# Former Homebase,
# Manor Road,
# Richmond

## Response to Stage 1 Decision
## Flood Risk, Water and Drainage

**April 2019**

FAIRHURST

**CONTROL SHEET**

**CLIENT:** **Avanton**

**PROJECT TITLE:** **Former Homebase, Manor Road, Richmond**

**REPORT TITLE:** **Response to Stage 1 Decision - Flood Risk, Water and Drainage**

**PROJECT REFERENCE:** **126782**

**REPORT REFERENCE:** **126782-FHT-ZZ-XX-RP-C-0002**

| Issue & Approval Schedule | ISSUE 1 DRAFT | Name | Signature | Date |
|---|---|---|---|---|
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**This document has been prepared in accordance with procedure OP/P02 of the *Fairhurst Quality and Environmental Management System***

# Contents

# 1 Introduction

1.1.1 This technical note has been prepared in response to the GLA Stage 1 Report for Manor Road, Richmond, to address points raised regarding flood risk, water and drainage, in order that the proposals will be deemed compliant with the London Plan and the draft London Plan.

1.1.2 The updated Flood Risk Assessment and Drainage Strategy as referenced to in this Technical Note are included as appendices to this Technical Note.

# 2 Decision Notice

## 2.1 Greater London Authority Comments

2.1.1 The Greater London Authority (GLA) Development Planning Committee have reviewed the planning application (reference 19/0510/FUL) and returned the comments below with regards to Flood risk, drainage and water.

**Flood risk, drainage and water**

57 A detailed report on flood risk, drainage and water has been issued under separate cover to the LPA and applicant. The key points requiring action are outlined below.

58 The Flood Risk Assessment provided for the proposed development does not comply with London Plan policy 5.12 and draft London Plan policy SI12, as it does not give appropriate regard to residual flood risks from surface water and groundwater. A full review of flood risk (including residual risks) from all sources of flooding should be provided, and flood resilience and emergency planning measures should be included to manage these risks.

59 The surface water drainage strategy for the proposed development does not comply with London Plan policy 5.13 and draft policy SI13. The applicant should provide revised additional attenuation storage volume calculations, and exceedance assessment.

60 The proposed development generally meets the requirements of London Plan policy 5.15 and draft London Plan policy SI5.

## 2.2 Response

Item 57

2.2.1 Comment only, no response required.

Item 58 – Surface Water & Groundwater Flooding Residual Risks

2.2.2 The risk of surface flooding is addressed in the FRA in section 4.2 where data from the EA was presented and in section 5.2 where it was deemed that there was no probability of flooding from surface water based on the data provided by Thames Water.

2.2.3 A section has been added to the FRA which discusses the probability of flooding from groundwater (5.3). Although borehole records exist nearby to the site, groundwater levels vary and it is not possible to properly assess the risk and potential of flooding from groundwater without site specific boreholes and site investigations.

2.2.4 Section 7.1 has been added to the FRA which covers mitigation against the risk of flooding by groundwater through limiting the run-off from blue roofs to 1 l/s per building and provision of an exceedance flow path through the site which routes water resulting from groundwater flooding away from the buildings and road adjacent to the site and into areas where any flooding which occurs would leave a safe route

of exit for residents. This is shown on Fairhurst drawing 126782-C-4000 which is included as an Appendix to this document as well as to the FRA.

2.2.5 Due to the low risk of surface water flooding, no further resilience or emergency planning measures are considered necessary to protect the development or users of the development.

Item 59

2.2.6 The storage volume proposed in the previous revision of the FRA was based on the whole of the non-roof area being hard landscaping to provide a conservative design based on the limited information available at the time of writing.

2.2.7 An infiltration coefficient of 0.1 m/hr[1] was used in these calculations as the most conservative estimate for expected soil conditions (gravels) in absence of site specific soakage tests at this stage. To mitigate the risk of no site specific tests being available, an additional 5% as a safety factor was added to the required volume.

2.2.8 A review of the storage required has been undertaken;

- The soft landscaping has been measured and the impermeable non roof area has been revised to 0.53ha based on the most up-to-date development plans
- The infiltration coefficient has been adjusted to be in the mid-range of that for gravel to a value of 0.5 m/hr.
- The 5% for safety factor has been removed

2.2.9 The revised site and calculation methodology has been modelled in MicroDrainage Source Control which results in a storage requirement of 216m³.

2.2.10 The revised calculations are provided in Appendix A1 of this Technical Note and as a Appendix A5 of the FRA.

2.2.11 Details of the tank sizes and volumes are provided in Appendix A1 of this Technical Note.

2.2.12 Fairhurst drawing 126782-C-4000 (provided in Appendix A2 of this Technical Note and A6 of the FRA) shows the updated strategy layout including exceedance routes.

Item 60

2.2.13 Comment only, no response required.

# 3 Stage I Consultation Response

## 3.1 Comments

3.1.1 The Greater London Authority Water Department have further reviewed the application (reference 4796) and returned the additional comments below:

[1] Typical infiltration rates for soil types from CIRIA R156 report.

## Flood Risk Management (London Plan Policy 5.12, draft new London Plan Policy SI.12)

| Flood Source | Flood Risk |
|---|---|
| Rivers and the sea | 1 |
| Surface water | High |
| Reservoir | None |
| Groundwater | Not Assessed |
| Sewer | Low |
| Other | N/A |

1. The site is in Flood Zone 1 and greater than 1 hectare in area (1.8ha). A Flood Risk Assessment (FRA) has been submitted as required under the NPPF.

2. The FRA considers the risk of flooding from a range of sources, but does not adequately address the residual risk of flooding due to surface water and groundwater. The FRA should address the high risk of surface flooding present within the site, and evaluate the groundwater flooding risk consulting relevant sources such as the borough SFRA.

3. The FRA provides a Sequential Test and Exception Test for the development, as required by the NPPF. The Sequential Test notes that lower vulnerability uses are proposed on lower floors, with more vulnerable uses on higher floors.

4. The Flood Risk Assessment provided for the proposed development does not comply with London Plan policy 5.12 (and draft New London Plan policy SI.12), as it does not give appropriate regard to residual flood risks from Surface water and groundwater. A full review of flood risk (including residual risks) from all sources of flooding should be provided, and flood resilience and emergency planning measures should be included to manage these risks.

## Sustainable Drainage (London Plan Policy 5.13, draft new London Plan Policy SI.13)

5. The surface water drainage strategy provides an assessment of existing runoff rates, greenfield runoff rates, and required attenuation storage for a range of post-development discharge rates. Selected discharge rate is 25.2 l/s (Greenfield for 1 in 100yr + Climate Change).

