

Flood Risk Assessment & Sustainable Drainage Strategy

Moorlands Farm, West End

September 2022

Prepared for
Country Homes

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1. Introduction

- 1.1 Fernbrook Consulting Engineers has been appointed by Country Homes to provide a Flood Risk Assessment and Sustainable Drainage Strategy for the proposed development Moorlands Farm, West End, Southampton.
- 1.2 This report has been prepared with specific reference to the requirements of National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG). This report also takes into consideration requirements of the Local Flood Risk Management Strategy, the Non-statutory technical standards for sustainable drainage systems, and CIRIA C753 The SuDS Manual.

Site Characteristics

- 1.3 The site is located between Hedge End and West End in Southampton and sits to the north-west of Hedge End industrial estate, alongside the M27. The Site's location is illustrated in **Figure 1.1** below.

Table 1-1 Site Details

Site Address	Moorlands Farm, Botley Road, West End, SO30 3HD
Grid Reference	448172mE, 114502mN (SU 48172 14502)
Site Area (ha)	1.71
Existing use	Agriculture
Access	Botley Road



Figure 1.1 Site Location Plan

Development Proposals

- 1.4 The development proposals are comprised of the demolition of all existing buildings and detailed planning approval for light industrial floorspace [Use Class E(g)(ii) & E(g)(iii)], warehouse floorspace [Use Class B8] and estate office (Use Class E(g)(i)).
- 1.5 An excerpt of the proposed development plan is included in **Figure 1.2** below, and the full plan is included in **Appendix A**.



Figure 1.2 Proposed Development Plan

2. Policy Review

National Planning Policy Framework

- 2.1 The National Planning Policy Framework (NPPF) sets out policies to ensure that flood risk is considered during the planning process to prevent inappropriate development in areas at risk of flooding and to direct development away from areas at high risk. The Planning Practice Guidance is the on-line technical guidance to the NPPF, providing guidance and links to current documents.
- 2.2 All land in England and Wales is classified into three main Flood Zones, which refer to the probability of river or sea flooding (ignoring the existence of defences). The three Flood Zones are:
- Flood Zone 1 (Low Probability) – less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%);
 - Flood Zone 2 (Medium Probability) – having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) in any year or having between a 1 in 200 and 1 in 1000 annual probability of sea flooding in any year (0.5% - 0.1%);
 - Flood Zone 3a (High Probability) – having a 1 in 100 or greater annual probability of river flooding ($\geq 1\%$) or having a 1 in 200 or greater annual probability of sea flooding ($\geq 0.5\%$);
 - Flood Zone 3b (the Functional Floodplain) – having a 1 in 20 or greater annual probability of river flooding. The zone comprises land where water flows to be stored in times of flood.
- 2.3 The NPPF states that “inappropriate development in areas at risk of flooding should be avoided by directing development away from areas of highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.”

Flood and Water Management Act

- 2.4 The Flood and Water Management Act 2010 (FWMA) received Royal Assent on 8th April 2010. The Act was introduced to enforce some of the key proposals set out within UK Government flood and water strategies along with the UK Government’s response to Sir Michael Pitt’s Review of the Summer 2007 floods.
- 2.5 The Lead Local Flood Authority (LLFA) for the site is Hampshire County Council. All LLFAs have a responsibility under the FWMA to develop, maintain, apply and monitor the application of a strategy for local flood risk in their area. Local flood risk is defined as flood risk arising from surface run-off, groundwater and ordinary watercourses (i.e. non-main rivers).

- 2.6 Relevant to any site, the FWMA will encourage the uptake of sustainable drainage systems (SuDS) by removing the automatic right to connect to sewers and providing for Lead Local Flood Authorities to adopt SuDS for new developments.

- 2.7 The development proposals will adhere to the Act through the provision of SuDS as a fundamental element of the surface water drainage system. Furthermore, the developer is committed to work with the relevant stakeholders, such as the EA and Hampshire County Council (as LLFA), in implementing the requirements of the FWMA where necessary.

Sustainable Drainage Systems: Non-statutory technical standards

- 2.8 The Non-statutory technical standards for sustainable drainage systems were published in March 2015. This document sets out non-statutory technical standards for sustainable drainage systems. They should be used in conjunction with the Planning Practice Guidance (PPG).
- 2.9 The LPA may set local requirements for planning permission that have the effect of more stringent requirements than the non-statutory technical standards.
- 2.10 In addition, SuDS should be designed in accordance with CIRIA 753 SuDS Manual, which represents current best practice.
- 2.11 The Non-Statutory Technical Standards for Sustainable Drainage Systems: Best Practice Guidance was published by Local Authority SuDS Officer Organisation (LASOO) in July 2015 to provide an interpretation of the technical standard.

Eastleigh Borough Submitted Local Plan 2016-2036 (April 2022)

- 2.12 The principles of ‘sustainable development’ are central to national planning policies, and they underpin the Council’s approach to planning in the Borough. The following policies have been reviewed in the preparation of this document:

- S1 (Delivering sustainable development);
- S9 (Green Infrastructure)
- DM2 (Environmentally sustainable development);
- DM3 (Adaption to climate change);
- DM5 (Managing flood risk);
- DM6 (Sustainable surface Water management and watercourse management);
- DM8 (Pollution);
- DM10 (Water and waste water);

The following SPDs are also of note:

- Biodiversity (December 2009);
- Environmentally Sustainable Development (March 2009).

3. Baseline Conditions

Topography

- 3.1 Based on the Site Survey by KND Surveys, ref. H16 07, the developable area of the site appears to fall in a south-easterly direction from 32.92m AOD in the north-west to 29.39m AOD in the south-east. Refer to **Appendix B** for the Site Survey drawing.

Hydrology

- 3.2 There are a number of waterbodies in close proximity to the site, including a pond north of the site and the Moorgreen Stream, a tributary of the River Hamble flowing along the site's east boundary. Refer to **Figure 3.1** below.

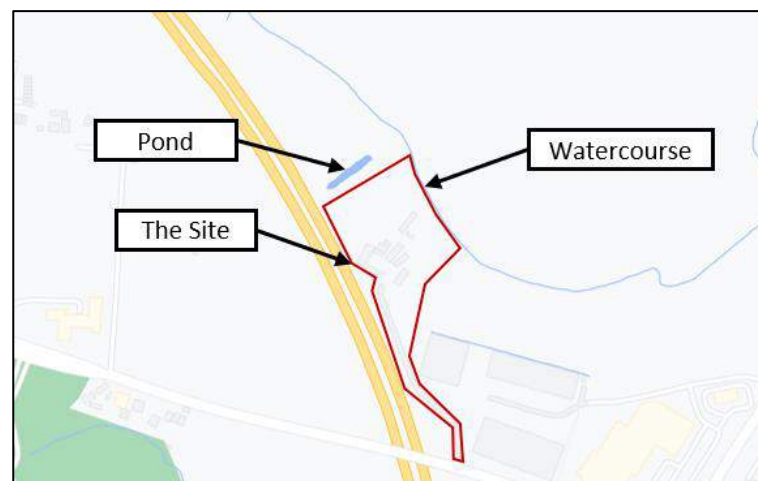


Figure 3.1 Hydrology

Geology

- 3.3 Based on the British Geological Survey online data, the site appears to be underlain by Earnley Sand Formation (Sand, Silt, and Clay) bedrock, with no superficial deposits. Refer to **Figure 3.2** to below, and **Appendix C** for Geological information.

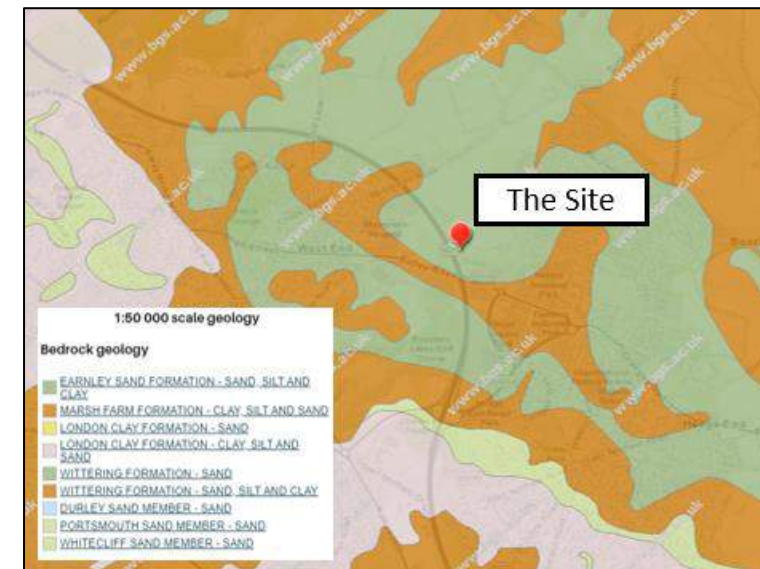


Figure 3.2 British Geological Survey data

- 3.4 Based on Defra's MAGIC map application, the site is not located in a Source Protection Zone.

Existing Sewer Infrastructure

- 3.5 Based on the Southern Water Sewer Records, there appears to be a public sewer network west of the M27, although no sewers in close proximity to the site. Refer to **Figure 3.3** below for an extract of the sewer records, and **Appendix D** for the full records.



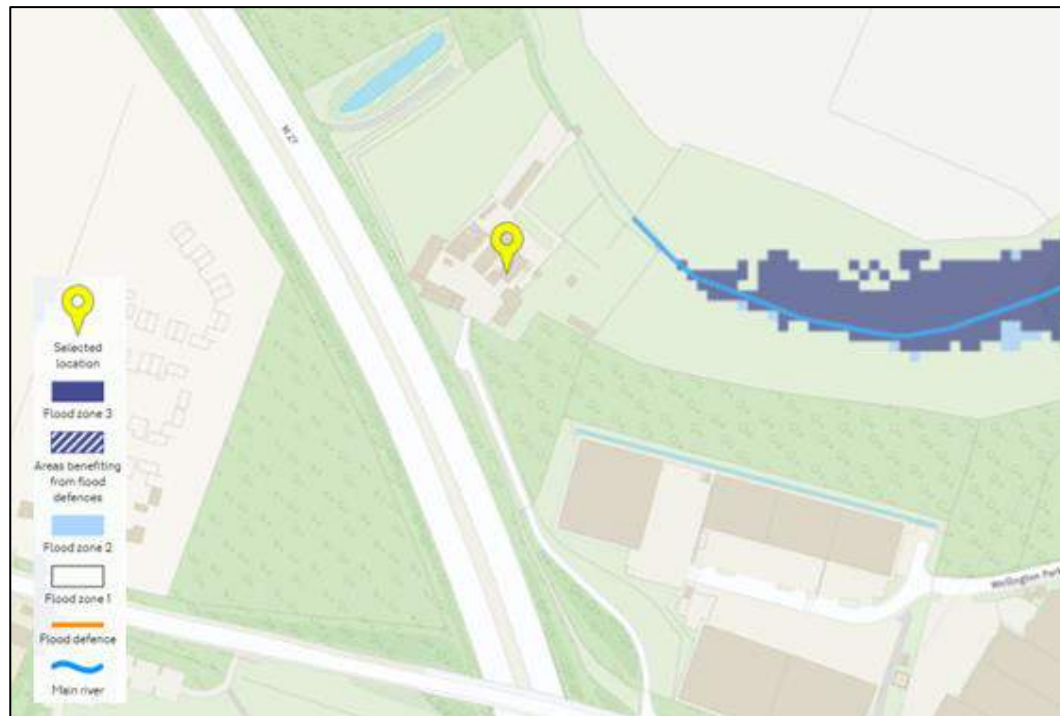
Figure 3.3 Southern Water Sewer Records

4. Flood Risk Assessment

Tidal / Fluvial Flooding

- 4.1 Based on the EA Flood map for planning, the site appears to be located in Flood Zone 1, refer to **Figure 4.1** below.

Figure 4.1 EA Flood map for planning



- 4.2 Areas within Flood Zone 1 are considered to have a less than 1 in 1,000 year annual probability of flooding (0.1%). Therefore, the risk of tidal/fluvial flooding is assessed as low.

Pluvial Flooding

- 4.3 Based on the EA long term flood risk information, the majority of the site appears to be at very low risk of surface water flooding, refer to **Figure 4.2** below.

