

TECHNICAL NOTE – Review of Soil Infiltration Test Results

Introduction

Travis Baker Ltd have been approached by Persimmon Homes North Midlands to review infiltration test results supplied by their Geo-technical Consultants for the above site. This technical note reviews the infiltration potential against the current Travis Baker Drainage Strategy to assess the potential benefit.

Documents Reviewed:

- MEC Soakaway Test Report 29018-CALC-0401
- Travis Baker S104 Drainage Layout(s) 21246 103/104
- 21246 Hydraulic Model

Nation Planning Policy Framework – Sustainable Drainage Systems

Current Building Regulations and National Best Practice guidance states that;

Rainwater from a surface water drainage system shall discharge to one of the following, listed in order of priority:

- An adequate soakaway or some other adequate infiltration system or where that is not reasonably practicable,
- A watercourse or where that is not reasonably practicable,
- A sewer

Given the above, the development drainage system should seek to exploit any infiltration potential within the site subsoils as a primary means of surface water disposal.

MEC Soakaway Test Results

The report confirms that the soakaway tests were conducted and recorded in accordance with BRE365. Design infiltration rates are to be based upon the poorest test results of three consecutive tests taken at a location representative of the basin location.

For the purposes of the assessment the hydraulic assessment has been based upon the results of SA202, the location of which is within the proposed basin footprint.

The recommended design infiltration rate is stated as 1.96×10^{-5} m/s. The hydraulic model has been updated to apply this infiltration rate to the base area of the basin. The long term effects of siltation and reduced infiltration have been considered by applying no infiltration potential to the sides of the basin, despite these being constructed through granular material.

Hydraulic Modelling Conclusions

The modelling outputs demonstrate that an infiltration rate of 0.2l/s can be expected from the basin area for all modelled design storms. The discharge rate is not sufficiently high to omit the need for a piped outfall from the basin, therefore a secondary discharge to the watercourse north of Thurlaston Lane is required.

The outfalls for development surface water system accords with the hierarchical approach stipulated in the NPPF and Building Regulations, therefore should be supported by the Lead Local Flood Authority.

The base area of the basin should be constructed in free draining material that encourages infiltration to ground and reduces the likelihood of the base area self seeding with vegetation.

Any embankment works that potentially impound flood water in the basin should be constructed in impermeable material and in accordance with a site specific Earthworks specification.

Hydraulic Modell Outputs are appended to this Technical Note.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	9.999
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.067	5.00	101.510	Manhole	Adoptable	1200	447836.105	298006.451	1.434
2	0.074	5.00	100.770	Manhole	Adoptable	1200	447841.544	298036.814	1.438
3	0.151	5.00	100.030	Manhole	Adoptable	1200	447840.311	298067.254	1.505
4	0.068	5.00	99.180	Manhole	Adoptable	1200	447838.018	298102.555	1.505
5	0.049	5.00	100.330	Manhole	Adoptable	1200	447768.594	298109.535	1.428
6	0.092	5.00	99.270	Manhole	Adoptable	1200	447821.484	298105.361	1.432
7	0.017	5.00	99.010	Manhole	Adoptable	1200	447832.719	298110.966	1.520
8	0.023	5.00	98.620	Manhole	Adoptable	1200	447837.557	298123.434	1.575
9	0.057	5.00	97.910	Manhole	Adoptable	1200	447836.398	298140.474	1.642
10	0.090	5.00	96.900	Manhole	Adoptable	1350	447840.683	298163.292	1.762
11A	0.000	5.00	97.675	Manhole	Adoptable	1350	447816.965	298169.719	2.697
11	0.000	5.00	96.500	Manhole	Adoptable	1350	447788.660	298180.121	1.725
12	0.040	5.00	103.550	Manhole	Adoptable	1200	447744.479	297997.866	2.225
13	0.036	5.00	102.540	Manhole	Adoptable	1200	447740.720	298023.669	1.486
14	0.198	5.00	101.300	Manhole	Adoptable	1200	447731.779	298085.047	1.981
15	0.000	5.00	101.120	Manhole	Adoptable	1200	447732.570	298094.033	2.395
16	0.015	5.00	100.800	Manhole	Adoptable	1200	447739.575	298105.961	2.133
17	0.034	5.00	100.110	Manhole	Adoptable	1200	447731.722	298123.693	1.960
18	0.080	5.00	98.210	Manhole	Adoptable	1200	447726.082	298162.064	1.987
19	0.150	5.00	98.054	Manhole	Adoptable	1200	447740.670	298164.205	2.014
20	0.000	5.00	96.500	Manhole	Adoptable	1200	447743.323	298180.746	1.800
21	0.000		96.500	Manhole	Adoptable	1350	447736.093	298184.442	2.000
22	0.000		96.500	Manhole	Adoptable	3000	447730.742	298186.896	2.050
23	0.000		92.520	Manhole	Adoptable	1350	447732.099	298216.398	1.575
24	0.000		92.469	Manhole	Adoptable	1350	447729.580	298222.320	1.575
CP1	0.075	5.00	102.560	Manhole	Adoptable	1200	447749.960	298018.596	1.206