6. The surface water drainage strategy addresses the Drainage Hierarchy, and notes that rainwater harvesting, blue/green roofs, permeable paving, and underground storage tanks would be possible options, and that infiltration is feasible. Measures are shown on plans. This approach does satisfy the requirements of London Plan policy 5.13 (and draft London Plan SI.13). The Applicant is also suggesting trees and we recommend that tree pits are consider for these.

7. The attenuation tank volume has been estimated using a simplified method, which gives an estimated attenuation requirement of 715-962m$^3$. The applicant is proposing a volume of 1020m$^3$, with no further explanation. Proposed volume might be enough, but the selected method is not considered sufficiently accurate to ensure that the specified tank volume will allow discharge rates to be restricted to the desired rate. Applicant should ensure proposed volume is adequate by providing evidence of a suitable method of calculation.

8. No assessment of exceedance flow paths has been provided. Additional information should be provided showing that exceedance flow paths through the site are available in the case of attenuation system blockage or an extreme rainfall event.

9. The surface water drainage strategy for the proposed development does not comply with London Plan policy 5.13 (and draft policy SI.13). Applicant should provide revised additional attenuation storage volume calculations, and exceedance assessment.

Further comments were included with regards to Water Efficiency which should be addressed by Hoare Lee who are responsible for water supply on the development

**3.2 Response**

Item 1

3.2.1 Comment only, no response required.

Item 2 – Flood Risk Management

3.2.2 Refer to paragraphs 2.2.2 to 2.2.4 above which address Item 58 of the GLA Stage 1 Report response and this comment.

Item 3

3.2.3 Comment only, no response required.

Item 4 - Flood Risk Management

3.2.4 Refer to Item 2 above and paragraphs 2.2.2 to 2.2.4 above which address Item 58 of the GLA Stage 1 Report response and this comment.

Item 5

3.2.5 Comment only, no response required.

Item 6

3.2.6 Comment only, no response required.

Item 7 – Attenuation Volume

3.2.7 Refer to paragraphs 2.2.6 to 2.2.11 above which address Item 59 of the GLA Stage 1 Report response and this comment.

Item 8 – Exceedance Flow Paths

3.2.8 Refer to Fairhurst Drawing 126782-C-4000 included as an appendix to this Technical Note which has been updated to include exceedance flow routes. It should be noted the drainage network is designed to have sufficient capacity to fully contain all storms up to and including the 100yr + climate change storm. These routes are for any storms more severe than this only.

Item 9 – Attenuation Volume

3.2.9 Refer to Item 7 and 8 above and paragraphs 2.2.6 to 2.2.11 above which address Item 59 of the GLA Stage 1 Report response and this comment.

## A.1 MicroDrainage and Surface Water Attenuation Calculations

## Summary of Results for 100 year Return Period (+35%)

Half Drain Time : 95 minutes.

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 5.475 | 0.475 | 18.8 | 121.9 | O K |
| 30 min Summer | 5.594 | 0.594 | 18.8 | 152.4 | O K |
| 60 min Summer | 5.671 | 0.671 | 18.8 | 172.1 | O K |
| 120 min Summer | 5.669 | 0.669 | 18.8 | 171.6 | O K |
| 180 min Summer | 5.633 | 0.633 | 18.8 | 162.3 | O K |
| 240 min Summer | 5.596 | 0.596 | 18.8 | 153.0 | O K |
| 360 min Summer | 5.526 | 0.526 | 18.8 | 134.9 | O K |
| 480 min Summer | 5.462 | 0.462 | 18.8 | 118.6 | O K |
| 600 min Summer | 5.403 | 0.403 | 18.8 | 103.3 | O K |
| 720 min Summer | 5.348 | 0.348 | 18.8 | 89.2 | O K |
| 960 min Summer | 5.252 | 0.252 | 18.8 | 64.6 | O K |
| 1440 min Summer | 5.119 | 0.119 | 18.8 | 30.6 | O K |
| 2160 min Summer | 5.049 | 0.049 | 18.3 | 12.5 | O K |
| 2880 min Summer | 5.041 | 0.041 | 15.5 | 10.6 | O K |
| 4320 min Summer | 5.033 | 0.033 | 12.5 | 8.6 | O K |
| 5760 min Summer | 5.029 | 0.029 | 11.0 | 7.5 | O K |
| 7200 min Summer | 5.027 | 0.027 | 10.0 | 6.8 | O K |
| 8640 min Summer | 5.025 | 0.025 | 9.3 | 6.3 | O K |
| 10080 min Summer | 5.023 | 0.023 | 8.7 | 6.0 | O K |
| 15 min Winter | 5.538 | 0.538 | 18.8 | 138.1 | O K |
| 30 min Winter | 5.676 | 0.676 | 18.8 | 173.5 | O K |
| 60 min Winter | 5.773 | 0.773 | 18.8 | 198.3 | O K |
| 120 min Winter | 5.789 | 0.789 | 18.8 | 202.3 | O K |
| 180 min Winter | 5.741 | 0.741 | 18.8 | 190.1 | O K |
| 240 min Winter | 5.693 | 0.693 | 18.8 | 177.7 | O K |
| 360 min Winter | 5.590 | 0.590 | 18.8 | 151.5 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Time-Peak (mins) |
|---|---|---|---|
| 15 min Summer | 138.813 | 0.0 | 24 |
| 30 min Summer | 89.321 | 0.0 | 37 |
| 60 min Summer | 54.688 | 0.0 | 64 |
| 120 min Summer | 32.384 | 0.0 | 112 |
| 180 min Summer | 23.552 | 0.0 | 142 |
| 240 min Summer | 18.697 | 0.0 | 174 |
| 360 min Summer | 13.427 | 0.0 | 242 |
| 480 min Summer | 10.624 | 0.0 | 308 |
| 600 min Summer | 8.854 | 0.0 | 374 |
| 720 min Summer | 7.626 | 0.0 | 436 |
| 960 min Summer | 6.022 | 0.0 | 558 |
| 1440 min Summer | 4.311 | 0.0 | 782 |
| 2160 min Summer | 3.083 | 0.0 | 1100 |
| 2880 min Summer | 2.428 | 0.0 | 1468 |
| 4320 min Summer | 1.732 | 0.0 | 2204 |
| 5760 min Summer | 1.362 | 0.0 | 2888 |
| 7200 min Summer | 1.130 | 0.0 | 3656 |
| 8640 min Summer | 0.970 | 0.0 | 4280 |
| 10080 min Summer | 0.852 | 0.0 | 4976 |
| 15 min Winter | 138.813 | 0.0 | 24 |
| 30 min Winter | 89.321 | 0.0 | 38 |
| 60 min Winter | 54.688 | 0.0 | 64 |
| 120 min Winter | 32.384 | 0.0 | 118 |
| 180 min Winter | 23.552 | 0.0 | 152 |
| 240 min Winter | 18.697 | 0.0 | 188 |
| 360 min Winter | 13.427 | 0.0 | 262 |

