190	0.0	512.5	514	
720 min Summer		2.803	0.0	540.8	572	
960 min Summer		2.286	0.0	586.3	696	
1440 min Summer		1.716	0.0	647.9	968	
2160 min Summer		1.287	0.0	845.6	1376	
2880 min Summer		1.049	0.0	914.5	1776	
4320 min Summer		0.787	0.0	1004.1	2560	
5760 min Summer		0.642	0.0	1181.2	3336	
7200 min Summer		0.548	0.0	1255.4	4056	
8640 min Summer		0.481	0.0	1312.2	4840	
10080 min Summer		0.431	0.0	1352.0	5552	
15 min Winter		37.154	0.0	99.6	34	
30 min Winter		24.581	0.0	147.0	48	
60 min Winter		15.691	0.0	262.7	76	
120 min Winter		9.821	0.0	342.1	132	
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58-62 Ock Street Abingdon Oxon OX14 5BZ	Southern Attenuation Pond 1:2 year Max Discharge =12 l/s				
Date 19.03.13 File Southern Attenuation Pond - ...	Designed by C.Pendle Checked by				
Micro Drainage	Source Control 2013.1				
Summary of Results for 2 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	99.447	0.147	6.7	460.4	O K
240 min Winter	99.456	0.156	7.2	491.7	O K
360 min Winter	99.468	0.168	7.7	530.2	O K
480 min Winter	99.474	0.174	8.0	551.9	O K
600 min Winter	99.478	0.178	8.1	564.7	O K
720 min Winter	99.481	0.181	8.2	574.4	O K
960 min Winter	99.486	0.186	8.4	589.9	O K
1440 min Winter	99.489	0.189	8.5	600.9	O K
2160 min Winter	99.487	0.187	8.4	593.2	O K
2880 min Winter	99.481	0.181	8.2	574.7	O K
4320 min Winter	99.468	0.168	7.7	531.1	O K
5760 min Winter	99.456	0.156	7.2	490.7	O K
7200 min Winter	99.446	0.146	6.6	456.2	O K
8640 min Winter	99.437	0.137	6.1	427.0	O K
10080 min Winter	99.429	0.129	5.7	402.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
180 min Winter	7.430	0.0	395.3	188	
240 min Winter	6.089	0.0	436.5	244	
360 min Winter	4.578	0.0	497.7	356	
480 min Winter	3.735	0.0	544.2	466	
600 min Winter	3.190	0.0	581.9	564	
720 min Winter	2.803	0.0	613.7	588	
960 min Winter	2.286	0.0	664.6	738	
1440 min Winter	1.716	0.0	733.3	1042	
2160 min Winter	1.287	0.0	953.3	1484	
2880 min Winter	1.049	0.0	1031.2	1904	
4320 min Winter	0.787	0.0	1133.5	2696	
5760 min Winter	0.642	0.0	1327.2	3472	
7200 min Winter	0.548	0.0	1411.1	4248	
8640 min Winter	0.481	0.0	1476.0	5008	
10080 min Winter	0.431	0.0	1522.6	5752	
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58-62 Ock Street Abingdon Oxon OX14 5BZ	Southern Attenuation Pond 1:2 year Max Discharge =12 l/s																																																	
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58-62 Ock Street Abingdon Oxon OX14 5BZ	Southern Attenuation Pond 1:2 year Max Discharge =12 l/s	
Date 19.03.13 File Southern Attenuation Pond - ...	Designed by C.Pendle Checked by	
Micro Drainage Source Control 2013.1		

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.300

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2960.0	0.700	4671.0	1.400	0.0	2.100	0.0
0.100	3194.0	0.701	0.0	1.500	0.0	2.200	0.0
0.200	3435.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	3673.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	3919.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	4167.0	1.200	0.0	1.900	0.0		
0.600	4417.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Outflow Control

Design Head (m) 0.530 Hydro-Brake® Type Md7 Invert Level (m) 99.300
Design Flow (l/s) 12.0 Diameter (mm) 156

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	18.0	3.000	28.4	7.000	43.5
0.200	8.8	1.400	19.4	3.500	30.7	7.500	45.0
0.300	9.0	1.600	20.8	4.000	32.8	8.000	46.5
0.400	10.4	1.800	22.0	4.500	34.8	8.500	47.9
0.500	11.6	2.000	23.2	5.000	36.7	9.000	49.3
0.600	12.7	2.200	24.4	5.500	38.5	9.500	50.6
0.800	14.7	2.400	25.4	6.000	40.2		
1.000	16.4	2.600	26.5	6.500	41.9		

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<table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>99.389</td><td>0.089</td><td>3.3</td><td>272.8</td><td>O K</td></tr><tr><td>30 min Summer</td><td>99.416</td><td>0.116</td><td>4.9</td><td>357.5</td><td>O K</td></tr><tr><td>60 min Summer</td><td>99.443</td><td>0.143</td><td>6.5</td><td>447.7</td><td>O K</td></tr><tr><td>120 min Summer</td><td>99.471</td><td>0.171</td><td>7.8</td><td>540.9</td><td>O K</td></tr><tr><td>180 min Summer</td><td>99.487</td><td>0.187</td><td>8.4</td><td>594.1</td><td>O K</td></tr><tr><td>240 min Summer</td><td>99.497</td><td>0.197</td><td>8.7</td><td>629.2</td><td>O K</td></tr><tr><td>360 min Summer</td><td>99.510</td><td>0.210</td><td>9.0</td><td>673.7</td><td>O K</td></tr><tr><td>480 min Summer</td><td>99.517</td><td>0.217</td><td>9.0</td><td>699.1</td><td>O K</td></tr><tr><td>600 min Summer</td><td>99.522</td><td>0.222</td><td>9.1</td><td>714.5</td><td>O K</td></tr><tr><td>720 min Summer</td><td>99.525</td><td>0.225</td><td>9.1</td><td>727.2</td><td>O K</td></tr><tr><td>960 min Summer</td><td>99.531</td><td>0.231</td><td>9.1</td><td>745.4</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>99.536</td><td>0.236</td><td>9.1</td><td>763.7</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>99.536</td><td>0.236</td><td>9.1</td><td>764.7</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>99.532</td><td>0.232</td><td>9.1</td><td>750.1</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>99.519</td><td>0.219</td><td>9.1</td><td>704.1</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>99.505</td><td>0.205</td><td>8.9</td><td>656.1</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>99.493</td><td>0.193</td><td>8.6</td><td>613.5</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>99.482</td><td>0.182</td><td>8.2</td><td>576.9</td><td>O K</td></tr><tr><td>10080 min 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Summer</td><td>10.791</td><td>0.0</td><td>531.1</td><td>192</td></tr><tr><td>240 min Summer</td><td>8.764</td><td>0.0</td><td>578.9</td><td>250</td></tr><tr><td>360 min Summer</td><td>6.528</td><td>0.0</td><td>650.7</td><td>366</td></tr><tr><td>480 min Summer</td><td>5.292</td><td>0.0</td><td>704.4</td><td>482</td></tr><tr><td>600 min Summer</td><td>4.495</td><td>0.0</td><td>747.1</td><td>554</td></tr><tr><td>720 min Summer</td><td>3.932</td><td>0.0</td><td>782.3</td><td>614</td></tr><tr><td>960 min Summer</td><td>3.183</td><td>0.0</td><td>837.1</td><td>740</td></tr><tr><td>1440 min Summer</td><td>2.361</td><td>0.0</td><td>905.4</td><td>1010</td></tr><tr><td>2160 min Summer</td><td>1.750</td><td>0.0</td><td>1167.3</td><td>1420</td></tr><tr><td>2880 min Summer</td><td>1.414</td><td>0.0</td><td>1251.4</td><td>1828</td></tr><tr><td>4320 min Summer</td><td>1.047</td><td>0.0</td><td>1357.9</td><td>2608</td></tr><tr><td>5760 min Summer</td><td>0.846</td><td>0.0</td><td>1566.7</td><td>3360</td></tr><tr><td>7200 min Summer</td><td>0.716</td><td>0.0</td><td>1652.8</td><td>4112</td></tr><tr><td>8640 min Summer</td><td>0.626</td><td>0.0</td><td>1720.8</td><td>4848</td></tr><tr><td>10080 min Summer</td><td>0.558</td><td>0.0</td><td>1768.0</td><td>5560</td></tr><tr><td>15 min Winter</td><td>55.614</td><td>0.0</td><td>174.2</td><td>34</td></tr><tr><td>30 min Winter</td><td>36.694</td><td>0.0</td><td>249.1</td><td>48</td></tr><tr><td>60 min Winter</td><td>23.276</td><td>0.0</td><td>417.8</td><td>76</td></tr><tr><td>120 min Winter</td><td>14.404</td><td>0.0</td><td>530.5</td><td>132</td></tr></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	99.389	0.089	3.3	272.8	O K	30 min Summer	99.416	0.116	4.9	357.5	O K	60 min Summer	99.443	0.143	6.5	447.7	O K	120 min Summer	99.471	0.171	7.8	540.9	O K	180 min Summer	99.487	0.187	8.4	594.1	O K	240 min Summer	99.497	0.197	8.7	629.2	O K	360 min Summer	99.510	0.210	9.0	673.7	O K	480 min Summer	99.517	0.217	9.0	699.1	O K	600 min Summer	99.522	0.222	9.1	714.5	O K	720 min Summer	99.525	0.225	9.1	727.2	O K	960 min Summer	99.531	0.231	9.1	745.4	O K	1440 min Summer	99.536	0.236	9.1	763.7	O K	2160 min Summer	99.536	0.236	9.1	764.7	O K	2880 min Summer	99.532	0.232	9.1	750.1	O K	4320 min Summer	99.519	0.219	9.1	704.1	O K	5760 min Summer	99.505	0.205	8.9	656.1	O K	7200 min Summer	99.493	0.193	8.6	613.5	O K	8640 min Summer	99.482	0.182	8.2	576.9	O K	10080 min Summer	99.473	0.173	7.9	545.7	O K	15 min Winter	99.399	0.099	3.9	305.4	O K	30 min Winter	99.429	0.129	5.7	400.2	O K	60 min Winter	99.459	0.159	7.3	501.6	O K	120 min Winter	99.491	0.191	8.5	607.1	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	55.614	0.0	149.5	34	30 min Summer	36.694	0.0	215.5	49	60 min Summer	23.276	0.0	366.5	78	120 min Summer	14.404	0.0	467.0	134	180 min Summer	10.791	0.0	531.1	192	240 min Summer	8.764	0.0	578.9	250	360 min Summer	6.528	0.0	650.7	366	480 min Summer	5.292	0.0	704.4	482	600 min Summer	4.495	0.0	747.1	554	720 min Summer	3.932	0.0	782.3	614	960 min Summer	3.183	0.0	837.1	740	1440 min Summer	2.361	0.0	905.4	1010	2160 min Summer	1.750	0.0	1167.3	1420	2880 min Summer	1.414	0.0	1251.4	1828	4320 min Summer	1.047	0.0	1357.9	2608	5760 min Summer	0.846	0.0	1566.7	3360	7200 min Summer	0.716	0.0	1652.8	4112	8640 min Summer	0.626	0.0	1720.8	4848	10080 min Summer	0.558	0.0	1768.0	5560	15 min Winter	55.614	0.0	174.2	34	30 min Winter	36.694	0.0	249.1	48	60 min Winter	23.276	0.0	417.8	76	120 min Winter	14.404	0.0	530.5	132
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Date 19.03.13 File SOUTHERN ATTENUATION PO...	Designed by C.Pendle Checked by	
Micro Drainage	Source Control 2013.1	