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	✓
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	5	0
30	0	5	0
100	40	5	0

Node 22 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	94.450	Product Number	CTL-SHE-0159-1400-1700-1400
Design Depth (m)	1.700	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	14.0	Min Node Diameter (mm)	1500

Node 22 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.01152	Safety Factor	2.0	Invert Level (m)	94.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	140.0	140.0	2.000	942.0	942.0

Results for 1 year +5% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	100.129	0.053	9.9	0.1110	0.0000	OK
15 minute winter	2	10	99.411	0.079	20.8	0.1741	0.0000	OK
15 minute winter	3	10	98.625	0.100	42.5	0.3236	0.0000	OK
15 minute winter	4	11	97.811	0.136	52.1	0.2832	0.0000	OK
15 minute winter	5	10	98.949	0.047	7.3	0.0869	0.0000	OK
15 minute winter	6	10	97.922	0.084	20.7	0.2081	0.0000	OK
15 minute winter	7	11	97.630	0.140	74.2	0.1912	0.0000	OK
15 minute winter	8	11	97.170	0.125	77.7	0.1804	0.0000	OK
15 minute winter	9	11	96.402	0.134	85.9	0.2489	0.0000	OK
15 minute winter	10	11	95.370	0.232	98.8	0.5816	0.0000	OK
15 minute winter	11A	11	95.204	0.226	99.2	0.3234	0.0000	OK
15 minute winter	11	12	95.000	0.225	98.6	0.3214	0.0000	OK
15 minute winter	12	10	101.375	0.050	5.9	0.0755	0.0000	OK
15 minute winter	13	11	101.130	0.076	22.1	0.1245	0.0000	OK
15 minute winter	14	10	99.430	0.111	50.9	0.3582	0.0000	OK
15 minute winter	15	10	98.905	0.180	50.0	0.2034	0.0000	OK
15 minute winter	16	11	98.787	0.120	52.2	0.1530	0.0000	OK
15 minute winter	17	11	98.247	0.097	57.2	0.1455	0.0000	OK
15 minute winter	18	11	96.401	0.178	68.6	0.3516	0.0000	OK
15 minute winter	19	11	96.157	0.117	89.7	0.3148	0.0000	OK
120 minute winter	20	84	94.956	0.256	79.9	0.2898	0.0000	OK
120 minute winter	21	98	94.944	0.444	122.4	0.6354	0.0000	OK
120 minute winter	22	100	94.937	0.487	74.1	102.8233	0.0000	SURCHARGED
120 minute winter	23	100	91.022	0.077	14.0	0.1101	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	9.8	1.015	0.120	0.2991	
15 minute winter	2	1.001	3	20.2	1.673	0.250	0.3680	
15 minute winter	3	1.002	4	42.0	1.633	0.243	0.9120	
15 minute winter	4	1.003	7	51.6	1.632	0.340	0.3146	
15 minute winter	5	2.000	6	7.1	0.741	0.096	0.5164	
15 minute winter	6	2.001	7	20.2	1.568	0.262	0.1615	
15 minute winter	7	1.004	8	74.5	2.480	0.366	0.4019	
15 minute winter	8	1.005	9	78.0	2.677	0.328	0.4977	
15 minute winter	9	1.006	10	86.3	2.559	0.395	0.9310	
15 minute winter	10	4.001	11A	99.2	1.407	0.616	1.7332	
15 minute winter	11A	4.002	11	98.6	1.438	0.602	2.0680	
15 minute winter	11	1.008	21	97.5	1.020	0.518	7.7362	
15 minute winter	12	3.000	13	5.8	0.640	0.110	0.2387	
15 minute winter	13	3.001	14	21.6	1.397	0.248	0.9684	
15 minute winter	14	3.002	15	50.0	2.666	0.396	0.1666	
15 minute winter	15	3.003	16	50.1	1.426	0.699	0.4849	
15 minute winter	16	3.004	17	52.5	2.288	0.289	0.4458	
15 minute winter	17	3.005	18	57.5	1.824	0.231	1.2274	
15 minute winter	18	3.006	19	68.8	2.000	0.556	0.5079	
15 minute winter	19	3.007	20	89.7	3.390	0.296	0.4952	
120 minute winter	20	3.008	21	93.4	0.797	0.082	1.1886	
120 minute winter	21	1.009	22	74.1	0.761	0.269	1.0915	
120 minute winter	22	1.010	23	14.0	2.571	0.037	0.1606	
120 minute winter	22	Infiltration		0.2				
120 minute winter	23	1.011	24	14.0	0.919	0.079	0.0980	180.4