## Summary of Results for 100 year Return Period (+35%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 480 min Winter | 5.494 | 0.494 | 18.8 | 126.7 | O K |
| 600 min Winter | 5.404 | 0.404 | 18.8 | 103.6 | O K |
| 720 min Winter | 5.321 | 0.321 | 18.8 | 82.4 | O K |
| 960 min Winter | 5.183 | 0.183 | 18.8 | 47.1 | O K |
| 1440 min Winter | 5.049 | 0.049 | 18.5 | 12.6 | O K |
| 2160 min Winter | 5.039 | 0.039 | 14.7 | 10.0 | O K |
| 2880 min Winter | 5.034 | 0.034 | 12.7 | 8.6 | O K |
| 4320 min Winter | 5.028 | 0.028 | 10.4 | 7.1 | O K |
| 5760 min Winter | 5.025 | 0.025 | 9.3 | 6.3 | O K |
| 7200 min Winter | 5.023 | 0.023 | 8.5 | 5.8 | O K |
| 8640 min Winter | 5.022 | 0.022 | 8.2 | 5.5 | O K |
| 10080 min Winter | 5.021 | 0.021 | 7.8 | 5.3 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Time-Peak (mins) |
|---|---|---|---|
| 480 min Winter | 10.624 | 0.0 | 334 |
| 600 min Winter | 8.854 | 0.0 | 402 |
| 720 min Winter | 7.626 | 0.0 | 464 |
| 960 min Winter | 6.022 | 0.0 | 580 |
| 1440 min Winter | 4.311 | 0.0 | 736 |
| 2160 min Winter | 3.083 | 0.0 | 1104 |
| 2880 min Winter | 2.428 | 0.0 | 1436 |
| 4320 min Winter | 1.732 | 0.0 | 2204 |
| 5760 min Winter | 1.362 | 0.0 | 2904 |
| 7200 min Winter | 1.130 | 0.0 | 3672 |
| 8640 min Winter | 0.970 | 0.0 | 4408 |
| 10080 min Winter | 0.852 | 0.0 | 4920 |

## 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) | 20.000 | Shortest Storm (mins) | 15 |
| Ratio R | 0.450 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +35 |

## Time Area Diagram

Total Area (ha) 0.530

| Time From: | (mins) To: | Area (ha) | Time From: | (mins) To: | Area (ha) | Time From: | (mins) To: | Area (ha) |
|---|---|---|---|---|---|---|---|---|
| 0 | 4 | 0.177 | 4 | 8 | 0.177 | 8 | 12 | 0.177 |

## Model Details

Storage is Online Cover Level (m) 7.000

## Cellular Storage Structure

Invert Level (m) 5.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.50000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.50000

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 270.0 | 270.0 | 0.800 | 270.0 | 270.0 | 0.801 | 0.0 | 270.0 |