Figure 4.2 EA Flood risk from surface water

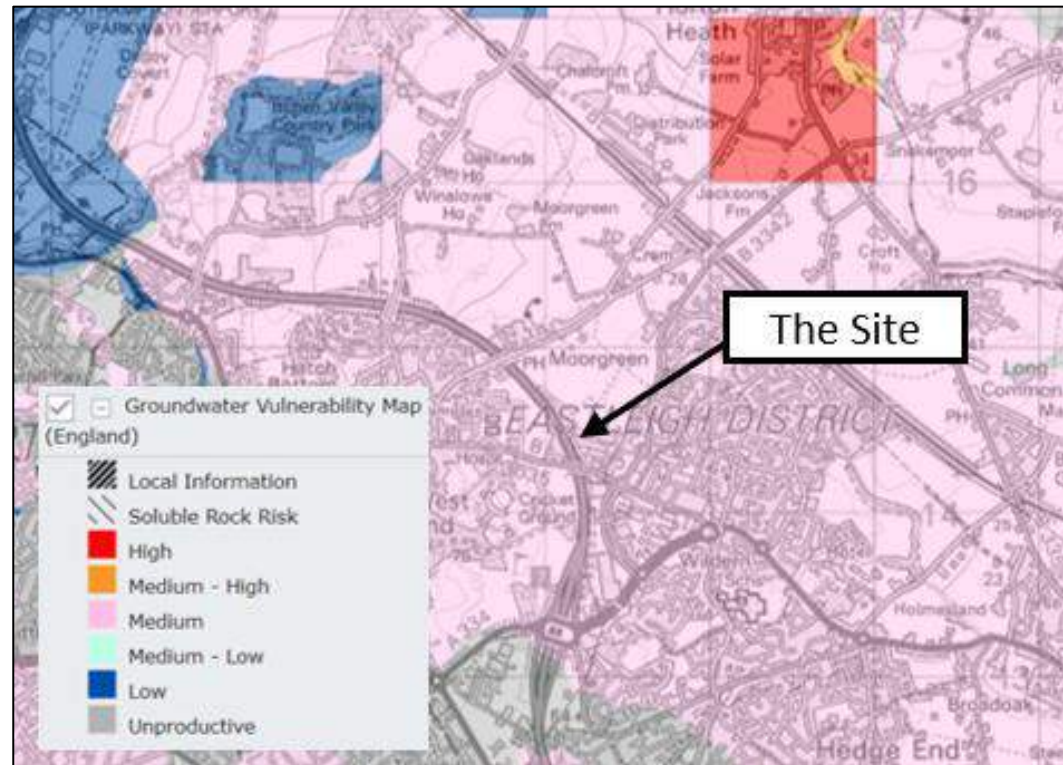


- 4.4 There appears to be a risk of flooding associated with the watercourse adjacent to the site's east boundary, however flooding appears to stay in channel. Therefore, the risk of surface water flooding is assessed as low.

Groundwater Flooding

- 4.5 Based on Defra's MAGIC Map application, the site appears to have a medium vulnerability to groundwater. Refer to **Figure 4.3** below.

Figure 4.3 Groundwater Vulnerability Map



- 4.6 The site's underlying geology will be confirmed at detailed design through intrusive geotechnical site investigations, which will also set out the strategy to mitigate groundwater flood risk. All structures will be designed and built in accordance with best practice. Therefore, the risk of groundwater flooding is assessed as low.

Flooding from Sewers

- 4.7 Based on Southern Water's sewer records, there does not appear to be any public sewers in close proximity to the site. Therefore, the risk of flooding from sewer surcharge is assessed as low.

Artificial Sources

- 4.8 The site is not located in an area at risk of flooding from artificial sources. Therefore, the risk of flooding from reservoirs, lakes, and artificial sources is assessed as low.

5. Surface Water Management

- 5.1 This surface water drainage strategy has been developed based on the Non-statutory Technical Guidance for Sustainable Drainage Systems, CIRIA Guidance C753 “The SuDS Manual”, and Hampshire County Council’s “Information for developers on SuDS - Principals and Application” – taking into account the spatial and environmental constraints of the site.
- 5.2 The NPPF requires that to allow for predicted impacts of climate change on surface water runoff, the following increases to rainfall intensity should be allowed for:
- 2015 to 2039: +5% (10% Upper end);
 - 2040 to 2069: +10% (20% Upper end); and
 - 2070 to 2115: +20% (40% Upper end).
- 5.3 Therefore, under the NPPF an allowance of 20% for the effects of climate change will achieve the policy requirements for the proposed commercial development.

Pre-development surface water run-off conditions

- 5.4 The developable area of the site area is 1.60 ha, and approximately 0.30 ha is comprised of impermeable area (19%). It is assumed that surface water runoff from the existing impermeable areas is currently conveyed to the watercourse unrestricted via a network of land drains.
- 5.5 To ensure that pre-development runoff rates are not exceeded, the brownfield runoff rates from the site were determined using the Wallingford procedure rational method for an assumed critical 5-minute storm: $Q = 2.78 \times C \times i \times A$
- Where: Q = Peak discharge (l/s)
 C = Dimensionless Runoff coefficient
 i = Rainfall intensity (mm/hr)
 A = Contributing impermeable areas (ha)

- 5.6 Refer to **Table 5-1** below, and **Appendix E** for calculations.

Table 5-1 Brownfield runoff rate

Rainfall event	Runoff rate (l/s)
Q1	42.4
Q30	94.3
Q100	120.0

Post-development surface water runoff

- 5.7 In accordance with the Building Act 2000 Clause H3.3 surface water run off not collected for re-use must be discharged in the following hierarchy:
- 1) To ground (infiltration techniques);
 - 2) To a surface water body;
 - 3) To a surface water sewer; or
 - 4) To the combined sewer.
- 5.8 Refer to **Table 5-2** for an assessment of the drainage hierarchy.

Table 5-2 Drainage Hierarchy Assessment

Disposal method	Feasible	Comments
1 st) Infiltration	✗	The site appears to be underlain by sand over clay, with potential for high groundwater.
2 nd) Watercourse	✓	There is an existing watercourse adjacent to the site’s eastern boundary.
3 rd) Surface Water sewer	✗	No surface water sewers in close vicinity.
4 th) Combined sewer	✗	No combined sewers in close vicinity.

- 5.9 Based on the drainage hierarchy assessment, the proposed drainage strategy will seek to convey surface water to the Moorgreen Stream along the site’s eastern boundary.

Sustainable Drainage Systems

- 5.10 The proposed strategy will seek to maximise the use of Sustainable Drainage Systems (SuDS) to increase the biodiversity, provide amenity, control discharge volumes, and manage water quality.
- 5.11 The opportunities and constraints for the use of SuDS within the site are assessed in **Table 5-3**. The assessment is based on the management train approach outlined in CIRIA C753 "The SuDS Manual".

Table 5-3 SuDS Hierarchy

SuDS Component	Feasible	Comment
Green Roofs	✓	Green roofs will be maximised throughout the site.
Swales	✓	Swales could be incorporated in landscaped areas to provide inception storage and improved bio-diversity.
Ponds / Basins	✓	Small basins could be incorporated to provide water quality benefits.
Permeable Surfacing	✓	Opportunities to utilise permeable paving will be maximised in parking areas and service yards to improve the water quality of the surface water discharge.
Tanked systems	✓	Should attenuation be required this could be achieved by use of oversized sewers or geo-cellular storage attenuation below the surface.

- 5.12 Based on the SuDS Hierarchy, the most appropriate SuDS for this development are green roofs, swales, basins and permeable surfaces.
- 5.13 The proposed buildings and access roads will also be set back from the boundaries which will allow for native woodland and hedge buffer planting. A large ecological buffer is proposed in the northern sections of the site which can be planted up with native woodland blocks and an orchard. The increased vegetation will contribute to the sustainable drainage strategy through water interception and infiltration while increasing evapotranspiration potential.

Peak Flow Control

- 5.14 The proposed drainage will be designed to ensure that flooding does not occur on any part of the site for the 1 in 30 year rainfall event, and any flooding up to the 1 in 100 year plus 20% for climate change will be contained on site.
- 5.15 Therefore, the proposed drainage strategy will seek to restrict surface water runoff to 50% of the existing 1 in 1 year runoff rate at 21 l/s using a vortex flow controls for all events up to the 1 in 100 year plus 40% climate change rainfall event.

- 5.16 Runoff will be restricted through the provision of 192m³ attenuation storage within the attenuation basin.
- 5.17 The peak surface water run-off generated from the Site for the 1 year, 30 year and 100 year rainfall events, for the pre and post-development scenarios, is detailed in **Table 5-4** below. Refer to **Appendix E** for full MicroDrainage calculations.

Table 5-4 Comparison of runoff rates

Return Period	Existing Brownfield Rate (l/s)	Proposed Rate (l/s)	Reduction
1 in 1 year	42.4	21.0	-50%
1 in 30 year	94.3	21.0	-78%
1 in 100 year	120.0	21.0	-82%
1 in 100 year + 40% CC	-	21.0	-

- 5.18 Refer to drawing **21035-MA-XX-XX-DR-D-0500** for the Indicative Drainage Strategy illustrating how the Site could be drained in **Appendix E**.
- 5.19 In accordance with the Non-statutory Technical Guidance for Sustainable Drainage Systems, the post-development discharge rate does not exceed the rate of discharge from the development prior to redevelopment. Therefore, the risk of flooding from impermeable areas is assessed as low.

Urbanisation & Long Term Storage

- 5.20 Based on the industrial development proposals, it is unlikely that the buildings will be extended. Therefore, urban creep has not been considered.
- 5.21 The long term storage requirement can be provided within the permeable paving sub-base.

Overland Flow Routes

- 5.22 The site will be designed so that exceedance flows above the 1 in 100 year, including climate change rainfall event will be conveyed eastbound towards the Moorgreen Stream via the access roads across the site.

Water Quality Management

- 5.23 In accordance with Policy DM6 of the Local Plan Eastleigh Borough Council for sites of 1 hectare or more, or within 100m of the River Itchen SAC or Solent Maritime SAC, SuDS schemes should include at least three above ground forms of naturalised filtration. The strategy includes green roofs, permeable paving, a swale and an attenuation pond to provide filtration.
- 5.24 SuDS will be provided to form a management train in line with the best practice outlined in CIRIA C753 “The SuDS Manual”. Source control techniques rain gardens and permeable paving could manage runoff and reduce the time of concentration within the pipe network, reducing the risk of sewer surcharge and flash flooding, and provide water quality benefits.
- 5.25 In line with CIRIA C753 The SuDS Manual, Tables 26.2 and 26.3, the pollution hazards indices associated with an industrial development are mitigated by the proposed SuDS. Refer to **Table 5-5** below for the Simple Index Method assessment, and **Appendix F** for Mitigation data.

Table 5-5 Simple Index Method

Pollution Hazard Indices			
Pollution hazard	TSS	Metals	Hydrocarbons
High – Industrial Estates	0.8	0.8	0.9
Pollution Mitigation Indices provided			
SuDS component	TSS	Metals	Hydrocarbons
Basin / Swale	0.5	0.6	0.6
Downstream Defender	0.25	0.2	0.4
Sediment Forebay	0.25	0.25	0.3
Check	+0.2	+0.25	+0.4

Biodiversity

- 5.26 SuDS can make a significant contribution to the biodiversity and ecological value of an area through green roofs, basins, swales, wetlands, trees and grassland. The basin and swale will include aquatic planting and specially designed areas for wildlife. The enhanced planting across the site including a wildflower grassland within the southern builders yard, mesh surfaces with species-rich grassland planting in parking areas and an orchard priority habitat will increase the local biodiversity.
- 5.27 The site layout includes generous areas of green space associated with the proposed estate office and garden/amenity areas to the west, together with wide roadside verges which will allow space for planting an 30no. native trees and hedges to soften the built form.

Amenity

- 5.28 In addition to creating habitats that encourage biodiversity, SuDS can simultaneously provide open space through the provision of swales and attenuation basins.

- 5.29 The swales and basins located around the site will create visually attractive green (vegetated and landscaped) and blue (water) corridors within the development to connect people to water. This in turn can improve the well-being of people working on site.

Maintenance

- 5.30 The maintenance of all SuDS components will be in accord with the best practices and the CIRIA C753 The SuDS Manual. The recommended Operation and Maintenance requirements for the proposed permeable paving, swale, basin, and tanks are outlined in **Table 5-6**. Refer to **Appendix G** for a recommended SuDS Management Plan. The management plan will be undertaken by the site management team.