Results for 1 year +5% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	24	100	90.964	0.070	14.0	0.0000	0.0000	OK
15 minute winter	CP1	10	101.408	0.054	11.1	0.1308	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	CP1	5.002	13	11.0	1.168	0.125	0.1001	

Results for 30 year +5% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	100.160	0.084	24.3	0.1766	0.0000	OK
15 minute winter	2	10	99.467	0.135	51.0	0.2980	0.0000	OK
15 minute winter	3	11	98.696	0.170	104.6	0.5521	0.0000	OK
15 minute winter	4	12	98.180	0.505	128.4	1.0496	0.0000	SURCHARGED
15 minute winter	5	10	98.976	0.074	17.8	0.1374	0.0000	OK
15 minute winter	6	12	98.111	0.273	50.9	0.6766	0.0000	SURCHARGED
15 minute winter	7	12	98.015	0.525	179.5	0.7172	0.0000	SURCHARGED
15 minute winter	8	12	97.629	0.584	183.8	0.8395	0.0000	SURCHARGED
15 minute winter	9	12	97.130	0.862	186.9	1.6041	0.0000	SURCHARGED
15 minute winter	10	12	96.257	1.119	213.1	2.8024	0.0000	SURCHARGED
15 minute winter	11A	13	95.921	0.943	200.7	1.3501	0.0000	SURCHARGED
15 minute winter	11	13	95.552	0.777	200.2	1.1125	0.0000	SURCHARGED
15 minute winter	12	10	101.404	0.079	14.5	0.1198	0.0000	OK
15 minute winter	13	10	101.180	0.126	54.4	0.2072	0.0000	OK
15 minute winter	14	11	99.806	0.487	125.3	1.5721	0.0000	SURCHARGED
15 minute winter	15	11	99.125	0.400	116.0	0.4521	0.0000	SURCHARGED
15 minute winter	16	11	98.871	0.204	120.7	0.2604	0.0000	OK
15 minute winter	17	11	98.303	0.153	131.9	0.2295	0.0000	OK
15 minute winter	18	11	96.716	0.493	158.8	0.9738	0.0000	SURCHARGED
15 minute winter	19	11	96.241	0.201	207.0	0.5407	0.0000	OK
180 minute winter	20	180	95.462	0.762	57.7	0.8621	0.0000	SURCHARGED
180 minute winter	21	176	95.463	0.963	102.9	1.3777	0.0000	SURCHARGED
180 minute winter	22	180	95.462	1.012	105.3	327.5776	0.0000	SURCHARGED
180 minute summer	23	92	91.022	0.077	14.0	0.1102	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	24.1	1.261	0.297	0.5894	
15 minute winter	2	1.001	3	49.8	2.087	0.615	0.7285	
15 minute winter	3	1.002	4	103.7	1.865	0.601	1.9765	
15 minute winter	4	1.003	7	124.1	1.808	0.817	0.7000	
15 minute winter	5	2.000	6	17.5	0.889	0.237	1.3213	
15 minute winter	6	2.001	7	49.2	1.628	0.639	0.4994	
15 minute winter	7	1.004	8	175.4	2.785	0.862	0.9418	
15 minute winter	8	1.005	9	166.2	2.938	0.698	1.2027	
15 minute winter	9	1.006	10	180.5	2.563	0.825	1.9345	
15 minute winter	10	4.001	11A	200.7	1.820	1.245	2.7103	
15 minute winter	11A	4.002	11	200.2	1.816	1.222	3.3261	
15 minute winter	11	1.008	21	199.3	1.258	1.058	12.7251	
15 minute winter	12	3.000	13	14.3	0.811	0.270	0.4621	
15 minute winter	13	3.001	14	53.4	1.542	0.612	1.9450	
15 minute winter	14	3.002	15	116.0	2.918	0.917	0.3525	
15 minute winter	15	3.003	16	115.6	1.746	1.612	0.8373	
15 minute winter	16	3.004	17	120.3	2.763	0.661	0.8452	
15 minute winter	17	3.005	18	131.4	2.160	0.528	2.0686	
15 minute winter	18	3.006	19	156.0	2.374	1.259	0.8883	
15 minute winter	19	3.007	20	205.4	3.603	0.677	1.0942	
180 minute winter	20	3.008	21	52.7	0.720	0.046	2.0486	
180 minute winter	21	1.009	22	105.3	0.901	0.383	1.0928	
180 minute winter	22	1.010	23	14.0	2.572	0.037	0.1608	
180 minute winter	22	Infiltration		0.2				
180 minute summer	23	1.011	24	14.0	0.919	0.079	0.0981	310.8

Results for 30 year +5% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute summer	24	92	90.964	0.070	14.0	0.0000	0.0000	OK
15 minute winter	CP1	10	101.444	0.090	27.2	0.2192	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	CP1	5.002	13	27.0	1.432	0.307	0.1989	