## Additional Hydrograph #1

| Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 5.0 | 620 | 5.0 | 1230 | 5.0 | 1840 | 5.0 | 2450 | 5.0 | 3060 | 5.0 | 3670 | 5.0 | 4280 | 5.0 |
| 20 | 5.0 | 630 | 5.0 | 1240 | 5.0 | 1850 | 5.0 | 2460 | 5.0 | 3070 | 5.0 | 3680 | 5.0 | 4290 | 5.0 |
| 30 | 5.0 | 640 | 5.0 | 1250 | 5.0 | 1860 | 5.0 | 2470 | 5.0 | 3080 | 5.0 | 3690 | 5.0 | 4300 | 5.0 |
| 40 | 5.0 | 650 | 5.0 | 1260 | 5.0 | 1870 | 5.0 | 2480 | 5.0 | 3090 | 5.0 | 3700 | 5.0 | 4310 | 5.0 |
| 50 | 5.0 | 660 | 5.0 | 1270 | 5.0 | 1880 | 5.0 | 2490 | 5.0 | 3100 | 5.0 | 3710 | 5.0 | 4320 | 5.0 |
| 60 | 5.0 | 670 | 5.0 | 1280 | 5.0 | 1890 | 5.0 | 2500 | 5.0 | 3110 | 5.0 | 3720 | 5.0 | 4330 | 5.0 |
| 70 | 5.0 | 680 | 5.0 | 1290 | 5.0 | 1900 | 5.0 | 2510 | 5.0 | 3120 | 5.0 | 3730 | 5.0 | 4340 | 5.0 |
| 80 | 5.0 | 690 | 5.0 | 1300 | 5.0 | 1910 | 5.0 | 2520 | 5.0 | 3130 | 5.0 | 3740 | 5.0 | 4350 | 5.0 |
| 90 | 5.0 | 700 | 5.0 | 1310 | 5.0 | 1920 | 5.0 | 2530 | 5.0 | 3140 | 5.0 | 3750 | 5.0 | 4360 | 5.0 |
| 100 | 5.0 | 710 | 5.0 | 1320 | 5.0 | 1930 | 5.0 | 2540 | 5.0 | 3150 | 5.0 | 3760 | 5.0 | 4370 | 5.0 |
| 110 | 5.0 | 720 | 5.0 | 1330 | 5.0 | 1940 | 5.0 | 2550 | 5.0 | 3160 | 5.0 | 3770 | 5.0 | 4380 | 5.0 |
| 120 | 5.0 | 730 | 5.0 | 1340 | 5.0 | 1950 | 5.0 | 2560 | 5.0 | 3170 | 5.0 | 3780 | 5.0 | 4390 | 5.0 |
| 130 | 5.0 | 740 | 5.0 | 1350 | 5.0 | 1960 | 5.0 | 2570 | 5.0 | 3180 | 5.0 | 3790 | 5.0 | 4400 | 5.0 |
| 140 | 5.0 | 750 | 5.0 | 1360 | 5.0 | 1970 | 5.0 | 2580 | 5.0 | 3190 | 5.0 | 3800 | 5.0 | 4410 | 5.0 |
| 150 | 5.0 | 760 | 5.0 | 1370 | 5.0 | 1980 | 5.0 | 2590 | 5.0 | 3200 | 5.0 | 3810 | 5.0 | 4420 | 5.0 |
| 160 | 5.0 | 770 | 5.0 | 1380 | 5.0 | 1990 | 5.0 | 2600 | 5.0 | 3210 | 5.0 | 3820 | 5.0 | 4430 | 5.0 |
| 170 | 5.0 | 780 | 5.0 | 1390 | 5.0 | 2000 | 5.0 | 2610 | 5.0 | 3220 | 5.0 | 3830 | 5.0 | 4440 | 5.0 |
| 180 | 5.0 | 790 | 5.0 | 1400 | 5.0 | 2010 | 5.0 | 2620 | 5.0 | 3230 | 5.0 | 3840 | 5.0 | 4450 | 5.0 |
| 190 | 5.0 | 800 | 5.0 | 1410 | 5.0 | 2020 | 5.0 | 2630 | 5.0 | 3240 | 5.0 | 3850 | 5.0 | 4460 | 5.0 |
| 200 | 5.0 | 810 | 5.0 | 1420 | 5.0 | 2030 | 5.0 | 2640 | 5.0 | 3250 | 5.0 | 3860 | 5.0 | 4470 | 5.0 |
| 210 | 5.0 | 820 | 5.0 | 1430 | 5.0 | 2040 | 5.0 | 2650 | 5.0 | 3260 | 5.0 | 3870 | 5.0 | 4480 | 5.0 |
| 220 | 5.0 | 830 | 5.0 | 1440 | 5.0 | 2050 | 5.0 | 2660 | 5.0 | 3270 | 5.0 | 3880 | 5.0 | 4490 | 5.0 |
| 230 | 5.0 | 840 | 5.0 | 1450 | 5.0 | 2060 | 5.0 | 2670 | 5.0 | 3280 | 5.0 | 3890 | 5.0 | 4500 | 5.0 |
| 240 | 5.0 | 850 | 5.0 | 1460 | 5.0 | 2070 | 5.0 | 2680 | 5.0 | 3290 | 5.0 | 3900 | 5.0 | 4510 | 5.0 |
| 250 | 5.0 | 860 | 5.0 | 1470 | 5.0 | 2080 | 5.0 | 2690 | 5.0 | 3300 | 5.0 | 3910 | 5.0 | 4520 | 5.0 |
| 260 | 5.0 | 870 | 5.0 | 1480 | 5.0 | 2090 | 5.0 | 2700 | 5.0 | 3310 | 5.0 | 3920 | 5.0 | 4530 | 5.0 |
| 270 | 5.0 | 880 | 5.0 | 1490 | 5.0 | 2100 | 5.0 | 2710 | 5.0 | 3320 | 5.0 | 3930 | 5.0 | 4540 | 5.0 |
| 280 | 5.0 | 890 | 5.0 | 1500 | 5.0 | 2110 | 5.0 | 2720 | 5.0 | 3330 | 5.0 | 3940 | 5.0 | 4550 | 5.0 |
| 290 | 5.0 | 900 | 5.0 | 1510 | 5.0 | 2120 | 5.0 | 2730 | 5.0 | 3340 | 5.0 | 3950 | 5.0 | 4560 | 5.0 |
| 300 | 5.0 | 910 | 5.0 | 1520 | 5.0 | 2130 | 5.0 | 2740 | 5.0 | 3350 | 5.0 | 3960 | 5.0 | 4570 | 5.0 |
| 310 | 5.0 | 920 | 5.0 | 1530 | 5.0 | 2140 | 5.0 | 2750 | 5.0 | 3360 | 5.0 | 3970 | 5.0 | 4580 | 5.0 |
| 320 | 5.0 | 930 | 5.0 | 1540 | 5.0 | 2150 | 5.0 | 2760 | 5.0 | 3370 | 5.0 | 3980 | 5.0 | 4590 | 5.0 |
| 330 | 5.0 | 940 | 5.0 | 1550 | 5.0 | 2160 | 5.0 | 2770 | 5.0 | 3380 | 5.0 | 3990 | 5.0 | 4600 | 5.0 |
| 340 | 5.0 | 950 | 5.0 | 1560 | 5.0 | 2170 | 5.0 | 2780 | 5.0 | 3390 | 5.0 | 4000 | 5.0 | 4610 | 5.0 |
| 350 | 5.0 | 960 | 5.0 | 1570 | 5.0 | 2180 | 5.0 | 2790 | 5.0 | 3400 | 5.0 | 4010 | 5.0 | 4620 | 5.0 |
| 360 | 5.0 | 970 | 5.0 | 1580 | 5.0 | 2190 | 5.0 | 2800 | 5.0 | 3410 | 5.0 | 4020 | 5.0 | 4630 | 5.0 |
| 370 | 5.0 | 980 | 5.0 | 1590 | 5.0 | 2200 | 5.0 | 2810 | 5.0 | 3420 | 5.0 | 4030 | 5.0 | 4640 | 5.0 |
| 380 | 5.0 | 990 | 5.0 | 1600 | 5.0 | 2210 | 5.0 | 2820 | 5.0 | 3430 | 5.0 | 4040 | 5.0 | 4650 | 5.0 |
| 390 | 5.0 | 1000 | 5.0 | 1610 | 5.0 | 2220 | 5.0 | 2830 | 5.0 | 3440 | 5.0 | 4050 | 5.0 | 4660 | 5.0 |
| 400 | 5.0 | 1010 | 5.0 | 1620 | 5.0 | 2230 | 5.0 | 2840 | 5.0 | 3450 | 5.0 | 4060 | 5.0 | 4670 | 5.0 |
| 410 | 5.0 | 1020 | 5.0 | 1630 | 5.0 | 2240 | 5.0 | 2850 | 5.0 | 3460 | 5.0 | 4070 | 5.0 | 4680 | 5.0 |
| 420 | 5.0 | 1030 | 5.0 | 1640 | 5.0 | 2250 | 5.0 | 2860 | 5.0 | 3470 | 5.0 | 4080 | 5.0 | 4690 | 5.0 |
| 430 | 5.0 | 1040 | 5.0 | 1650 | 5.0 | 2260 | 5.0 | 2870 | 5.0 | 3480 | 5.0 | 4090 | 5.0 | 4700 | 5.0 |
| 440 | 5.0 | 1050 | 5.0 | 1660 | 5.0 | 2270 | 5.0 | 2880 | 5.0 | 3490 | 5.0 | 4100 | 5.0 | 4710 | 5.0 |
| 450 | 5.0 | 1060 | 5.0 | 1670 | 5.0 | 2280 | 5.0 | 2890 | 5.0 | 3500 | 5.0 | 4110 | 5.0 | 4720 | 5.0 |
| 460 | 5.0 | 1070 | 5.0 | 1680 | 5.0 | 2290 | 5.0 | 2900 | 5.0 | 3510 | 5.0 | 4120 | 5.0 | 4730 | 5.0 |
| 470 | 5.0 | 1080 | 5.0 | 1690 | 5.0 | 2300 | 5.0 | 2910 | 5.0 | 3520 | 5.0 | 4130 | 5.0 | 4740 | 5.0 |
| 480 | 5.0 | 1090 | 5.0 | 1700 | 5.0 | 2310 | 5.0 | 2920 | 5.0 | 3530 | 5.0 | 4140 | 5.0 | 4750 | 5.0 |
| 490 | 5.0 | 1100 | 5.0 | 1710 | 5.0 | 2320 | 5.0 | 2930 | 5.0 | 3540 | 5.0 | 4150 | 5.0 | 4760 | 5.0 |
| 500 | 5.0 | 1110 | 5.0 | 1720 | 5.0 | 2330 | 5.0 | 2940 | 5.0 | 3550 | 5.0 | 4160 | 5.0 | 4770 | 5.0 |
| 510 | 5.0 | 1120 | 5.0 | 1730 | 5.0 | 2340 | 5.0 | 2950 | 5.0 | 3560 | 5.0 | 4170 | 5.0 | 4780 | 5.0 |
| 520 | 5.0 | 1130 | 5.0 | 1740 | 5.0 | 2350 | 5.0 | 2960 | 5.0 | 3570 | 5.0 | 4180 | 5.0 | 4790 | 5.0 |
| 530 | 5.0 | 1140 | 5.0 | 1750 | 5.0 | 2360 | 5.0 | 2970 | 5.0 | 3580 | 5.0 | 4190 | 5.0 | 4800 | 5.0 |
| 540 | 5.0 | 1150 | 5.0 | 1760 | 5.0 | 2370 | 5.0 | 2980 | 5.0 | 3590 | 5.0 | 4200 | 5.0 | 4810 | 5.0 |
| 550 | 5.0 | 1160 | 5.0 | 1770 | 5.0 | 2380 | 5.0 | 2990 | 5.0 | 3600 | 5.0 | 4210 | 5.0 | 4820 | 5.0 |
| 560 | 5.0 | 1170 | 5.0 | 1780 | 5.0 | 2390 | 5.0 | 3000 | 5.0 | 3610 | 5.0 | 4220 | 5.0 | 4830 | 5.0 |
| 570 | 5.0 | 1180 | 5.0 | 1790 | 5.0 | 2400 | 5.0 | 3010 | 5.0 | 3620 | 5.0 | 4230 | 5.0 | 4840 | 5.0 |
| 580 | 5.0 | 1190 | 5.0 | 1800 | 5.0 | 2410 | 5.0 | 3020 | 5.0 | 3630 | 5.0 | 4240 | 5.0 | 4850 | 5.0 |
| 590 | 5.0 | 1200 | 5.0 | 1810 | 5.0 | 2420 | 5.0 | 3030 | 5.0 | 3640 | 5.0 | 4250 | 5.0 | 4860 | 5.0 |
| 600 | 5.0 | 1210 | 5.0 | 1820 | 5.0 | 2430 | 5.0 | 3040 | 5.0 | 3650 | 5.0 | 4260 | 5.0 | 4870 | 5.0 |
| 610 | 5.0 | 1220 | 5.0 | 1830 | 5.0 | 2440 | 5.0 | 3050 | 5.0 | 3660 | 5.0 | 4270 | 5.0 | 4880 | 5.0 |

