

Project Name : Yapton Metal Company, Burndell Road, Yapton
Job No : 19-167
Note Title : Drainage Strategy Technical Note
Author : SG
Checked : LH
Approved : RS
Date : August 2019

1.0 INTRODUCTION

- 1.1 Odyssey has been instructed by Lakewood Homes to prepare this drainage technical note in support of their Planning application for the 4-unit residential development at Burndell Road, Yapton.
- 1.2 The description of the development at Planning was:
- “4 No. dwellings with associated ancillary services and access (resubmission following Y/108/15/PL. This application affects the setting of a Listed Building”*
- 1.3 The aim of this report is to support the discharge of Conditions 3 and 4, which are set out below.

Condition 3

“Development shall not commence until full details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority.”

Condition 4

“Development shall not commence until full details of the maintenance and management of the SuDS system is set out in a site-specific maintenance manual and submitted to, and approved in writing, by the Local Planning Authority. The manual is to include (a) details of financial management of the site including arrangement made in the event that the management company (or any subsequent management company) is no longer able to fulfil its duties; and (b) arrangements for the replacement of major components at the end of the manufacturers recommended design life.”

2.0 EXISTING SITE

- 2.1 The proposed development site is a former scrap metal yard comprising of storage buildings, an area of hard standing, a car park and an area of green space formerly used by the listed cottage.
- 2.2 The site is bounded to the north by Burndell Road, residential dwellings to the east and south and an access road leading to a new residential development to the west.
- 2.3 The topographical survey shows the site to be generally flat with a slight fall from west to north-east. Levels range from 7.33m in the west to 6.44m in the north-east.
- 2.4 The existing drainage regime has not been confirmed but with no drainage features shown on the topographical survey, it is assumed that areas of existing hard standing drain to surrounding green areas.
- 2.5 Sewer records obtained from Southern Water indicate that there are no public surface water sewers in close proximity to the site.
- 2.6 Existing geology maps and further trial pit testing has proven that the underlying geology consists predominantly of sandy, gravelly clay above the Upper Chalk Formation. A mantle of Made Ground was also encountered overlying the natural strata in each trial pit.

3.0 SURFACE WATER DRAINAGE STRATEGY

3.1 The surface water drainage strategy for the proposed development is shown on the drawing listed below which can be found in **Appendix A**:

- **18-167/001** – Surface Water Drainage Strategy

3.2 It is proposed that the parking court area serving the 4 units be constructed as infiltrating permeable paving. Run off from roof areas and other non-porous surfaces will be collected and discharged into the base of the permeable paving via diffuser units. A surface water catchment plan showing the impermeable areas can be found within **Appendix B**.

3.3 The surface water drainage system has been designed to accommodate all rainfall events up to the 1 in 100 year event plus climate change (40%). Supporting calculations can be found within **Appendix C**.

3.4 During extreme events, excess flood water will be conveyed within the parking area to the north-east of the site towards Burndell Road. The overland flow routes can be found on drawing **19-167/003** in **Appendix D**.

3.5 Recent soakage testing undertaken by Geo-Environmental in July 2019 recorded infiltration rates from 2.03×10^{-6} m/s to 1.2×10^{-6} m/s. The worst case rate of 1.2×10^{-6} m/s has been used for this site.

3.6 Winter groundwater monitoring has not yet been undertaken. In the absence of this information, data from a nearby site (Planning Ref: F/5/18/RES) has been obtained from the Arun District Council planning portal which shows groundwater levels to have been recorded at a maximum elevation of 0.6m bgl. This would equate to a groundwater level of 6.200mAOD based on that site's topographical survey, which indicates an approximate ground level of 6.800mAOD for the site. With the base of the permeable paving on our site at 6.300mAOD, this would provide clearance to potential groundwater level and ensure infiltration into the strata below.

3.7 It should also be noted that although soakage testing was undertaken outside for the winter period, groundwater was not encountered during the excavation of any trial pits which reached a maximum depth of 1.9m bgl.

3.8 Surface water treatment will be provided by the permeable paving via both the grit layer and geotextile that the blocks are bedded on, as well as the underlying gravel media comprising of washed no-fines material. These measures will provide filtration and the breakdown of

hydrocarbons as the water is conveyed through the system and into the strata below. A detail showing the proposed construction of the paving is shown on drawing **19-167/004** in **Appendix E**.

- 3.9 A completed Arun District Council surface water drainage proposal checklist is provided in **Appendix F**.

4.0 PROPOSED MANAGEMENT AND MAINTENANCE

- 4.1 All drainage, including the permeable paving is to remain to private and be maintained by a private management company in accordance with the following schedule and recommendations made by manufacturers.

Permeable Paving

Maintenance Category	Maintenance Activity	Comments	Frequency
Routine Maintenance	Visual inspection of paving.	Ensure joints are kept fully filled.	Monthly (depending on local environment)
	Paving should be agitated (e.g. brushed, vacuumed, etc.)	To ensure no vegetation of any sort is allowed to grow and develop in the joints.	Six monthly or as required (Spring and Autumn seasons).
	Paving should be inspected after any heavy precipitations.	Ensure no displacement of any organic matter into the surface of the pavement.	As required.
Corrective Maintenance	Inspection of outfall should be undertaken.	Non-infiltration systems to have outfall checked for debris and blockages.	Six monthly or as required.
	Removal of weeds.	To ensure weeds are killed effectively they should be actively growing so that the glyphosate will go down to the roots. Glyphosate based weed killers include Roundup and Tumbleweed.	As required.
	Laying material may require cleaning and /or replacing.	Depending on the environment the permeable pavement has received and been exposed to.	25 to 30-year period.

Pipe Systems, Gullies, and Manholes/Inspection Chambers

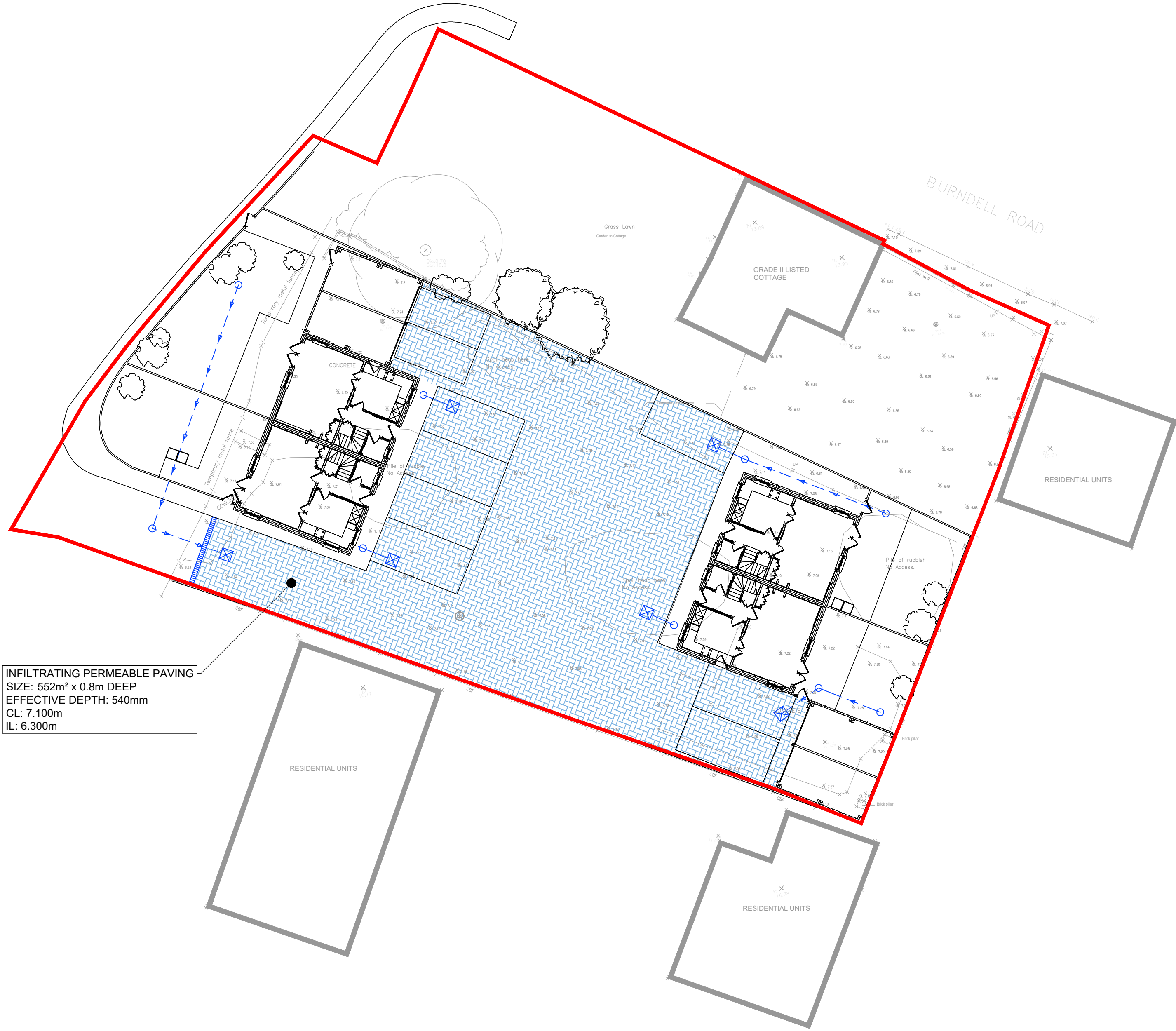
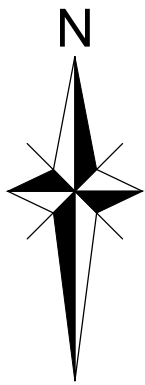
Maintenance Category	Maintenance Activity	Comments	Frequency
Routine Maintenance	Inspect and identify any areas that are not operating correctly.	Gullies and private manholes and inspection chambers	Monthly (for the first 3 months) then annually.
	Remove debris from gratings, sumps / silt traps.		Annually
Infrequent Maintenance	Clear blockages.	Piped system.	As required.