Results for 100 year +40% CC +5% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	100.879	0.803	44.2	1.6958	0.0000	SURCHARGED
15 minute winter	2	12	100.718	1.386	86.6	3.0648	0.0000	FLOOD RISK
15 minute winter	3	12	100.008	1.483	158.1	4.8004	0.0000	FLOOD RISK
15 minute winter	4	10	99.180	1.505	194.5	3.1304	17.6274	FLOOD
15 minute winter	5	11	99.548	0.646	32.3	1.1966	0.0000	SURCHARGED
15 minute winter	6	11	99.270	1.432	90.8	3.5514	2.3525	FLOOD
15 minute winter	7	10	99.010	1.520	186.0	2.0763	2.9626	FLOOD
15 minute winter	8	10	98.559	1.514	181.7	2.1777	0.0000	FLOOD RISK
15 minute winter	9	10	97.910	1.642	218.3	3.0541	5.1427	FLOOD
30 minute winter	10	18	96.900	1.762	234.8	4.4120	3.1578	FLOOD
30 minute winter	11A	24	96.545	1.567	226.5	2.2428	0.0000	SURCHARGED
30 minute winter	11	24	96.142	1.367	226.0	1.9566	0.0000	SURCHARGED
15 minute winter	12	13	102.474	1.149	26.4	1.7331	0.0000	SURCHARGED
15 minute winter	13	13	102.437	1.383	86.9	2.2676	0.0000	FLOOD RISK
15 minute winter	14	11	101.300	1.981	187.9	6.3986	2.3505	FLOOD
15 minute winter	15	12	100.170	1.445	166.0	1.6341	0.0000	SURCHARGED
15 minute winter	16	12	99.797	1.130	163.6	1.4457	0.0000	SURCHARGED
15 minute winter	17	12	99.274	1.124	176.3	1.6806	0.0000	SURCHARGED
15 minute winter	18	12	98.141	1.918	216.9	3.7901	0.0000	FLOOD RISK
15 minute winter	19	12	97.331	1.291	301.6	3.4793	0.0000	SURCHARGED
240 minute winter	20	244	96.066	1.366	84.1	1.5454	0.0000	SURCHARGED
240 minute winter	21	236	96.066	1.566	159.6	2.2412	0.0000	SURCHARGED
240 minute winter	22	240	96.066	1.616	159.2	722.1600	0.0000	SURCHARGED
360 minute winter	23	136	91.022	0.077	14.0	0.1102	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	40.6	1.366	0.501	1.2268	
15 minute winter	2	1.001	3	73.1	2.144	0.904	1.2116	
15 minute winter	3	1.002	4	154.2	2.190	0.893	2.4911	
15 minute winter	4	1.003	7	137.0	1.946	0.902	0.7000	
15 minute winter	5	2.000	6	33.7	0.902	0.456	2.1100	
15 minute winter	6	2.001	7	63.3	1.651	0.824	0.4994	
15 minute winter	7	1.004	8	169.9	2.765	0.835	0.9418	
15 minute winter	8	1.005	9	181.2	2.977	0.761	1.2027	
15 minute winter	9	1.006	10	192.3	2.732	0.880	1.9345	
30 minute winter	10	4.001	11A	226.5	2.054	1.406	2.7103	
30 minute winter	11A	4.002	11	226.0	2.049	1.379	3.3261	
30 minute winter	11	1.008	21	224.0	1.414	1.189	12.7251	
15 minute winter	12	3.000	13	23.3	0.870	0.440	1.0370	
15 minute winter	13	3.001	14	74.9	1.883	0.858	2.4668	
15 minute winter	14	3.002	15	166.0	4.175	1.313	0.3525	
15 minute winter	15	3.003	16	153.7	2.183	2.143	0.9719	
15 minute winter	16	3.004	17	162.0	2.747	0.890	1.3656	
15 minute winter	17	3.005	18	178.6	2.536	0.718	2.7311	
15 minute winter	18	3.006	19	214.4	3.045	1.731	1.0383	
15 minute winter	19	3.007	20	293.1	4.163	0.966	1.2790	
240 minute winter	20	3.008	21	78.9	0.722	0.069	2.0486	
240 minute winter	21	1.009	22	159.2	1.005	0.579	1.0928	
240 minute winter	22	1.010	23	14.0	2.572	0.037	0.1608	
240 minute winter	22	Infiltration		0.2				
360 minute winter	23	1.011	24	14.0	0.919	0.079	0.0981	439.4

Results for 100 year +40% CC +5% A Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	24	136	90.964	0.070	14.0	0.0000	0.0000	OK
15 minute winter	CP1	13	102.498	1.144	49.5	2.7871	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	CP1	5.002	13	41.2	1.529	0.468	0.4192	