Table 5-6 SuDS Management Plan

Maintenance Task	Description	Frequency
Regular Maintenance		
Litter management	Pick up all litter in SuDS and landscape areas and remove from site	Monthly
Tree / Grass maintenance	Mow all grass verges, paths and amenity at 35-50mm with 75mm max. Leaving grass in situ.	As required or monthly
Inlets and outlets	Inspect monthly, remove silt from slab aprons and debris. Strim 1m round for access	Monthly
Hard surfaces	Sweep all paving regularly.	As required
Occasional tasks		
Inspection and control chambers	Annual inspection, remove silt and check free flow	Annually
Silt management	Inspect swales for silt accumulation	Annually
	Excavate silt, stack and dry within 10m of the SuDS feature, but outside the design profile where water flows, spread, rake and overseed.	As required
Remedial work		
Repairs	Inspect SuDS system regularly to check for damage or failure. Undertake remedial work as required.	As required

6. Foul Drainage

- 6.1 Based on the topographical survey, at present foul flows from the site appear to be conveyed to an existing cess pit, which is assumed to be emptied periodically.
- 6.2 Post-development foul flows from the offices and industrial units could be conveyed to packaged sewerage treatment plants in the north and southern areas of the site. Treated foul effluent could then be discharged to the Moorgreen Stream along the site's east boundary as there are no foul sewers in close proximity to the site.
- 6.3 The post-development foul flows have been assessed on the conservative assumption that Blocks A, B and C will be in Light Industrial use as a worst case scenario. However, it is possible that the space could be used for warehousing, in which case foul flows will be lower.
- 6.4 Based on British Water Flows and Loads, the total treated effluent per day is 3m³ / day based on 2no. treatment plants serving 60no people. This gives an equivalent peak foul flow of 1.67 l/s based on a proposed development comprised of 200m² Office space and 1924m² Light Industrial buildings.
- 6.5 Foul effluent could be treated by a Klargester Bio-Disc (or similar approved) to ensure that the effluent quality meets the requirements of BS EN 12566 for Biological Oxygen Demand (BOD), Suspended Solids (SS), and Ammonia (NH₃-N). Refer to **Table 6-1** below for a foul flows from the development and Appendix E for treatment plant specification.

Table 6-1 Foul flows

North Catchment	Block	Use	Area (m²)	Population	Peak (l/s)	Flow (m³/day)	BOD (kg)
	A	Light Industrial	824	14	0.57	0.7	0.35
	B	Light Industrial	824	20	0.57	1	0.50
Sub-total			1648	34	1.14	1.7	0.85
South Catchment	C	Light Industrial	276	20	0.19	1	0.50
	D	Office	200	6	0.35	0.3	0.15
Sub-total			476	26	.54	1.3	0.65
Total			2124	60	1.67	3	1.5

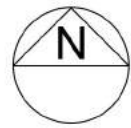
- 6.6 Refer to drawing **21035-MA-XX-XX-DR-D-0500** for the Indicative Drainage Strategy illustrating how foul flows could be drained in **Appendix E**.

7. Conclusion

- 7.1 Fernbrook Consulting Engineers has been appointed by Country Homes to provide a Flood Risk Assessment and Sustainable Drainage Strategy for the proposed development Moorlands Farm, West End, Southampton, SO30 3HD.
- 7.2 The development proposals are comprised of the demolition of ancillary farm buildings and construction of industrial buildings to provide three new light industrial blocks, a new estate office and a new builder's yard (open storage).
- 7.3 The Site is situated within Flood Zone 1. Areas within Flood Zone 1 are considered to have a less than 1 in 1,000 year annual probability of flooding (0.1%). All other sources of flood risk have been assessed as low.
- 7.4 The proposed drainage strategy will seek to discharge surface water runoff to the existing watercourse adjacent to the site's eastern boundary. Runoff will be restricted to 50% of the existing 1 in 1 year brownfield runoff rate at 21 l/s for all rainfall events up to the 1 in 100 year plus 20% climate change rainfall event.
- 7.5 The drainage strategy will provide 192m³ attenuation storage, in addition to green roofs, swales, basins and permeable surfacing to provide inception storage and water quality benefits.
- 7.6 The basin and swale will include aquatic planting and specially designed areas for wildlife and combined with the enhanced planting across the site and ecology buffer will increase the local biodiversity.
- 7.7 The swales and basins located around the site will create visually attractive green (vegetated and landscaped) and blue (water) corridors within the development to connect people to water and provide amenity spaces improving the well-being of people working on site.
- 7.8 In conclusion, this report demonstrates that the proposals are consistent with the aims of the NPPF and its Planning Practice Guidance, along with the aims of the Local Flood Risk Management Strategy. Surface water runoff can be adequately managed without increasing the risk of flooding on site or elsewhere.

APPENDIX A – PROPOSED DEVELOPMENT PLAN

- CLH_PS Pipe
6m wide easement
above pipe
- Existing trees
- Existing RPAs
Demolition/trees to be removed
Outline of previously approved
application (F/18/84683)
- New trees
- Sheltered cycle parking
- Refuse storage
(23 x 1100 litre bins)
- Public Path (Foot Path 10)
- Mesh surface with species-rich
grassland planting underneath



DRAWN BY
AG

CHECKED
JM

DRWG NO
D01

Note:

- 50% parking spaces to be serviced with electrical charging points. Please refer to Design and Access. Statement for more details.
- Parking spaces to be permeable hardstanding.



H	08.09.22	Minor amendments - PLANNING ISSUE
G	23.08.22	PLANNING ISSUE
F	11.08.22	Bins added
E	09.08.22	Notes added
D	08.08.22	Shading added to highlight Existing & Proposed roadway.
C	05.08.22	Verge added between new road & Footpath 10
B	13.07.22	Revisions to Consultant comments
A	08.06.22	Revised to client's comments

REVISIONS

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ARCHITECTS

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JOB | Moorlands Farm

DWG | Proposed Site Plan
1 of 2

S | 1:500@A2

D | JUNE 2022 No. | 7912_D01/H

Accommodation Schedule (GIA):

A - Light Industrial/ Storage - 824 sqm

B - Light Industrial/ Storage - 824 sqm

C - Light Industrial/ Storage - 276 sqm

D - Estate Office 200 sqm*

LIGHT INDUSTRIAL	1924m ²
ESTATE OFFICE	200.00m ²

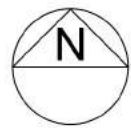
TOTAL 2124m²

* 200 sqm over 2no storeys

EXISTING AREAS (assumed)	GIA
FARMHOUSE	182.46m ²
OUTBUILDINGS	1040.53m ²
GREENHOUSES/SHEDS	58.15m ²
TOTAL	1281.14m ²



- CLH_PS Pipe
6m wide easement
above pipe
- Existing trees
- Existing RPAs
Demolition/trees to be removed
Outline of previously approved
application (F/18/84683)
- New trees
- Sheltered cycle parking
- Refuse storage
(23 x 1100 litre bins)
- Public Path (Foot Path 10)
- Mesh surface with species-rich
grassland planting underneath



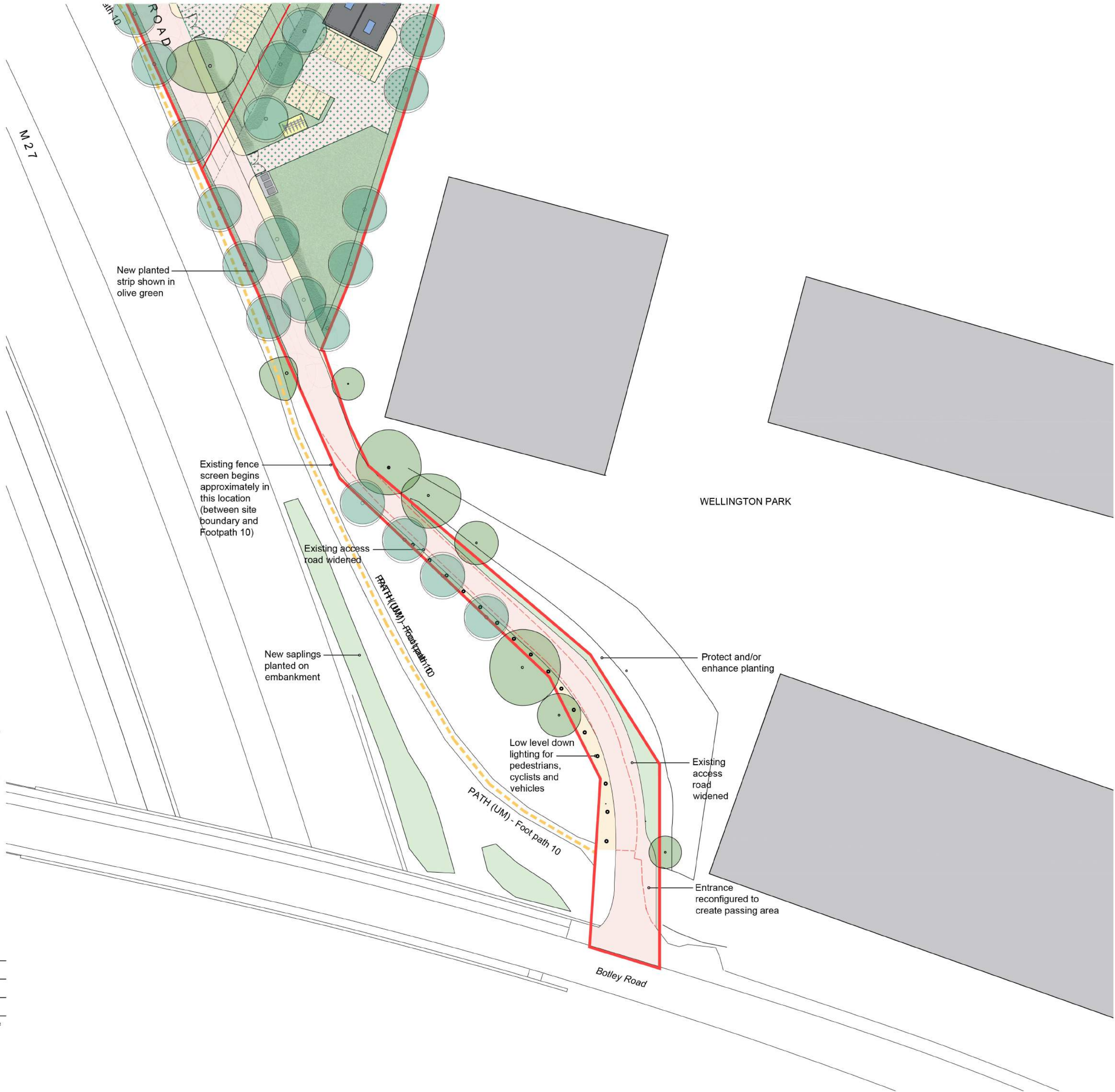
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DRWG NO
D02

Note:

- 50% parking spaces to be serviced with electrical charging points. Please refer to Design and Access. Statement for more details.
- Parking spaces to be permeable hardstanding.