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.300

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2960.0	0.700	4671.0	1.400	0.0	2.100	0.0
0.100	3194.0	0.701	0.0	1.500	0.0	2.200	0.0
0.200	3435.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	3673.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	3919.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	4167.0	1.200	0.0	1.900	0.0		
0.600	4417.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Outflow Control

Design Head (m) 0.530 Hydro-Brake® Type Md7 Invert Level (m) 99.300
Design Flow (l/s) 12.0 Diameter (mm) 156

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	18.0	3.000	28.4	7.000	43.5
0.200	8.8	1.400	19.4	3.500	30.7	7.500	45.0
0.300	9.0	1.600	20.8	4.000	32.8	8.000	46.5
0.400	10.4	1.800	22.0	4.500	34.8	8.500	47.9
0.500	11.6	2.000	23.2	5.000	36.7	9.000	49.3
0.600	12.7	2.200	24.4	5.500	38.5	9.500	50.6
0.800	14.7	2.400	25.4	6.000	40.2		
1.000	16.4	2.600	26.5	6.500	41.9		

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Summer</td><td>99.583</td><td>0.283</td><td>9.1</td><td>933.1</td><td>O K</td></tr><tr><td>720 min Summer</td><td>99.587</td><td>0.287</td><td>9.1</td><td>946.4</td><td>O K</td></tr><tr><td>960 min Summer</td><td>99.591</td><td>0.291</td><td>9.1</td><td>961.7</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>99.595</td><td>0.295</td><td>9.1</td><td>976.2</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>99.594</td><td>0.294</td><td>9.1</td><td>973.2</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>99.589</td><td>0.289</td><td>9.1</td><td>953.7</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>99.572</td><td>0.272</td><td>9.1</td><td>893.3</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>99.552</td><td>0.252</td><td>9.1</td><td>820.9</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>99.532</td><td>0.232</td><td>9.1</td><td>749.5</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>99.515</td><td>0.215</td><td>9.0</td><td>692.1</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>99.502</td><td>0.202</td><td>8.8</td><td>646.3</td><td>O K</td></tr><tr><td>15 min Winter</td><td>99.424</td><td>0.124</td><td>5.4</td><td>385.9</td><td>O K</td></tr><tr><td>30 min Winter</td><td>99.462</td><td>0.162</td><td>7.4</td><td>510.3</td><td>O K</td></tr><tr><td>60 min Winter</td><td>99.501</td><td>0.201</td><td>8.8</td><td>643.6</td><td>O K</td></tr><tr><td>120 min Winter</td><td>99.541</td><td>0.241</td><td>9.1</td><td>782.5</td><td>O K</td></tr><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>70.373</td><td>0.0</td><td>204.6</td><td>34</td></tr><tr><td>30 min Summer</td><td>46.843</td><td>0.0</td><td>293.3</td><td>49</td></tr><tr><td>60 min Summer</td><td>29.868</td><td>0.0</td><td>487.6</td><td>78</td></tr><tr><td>120 min Summer</td><td>18.484</td><td>0.0</td><td>616.5</td><td>136</td></tr><tr><td>180 min Summer</td><td>13.799</td><td>0.0</td><td>695.3</td><td>194</td></tr><tr><td>240 min Summer</td><td>11.157</td><td>0.0</td><td>751.4</td><td>252</td></tr><tr><td>360 min Summer</td><td>8.261</td><td>0.0</td><td>834.2</td><td>368</td></tr><tr><td>480 min Summer</td><td>6.668</td><td>0.0</td><td>894.6</td><td>486</td></tr><tr><td>600 min Summer</td><td>5.644</td><td>0.0</td><td>941.4</td><td>602</td></tr><tr><td>720 min Summer</td><td>4.923</td><td>0.0</td><td>978.8</td><td>720</td></tr><tr><td>960 min Summer</td><td>3.965</td><td>0.0</td><td>1033.6</td><td>824</td></tr><tr><td>1440 min Summer</td><td>2.919</td><td>0.0</td><td>1087.4</td><td>1070</td></tr><tr><td>2160 min Summer</td><td>2.146</td><td>0.0</td><td>1437.2</td><td>1476</td></tr><tr><td>2880 min Summer</td><td>1.724</td><td>0.0</td><td>1529.0</td><td>1888</td></tr><tr><td>4320 min Summer</td><td>1.264</td><td>0.0</td><td>1641.0</td><td>2696</td></tr><tr><td>5760 min Summer</td><td>1.014</td><td>0.0</td><td>1884.9</td><td>3472</td></tr><tr><td>7200 min Summer</td><td>0.854</td><td>0.0</td><td>1978.2</td><td>4192</td></tr><tr><td>8640 min Summer</td><td>0.743</td><td>0.0</td><td>2052.2</td><td>4936</td></tr><tr><td>10080 min Summer</td><td>0.660</td><td>0.0</td><td>2102.7</td><td>5648</td></tr><tr><td>15 min Winter</td><td>70.373</td><td>0.0</td><td>236.8</td><td>34</td></tr><tr><td>30 min Winter</td><td>46.843</td><td>0.0</td><td>336.7</td><td>48</td></tr><tr><td>60 min Winter</td><td>29.868</td><td>0.0</td><td>553.5</td><td>76</td></tr><tr><td>120 min Winter</td><td>18.484</td><td>0.0</td><td>696.9</td><td>134</td></tr></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	99.412	0.112	4.7	344.7	O K	30 min Summer	99.446	0.146	6.6	455.6	O K	60 min Summer	99.481	0.181	8.2	574.0	O K	120 min Summer	99.516	0.216	9.0	695.4	O K	180 min Summer	99.536	0.236	9.1	764.6	O K	240 min Summer	99.549	0.249	9.1	810.6	O K	360 min Summer	99.566	0.266	9.1	872.4	O K	480 min Summer	99.577	0.277	9.1	910.1	O K	600 min Summer	99.583	0.283	