5.0 CONCLUSION

- 5.1 This technical note has provided details of the proposed surface water drainage system within the proposed development at the Yapton Metal Company site in Burndell Road, Yapton.
- 5.2 This technical note, combined with other documents submitted as part of the Planning application provides the detail required to discharge Conditions 3 and 4.
- 5.3 This note has demonstrated how the proposals accord with the local planning policies with regards to surface water drainage.

APPENDIX A

Odyssey Surface Water Drainage Strategy



INFILTRATING PERMEABLE PAVING
SIZE: 552m² x 0.8m DEEP
EFFECTIVE DEPTH: 540mm
CL: 7.100m
IL: 6.300m

- NOTES**
- DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
 - ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.
 - THIS DRAWING IS A PRELIMINARY REVIEW ONLY AND SUBJECT TO DETAILED DESIGN.
 - TOPOGRAPHICAL SURVEY HAS BEEN TAKEN FROM ARCHIDATA LIMITED DRAWING AD19080_1_01, DATED APRIL 19'.
 - PROPOSED SITE LAYOUT HAS BEEN PROVIDED BY LAKEWOOD HOMES.
 - ODYSSEY ACCEPT NO LIABILITY FOR THE ACCURACY OF SURVEY INFORMATION AND LAYOUTS SUPPLIED BY OTHERS.
 - INFILTRATING SUDS HAVE BEEN DESIGNED USING A SOAKAGE RATE OF 1.2 x 10⁻⁶ AS RECORDED BY GEO-ENVIRONMENTAL SERVICES LIMITED IN JULY 19
 - GROUNDWATER WAS NOT ENCOUNTERED AT THE SITE DURING THE GEO-ENVIRONMENTAL INVESTIGATION.

- LEGEND**
- DEVELOPMENT BOUNDARY
 - PROPOSED INFILTRATING PERMEABLE PAVING
 - PROPOSED SURFACE WATER CHAMBER
 - PROPOSED SURFACE WATER PIPE
 - PROPOSED DIFFUSER UNIT
 - PROPOSED LINEAR DRAINAGE CHANNEL

FOR PLANNING
PURPOSES ONLY

Rev	Amendments	Drn	Chk	App	Date



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Job Title

YAPTON METAL COMPANY,
BURNDELL ROAD, YAPTON

Drawing Title

SURFACE WATER
DRAINAGE STRATEGY

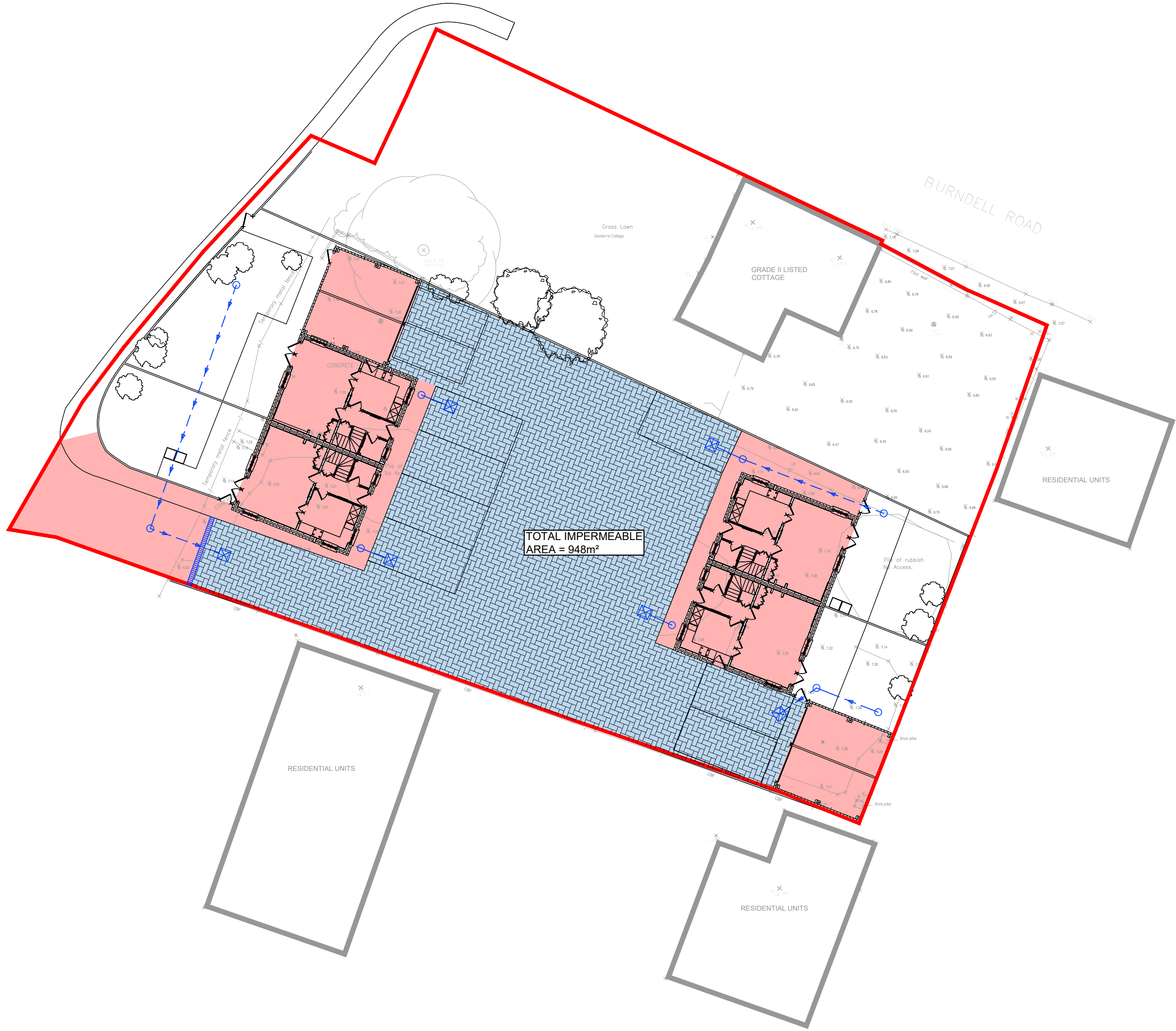
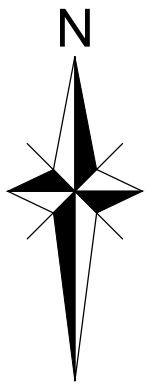
Client

LAKEWOOD HOMES

Scale	Date	Designed
1:200 @ A2	AUG 19	SG
Drawn	Checked	Approved
JA	SG	LH
Job No	Drawing No	Rev
19-167	19-167/001	

APPENDIX B

Odyssey Catchment Plan



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 - ODYSSEY ACCEPT NO LIABILITY FOR THE ACCURACY OF SURVEY INFORMATION AND LAYOUTS SUPPLIED BY OTHERS.
 - PROPOSED SITE LAYOUT HAS BEEN PROVIDED BY LAKEWOOD HOMES.
 - FOR SURFACE WATER DRAINAGE STRATEGY REFER TO ODYSSEY DRAWING 19-167/001.

- LEGEND**
- ROOF/ HARD LANDSCAPING
TOTAL AREA = 396m²
 - PERMEABLE PAVING
TOTAL AREA = 552m²
 - PROPOSED SURFACE WATER CHAMBER
 - PROPOSED SURFACE WATER PIPE
 - PROPOSED DIFFUSER UNIT
 - PROPOSED LINEAR DRAINAGE CHANNEL

FOR PLANNING
PURPOSES ONLY

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Job Title
**YAPTON METAL COMPANY,
BURNDELL ROAD, YAPTON**

Drawing Title
**SURFACE WATER
CATCHMENT PLAN**

Client
LAKEWOOD HOMES

Scale 1:200 @ A2	Date AUG 19	Designed SG
Drawn JA	Checked SG	Approved LH
Job No 19-167	Drawing No 19-167/002	Rev

