

Confidential

The Heights Free School,
Caversham

Surface Water Management Plan

For

Turner and Townsend

Project Number: 12243

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1.0 EXECUTIVE SUMMARY

- 1.1.1. The Proposed Development will consist of a two-storey primary school block accommodating 420 pupils, with a Multi Games Area (MUGA), hard informal areas, soft play areas and car parking.
- 1.1.2. This report forms an assessment of the surface water strategy and maintenance plan.
- 1.1.3. The surface water runoff generated by the proposed development will be contained within the site using Sustainable Drainage Systems (SuDS).
- 1.1.4. The development will use SuDS in the form of permeable surfacing and cellular storage.
- 1.1.5. Surface water runoff from the development will infiltrate into the ground assuming that ground conditions are suitable for infiltration methods. It is recommended that a site investigation is undertaken to determine infiltration rates, ground water level and contamination.

2.0 INTRODUCTION

2.1. Brief

- 2.1.1. CampbellReith have been appointed by Turner and Townsend to prepare a Surface Water Management Plan for the site located at the Heights Free School, Caversham, centred on National Grid Reference of 472733 172822.

2.2. Report Structure

- 2.2.1. This report reviews the proposed development and site context and identifies a strategy for managing surface water runoff generated by the proposed redevelopment of the site.

2.3. Limitations

- 2.3.1. This report has been prepared for exclusive use by Turner and Townsend for the purpose of assisting them in evaluating the surface water management strategy and maintenance plan associated with the site. CampbellReith accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part) use or rely on the contents of this document, without the prior written permission of Campbell Reith Hill LLP. Any advice, opinions, or recommendations within this document should be read and relied upon only in the context of the document as a whole.

3.0 SITE CONTEXT

3.1. Site Location

3.1.1. The site is located in the Borough of Reading, situated at the top of Caversham Hill, and is bounded by Upper Woodcote Road in the north, Chazey Road in the south, Hewett Road in the west and St Peters Avenue in the east.

3.1.2. The site is currently a public area known as Mapledurham Playing Fields and is mainly grassland except for the south eastern edge which is wooded. Much of site is generally flat although the eastern grassland area slopes from north to south. The site location is shown in Figure 1 where the red line indicates the site boundary.

3.1.3. The site location plan can be found in Appendix 1.

3.1.4. Preliminary borehole and trial pit logs from a Phase II site investigation being carried out by others indicate a soil succession of Boyn Hill Gravel overlying Chalk. The Boyn Hill Member consists of sands and gravels, with possible localised layers of silt, peat or clay. It is considered that the Boyn Hill Member offers potential for infiltration, and for initial design purposes, a permeability of 1×10^{-5} m/s has been assumed. This will require verification by site tests.

3.2. Proposed development

3.2.1. The proposed development will consist of a two-storey primary school block accommodating 420 pupils, with a Multi Games Area (MUGA), hard informal areas, soft play areas and car parking

3.2.2. The proposed development is shown in Appendix 2.

4.0 CATCHMENT AREAS

4.1. Existing Catchment

The existing site is a soft landscaped area with an approximate area of 0.5 hectares. It is believed that there is no existing surface water drainage on site.

4.2. Proposed Catchment Areas

4.2.1. A summary of the proposed catchment areas as a result of the redevelopment is tabulated below:-

LOCATIONS	PROPOSED CATCHMENT AREAS (m ²)
Roof Area	1200
Car Park	680
MUGA	720
Reception Play Area	300
Hard Informal Areas	900
Soft Landscaping	1200
Total Site Area	5000

4.2.2. The proposed impermeable areas comprise the building's roof area, the reception play area and hard informal areas.

4.2.3. The proposed development will create an impermeable area of 2400m² or 0.24 hectare.

4.2.4. The surface water runoff generated by the proposed development will be managed within the site using Sustainable Drainage Systems (SuDS) by utilising infiltration techniques.

5.0 SUSTAINABLE DRAINAGE SYSTEMS (SUDS)

5.1. SUDS Management

- 5.1.1. SUDS are intended to provide source control, to reintroduce water into the ground, to improve water quality, to reduce the risk of flooding and support biodiversity.
- 5.1.2. A SUDS management train should be central to the surface water management of a site, seeking to control runoff as near to the source as possible and practical.
- 5.1.3. SUDS management uses a hierarchy of drainage techniques to incrementally reduce the pollution, flow rates and volumes of surface water discharge from the development as follows:-
- 5.1.4. Prevention – The use of good site design and housekeeping measures to prevent runoff and pollution.
- 5.1.5. Source Controls – Control of runoff at source or as close to source as possible (e.g. soakaways, green roofs and pervious pavements).
- 5.1.6. Site control – Management of water in local area which can include below ground storage/attenuation, detention basins, large infiltration devices.
- 5.1.7. Regional control – Management of water from a site or various sites and can include wetlands and balancing ponds.

