

Land Adjacent to Albion Road & Copper Lane  
Marden

# Flood Risk Assessment

HSP2023-C3571-C&S-FRAS1-1263  
July 2023



CIVIL | STRUCTURAL | GEOTECHNICAL & ENVIRONMENTAL | TRAFFIC AND TRANSPORT

Lawrence House | 6 Meadowbank Way | Nottingham | NG16 3SB  
01773 535555 | [design@hspconsulting.com](mailto:design@hspconsulting.com) | [www.hspconsulting.com](http://www.hspconsulting.com)

## Reliance

This report was produced by HSP Consulting Engineers Ltd for Rydon Homes Ltd (Rydon/Client) as a Stage 1 Flood Risk Assessment for a residential development off land to the east of Albion Road and to the north of Copper Lane, Marden, Kent.

This report may not be used by any person other than the Client and must not be relied upon by any other party and/or for any other purpose without the explicit written permission of HSP Consulting Engineers Ltd. In any event, HSP Consulting Engineers Ltd accepts no liability for any costs, liabilities or losses arising as a result of the use or reliance upon the contents of this report by any person other than the Client.

All parties to this report do not intend any of the terms of the Contracts (Rights of Third Party Act 1999) to apply to this report. Please note that this report does not purport to provide definitive legal advice.

## Report Limitations

This report is based on information available to HSP during its preparation and as may have been supplied by Third Parties. HSP accepts no liability if the information used is found to be inaccurate or incomplete or if additional information exists or becomes available at a later date.

HSP disclaims any duty to update the report for events taking place after the date on which the report is delivered.

This report is provided for guidance purposes only and provides no guarantee against flooding. HSP accepts no liability for the accuracy of water levels, flow rates and associated probabilities.

This report has been prepared for the purpose of evaluating feasibility and does not purport to be a detailed design for construction. Additional works may be required to secure detailed planning and/or building consent.

This report has been produced for the sole use of the Client and no extended duty of care to any third party is implied or offered.

Third parties making reference to this report should consult the Client and HSP as to the extent to which findings may be appropriate for their use.

## Quality Assurance

HSP Consulting confirms that all reasonable efforts have been made to ensure that information contained within this report is accurate. HSP Consulting would further confirm that due care, attention and technical skill were used in creation of this report.

## Issue & Revision History

Revision	Status	Originator	Checked	Approved	Date
A	FINAL	C Jeffrey BSc (Hons)	P Daykin BSc(Hons) MCIHT MCIQB CEnv	P Daykin BSc(Hons) MCIHT MCIQB CEnv	18.07.2023
-	DRAFT	C Jeffrey BSc (Hons)	P Daykin BSc(Hons) MCIHT MCIQB CEnv	P Daykin BSc(Hons) MCIHT MCIQB CEnv	02.02.2023
Project Number:C3571			Doc Ref: HSP2023-C3571-C&S-FRAS1-1263 Rev A		

## Contents

1	Introduction .....	1
	1.1 General .....	1
	1.2 Format of this Report .....	1
	1.3 Sources of Data .....	2
2	Site Location, Description & Proposed Development .....	2
	2.1 Site Location .....	2
	2.2 Description .....	3
	2.3 Proposed Development .....	4
3	Geology, Hydrogeology, Hydrology .....	5
	3.1 Introduction .....	5
	3.2 Geology .....	5
	3.3 Hydrogeology .....	5
	3.4 Hydrology .....	6
	3.5 Site Investigation .....	6
	3.6 Miscellaneous .....	7
4	National Planning Framework .....	7
	4.1 General .....	7
	4.2 The Sequential Test .....	7
	4.3 Land Use and Development .....	8
	4.4 The Exception Test .....	10
5	Local Planning Framework .....	10
	5.1 General .....	10
	5.2 Marden Surface Water Management Plan, 2017 (SWMP) .....	10
	5.3 Kent County Council Drainage and Planning Policy, 2019 .....	13
	5.4 Kent Local Flood Risk Management Strategy (LFRMS) 2017-2023 .....	15
6	Miscellaneous References and/or Reports .....	15
7	Consultation Responses .....	16
	7.1 Public Sewers/Local Drainage Infrastructure .....	16
	7.2 Environment Agency (EA) .....	16
	7.3 Lead Local Flood Authority (LLFA) .....	18
8	Planning Policy & Compatibility of the Proposed Development .....	19
9	Existing Drainage .....	19
	9.1 Site Specific Existing Surface Water Drainage .....	19
	9.2 Site Specific Existing Foul Water Drainage .....	19
10	Climate Change and Design Event .....	19
	10.1 Lifetime of Development .....	19
	10.2 Peak Rainfall Intensity .....	20
	10.3 Peak River Flow .....	20
	10.4 Design Event (Drainage) .....	20
11	Potential Sources of Flooding .....	21
	11.1 General .....	21

12	Flooding Risks to the Development.....	22
	12.1 Tidal Flood Risk .....	22
	12.2 Fluvial Flood Risk .....	22
	12.3 Groundwater Flooding .....	22
	12.4 Pluvial Flood Risk .....	22
	12.5 Sewer Flooding.....	23
	12.6 Infrastructure/Reservoir Flood Risk .....	23
13	Effect of Development on Flooding & Design Inclusions .....	23
	13.1 Surface Water Drainage .....	23
	13.2 Foul Water Drainage.....	24
	13.3 Overland Flows.....	24
	13.4 Floodplain/Displacement of Floodwaters.....	25
	13.5 Means of Access/Egress .....	25
	13.6 Groundwater .....	25
	13.7 Flood Resistant/Resilient Construction.....	26
14	Proposed Surface Water Drainage Strategy .....	26
	14.1 Preface.....	26
	14.2 Sustainability: Attenuation .....	26
	14.3 Sustainability: Pollution.....	28
	14.4 Operation and Maintenance .....	29
15	Further Actions .....	29
	15.1 Groundwater Monitoring .....	29
	15.2 Sewerage Undertaker.....	30
	15.3 Design Co-ordination .....	30
16	Conclusions .....	30

## APPENDIX 1

- Topographic Survey
- Site Investigation

## APPENDIX 2

- Proposed Layout
- Drainage Strategy

## APPENDIX 3

- Consultation Responses
- Lead Local Flood Authority
- Sewer Records

## APPENDIX 4

- EA Flood Map for Planning
- Long-term Flood Risk Mapping

# Flood Risk Assessment

## APPENDIX 5

- Greenfield Runoff Estimate
- Drainage Strategy Simulation Summary

## APPENDIX 6

- Sample Drainage Maintenance Strategy

## 1 Introduction

### 1.1 General

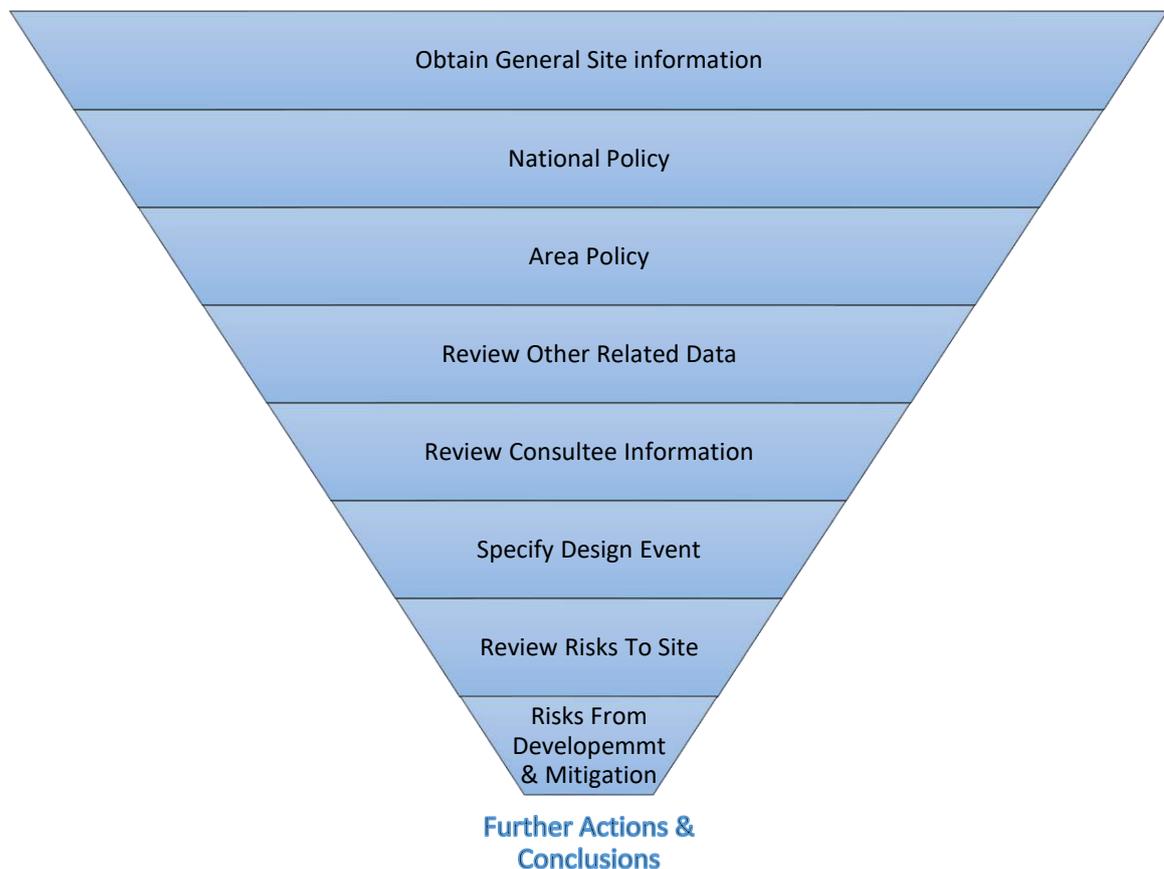
1.1.1 HSP Consulting Engineers Ltd has been commissioned to undertake a Stage 1 Flood Risk Assessment for a potential residential development at a site located in Marden, Kent.

1.1.2 This report is based upon outline development proposals. It is therefore the intention of this appraisal to establish the principles of development rather than present a definitive construction proposal. Further works will be required once a detailed planning submission is prepared, and the resultant detailed design solutions have developed for approval.

1.1.3 Notwithstanding the above, it is considered likely that this first stage appraisal will identify significant flood risk related matters and mitigation methods for any residual risk identified.