## Additional Hydrograph #1

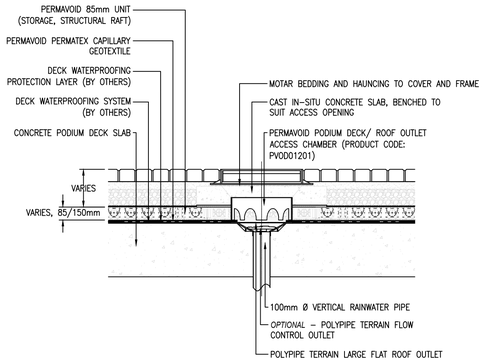
| Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4890 | 5.0 | 5500 | 5.0 | 6110 | 5.0 | 6720 | 5.0 | 7330 | 5.0 | 7940 | 5.0 | 8550 | 5.0 | 9160 | 5.0 |
| 4900 | 5.0 | 5510 | 5.0 | 6120 | 5.0 | 6730 | 5.0 | 7340 | 5.0 | 7950 | 5.0 | 8560 | 5.0 | 9170 | 5.0 |
| 4910 | 5.0 | 5520 | 5.0 | 6130 | 5.0 | 6740 | 5.0 | 7350 | 5.0 | 7960 | 5.0 | 8570 | 5.0 | 9180 | 5.0 |
| 4920 | 5.0 | 5530 | 5.0 | 6140 | 5.0 | 6750 | 5.0 | 7360 | 5.0 | 7970 | 5.0 | 8580 | 5.0 | 9190 | 5.0 |
| 4930 | 5.0 | 5540 | 5.0 | 6150 | 5.0 | 6760 | 5.0 | 7370 | 5.0 | 7980 | 5.0 | 8590 | 5.0 | 9200 | 5.0 |
| 4940 | 5.0 | 5550 | 5.0 | 6160 | 5.0 | 6770 | 5.0 | 7380 | 5.0 | 7990 | 5.0 | 8600 | 5.0 | 9210 | 5.0 |
| 4950 | 5.0 | 5560 | 5.0 | 6170 | 5.0 | 6780 | 5.0 | 7390 | 5.0 | 8000 | 5.0 | 8610 | 5.0 | 9220 | 5.0 |
| 4960 | 5.0 | 5570 | 5.0 | 6180 | 5.0 | 6790 | 5.0 | 7400 | 5.0 | 8010 | 5.0 | 8620 | 5.0 | 9230 | 5.0 |
| 4970 | 5.0 | 5580 | 5.0 | 6190 | 5.0 | 6800 | 5.0 | 7410 | 5.0 | 8020 | 5.0 | 8630 | 5.0 | 9240 | 5.0 |
| 4980 | 5.0 | 5590 | 5.0 | 6200 | 5.0 | 6810 | 5.0 | 7420 | 5.0 | 8030 | 5.0 | 8640 | 5.0 | 9250 | 5.0 |
| 4990 | 5.0 | 5600 | 5.0 | 6210 | 5.0 | 6820 | 5.0 | 7430 | 5.0 | 8040 | 5.0 | 8650 | 5.0 | 9260 | 5.0 |
| 5000 | 5.0 | 5610 | 5.0 | 6220 | 5.0 | 6830 | 5.0 | 7440 | 5.0 | 8050 | 5.0 | 8660 | 5.0 | 9270 | 5.0 |
| 5010 | 5.0 | 5620 | 5.0 | 6230 | 5.0 | 6840 | 5.0 | 7450 | 5.0 | 8060 | 5.0 | 8670 | 5.0 | 9280 | 5.0 |
| 5020 | 5.0 | 5630 | 5.0 | 6240 | 5.0 | 6850 | 5.0 | 7460 | 5.0 | 8070 | 5.0 | 8680 | 5.0 | 9290 | 5.0 |
| 5030 | 5.0 | 5640 | 5.0 | 6250 | 5.0 | 6860 | 5.0 | 7470 | 5.0 | 8080 | 5.0 | 8690 | 5.0 | 9300 | 5.0 |
| 5040 | 5.0 | 5650 | 5.0 | 6260 | 5.0 | 6870 | 5.0 | 7480 | 5.0 | 8090 | 5.0 | 8700 | 5.0 | 9310 | 5.0 |
| 5050 | 5.0 | 5660 | 5.0 | 6270 | 5.0 | 6880 | 5.0 | 7490 | 5.0 | 8100 | 5.0 | 8710 | 5.0 | 9320 | 5.0 |
| 5060 | 5.0 | 5670 | 5.0 | 6280 | 5.0 | 6890 | 5.0 | 7500 | 5.0 | 8110 | 5.0 | 8720 | 5.0 | 9330 | 5.0 |
| 5070 | 5.0 | 5680 | 5.0 | 6290 | 5.0 | 6900 | 5.0 | 7510 | 5.0 | 8120 | 5.0 | 8730 | 5.0 | 9340 | 5.0 |
| 5080 | 5.0 | 5690 | 5.0 | 6300 | 5.0 | 6910 | 5.0 | 7520 | 5.0 | 8130 | 5.0 | 8740 | 5.0 | 9350 | 5.0 |
| 5090 | 5.0 | 5700 | 5.0 | 6310 | 5.0 | 6920 | 5.0 | 7530 | 5.0 | 8140 | 5.0 | 8750 | 5.0 | 9360 | 5.0 |
| 5100 | 5.0 | 5710 | 5.0 | 6320 | 5.0 | 6930 | 5.0 | 7540 | 5.0 | 8150 | 5.0 | 8760 | 5.0 | 9370 | 5.0 |
| 5110 | 5.0 | 5720 | 5.0 | 6330 | 5.0 | 6940 | 5.0 | 7550 | 5.0 | 8160 | 5.0 | 8770 | 5.0 | 9380 | 5.0 |
| 5120 | 5.0 | 5730 | 5.0 | 6340 | 5.0 | 6950 | 5.0 | 7560 | 5.0 | 8170 | 5.0 | 8780 | 5.0 | 9390 | 5.0 |
| 5130 | 5.0 | 5740 | 5.0 | 6350 | 5.0 | 6960 | 5.0 | 7570 | 5.0 | 8180 | 5.0 | 8790 | 5.0 | 9400 | 5.0 |
| 5140 | 5.0 | 5750 | 5.0 | 6360 | 5.0 | 6970 | 5.0 | 7580 | 5.0 | 8190 | 5.0 | 8800 | 5.0 | 9410 | 5.0 |
| 5150 | 5.0 | 5760 | 5.0 | 6370 | 5.0 | 6980 | 5.0 | 7590 | 5.0 | 8200 | 5.0 | 8810 | 5.0 | 9420 | 5.0 |
| 5160 | 5.0 | 5770 | 5.0 | 6380 | 5.0 | 6990 | 5.0 | 7600 | 5.0 | 8210 | 5.0 | 8820 | 5.0 | 9430 | 5.0 |
| 5170 | 5.0 | 5780 | 5.0 | 6390 | 5.0 | 7000 | 5.0 | 7610 | 5.0 | 8220 | 5.0 | 8830 | 5.0 | 9440 | 5.0 |
| 5180 | 5.0 | 5790 | 5.0 | 6400 | 5.0 | 7010 | 5.0 | 7620 | 5.0 | 8230 | 5.0 | 8840 | 5.0 | 9450 | 5.0 |