5.2. SUDS Selection

- 5.2.1. A surface water drainage plan indicating the proposed surface water scheme and the SUDS selected is included in Appendix 3.
- 5.2.2. Although the final site investigation report is not available, it is anticipated that infiltration methods will be feasible based on the likely geology of Boyn Hill Gravel. The infiltration techniques proposed will need to be reviewed upon completion of the site investigation.
- 5.2.3. Infiltration has been assumed as 10^{-5} m/s, subject to onsite testing.
- 5.2.4. The potential for the implementation of SUDS within the development is discussed below:-

5.3. Source Control

- 5.3.1. An infiltration structure is proposed underneath the soft landscaping area in the south of the site to collect runoff from the building roof and hard surface areas and discharge it into the sub soil via infiltration.

- 5.3.2. The infiltration structure provides approximately 170m³ of storage for the 1 in 100 year storm event including 30% climate change assuming an infiltration rate of 10⁻⁵ m/s subject to site testing and ground investigation. Indicative calculations for the size of the infiltration structure are provided in Appendix 3.
- 5.3.3. The car parking area and Multi Use Games Area (MUGA) are proposed to have permeable surfacing with the car parking adopting either porous asphalt or permeable block paving, and the MUGA having a specialist surfacing. The permeable surfacing utilises a voided sub base material to provide attenuation and allow treatment of the surface water prior to it percolating into the ground.
- 5.3.4. Green roofs can be installed on low pitched roofs and contribute to surface water management by reducing the runoff volume as the green roof build up retains water within its soil matrix, and slowing the rate of runoff due to the attenuation of the surface water flow as it percolates through the soil.
- 5.3.5. It is proposed that a green roof is installed on the building to provide the benefits noted above in respect of surface water management.
- 5.3.6. The inclusion of a green roof system is one method of source control for SuDS as identified in chapter 12 of the SuDS manual.
- 5.4. SUDs Provision
 - 5.4.1. The proposed SUDs techniques are shown on the surface water management plan in Appendix 4.

6.0 SUDS OPERATION AND MAINTENANCE

6.1. Surface Water Maintenance

6.1.1. The following is a suggested operational and maintenance regime for the above site post construction to ensure the satisfactory performance of the SUDS drainage features.

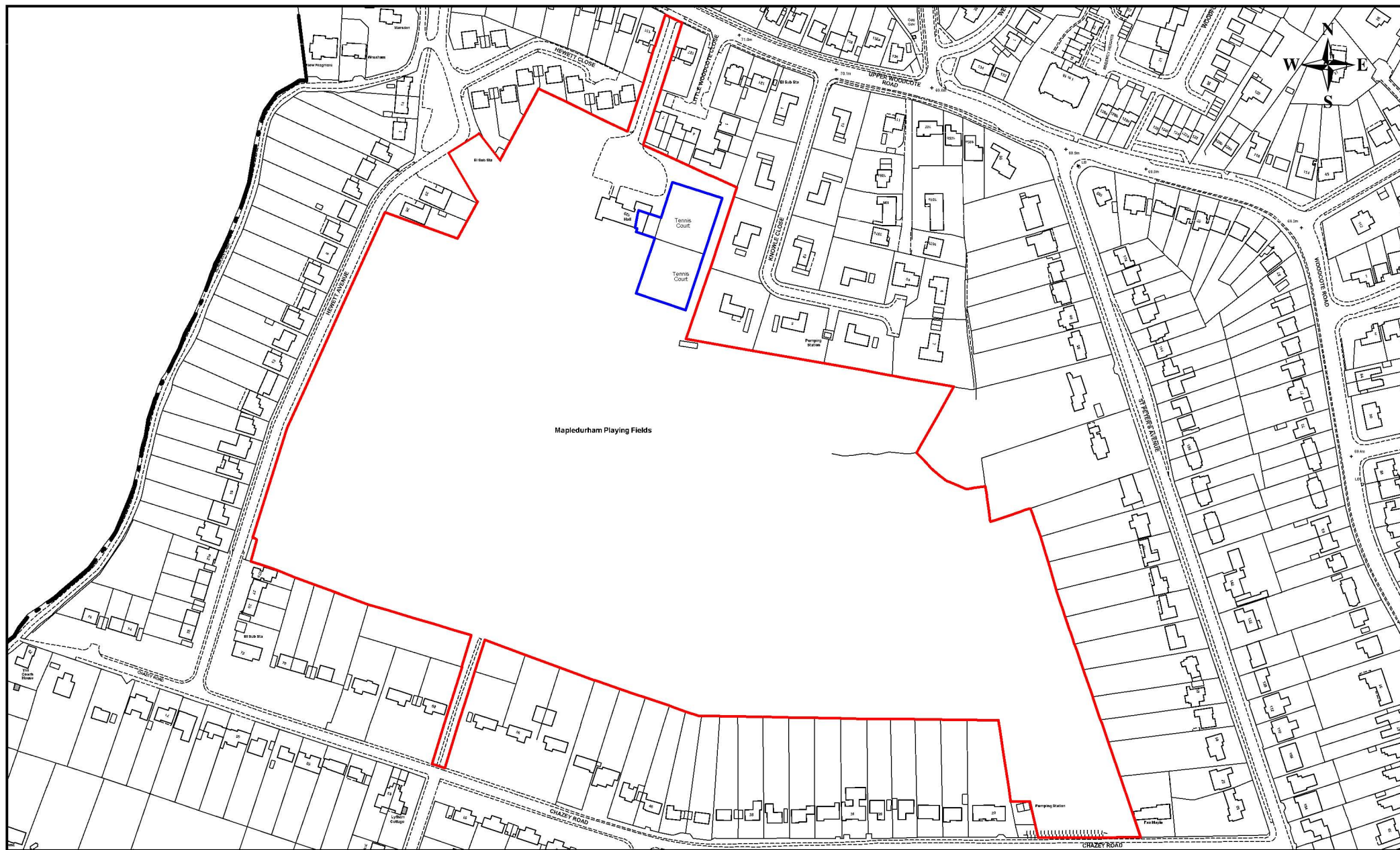
Pervious Paving		
Regular Maintenance	Brushing and vacuuming over surface	Annually
Occasional Maintenance	Removal of weeds, or treatment with suitable weed killer directly on weeds	As required (dependent on frequency of use)
Remedial Actions	Sweeping of surface if becoming clogged	10-15 years, or as required
Monitoring	Inspection for general stability of pavement	Monthly for first 3 months
	Indications of poor performance	After 3 months, and 2 days after large storms
	Inspect for silt accumulation to establish sweeping frequency	Annually
Infiltration structure		
Regular Maintenance	Remove debris from the catchments surface	Monthly
	Check surface of filter for blockage by sediment, algae or other matter; remove or replace surface infiltration medium as necessary	Annually
Remedial Actions	Repair/rehabilitate inlets, outlets, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows	Annually
Green Roofs		
Regular Inspections	Inspect all components for proper operation, integrity of waterproofing, structural stability and evidence of erosion channels	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer	Annually and after severe storms
	Inspect underside of the roof for leakage	Annually and after severe storms
Regular Maintenance	Remove debris and litter to prevent clogging	Six monthly and annually or as required
	Replace dead plants as required	Monthly (but usually responsibility of manufacturer)