Accommodation Schedule (GIA):

- A - Light Industrial/ Storage - 824 sqm
- B - Light Industrial/ Storage - 824 sqm
- C - Light Industrial/ Storage - 276 sqm
- D - Estate Office 200 sqm*

LIGHT INDUSTRIAL	1924m²
ESTATE OFFICE	200.00m²
TOTAL	2124m²

* 200 sqm over 2no storeys

EXISTING AREAS (assumed)	GIA
FARMHOUSE	182.46m²
OUTBUILDINGS	1040.53m²
GREENHOUSES/SHEDS	58.15m²
TOTAL	1281.14m²



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E	09.08.22	Notes added
D	08.08.22	Shading added to highlight Existing & Proposed roadway.
C	05.08.22	Verge added between new road & Footpath 10
B	14.07.22	Revisions to Consultant comments
A	08.06.22	Revised to client's comments

REVISIONS

RADLEY HOUSE
PARTNERSHIP | CHARTERED ARCHITECTS

t. 01962842228
e. architects@radleyhouse.co.uk
w. www.radleyhouse.co.uk

20 Staple Gardens | Winchester | SO23 8SR

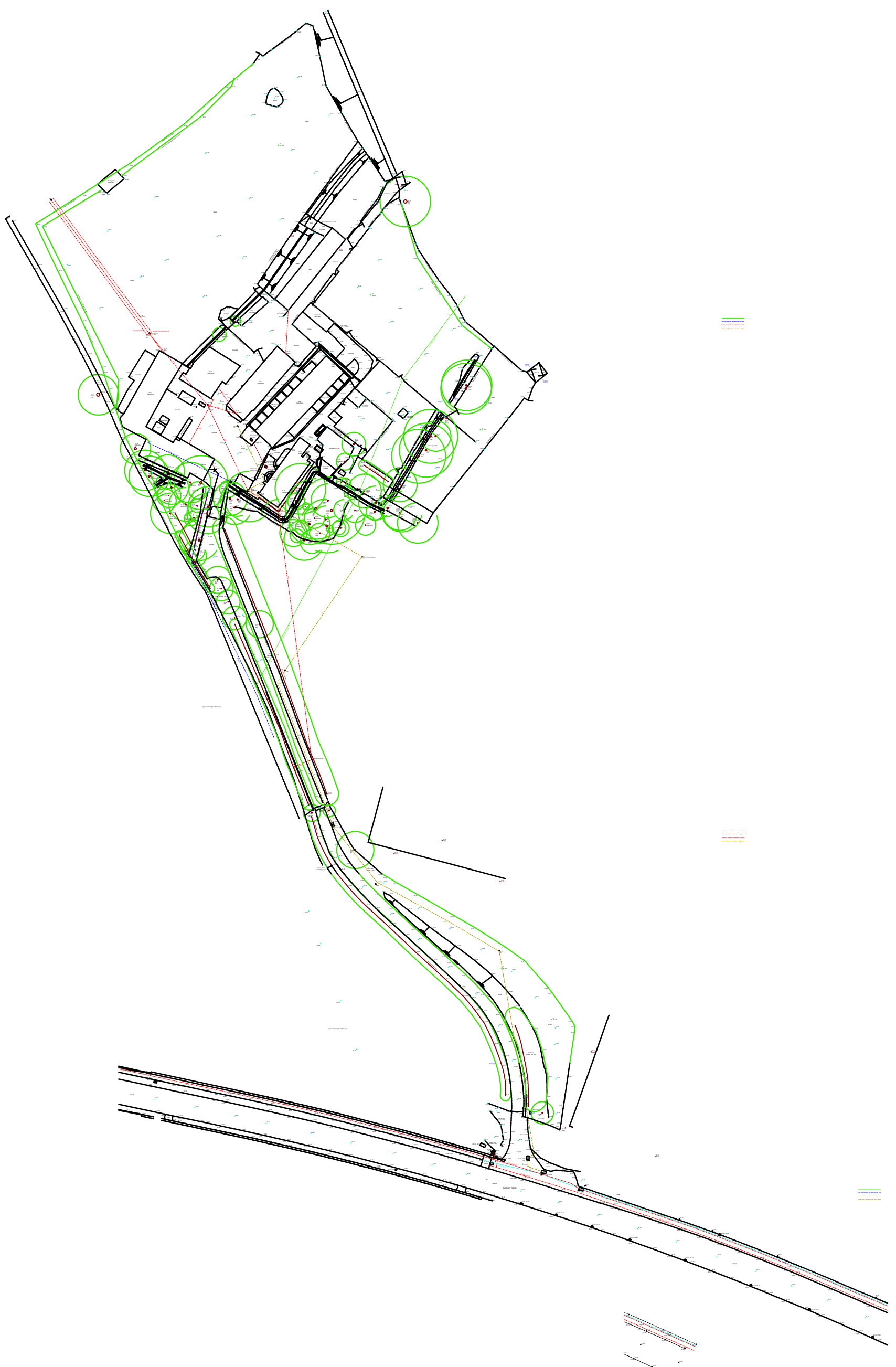
JOB | Moorlands Farm

DWG | Proposed Site Plan
2 of 2

S | 1:500@A2

D | JUNE 2022 No. | 7912_D02/H

APPENDIX B – TOPOGRAPHICAL SURVEY



NOTES

1. All areas and lines shall be constructed in accordance with the latest edition of the relevant codes and standards.
2. All areas and lines shall be constructed in accordance with the latest edition of the relevant codes and standards.
3. All areas and lines shall be constructed in accordance with the latest edition of the relevant codes and standards.
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9. All areas and lines shall be constructed in accordance with the latest edition of the relevant codes and standards.
10. All areas and lines shall be constructed in accordance with the latest edition of the relevant codes and standards.

ABBREVIATION LIST

Symbol	Description
...	...

REVISIONS

No.	Description	Date
1	Initial Issue	...

APPROVED BY

...

DATE

...

SCALE

1:200

PROJECT NO.

...

CLIENT

...

DESIGNER

...

DATE

...

SCALE

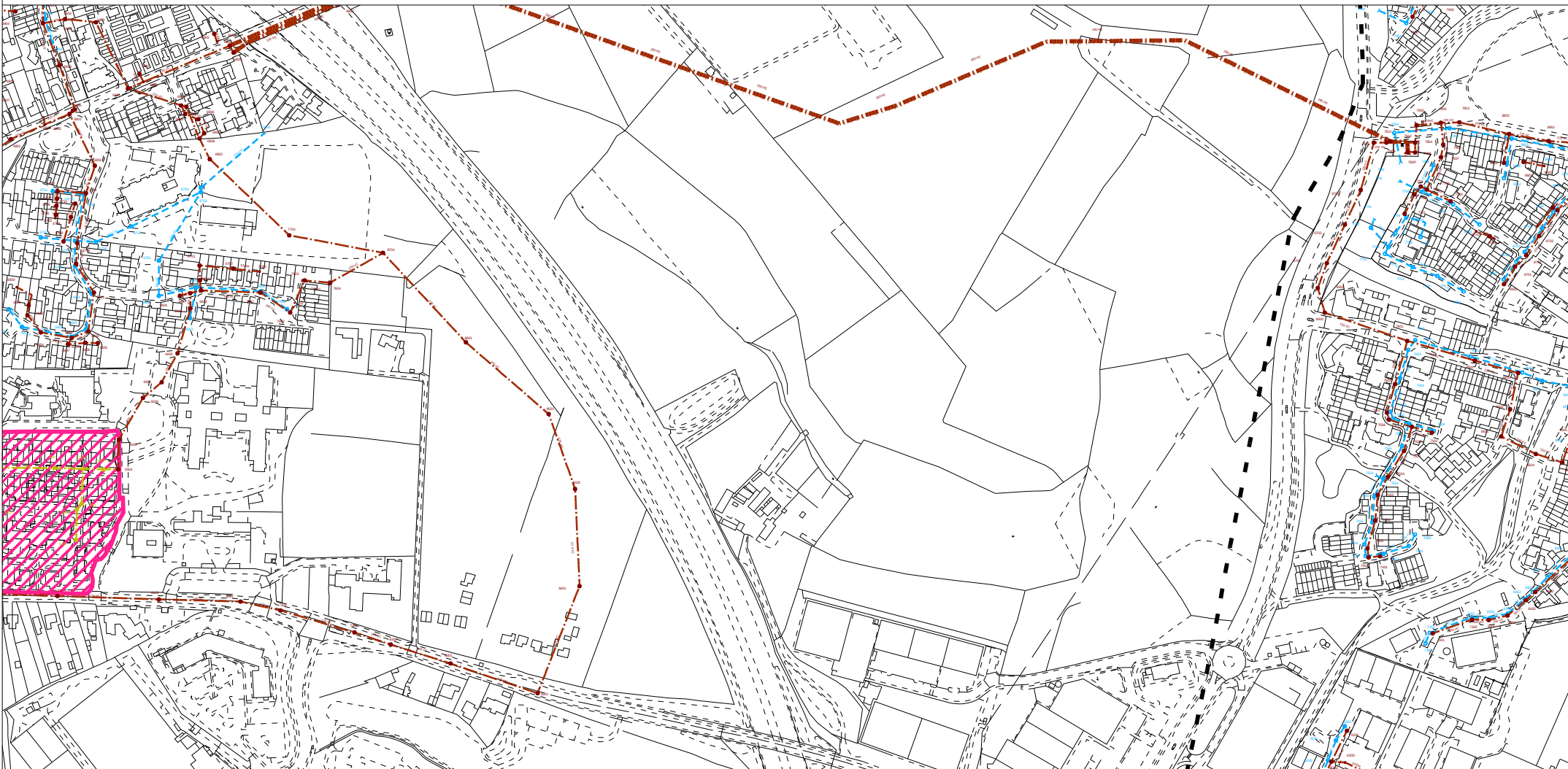
1:200

APPENDIX C – GEOLOGICAL INFORMATION

54125 MW 128VZ/9-3 1:54 2m 10/04 C:W H:1.04 C:00 00:3

APPENDIX D – SOUTHERN WATER SEWER RECORDS

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530

O.S. REF: SU4814NW

Scale: 1:5000

Sewer Plot

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement



Printed By: RD

Date: 10-11-2020

Moorlands Farm Botley Road

Requested By:

Land Searches Map Legend

Sewer

Pipe Line Styles/Colours

	Foul Sewer
	Foul Rising Main
	Foul Syphon Sewer
	Foul Vacuum Sewer
	Foul Trunk Sewer
	Foul Tank Sewer
	Surface Water Sewer
	Surface Water Rising Main
	Surface Water Syphon Sewer
	Surface Water Trunk Sewer
	Surface Water Tank Sewer
	Culverted Watercourse
	Combined Sewer
	Combined Rising Main
	Combined Syphon Sewer
	Combined Trunk Sewer
	Combined Tank Sewer
	Treated Effluent
	Treated Effluent Rising Main
	Sludge Rising Main
	Flow Direction Arrows (All Styles)
	As above line styles but decommissioned
	(Yellow) As above line styles but private
	Access Shaft – Personnel Only

Boundary Line Styles/Colours

	Catchment Boundary
	Sub-Catchment Boundary
	Section 104 Agreement Area
	Building Over Agreement Area

Materials

AK Alkathene	GRP Glass Reinforced Plastic
BAC Bonded Asbestos Cement *	MAC Masonry in regular courses
BRE Brick (Engineering)	MAR Masonry in random courses
BRC Brick (Common)	PE Polyethylene
CC Concrete Box Culvert	PF Pitch Fibre
CI Cast Iron	PP Polypropylene
CO Concrete (In-Situ)	PVC Polyvinyl Chloride
CP Concrete (Pre-Cast)	RPM Reinforced Plastic Matrix
CSB Concrete Segments (Bolted)	SI Spun Iron
CSU Concrete Segments (Un-Bolted)	ST Steel
DI Ductile Iron	VC Vitrified Clay
GRC Glass Reinforced Concrete	UNK Unknown*

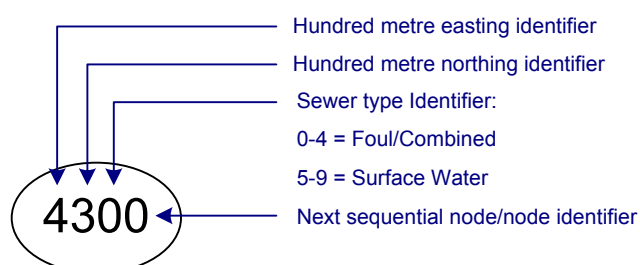
*Warning
BAC Pipes are constructed of Bonded Asbestos Cement
UNK Pipes are may be constructed of Bonded Asbestos Cement

Symbols

Surface	Foul	Combined	
			Label Ellipse
			Manhole
			Dummy/S.24 Manhole
			Manhole Backdrop
			Catchpit
			Soakaway
			Balancing Pond
			Rodding Eye
			Washout
			Flushing Chamber Mn-E
			Flushing Chamber No-E
			Hatch Box
			Lamphole
			Interceptor Chamber
			Blind Shaft
			Storm Tank
			Vortex Chamber
			Vent
			Vent Column
			Other/Unknown
			Penstock
			Cascade
			Change Node
			Pumping Station
			Micro Pumping Station
			Air Valve
			Valve
			Reflux Valve
			Anti-Flood Device
			Blank End
			Head of Public Sewer
			Inlet
			Outfall
			Storm Overflow
			Treatment Works

Other symbols or text may be visible which are not shown here.
These are used for Southern Water operational guidance only.