9.1	933.1	O K	720 min Summer	99.587	0.287	9.1	946.4	O K	960 min Summer	99.591	0.291	9.1	961.7	O K	1440 min Summer	99.595	0.295	9.1	976.2	O K	2160 min Summer	99.594	0.294	9.1	973.2	O K	2880 min Summer	99.589	0.289	9.1	953.7	O K	4320 min Summer	99.572	0.272	9.1	893.3	O K	5760 min Summer	99.552	0.252	9.1	820.9	O K	7200 min Summer	99.532	0.232	9.1	749.5	O K	8640 min Summer	99.515	0.215	9.0	692.1	O K	10080 min Summer	99.502	0.202	8.8	646.3	O K	15 min Winter	99.424	0.124	5.4	385.9	O K	30 min Winter	99.462	0.162	7.4	510.3	O K	60 min Winter	99.501	0.201	8.8	643.6	O K	120 min Winter	99.541	0.241	9.1	782.5	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	70.373	0.0	204.6	34	30 min Summer	46.843	0.0	293.3	49	60 min Summer	29.868	0.0	487.6	78	120 min Summer	18.484	0.0	616.5	136	180 min Summer	13.799	0.0	695.3	194	240 min Summer	11.157	0.0	751.4	252	360 min Summer	8.261	0.0	834.2	368	480 min Summer	6.668	0.0	894.6	486	600 min Summer	5.644	0.0	941.4	602	720 min Summer	4.923	0.0	978.8	720	960 min Summer	3.965	0.0	1033.6	824	1440 min Summer	2.919	0.0	1087.4	1070	2160 min Summer	2.146	0.0	1437.2	1476	2880 min Summer	1.724	0.0	1529.0	1888	4320 min Summer	1.264	0.0	1641.0	2696	5760 min Summer	1.014	0.0	1884.9	3472	7200 min Summer	0.854	0.0	1978.2	4192	8640 min Summer	0.743	0.0	2052.2	4936	10080 min Summer	0.660	0.0	2102.7	5648	15 min Winter	70.373	0.0	236.8	34	30 min Winter	46.843	0.0	336.7	48	60 min Winter	29.868	0.0	553.5	76	120 min Winter	18.484	0.0	696.9	134
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Michael A Jennings Associates			Page 2		
58-62 Ock Street Abingdon Oxon OX14 5BZ	Southern Attenuation Pond 1:30 year Max Discharge =12 l/s				
Date 19.03.13 File Southern Attenuation Pond - ...	Designed by C.Pendle Checked by				
Micro Drainage	Source Control 2013.1				
Summary of Results for 30 year Return Period					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	99.564	0.264	9.1	862.9	O K
240 min Winter	99.579	0.279	9.1	916.1	O K
360 min Winter	99.598	0.298	9.1	986.9	O K
480 min Winter	99.610	0.310	9.1	1030.6	O K
600 min Winter	99.617	0.317	9.3	1058.3	O K
720 min Winter	99.622	0.322	9.3	1075.8	O K
960 min Winter	99.626	0.326	9.4	1091.2	O K
1440 min Winter	99.627	0.327	9.4	1095.0	O K
2160 min Winter	99.622	0.322	9.3	1076.5	O K
2880 min Winter	99.612	0.312	9.2	1037.5	O K
4320 min Winter	99.584	0.284	9.1	936.3	O K
5760 min Winter	99.552	0.252	9.1	821.3	O K
7200 min Winter	99.522	0.222	9.1	715.9	O K
8640 min Winter	99.501	0.201	8.8	643.3	O K
10080 min Winter	99.485	0.185	8.4	588.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
180 min Winter	13.799	0.0	783.6	190	
240 min Winter	11.157	0.0	845.1	248	
360 min Winter	8.261	0.0	935.8	362	
480 min Winter	6.668	0.0	1001.5	476	
600 min Winter	5.644	0.0	1051.9	590	
720 min Winter	4.923	0.0	1091.4	700	
960 min Winter	3.965	0.0	1147.2	910	
1440 min Winter	2.919	0.0	1192.3	1134	
2160 min Winter	2.146	0.0	1613.1	1596	
2880 min Winter	1.724	0.0	1714.4	2052	
4320 min Winter	1.264	0.0	1835.8	2912	
5760 min Winter	1.014	0.0	2115.3	3712	
7200 min Winter	0.854	0.0	2221.1	4408	
8640 min Winter	0.743	0.0	2305.7	5112	
10080 min Winter	0.660	0.0	2365.3	5848	
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58-62 Ock Street Abingdon Oxon OX14 5BZ	Southern Attenuation Pond 1:30 year Max Discharge =12 l/s	
Date 19.03.13 File Southern Attenuation Pond - ...	Designed by C.Pendle Checked by	
Micro Drainage Source Control 2013.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.400	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.643

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4 0.500	8	12 0.500	16	20 0.643
4	8 0.500	12	16 0.500		

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58-62 Ock Street Abingdon Oxon OX14 5BZ	Southern Attenuation Pond 1:30 year Max Discharge =12 l/s	
Date 19.03.13 File Southern Attenuation Pond - ...	Designed by C.Pendle Checked by	
Micro Drainage	Source Control 2013.1	

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.300

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2960.0	0.700	4671.0	1.400	0.0	2.100	0.0
0.100	3194.0	0.701	0.0	1.500	0.0	2.200	0.0
0.200	3435.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	3673.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	3919.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	4167.0	1.200	0.0	1.900	0.0		
0.600	4417.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Outflow Control

Design Head (m) 0.530 Hydro-Brake® Type Md7 Invert Level (m) 99.300
Design Flow (l/s) 12.0 Diameter (mm) 156

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	18.0	3.000	28.4	7.000	43.5
0.200	8.8	1.400	19.4	3.500	30.7	7.500	45.0
0.300	9.0	1.600	20.8	4.000	32.8	8.000	46.5
0.400	10.4	1.800	22.0	4.500	34.8	8.500	47.9
0.500	11.6	2.000	23.2	5.000	36.7	9.000	49.3
0.600	12.7	2.200	24.4	5.500	38.5	9.500	50.6
0.800	14.7	2.400	25.4	6.000	40.2		
1.000	16.4	2.600	26.5	6.500	41.9		