	Remove fallen leaves and invasive vegetation	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting	Six monthly or as required
Remedial Actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

7.0 CONCLUSION

- 7.1.1. The surface water runoff generated by the proposed development will be contained within the site using Sustainable Drainage Systems (SuDS).
- 7.1.2. The proposed development will use SuDS in the form of permeable surfacing and infiltration structures.
- 7.1.3. Surface water runoff from the development will infiltrate into the ground subject to confirmation that ground conditions are suitable for infiltration methods.
- 7.1.4. A cellular storage to collect rainfall from building roof and hard surface areas and discharge it into the sub soil via infiltration.
- 7.1.5. The car parking and MUGA areas will have permeable surfacing with a voided sub base.
- 7.1.6. The run off from the building roof and hard surface areas will be routed to a cellular storage structure which will attenuate the flows and allow the run off to infiltrate into the sub soil. Indicative sizing of the structure is included in Appendix 3.

Appendix 1: Site Location Plan



Title: Location Plan

Mapledurham Playing Fields, Upper Woodcote Road, Caversham, Reading

File:

Date: 25/11/2015

Scale at A4: 1:3000

Produced by Valuation Section

Ref: 54008\

Appendix 2: Development Proposals



REVISION DETAILS			DATE	DRAWN BY
P	1	Issued to T&T	23.01.17	DMA

KEY	RESIDUAL RISK
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KEY PLAN

ORIGINATOR DMA		TITLE THE HEIGHTS PRIMARY SCHOOL - PROPOSED GROUND FLOOR PLAN			
PROJECT The Heights Primary School - Mapledurham Playing Fields		PURPOSE OF ISSUE FOR INFORMATION		STATUS S1	REVISION: P
JOB NO. 350	SCALE 1:100 @A1	DRAWN KM	CHECKED DMA	APPROVED DMA	
PROJECT HPS	ORIGINATOR DMA	ZONE ALL	LEVEL 00	TYPE GA	ROLE A
				DOC NO 02004	