| 5190 | 5.0 | 5800 | 5.0 | 6410 | 5.0 | 7020 | 5.0 | 7630 | 5.0 | 8240 | 5.0 | 8850 | 5.0 | 9460 | 5.0 |
| 5200 | 5.0 | 5810 | 5.0 | 6420 | 5.0 | 7030 | 5.0 | 7640 | 5.0 | 8250 | 5.0 | 8860 | 5.0 | 9470 | 5.0 |
| 5210 | 5.0 | 5820 | 5.0 | 6430 | 5.0 | 7040 | 5.0 | 7650 | 5.0 | 8260 | 5.0 | 8870 | 5.0 | 9480 | 5.0 |
| 5220 | 5.0 | 5830 | 5.0 | 6440 | 5.0 | 7050 | 5.0 | 7660 | 5.0 | 8270 | 5.0 | 8880 | 5.0 | 9490 | 5.0 |
| 5230 | 5.0 | 5840 | 5.0 | 6450 | 5.0 | 7060 | 5.0 | 7670 | 5.0 | 8280 | 5.0 | 8890 | 5.0 | 9500 | 5.0 |
| 5240 | 5.0 | 5850 | 5.0 | 6460 | 5.0 | 7070 | 5.0 | 7680 | 5.0 | 8290 | 5.0 | 8900 | 5.0 | 9510 | 5.0 |
| 5250 | 5.0 | 5860 | 5.0 | 6470 | 5.0 | 7080 | 5.0 | 7690 | 5.0 | 8300 | 5.0 | 8910 | 5.0 | 9520 | 5.0 |
| 5260 | 5.0 | 5870 | 5.0 | 6480 | 5.0 | 7090 | 5.0 | 7700 | 5.0 | 8310 | 5.0 | 8920 | 5.0 | 9530 | 5.0 |
| 5270 | 5.0 | 5880 | 5.0 | 6490 | 5.0 | 7100 | 5.0 | 7710 | 5.0 | 8320 | 5.0 | 8930 | 5.0 | 9540 | 5.0 |
| 5280 | 5.0 | 5890 | 5.0 | 6500 | 5.0 | 7110 | 5.0 | 7720 | 5.0 | 8330 | 5.0 | 8940 | 5.0 | 9550 | 5.0 |
| 5290 | 5.0 | 5900 | 5.0 | 6510 | 5.0 | 7120 | 5.0 | 7730 | 5.0 | 8340 | 5.0 | 8950 | 5.0 | 9560 | 5.0 |
| 5300 | 5.0 | 5910 | 5.0 | 6520 | 5.0 | 7130 | 5.0 | 7740 | 5.0 | 8350 | 5.0 | 8960 | 5.0 | 9570 | 5.0 |
| 5310 | 5.0 | 5920 | 5.0 | 6530 | 5.0 | 7140 | 5.0 | 7750 | 5.0 | 8360 | 5.0 | 8970 | 5.0 | 9580 | 5.0 |
| 5320 | 5.0 | 5930 | 5.0 | 6540 | 5.0 | 7150 | 5.0 | 7760 | 5.0 | 8370 | 5.0 | 8980 | 5.0 | 9590 | 5.0 |
| 5330 | 5.0 | 5940 | 5.0 | 6550 | 5.0 | 7160 | 5.0 | 7770 | 5.0 | 8380 | 5.0 | 8990 | 5.0 | 9600 | 5.0 |
| 5340 | 5.0 | 5950 | 5.0 | 6560 | 5.0 | 7170 | 5.0 | 7780 | 5.0 | 8390 | 5.0 | 9000 | 5.0 | 9610 | 5.0 |
| 5350 | 5.0 | 5960 | 5.0 | 6570 | 5.0 | 7180 | 5.0 | 7790 | 5.0 | 8400 | 5.0 | 9010 | 5.0 | 9620 | 5.0 |
| 5360 | 5.0 | 5970 | 5.0 | 6580 | 5.0 | 7190 | 5.0 | 7800 | 5.0 | 8410 | 5.0 | 9020 | 5.0 | 9630 | 5.0 |
| 5370 | 5.0 | 5980 | 5.0 | 6590 | 5.0 | 7200 | 5.0 | 7810 | 5.0 | 8420 | 5.0 | 9030 | 5.0 | 9640 | 5.0 |
| 5380 | 5.0 | 5990 | 5.0 | 6600 | 5.0 | 7210 | 5.0 | 7820 | 5.0 | 8430 | 5.0 | 9040 | 5.0 | 9650 | 5.0 |
| 5390 | 5.0 | 6000 | 5.0 | 6610 | 5.0 | 7220 | 5.0 | 7830 | 5.0 | 8440 | 5.0 | 9050 | 5.0 | 9660 | 5.0 |
| 5400 | 5.0 | 6010 | 5.0 | 6620 | 5.0 | 7230 | 5.0 | 7840 | 5.0 | 8450 | 5.0 | 9060 | 5.0 | 9670 | 5.0 |
| 5410 | 5.0 | 6020 | 5.0 | 6630 | 5.0 | 7240 | 5.0 | 7850 | 5.0 | 8460 | 5.0 | 9070 | 5.0 | 9680 | 5.0 |
| 5420 | 5.0 | 6030 | 5.0 | 6640 | 5.0 | 7250 | 5.0 | 7860 | 5.0 | 8470 | 5.0 | 9080 | 5.0 | 9690 | 5.0 |
| 5430 | 5.0 | 6040 | 5.0 | 6650 | 5.0 | 7260 | 5.0 | 7870 | 5.0 | 8480 | 5.0 | 9090 | 5.0 | 9700 | 5.0 |
| 5440 | 5.0 | 6050 | 5.0 | 6660 | 5.0 | 7270 | 5.0 | 7880 | 5.0 | 8490 | 5.0 | 9100 | 5.0 | 9710 | 5.0 |
| 5450 | 5.0 | 6060 | 5.0 | 6670 | 5.0 | 7280 | 5.0 | 7890 | 5.0 | 8500 | 5.0 | 9110 | 5.0 | 9720 | 5.0 |
| 5460 | 5.0 | 6070 | 5.0 | 6680 | 5.0 | 7290 | 5.0 | 7900 | 5.0 | 8510 | 5.0 | 9120 | 5.0 | 9730 | 5.0 |
| 5470 | 5.0 | 6080 | 5.0 | 6690 | 5.0 | 7300 | 5.0 | 7910 | 5.0 | 8520 | 5.0 | 9130 | 5.0 | 9740 | 5.0 |
| 5480 | 5.0 | 6090 | 5.0 | 6700 | 5.0 | 7310 | 5.0 | 7920 | 5.0 | 8530 | 5.0 | 9140 | 5.0 | 9750 | 5.0 |
| 5490 | 5.0 | 6100 | 5.0 | 6710 | 5.0 | 7320 | 5.0 | 7930 | 5.0 | 8540 | 5.0 | 9150 | 5.0 | 9760 | 5.0 |