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58-62 Ock Street Abingdon Oxon OX14 5BZ		Southern Attenuation Pond 1:100 year Max Discharge =12 l/s																																																																																																																																																																																																																																																																												
Date 19.03.13 File SOUTHERN ATTENUATION PO...		Designed by C.Pendle Checked by																																																																																																																																																																																																																																																																												
Micro Drainage		Source Control 2013.1																																																																																																																																																																																																																																																																												
Summary of Results for 100 year Return Period <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>99.443</td><td>0.143</td><td>6.5</td><td>445.6</td><td>O K</td></tr><tr><td>30 min Summer</td><td>99.487</td><td>0.187</td><td>8.4</td><td>595.1</td><td>O K</td></tr><tr><td>60 min Summer</td><td>99.534</td><td>0.234</td><td>9.1</td><td>756.1</td><td>O K</td></tr><tr><td>120 min Summer</td><td>99.580</td><td>0.280</td><td>9.1</td><td>922.6</td><td>O K</td></tr><tr><td>180 min Summer</td><td>99.605</td><td>0.305</td><td>9.1</td><td>1014.3</td><td>O K</td></tr><tr><td>240 min Summer</td><td>99.621</td><td>0.321</td><td>9.3</td><td>1071.9</td><td>O K</td></tr><tr><td>360 min Summer</td><td>99.641</td><td>0.341</td><td>9.6</td><td>1148.6</td><td>O K</td></tr><tr><td>480 min Summer</td><td>99.654</td><td>0.354</td><td>9.8</td><td>1195.4</td><td>O K</td></tr><tr><td>600 min Summer</td><td>99.661</td><td>0.361</td><td>9.9</td><td>1224.2</td><td>O K</td></tr><tr><td>720 min Summer</td><td>99.666</td><td>0.366</td><td>9.9</td><td>1241.3</td><td>O K</td></tr><tr><td>960 min Summer</td><td>99.669</td><td>0.369</td><td>10.0</td><td>1254.4</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>99.671</td><td>0.371</td><td>10.0</td><td>1262.0</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>99.668</td><td>0.368</td><td>10.0</td><td>1250.0</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>99.661</td><td>0.361</td><td>9.9</td><td>1221.8</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>99.641</td><td>0.341</td><td>9.6</td><td>1145.9</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>99.619</td><td>0.319</td><td>9.3</td><td>1062.7</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>99.597</td><td>0.297</td><td>9.1</td><td>981.8</td><td>O K</td></tr><tr><td>8640 min 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Summer</td><td>2.141</td><td>0.0</td><td>1898.3</td><td>1928</td></tr><tr><td>4320 min Summer</td><td>1.554</td><td>0.0</td><td>1994.6</td><td>2740</td></tr><tr><td>5760 min Summer</td><td>1.237</td><td>0.0</td><td>2305.6</td><td>3544</td></tr><tr><td>7200 min Summer</td><td>1.035</td><td>0.0</td><td>2406.0</td><td>4336</td></tr><tr><td>8640 min Summer</td><td>0.896</td><td>0.0</td><td>2486.2</td><td>5112</td></tr><tr><td>10080 min Summer</td><td>0.793</td><td>0.0</td><td>2540.0</td><td>5856</td></tr><tr><td>15 min Winter</td><td>91.083</td><td>0.0</td><td>326.2</td><td>34</td></tr><tr><td>30 min Winter</td><td>61.215</td><td>0.0</td><td>458.4</td><td>48</td></tr><tr><td>60 min Winter</td><td>39.255</td><td>0.0</td><td>744.0</td><td>78</td></tr><tr><td>120 min Winter</td><td>24.293</td><td>0.0</td><td>925.2</td><td>134</td></tr></tbody></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	99.443	0.143	6.5	445.6	O K	30 min Summer	99.487	0.187	8.4	595.1	O K	60 min Summer	99.534	0.234	9.1	756.1	O K	120 min Summer	99.580	0.280	9.1	922.6	O K	180 min Summer	99.605	0.305	9.1	1014.3	O K	240 min Summer	99.621	0.321	9.3	1071.9	O K	360 min Summer	99.641	0.341	9.6	1148.6	O K	480 min Summer	99.654	0.354	9.8	1195.4	O K	600 min Summer	99.661	0.361	9.9	1224.2	O K	720 min Summer	99.666	0.366	9.9	1241.3	O K	960 min Summer	99.669	0.369	10.0	1254.4	O K	1440 min Summer	99.671	0.371	10.0	1262.0	O K	2160 min Summer	99.668	0.368	10.0	1250.0	O K	2880 min Summer	99.661	0.361	9.9	1221.8	O K	4320 min Summer	99.641	0.341	9.6	1145.9	O K	5760 min Summer	99.619	0.319	9.3	1062.7	O K	7200 min Summer	99.597	0.297	9.1	981.8	O K	8640 min Summer	99.575	0.275	9.1	904.5	O K	10080 min Summer	99.554	0.254	9.1	827.5	O K	15 min Winter	99.459	0.159	7.3	499.0	O K	30 min Winter	99.508	0.208	8.9	667.0	O K	60 min Winter	99.560	0.260	9.1	849.2	O K	120 min Winter	99.611	0.311	9.2	1036.7	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	91.083	0.0	284.0	34	30 min Summer	61.215	0.0	403.5	49	60 min Summer	39.255	0.0	659.4	78	120 min Summer	24.293	0.0	824.0	136	180 min Summer	18.068	0.0	919.5	196	240 min Summer	14.537	0.0	984.3	254	360 min Summer	10.694	0.0	1078.3	370	480 min Summer	8.592	0.0	1144.2	488	600 min Summer	7.244	0.0	1192.5	606	720 min Summer	6.298	0.0	1228.3	722	960 min Summer	5.045	0.0	1272.8	894	1440 min Summer	3.684	0.0	1283.7	1126	2160 min Summer	2.684	0.0	1801.5	1516	2880 min Summer	2.141	0.0	1898.3	1928	4320 min Summer	1.554	0.0	1994.6	2740	5760 min Summer	1.237	0.0	2305.6	3544	7200 min Summer	1.035	0.0	2406.0	4336	8640 min Summer	0.896	0.0	2486.2	5112	10080 min Summer	0.793	0.0	2540.0	5856	15 min Winter	91.083	0.0	326.2	34	30 min Winter	61.215	0.0	458.4	48	60 min Winter	39.255	0.0	744.0	78	120 min Winter	24.293	0.0	925.2	134
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Michael A Jennings Associates		Page 2																																																																																																																																																																																
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<u>Summary of Results for 100 year Return Period</u> <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>180 min Winter</td><td>99.639</td><td>0.339</td><td>9.6</td><td>1140.2</td><td>O K</td></tr><tr><td>240 min Winter</td><td>99.657</td><td>0.357</td><td>9.8</td><td>1205.9</td><td>O K</td></tr><tr><td>360 min Winter</td><td>99.680</td><td>0.380</td><td>10.1</td><td>1294.4</td><td>O K</td></tr><tr><td>480 min Winter</td><td>99.694</td><td>0.394</td><td>10.3</td><td>1349.6</td><td>O K</td></tr><tr><td>600 min Winter</td><td>99.703</td><td>0.403</td><td>10.4</td><td>1384.8</td><td>Flood Risk</td></tr><tr><td>720 min Winter</td><td>99.708</td><td>0.408</td><td>10.5</td><td>1407.2</td><td>Flood Risk</td></tr><tr><td>960 min Winter</td><td>99.714</td><td>0.414</td><td>10.6</td><td>1427.7</td><td>Flood Risk</td></tr><tr><td>1440 min Winter</td><td>99.712</td><td>0.412</td><td>10.5</td><td>1421.7</td><td>Flood Risk</td></tr><tr><td>2160 min Winter</td><td>99.705</td><td>0.405</td><td>10.5</td><td>1395.3</td><td>Flood Risk</td></tr><tr><td>2880 min Winter</td><td>99.693</td><td>0.393</td><td>10.3</td><td>1346.2</td><td>O K</td></tr><tr><td>4320 min Winter</td><td>99.661</td><td>0.361</td><td>9.9</td><td>1224.7</td><td>O K</td></tr><tr><td>5760 min Winter</td><td>99.628</td><td>0.328</td><td>9.4</td><td>1099.1</td><td>O K</td></tr><tr><td>7200 min Winter</td><td>99.596</td><td>0.296</td><td>9.1</td><td>978.4</td><td>O K</td></tr><tr><td>8640 min Winter</td><td>99.563</td><td>0.263</td><td>9.1</td><td>859.6</td><td>O K</td></tr><tr><td>10080 min Winter</td><td>99.530</td><td>0.230</td><td>9.1</td><td>744.6</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>180 min Winter</td><td>18.068</td><td>0.0</td><td>1029.8</td><td>192</td></tr><tr><td>240 min Winter</td><td>14.537</td><td>0.0</td><td>1100.1</td><td>248</td></tr><tr><td>360 