Appendix 3: Initial Soakaway Calculations

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Raven House 29 Linkfield Lane Surrey RH1 1SS		Mapledurham Playing Fields Initial soakaway calcs 10 year return period																																																																																																																																																																																																																					
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<u>Summary of Results for 10 year Return Period (+30%)</u> Half Drain Time : 1029 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>0.295</td><td>0.295</td><td>0.7</td><td>33.9</td><td>0 K</td></tr><tr><td>30 min Summer</td><td>0.379</td><td>0.379</td><td>0.7</td><td>43.6</td><td>0 K</td></tr><tr><td>60 min Summer</td><td>0.464</td><td>0.464</td><td>0.7</td><td>53.3</td><td>0 K</td></tr><tr><td>120 min Summer</td><td>0.546</td><td>0.546</td><td>0.7</td><td>62.8</td><td>0 K</td></tr><tr><td>180 min Summer</td><td>0.590</td><td>0.590</td><td>0.7</td><td>67.9</td><td>0 K</td></tr><tr><td>240 min Summer</td><td>0.618</td><td>0.618</td><td>0.7</td><td>71.1</td><td>0 K</td></tr><tr><td>360 min Summer</td><td>0.650</td><td>0.650</td><td>0.7</td><td>74.8</td><td>0 K</td></tr><tr><td>480 min Summer</td><td>0.665</td><td>0.665</td><td>0.8</td><td>76.5</td><td>0 K</td></tr><tr><td>600 min Summer</td><td>0.671</td><td>0.671</td><td>0.8</td><td>77.1</td><td>0 K</td></tr><tr><td>720 min Summer</td><td>0.670</td><td>0.670</td><td>0.8</td><td>77.0</td><td>0 K</td></tr><tr><td>960 min Summer</td><td>0.661</td><td>0.661</td><td>0.8</td><td>76.0</td><td>0 K</td></tr><tr><td>1440 min Summer</td><td>0.638</td><td>0.638</td><td>0.7</td><td>73.4</td><td>0 K</td></tr><tr><td>2160 min Summer</td><td>0.603</td><td>0.603</td><td>0.7</td><td>69.3</td><td>0 K</td></tr><tr><td>2880 min Summer</td><td>0.567</td><td>0.567</td><td>0.7</td><td>65.2</td><td>0 K</td></tr><tr><td>4320 min Summer</td><td>0.500</td><td>0.500</td><td>0.7</td><td>57.5</td><td>0 K</td></tr><tr><td>5760 min Summer</td><td>0.437</td><td>0.437</td><td>0.7</td><td>50.2</td><td>0 K</td></tr><tr><td>7200 min Summer</td><td>0.378</td><td>0.378</td><td>0.7</td><td>43.5</td><td>0 K</td></tr><tr><td>8640 min Summer</td><td>0.325</td><td>0.325</td><td>0.7</td><td>37.4</td><td>0 K</td></tr><tr><td>10080 min Summer</td><td>0.277</td><td>0.277</td><td>0.7</td><td>31.9</td><td>0 K</td></tr><tr><td>15 min Winter</td><td>0.331</td><td>0.331</td><td>0.7</td><td>38.1</td><td>0 K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>77.120</td><td>0.0</td><td>26</td></tr><tr><td>30 min Summer</td><td>49.821</td><td>0.0</td><td>41</td></tr><tr><td>60 min Summer</td><td>30.889</td><td>0.0</td><td>70</td></tr><tr><td>120 min Summer</td><td>18.674</td><td>0.0</td><td>130</td></tr><tr><td>180 min Summer</td><td>13.803</td><td>0.0</td><td>188</td></tr><tr><td>240 min Summer</td><td>11.108</td><td>0.0</td><td>248</td></tr><tr><td>360 min Summer</td><td>8.161</td><td>0.0</td><td>366</td></tr><tr><td>480 min Summer</td><td>6.553</td><td>0.0</td><td>484</td></tr><tr><td>600 min Summer</td><td>5.525</td><td>0.0</td><td>602</td></tr><tr><td>720 min Summer</td><td>4.805</td><td>0.0</td><td>720</td></tr><tr><td>960 min Summer</td><td>3.853</td><td>0.0</td><td>836</td></tr><tr><td>1440 min Summer</td><td>2.821</td><td>0.0</td><td>1086</td></tr><tr><td>2160 min Summer</td><td>2.064</td><td>0.0</td><td>1492</td></tr><tr><td>2880 min Summer</td><td>1.653</td><td>0.0</td><td>1904</td></tr><tr><td>4320 min Summer</td><td>1.208</td><td>0.0</td><td>2724</td></tr><tr><td>5760 min Summer</td><td>0.967</td><td>0.0</td><td>3520</td></tr><tr><td>7200 min Summer</td><td>0.813</td><td>0.0</td><td>4320</td></tr><tr><td>8640 min Summer</td><td>0.706</td><td>0.0</td><td>5024</td></tr><tr><td>10080 min Summer</td><td>0.626</td><td>0.0</td><td>5760</td></tr><tr><td>15 min Winter</td><td>77.120</td><td>0.0</td><td>26</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	0.295	0.295	0.7	33.9	0 K	30 min 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480 min Summer	6.553	0.0	484																																																																																																																																																																																																																				
600 min Summer	5.525	0.0	602																																																																																																																																																																																																																				
720 min Summer	4.805	0.0	720																																																																																																																																																																																																																				
960 min Summer	3.853	0.0	836																																																																																																																																																																																																																				
1440 min Summer	2.821	0.0	1086																																																																																																																																																																																																																				
2160 min Summer	2.064	0.0	1492																																																																																																																																																																																																																				
2880 min Summer	1.653	0.0	1904																																																																																																																																																																																																																				
4320 min Summer	1.208	0.0	2724																																																																																																																																																																																																																				
5760 min Summer	0.967	0.0	3520																																																																																																																																																																																																																				
7200 min Summer	0.813	0.0	4320																																																																																																																																																																																																																				
8640 min Summer	0.706	0.0	5024																																																																																																																																																																																																																				
10080 min Summer	0.626	0.0	5760																																																																																																																																																																																																																				
15 min Winter	77.120	0.0	26																																																																																																																																																																																																																				
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Raven House 29 Linkfield Lane Surrey RH1 1SS	Mapledurham Playing Fields Initial soakaway calcs 10 year return period	
Date 21/03/2017 File 12243-soakaway cellular...	Designed by fga Checked by	
XP Solutions	Source Control 2016.1.1	