APPENDIX C

Microdrainage Calculations

Odyssey Markides LLP				Page 1																																																																																																																																																																																																																			
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<u>Summary of Results for 10 year Return Period (+40%)</u> Half Drain Time : 989 minutes. <table><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><tr><td>15 min Summer</td><td>6.360</td><td>0.060</td><td>0.3</td><td>9.9</td><td>O K</td></tr><tr><td>30 min Summer</td><td>6.379</td><td>0.079</td><td>0.3</td><td>13.1</td><td>O K</td></tr><tr><td>60 min Summer</td><td>6.402</td><td>0.102</td><td>0.3</td><td>16.9</td><td>O K</td></tr><tr><td>120 min Summer</td><td>6.430</td><td>0.130</td><td>0.3</td><td>21.4</td><td>O K</td></tr><tr><td>180 min Summer</td><td>6.447</td><td>0.147</td><td>0.3</td><td>24.3</td><td>O K</td></tr><tr><td>240 min Summer</td><td>6.460</td><td>0.160</td><td>0.3</td><td>26.4</td><td>O K</td></tr><tr><td>360 min Summer</td><td>6.478</td><td>0.178</td><td>0.3</td><td>29.4</td><td>O K</td></tr><tr><td>480 min Summer</td><td>6.490</td><td>0.190</td><td>0.3</td><td>31.3</td><td>O K</td></tr><tr><td>600 min Summer</td><td>6.498</td><td>0.198</td><td>0.3</td><td>32.7</td><td>O K</td></tr><tr><td>720 min Summer</td><td>6.504</td><td>0.204</td><td>0.3</td><td>33.6</td><td>O K</td></tr><tr><td>960 min Summer</td><td>6.500</td><td>0.200</td><td>0.3</td><td>33.1</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>6.493</td><td>0.193</td><td>0.3</td><td>31.9</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>6.480</td><td>0.180</td><td>0.3</td><td>29.8</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>6.467</td><td>0.167</td><td>0.3</td><td>27.6</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>6.457</td><td>0.157</td><td>0.3</td><td>25.9</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>6.444</td><td>0.144</td><td>0.3</td><td>23.7</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>6.430</td><td>0.130</td><td>0.3</td><td>21.5</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>6.417</td><td>0.117</td><td>0.3</td><td>19.3</td><td>O 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Summer</td><td>5.471</td><td>0.0</td><td>716</td></tr><tr><td>960 min Summer</td><td>4.332</td><td>0.0</td><td>818</td></tr><tr><td>1440 min Summer</td><td>3.118</td><td>0.0</td><td>1054</td></tr><tr><td>2160 min Summer</td><td>2.244</td><td>0.0</td><td>1452</td></tr><tr><td>2880 min Summer</td><td>1.777</td><td>0.0</td><td>1848</td></tr><tr><td>4320 min Summer</td><td>1.363</td><td>0.0</td><td>2680</td></tr><tr><td>5760 min Summer</td><td>1.130</td><td>0.0</td><td>3464</td></tr><tr><td>7200 min Summer</td><td>0.977</td><td>0.0</td><td>4248</td></tr><tr><td>8640 min Summer</td><td>0.867</td><td>0.0</td><td>5008</td></tr><tr><td>10080 min Summer</td><td>0.784</td><td>0.0</td><td>5744</td></tr><tr><td>15 min Winter</td><td>72.148</td><td>0.0</td><td>19</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	6.360	0.060	0.3	9.9	O K	30 min Summer	6.379	0.079	0.3	13.1	O K	60 min Summer	6.402	0.102	0.3	16.9	O K	120 min 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10080 min Summer	0.784	0.0	5744																																																																																																																																																																																																																				
15 min Winter	72.148	0.0	19																																																																																																																																																																																																																				
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Tuscany House White Hart Lane Basingstoke RG21 4AF		Yapton Metal Company Burndell Road Yapton			
Date 21/08/2019 11:58 File 19-167 PAVING (10YR + 4...		Designed by SG Checked by LH			
Innovyze		Source Control 2018.1			
<u>Summary of Results for 10 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	6.391	0.091	0.3	15.0	O K
60 min Winter	6.417	0.117	0.3	19.3	O K
120 min Winter	6.448	0.148	0.3	24.4	O K
180 min Winter	6.468	0.168	0.3	27.7	O K
240 min Winter	6.483	0.183	0.3	30.2	O K
360 min Winter	6.504	0.204	0.3	33.6	O K
480 min Winter	6.518	0.218	0.3	36.0	O K
600 min Winter	6.529	0.229	0.3	37.7	O K
720 min Winter	6.536	0.236	0.3	39.0	O K
960 min Winter	6.533	0.233	0.3	38.4	O K
1440 min Winter	6.521	0.221	0.3	36.5	O K
2160 min Winter	6.503	0.203	0.3	33.6	O K
2880 min Winter	6.483	0.183	0.3	30.3	O K
4320 min Winter	6.463	0.163	0.3	26.9	O K
5760 min Winter	6.440	0.140	0.3	23.0	O K
7200 min Winter	6.417	0.117	0.3	19.3	O K
8640 min Winter	6.396	0.096	0.3	15.8	O K
10080 min Winter	6.378	0.078	0.3	12.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	45.463	0.0	33		
60 min Winter	28.648	0.0	62		
120 min Winter	18.052	0.0	120		
180 min Winter	13.779	0.0	180		
240 min Winter	11.375	0.0	238		
360 min Winter	8.683	0.0	354		
480 min Winter	7.168	0.0	470		
600 min Winter	6.178	0.0	584		
720 min Winter	5.471	0.0	694		
960 min Winter	4.332	0.0	908		
1440 min Winter	3.118	0.0	1138		
2160 min Winter	2.244	0.0	1584		
2880 min Winter	1.777	0.0	2020		
4320 min Winter	1.363	0.0	2896		
5760 min Winter	1.130	0.0	3696		
7200 min Winter	0.977	0.0	4472		
8640 min Winter	0.867	0.0	5192		
10080 min Winter	0.784	0.0	5856		
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Tuscany House White Hart Lane Basingstoke RG21 4AF	Yapton Metal Company Burndell Road Yapton	
Date 21/08/2019 11:58 File 19-167 PAVING (10YR + 4...	Designed by SG Checked by LH	
Innovyze Source Control 2018.1		

Rainfall Details

Rainfall Model	FEH
Return Period (years)	10
FEH Rainfall Version	1999
Site Location	GB 498650 101750 SU 98650 01750
C (1km)	-0.025
D1 (1km)	0.390
D2 (1km)	0.245
D3 (1km)	0.403
E (1km)	0.310
F (1km)	2.321
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.095