### 1.2 Format of this Report

1.2.1 This report is reliant upon publicly available information and/or that provided by Consultees which is then reviewed, in outline terms, in accordance with the graphic below:



## 1.3 Sources of Data

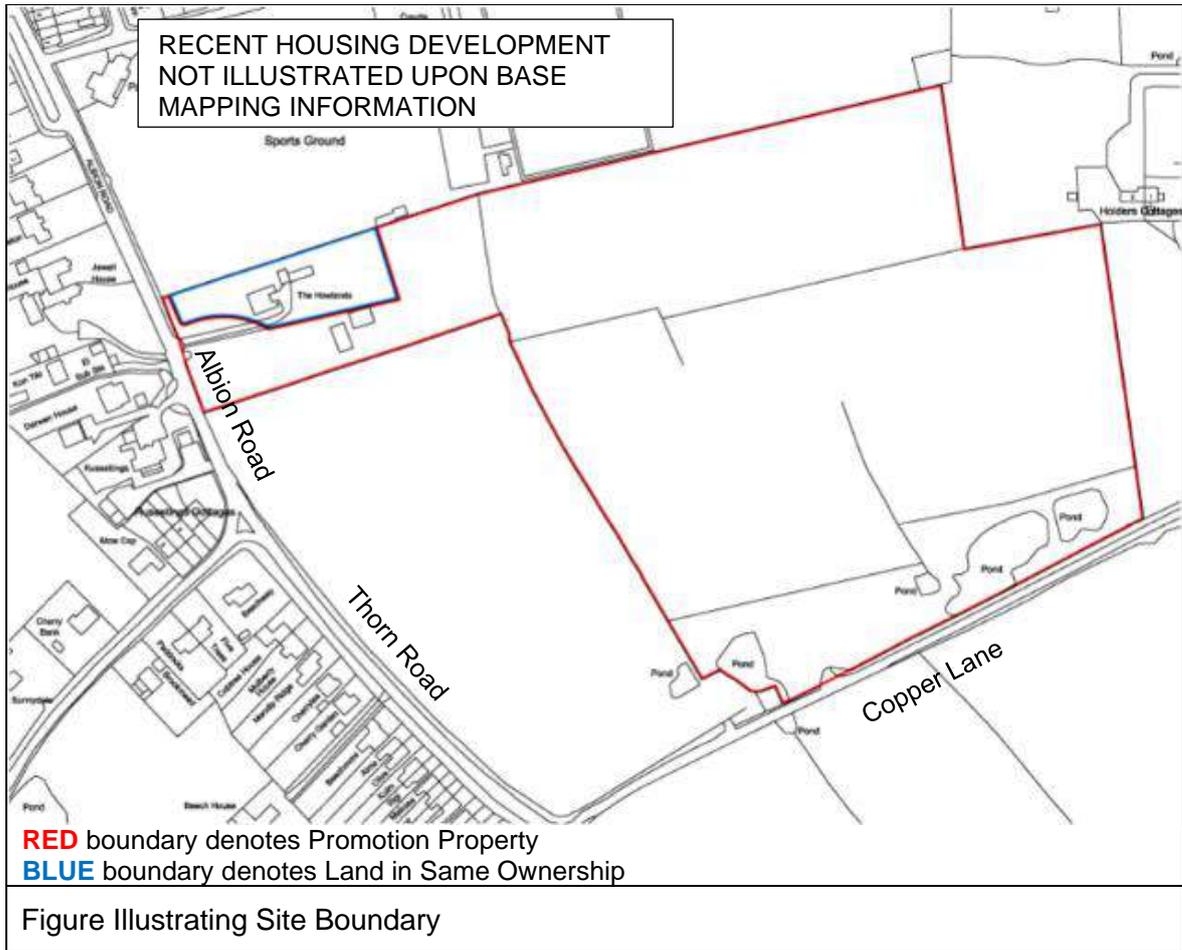
1.3.1 This report is based on information from the following principal sources of information:

- i.* Environment Agency Flood Zone (for Planning) Mapping
- ii.* Government Long Term Flood Risk Mapping
- iii.* Lead Local Flood Authority
- iv.* Kent Local Flood Risk Management Strategy 2017-2023
- v.* Marden Surface Water Management Plan, 2017
- vi.* Kent County Council Drainage and Planning Policy, 2019
- vii.* Topographic survey and 2019 LiDAR terrain data
- viii.* Walkover survey
- ix.* Intrusive site investigation

## 2 Site Location, Description & Proposed Development

### 2.1 Site Location

- 2.1.1 The site is located at National Grid reference (NGR) E575085, N144265 (approximately).
- 2.1.2 The site is undeveloped.
- 2.1.3 A nearby postcode within the vicinity of the site is TN12 9EF.
- 2.1.4 Access is gained via Albion Road or Copper Lane.
- 2.1.5 The Lead Local Flood Authority is Kent County Council.
- 2.1.6 For illustration, the site is highlighted in the figure below:



## 2.2 Description

- 2.2.1 The development parcel is presented as a notionally rectangular footprint with a 'finger of land' extending from the main body towards Albion Road.
- 2.2.2 The site is greenfield and approximately 6 hectares in plan area.
- 2.2.3 The immediate site environs are categorised as:
  - i. Residential/urban to the north and west.
  - ii. Undeveloped and agricultural to the south and east.
- 2.2.4 The site is currently greenfield (Orchard) and located within an increasingly urbanised environment. However, abundant 'greenfields' remain within the wider setting.
- 2.2.5 Boundaries formed as follows:
  - i. North: Recent residential development with older development beyond.

- ii.* East: Farmland (Holders Farm).
- iii.* South: Copper Lane with open field beyond.
- iv.* West: Fields and Albion Road/Thorn Road. Residential development is present to the west of Albion Road/Thorn Road.

2.2.6 The topographical survey of the site, reproduced within Appendix 1, indicates that the site is typically elevated in the range of 32.0 mAOD and 24.0 mAO; however, areas of the site are marginally outside of this range. The site is regularly graded, falling from north to south.

2.2.7 Four ponds are located in the low-lying area of the site.

2.2.8 Three of the ponds are located in the southeast and are in relatively close proximity to each other. No formal inlets or outlets to these features are recorded.

2.2.9 The fourth pond is located in the southwestern margin of the site and is provided with a culverted outfall into a ditch within the fields beyond Copper Lane.

2.2.10 An offsite pond is also present adjacent to the site's southwestern boundary. This does not appear to be connected to the on-site ponds.

## 2.3 Proposed Development

2.3.1 A feasibility site layout has been prepared by OSP Architects; refer to Appendix 2 for reproduction.

2.3.2 In brief, this feasibility layout comprises 117 dwellings in various forms including terraces, semidetached and detached.

2.3.3 The southern, lower lying margin of the site is free from dwellings but includes footways, landscaping and the inclusion of an additional basin. The existing basins in this area are retained.

## 3 Geology, Hydrogeology, Hydrology

### 3.1 Introduction

3.1.1 For guidance, publicly available reference material has been reviewed to establish the likely geological setting. See also subsequent commentary relating to intrusive site investigation.

### 3.2 Geology

3.2.1 Published British Geological Society (BGS) online database records indicate the following:

#### 3.2.2 Made Ground

BGS mapping does not indicate Made Ground to be present on the site.

#### 3.2.3 Superficial Deposits

The superficial soils are identified as River Terrace Deposits, Sand and Gravel. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by rivers.

#### 3.2.4 Bedrock

The site to be underlain Weald Clay Formation - Mudstone. Sedimentary Bedrock formed approximately 126 to 134 million years ago in the Cretaceous Period. Local environment previously dominated by swamps, estuaries and deltas.

3.2.5 In addition to the above, DEFRA's Magic Map describes the soilscape of the site as "*Freely draining...loamy soils*".

### 3.3 Hydrogeology

3.3.1 MagicMap and the Environment Agency website have been reviewed to determine the aquifer designations.

3.3.2 These sources show that:

- i. The site is not situated within a Groundwater Source Protection Zone.
- ii. With respect to Groundwater Vulnerability, the site is located within an area designated as "Low"; these are areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low leaching soils and/or the presence of low permeability superficial deposits. Activities in areas of unproductive strata are unlikely to represent a risk to groundwater.
- iii. The drift/superficial deposits are classified as "Secondary A"; that is, permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some

cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

- iv.* The underlying bedrock is recorded as being “Unproductive”; that is, layers or deposits with low permeability that have negligible significance for water supply or river base flow.

## 3.4 Hydrology

3.4.1 There are no main rivers in the vicinity of the site; the nearest being the Lesser Teise approximately 1.75 km west of the site.

3.4.2 Mapping indicates there are numerous ordinary watercourses, ditches and ponds in the area including:

- i.* Basins adjacent to the site’s southern boundary
- ii.* A ditch originating from the south of Copper Lane, near to the south western corner of the site. This flows southwards within open fields towards Cannon Farm.

3.4.3 Copper Lane is generally elevated above the adjacent land and serves as a barrier to overland flow.

3.4.4 A culvert exists which connects the site to the ditch noted above; see Appendix 1 for additional details.

## 3.5 Site Investigation

3.5.1 An intrusive site investigation was undertaken in May 2022 by RSK Geosciences (RSK). This comprised a mix of trial holes, window samples and hand pits at 11 No locations distributed across the site. Infiltration testing was also undertaken at 6 No locations.

3.5.2 The findings of the site investigation works are summarised below:

- i.* Topsoil at the site is typically underlain by clay.
- ii.* Silts and gravels are present within the upper soils at the north of the site but are themselves underlain by clay at (notionally) 3 m depth.
- iii.* The site is considered unsuitable for infiltration drainage solutions. Infiltration rates in the order of magnitude of  $10^{-6}$  m/s and  $10^{-7}$  m/s have been inferred by RSK.
- iv.* Generally, groundwater was not encountered. However, strikes were recorded; the most significant being at location WS1 at 1m below existing ground level.

3.5.3 The RSK information is reproduced within Appendix 1.

## 3.6 Miscellaneous

- 3.6.1 HSP has attended public presentations made in relation to the proposed development.
- 3.6.2 Anecdotal evidence suggests the potential for high groundwater and/or localised springs. Similarly, water levels within the on-site ponds was confirmed to fluctuate with seasonal changes but tend to remain 'wet' during all/most periods.

## 4 National Planning Framework

### 4.1 General

- 4.1.1 Flood Risk Assessments in England are undertaken using the prescriptive procedures and guidance within the National Planning Policy Framework (NPPF) and "Planning practice Guide – Flood Risk and Coastal Change" (PPG) produced by Communities and Local Government, in addition to the details set out in BS 8533:2017 "Assessing and managing flood risk in development - Code of practice".
- 4.1.2 NPPF provides a directive which seeks to ensure that development does not take place in areas at risk or increase flood risk in offsite areas. NPPF acknowledges that developments vary in their sensitivity to flooding and enables the correlation between proposed use and the underlying environs (flood risk) through the application of the Sequential Test.

### 4.2 The Sequential Test

- 4.2.1 The aim of the Sequential Test is to steer new development into areas with the lowest and/or appropriate probability of flooding.
- 4.2.2 The sequential test provides the potential to compare the subject site with other available sites to determine which has the lowest flood risk.
- 4.2.3 Table 1 of PPG prescribes three principal flood risk zones:
- Zone 1 (Low Probability) - land assessed as having a less than 0.1% (1 in 1000) annual probability of river or sea flooding;
  - Zone 2 (Medium Probability) - land assessed as having between a 1% (1 in 100) and 0.1% (1 in 1000) annual probability of river flooding; or between a 0.5% (1 in 200) and 0.1% (1 in 1000) annual probability of sea flooding;
  - Zone 3a (High Probability) - land assessed as having a 1% (1 in 100) or greater annual probability of river flooding or a 0.5% (1 in 200) or greater annual probability of flooding from the sea;

- Zone 3b (The Functional Floodplain) - land where water flows or is stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, is typically assumed to be functional floodplain.

4.2.4 The Sequential Test is not normally required for developments in Flood Zone 1 (i.e. the lowest probability of flooding), unless other flood related issues exist within the area of the development; for example, a critical drainage area.

4.2.5 Similarly, a Sequential Test is not required in respect of the intended Planning Application if one has already been undertaken for a development of the type proposed (e.g. a residential development) on the subject site. This may be the case where the site is 'allocated' in the Authorities Local Plan.

4.2.6 A Sequential Test is required where both of the following apply:

- The proposed development is in Flood Zone 2 or 3
- A sequential test has not already been undertaken for a development of the type which is planned.

### 4.3 Land Use and Development

4.3.1 Current guidance accepts that it is not always possible to direct developments into areas of low flood risk and that the type of development/end use materially affects flood risk sensitivity.

4.3.2 Table 3 of "Planning Practice Guide – Flood Risk and Coastal Change", reproduced below, provides the outline mechanism for assessing the suitability of a development within a specific Flood Zone.