Summary of Results for 10 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.426	0.426	0.7	49.0	0 K
60 min Winter	0.522	0.522	0.7	60.0	0 K
120 min Winter	0.616	0.616	0.7	70.8	0 K
180 min Winter	0.668	0.668	0.8	76.8	0 K
240 min Winter	0.702	0.702	0.8	80.7	0 K
360 min Winter	0.742	0.742	0.8	85.3	0 K
480 min Winter	0.764	0.764	0.8	87.8	0 K
600 min Winter	0.775	0.775	0.8	89.0	0 K
720 min Winter	0.778	0.778	0.8	89.5	0 K
960 min Winter	0.773	0.773	0.8	88.8	0 K
1440 min Winter	0.742	0.742	0.8	85.3	0 K
2160 min Winter	0.695	0.695	0.8	79.8	0 K
2880 min Winter	0.643	0.643	0.7	73.9	0 K
4320 min Winter	0.539	0.539	0.7	62.0	0 K
5760 min Winter	0.443	0.443	0.7	50.9	0 K
7200 min Winter	0.355	0.355	0.7	40.9	0 K
8640 min Winter	0.278	0.278	0.7	32.0	0 K
10080 min Winter	0.211	0.211	0.7	24.2	0 K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	49.821	0.0	41
60 min Winter	30.889	0.0	70
120 min Winter	18.674	0.0	128
180 min Winter	13.803	0.0	184
240 min Winter	11.108	0.0	242
360 min Winter	8.161	0.0	358
480 min Winter	6.553	0.0	474
600 min Winter	5.525	0.0	586
720 min Winter	4.805	0.0	698
960 min Winter	3.853	0.0	914
1440 min Winter	2.821	0.0	1154
2160 min Winter	2.064	0.0	1608
2880 min Winter	1.653	0.0	2076
4320 min Winter	1.208	0.0	2944
5760 min Winter	0.967	0.0	3760
7200 min Winter	0.813	0.0	4544
8640 min Winter	0.706	0.0	5288
10080 min Winter	0.626	0.0	6048

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Raven House 29 Linkfield Lane Surrey RH1 1SS	Mapledurham Playing Fields Initial soakaway calcs 10 year return period	
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XP Solutions	Source Control 2016.1.1	

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)	19.800	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.240

Time (mins) Area			Time (mins) Area			Time (mins) Area		
From:	To:	(ha)	From:	To:	(ha)	From:	To:	(ha)
0	4	0.080	4	8	0.080	8	12	0.080

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Raven House 29 Linkfield Lane Surrey RH1 1SS	Mapledurham Playing Fields Initial soakaway calcs 10 year return period	
Date 21/03/2017	Designed by fga	
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XP Solutions	Source Control 2016.1.1	

Model Details

Storage is Online Cover Level (m) 2.500

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	121.0	121.0	1.600	0.0	187.0
1.500	121.0	187.0			

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Raven House 29 Linkfield Lane Surrey RH1 1SS	Mapledurham Playing fields Initial soakaway calcs 100 year return period	
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Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 1601 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.489	0.489	0.7	56.2	0 K
30 min Summer	0.640	0.640	0.7	73.6	0 K
60 min Summer	0.794	0.794	0.8	91.2	0 K
120 min Summer	0.943	0.943	0.8	108.4	0 K
180 min Summer	1.022	1.022	0.8	117.4	0 K
240 min Summer	1.071	1.071	0.8	123.1	0 K
360 min Summer	1.130	1.130	0.9	129.9	0 K
480 min Summer	1.164	1.164	0.9	133.8	0 K
600 min Summer	1.183	1.183	0.9	136.0	0 K
720 min Summer	1.192	1.192	0.9	137.1	0 K
960 min Summer	1.192	1.192	0.9	137.0	0 K
1440 min Summer	1.155	1.155	0.9	132.8	0 K
2160 min Summer	1.096	1.096	0.8	125.9	0 K
2880 min Summer	1.040	1.040	0.8	119.5	0 K
4320 min Summer	0.943	0.943	0.8	108.4	0 K
5760 min Summer	0.856	0.856	0.8	98.4	0 K
7200 min Summer	0.776	0.776	0.8	89.2	0 K
8640 min Summer	0.701	0.701	0.8	80.6	0 K
10080 min Summer	0.632	0.632	0.7	72.6	0 K
15 min Winter	0.549	0.549	0.7	63.1	0 K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	126.880	0.0	27
30 min Summer	83.321	0.0	41
60 min Summer	52.120	0.0	70
120 min Summer	31.497	0.0	130
180 min Summer	23.145	0.0	190
240 min Summer	18.489	0.0	248
360 min Summer	13.427	0.0	368
480 min Summer	10.700	0.0	486
600 min Summer	8.966	0.0	604
720 min Summer	7.757	0.0	724
960 min Summer	6.167	0.0	962
1440 min Summer	4.457	0.0	1258
2160 min Summer	3.215	0.0	1628
2880 min Summer	2.548	0.0	2024
4320 min Summer	1.833	0.0	2856
5760 min Summer	1.450	0.0	3680
7200 min Summer	1.208	0.0	4472
8640 min Summer	1.040	0.0	5272
10080 min Summer	0.916	0.0	6056
15 min Winter	126.880	0.0	26