Time (mins)	Area
From:	To: (ha)
0	4 0.095

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Tuscany House White Hart Lane Basingstoke RG21 4AF	Yapton Metal Company Burndell Road Yapton																									
Date 21/08/2019 11:58 File 19-167 PAVING (10YR + 4...	Designed by SG Checked by LH																									
Innovyze	Source Control 2018.1																									
<u>Model Details</u> Storage is Online Cover Level (m) 7.100 <u>Porous Car Park Structure</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.00432</td> <td>Width (m)</td> <td>10.0</td> </tr> <tr> <td>Membrane Percolation (mm/hr)</td> <td>1000</td> <td>Length (m)</td> <td>55.0</td> </tr> <tr> <td>Max Percolation (l/s)</td> <td>152.8</td> <td>Slope (1:X)</td> <td>0.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Depression Storage (mm)</td> <td>5</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Evaporation (mm/day)</td> <td>3</td> </tr> <tr> <td>Invert Level (m)</td> <td>6.300</td> <td>Membrane Depth (m)</td> <td>260</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.00432	Width (m)	10.0	Membrane Percolation (mm/hr)	1000	Length (m)	55.0	Max Percolation (l/s)	152.8	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	6.300	Membrane Depth (m)	260
Infiltration Coefficient Base (m/hr)	0.00432	Width (m)	10.0																							
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<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 2026 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>6.457</td><td>0.157</td><td>0.3</td><td>25.9</td><td>O K</td></tr><tr><td>30 min Summer</td><td>6.492</td><td>0.192</td><td>0.3</td><td>31.7</td><td>O K</td></tr><tr><td>60 min Summer</td><td>6.534</td><td>0.234</td><td>0.3</td><td>38.6</td><td>O K</td></tr><tr><td>120 min Summer</td><td>6.582</td><td>0.282</td><td>0.3</td><td>46.6</td><td>O K</td></tr><tr><td>180 min Summer</td><td>6.613</td><td>0.313</td><td>0.3</td><td>51.6</td><td>O K</td></tr><tr><td>240 min Summer</td><td>6.636</td><td>0.336</td><td>0.3</td><td>55.4</td><td>O K</td></tr><tr><td>360 min Summer</td><td>6.668</td><td>0.368</td><td>0.3</td><td>60.7</td><td>O K</td></tr><tr><td>480 min Summer</td><td>6.690</td><td>0.390</td><td>0.3</td><td>64.4</td><td>O K</td></tr><tr><td>600 min Summer</td><td>6.706</td><td>0.406</td><td>0.3</td><td>67.1</td><td>O K</td></tr><tr><td>720 min Summer</td><td>6.719</td><td>0.419</td><td>0.3</td><td>69.1</td><td>O K</td></tr><tr><td>960 min Summer</td><td>6.714</td><td>0.414</td><td>0.3</td><td>68.3</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>6.695</td><td>0.395</td><td>0.3</td><td>65.2</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>6.666</td><td>0.366</td><td>0.3</td><td>60.5</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>6.642</td><td>0.342</td><td>0.3</td><td>56.4</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>6.629</td><td>0.329</td><td>0.3</td><td>54.3</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>6.612</td><td>0.312</td><td>0.3</td><td>51.5</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>6.594</td><td>0.294</td><td>0.3</td><td>48.5</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>6.575</td><td>0.275</td><td>0.3</td><td>45.4</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>6.556</td><td>0.256</td><td>0.3</td><td>42.3</td><td>O K</td></tr><tr><td>15 min Winter</td><td>6.478</td><td>0.178</td><td>0.3</td><td>29.3</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>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>162.161</td><td>0.0</td><td>19</td></tr><tr><td>30 min Summer</td><td>98.106</td><td>0.0</td><td>34</td></tr><tr><td>60 min Summer</td><td>59.354</td><td>0.0</td><td>64</td></tr><tr><td>120 min Summer</td><td>35.909</td><td>0.0</td><td>124</td></tr><tr><td>180 min Summer</td><td>26.763</td><td>0.0</td><td>184</td></tr><tr><td>240 min Summer</td><td>21.725</td><td>0.0</td><td>244</td></tr><tr><td>360 min Summer</td><td>16.191</td><td>0.0</td><td>362</td></tr><tr><td>480 min Summer</td><td>13.143</td><td>0.0</td><td>482</td></tr><tr><td>600 min Summer</td><td>11.180</td><td>0.0</td><td>602</td></tr><tr><td>720 min Summer</td><td>9.796</td><td>0.0</td><td>722</td></tr><tr><td>960 min Summer</td><td>7.627</td><td>0.0</td><td>962</td></tr><tr><td>1440 min Summer</td><td>5.360</td><td>0.0</td><td>1426</td></tr><tr><td>2160 min Summer</td><td>3.767</td><td>0.0</td><td>1708</td></tr><tr><td>2880 min Summer</td><td>2.933</td><td>0.0</td><td>2072</td></tr><tr><td>4320 min Summer</td><td>2.197</td><td>0.0</td><td>2896</td></tr><tr><td>5760 min Summer</td><td>1.790</td><td>0.0</td><td>3744</td></tr><tr><td>7200 min Summer</td><td>1.527</td><td>0.0</td><td>4544</td></tr><tr><td>8640 min Summer</td><td>1.341</td><td>0.0</td><td>5360</td></tr><tr><td>10080 min Summer</td><td>1.202</td><td>0.0</td><td>6152</td></tr><tr><td>15 min Winter</td><td>162.161</td><td>0.0</td><td>19</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	6.457	0.157	0.3	25.9	O K	30 min Summer	6.492	0.192	0.3	31.7	O K	60 min Summer	6.534	0.234	0.3	38.6	O K	120 min Summer	6.582	0.282	0.3	46.6	O K	180 min Summer	6.613	0.313	0.3	51.6	O K	240 min Summer	6.636	0.336	0.3	55.4	O K	360 min Summer	6.668	0.368	0.3	60.7	O K	480 min Summer	6.690	0.390	0.3	64.4	O K	600 min Summer	6.706	0.406	0.3	67.1	O K	720 min Summer	6.719	0.419	0.3	69.1	O K	960 min Summer	6.714	0.414	0.3	68.3	O K	1440 min Summer	6.695	0.395	0.3	65.2	O K	2160 min Summer	6.666	0.366	0.3	60.5	O K	2880 min Summer	6.642	0.342	0.3	56.4	O K	4320 min Summer	6.629	0.329	0.3	54.3	O K	5760 min Summer	6.612	0.312	0.3	51.5	O K	7200 min Summer	6.594	0.294	0.3	48.5	O K	8640 min Summer	6.575	0.275	0.3	45.4	O K	10080 min Summer	6.556	0.256	0.3	42.3	O K	15 min Winter	6.478	0.178	0.3	29.3	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	162.161	0.0	19	30 min Summer	98.106	0.0	34	60 min Summer	59.354	0.0	64	120 min Summer	35.909	0.0	124	180 min Summer	26.763	0.0	184	240 min Summer	21.725	0.0	244	360 min Summer	16.191	0.0	362	480 min Summer	13.143	0.0	482	600 min Summer	11.180	0.0	602	720 min Summer	9.796	0.0	722	960 min Summer	7.627	0.0	962	1440 min Summer	5.360	0.0	1426	2160 min Summer	3.767	0.0	1708	2880 min Summer	2.933	0.0	2072	4320 min Summer	2.197	0.0	2896	5760 min Summer	1.790	0.0	3744	7200 min Summer	1.527	0.0	4544	8640 min Summer	1.341	0.0	5360	10080 min Summer	1.202	0.0	6152	15 min Winter	162.161	0.0	19
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Tuscany House White Hart Lane Basingstoke RG21 4AF		Yapton Metal Company Brundell Road Yapton			
Date 21/08/2019 11:57 File 19-167 PAVING (100YR + ...		Designed by SG Checked by LH			
Innovyze		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	6.518	0.218	0.3	35.9	O K
60 min Winter	6.565	0.265	0.3	43.7	O K
120 min Winter	6.619	0.319	0.3	52.7	O K
180 min Winter	6.654	0.354	0.3	58.4	O K
240 min Winter	6.680	0.380	0.3	62.7	O K
360 min Winter	6.717	0.417	0.3	68.9	O K
480 min Winter	6.744	0.444	0.3	73.2	O K
600 min Winter	6.764	0.464	0.3	76.5	O K
720 min Winter	6.779	0.479	0.3	79.0	O K
960 min Winter	6.776	0.476	0.3	78.6	O K
1440 min Winter	6.761	0.461	0.3	76.1	O K
2160 min Winter	6.727	0.427	0.3	70.4	O K
2880 min Winter	6.695	0.395	0.3	65.2	O K
4320 min Winter	6.674	0.374	0.3	61.8	O K
5760 min Winter	6.646	0.346	0.3	57.1	O K
7200 min Winter	6.615	0.315	0.3	52.0	O K
8640 min Winter	6.584	0.284	0.3	46.9	O K
10080 min Winter	6.553	0.253	0.3	41.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	98.106	0.0	34		
60 min Winter	59.354	0.0	64		
120 min Winter	35.909	0.0	122		
180 min Winter	26.763	0.0	180		
240 min Winter	21.725	0.0	240		
360 min Winter	16.191	0.0	358		
480 min Winter	13.143	0.0	476		
600 min Winter	11.180	0.0	592		
720 min Winter	9.796	0.0	708		
960 min Winter	7.627	0.0	940		
1440 min Winter	5.360	0.0	1384		
2160 min Winter	3.767	0.0	1992		
2880 min Winter	2.933	0.0	2224		
4320 min Winter	2.197	0.0	3156		
5760 min Winter	1.790	0.0	4088		
7200 min Winter	1.527	0.0	4968		
8640 min Winter	1.341	0.0	5792		
10080 min Winter	1.202	0.0	6560		
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Tuscany House White Hart Lane Basingstoke RG21 4AF	Yapton Metal Company Brundell Road Yapton	
Date 21/08/2019 11:57 File 19-167 PAVING (100YR + ...	Designed by SG Checked by LH	
Innovyze Source Control 2018.1		

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 498650 101750 SU 98650 01750
C (1km)	-0.025
D1 (1km)	0.390
D2 (1km)	0.245
D3 (1km)	0.403
E (1km)	0.310
F (1km)	2.321
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.095

Time (mins)	Area
From:	To: (ha)
0	4 0.095

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Odyssey Markides LLP		Page 4
Tuscany House White Hart Lane Basingstoke RG21 4AF	Yapton Metal Company Brundell Road Yapton	
Date 21/08/2019 11:57 File 19-167 PAVING (100YR + ...	Designed by SG Checked by LH	
Innovyze	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 7.100

Porous Car Park Structure

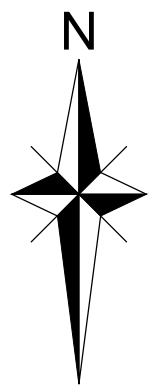
Infiltration Coefficient Base (m/hr)	0.00432	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	55.0
Max Percolation (l/s)	152.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	6.300	Membrane Depth (m)	260

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APPENDIX D

Odyssey Overland Flow Routes

P:\19-167 - Yapton Metal Company, Burndell Road, Yapton\Tech\Acad\Drawings\19-167-003 Overland Flow Route.dwg



- NOTES
- DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
 - ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.
 - THIS DRAWING IS A PRELIMINARY REVIEW ONLY AND SUBJECT TO DETAILED DESIGN.
 - TOPOGRAPHICAL SURVEY HAS BEEN TAKEN FROM ARCHIDATA LIMITED DRAWING AD19080_1_01, DATED APRIL 19'.
 - PROPOSED SITE LAYOUT HAS BEEN PROVIDED BY LAKEWOOD HOMES.
 - ODYSSEY ACCEPT NO LIABILITY FOR THE ACCURACY OF SURVEY INFORMATION AND LAYOUTS SUPPLIED BY OTHERS.