Reproduction of Table 3 of "Planning Practice Guide – Flood Risk and Coastal Change"					
Flood risk vulnerability classification	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	x	Exception Test required	✓
Zone 3b	Exception Test required	✓	x	x	x

Key: ✓ Development is appropriate  
x Development should not be permitted

4.3.3 For guidance, Table 2 of “Planning Practice Guide – Flood Risk and Coastal Change”, is reproduced below to illustrate Flood Risk Vulnerability classifications.

Reproduction of Table 2 of “Planning Practice Guide – Flood Risk and Coastal Change”	
Essential Infrastructure	<ul style="list-style-type: none"> <li>• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.</li> <li>• Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.</li> <li>• Wind turbines.</li> </ul>
Highly Vulnerable	<ul style="list-style-type: none"> <li>• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding.</li> <li>• Emergency dispersal points.</li> <li>• Basement dwellings.</li> <li>• Caravans, mobile homes and park homes intended for permanent residential use.</li> <li>• Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as ‘Essential Infrastructure’).</li> </ul>
More Vulnerable	<ul style="list-style-type: none"> <li>• Hospitals.</li> <li>• Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels.</li> <li>• Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels.</li> <li>• Non-residential uses for health services, nurseries and educational establishments.</li> <li>• Landfill and sites used for waste management facilities for hazardous waste.</li> <li>• Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.</li> </ul>
Less Vulnerable	<ul style="list-style-type: none"> <li>• Police, ambulance and fire stations which are not required to be operational during flooding.</li> <li>• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in ‘more vulnerable’; and assembly and leisure.</li> <li>• Land and buildings used for agriculture and forestry.</li> <li>• Waste treatment (except landfill and hazardous waste facilities).</li> <li>• Minerals working and processing (except for sand and gravel working).</li> <li>• Water treatment works which do not need to remain operational during times of flood.</li> <li>• Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).</li> </ul>
Water compatible Development	<ul style="list-style-type: none"> <li>• Flood control infrastructure.</li> <li>• Water transmission infrastructure and pumping stations.</li> <li>• Sewage transmission infrastructure and pumping stations.</li> <li>• Sand and gravel workings.</li> <li>• Docks, marinas and wharves.</li> <li>• Navigation facilities.</li> <li>• MOD defence installations.</li> <li>• Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.</li> </ul>

Reproduction of Table 2 of “Planning Practice Guide – Flood Risk and Coastal Change”	
	<ul style="list-style-type: none"> <li>• Water-based recreation (excluding sleeping accommodation).</li> <li>• Lifeguard and coastguard stations.</li> <li>• Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.</li> <li>• Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.</li> </ul>

## 4.4 The Exception Test

4.4.1 The Exception Test may be applied where, following application of the Sequential Test, it is not possible for the development to be located in zones with a lower probability of flooding.

4.4.2 For the Exception Test to be passed both of the following conditions must be met:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk; and,
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

## 5 Local Planning Framework

### 5.1 General

5.1.1 Flood risk and drainage matters are the subject of numerous national and local policy documents and procedures.

5.1.2 Kent County Council (KCC), as Lead Local Flood Authority has published its own appraisal and guidance documents which incorporate the requirements of national policy (such as National Planning Policy Framework, Planning Practice Policy, et al) together with delivering its own sustainability and good practice aims.

5.1.3 Given the low risk of flooding from rivers and sea, the following commentary highlights matters contained within regional guidance, and which focuses on items with a ‘local level’ interest.

### 5.2 Marden Surface Water Management Plan, 2017 (SWMP)

5.2.1 Undertaken by JBA Consulting for Kent County Council, the SWMP for Marden was undertaken to explore local flood risk from surface water runoff, groundwater and ordinary watercourses. Contributors included the Environment Agency, Maidstone Borough Council, Upper Medway Internal Drainage Board (IDB), Southern Water and Marden Parish Council.

# Flood Risk Assessment

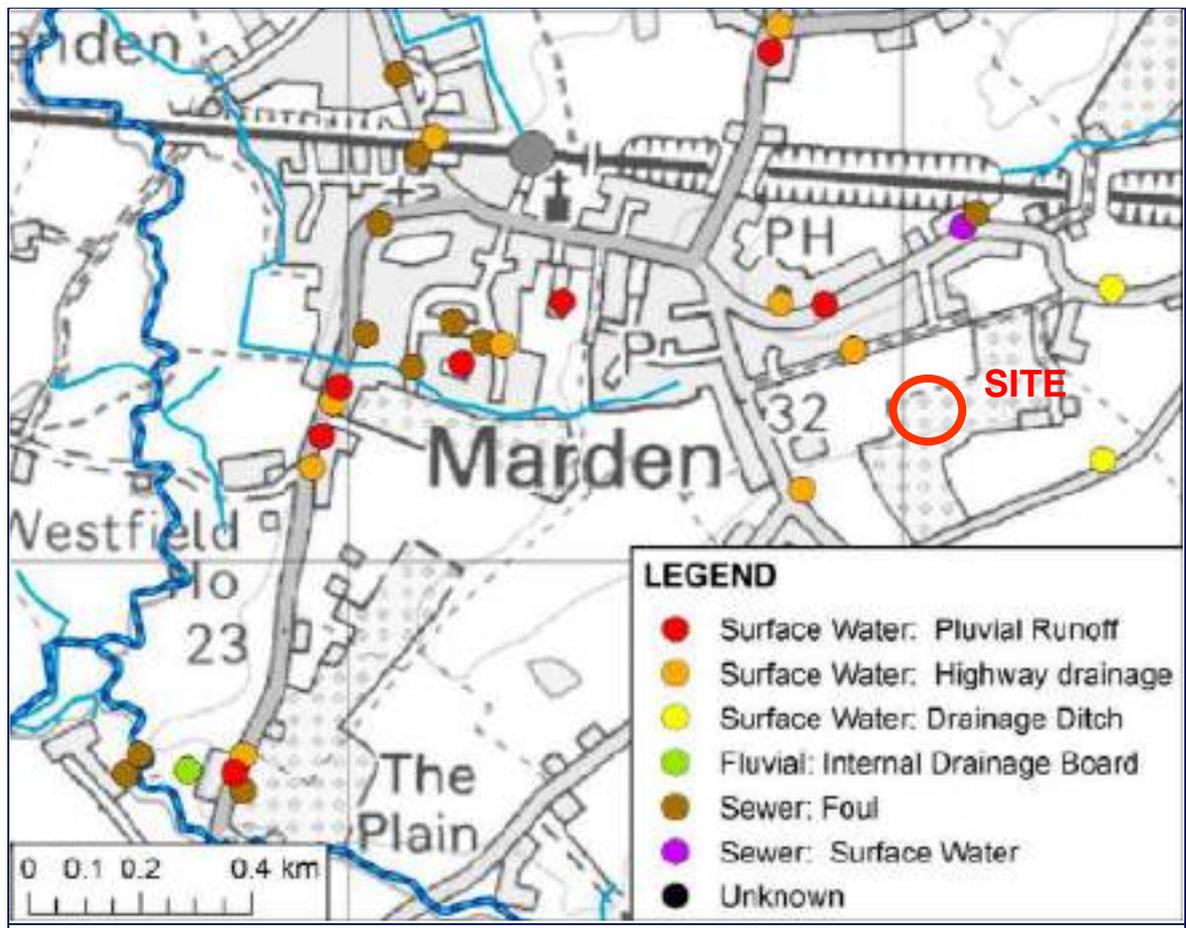
5.2.2 The SWMP provides a number of informative plans which summarise flood risk. These are discussed in-turn below.

5.2.2.1 Flood History

The plan reproduced below illustrates that there has been recorded instances of flooding in the vicinity of the site. Incidents have been attributed to failing highway drainage and inadequacy of drainage ditches.

With respect to the flooding incident to the southeast of the site, it is inferred that a culvert which connects a basin at this location with the adjacent ditch may have become blocked; however, it should be noted that this assertion has not been proven during the course of this appraisal.

Where flooding is the result of blockage, this is typically easily remedied.



Extract from Surface Water Management Plan, Figure 3-6: Flood History

## 5.2.2.2 Updated Flood Map for Surface Water (uFMfSW)

With respect to the subject site, the risks illustrated upon the uFMfSW plan is as presented within Section 7.2 “Flood Risk from Surface Water” and is therefore not discussed further.

## 5.2.2.3 Model Results

As part of the SWMP a comprehensive catchment model was constructed and the effects of storms of varying severity were simulated.

The inserts below illustrate that the predicted flooding resulting from the 1% AEP (100 year) plus climate change event and the 0.1% AEP (1000 year) event have negligible impact upon the site. Small, distinct areas of flooding are evident in the south of the site; however, this is as would be expected with standing water within the relatively low-lying areas associated with the existing ponds.



Extract from Surface Water Management Plan, Appendix E:  
1% AEP (100 year) plus Climate Change Flood Extent



Extract from Surface Water Management Plan, Appendix E:  
0.1% AEP (1000 year) Flood Extent

### 5.3 Kent County Council Drainage and Planning Policy, 2019

5.3.1 As Lead Local Flood Authority, Kent County Council (KCC) will be consulted by the Planning Authority and will review drainage strategies and surface water drainage provisions on major developments and/or those sites which are subject to elevated flood risk.

5.3.2 The following matters are reproduced and/or paraphrased from KCC's Drainage and Planning Policy document.

5.3.3 KCC highlight the general principle that:

*"applicants should be aware that the NPPF priorities for sustainable drainage do apply to all development, irrespective of scale (NPPF, Paragraph 163)" (Section 4.1)*

5.3.4 KCC has defined 6 No Drainage/SuDS policies which require compliance; namely,

- i. SuDS Policy 1 Follow the drainage disposal hierarchy
- ii. SuDS Policy 2 Deliver effective drainage design
- iii. SuDS Policy 3 Maintain Existing Drainage Flow Paths & Watercourses
- iv. SuDS Policy 4 Seek to Reduce and Avoid Existing Flood Risk
- v. SuDS Policy 5 Drainage sustainability and resilience

5.3.5 Additionally, 3 No Environmental/SuDS policies which require consideration are also specified; namely,

- i.* SuDS Policy 7 Safeguard Water Quality
- ii.* SuDS Policy 8 Design for Amenity and Multi-Functionality
- iii.* SuDS Policy 9 Enhance Biodiversity

5.3.6 Of particular note with respect to drainage design are the following requirements:

- i.* The drainage system must be designed to be consistent with pre-development flow rates and designed to operate without any flooding occurring during any rainfall event up to (and including) the critical 1 in 30 year storm (3.33% AEP). The system must also be able to accommodate the rainfall generated by events of varying durations and intensities up to (and including) the critical, climate change adjusted 1 in 100 year storm (1% AEP) without any on-site property flooding and without exacerbating the off-site flood-risk. The choice of where these volumes are accommodated may be within the drainage system itself or within other areas designated within the site for conveyance and storage.
- ii.* Flooding of the highway may be permitted in exceptional circumstances for rainfall events between 1 in 30 year and 1 in 100 year events provided that:
  - depths do not exceed the kerb height;
  - no excessive or prolonged ponding (beyond 10 minutes) so that the highway primarily operates as a conveyance route to another attenuation feature;
  - flood extents are within the site boundary.
- iii.* Rainfall simulation to be based upon FEH inputs wherever possible. If FEH13 is unavailable (and unless otherwise calculated), KCC will accept a rainfall depth M5-60 of 26.25 mm to be utilised in appropriate modelling software to account for this variation.
- iv.* Given advances in technology and design of flow controls, it is now possible to achieve controlled flow rates of 2 l/s. This should be considered the minimum rate to be set for small sites, unless agreed with KCC.
- v.* The long-term storage volume must discharge at a rate no greater than 2 l/s/ha and the total flow rate must not exceed the 1:100 year greenfield flow rate.
- vi.* If the proposed system discharges to a watercourse or main river, consideration must also be given to any requirements due to high water levels in the receiving watercourse due either to tide (i.e. tide-locking) or flood flows. Attenuation volumes

required onsite to manage flows must take into account the effects of high receiving water levels. This also applies to connection made to sewers.