min Winter</td><td>10.694</td><td>0.0</td><td>1200.5</td><td>364</td></tr><tr><td>480 min Winter</td><td>8.592</td><td>0.0</td><td>1268.8</td><td>478</td></tr><tr><td>600 min Winter</td><td>7.244</td><td>0.0</td><td>1316.7</td><td>592</td></tr><tr><td>720 min Winter</td><td>6.298</td><td>0.0</td><td>1350.1</td><td>704</td></tr><tr><td>960 min Winter</td><td>5.045</td><td>0.0</td><td>1385.0</td><td>922</td></tr><tr><td>1440 min Winter</td><td>3.684</td><td>0.0</td><td>1368.8</td><td>1180</td></tr><tr><td>2160 min Winter</td><td>2.684</td><td>0.0</td><td>2018.2</td><td>1628</td></tr><tr><td>2880 min Winter</td><td>2.141</td><td>0.0</td><td>2123.3</td><td>2084</td></tr><tr><td>4320 min Winter</td><td>1.554</td><td>0.0</td><td>2213.0</td><td>2980</td></tr><tr><td>5760 min Winter</td><td>1.237</td><td>0.0</td><td>2585.8</td><td>3816</td></tr><tr><td>7200 min Winter</td><td>1.035</td><td>0.0</td><td>2699.5</td><td>4624</td></tr><tr><td>8640 min Winter</td><td>0.896</td><td>0.0</td><td>2791.7</td><td>5448</td></tr><tr><td>10080 min Winter</td><td>0.793</td><td>0.0</td><td>2856.2</td><td>6056</td></tr></table>			Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	180 min Winter	99.639	0.339	9.6	1140.2	O K	240 min Winter	99.657	0.357	9.8	1205.9	O K	360 min Winter	99.680	0.380	10.1	1294.4	O K	480 min Winter	99.694	0.394	10.3	1349.6	O K	600 min Winter	99.703	0.403	10.4	1384.8	Flood Risk	720 min Winter	99.708	0.408	10.5	1407.2	Flood Risk	960 min Winter	99.714	0.414	10.6	1427.7	Flood Risk	1440 min Winter	99.712	0.412	10.5	1421.7	Flood Risk	2160 min Winter	99.705	0.405	10.5	1395.3	Flood Risk	2880 min Winter	99.693	0.393	10.3	1346.2	O K	4320 min Winter	99.661	0.361	9.9	1224.7	O K	5760 min Winter	99.628	0.328	9.4	1099.1	O K	7200 min Winter	99.596	0.296	9.1	978.4	O K	8640 min Winter	99.563	0.263	9.1	859.6	O K	10080 min Winter	99.530	0.230	9.1	744.6	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	180 min Winter	18.068	0.0	1029.8	192	240 min Winter	14.537	0.0	1100.1	248	360 min Winter	10.694	0.0	1200.5	364	480 min Winter	8.592	0.0	1268.8	478	600 min Winter	7.244	0.0	1316.7	592	720 min Winter	6.298	0.0	1350.1	704	960 min Winter	5.045	0.0	1385.0	922	1440 min Winter	3.684	0.0	1368.8	1180	2160 min Winter	2.684	0.0	2018.2	1628	2880 min Winter	2.141	0.0	2123.3	2084	4320 min Winter	1.554	0.0	2213.0	2980	5760 min Winter	1.237	0.0	2585.8	3816	7200 min Winter	1.035	0.0	2699.5	4624	8640 min Winter	0.896	0.0	2791.7	5448	10080 min Winter	0.793	0.0	2856.2	6056
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Summary of Results for 100 year Return Period (+30%) <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Control (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>99.482</td><td>0.182</td><td>8.3</td><td>578.9</td><td>O K</td></tr><tr><td>30 min Summer</td><td>99.539</td><td>0.239</td><td>9.1</td><td>774.9</td><td>O K</td></tr><tr><td>60 min Summer</td><td>99.598</td><td>0.298</td><td>9.1</td><td>987.9</td><td>O K</td></tr><tr><td>120 min Summer</td><td>99.657</td><td>0.357</td><td>9.8</td><td>1206.2</td><td>O K</td></tr><tr><td>180 min Summer</td><td>99.688</td><td>0.388</td><td>10.2</td><td>1327.8</td><td>O K</td></tr><tr><td>240 min Summer</td><td>99.708</td><td>0.408</td><td>10.5</td><td>1405.4</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>99.735</td><td>0.435</td><td>10.8</td><td>1510.8</td><td>Flood Risk</td></tr><tr><td>480 min Summer</td><td>99.751</td><td>0.451</td><td>11.0</td><td>1577.5</td><td>Flood Risk</td></tr><tr><td>600 min Summer</td><td>99.762</td><td>0.462</td><td>11.2</td><td>1621.1</td><td>Flood Risk</td></tr><tr><td>720 min Summer</td><td>99.769</td><td>0.469</td><td>11.2</td><td>1649.4</td><td>Flood Risk</td></tr><tr><td>960 min Summer</td><td>99.775</td><td>0.475</td><td>11.3</td><td>1676.5</td><td>Flood Risk</td></tr><tr><td>1440 min Summer</td><td>99.778</td><td>0.478</td><td>11.4</td><td>1686.0</td><td>Flood Risk</td></tr><tr><td>2160 min Summer</td><td>99.775</td><td>0.475</td><td>11.3</td><td>1674.8</td><td>Flood Risk</td></tr><tr><td>2880 min Summer</td><td>99.768</td><td>0.468</td><td>11.2</td><td>1645.1</td><td>Flood Risk</td></tr><tr><td>4320 min Summer</td><td>99.747</td><td>0.447</td><td>11.0</td><td>1558.9</td><td>Flood Risk</td></tr><tr><td>5760 min Summer</td><td>99.722</td><td>0.422</td><td>10.7</td><td>1462.4</td><td>Flood Risk</td></tr><tr><td>7200 min 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Summer</td><td>3.489</td><td>0.0</td><td>2335.0</td><td>1568</td></tr><tr><td>2880 min Summer</td><td>2.783</td><td>0.0</td><td>2445.2</td><td>1976</td></tr><tr><td>4320 min Summer</td><td>2.020</td><td>0.0</td><td>2488.0</td><td>2808</td></tr><tr><td>5760 min Summer</td><td>1.607</td><td>0.0</td><td>3004.3</td><td>3632</td></tr><tr><td>7200 min Summer</td><td>1.346</td><td>0.0</td><td>3136.0</td><td>4408</td></tr><tr><td>8640 min Summer</td><td>1.165</td><td>0.0</td><td>3243.0</td><td>5200</td></tr><tr><td>10080 min Summer</td><td>1.032</td><td>0.0</td><td>3316.2</td><td>5968</td></tr><tr><td>15 min Winter</td><td>118.408</td><td>0.0</td><td>442.8</td><td>34</td></tr><tr><td>30 min Winter</td><td>79.579</td><td>0.0</td><td>596.2</td><td>49</td></tr><tr><td>60 min Winter</td><td>51.031</td><td>0.0</td><td>974.1</td><td>78</td></tr><tr><td>120 min Winter</td><td>31.581</td><td>0.0</td><td>1196.3</td><td>134</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	15 min Summer	99.482	0.182	8.3	578.9	O K	30 min Summer	99.539	0.239	9.1	774.9	O K	60 min Summer	99.598	0.298	9.1	987.9	O K	120 min Summer	99.657	0.357	9.8	1206.2	O K	180 min Summer	99.688	0.388	10.2	1327.8	O K	240 min Summer	99.708	0.408	10.5	1405.4	Flood Risk	360 min Summer	99.735	0.435	10.8	1510.8	Flood Risk	480 min Summer	99.751	0.451	11.0	1577.5	Flood Risk	600 min Summer	99.762	0.462	11.2	1621.1	Flood Risk	720 min Summer	99.769	0.469	11.2	1649.4	Flood Risk	960 min Summer	99.775	0.475	11.3	1676.5	Flood Risk	1440 min Summer	99.778	0.478	11.4	1686.0	Flood Risk	2160 min Summer	99.775	0.475	11.3	1674.8	Flood Risk	2880 min Summer	99.768	0.468	11.2	1645.1	Flood Risk	4320 min Summer	99.747	0.447	11.0	1558.9	Flood Risk	5760 min Summer	99.722	0.422	10.7	1462.4	Flood Risk	7200 min Summer	99.698	0.398	10.4	1367.5	O K	8640 min Summer	99.676	0.376	10.1	1280.0	O K	10080 min Summer	99.655	0.355	9.8	1198.2	O K	15 min Winter	99.503	0.203	8.8	648.6	O K	30 min Winter	99.566	0.266	9.1	869.3	O K	60 min Winter	99.631	0.331	9.4	1108.1	O K	120 min Winter	99.695	0.395	10.3	1354.1	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	118.408	0.0	389.2	34	30 min Summer	79.579	0.0	536.3	49	60 min Summer	51.031	0.0	868.4	78	120 min Summer	31.581	0.0	1072.9	138	180 min Summer	23.488	0.0	1188.5	196	240 min Summer	18.897	0.0	1264.4	254	360 min Summer	13.902	0.0	1368.1	372	480 min Summer	11.169	0.0	1433.1	490	600 min Summer	9.417	0.0	1473.0	608	720 min Summer	8.187	0.0	1495.4	724	960 min Summer	6.558	0.0	1504.3	960	1440 min Summer	4.789	0.0	1460.7	1198	2160 min Summer	3.489	0.0	2335.0	1568	2880 min Summer	2.783	0.0	2445.2	1976	4320 min Summer	2.020	0.0	2488.0	2808	5760 min Summer	1.607	0.0	3004.3	3632	7200 min Summer	1.346	0.0	3136.0	4408	8640 min Summer	1.165	0.0	3243.0	5200	10080 min Summer	1.032	0.0	3316.2	5968	15 min Winter	118.408	0.0	442.8	34	30 min Winter	79.579	0.0	596.2	49	60 min 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Michael A Jennings Associates		Page 2																																																																																																																																																																																
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Michael A Jennings Associates		Page 4
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Date 19.03.13 File Southern Attenuation Pond - ...	Designed by C.Pendle Checked by	
Micro Drainage Source Control 2013.1		