- LEGEND
- DEVELOPMENT BOUNDARY
 - INDICATIVE DIRECTION OF OVERLAND FLOW

FOR PLANNING
PURPOSES ONLY

Rev	Amendments	Drn	Chk	App	Date



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Job Title
**YAPTON METAL COMPANY,
BURNDELL ROAD, YAPTON**

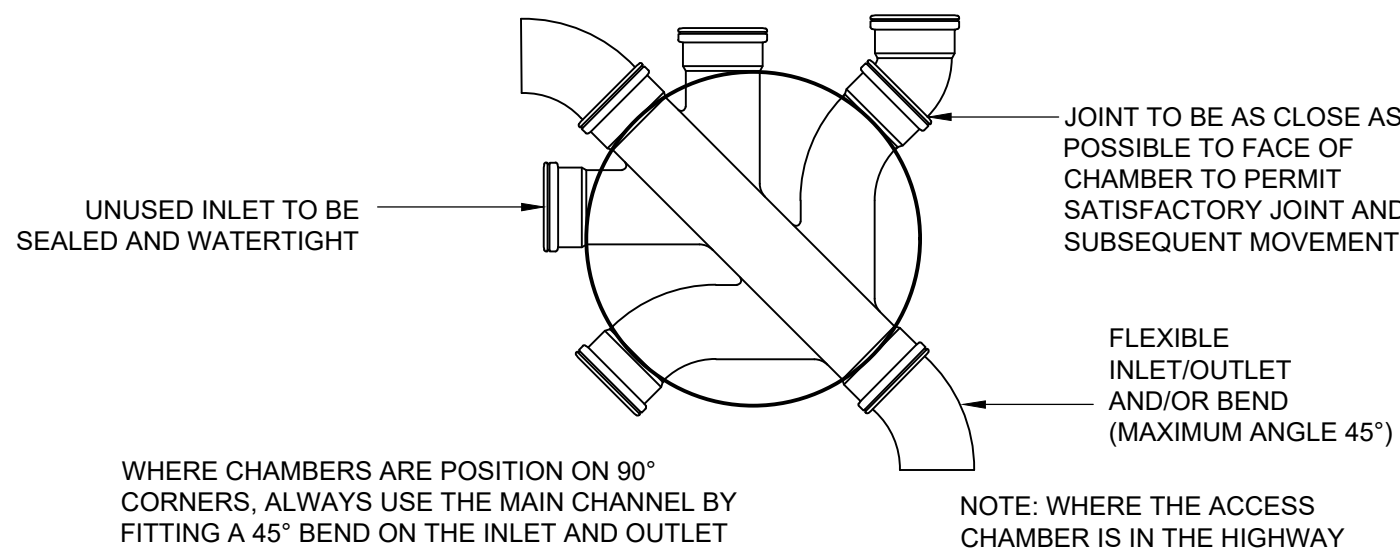
Drawing Title
OVERLAND FLOW ROUTES

Client
LAKEWOOD HOMES

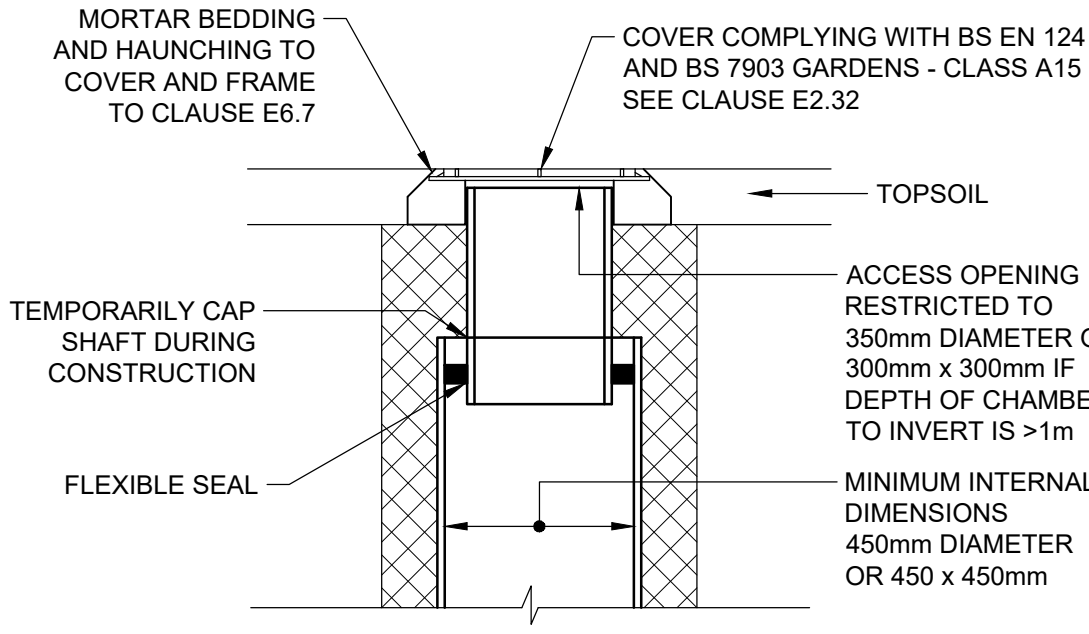
Scale 1:200 @ A2	Date AUG 19	Designed SG
Drawn JA	Checked SG	Approved LH
Job No 19-167	Drawing No 19-167/003	Rev

APPENDIX E

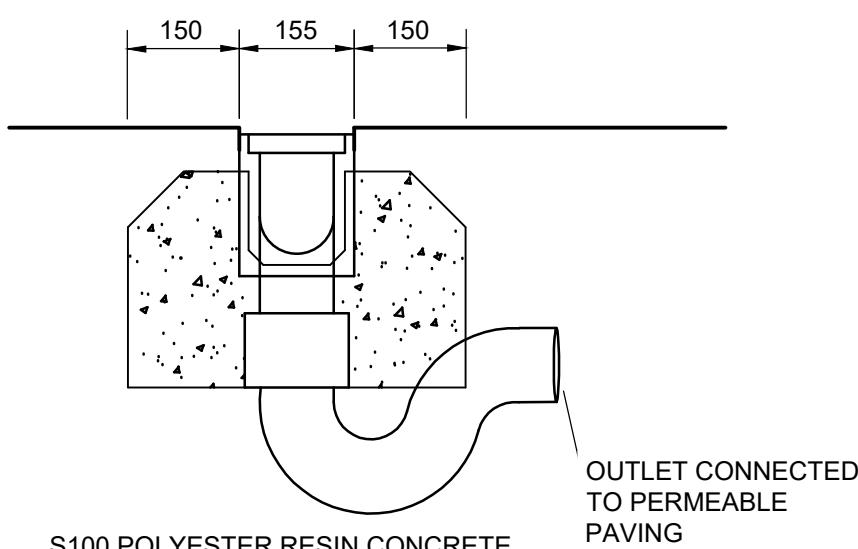
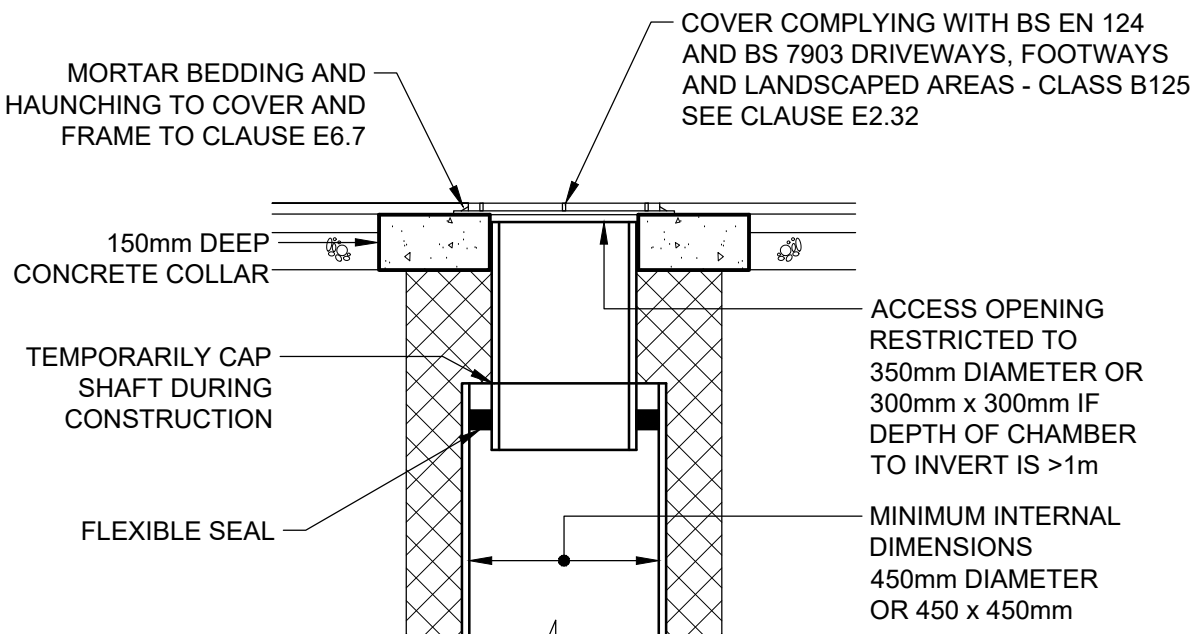
Odyssey Construction Details



TYPICAL INSPECTION CHAMBER BASE LAYOUT - TYPE 3
(FLEXIBLE MATERIAL DETAIL)