## 5.4 Kent Local Flood Risk Management Strategy (LFRMS) 2017-2023

5.4.1 The aims of the LFRMS are reproduced below

*“• To support and improve the safety and wellbeing of Kent’s residents and the economy of Kent through appropriate flood risk management;*

*• To ensure that we all work together effectively to understand and deliver appropriate flood risk management in Kent*

*• To contribute to sustainable development, regeneration and land management in Kent through the promotion of sustainable flood risk management practices that utilise natural processes where appropriate.” (Para 1.2)*

5.4.2 The following salient information is reproduced for information;

*“landscaped features that hold or direct water away from properties, which can be green infrastructure or more conventional engineering features;*

*• natural features and restoring natural processes that reduce runoff and slows the flow of water;*

*• improved drainage including sustainable drainage systems (SuDS); and*

*• transferring risk to other areas where the consequences are low, for example by allowing land to flood and containing floodwater to prevent flooding elsewhere” (Para 2.2)*

*“Unfortunately, these open, surface features [Swales, Basins, Ponds et al], the most beneficial forms of SuDS, cannot be adopted by Water Companies (who adopt conventional drainage) and there is no other authority who has the powers necessary to adopt them and a funding mechanism to cover the costs of maintenance. This means that there is often not uptake of these types of SuDS in developments.” (Para 5.6)*

*“In the previous round [of Preliminary Flood Risk Assessment] there were no Flood Risk Areas in Kent. The criteria in this review of the PFRA are different from the previous round, as a consequence, six have been proposed in this round. KCC and our partners in the county agree that none of the proposed areas presents a significant risk of local flooding” (Para 7.1)*

## 6 Miscellaneous References and/or Reports

6.1 No additional documents of relevance were identified and/or reviewed during the preparation of this report.

## 7 Consultation Responses

### 7.1 Public Sewers/Local Drainage Infrastructure

7.1.1 Public sewer records have been provided by Southern Water.

7.1.2 The indicate:

- i.* There are no public surface water sewers in the area; and,
- ii.* Public foul sewers are present within Albion Road/Thorn Road. A foul pumping station is present to the southwest of the site, off Thorn Road, which discharges in to a gravity system near to the site entrance.

7.1.3 Refer to Appendix 3 for a copy of the public sewer records.

### 7.2 Environment Agency (EA)

7.2.1 The Environment Agency (EA) currently preference is to direct consultants to website based data unless significant abnormal risks are present.

7.2.2 The publicly available reference material has been reviewed, the content of which is summarised below.

#### **Flood Map for Planning**

7.2.3 The entirety of the site is located within Flood Zone 1; that is, an area with a low probability of flooding.

7.2.4 Land in Flood Zone 1 is considered as having a less than 1 in 1000 annual probability of river or sea flooding.

7.2.5 The site is, notionally, located 1 km east of an elevated tidal/fluvial flood risk zone.

7.2.6 Refer to section entitled “The Sequential Test” for definitions of the ‘Flood map for planning’ Flood Zones.

#### **Flood Risk from Rivers or the Sea**

7.2.7 The Environment Agency “Flood Risk from Rivers or the Sea” map categorises risk as follows:

- i.* High - a chance of flooding of greater than 3.3%.
- ii.* Medium - a chance of flooding of between 1% and 3.3%.
- iii.* Low - a chance of flooding of between 0.1% and 1%.

*iv.* Very Low - a chance of flooding of less than 0.1%.

7.2.8 These risk categories take into account the effect of any flood defences in the area. Where defences exist, these will reduce, but not completely stop, the chance of flooding as they can be overtopped or fail.

7.2.9 The site is identified as being at “very low” risk of flooding. That is, land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (< 0.1%).

7.2.10 Given the above, the site is not considered to be at risk of flooding from rivers or the sea.

### **Flood Risk from Surface Water**

7.2.11 The Environment Agency “Flood Risk from Surface Water” map categorises surface water flooding as follows:

*i.* High - a chance of flooding of greater than 3.3%.

*ii.* Medium - a chance of flooding of between 1% and 3.3%.

*iii.* Low - a chance of flooding of between 0.1% and 1%.

*iv.* Very Low - a chance of flooding of less than 0.1%.

7.2.12 The majority of the potential development site is categorised as being at ‘very low’ risk of long-term surface water flooding.

7.2.13 Two ribbons of elevated risk are evident within the west and east of the main land parcel. These ribbons progress southwards toward existing ponds located adjacent to and within the site’s southern boundary. Aside from the ponds, the elevated areas of surface water flood risk are typically categorised as ‘low’. However, small discrete areas of ‘medium’ risk are also evident.

7.2.14 The recent development to the north includes a positive drainage system and will form practical barrier to overland flow originating from the higher elevation to the north. The site is therefore not inferred to present at significant preferential flow path for offsite derived runoff.

7.2.15 Given the above, the site is not considered to be at significant risk of surface water flooding.

7.2.16 Elevated surface water flood risk is identified in highways at distance from the site. However, these are not considered likely to preclude access/egress from the site.

7.2.17 Notwithstanding the above, flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features, maintenance and terrain aberrations can greatly affect the chance and severity of flooding.

## Reservoir

7.2.18 Based upon EA Long-term flood risk mapping, the site is not located within an area depicted as being at risk of flooding from reservoirs.

7.2.19 The Environment Agency online mapping is reproduced within Appendix 4.

## 7.3 Lead Local Flood Authority (LLFA)

7.3.1 As Lead Local Flood Authority (LLFA), Kent County Council (KCC) was consulted in respect of the proposed development site. Their response, provided in two parts following site attendance, is reproduced in Appendix 3 and summarised below.

- i.* Only the southwestern pond has connectivity to an ordinary watercourse
- ii.* The other ponds present on the site appear to be waterbodies with no connections to the wider area.
- iii.* Land drainage consent will be required for works which affect an ordinary watercourse. However, outfalls smaller than 150mm internal diameter do not require consent as no formal headwall is required
- iv.* The LLFA would seek for the off-site discharge to be limited to greenfield rates for the equivalent developable/contributing areas, in line with policy. This is to ensure that the receiving watercourse and subsequent network do not have an increased risk of causing flooding.
- v.* The LLFA would not object to the use of proprietary interceptors as a means of managing surface water runoff quality.
- vi.* In respect of climate change, The LLFA will seek the 'upper end' allowance is designed for on both the 30 (3.3%) and 100 (1%) year storm scenarios.
- vii.* The most eastern of the ponds may currently overflow during extreme events, contributing to flooding further along Copper Lane. To improve upon this, the proposal would see the creation of a bund around the south side of the pond to increase capacity and reduce the frequency of overtopping. The LLFA agree with this approach.
- viii.* With respect to the proposed basin, the side slopes should not exceed 1 in 3, have a water depth not exceeding 2 m and have a minimum freeboard of 300 mm. Consideration of the inclusion of a permanent water level, sediment forebay or aquatic benches and the positioning of inlets and outlets should be given to maximise the potential of contaminant removal.

- ix. The proposed basin may require lining to mitigate the effects of groundwater ingress (subject to appropriate groundwater monitoring)

7.3.2 While not explicitly referenced with the LLFA correspondence, based upon recent experience of similar developments within the KCC jurisdiction:

- i. The use of the FEH dataset will be required within detailed drainage design submissions.
- ii. Runoff rates from developments should match greenfield runoff, follow natural or existing drainage routes and match infiltration rates and discharges as far as possible for all events up to and including the climate-change adjusted 1 in 100 year (1% AEP) design event.

## 8 Planning Policy & Compatibility of the Proposed Development

8.1 Table 2 of PPG categorises a residential development as “More Vulnerable”.

8.2 Table 3 of PPG indicates that More Vulnerable end uses are compatible with Flood Zone 1. The Exception Test is not required.

## 9 Existing Drainage

### 9.1 Site Specific Existing Surface Water Drainage

9.1.1 The site is greenfield and no formal infrastructure is anticipated to be present within the main body of the site.

9.1.2 Local field drainage may be present but is unlikely to anything other than self-serving. This will be rendered redundant by the development.

9.1.3 An outfall from the basin at the southwest of the site is present. This discharges via a culvert beneath Copper Lane into offsite ditch network.

9.1.4 No formal inlets have been observed in the basins.

### 9.2 Site Specific Existing Foul Water Drainage

9.2.1 As with surface water, given the undeveloped nature of the site, existing foul drainage infrastructure is not anticipated on the site.

## 10 Climate Change and Design Event

### 10.1 Lifetime of Development

10.1.1 A development of this type is typically considered to have a design life of 100 years.

## 10.2 Peak Rainfall Intensity

10.2.1 The table below, summarises the contemporary Climate Change Allowances provided by the Department for Environment Food & Rural Affairs website.

Epoch	Annual Exceedance	Central	Upper
2050s	3.3%	20%	35%
2070s	3.3%	20%	35%
2050s	1%	20%	45%
2070s	1%	20%	40%

10.2.2 Development with a lifetime beyond 2100, this includes development proposed in applications or local plan allocations, should include an appraisal of upper end allowances; see also Consultee Responses. This should include the 1% (100 year) and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125), albeit the 1% (100 year) event is likely to define the attenuation requirements.

## 10.3 Peak River Flow

10.3.1 Given the site setting, river flows are not considered necessary for further discussion within this appraisal.

## 10.4 Design Event (Drainage)

10.4.1 Notwithstanding the design life variability, using the precautionary principal it is considered appropriate to study the development, and in particular the surface water drainage design, relative to the 1 in 100 year event, including an uplift of 40% for the effects of climate change.

10.4.2 It should be noted that this analysis must determine if the impacts of the climate change allowance are significant and lead to any unacceptable flood risks (it is not normally expected that the site would not flood in this scenario, only that if this storm were to occur the impacts would be minimal). The design may need to be modified to avoid any unacceptable risks, but may also need additional mitigation allowances, for example a higher freeboard on attenuation features and/or provision of exceedance routes.

10.4.3 An additional allowance for urban creep will be required during the design process and will influence the surface water drainage design; in particular, the attenuation requirements.

10.4.4 Rainfall Runoff Management for Developments, jointly published by the Department for Food & Rural Affairs and the Environment Agency, recommends the following:

*“Urban creep is now an acknowledged issue which results in an increase in runoff from an estate over time. An allowance should be made by factoring the impermeability percentage by 1.1 (10% increase) ...”*

- 10.4.5 In 2016, the advice in respect of urban creep was expanded upon by the Local Authority SuDS Officer Organisation (LASOO) document entitled “Non-Statutory Technical Standards for Sustainable Drainage: Practice Guide”. The LASOO guidance correlates potential space for future expansion with uplifts in drainage design requirements and is typically directed towards residential development. The table below summarises urban creep allowances:

Residential Development Density Dwelling per hectare	Change Allowance % of Impermeable Area
<25	10
30	8
35	6
45	4
>50	2
Flats & Apartments	0
Reproduced from “Non-Statutory Technical Standards for Sustainable Drainage: Practice Guide”	

- 10.4.6 The subject site is likely to be categorised as being less than 25 dwellings per hectare and, accordingly, a 10% uplift in hard area included within the drainage design. However, this should be confirmed at detailed design stage.