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Raven House 29 Linkfield Lane Surrey RH1 1SS		Mapledurham Playing fields Initial soakaway calcs 100 year return period			
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XP Solutions		Source Control 2016.1.1			
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.718	0.718	0.8	82.6	0 K
60 min Winter	0.892	0.892	0.8	102.5	0 K
120 min Winter	1.061	1.061	0.8	122.0	0 K
180 min Winter	1.152	1.152	0.9	132.4	0 K
240 min Winter	1.210	1.210	0.9	139.0	0 K
360 min Winter	1.281	1.281	0.9	147.3	0 K
480 min Winter	1.325	1.325	0.9	152.3	0 K
600 min Winter	1.351	1.351	0.9	155.3	0 K
720 min Winter	1.367	1.367	0.9	157.1	0 K
960 min Winter	1.377	1.377	0.9	158.2	0 K
1440 min Winter	1.351	1.351	0.9	155.3	0 K
2160 min Winter	1.277	1.277	0.9	146.8	0 K
2880 min Winter	1.206	1.206	0.9	138.6	0 K
4320 min Winter	1.070	1.070	0.8	123.0	0 K
5760 min Winter	0.943	0.943	0.8	108.4	0 K
7200 min Winter	0.825	0.825	0.8	94.8	0 K
8640 min Winter	0.716	0.716	0.8	82.3	0 K
10080 min Winter	0.616	0.616	0.7	70.8	0 K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	83.321	0.0	41		
60 min Winter	52.120	0.0	70		
120 min Winter	31.497	0.0	128		
180 min Winter	23.145	0.0	186		
240 min Winter	18.489	0.0	244		
360 min Winter	13.427	0.0	360		
480 min Winter	10.700	0.0	478		
600 min Winter	8.966	0.0	594		
720 min Winter	7.757	0.0	708		
960 min Winter	6.167	0.0	934		
1440 min Winter	4.457	0.0	1368		
2160 min Winter	3.215	0.0	1716		
2880 min Winter	2.548	0.0	2172		
4320 min Winter	1.833	0.0	3080		
5760 min Winter	1.450	0.0	3976		
7200 min Winter	1.208	0.0	4832		
8640 min Winter	1.040	0.0	5624		
10080 min Winter	0.916	0.0	6456		
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Raven House 29 Linkfield Lane Surrey RH1 1SS	Mapledurham Playing fields Initial soakaway calcs 100 year return period	
Date 23/03/2017	Designed by fga	
File 12243-soakaway cellular...	Checked by	
XP Solutions	Source Control 2016.1.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.240

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To: (ha)		From: To: (ha)		From: To: (ha)	
0 4 0.080		4 8 0.080		8 12 0.080	

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Raven House 29 Linkfield Lane Surrey RH1 1SS	Mapledurham Playing fields Initial soakaway calcs 100 year return period	
Date 23/03/2017 File 12243-soakaway cellular...	Designed by fga Checked by	
XP Solutions	Source Control 2016.1.1	

Model Details

Storage is Online Cover Level (m) 2.500

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	121.0	121.0	1.600	0.0	187.0
1.500	121.0	187.0			