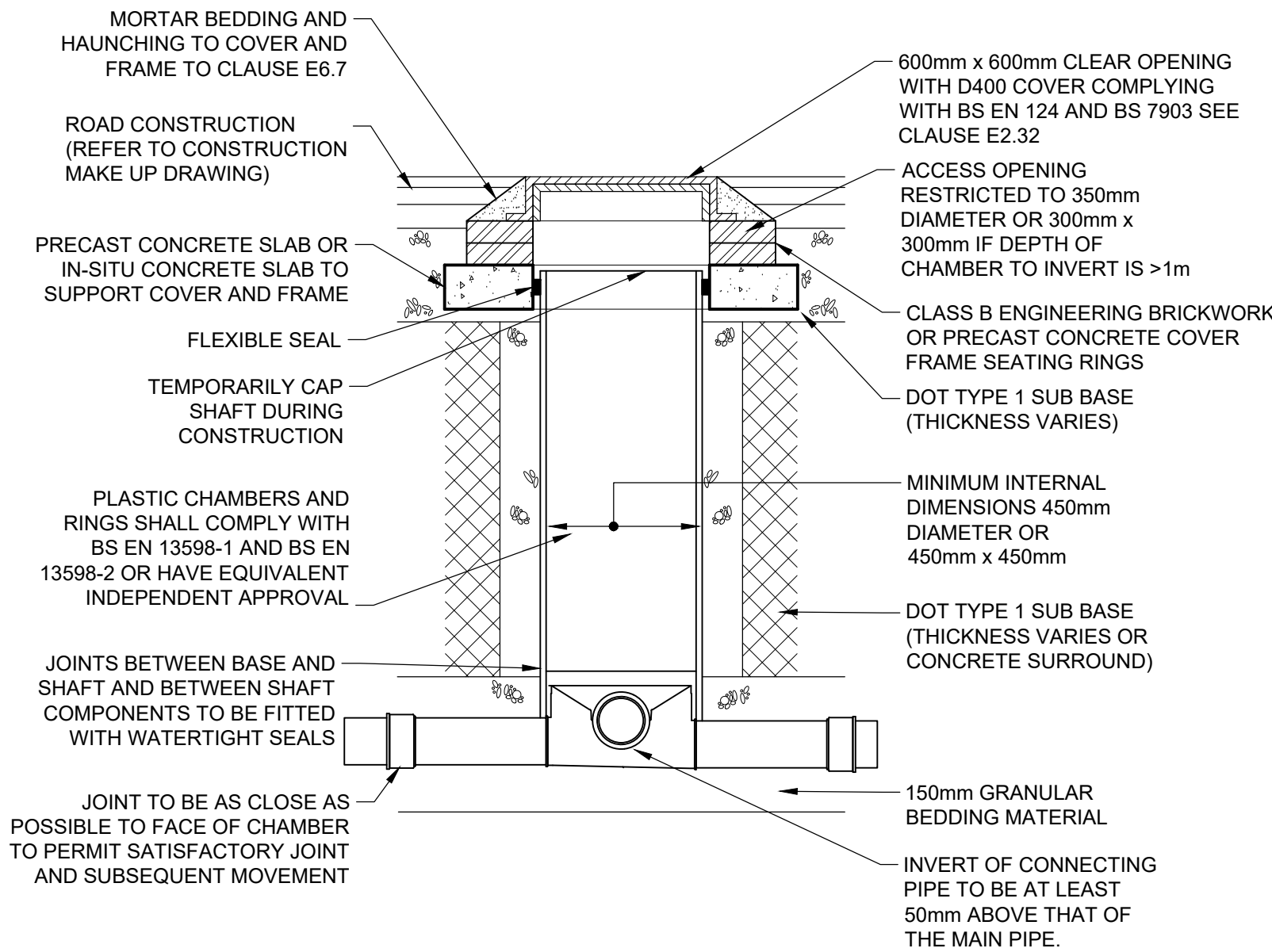


ALTERNATIVE TOP DETAILS FOR DOMESTIC DRIVEWAYS/
FOOTWAYS/ LANDSCAPED AREAS - TYPE 3

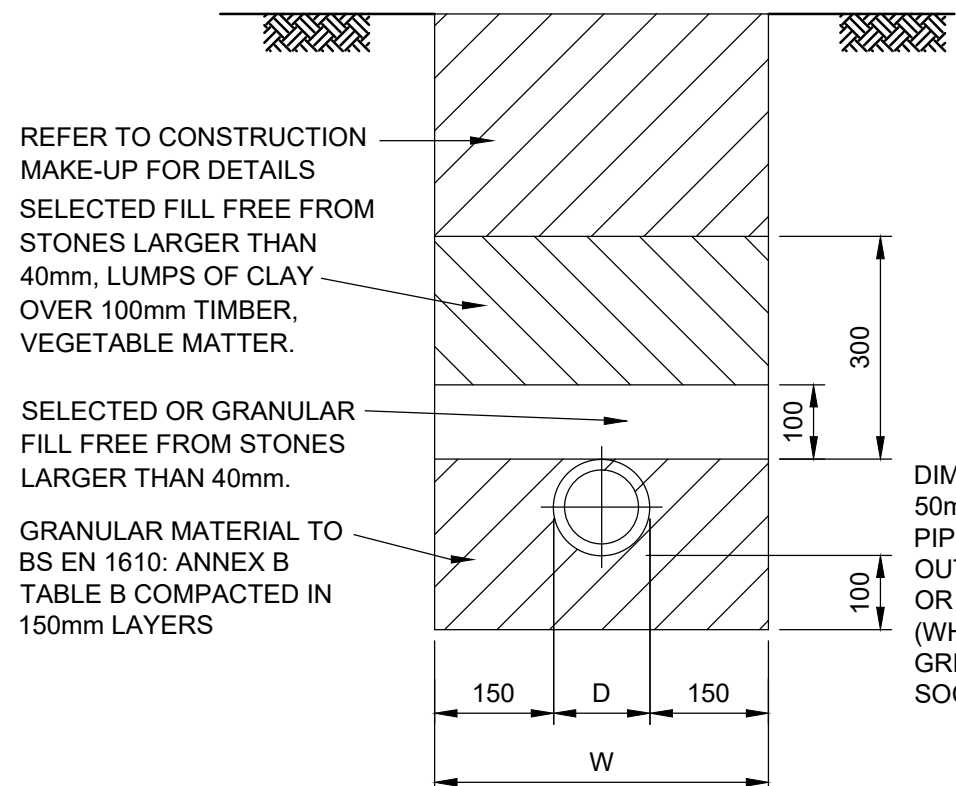


TYPICAL ACO DETAIL

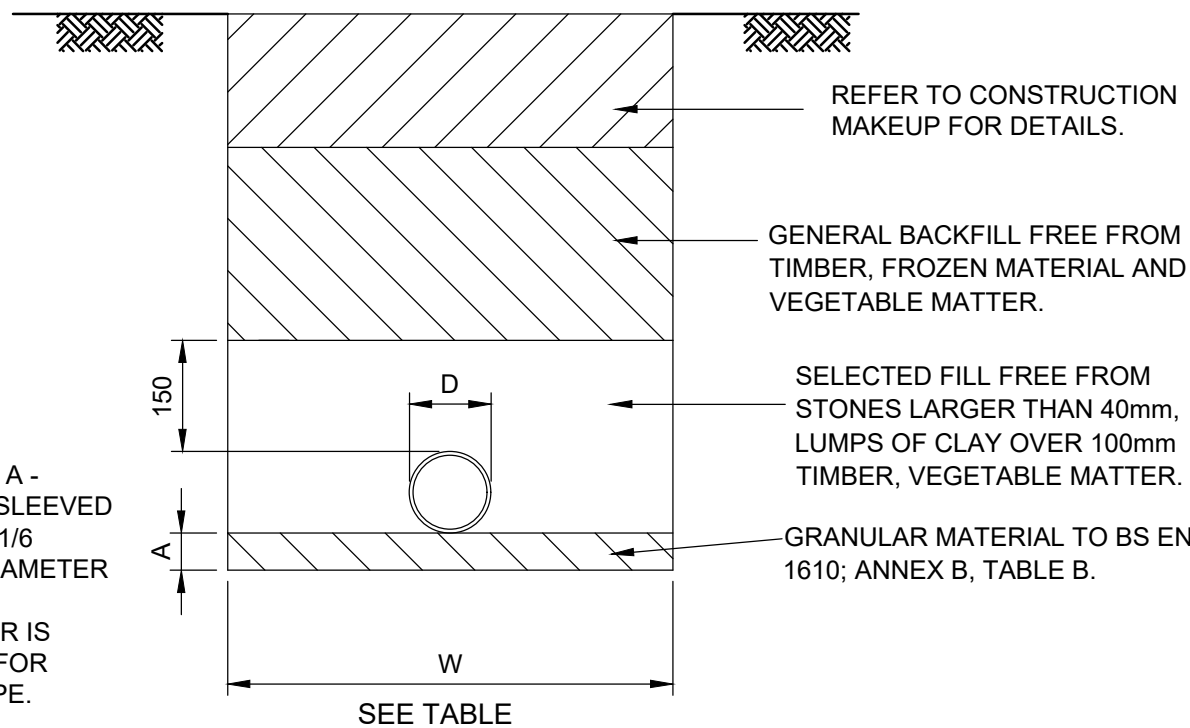
- NOTES
- DO NOT SCALE FROM THIS DRAWING. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE MANUAL FOR CONTRACT DOCUMENTS, VOLUME 1, SPECIFICATION FOR HIGHWAY WORKS AND ALL OTHER RELATED DRAWINGS ISSUED.
 - IF THERE IS ANY AMBIGUITY BETWEEN THE SPECIFICATION AND THE DRAWINGS, THE CONTRACTOR SHALL IMMEDIATELY INFORM THE ENGINEER.
 - DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
 - ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES.
 - ALL DIMENSIONS, LEVELS AND SURVEY GRID CO-ORDINATES ARE TO BE CHECKED ON SITE AND THE ENGINEER NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF THE WORKS.
 - NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS PERMITTED WITHOUT PERMISSION FROM THE ENGINEER.