## 11 Potential Sources of Flooding

### 11.1 General

- 11.1.1 BS 8533: 2011 “Assessing and managing flood risk in development – Code of practice” provides recommendations and guidance the assessment and management of flood risk for proposed development within the UK.
- 11.1.2 Assessment should include an appraisal of risk both to- and from- the development from all sources of flooding, including:
- i. Tidal and fluvial flooding – flooding from main rivers, ordinary watercourses and the sea.
  - ii. Surface water flooding – flooding from overland flow due to rainfall.

- iii.* Flooding from sewers and drains – flooding from surcharging of below ground drainage systems.
- iv.* Groundwater flooding – flooding related to the water table, where ground water levels rise above surface levels.
- v.* Flooding caused by the failure of infrastructure, such as from reservoir, canal or land drainage infrastructure, usually as a result of catastrophic failure.

## 12 Flooding Risks to the Development

### 12.1 Tidal Flood Risk

12.1.1 The site is located a considerable distance from a tidally influenced watercourse and is therefore not considered to be at risk of tidal flooding.

### 12.2 Fluvial Flood Risk

12.2.1 The site is identified as being at “very low” risk of flooding. That is, land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (< 0.1%).

12.2.2 The site is not considered to be at risk of fluvial flooding.

### 12.3 Groundwater Flooding

12.3.1 Potential for shallow groundwater has been identified during site investigation works.

12.3.2 The results obtained to-date are inconclusive and further ground water investigation is recommended to assess the potential for groundwater to impact the site and drainage solutions.

12.3.3 Notwithstanding the above, it is considered likely that mitigation will be possible.

### 12.4 Pluvial Flood Risk

12.4.1 The site is generally identified as being at “very low” risk of surface water flooding. That is, land assessed as having between a 1 in 1,000 and 1 in 100 annual probability of flooding from surface water (0.1% - 1%).

12.4.2 Localised elevations in risk have been identified.

12.4.3 The site is not considered to be a significant preferential route for offsite derived flows.

12.4.4 Elevated surface water flood risk is identified in highways at distance from the site. However, these are not considered likely to preclude access/egress from the site.

12.4.5 Overall, the site is not considered to be at significant risk of surface water flooding but mitigations will be required.

## 12.5 Sewer Flooding

12.5.1 No evidence of impact upon the subject site has been identified during the preparation of this report. Importantly, 'no evidence' should not necessarily be interpreted as 'no risk'.

12.5.2 However, given the general absence of sewers on- and in the vicinity of the site, the risk of sewer flooding is considered to be 'low'.

## 12.6 Infrastructure/Reservoir Flood Risk

12.6.1 Based upon publicly available Flood Risk Mapping published by the Environment Agency, the site is not located within an area considered to be at risk of flooding from reservoirs.

# 13 Effect of Development on Flooding & Design Inclusions

## 13.1 Surface Water Drainage

13.1.1 Increased potential for adverse impacts typically correlate with an increase in drained area.

13.1.2 Given the previous undeveloped nature of the site the proposed development will increase the rainfall runoff and an appropriately designed drainage system will be required.

13.1.3 Assuming on-parcel drainage is appropriately managed the development will not have an adverse impact on the site or surrounding area.

13.1.4 Appropriate management will require consideration of discharge:

- i.* Rate
- ii.* Quantity
- iii.* Quality

13.1.5 Assuming on-parcel drainage is designed:

- i.* In accordance with good practice;
- ii.* To attenuate flows to existing greenfield rates, and;
- iii.* To accommodate the 1 in 100 year (plus uplift for climate change) event;

the development will not have an adverse impact on surface water drainage.

13.1.6 Section 14 provides additional guidance and commentary on surface water drainage.

## 13.2 Foul Water Drainage

- 13.2.1 The detailed design and appraisal of foul water drainage is outside of the scope of this assessment.
- 13.2.2 Notwithstanding the above, it is anticipated that foul effluent originating from the site will discharge into the public sewer within Albion Road, near to the site access. It is anticipated that a foul pumping station will be required.
- 13.2.3 Notwithstanding the above, once anticipated discharge rates can be confirmed, confirmation of capacity and/or sewer reinforcement requirements should be sought from the Undertaker.
- 13.2.4 It should be noted that all connections to the public sewer, whether made directly to the sewer or indirectly via existing pipework, can only be legally made with the permission of the Undertaker. Such permission will not be given where this presents an unacceptable risk to the receiving sewer. Where there is insufficient capacity, the applicant may be required to contribute to public sewer reinforcements.
- 13.2.5 Assuming on-parcel drainage is designed:
- i.* In accordance with good practice; and,
  - ii.* To discharge flows to the existing public sewer to the northwest of the site;

the proposed works are not considered likely to adversely impact on offsite flood risk as a result of foul water drainage.

## 13.3 Overland Flows

- 13.3.1 Based upon available information, the site does not present itself as being an identified overland surface water flow route(s) associated with significant off-site sources of watershed.
- 13.3.2 It is therefore considered unlikely that the development of the subject parcel will have an adverse post-development effect as a result of displaced or obstructed watershed.
- 13.3.3 The development form, including the spacing of dwellings and road pattern, and the over-arching landform is likely to enable the passage of overland flow during exceedance events.
- 13.3.4 Notwithstanding the above, it is recommended that during detailed design finished floor levels are generally elevated above the surroundings and preferential flow routes are provided away from building entrances.
- 13.3.5 Reprofiting of the site to remove low lying zones within the development area will mitigate the existing elevated surface water flood risk.

13.3.6 During consultations with the LLFA and the general public it was noted that the existing basins in the southeast have the potential to overtop onto Copper Lane. Where practicable, and subject to approval from other disciplines such as ecology, it is proposed to provide a bund to the south of the basins to reduce the frequency/existing risk of over-topping.

## 13.4 Floodplain/Displacement of Floodwaters

13.4.1 The development area is located within Flood Zone 1; that is, land assessed as having a less than 0.1% (1 in 1000) annual probability of river or sea flooding.

13.4.2 Given the 'very low' fluvial flood risk, it is suggested that floodplain compensation should not be a prerequisite of the development works.

## 13.5 Means of Access/Egress

13.5.1 Access/egress to the site is expected to be made via Albion Road.

13.5.2 The road network in the vicinity of the site is not considered to be a significant risk of flooding and it is anticipated that dry access/egress to the site will be afforded during all but the most extreme flooding events.

## 13.6 Groundwater

13.6.1 It is considered unlikely that the proposed works will have an adverse effect upon groundwater.

13.6.2 The depth of groundwater is not a fully appraised risk and requires further investigation.

13.6.3 The following items may require additional consideration where they are to be included in the detailed design:

- i.* Earthworks cuttings
- ii.* Basements. Ideally, these should be omitted.
- iii.* Flootation of buried surface water attenuation devices
- iv.* Groundwater ingress into surficial attenuation features (e.g. basins)

13.6.4 Where groundwater is observed to be shallow, finished levels should also be developed to ensure that 'clear water flooding' does not result in areas where ground levels are lowered.

13.6.5 Consideration may also be required for construction activities, for example trenches.

13.6.6 Where 'springs' are identified during construction it may be necessary to intercept and divert the flow around the development area.

## 13.7 Flood Resistant/Resilient Construction

- 13.7.1 The site is not located within an identified floodplain.
- 13.7.2 Specific flood resistant/resilient construction techniques are not considered necessary.

## 14 Proposed Surface Water Drainage Strategy

### 14.1 Preface

- 14.1.1 The management and/or disposal of surface water is a material planning matter.
- 14.1.2 Building Regulations (Part H) and other contemporary guidance requires that surface water should be disposed according to the following hierarchy:
  - i.* Infiltration to ground.
  - ii.* Discharge to a local watercourse.
  - iii.* Discharge to the local sewerage network.
- 14.1.3 In the absence of soils which support the use of infiltration devices and/or a nearby public sewer, it is proposed to re-use the existing discharge to watercourse which is located at the south west of the site.
- 14.1.4 The existing piped culvert may require reconstruction. Any such requirement is to be confirmed during detailed design.

### 14.2 Sustainability: Attenuation

- 14.2.1 Using the precautionary principal, it is assumed that the Regulators will require the development to mimic greenfield runoff rates as far as possible for all events up to and including the climate adjusted 1 in 100 year (1% AEP) design event and an allowance for urban creep.
- 14.2.2 The UK SuDs online Greenfield Runoff Rate Estimation Tool has been used to estimate the greenfield runoff rate using the ICP SUDS methodology, from the existing site. The results are summarised in the table below:

Period	Runoff (l/s/ha)*
Qbar	4.57
1 year	3.89
30 year	10.51
100 year	14.58
*Based on new developed area of 1.0.ha	

- 14.2.3 For guidance, Causeway Flow's Quick Storage Estimate tool has been used to calculate the required volume of attenuation based upon estimates of the proposed hard area and climate change scenarios; see table below.

It should be noted that the proposed hard area is an estimate only based upon a digitised .PDF image, and is subject to confirmation during detailed design. Similarly, the attenuation volume is a preliminary estimate only and is provided for guidance purposes. Detailed modelling/simulation of the proposed drainage may result in a differing requirements.

New Impermeable Area*	Discharge Rate** (l/s)	Attenuation (cu.m) 100 year + 40% CC FSR Inputs	Attenuation (cu.m) 100 year + 40% FEH Inputs
2.75 ha	11.4	1214-1626	2395-3023
*100% of new developed area assumed to be impermeable, including 10% uplift for urban creep. **Based upon a <i>prorata</i> adjustment of Qbar on development area excluding urban creep (2.5 ha)			

- 14.2.4 Notwithstanding the above estimates, and in order to demonstrate '*proof of concept*' an outline drainage strategy has been developed and modelled using Causeway's "Flow".
- 14.2.5 The model constructed is considered to be 'sensible worst case' in order ensure sufficient space is allocated to the drainage provisions, and in particular to the attenuation required; that is, hard areas are impermeable. The use of impermeable surfacing may lessen the storage required within the proposed basin. Refer to the drainage strategy drawing for a description of the outline surface water drainage strategy.
- 14.2.6 It may be inferred from the LLFA's requirements that the discharge rate could be increased for the 1 in 30 year and 1 in 100 year storms in order to mimic the existing.
- 14.2.7 Complex controls (i.e. variable discharge rates) may not be deliverable on all sites. For this reason, the precautionary approach has been used within the surface water management strategy and Qbar peak discharge rate used for all storm events. However, during detailed design it is recommended that the potential for a complex control is further evaluated.
- 14.2.8 In brief, the simulation results for the outline drainage strategy indicate:
- i. No surcharge within the pipework during 2 year return period events, including at the manhole containing the flow control device.
  - ii. No flooding during any event up to and including the 1 in 100 year +40% event.
  - iii. Space can be afforded for the sensible 'worst case' scenario of all attenuation being provided within a basin.

- 14.2.9 Significantly, in using a single, low rate of discharge for all events, the development affords additional protection to offsite areas during significant storms as the post development discharge site will not exceed the equivalent undeveloped Qbar rate; see table below for illustration.

Period	Existing Discharge Rate* (l/s)	Proposed Rate (l/s)*	% Improvement
Qbar	11.4	11.4	N/A
30 year	26.3	11.4	56
100 year	36.5	11.4	69

\*Based upon 2.5 ha developed area (i.e. excluding urban creep)

- 14.2.10 Refer to Appendix 2 and 5 respectively for reproductions of the drainage strategy drawing drainage calculations.