Node Referencing System



APPENDIX E – DRAINAGE CALCULATIONS & DRAWINGS

PROJECT	MOORLANDS FARM, WEST END		
SUBJECT	PRELIMINARY DRAINAGE CALCULATIONS		
JOB NO.	21030	PAGE NO.	1
DATE	18/06/21	REV NO.	P01
PREPARED	DR	CHECKED	

EXISTING SITE INFORMATION

Total Site Area	1.60	ha
Impermeable Area	0.30	ha
PIMP	19	%

MODIFIED RATIONALE METHOD

$$Q_n = 2.78 CiA$$

where:

C *Runoff Coefficients* = 1 (in this case 1 as using impermeable area)
 i_n *Rainfall Intensity for n return period (mm/hr)*
A *Impermeable Area (Ha)*
 Q_n *Runoff for n return period (l/s)*

Rainfall Intensity

The rainfall intensities for various return periods were extracted from Table 1(a) of the Transport and Road Research Laboratory Report - Estimated rainfall for drainage calculations in the United Kingdom (TRRL Report LR 595) by C. P. Young. For the 5 min duration.

i_1	50.8 mm/hr
i_{10}	94.9 mm/hr
i_{30}	113.02 mm/hr
i_{100}	143.9 mm/hr

PRE-DEVELOPMENT SURFACE WATER RUNOFF

		C	i_n	A		Q_n	
Q_1	2.78	1	50.8	0.3	=	42.37	l/s
Q_{10}	2.78	1	94.9	0.3	=	79.15	l/s
Q_{30}	2.78	1	113.0	0.3	=	94.26	l/s
Q_{100}	2.78	1	143.9	0.3	=	120.01	l/s
$Q_{100+40\% \text{ CC}}$	2.78	1	201.5	0.3	=	168.02	l/s

		Page 1																																															
																																																	
Innovyze	Network 2020.1.3																																																
STORM SEWER DESIGN by the Modified Rational Method Design Criteria for Storm Pipe Sizes STANDARD Manhole Sizes STANDARD FSR Rainfall Model - England and Wales <table><tr><td>Return Period (years)</td><td>2</td><td>PIMP (%)</td><td>100</td></tr><tr><td>M5-60 (mm)</td><td>19.700</td><td>Add Flow / Climate Change (%)</td><td>0</td></tr><tr><td>Ratio R</td><td>0.350</td><td>Minimum Backdrop Height (m)</td><td>0.200</td></tr><tr><td>Maximum Rainfall (mm/hr)</td><td>50</td><td>Maximum Backdrop Height (m)</td><td>1.500</td></tr><tr><td>Maximum Time of Concentration (mins)</td><td>30</td><td>Min Design Depth for Optimisation (m)</td><td>1.200</td></tr><tr><td>Foul Sewage (l/s/ha)</td><td>0.000</td><td>Min Vel for Auto Design only (m/s)</td><td>1.00</td></tr><tr><td>Volumetric Runoff Coeff.</td><td>0.750</td><td>Min Slope for Optimisation (1:X)</td><td>500</td></tr></table> Designed with Level Soffits Time Area Diagram for Storm at outfall (pipe 1.007) <table><tr><td>Time Area (mins) (ha)</td><td>Time Area (mins) (ha)</td></tr><tr><td>0-4 0.077</td><td>4-8 0.022</td></tr></table> Total Area Contributing (ha) = 0.099 Total Pipe Volume (m³) = 118.692 Time Area Diagram at outfall (pipe 2.005) <table><tr><td>Time Area (mins) (ha)</td><td>Time Area (mins) (ha)</td></tr><tr><td>0-4 0.328</td><td>4-8 0.177</td></tr></table> Total Area Contributing (ha) = 0.505 Total Pipe Volume (m³) = 11.094				Return Period (years)	2	PIMP (%)	100	M5-60 (mm)	19.700	Add Flow / Climate Change (%)	0	Ratio R	0.350	Minimum Backdrop Height (m)	0.200	Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500	Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200	Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00	Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500	Time Area (mins) (ha)	Time Area (mins) (ha)	0-4 0.077	4-8 0.022	Time Area (mins) (ha)	Time Area (mins) (ha)	0-4 0.328	4-8 0.177										
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Network Design Table for Storm « - Indicates pipe capacity < flow <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>Area (ha)</th><th>T.E. (mins)</th><th>Base Flow (l/s)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th><th>Section Type</th><th>Auto Design</th></tr><tr><td>1.000</td><td>19.544</td><td>0.600</td><td>32.6</td><td>0.032</td><td>4.00</td><td>0.0</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td><td></td></tr></table> Network Results Table <table><tr><th>PN</th><th>Rain (mm/hr)</th><th>T.C. (mins)</th><th>US/IL (m)</th><th>Σ Area (ha)</th><th>Σ Base Flow (l/s)</th><th>Foul (l/s)</th><th>Add Flow (l/s)</th><th>Vel (m/s)</th><th>Cap (l/s)</th><th>Flow (l/s)</th></tr><tr><td>1.000</td><td>50.00</td><td>4.12</td><td>30.350</td><td>0.032</td><td>0.0</td><td>0.0</td><td>0.0</td><td>2.76</td><td>195.4</td><td>4.3</td></tr></table> ©1982-2020 Innovyze				PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design	1.000	19.544	0.600	32.6	0.032	4.00	0.0	0.600	o	300	Pipe/Conduit		PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	1.000	50.00	4.12	30.350	0.032	0.0	0.0	0.0	2.76	195.4	4.3
PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design																																						
1.000	19.544	0.600	32.6	0.032	4.00	0.0	0.600	o	300	Pipe/Conduit																																							
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Innovyze

Network 2020.1.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.001	30.735	0.250	122.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	34.056	1.000	34.1	0.033	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	14.378	0.060	239.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	23.656	0.100	236.6	0.000	0.00	0.0	0.600	2 _ /	300	1:2 Ditch	
1.005	21.195	0.200	106.0	0.034	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	3.525	0.050	70.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	2.881	0.550	5.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	34.862	0.350	99.6	0.070	4.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	34.846	0.350	99.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	38.898	0.150	259.3	0.360	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.003	29.531	0.100	295.3	0.075	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.004	13.381	0.150	89.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.005	5.432	0.050	108.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.001	50.00	4.48	29.750	0.032	0.0	0.0	0.0	1.42	100.1	4.3
1.002	50.00	4.69	29.500	0.065	0.0	0.0	0.0	2.70	191.1	8.8
1.003	50.00	4.93	28.600	0.065	0.0	0.0	0.0	1.01	71.5	8.8
1.004	50.00	5.16	28.550	0.065	0.0	0.0	0.0	1.67	451.6	8.8
1.005	50.00	5.39	28.450	0.099	0.0	0.0	0.0	1.53	107.9	13.4
1.006	50.00	5.42	28.250	0.099	0.0	0.0	0.0	1.87	132.5	13.4
1.007	50.00	5.43	28.200	0.099	0.0	0.0	0.0	6.91	488.7	13.4
2.000	50.00	4.37	29.750	0.070	0.0	0.0	0.0	1.58	111.4	9.5
2.001	50.00	4.74	29.400	0.070	0.0	0.0	0.0	1.58	111.4	9.5
2.002	50.00	5.40	29.050	0.430	0.0	0.0	0.0	0.97	68.7	58.2
2.003	50.00	5.95	28.900	0.505	0.0	0.0	0.0	0.91	64.3	68.4
2.004	50.00	6.08	28.800	0.505	0.0	0.0	0.0	1.67	117.7	68.4
2.005	50.00	6.14	28.650	0.505	0.0	0.0	0.0	1.51	106.6	68.4

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007		29.700	27.650	0.000	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
2.005		29.850	28.600	0.000	0	0

		Page 3	
			
Innovyze	Network 2020.1.3		
Online Controls for Storm			
Hydro-Brake® Optimum Manhole: 9, DS/PN: 1.007, Volume (m³): 2.2			
Unit Reference		MD-SHE-0059-2000-1700-2000	
Design Head (m)		1.700	
Design Flow (l/s)		2.0	
Flush-Flo™		Calculated	
Objective		Minimise upstream storage	
Application		Surface	
Sump Available		Yes	
Diameter (mm)		59	
Invert Level (m)		28.200	
Minimum Outlet Pipe Diameter (mm)		75	
Suggested Manhole Diameter (mm)		1200	
Control Points		Head (m) Flow (l/s)	
Design Point (Calculated)		1.700 2.0	
Flush-Flo™		0.257 1.5	
Control Points		Head (m) Flow (l/s)	
Kick-Flo®		0.527 1.2	
Mean Flow over Head Range		- 1.5	
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated			
Depth (m) Flow (l/s)		Depth (m) Flow (l/s)	
0.100 1.3		1.200 1.7	
0.200 1.4		1.400 1.8	
0.300 1.4		1.600 1.9	
0.400 1.4		1.800 2.1	
0.500 1.3		2.000 2.2	
0.600 1.3		2.200 2.2	
0.800 1.4		2.400 2.3	
1.000 1.6		2.600 2.4	
3.000 2.6		7.000 3.8	
3.500 2.8		7.500 4.0	
4.000 3.0		8.000 4.1	
4.500 3.1		8.500 4.2	
5.000 3.3		9.000 4.3	
5.500 3.4		9.500 4.4	
6.000 3.6			
6.500 3.7			
Hydro-Brake® Optimum Manhole: 15, DS/PN: 2.004, Volume (m³): 3.9			
Unit Reference		MD-SHE-0187-1900-1500-1900	
Design Head (m)		1.500	
Design Flow (l/s)		19.0	
Flush-Flo™		Calculated	
Objective		Minimise upstream storage	
Application		Surface	
Sump Available		Yes	
Diameter (mm)		187	
Invert Level (m)		28.800	
Minimum Outlet Pipe Diameter (mm)		225	
Suggested Manhole Diameter (mm)		1500	
Control Points		Head (m) Flow (l/s)	
Design Point (Calculated)		1.500 19.0	
Flush-Flo™		0.449 19.0	
Control Points		Head (m) Flow (l/s)	
Kick-Flo®		0.977 15.5	
Mean Flow over Head Range		- 16.4	
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake			
©1982-2020 Innovyze			

Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m) Flow (l/s)		Depth (m) Flow (l/s)		Depth (m) Flow (l/s)		Depth (m) Flow (l/s)	
0.100	6.5	1.200	17.1	3.000	26.5	7.000	39.8
0.200	17.1	1.400	18.4	3.500	28.5	7.500	41.1
0.300	18.5	1.600	19.6	4.000	30.4	8.000	42.4
0.400	19.0	1.800	20.7	4.500	32.1	8.500	43.7
0.500	19.0	2.000	21.8	5.000	33.8	9.000	44.9
0.600	18.7	2.200	22.8	5.500	35.4	9.500	46.1
0.800	17.8	2.400	23.8	6.000	36.9		
1.000	15.7	2.600	24.7	6.500	38.4		

		Page 5								
										
Innovyze	Network 2020.1.3									
<u>Storage Structures for Storm</u> <u>Tank or Pond Manhole: 15, DS/PN: 2.004</u> Invert Level (m) 28.800 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>34.0</td><td>1.500</td><td>257.0</td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	34.0	1.500	257.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	34.0	1.500	257.0							
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Innovyze

Network 2020.1.3

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Area Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 2 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.700 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%					30.399
1.001	2	15 Summer	30	+0%					29.819
1.002	3	15 Winter	30	+0%					29.571
1.003	4	120 Winter	30	+0%	30/15 Winter				29.097
1.004	5	120 Winter	30	+0%					29.098
1.005	6	120 Winter	30	+0%	30/15 Summer				29.098
1.006	7	120 Winter	30	+0%	1/15 Summer				29.261
1.007	9	120 Winter	30	+0%	1/15 Summer				29.307
2.000	10	15 Winter	30	+0%	30/15 Summer				30.178
2.001	11	15 Winter	30	+0%	30/15 Summer				30.157
2.002	12	15 Winter	30	+0%	30/15 Summer	100/15 Summer			30.139
2.003	13	15 Winter	30	+0%	30/15 Summer				29.712
2.004	15	60 Winter	30	+0%	1/15 Winter				29.631
2.005	17	15 Summer	30	+0%					28.764