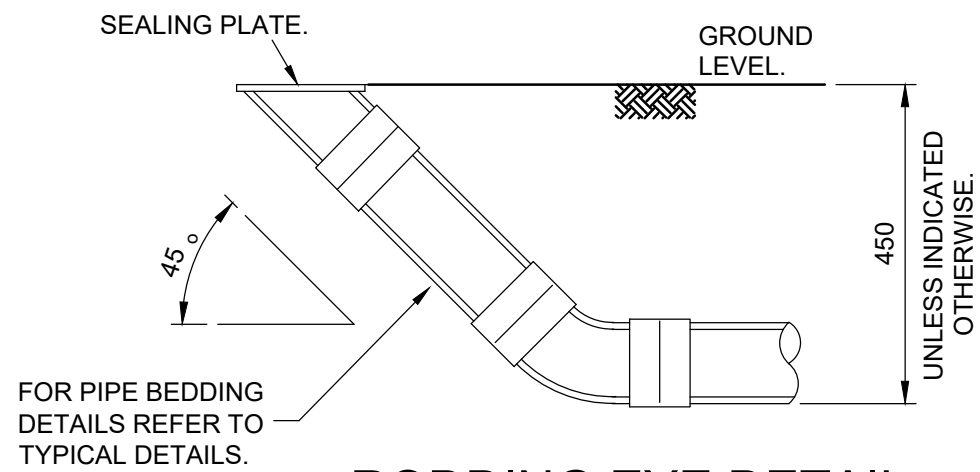
TYPICAL INSPECTION CHAMBER DETAIL - TYPE 3
(FLEXIBLE MATERIAL DETAIL) MAXIMUM DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE IN AREAS SUBJECT TO VEHICLE LOADING 3m, NON-ENTRY



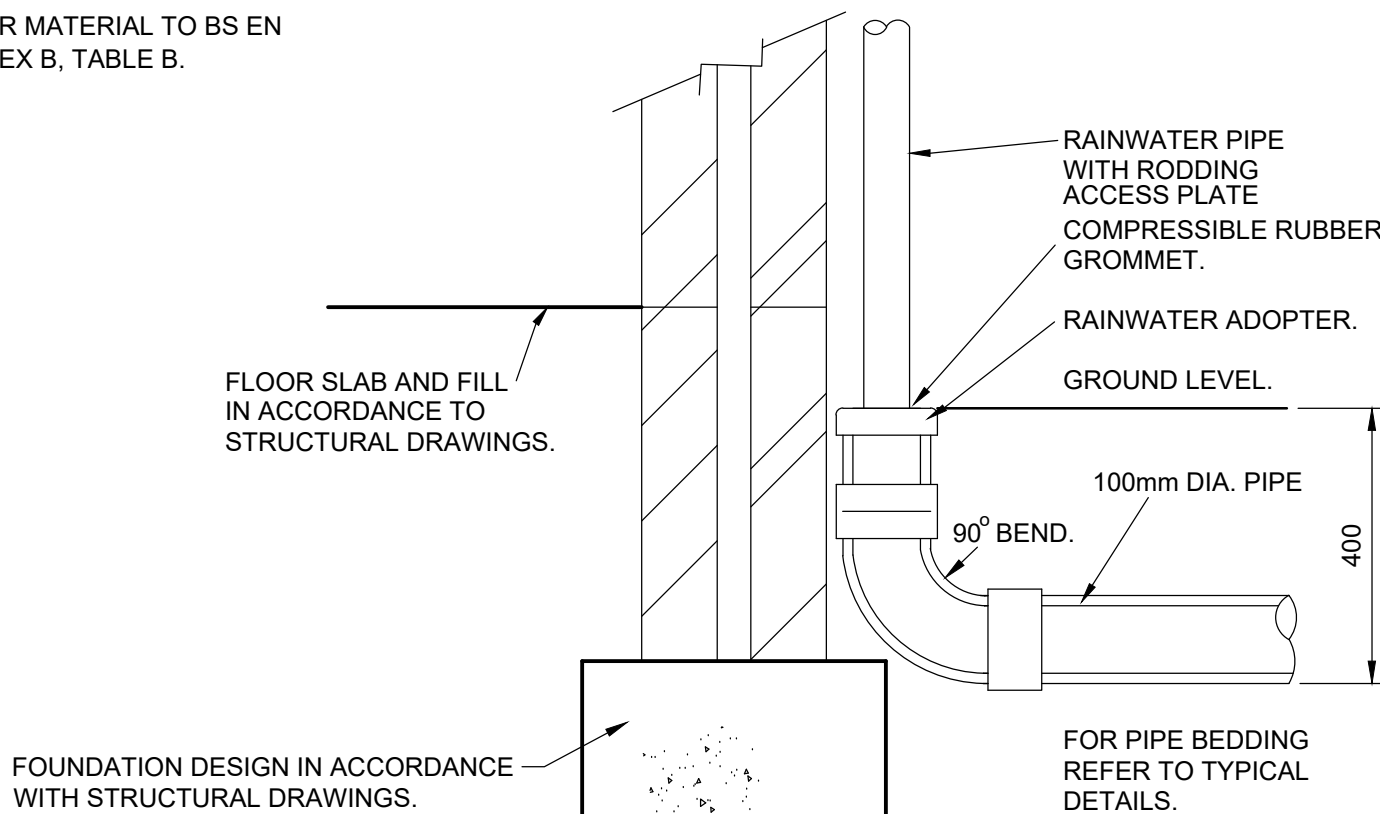
TYPICAL PIPE BEDDING DETAIL:
TYPE 3 (UPVC PIPES)
LOCATION: PEDESTRIAN AREAS: 0.6 m - 8.0 m DEEP.
VEHICLE AREAS: 1.2 m - 8.0 m DEEP.



TYPICAL PIPE BEDDING DETAIL:
TYPE 1 (CLAY PIPES) CLASS F
LOCATION: PEDESTRIAN AREAS UP TO 8.0 m DEEP.
VEHICLE AREAS: 1.2 m - 8.0 m (100mm DIA. PIPE),
1.2 m - 8 m (150mm DIA. PIPE).

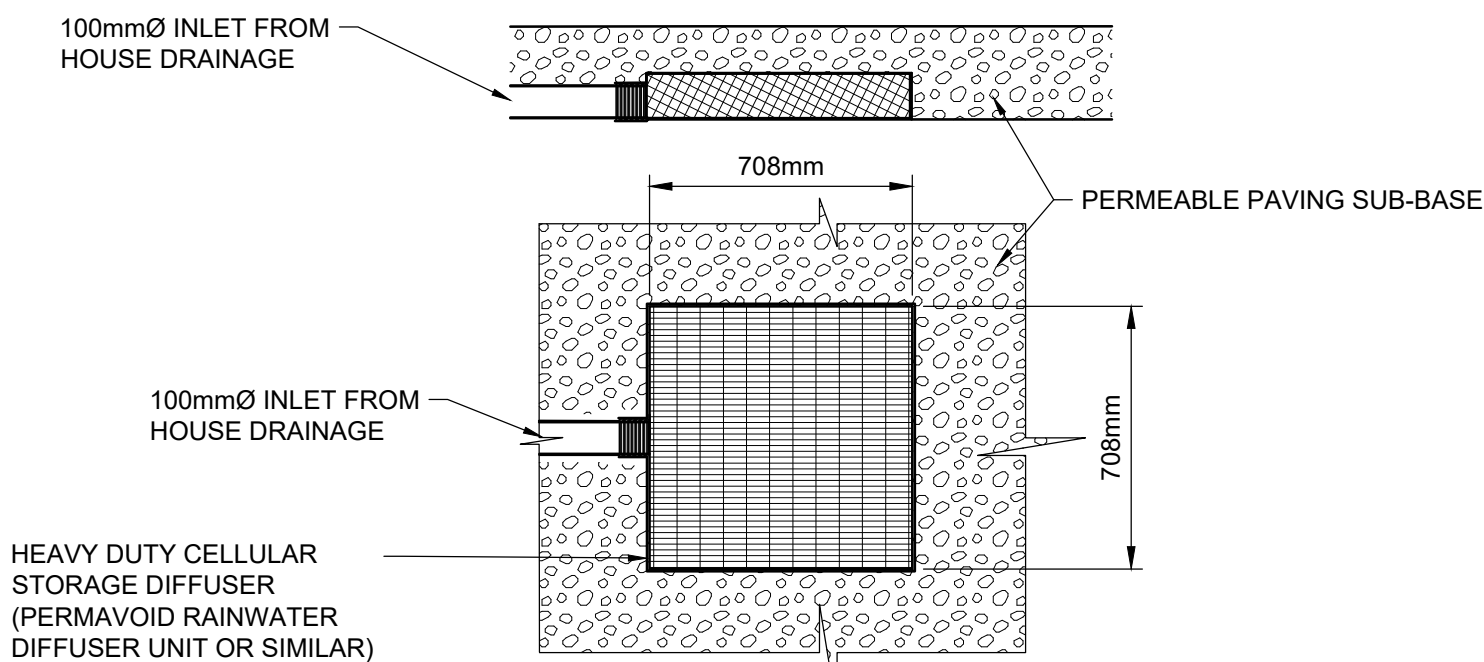


RODDING EYE DETAIL
TO BE USED IN PEDESTRAIN AND LANDSCAPED AREAS NOT SUBJECT TO VEHICULAR LOADING. MAXIMUM DEPTH TO INVERT 600mm.