Appendix 4: Surface Water Management Plan

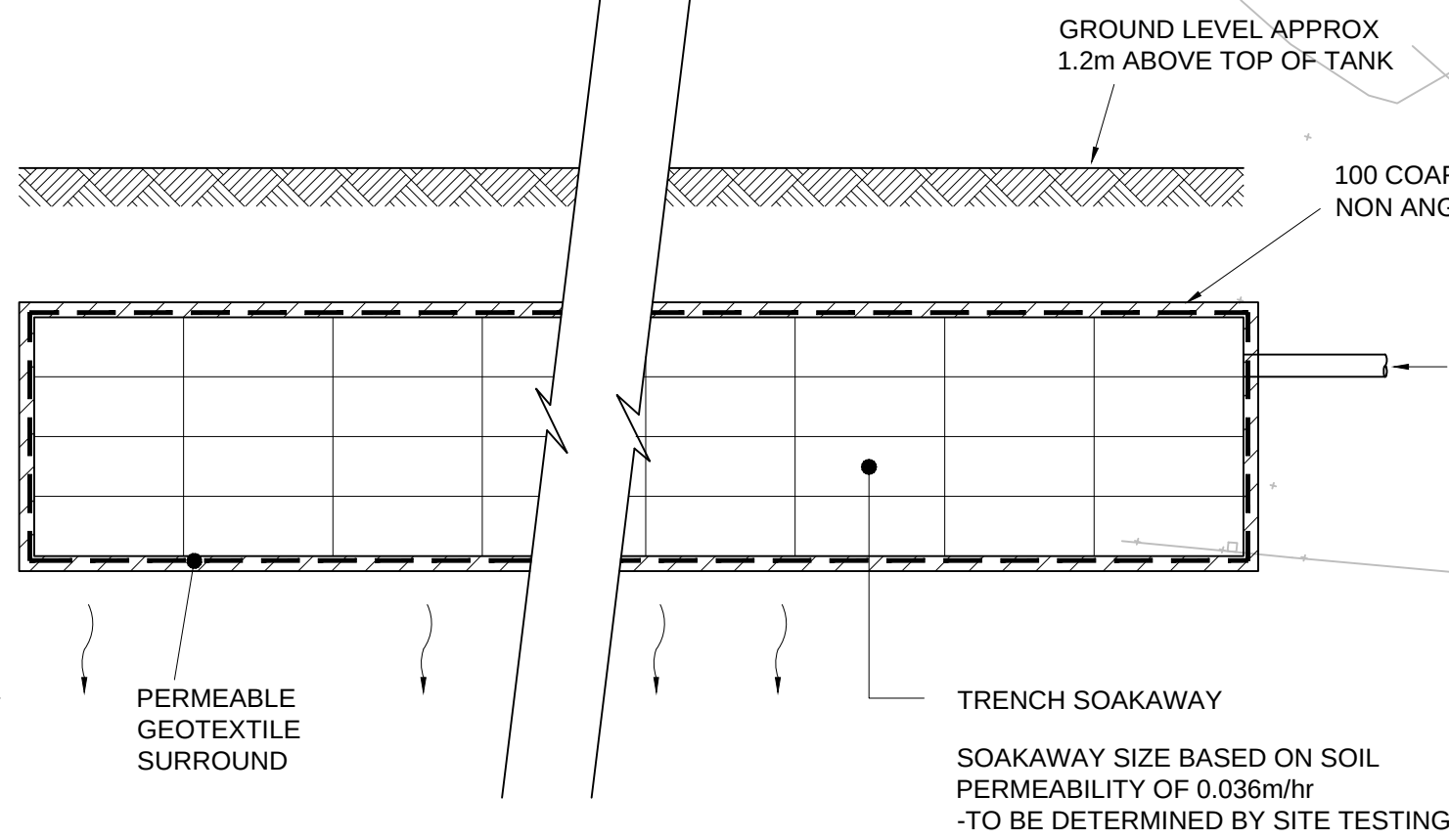
EXISTING SITE AREA (ALL SOFT LANDSCAPING) = 0.5Ha

PROPOSED CATCHMENT AREAS:

LOCATION	CATCHMENT AREAS (Ha)	COMMENTS
ROOF	0.120	TO INFILTRATION STRUCTURE
CAR PARK	0.068	INFILTRATE TO GROUND
MUGA	0.072	INFILTRATE TO GROUND
RECEPTION PLAY AREA	0.030	TO INFILTRATION STRUCTURE
HARD INFORMAL AREAS	0.090	TO INFILTRATION STRUCTURE
SOFT LANDSCAPING	0.120	