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.251	0.000	0.06		11.0	OK	
1.001	2	-0.231	0.000	0.12		10.9	OK	
1.002	3	-0.229	0.000	0.13		22.3	OK	
1.003	4	0.197	0.000	0.11		6.5	SURCHARGED	
1.004	5	-0.902	0.000	0.00		6.1	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)		
1.005	6	0.348	0.000	0.06			6.1	SURCHARGED	
1.006	7	0.711	0.000	0.06			3.6	SURCHARGED	
1.007	9	0.807	0.000	0.01			1.5	SURCHARGED	
2.000	10	0.128	0.000	0.02			22.2	SURCHARGED	
2.001	11	0.457	0.000	0.24			24.1	SURCHARGED	
2.002	12	0.789	0.000	1.67			106.6	SURCHARGED	4
2.003	13	0.512	0.000	2.12			123.5	SURCHARGED	
2.004	15	0.531	0.000	0.20			18.9	SURCHARGED	
2.005	17	-0.186	0.000	0.31			18.9	OK	



Innovyze

Network 2020.1.3

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Area Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
 Hot Start Level (mm) 0 Inlet Coefficient 0.800
 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 2 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 19.700 Cv (Winter) 0.840

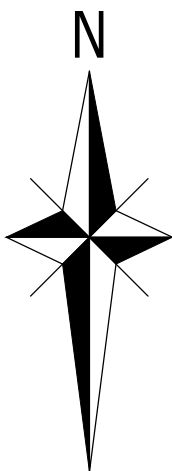
Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+20%					30.413
1.001	2	15 Winter	100	+20%					29.837
1.002	3	15 Winter	100	+20%					29.590
1.003	4	120 Winter	100	+20%	30/15 Winter				29.343
1.004	5	120 Winter	100	+20%					29.340
1.005	6	120 Winter	100	+20%	30/15 Summer				29.340
1.006	7	120 Winter	100	+20%	1/15 Summer				29.525
1.007	9	120 Winter	100	+20%	1/15 Summer				29.572
2.000	10	15 Winter	100	+20%	30/15 Summer				31.135
2.001	11	15 Winter	100	+20%	30/15 Summer				31.094
2.002	12	15 Winter	100	+20%	30/15 Summer	100/15 Summer			31.054
2.003	13	30 Winter	100	+20%	30/15 Summer				30.363
2.004	15	60 Winter	100	+20%	1/15 Winter				30.020
2.005	17	15 Winter	100	+20%					28.764

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.237	0.000	0.10		17.1	OK	
1.001	2	-0.213	0.000	0.19		17.0	OK	
1.002	3	-0.210	0.000	0.20		34.6	OK	
1.003	4	0.443	0.000	0.18		10.6	SURCHARGED	
1.004	5	-0.660	0.000	0.00		10.3	OK	

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	6	0.590	0.000	0.06			6.0	SURCHARGED	
1.006	7	0.975	0.000	0.06			3.8	SURCHARGED	
1.007	9	1.072	0.000	0.01			1.7	SURCHARGED	
2.000	10	1.085	0.000	0.30			30.5	FLOOD RISK	
2.001	11	1.394	0.000	0.29			30.0	FLOOD RISK	
2.002	12	1.704	3.945	2.32			148.1	FLOOD	4
2.003	13	1.163	0.000	2.77			161.7	FLOOD RISK	
2.004	15	0.920	0.000	0.20			18.9	SURCHARGED	
2.005	17	-0.186	0.000	0.31			18.9	OK	



NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RELEVANT SPECIFICATION AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER.
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- ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES, UNLESS OTHERWISE STATED.
- 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 PRIOR PERMISSION FROM THE ENGINEER.
- THIS DRAWING HAS BEEN BASED ON "ILLUSTRATIVE SITE PLAN", DRAWING No. 7912_D01 REV H, DATED 08.09.22 BY RADLEY HOUSE PARTNERSHIP.
- THIS DRAWING HAS BEEN BASED ON "SITE SURVEY", DRAWING No. H16-07, BY KND SURVEYS, DATED 9th AUGUST 2007.

CDM NOTES

THE ATTENTION OF THE CLIENT, PRINCIPAL DESIGNER, PRINCIPAL CONTRACTOR, DESIGNERS AND CONTRACTORS IS DRAWN TO THE FOLLOWING POTENTIAL RISKS IN CONJUNCTION WITH THE PROPOSED ON-SITE AND OFF-SITE WORKS AS DESIGNED FOR THIS PROJECT:

- WORKS IN THE VICINITY OF LIVE SERVICES INCLUDING GAS, ELECTRICITY AND BT WILL BE NECESSARY AND THE ADVICE OF ALL STATUTORY SERVICE COMPANIES MUST BE SOUGHT BEFORE ANY WORKS COMMENCE.
- WORKS WITHIN AND ABUTTING THE EXISTING HIGHWAY WILL ENTAIL TRAFFIC HAZARDS AND ALL APPROPRIATE SAFETY MEASURES INCLUDING BARRIERS, SIGNS AND LIGHTING MUST BE UNDERTAKEN TO THE APPROVAL OF THE LOCAL AUTHORITY, THE HIGHWAY AUTHORITY AND THE POLICE DEPARTMENT.
- HAZARDOUS MATERIALS INCLUDING CEMENT AND BITUMINOUS MATERIALS ARE SPECIFIED AND THE MANUFACTURERS ADVICE ON SAFE HANDLING PROCEDURES MUST BE OBTAINED AND MADE CLEAR TO ALL OPERATIVES.
- THE CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING ALL EXISTING SERVICES WITHIN THE VICINITY OF THE WORKS HAND DUG AND ENSURE THESE ARE PROTECTED THROUGHOUT THE DURATION OF THE WORKS. ALL UTILITY PLANT SHOULD BE CLEARLY MARKED ON THE GROUND PRIOR TO COMMENCEMENT OF THE WORKS.
- THE CONTRACTOR MUST ENSURE ALL WORKING AREAS ARE FULLY SECURE.

KEY

- SITE BOUNDARY
- INDICATIVE SURFACE WATER SEWER
- INDICATIVE PERMEABLE PAVING
- INDICATIVE SEDUM ROOF
- INDICATIVE MESH SURFACE WITH WILDFLOWERS/ GRASSLAND
- INDICATIVE ATTENUATION TANK
- INDICATIVE SWALE / BASIN
- INDICATIVE HEADWALL
- INDICATIVE SAFETY FENCING / KNEE RAIL
- INDICATIVE OVERLAND FLOW ROUTE
- INDICATIVE FOUL SEWER
- INDICATIVE COMBINED SEWER

FOR INFORMATION ONLY

P02	FOR INFORMATION	DR	CR	DR	13.09.22
P01	FOR INFORMATION	DR	CR	DR	16.08.22
Rev	Description	Drm	Chk	App	Date

FERNBROOK
CONSULTING ENGINEERS

The Finbury Business Centre
40 Bowling Green Lane
London
EC1R 0NE

info@ferbrook.co

Client

COUNTRY HOMES

Project Title:

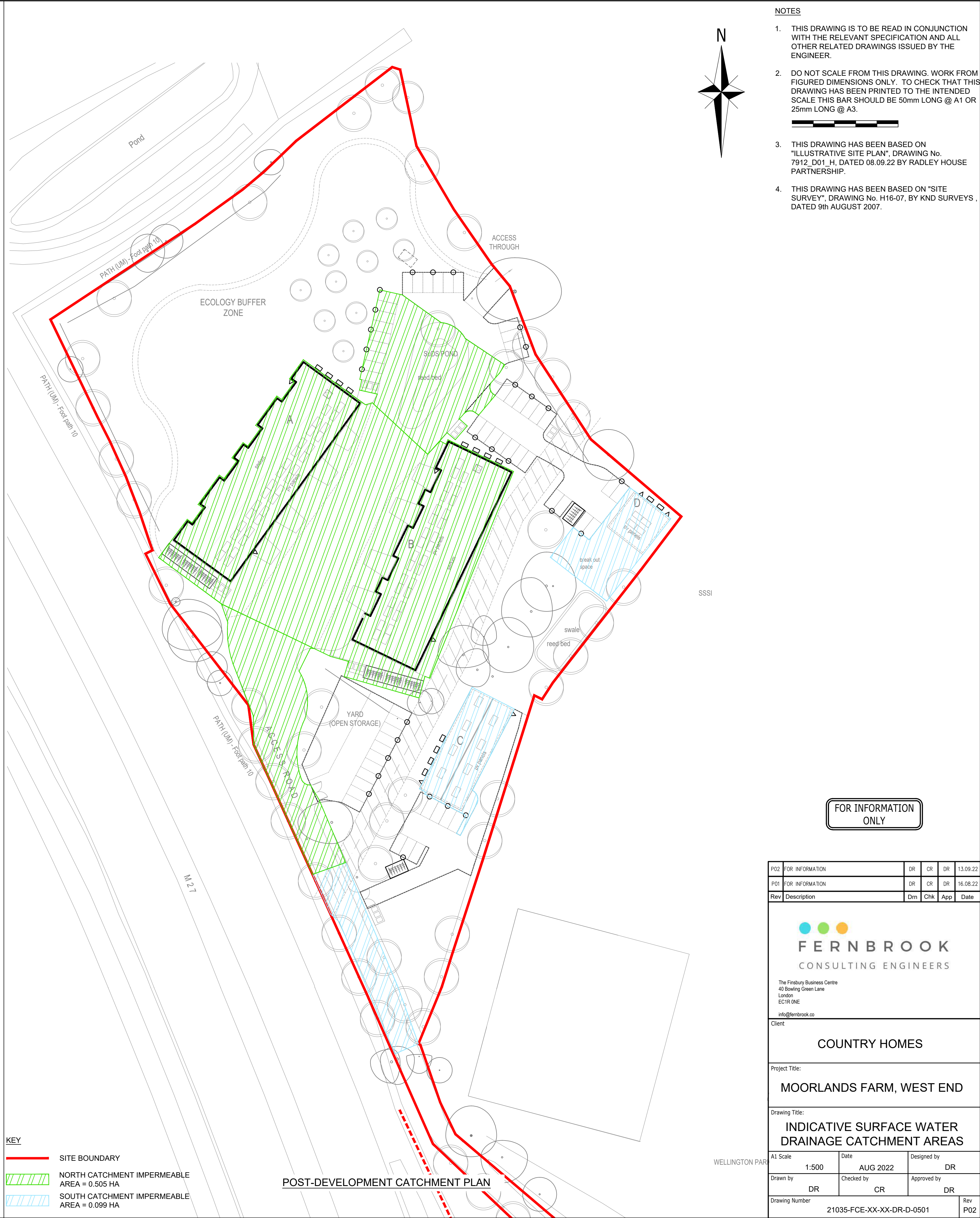
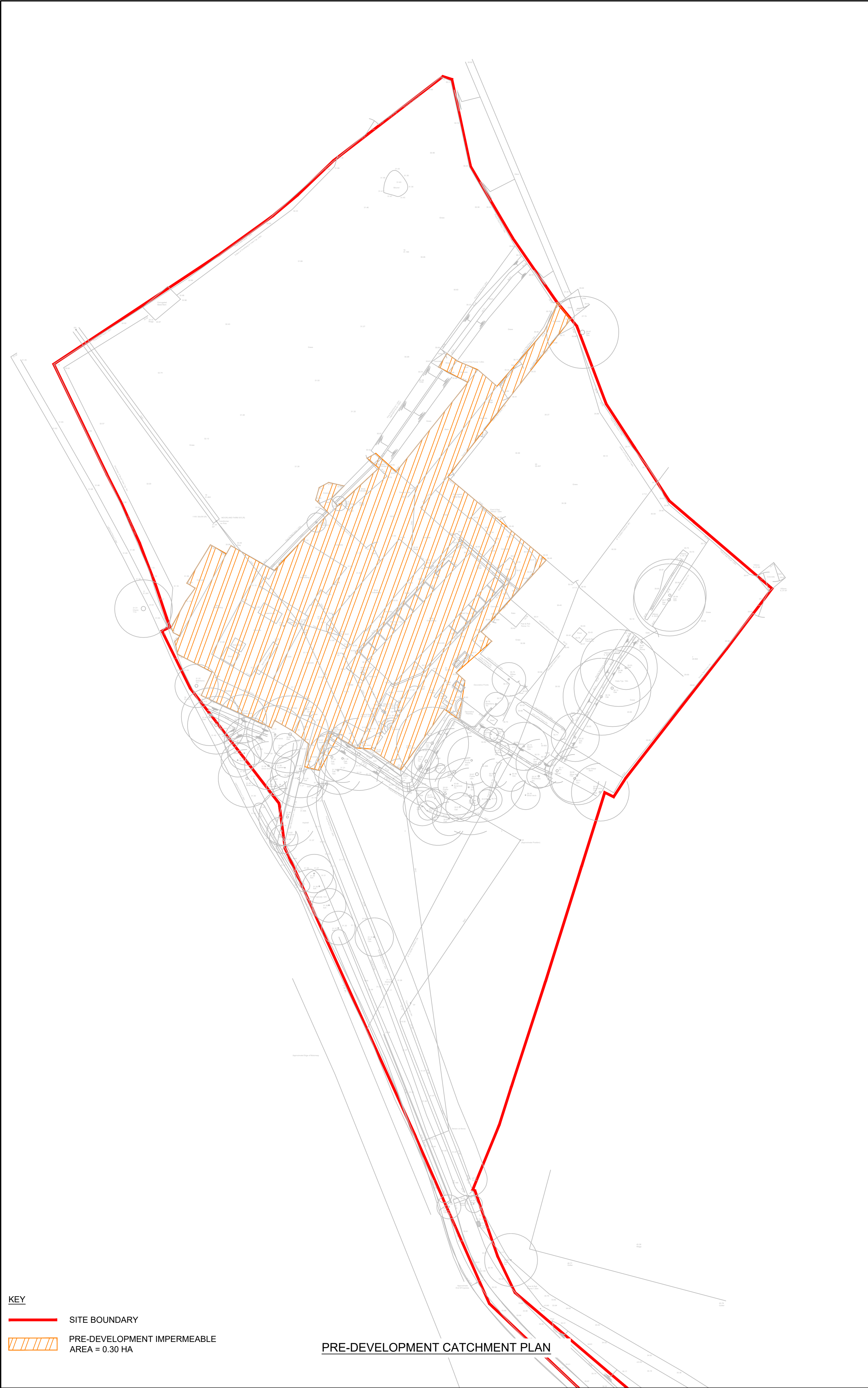
MOORLANDS FARM, WEST END