### 14.3 Sustainability: Pollution

- 14.3.1 Pollution/discharge quality should also be considered within the detailed drainage design.
- 14.3.2 In accordance with CIRIA C753 The SuDS Manual, the simple index approach can be utilised to establish that suitable water quality treatment and pollution mitigation will be provided by the proposed and/or required by the development.
- 14.3.3 In outline terms, a suitable pollution hazard indices should be allocated, and the drainage/SuDS specific pollution mitigation indices are required to equal, or exceed, the pollution hazard indices.
- 14.3.4 The following extracts illustrate the conjectural hazard and key features incorporated within the drainage strategy and, importantly, that the mitigation features equal or exceed the hazard:

Pollution Hazard Indices				
Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05
Low traffic roads	Low	0.5	0.4	0.4

Mitigation Indices for Discharge to Surface Water			
Component	TSS	Metals	Hydrocarbons
Basin	0.5	0.5	0.6
Permeable pavement	0.7	0.6	0.7

Pond	0.7	0.7	0.5
Proprietary Interceptor*#	0.75	0.6	0.6
<p>*Typical value supplied by manufacturer.          #Used on strategy drawing as sole means of mitigation for demonstration purposes only. Alternatives shown in table for illustrative purposes and consideration during detailed design purposes.</p>			

14.3.5 In the absence of a detailed of a detailed design, and using the precautionary principle, a proprietary interceptor is recommended for inclusion within the drainage strategy. However, during detailed design it may be possible for other inclusions to demonstrate that the interceptor may be omitted.

14.3.6 Significantly, it can be demonstrated that the downstream watercourse can be protected from pollution.

#### 14.4 Operation and Maintenance

14.4.1 The long-term efficacy of any installed drainage system will be compromised by a lack of maintenance.

14.4.2 During the detailed design stage, consideration should be given to the maintenance of any proposed system. It is recommended that a drainage maintenance regime is developed and provided in an "Operation and Maintenance Manual" for the scheme.

14.4.3 The maintenance regime should conform to the requirements set out within CIRIA C753 The SuDS Manual.

14.4.4 Refer to Appendix 6 for typical considerations.

## 15 Further Actions

### 15.1 Groundwater Monitoring

15.1.1 While the potential for groundwater to impact upon the subject parcel is considered to be relatively low this assertion is not substantiated.

15.1.2 The risk (both in the completed works and during construction) cannot be eliminated based upon the information currently held and it is recommended that the depth to groundwater is established and that it is monitored during the winter period for potential fluctuation.

## 15.2 Sewerage Undertaker

15.2.1 The sewerage undertaker should be contacted in order to formally confirm discharge constraints, where a connection is proposed and to obtain any additional records of sewer flooding.

## 15.3 Design Co-ordination

15.3.1 The management of surface water will require the provision of significant resources, each with their own constraints; for example, legal easements and access for maintenance/maintenance equipment.

15.3.2 It is recommended that the provision of drainage is considered during the evolution of the detailed design to ensure that an appropriate compromise between cost, performance and environmental responsibility can be provided.

## 16 Conclusions

16.1 The site is currently greenfield. It is proposed to construct residential properties on the site.

16.2 The site is relatively steeply graded with a generalised fall from north to south.

16.3 Four basins are present at the south of the site. Three basins in the east are unconnected and do not appear to have a positive outfall. The fourth basin in the west outfalls via a pipe beneath copper lane into a ditch network to the south of the site.

16.4 Anecdotal evidence suggests that the basins are fed via overland flow and by groundwater.

16.5 Intrusive site investigation works have been undertaken. These indicate that the soils which underly the site will not support infiltration drainage systems. Shallow groundwater was identified but is variable across the site.

16.6 The purpose of this report is to provide feasibility commentary and demonstrate '*proof of concept*'. This document does not purport to present a definitive construction solution and final designs may differ; however, the principles established herein should be respected.

16.7 Based upon its end use as a school, the proposed development is classified as More Vulnerable.

16.8 The entirety of the site is located within Flood Zone 1; that is, an area with a low probability of flooding. Planning Policy Guidance advises that More Vulnerable end uses are compatible with Flood Zone 1 and, as such, the Exception Test is not required.

16.9 The nearest main river is located in excess of 1.75 km west of the site.

- 16.10 Mapping indicates there are numerous ordinary watercourses, ditches and ponds in the area. As referenced above, a ditch to the south of Copper Lane receives water from the site, via a pipe/culvert and flows southwards within open fields towards Cannon Farm.
- 16.11 Public sewer records demonstrate an absence of surface water sewers in the area. A public sewer network is present within the highway network to the west of the site (Albion Road/Thorn Road); this is a pumped system but defers to gravity near to the site entrance.
- 16.12 Given the absence of suitable soils for infiltration and surface water sewer network, it is proposed to utilise the existing surface water discharge from the site into the adjacent ditch network.
- 16.13 The site is located a considerable distance from a fluvial/tidally influenced watercourse and is therefore not considered to be at risk of fluvial/tidal flooding.
- 16.14 No instances of sewer flooding impacting the site have been identified during the preparation of this report.
- 16.15 According to publicly available Flood Risk Mapping published by the Environment Agency, the site is not located within an area considered to be at risk of flooding from reservoirs.
- 16.16 The site is generally identified as being at “very low” risk of surface water flooding. That is, land assessed as having between a 1 in 1,000 and 1 in 100 annual probability of flooding from surface water (0.1% - 1%). However, localised elevated surface water flood risks have been identified on the site.
- 16.17 Similarly, elevated surface water flood risk is identified in highways at distance from the site. With regards to site access/egress, it is considered likely that the site will be afforded a means of safe escape during all but the most extreme events.
- 16.18 From the flood risk envelope depicted, the site does not present as being a preferential route for offsite originating overland flows. It should also be noted that a recent residential development is present on the site’s northern boundary. This includes a positive drainage system which is designed to contemporary standards. It is considered likely that the adjacent development will reduce overland flows on the site.
- 16.19 Research and site investigation works do not suggest that the site is at risk of groundwater flooding. However, shallow groundwater and/or localised springs may be present, and mitigations should be considered. These include lining of proposed basins.
- 16.20 It is inferred that the site will discharge foul water to public sewer. While outside of the scope of this appraisal, it is expected that a pumping station will be required on the site.
- 16.21 A drainage strategy has been developed as part of the appraisal works. This does not purport to be a detailed design but is intended to assist in concept and allocation of space.

As such, a precautionary approach has been used when sizing the proposed basin which assumes that no other attenuation features are present (e.g. permeable paving). It will be possible to optimise pipe routes, pipe sizes, chamber provisions and the like during detailed design.

- 16.22 Features such as permeable paving may reduce the overall size of the basin but may adversely impact space allocation during the outline design stages.
- 16.23 The existing basins will remain and will not form part of the formal drainage strategy.
- 16.24 It is noted that the existing basins in the southeast have the potential to overtop onto Copper Lane. Where practicable, and subject to approval from other disciplines such as ecology, it is proposed to provide a bund to the south of the basins to reduce the existing flood risk. It is not proposed to provide a detailed engineering appraisal and the works will be undertaken on a 'sense check' basis. Any bunds provided are anticipated to be relatively small, say 300 mm high and not intrusive.
- 16.25 The conceptual drainage models, constructed using Causeway's "Flow", demonstrate that:
- i.* The site can be serviced by a positive drainage solution;
  - ii.* No flooding occurs during the 1 in 100 year plus climate change event (40%);
  - iii.* Can accommodate a 10% uplift due to urban creep;
  - iv.* That sufficient space is available for attenuation to be provided by basin.
- 16.26 Based upon the SuDS Manual appraisal process, the site is considered to present a low risk of pollution. However, a proprietary interceptor is included within the drainage network to mitigate potential pollution risks to the receiving ditch. However, during detailed design it may be possible for other inclusions, such as permeable paving (Lined/Type C) and the proposed basin itself to negate the need for the proprietary interceptor.
- 16.27 The development form, including the spacing of dwellings and road pattern, and the over-arching landform is likely to enable the passage of overland flow during exceedance events.
- 16.28 Notwithstanding the above, it is recommended that during detailed design finished floor levels are generally elevated above the surroundings and preferential flow routes are provided away from building entrances.
- 16.29 Reprofilng of the site to remove low lying zones within the development area will mitigate the existing elevated surface water flood risk.
- 16.30 Further monitoring of the groundwater regime is recommended. However, it is considered unlikely to vary the development concept.

16.31 Overall, with respect to flood risk, the site is considered:

- i.* To be at the lowest risk of tidal/fluvial flooding;
- ii.* The inferred groundwater risk is low but is subject to further consideration;
- iii.* To be at the lowest risk of surface water flooding following mitigation; and,
- iv.* To require surface water discharge attenuation of both quantity and quality.

## Appendix 1

- Topographic Survey
- Site Investigation









# Aston Land Surveys

27 Davys Place  
Gravesend  
Kent DA12 4DL  
MOBILE 07831 628524

## LEGEND

EXTENT OF VEGETATION	BOLLARD	B
HEDGES	BORSHOLE	BS
BUSH	BUS STOP	BS
TREE (Trunk drawn to scale)	BRITISH TELECOM BOX	BT BOX
DEAD TREE	BRITISH TELECOM MANHOLE	BTMH
SINGLE GATE	CABLE TELEVISION MANHOLE	CAV
DOUBLE GATE	FIRE HYDRANT	FH
OVERHEAD CABLE	FOOTPATH	FP
WALL	GALLET	G
BUILDING	LAMP POST	LP
ORDNANCE SURVEY BENCH MARK	MANHOLE	MH
	POST BOX	PB
	ROAD SIGN	RS
	STOP VALVE	SV
	SURVEY STATION	ST
	TELEPHONE CALL BOX	TCCB
	TRAFFIC LIGHT	TL
	TELEGRAPH POLE	TP
	SPLIT LEVEL	SL
	LOWLY LEVEL	LL
	INVERT LEVEL	IL
	UNABLE TO LIFT	UTL
	BITCH	B
	BANKING	BK
	OSBM Value 28.86	

## TREE LEGEND

ALDER	ALD	LIME	LIM
ASH	ASH	LORCHIST	LOR
ASPEN	ASP	LONDON PLANE	LON
BEECH	BCH	MAPLE	MPL
BIRCH	BIR	OAK	OAK
CYPRESS	CYP	PINE	PNE
DOGWOOD	DGD	POPLAR	POP
ELDER	ELD	RHODODENDRONS	RHD
ELM	ELM	SAPLING	SAP
HAWTHORN	HAW	SILVER BIRCH	SIB
HORNBEAM	HBN	SWEET CHESTNUT	SCN
LARCH	LAR	WALNUT	WNT
LAUREL	LAR	WILLOW	WIL
		YEW	YEW

## FENCE DESCRIPTIONS

BARBED WIRE FENCE	BWF	INTERWOVEN FENCE	INF
CLOSE BOARD FENCE	CBF	POST AND CHAIN FENCE	PCF
FLYING BUTT FENCE	FBF	POST AND RAIL FENCE	PRF
CHAIR FENCE	CF	POST AND WIRE FENCE	PWF
ROCK BALANCE	RB	WIRE MESH FENCE	WMF