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.300

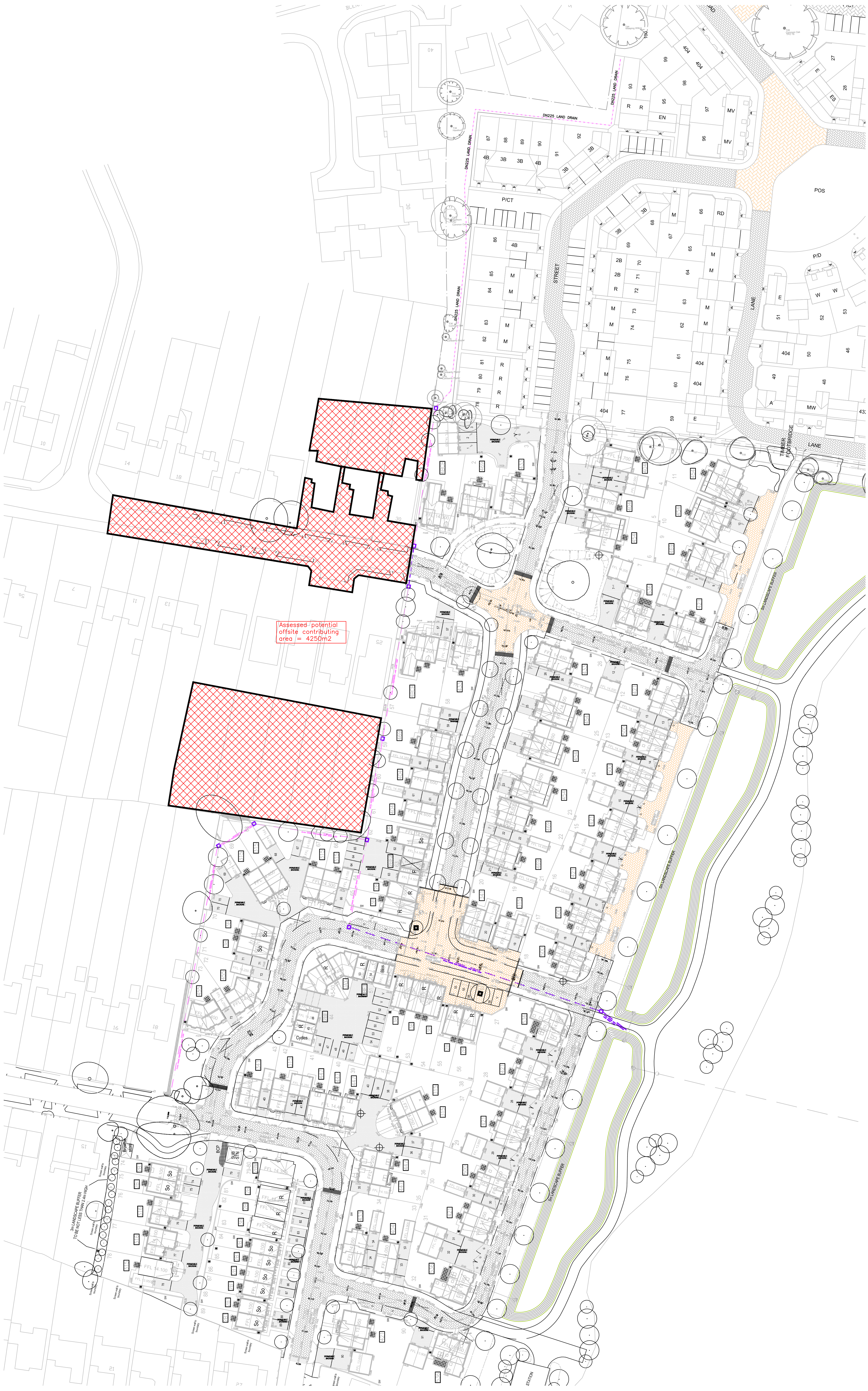
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2960.0	0.700	4671.0	1.400	0.0	2.100	0.0
0.100	3194.0	0.701	0.0	1.500	0.0	2.200	0.0
0.200	3435.0	0.900	0.0	1.600	0.0	2.300	0.0
0.300	3673.0	1.000	0.0	1.700	0.0	2.400	0.0
0.400	3919.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	4167.0	1.200	0.0	1.900	0.0		
0.600	4417.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Outflow Control

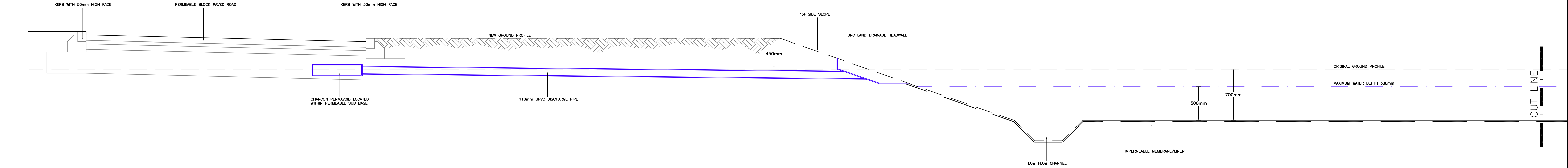
Design Head (m) 0.530 Hydro-Brake® Type Md7 Invert Level (m) 99.300
Design Flow (l/s) 12.0 Diameter (mm) 156

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	18.0	3.000	28.4	7.000	43.5
0.200	8.8	1.400	19.4	3.500	30.7	7.500	45.0
0.300	9.0	1.600	20.8	4.000	32.8	8.000	46.5
0.400	10.4	1.800	22.0	4.500	34.8	8.500	47.9
0.500	11.6	2.000	23.2	5.000	36.7	9.000	49.3
0.600	12.7	2.200	24.4	5.500	38.5	9.500	50.6
0.800	14.7	2.400	25.4	6.000	40.2		
1.000	16.4	2.600	26.5	6.500	41.9		

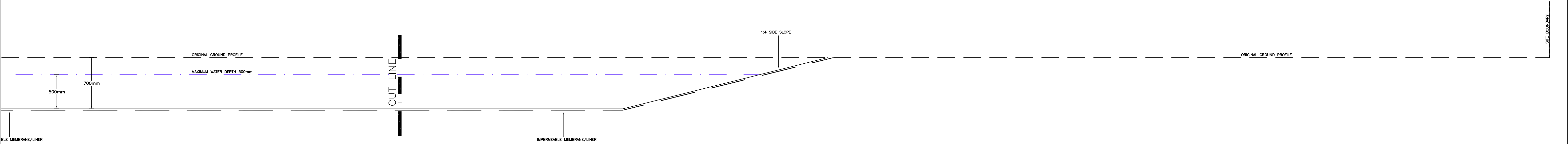
©1982-2012 Micro Drainage Ltd



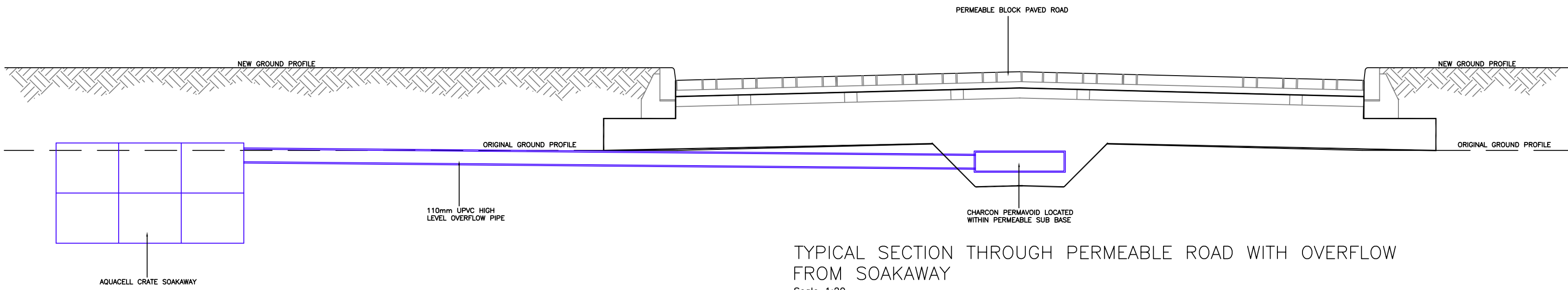
Assessed potential
offsite contributing
area = 4250m²



TYPICAL SECTION THROUGH IMPERMEABLE ATTENUATION POND
Scale 1:20



TYPICAL SECTION THROUGH IMPERMEABLE ATTENUATION POND
Scale 1:20



TYPICAL SECTION THROUGH PERMEABLE ROAD WITH OVERFLOW
FROM SOAKAWAY
Scale 1:20

PRELIMINARY				
REV. No.	DATE	DESCRIPTION	INITIALS	
Client				
				
Project		CIVIL AND STRUCTURAL ENGINEERS		
Manor Farm Denvilles		58-62 Oak Street, Abingdon Oxon, OX14 5BZ Tel: 01235 555173 Fax: 01235 523228		
				
Title	Scale	Date	Drawing No.	Rev
Drainage sections	As shown	Mar 13	4527:71	-
	Checked KTG	Drawn KTG		

APPENDIX H
ENVIRONMENT AGENCY CORRESPONDENCE

MJA CONSULTING
CIVIL AND STRUCTURAL ENGINEERS

58-62 Ock Street, Abingdon, Oxon OX14 5BZ
Tel: (01235) 555173 Fax: (01235) 523226

Environment Agency
Solent & South Downs Area Office
Colvedene Court (Wessex Business Park)
Wessex Way
Colden Common
Winchester
SO21 1WP

Our ref: CP/13:0043/4527
Date: 21st January 2013
E-mail: ChrisP@mjaconsulting.co.uk

HA/2012/113691/01-L01

Pre-application Enquiry
Flood Risk Assessment
Manor Farm and Copeys Nursery, Hallett Road, Havent

Dear Miss Giles,

Thank you for your comments relating to the FRA submitted for the above development.