Drawing Title:

**INDICATIVE SURFACE WATER
& FOUL DRAINAGE STRATEGY**

A1 Scale	Date	Designed by
1:500	AUG 2022	DR
Drawn by	Checked by	Approved by
DR	CR	DR

Drawing Number	Rev
21035-FCE-XX-XX-DR-D-0500	P02



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 - THIS DRAWING HAS BEEN BASED ON "SITE SURVEY", DRAWING No. H16-07, BY KND SURVEYS, DATED 9th AUGUST 2007.

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P02	FOR INFORMATION	DR	CR	DR	13.09.22
P01	FOR INFORMATION	DR	CR	DR	16.08.22
Rev	Description	Dm	Chk	App	Date

FERNBROOK
CONSULTING ENGINEERS

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info@fernbrook.co

Client

COUNTRY HOMES

Project Title:

MOORLANDS FARM, WEST END

Drawing Title:

**INDICATIVE SURFACE WATER
DRAINAGE CATCHMENT AREAS**

A1 Scale	Date	Designed by
1:500	AUG 2022	DR
Drawn by	Checked by	Approved by
DR	CR	DR
Drawing Number	21035-FCE-XX-XX-DR-D-0501	Rev
		P02

WELLINGTON PARK

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ONLY

P01	FOR INFORMATION	DR	CR	DR	16.08.2023
Rev	Description	Drn	Chk	App	Date




FERNBROOK
 CONSULTING ENGINEERS

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London
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Client

COUNTRY HOMES

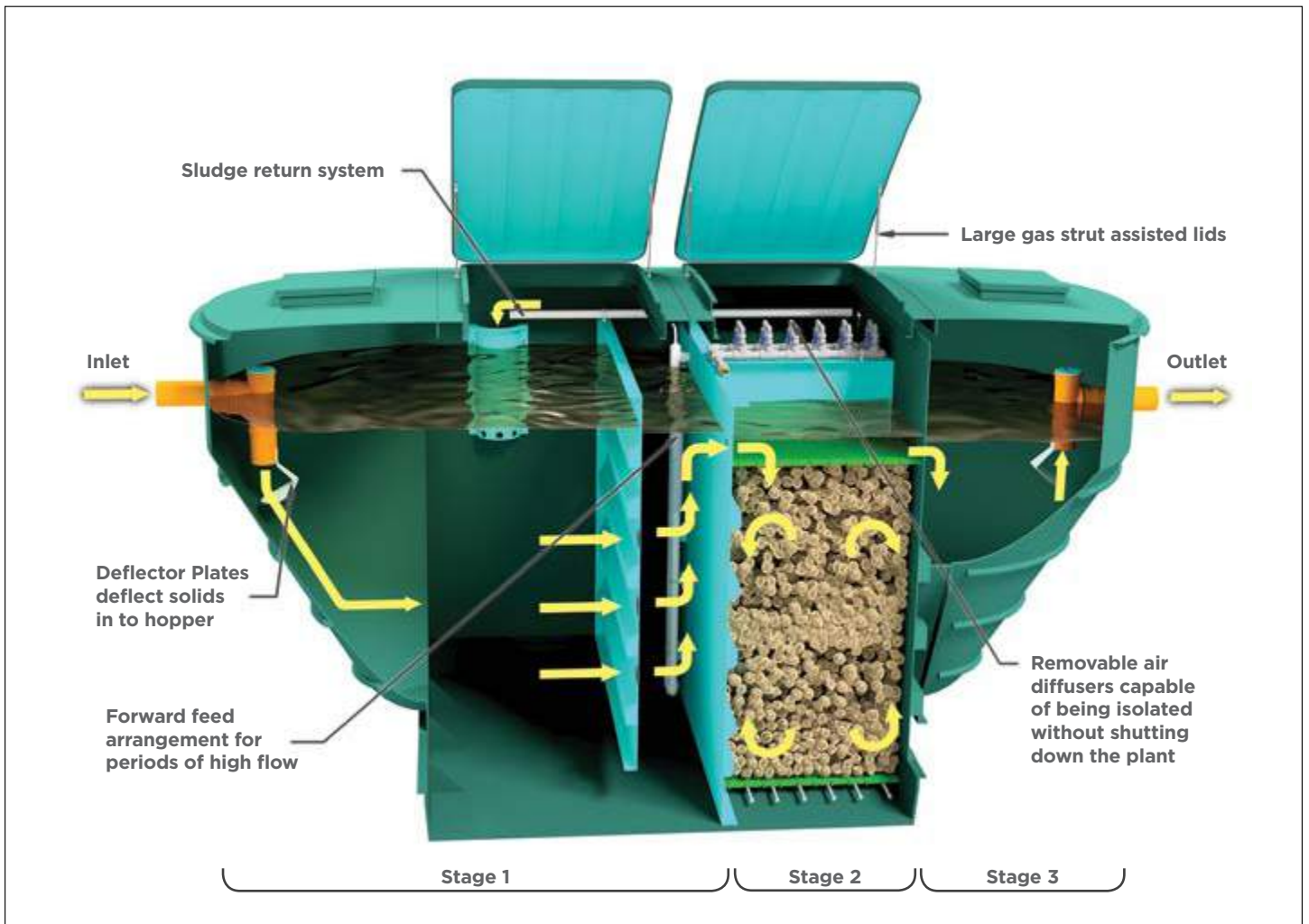
Project Title:

MOORLANDS FARM, WEST END

Drawing Title:

INDICATIVE SUSTAINABLE DRAINAGE DETAILS

A1 Scale	Date	Designed by
NTS	AUG 2022	DR
Drawn by	Checked by	Approved by
DR	CR	DR
Drawing Number		Rev
21035-FCE-XX-XX-DR-D-0505		P01



WPL HiPAF midi packaged sewage treatment plant illustration (above)

Internal Configuration

The internal sections of the plant can be accessed from the top of the unit to make servicing, maintenance and de-sludging easier. Plants are fitted-as-standard with large, stainless steel, gas strut assisted lids to give full access to the relevant parts of the plant.

Air is introduced to the WPL HiPAF unit by a series of air diffusers. Each diffuser is capable of being isolated and removed individually without the need to shut down the plant or affect air supply to the rest of the unit.

The complete absence of mechanical and electrical components within the hostile environment provides safe and clean working conditions on site.



Internal air diffusers (left) and large gas strut lids (right)

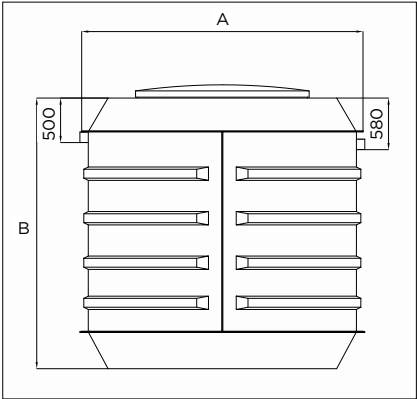
Technical Specification

Use the tables below as an indicative guide to selecting the right packaged treatment plant for your site. For advice on the modular system or more information on the range please contact WPL or a qualified contractor.

WPL HiPAF compact system 1 to 60 PE

Model PE	Standard Consent*	A Diameter (m)	B Height (m)	Inlet Invert (mm)	Outlet Invert (mm)
10	20:30:20	2.29	2.61	500	580
20	20:30:20	2.32	2.86	500	580
30	20:30:20	2.58	2.69	500	580
40	20:30:20	2.86	2.69	500	580
50	20:30:20	3.16	3.00	500	580
60	20:30:20	3.16	3.20	500	580

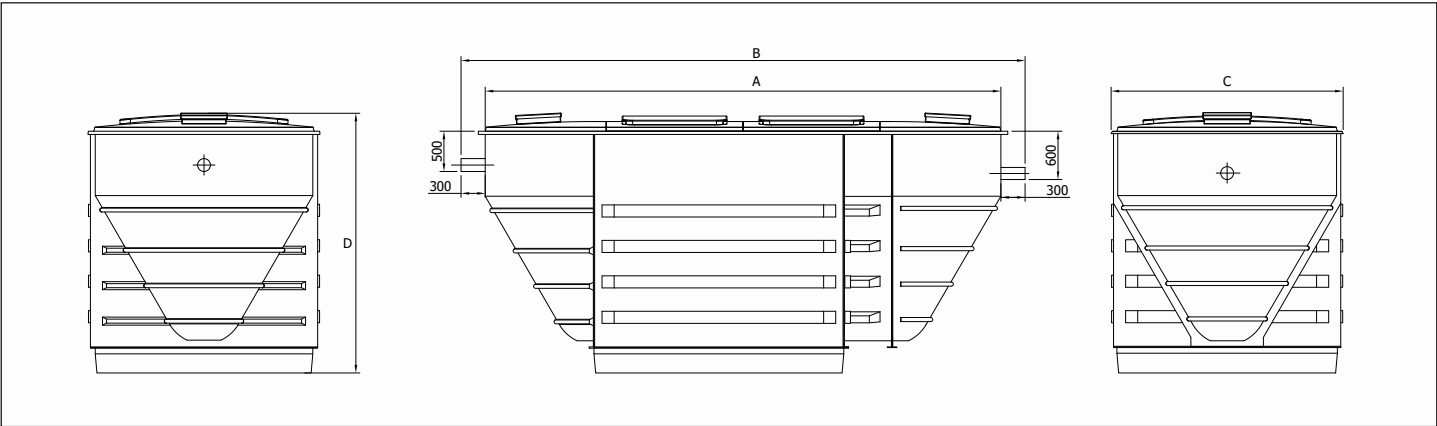
*Typical consent standards shown, tighter consent standards available to meet all requirements specified by the EA



WPL HiPAF midi system 60 to 300 PE

Model PE	Standard Consent**	A Length (m)	B Length w/pipes (m)	C Width (m)	D Height (m)	Inlet Invert (mm)	Outlet Invert (mm)	Weight (Tonne)
70	20:30:20	4.30	4.90	2.88	3.20	500	600	1.60
90	20:30:20	4.80	5.40	2.88	3.20	500	600	1.90
110	20:30:20	5.20	5.80	2.88	3.20	500	600	2.25
130	20:30:20	5.80	6.40	2.88	3.20	500	600	2.50
150	20:30:20	6.40	7.00	2.88	3.20	500	600	2.90
175	20:30:20	7.00	7.60	2.88	3.20	500	600	3.40
200	20:30:20	7.60	8.20	2.88	3.20	500	600	3.90

** Typical consent standards shown – tighter consent standards available to meet all requirements specified by the EA. For options above 200PE please contact WPL.