Client: Rydon Homes Ltd  
Rydon House  
Forest Row  
Sussex

Project: Copper Lane  
Marden

Drawing Title: Site Survey

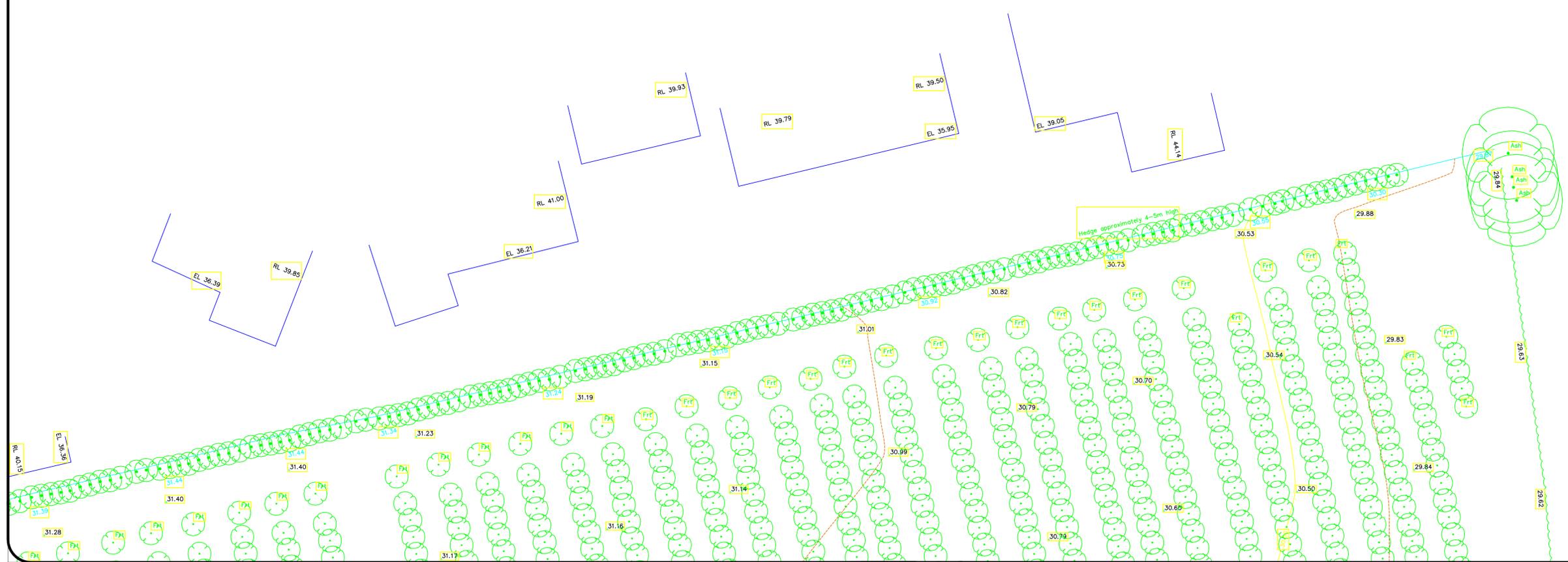
Scale: 1:200 Drawn By: T.S.

Date: Jan '22 Checked By: A.D.

Drawing No: CLM/2107/5 of 10

## NOTES

- TREES - The tree species have been identified to the best of the surveyors knowledge, with the mean spread drawn to scale. Tree heights are approximate.
- DRAINAGE - All drainage has been surveyed by visual inspection only and should be cross checked in critical areas.
- FENCES - Fences shown are not necessarily legal boundaries.
- GRID - The survey grid is based on Ordnance survey co-ordinates derived from GPS.
- LEVELS - Levels relate to OSBM derived from GPS.





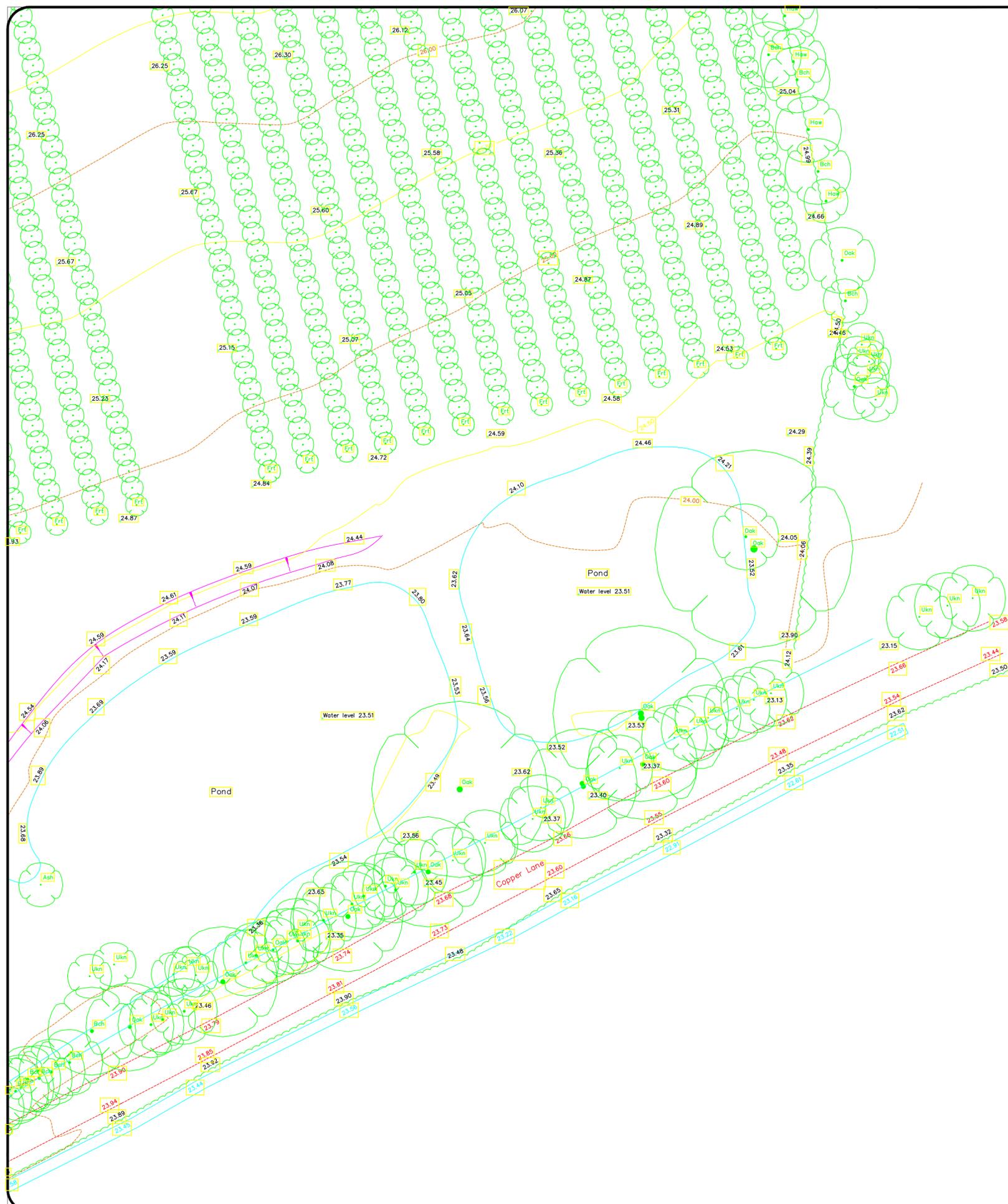






# Aston Land Surveys

27 Davys Place  
Gravesend  
Kent DA12 4DL  
MOBILE 07831 628524



## LEGEND

EXTENT OF VEGETATION	BOLLARD	B
HEDGES	BORSHOLE	Bh
BUSH	BUSH STOP	Bst
TREE (Think drawn to scale)	BRITISH TELECOM BOX	BT BOX
DEAD TREE	BRITISH TELECOM MANHOLE	BTMH
SINGLE GATE	CABLE TELEVISION MANHOLE	CTV
DOUBLE GATE	FIRE HYDRANT	FH
OVERHEAD CABLE	FOOTPATH	FP
WALL	GALLET	G
BUILDING	LAMP POST	LP
ORDNANCE SURVEY BENCH MARK	MANHOLE	MH
	POST BOX	PB
	POST WALK	PW
	Road SIGN	RS
	STOP VALVE	SV
	SURVEY STATION	ST
	TELEPHONE CALL BOX	TCB
	TELEPHONE POLE	TP
	TRAFFIC LIGHT	TL
	SPILL LEVEL	SL
	LOWLY LEVEL	LL
	UNABLE TO LIFT	UL
	UTL	UTL
	BANKING	BK
	OSBM Value 28.86	

## TREE LEGEND

ALDER	ALD	LIME	LIM
ASH	ASH	LORCHIST	LOR
ASPEN	ASP	LONDON PLANE	LON
BEECH	BCH	MAPLE	MPL
BIRCH	BIR	OAK	OAK
CYPRESS	CYP	PINE	PNE
ELDER	ELD	PINE	PNE
FIR	FIR	RHOODENDRON	RHO
HAWTHORN	HAW	SILVER BIRCH	SIL
HORNBEAM	HORN	SAPLING	SAP
LARCH	LAR	SILVER BIRCH	SIL
LAUREL	LAR	SWEET CHESTNUT	SWE
		WALNUT	WAL
		WILLOW	WIL
		WILLOW	WIL
		YEW	YEW

## FENCE DESCRIPTIONS

BARBED WIRE FENCE	BWF	INTERWOVEN FENCE	IWF
CLOSED BARRIER FENCE	CBF	POST AND CHAIN FENCE	PCF
FLYBUSHING BARK FENCE	FBF	POST AND RAIL FENCE	PRF
CHAIN LINK FENCE	CLF	POST AND WIRE FENCE	PWF
CHESTNUT PALING	CPF	WIRE MESH FENCE	WMF
IRON RAILINGS	IRF		

Client: Rydon Homes Ltd  
Rydon House  
Forest Row  
Sussex

Project: Copper Lane  
Marden

Drawing Title: Site Survey

Scale: 1:200 Drawn By: T.S.

Date: Jan '22 Checked By: A.D.

Drawing No: CLM/2107/10 of 10

## NOTES

- TREES - The tree species have been identified to the best of the surveyors knowledge, with the mean spread drawn to scale. Tree heights are approximate.
- DRAINAGE - All drainage has been surveyed by visual inspection only and should be cross checked in critical areas.
- FENCES - Fences shown are not necessarily legal boundaries.
- GRID - The survey grid is based on Ordnance survey co-ordinates derived from GPS.
- LEVELS - Levels relate to OSBM derived from GPS.



PAS 128: 2014 QUALITY LEVEL GUIDE

Q-LEVEL	DESCRIPTION	ACC.	Q-LEVEL	DESCRIPTION
QL-D	Service positions taken from records.	Undefined	QL-B2	Horizontal & vertical location using only one geophysical technique.
QL-C	Visual evidence of service existence but undetectable by geophysical techniques.	Undefined	QL-B1	Horizontal & vertical location using multiple geophysical techniques.
QL-B4	Undetectable service present shown as an assumed route (AR).	Undefined	QL-A	Horizontal & vertical position verification by open excavation, manholes, access, inspection chambers.
QL-B3	Horizontal location by one geophysical technique but with none or poor depth information.	Undefined		

DETECTION METHOD  
IN ACCORDANCE WITH PAS 128: 2014 SURVEY TYPE B

**Drainage Survey**

All accessible Manholes and Inspection chambers have had their respective covers lifted with pipe sizes, inverts, chamber sizes/types and service data recorded from ground level. All connections from DPs, Gullies, Drains, VP's, RE's and lampholes have been proven wherever possible using audible connections (AC) and/or sonde instrumentation where applicable. Where these methods have proved unsuccessful then assumed (AR) straight line connections will be shown.

**CCTV Drainage Survey**

All accessible Manholes and Inspection chambers have had their respective covers lifted with pipe sizes, inverts, chamber sizes/type and service data recorded from ground level. Pipework has been traced, accessed and collected for post processing. Drainage layout, including manhole covers not located by topographical survey, may be taken from CCTV chainage and will be shown as indicative only.