Please see the revised Flood Risk Assessment (Rev C) which has been updated to cover the deficiencies highlighted in your objection letter of 27.12.12.

1. Consider the impact of overland flow into the Nore Farm Stream given the known flooding problems experienced downstream.

Please refer to paragraphs: 5.4.6, 7.9 & 9.10

2. Appropriately address the likely infiltration problems at the site.

Please refer to paragraphs: 3.2.6, 5.4.4-5.4.6, 7.8-7.9 & 9.9

I trust you find the amendments to the FRA acceptable to overcome the objection, however should you require additional information then please do not hesitate to contact me.

Yours sincerely,



CHRIS PENDLE
FOR MJA CONSULTING



MICHAEL A JENNINGS ASSOCIATES LIMITED

Managing Director: P P Berrill Directors: K T Gebhart, J A Kerton BEng CEng MICE,

Consultant: G J Ford BSc CEng MICE MIHT

Registered Office: 24 Bath Street, Abingdon OX14 3QH

Incorporated in England & Wales Company Number: 4414364 VAT No. 787 8086 61



MJA CONSULTING
CIVIL AND STRUCTURAL ENGINEERS

58-62 Ock Street, Abingdon, Oxon OX14 5BZ
Tel: (01235) 555173 Fax: (01235) 523226

Environment Agency
Solent & South Downs Area Office
Colvedene Court (Wessex Business Park)
Wessex Way
Colden Common
Winchester
SO21 1WP

Our ref: CP/13:0001/4527
Date: 01st March 2013
E-mail: ChrisP@mjaconsulting.co.uk

HA/2013/113856/02-L01

Pre-application Enquiry
Flood Risk Assessment
Manor Farm and Copeys Nursery, Hallett Road, Havent

Dear Miss Giles,

Thank you for your recent comments relating to the FRA submitted for the above development.

Please find enclosed the revised Flood Risk Assessment (Rev E) which has been updated to cover the issues highlighted in your letter of 28.02.13 and my subsequent discussion with George Woodward on the 01.03.13.

Please also find below the individual responses to each of the comments:

You intend to intercept overland flows from the existing developed area to the west of your site and then convey these flows into your proposed drainage system. However, you have not taken account of these overland flows in your drainage calculations and storage requirements. This needs to be done and additional storage provided if necessary, to ensure that the existing properties are drained effectively and that flood risk is not increased to either the existing or proposed properties.

FRA Ref: Appendix D & 6.4.2

The attenuation ponds are presently shown as indicative in terms of size and available storage volumes.

Although we feel the occurrence of overland flow from the existing development to the west will be very rare, a full allowance for the potential runoff from this area will be included in the pond detailed design storage calculations.

This will ensure that the existing properties are drained effectively and that flood risk is not increased to either the existing or proposed properties.

Please see an update to the 'Post-Development Runoff' calculation in Appendix D of the FRA to also include an allowance for this offsite runoff.



MICHAEL A JENNINGS ASSOCIATES LIMITED

Managing Director: P P Berrill Directors: K T Gebhart, J A Kerton BEng CEng MICE,

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We note that you intend to raise ground levels even further than before, in the region of 450mm above existing levels, using a free-draining aggregate. This would result in a relatively permeable layer lying above the existing relatively impermeable ground, with the proposed soakaways cutting through both. This could lead to water moving laterally out of the soakaways through the fill material. What implications does this have from a geotechnical point of view? Could lateral flows travel sub-surface along the prevailing topography and affect either the existing or proposed properties?

FRA Ref: 5.2.5 & 5.5.3

Following discussions with our geotechnical engineer (Dominic Brightman of Wilson Bailey), whilst we feel that there would be a suitable level of interaction through the free-draining stone material used to raise the site and the existing strata, we acknowledge that the lower infiltration rates of the existing strata could cause residual lateral flows within the free-draining stone material.

The possibility of high groundwater and for lateral flow has been considered within the geotechnical design of the house foundations, potential issues will be mitigated through the use of vibro stone columns.

The topography of the site would suggest that any lateral groundwater flow at the site will be in an easterly direction away from the existing development and towards the Nore Farm Stream.

Any lateral flow that has not infiltrated into the existing strata will be collected at the eastern boundary of the site by a series of collector cells and distributed into the attenuation ponds.

This will ensure that the peak flow rate into the Nore Farm stream is not increased as a result of the raising of the site.

The borehole log in Appendix E indicates extremely high groundwater levels over this winter, in one location only 210mm below the ground. Whilst it is important that infiltration is included in the drainage design to reduce the amount of runoff entering the Nore Farm Stream as much as possible, there is a real risk of groundwater infiltration into the attenuation ponds. In your design, the attenuation ponds are effectively providing a backup means of safely attenuating runoff, and would only come into operation when the soakaways cannot function, i.e. when groundwater is high. Because of this we recommend that the ponds are lined to prevent groundwater ingress interfering with their designed operation. Will this change your storage requirements?

FRA Ref: 5.2.4, 7.10, 7.15 & 9.10

All attenuation ponds will be lined with an impermeable lining to prevent any interaction with the groundwater and the lack of infiltration within these ponds will be accounted for in the detailed design sizing calculations.

You state that a management company will own and maintain all of the SUDS features. Given the importance of the maintenance for the functioning of the system we recommend that this arrangement is incorporated into a Section 106 agreement. This would obviously be a matter of discussion for yourselves and Havant Borough Council though.

FRA Ref: 7.16

The arrangement for the long term maintenance of SUDS will be incorporated into a S106 agreement.

I trust you find the amendments to the FRA acceptable to overcome the objection, however should you require additional information then please do not hesitate to contact me.

Yours sincerely,



CHRIS PENDLE
FOR MJA CONSULTING

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Environment Agency
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Wessex Way
Colden Common
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SO21 1WP

Our ref: CP/13:0001/4527
Date: 19th March 2013
E-mail: ChrisP@mjaconsulting.co.uk

HA/2013/113856/03-L01

Pre-application Enquiry
Flood Risk Assessment
Manor Farm and Copeseys Nursery, Hallett Road, Havent

Dear Miss Giles,

Thank you for your recent comments relating to the FRA submitted for the above development.

Please find enclosed the revised Flood Risk Assessment (**Rev F**) which has been updated to cover the issues highlighted in your letter of 13.03.13.

Please also find below the individual responses to each of the comments:

Following the Environment Agency's comments, the ponds are now lined to prevent direct groundwater ingress, but there is still the potential for groundwater infiltration of the ponds via the overflows from the soakaways and from the collector cells for intercepting lateral flow. How will this be controlled? In addition, the additional storage volume required now that the pond is lined has not been calculated.

The principle surface water drainage strategy for the proposed site is infiltration, the attenuation ponds are designed solely as a protection measure to intercept any overland flows from the existing houses to the west and any overflows from the SuDS features within the proposed development (soakaways & permeable block paving) which subsequently MAY include high groundwater flows via the overflow system.

Whilst it may not be possible to completely prevent the infiltration of groundwater into the pond via overflows, it should be noted that only shallow soakaways will be used and the level of the overflows within the soakaways and collector cells within the permeable paving will be set as high as possible (approximately 150-300mm) above the highest recorded groundwater level (Jan 2013).



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Please find in Appendix G a set of calculations for the two attenuation ponds.

These have been calculated for the worst possible case scenario of zero infiltration through all the SuDS features across the whole site resulting in all impermeable areas from proposed development and the potential runoff from offsite areas discharging directly into the ponds.

There is no infiltration allowance through the ponds within the calculations.

These ponds will also have a minimum freeboard of 200mm.

We have included an additional 25% contingency of the total contributing impermeable area to allow for the potential groundwater infiltration into the attenuation ponds via the overflow system.