The tables are an indicative guide only. All applications are specified to comply with the British Water Code of Practice for Flows and Loads. Further technical information can be found on the WPL website, visit www.wplinternational.com.

APPENDIX F – TREATMENT MITIGATION INFORMATION

Downstream Defender® Advanced Hydrodynamic Vortex Separator

The Downstream Defender® is an advanced hydrodynamic vortex separator for the effective and reliable removal of fine particles, oils and other floatable debris from surface water runoff.

Its innovative design delivers high efficiency across a wide range of flows in a much smaller footprint than conventional or other swirl-type devices and it is the perfect choice for any catchment likely to convey high quantities of contamination.

1. Access for removal of floatables and sediments.
2. Inlet pipe.
3. Inlet chute.
4. Centre shaft.
5. Dip plate.
6. Centre cone.
7. Benching skirt.
8. Floatables and oil storage.
9. Isolated sediment storage zone.
10. Outlet pipe.

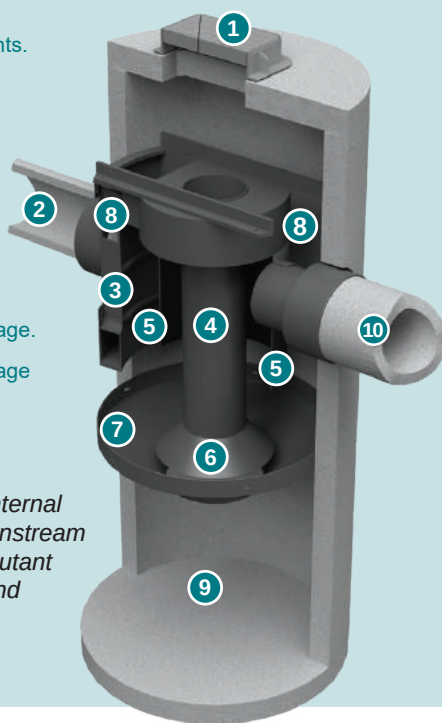


Figure 1 - The unique internal components of the Downstream Defender® enhance pollutant removal performance and prevent wash out.

Unique Flow Modifying Components

The Downstream Defender® consists of a choice of concrete or HDPE chamber with unique flow modifying internal components. It is these internal components that differentiate the Downstream Defender® from catchpits, sedimentation basins or sedimentation sumps. They facilitate advanced hydrodynamic vortex separation by reducing turbulence, lengthening the flow path to increase chamber residence time and introducing shear planes.

The internal components also ensure that the pollutant storage zones are isolated and protected from high flows that could cause pollutant re-entrainment or wash out.

Compared to devices that have poorly designed internal components, the Downstream Defender® captures and retains more of the annual pollutant load.

Watch a short video showing the Downstream Defender® components and operation at:

<http://www.hydro-int.com/en-gb/products/downstream-defender-0>



Repeatable, Reliable Performance

The Downstream Defender® delivers high removal of pollutants through advanced, hydrodynamic separation across a wide range of flows. The device has a proven track record of tackling an assortment of pollutants including:

Sediment (or Total Suspended Solids)



The Downstream Defender® is a highly effective sediment/TSS removal device. It can be sized in a number of ways to suit the application and level of protection required (see Table 1). **SuDS Mitigation Index = 0.5.**

Sediment Bound Hydrocarbons (including Polycyclic Aromatic Hydrocarbons - PAHs)



PAHs have low solubility in water and are readily adsorbed onto sediment particles. Effective removal of sediment particles will also ensure the removal of many PAHs.

Gross Pollutants



100% removal of floatable debris, such as food wrappers, Styrofoam cups and drinks cartons

Liquid Hydrocarbons



Effective spill containment device that meets the BS EN 858-1:2002 Class I and Class II effluent targets at low flow rates. Note these systems are not considered oil separators according to the BS EN 858-1 and must not be used in applications where full certification is required. **SuDS Mitigation Index = 0.8.**

Sediment Bound Heavy Metals and Nutrients

Heavy Metals

Nutrients

As an efficient device for removal of fine sediment, the Downstream Defender® is also effective for the removal of sediment bound pollutants. **SuDS Mitigation Index (Metals) = 0.4.**

Design Data

Downstream Defender®

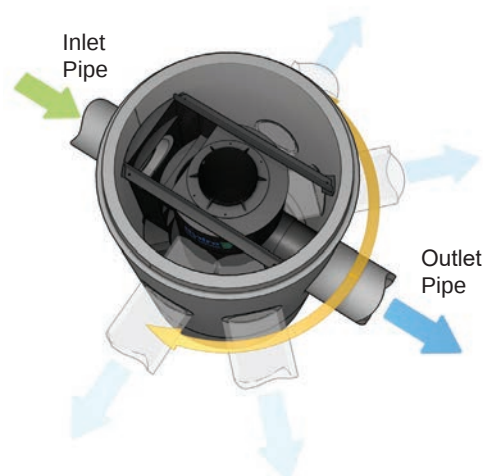
Advanced Hydrodynamic Vortex Separator

Setting Out

The Downstream Defender® can accommodate a change in pipe direction to suit site specific requirements. Combined with the high rate internal bypass, this helps to avoid the need for additional manholes on site. Head loss across the chamber is kept to a minimum (see Table 1). The inlet and outlet pipes should be sized in accordance with Table 2 (opposite), and a minimum of 90 degrees between inlet and outlet is required.

Inlet and outlet pipe connections are at the same invert level.

Additional manhole sections can be provided to extend the chamber to meet site cover and invert levels or provide additional pollutant storage where required.



Easy to Install

The Downstream Defender® is delivered to site as a near finished manhole with internal components already installed. Installation is therefore similar to any other manhole installation on site. Full installation guidelines are available.

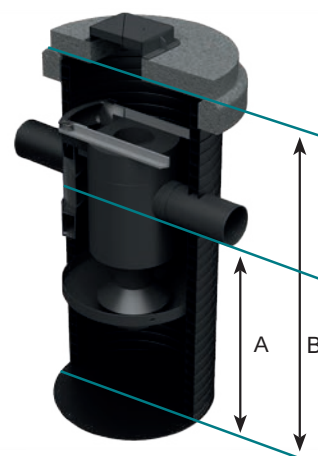
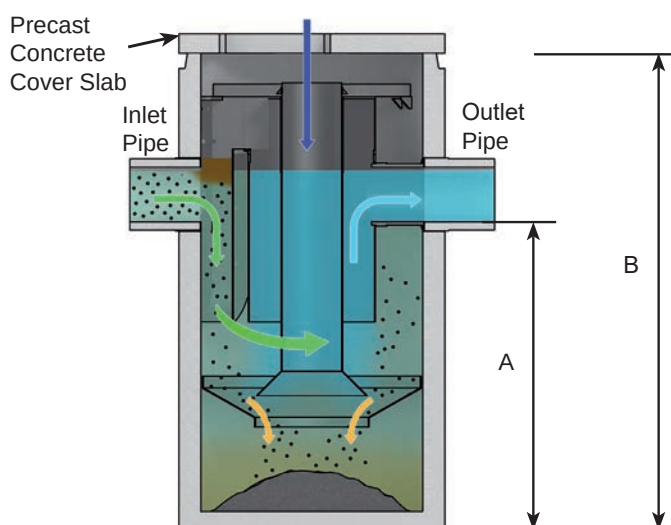
We can provide structural concrete systems for simple plug-and-play installation or choice of lightweight single and twin wall plastic chambers.

Easy to Maintain

Maintenance of the Downstream Defender® is simple, safe and cost-effective. Maintenance is carried out from the surface, using a standard vacuum tanker and personnel are not required to enter the device.

With a large capacity to store sediments and oils (see Table 1), and with a proven ability to prevent wash out, maintenance intervals can be years rather than months - depending on site conditions. The unit can also be fitted with a [Hydro-Logic™ Smart Monitoring](#) system to alert the site operator when maintenance is required and provide peace of mind that the unit is operating normally at other times.

Additional pollutant storage can be built into the chamber to extend maintenance intervals if required.



APPENDIX G – DRAINAGE MAINTENANCE PLAN

SuDS MANAGEMENT PLAN

This long-term Management Plan of the Sustainable Drainage System should be implemented at **Moorlands Farm, West End, Southampton, SO30 3HD** to ensure that the drainage network functions as designed. This plan is intended to cover all on-site drainage structures. The Site Management Team should oversee and implement the SuDS Management Plan and designate a qualified person who will be responsible for the proper operation and maintenance of the foul and stormwater structures.

Stormwater Runoff Quality

The stormwater management system protects and enhances the stormwater runoff water quality through the removal of sediment and pollutants, catchpit manholes and silt trapped gullies will reduce the amount of pollutants entering the system. Preventive maintenance of the system will include a comprehensive source reduction program of regular sweeping and litter removal, prohibitions on the use of pesticides, and maintenance of bin areas.

Drainage System

Maintenance and cleaning of gullies, stormwater manholes, and SuDS components will assure adequate performance. This maintenance program is outlined below;

Maintenance Program

The Site Management Team will conduct the operation and maintenance plan set forth in this document. The Site Management will ensure that inspections and record keeping are timely and accurate. Inspection & Maintenance Log Forms (attached) should include the date and physical conditions of the structures, depth of sediment in structures, evidence of overtopping or debris blockage and maintenance required of each structure. Records of maintenance will be kept on file at the property and copies of Inspection & Maintenance Log sheets indicating all work and inspections will be available to the Council upon request.

Concurrent with inspection and cleaning, all litter shall be picked up and removed from the parking areas, external bin store, wetland areas, and soft landscaping.

Regular maintenance should include;

1. Inspect permeable paving inlets/outlets and remove any debris every 6 months or as determined to be reasonable based on experience with the installed systems to ensure that the system continues to work as intended and is free of debris; quarterly, inspect inspection chambers and manholes; if depth of sediment in sumps exceeds 50% capacity, sediment must be removed. Excessive sediment shall be removed and properly disposed by a licensed drainage cleaning company.
2. Inspection of external bin store for spillage and scattered litter must be performed on a regular basis to prevent the spread of pollutants into the stormwater management system.
3. Attenuation storage tank inlets, and roof gully outlets and vents and overflows should be checked annually and after large storms to ensure that they are in good condition and operating as designed. Regular maintenance includes inspection and identification of any areas that are not operating correctly monthly for the first 3 months and then every 6 months after.

Winter Maintenance Program

Ensure that drainage structures are not blocked by ice, snow, debris or rubbish during winter months.

Fertiliser Use

Only slow-release organic low-phosphorous fertilisers will be used in any landscaped areas in order to limit the amount of nutrients that could enter the stormwater system.

Maintenance Task	Description	Frequency
Regular Maintenance		
Litter management	Pick up all litter in suds and landscape areas and remove from site	Monthly
Landscaped & Vegetated Areas	Trim plants and grass verges, paths and amenity at 35-50mm with 75mm max. Leaving grass in situ	As required or monthly
Inlets and outlets	Inspect monthly, remove silt from slab aprons and debris. Strim 1m round for access	Monthly
Hard surfaces	Sweep all paving regularly. Sweep and suction brush permeable paving in autumn after leaf fall.	Annually
Occasional tasks		
Inspection and control chambers	Annual inspection, remove silt and check free flow	Annually
Remedial work		
	Inspect suds system regularly to check for damage or failure. Undertake remedial work as required.	As required

Drainage Operation and Maintenance Log

Site Maintenance Supervisor: _____ Date: _____

☐ Routine ☐ Response to rainfall event __ in ☐ Other: _____

BMP	Frequency	Date Performed	Comments
Inlets/outlets and Manholes	Monthly Inspections		
	Maintenance Quarterly and as necessary		
Pavement Areas (parking, driveways, service areas)	Monthly Sweeping		
	Rubbish & Litter Removal as Necessary		
Landscaped & Vegetated Areas	Maintenance as necessary		
Attenuation Tanks	Inspect and identify areas not operating properly every 3 months (for the first 3 months) and every 6 months after		
	Full bi-annual inspection		