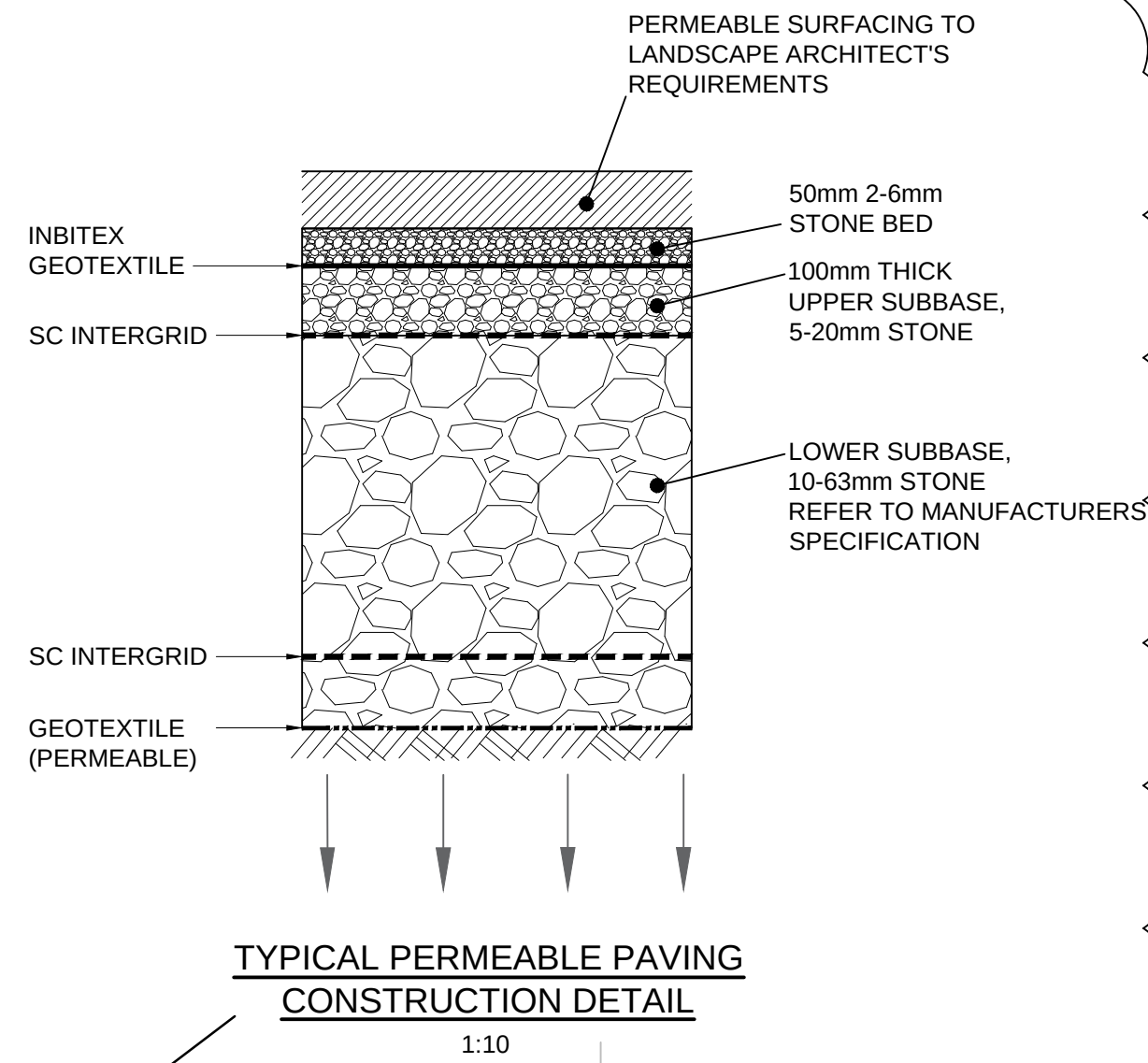
NOTES

- ASSUMED INFILTRATION RATE 10^{-5} m/s TO BE CONFIRMED BY SITE INVESTIGATION



SOAKAWAY DETAIL

1:50



TYPICAL PERMEABLE PAVING
CONSTRUCTION DETAIL

1:10

NOTES

1 DO NOT SCALE THIS DRAWING ON PRINT OR ELECTRONICALLY. WORK FROM FIGURED DIMENSIONS ONLY.

2 No deviation from the details shown on this drawing is allowed without CampbellReith's prior permission in writing.

3 Read this drawing with all Architects, Service Engineers and CampbellReith's relevant details and drawings.

4 All work is to be in accordance with the relevant specifications issued by CampbellReith, British Standard Codes of Practice, Statutory requirements and the Contract Documents.

5 DRAWING STATUS

P : PRELIMINARY - Evolving drawings for approvals, Tenders, Billings, etc.

C : CONSTRUCTION - Fully developed drawings issued under instruction for construction.

ONLY STATUS C DRAWINGS TO BE USED FOR CONSTRUCTION.

6 SUITABILITY CODE

WORK IN PROGRESS:

S0 - Work in progress

SHARED (NON-CONTRACTUAL):

S1 - For coordination, **S2** - For information, **S3** - For internal review and comment, **S4** - For construction approval.

DOCUMENTATION (FOR CONTRACTOR PURPOSES):

D1 - For costing, **D2** - For Tender, **D3** - For contractor design, **D4** - For manufacture / procurement.

CONSTRUCTION:

A - For construction, **B** - For construction but with comments (i.e. areas in abeyance) **C** - Comprehensive revisions required.

7 Denotes Section Number.
 Denotes Drawing Number

KEY

PROPOSED SURFACE WATER DRAINAGE

S1 PROPOSED SURFACE INSPECTION CHAMBER

INFILTRATION STRUCTURE

SITE BOUNDARY

G GULLY

ACO CHANNEL

P2	DETAILS ADDED, AS CLOUDED	21.03.17	AL
P1	ISSUED FOR INFORMATION	17.03.17	NA
Status/Rev	Description	Date	By

CampbellReith
consulting engineers

LONDON 020 7340 1700 ☒ MANCHESTER 0161 819 3060
SURREY 01737 784 500 ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ DUBAI 00 971 4345 7088
www.campbellreith.com

Job Title	MAPLEDURHAM PLAYING FIELDS
Client	TURNER AND TOWNSEND

SURFACE WATER MANAGEMENT PLAN

drawn	date	scale @ A1	C1 checked	CR Project No.
AL	15.03.17	1:250	-	12243

Drg No.	Suitability	Status/Revision
12243-CRH-Z1-00-DR-C-5050	S0	P2

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