Southern Attenuation Pond Criteria:

Site total impermeable area = 1.69ha

Offsite total impermeable area = 0.425ha

+25% for groundwater infiltration = 2.64ha

Design Storm = 100year +30% Climate Change

Max Discharge = 16 l/s

Max Water Depth =0.5m

Northern Attenuation Pond Criteria:

Site total impermeable area = 1.45ha

Offsite total impermeable area = 0ha

+25% for groundwater infiltration = 1.81ha

Design Storm = 100year +30% Climate Change

Max Discharge = 12 l/s

Max Water Depth =0.4m

Following the Environment Agency's comments regarding the lack of consideration of overland flows from offsite in the drainage design, an allowance has been made in the drainage calculations for a small area of additional land. How has this area been derived? The FRA should include a plan of the indicative catchment draining into the site.

Please find in Appendix G a plan highlighting the 4250m² of offsite land which could potentially contribute to overland flows onto the proposed site.

Please note that the offsite contributing area has been derived from areas of known historic flooding and via anecdotal evidence from residents.

Given the 2 points above the attenuation ponds may potentially need to be larger to provide additional storage. Is there space on site for these ponds and are they deliverable given the requirement for public open space on the site? Do Havant Borough Council accept the loss of this public open space to make way for the ponds? If they do not, will the drainage strategy need to be revised?

Please see revised layout plan within the FRA Appendix A highlighting the required area of the proposed attenuation ponds.

Although the ponds are situated within POS, as a backup for the drainage system and due to being lined with an impermeable membrane, they will be predominantly dry throughout the year and will only come into operation during exceedance events or as a result of exceptionally high groundwater levels over and above those recorded at the end of 2012 (one of the wettest years in record in England).

Also, as they will be only 0.7m deep from top of bank to base with side slopes of 1:4 they can be safely utilised as POS when dry.

The developer intends to raise ground levels substantially (up to 450mm) to increase the depth to the water table. The impacts of this ground raising on the drainage of the existing houses to the west have not been assessed in detail, other than noting that land drains will be installed along the boundary of the development. Will these drains be sufficient to address the localised flooding issues raised by residents? In addition, do Havant Borough Council accept the land raising proposals, given the potential for it to impact on other planning matters? If they do not, will the drainage strategy need to be revised?

Presently the proposed site does not have an influence on the occurrence of flooding events to the existing houses to the west.

These houses currently sit upstream of the proposed site and flood either due to a combination of blocked road gullies and possible lack of maintenance of the existing drainage regimes causing overland flooding to gardens.

If this flood water reaches the proposed site it infiltrates into the existing strata.

The topography of the existing site would suggest that lateral groundwater flows will be in an easterly direction away from the existing development and towards the Nore Farm Stream.

The ground level raising of the proposed site up to 450mm using a free draining material will not have a negative impact on the ability and rate of any offsite overland flood water infiltrating into the soils on the proposed site or reduce the groundwater lateral flows below the site, and will not affect the drainage capability of the existing houses.

Likewise, the raising of the site will not increase the flood risk to the existing houses due to runoff from the proposed site.

Due to the proposed topography of the development any overland runoff or lateral groundwater flows will continue to flow eastwards away from the existing houses.

The proposals include a network of shallow land drains at the western boundary of the proposed site which will intercept any overland flows from the existing houses to the west of the development and any residual runoff from the proposed site entrance roads that is not collected by a SuDS system.

This will provide a level of betterment over current conditions by providing a positive drainage route for overland flood water from the existing houses without relying wholly on infiltration.

These land drains will consist of perforated 225mm dia pipes laid at no flatter than 1:250, providing a system capable of disposing approximately 33l/s into the proposed attenuation ponds.

The drainage design calls for the new development's roads to be permeably paved. Have Hampshire Highways been consulted on whether they will adopt them? If they will not, will the roads be privately maintained or will the drainage strategy need to be revised?

The roads are to be private and will be maintained through a management company.

These will however be constructed to an adoptable standard.

*In the latest version of the drainage strategy plan (ref 4527:70, Revision **D** produced **02.04.13**) two basins are now shown adjacent the road junction in the centre of the development. What is the function of these basins? Are they for drainage purposes?*

No, these are not for drainage purposes.

These are embankments created where we are proposing to raise the surrounding round levels around retained existing trees.

Havant Borough Council and the developer need to agree on a Section 106 agreement to cover management and maintenance of the sustainable drainage. Have Havant Borough Council included this within their draft heads of terms? Management and maintenance is a critical issue for the proper functioning of the drainage system and we believe it should be included within a S106.

The developer has agreed to Havant Borough Council imposing a 'SuDs Management Scheme'.

I trust you find the amendments to the FRA acceptable to overcome the objection, however should you require additional information then please do not hesitate to contact me.

Yours sincerely,



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SO21 1WP

Our ref: CP/13:0001/4527
Date: 2nd April 2013
E-mail: ChrisP@mjaconsulting.co.uk

HA/2013/113856/04-L01

Pre-application Enquiry

Flood Risk Assessment

Manor Farm and Copses Nursery, Hallett Road, Havent

Dear Miss Giles,

Thank you for your recent comments relating to the FRA submitted for the above development.

Please find enclosed the revised Flood Risk Assessment (**Rev I**) which has been updated to cover the issues highlighted in your letter of 27.03.13.

Please also find below the individual responses to each of the comments:

The proposed discharge rates for the north and south ponds (serving the Copses Nursery site and the Manor Farm respectively) appear to have been assigned the wrong way round.

The proposed runoff rate for both sites combined has been calculated as 28 litres a second (l/s), which represents the greenfield runoff rate. MJA Consulting have assigned allowable discharge rates of 12 l/s from Copses Nursery and 16 l/s from Manor Farm, based upon the differing proportions that these 2 areas contribute to the site area when taken as a whole. However this does not appear to reflect the contributing areas accurately. The Copses Nursery site has an area of 4.48 Ha, while the Manor Farm site has an area of 3.37 Ha, representing 57% and 43% of the total site area respectively. It appears that the permitted discharge rates should therefore be 16 l/s for Copses Nursery and 12 l/s for Manor Farm.

As the required storage volumes are based upon the discharge rates above, the uncertainty over the accuracy of these rates means that it is unclear whether sufficient volume has been provided in either the north or south ponds. We are concerned that potential inaccuracies could lead to the provision of insufficient storage and clarity on this matter is required.

Given that either site could currently be developed separately, it is critical that the drainage for each is capable of working on its own without reliance on the other site.

The calculations and discharge rates do not appear to demonstrate this. MJA Consulting need to clearly explain how they have decided to split the flows between the north and south ponds. They also need to clearly show the total pond volume required to safely store runoff, and indicate how much volume each pond actually provides.

Following the Environment Agency's comments, the allowable discharge rates for the northern and southern ponds have been reassigned as follows:

Northern Pond (Copseys Nursery)

Existing Greenfield Area = 4.48ha

Greenfield Runoff = 16l/s

Maximum discharge = 16l/s

Impermeable Catchment = 1.81ha

Required attenuation volume (1:100y + 30% storm) = 1112m³

Actual volume of pond at 0.5m depth = 1496m³

0.7m depth = 2194m³

Maximum water depth (1:100y + 30% storm) = 0.382m

Southern Ponds (Manor Farm)

Existing Greenfield Area = 3.37ha

Greenfield Runoff = 12l/s

Maximum discharge = 12l/s

Impermeable Catchment = 2.64ha

Required attenuation volume (1:100y + 30% storm) = 1916m³

Actual volume of pond at 0.5m depth = 1778m³

0.7m depth = 2661m³

Maximum water depth (1:100y + 30% storm) = 0.533m

The volume of the attenuation ponds has been added to the drainage layout plan.

Please note the volume indicated for the southern ponds takes into account the overall volume of all three linked ponds at 700mm depth.

Following the meeting, MJA Consulting were going to revise the proposed drainage plan in Appendix A of the FRA to show the entire site (as part of Copseys Nursery was clipped off) but this has not been done in the latest revisions of the FRA. This should also be addressed.

The overall drainage layout plan Rev D (Appendix A) now shows the entire development boundary.

The proposed ground raising and potential for groundwater infiltration was also discussed at the meeting following the previous points raised by us in response to Revision E of the FRA (our reference: HA/2013/113856/03). To save any misunderstanding MJA Consulting or Barratt Homes should confirm if the ponds are to be built in areas of raised land or if only the proposed housing would be raised up. An indicative cross-section of the ponds and development showing the soakaway-overflow/collector cell-pond arrangement would be useful.

The ponds will not be within areas of raised land, only the houses.

Please refer to Appendix G, drawing 4527:71 for an indicative cross section of the ponds in relation to the development.