## Additional Hydrograph #1

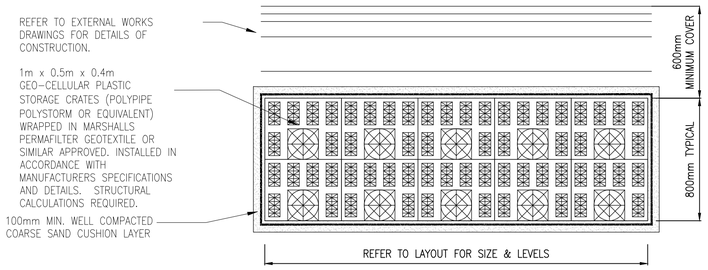
| Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) | Time (mins) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9770 | 5.0 | 9810 | 5.0 | 9850 | 5.0 | 9890 | 5.0 | 9930 | 5.0 | 9970 | 5.0 | 10010 | 5.0 | 10050 | 5.0 |
| 9780 | 5.0 | 9820 | 5.0 | 9860 | 5.0 | 9900 | 5.0 | 9940 | 5.0 | 9980 | 5.0 | 10020 | 5.0 | 10060 | 5.0 |
| 9790 | 5.0 | 9830 | 5.0 | 9870 | 5.0 | 9910 | 5.0 | 9950 | 5.0 | 9990 | 5.0 | 10030 | 5.0 | 10070 | 5.0 |
| 9800 | 5.0 | 9840 | 5.0 | 9880 | 5.0 | 9920 | 5.0 | 9960 | 5.0 | 10000 | 5.0 | 10040 | 5.0 | 10080 | 5.0 |

## A.2 Drawings

- 126782-C-4000 – Preliminary Drainage Strategy




TYPICAL BLUE ROOF DETAIL
PERMAVOID 85mm/150mm PODIUM DECK WITH ROOF ACCESS CHAMBER




CELLULAR SOAKAWAY TANK CONSTRUCTION DETAILS (TRAFFICKED AREAS)
1:20

DETAILS SHOWN ARE INDICATIVE. REFER TO MANUFACTURER FOR FULL DETAILS AND SPECIFICATIONS. REFER TO MANUFACTURERS DETAILS FOR INLET & OUTLET MANIFOLDS AND INSPECTION ACCESS. (REFER TO LAYOUT FOR LOCATIONS).