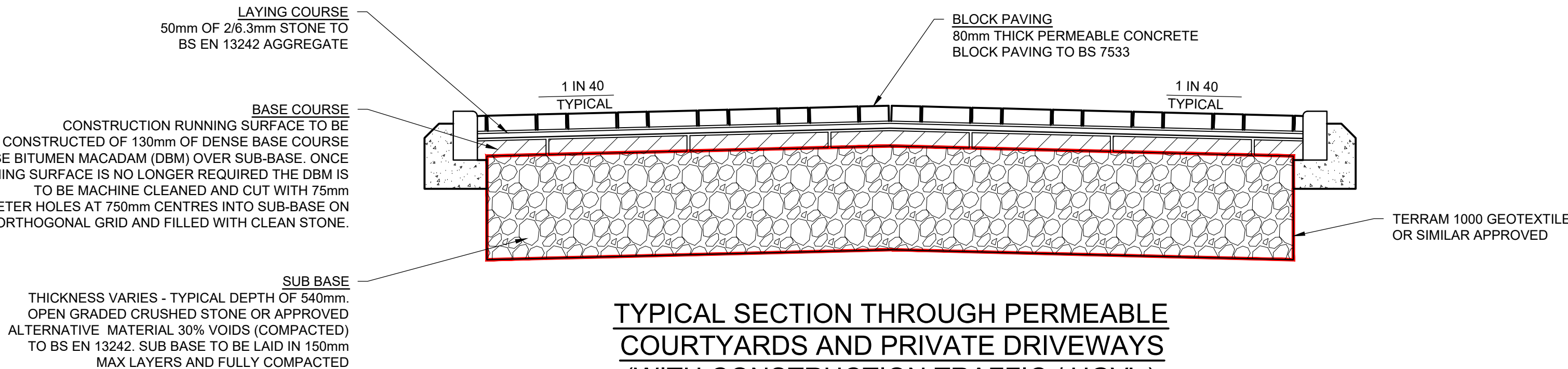


RAINWATER PIPE CONNECTION

TRENCH WIDTHS FOR VARIOUS SIZE PIPES					
D	100	150	225	300	375
W	450	600	750	750	900



TYPICAL PLAN & SECTION
THROUGH DIFFUSER DETAIL
PERMAVOID RAINWATER DIFFUSER
UNIT OR SIMILAR APPROVED



TYPICAL SECTION THROUGH PERMEABLE
COURTYARDS AND PRIVATE DRIVEWAYS
(WITH CONSTRUCTION TRAFFIC / HGV's)

(BASED ON CBR 3%)

FOR PLANNING
PURPOSES ONLY

Rev | Amendments | Dm | Chk | App | Date

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Job Title
**YAPTON METAL COMPANY,
BURNDELL ROAD, YAPTON**

Drawing Title
CONSTRUCTION DETAILS

Client
LAKEWOOD HOMES

Scale NTS @ A1	Date AUG 19	Designed SG
Drawn TSB	Checked SG	Approved LH
Job No 19-167	Drawing No 19-167/004	Rev

APPENDIX F

Arun DC Surface Water Drainage Proposal Checklist

Surface Water Drainage Proposal Checklist

Ground Investigation Results			
Results Required	Results Provided?		
Winter groundwater monitoring results (Please refer to guidance note 1 below)	Yes	☐	No ☒
Period of winter groundwater monitoring Note 1	From	DD/MM/YYYY	
	To	DD/MM/YYYY	
Maximum recorded groundwater level	mAOD mBGL		
Winter infiltration test results Note 2	Yes	☒	No ☐
Date of winter infiltration testing	03/07/2019		
Details of the location and depth of the infiltration testing Note 3	Yes	☒	No ☐
Minimum infiltration rate Note 4	1.2 x 10 ⁻⁶ m/s		

Guidance Notes

1. Groundwater monitoring should be undertaken during the wet winter months, (October to March) to enable the peak annual groundwater levels to be established. The extent of winter monitoring should be discussed with the council's Engineers.
2. Infiltration testing should be undertaken during the wet winter months, (October to March) and in line with BRE365, or a similar approved method. Tests should be repeated 3x, to replicate saturated ground conditions.
3. Infiltration testing should be undertaken at the location and depth of any proposed infiltration structures. This must be above the maximum recorded groundwater level in that vicinity.
4. The minimum infiltration rate obtained at the location and depth of the proposed infiltration structures should be used to inform the design of the structures.

Proposed Method of Surface Water Disposal			
Infiltration	Yes	☒	No ☐
On-site, via soak-away structures			
If on-site infiltration is not to be used, has justification for this been provided? Note 5	Yes	☐	No ☐
Attenuation (on-site) with a restricted discharge to a watercourse on, or adjacent to, the site	Yes	☐	No ☐
Attenuation (on-site) with a restricted discharge to a surface water sewer on, or adjacent to, the site	Yes	☐	No ☐
Attenuation (on-site) with a restricted discharge to a foul water sewer on, or adjacent to, the site	Yes	☐	No ☐

Guidance Notes

5. If on-site infiltration is not being used to drain the site you will need to provide evidence that demonstrates on-site infiltration is unviable.

Drainage Design: Supporting Calculations						
Calculations Required				Calculations Provided?		
Infiltration Structures	Half-drain time for 10 year event (plus climate change allowance)	Yes	☒	No	☐	
		16.5 Hours				
	Half-drain time for 100 year event (plus climate change allowance)	Yes	☒	No	☐	
		34 Hours				
	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7	Yes	☒	No	☐	
Attenuation and Subsequent Restricted Discharge	Lowest base level of infiltration structure	6.300 mAOD 0.800 mBGL				
	Has the design sought to provide treatment of potential contaminants? i.e. hydrocarbons.	Yes	☒	No	☐	
	Pre-development run-off rate calculations	Yes	☐	No	☐	
	Proposed discharge rate Note 6	l/s				
	Calculations demonstrating that the 1 in 100 year event, plus climate change allowance can be accommodated on-site. Note 7	Yes	☐	No	☐	
	Has the design sought to provide treatment of potential contaminants? i.e. hydrocarbons.	Yes	☐	No	☐	
	If your proposed scheme incorporates any impermeable lined attenuation features we require calculations to demonstrate that appropriate resistance to floatation (due to groundwater levels) is catered for in the design	Yes	☐	No	☐	
	If you propose discharging into or altering an ordinary watercourse; have you sought Ordinary Watercourse/Land Drainage Consent? Note 8	Yes	☐	No	☐	
	If discharging to a watercourse, piped system or the sea, has the proposed drainage network been modelled against predicted top water levels for the 1 in 100 year storm event plus climate change allowance, within the existing system? Note 9	Yes	☐	No	☐	

Guidance Notes

- Any proposed discharge rate must be less than, or equal to, the pre-development rate. Greenfield sites must use the mean flow rate (Q_{bar}). Additionally, if you are developing a brownfield site, we expect you to provide fully detailed plans of the existing surface water drainage arrangements on site, including impermeable areas, gullies, outfalls, pipes & diameters, manholes, etc.
- The appropriate factor of safety from the table below must be applied to your calculations to ensure your design is fully in accordance with CIRIA R156/ CIRIA C609.

Factor of Safety Table						
Size of Area to be Drained	Consequences of failure					
	No damage or inconvenience		Minor inconvenience, e.g. surface water on car park		Damage to buildings or structures or roads.	
	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75	Cv=1.0	Cv=0.75
<100 m ²	1.5	2	2	3	10	13
100m ² to 1000m ²	1.5	2	3	4	10	13
>1000m ²	1.5	2	5	6.5	10	13

8. [Ordinary Watercourse/Land Drainage Consent](#) will need to be sought, ideally in parallel with planning permission, if you propose discharging into, culverting or altering a watercourse.
9. Modelling is required to ensure that problems, such as surcharged outfalls, are addressed.

Plans/Drawings/Diagrams				
Required	Provided?			
Plan detailing the location of groundwater monitoring and infiltration testing	Yes	☒	No	☐
Detailed drainage layout plan Note 10	Yes	☒	No	☐
Construction detail plans Note 11	Yes	☒	No	☐
Exceedance flow route plans Note 12	Yes	☒	No	☐
Impermeable area plan	Yes	☒	No	☐
If ground levels are being raised $\geq 300\text{mm}$ above existing levels and is unavoidable, have fully detailed plans been provided, together with drainage proposals, to address any potential drainage related issues.	Yes	☐	No	☒
If any part of the development site is within recognised flood plain i.e. 1 in 100 & 1 in 200 year fluvial/tidal events, have plans been provided showing the extents, together with any proposals for ground raising/displacement within these areas. Note 13	Yes	☐	No	☒

Guidance Notes

10. Drainage layout plans should include:
 - All surface water drainage pipes labelled with; diameters, pipe materials, falls and invert levels.
 - All infiltrating and attenuating structures (including permeable paving) labelled with; dimensions, invert and cover levels.
 - All manholes labelled with; cover levels, invert levels, cover types detailed.
 - All silt traps clearly labelled with sump depths.
 - Control structures with outflow rates and invert levels.
 - Proposed/existing levels of any areas subject to ground raising, together with suitable measures/detailed drawings for the associated management of surface water runoff. Please note that ground raising should be avoided unless there are exceptional circumstances.
11. Site specific construction detail plans should be supplied if your proposed drainage scheme includes any of the following elements: pipe bed and surround; infiltrating structures; attenuating structures; manholes; catch-pits/silt traps; control devices; permeable paving; headwalls.
12. Unless specifically requested by the council's drainage engineers 'Exceedance Flow Route Plans' are only required for developments of more than 5 properties.
13. Product 4 'Detailed flood risk assessment mapping data' (available from the Environment Agency) must also be provided in support. Plans/details will be required to mitigate any unavoidable loss of flood plain/storage. Please also be aware that Environment Agency approval of such proposals will also be required.

Version 2.0 (13.06.2019)