SURFACE WATER ATTENUATION CALCULATION

| INFLOW | | TYPICAL INFILTRATION RATE FOR SOIL CONDITIONS (m/hr) | REQUIRED STORAGE BASED ON SOURCE CONTROL DESIGN ($m^3$) | TANK No. | INDICATIVE TANK DIMENSIONS BASED ON CONTRIBUTING AREAS | | | | | TOTAL STORAGE VOLUME (BASED ON 95% VOID RATIO) | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RAINFALL FROM IMPERMEABLE AREA (ha) | REDUCED FLOW FROM BLUE ROOF OUTLET (l/s) | | | | LENGTH (m) | WIDTH (m) | DEPTH (m) | VOLUME ($m^3$) | STORAGE VOLUME (BASED ON 95% VOID RATIO) | | |
| 0.53 | 5 | 0.50 | 216 | 1 | SUBJECT TO DETAILED DESIGN | | | 128 | 121 | 216 | INFILTRATION RATE TO BE CONFIRMED FOLLOWING SOAKAGE TESTING. TANK VOLUMES TO BE CONFIRMED BASED ON DETAILED NETWORK LAYOUT DESIGN |
| | | | | 2 | SUBJECT TO DETAILED DESIGN | | | 100 | 95 | | |

STRATEGY NOTES

1. LOCAL BOREHOLES INDICATE SOIL TO BE SANDY GRAVEL WITH AN ASSUMED TYPICAL INFILTRATION RATE OF 0.1–1m/hr BASED ON DESIGN GUIDES. MID RANGE VALUE OF 0.5m/hr ASSUMED FOR STRATEGY ASSESSMENT. SITE SPECIFIC TESTING TO BE COMPLETED PRIOR TO DETAILED DESIGN.
2. ALL BUILDINGS (5No.) TO HAVE BLUE ROOFS LIMITED TO 1l/s/BUILDING AS INDICATED USING LOW FLOW OUTLET CONTROLS. BLUE ROOFS AREA ASSUMED TO BE 70% OF TOTAL ROOF AREA TO ALLOW FOR PLANT AND ACCESS REQUIREMENTS (TO BE COORDINATED AT DETAILED DESIGN)
3. MICRODRAINAGE ESTIMATE FOR NON–ROOF, NON LANDSCAPED AREAS (0.53ha) WITH 5.0l/s ADDITIONAL INFLOW REQUIRES APPROXIMATELY 222$m^3$ ATTENUATION (SUBJECT TO DETAILED DESIGN) FOR A TANK WITH 315$m^2$ BASE FOR INFILTRATION.
4. VOLUMES ASSESSMENT BASED ON INFILTRATION AREA STATED. TANKS DEEPER TANKS WITH REDUCED BASE SURFACE BASE AREA MAY INFILTRATE SLOWER AND THEREFORE VOLUME REQUIREMENTS WILL NEED TO BE REVIEWED.
5. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE FAIRHURST FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY.

THIS DRAWING IS BASED ON THE FOLLOWING LAYOUTS:
1. GILLESPIES LANDSCAPING PLAN REFERENCE P11559–00–001–100_Rev04 RECEIVED 17/05/2019
2. ASSAEL SITE PLANS RECEIVED NOVEMBER 2018




NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RELEVANT SPECIFICATION, INC. RISK ASSESSMENTS (SEE CDM NOTES) AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER.
2. DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
3. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES UNLESS OTHERWISE STATED.
4. 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.
5. NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS PERMITTED WITHOUT PRIOR PERMISSION FROM THE ENGINEER.
6. ANY WORKS OUTSIDE SITE BOUNDARY ARE FOR INFORMATION PURPOSES ONLY. UNLESS SPECIFICALLY NOTED, ALL WORKS OUTSIDE THE SITE BOUNDARY WILL BE UNDERTAKEN BY OTHERS UNDER A SEPARATE CONTRACT.
7. THE CONTRACTOR SHALL UNDERTAKE SUCH MATERIALS TESTING AS INDICATED IN THE SPECIFICATIONS AND SHALL INCLUDE THE COST OF TESTING IN THE TENDER.
8. TOTAL SITE AREA = 1.65ha
   TOTAL NON ROOF AREA = 1ha
   TOTAL NON PERMEABLE NON ROOF AREA = 0.53ha

KEY

- SITE BOUNDARY
- 5m HOUSING EXCLUSION ZONE FOR INFILTRATION
- INFILTRATION CRATE
- BLUE ROOFS TYPICALLY 85–150mm THICK
- SURFACE WATER EXCEEDANCE ROUTES
- INDICATIVE AREA OF FLOODING
- EXISTING SW MANHOLE
- EXISTING SW PIPE
- JC — PROPOSED SW MANHOLE
- PROPOSED SW PIPE
- RWP — PROPOSED RAINWATER PIPE

| Rev. | Date | Description | Drwn. | Chkd. | Appd. |
|---|---|---|---|---|---|
| P05 | 20/05/19 | SITE LANDSCAPE LAYOUT UPDATED AND ATTENUATION UPDATED TO SUIT NEW LANDSCAPING AREAS | CD | AP | AC |
| P04 | 07/05/19 | SURFACE WATER EXCEEDANCE ROUTE, FLOODING AREAS, GREEN ROOF AREAS AND TANK VOLUMES AND CALCS ADDED | HJ | AP | AC |
| P03 | 14/12/18 | SITE LAYOUT UPDATED | CD | AP | AC |
| P02 | 21/11/18 | KEY AMENDED | CD | AP | AC |
| P01 | 20/11/18 | ISSUED FOR INFORMATION | CD | AP | AC |

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Fairhurst.co.uk

Client: AVANTON

Project Title:
FORMER HOMEBASE
MANOR ROAD
RICHMOND

Drawing Title:
PRELIMINARY SURFAE WATER DRAINAGE STRATEGY

| Scale at A1: | Status: | Fairhurst Project No: |
|---|---|---|
| 1:500 | DISCUSSION | 126782 |
| Drawn: AP | Checked: AP | Approved: AC |
| Date: NOV 18 | Date: NOV 18 | Date: NOV 18 |

Drawing No.: 126782–C–4000 Revision: P05

## A.3 Flood Risk Assessment

- 126782-XX-C001 - Flood Risk Assessment

www.fairhurstgga.co.uk

| | |
|---|---|
| Aberdeen | Leeds |
| Birmingham | London |
| Bristol | Manchester |
| Dundee | Newcastle |
| Edinburgh | Sevenoaks |
| Elgin | Sheffield |
| Glasgow | Taunton |
| Inverness | Watford |

Civil Engineering • Structural Engineering • Transportation • Roads & Bridges Ports & Harbours • Geotechnical & Environmental Engineering • Planning & Development • Water Services • CDM Coordinator Services

FAIRHURST