**Electricity**

Elec cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required.

**British Telecoms**

BT cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required. Due to current laws and legislation protecting all BT apparatus, cabling can only be located remotely. We therefore compare all our telecom findings against record information to produce the final service layout. In some instances, where high amount of cable ducts are present, we may only be able to identify a linear centre peak signal rather than identifying all the individual duct positions. For further information regarding Telecoms apparatus, please contact Openreach directly.

**Cable TV & Communications**

CTV and/or Com cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required.

**Fibre Optic**

FO cables will have been predominantly located using GPR methodology. This is due to the materials used within fibre optic cabling. In some rare instances, tracer cabling or conductive non fibre optic cabling will be present within some or all ducting. When this is the case, both EML and GPR methodology will be combined to identify service network and achieve greater quality levels.

**Lighting, Traffic Signal & Security Cables**

LC, TS and/or Sec cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required.

**Gas & Water Inc. Fuel Pipes and Hot Water Pipes**

GM/GS and/or WM/WS pipe work will have been attempted and located using both EML & GPR methodology with electronically derived depths shown for the former and depths to crown levels shown for the latter. When the Gas/Water pipe work is constructed using conductive materials, then we are able to employ multiple geophysical techniques to identify service network and achieve greater quality levels. When a non conductive material is used, GPR methodology will be employed to locate and plot the final service layout.

**Ground Penetrating Radar**

GPR methodology is used to identify and locate all non metallic, non conductive piping and cabling. We also employ GPR to obtain a greater accuracy levels on EML located services. The GPR has a greater success rate on pipe or service diameter upward of Ø63mm, C63mm, as size increments increase, so does the chance of detection. The GPR can produce varying results and as such, wouldn't be used as an independent utility surveying instrument.

**Unidentified Traces**

All UITs will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required. Every effort has been made to identify the service but in this instance, is not achievable. We recommend excavation work to determine identity and depth where applicable.

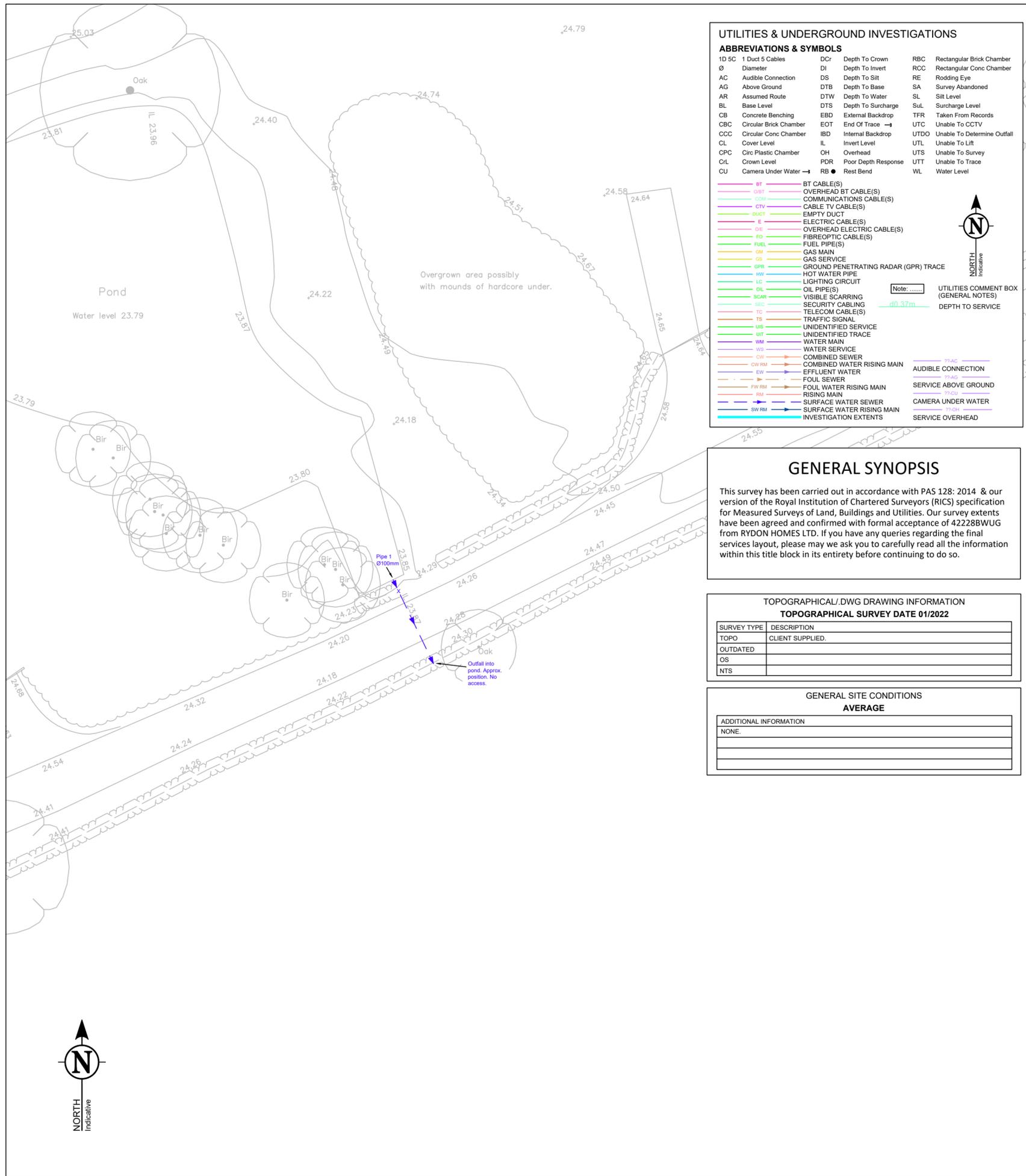
**Scarring (QL-C)**

Scarring has been identified on site with a potential of an undetectable service present.

**Assumed Routes & Taken from Records (QL-B4/D)**

Assumed routes (AR) are shown if there is evidence that a service exists but we are unable to trace it whilst on site. The surveyor will attempt to locate various risers/ics/valves/meters (service evidence) etc. around site area to successfully determine an assumed route between these points. If there is little evidence on site but they believe a service is still present, then a common sense approach to an assumed route shall be employed.

Taken from records (TFR) are service routes that are taken from STAT record plans or previous survey information and overlaid onto our drawings.



**UTILITIES & UNDERGROUND INVESTIGATIONS**

**ABBREVIATIONS & SYMBOLS**

1D 5C	1 Duct 5 Cables	DcR	Depth To Crown	RBC	Rectangular Brick Chamber
Ø	Diameter	DI	Depth To Invert	RCC	Rectangular Conc Chamber
AC	Audible Connection	DS	Depth To Silt	RE	Rodding Eye
AG	Above Ground	DTB	Depth To Base	SA	Survey Abandoned
AR	Assumed Route	DTW	Depth To Water	SL	Silt Level
BL	Base Level	DTS	Depth To Surcharge	Sul	Surcharge Level
CB	Concrete Benching	EBD	External Backdrop	TFR	Taken From Records
CBC	Circular Brick Chamber	EOT	End Of Trace →	UTC	Unable To CCTV
CCC	Circular Conc Chamber	IBD	Internal Backdrop	UTDO	Unable To Determine Outfall
CL	Cover Level	IL	Invert Level	UTL	Unable To Lift
CPC	Circ Plastic Chamber	OH	Overhead	UTS	Unable To Survey
CrL	Crown Level	PDR	Poor Depth Response	UTT	Unable To Trace
CU	Camera Under Water →	RB	Rest Bend	WL	Water Level

BT	BT CABLE(S)	BT CABLE(S)	BT CABLE(S)
ØBT	OVERHEAD BT CABLE(S)	COMMUNICATIONS CABLE(S)	COMMUNICATIONS CABLE(S)
CTV	CABLE TV CABLE(S)	EMPTY DUCT	EMPTY DUCT
DUCT	EMPTY DUCT	ELECTRIC CABLE(S)	ELECTRIC CABLE(S)
E	ELECTRIC CABLE(S)	OVERHEAD ELECTRIC CABLE(S)	OVERHEAD ELECTRIC CABLE(S)
FO	FIBROPTIC CABLE(S)	FIBROPTIC CABLE(S)	FIBROPTIC CABLE(S)
FUEL	FUEL PIPE(S)	GAS MAIN	GAS MAIN
GM	GAS MAIN	GAS SERVICE	GAS SERVICE
GS	GAS SERVICE	GROUND PENETRATING RADAR (GPR) TRACE	GROUND PENETRATING RADAR (GPR) TRACE
GPR	GROUND PENETRATING RADAR (GPR) TRACE	HOT WATER PIPE	HOT WATER PIPE
HW	HOT WATER PIPE	LIGHTING CIRCUIT	LIGHTING CIRCUIT
LC	LIGHTING CIRCUIT	OIL PIPE(S)	OIL PIPE(S)
OL	OIL PIPE(S)	VISIBLE SCARRING	VISIBLE SCARRING
SCAR	VISIBLE SCARRING	SECURITY CABLEING	SECURITY CABLEING
SEC	SECURITY CABLEING	TELECOM CABLE(S)	TELECOM CABLE(S)
TIC	TELECOM CABLE(S)	TRAFFIC SIGNAL	TRAFFIC SIGNAL
TS	TRAFFIC SIGNAL	UNIDENTIFIED SERVICE	UNIDENTIFIED SERVICE
US	UNIDENTIFIED SERVICE	UNIDENTIFIED TRACE	UNIDENTIFIED TRACE
UT	UNIDENTIFIED TRACE	WATER MAIN	WATER MAIN
WM	WATER MAIN	WATER SERVICE	WATER SERVICE
WS	WATER SERVICE	COMBINED SEWER	COMBINED SEWER
CW	COMBINED SEWER	COMBINED WATER RISING MAIN	COMBINED WATER RISING MAIN
CWRM	COMBINED WATER RISING MAIN	AUDIBLE CONNECTION	AUDIBLE CONNECTION
EW	EFFLUENT WATER	EFFLUENT WATER	EFFLUENT WATER
FS	FOULED SEWER	FOUL WATER RISING MAIN	FOUL WATER RISING MAIN
FWRM	FOUL WATER RISING MAIN	RISING MAIN	RISING MAIN
RM	RISING MAIN	SURFACE WATER SEWER	SURFACE WATER SEWER
SW	SURFACE WATER SEWER	SURFACE WATER RISING MAIN	SURFACE WATER RISING MAIN
SWRM	SURFACE WATER RISING MAIN	INVESTIGATION EXTENTS	INVESTIGATION EXTENTS

**UTILITIES COMMENT BOX (GENERAL NOTES)**

DEPTH TO SERVICE: rd0.37m

**GENERAL SYNOPSIS**

This survey has been carried out in accordance with PAS 128: 2014 & our version of the Royal Institution of Chartered Surveyors (RICS) specification for Measured Surveys of Land, Buildings and Utilities. Our survey extents have been agreed and confirmed with formal acceptance of 42228BWUG from RYDON HOMES LTD. If you have any queries regarding the final services layout, please may we ask you to carefully read all the information within this title block in its entirety before continuing to do so.

**TOPOGRAPHICAL/DWG DRAWING INFORMATION**

**TOPOGRAPHICAL SURVEY DATE 01/2022**

SURVEY TYPE	DESCRIPTION
TOPO	CLIENT SUPPLIED.
OUTDATED	
OS	
NTS	

**GENERAL SITE CONDITIONS**

**AVERAGE**

ADDITIONAL INFORMATION
NONE.

**UTILITIES & UNDERGROUND INVESTIGATIONS**  
**DRAWING NOTES**

All below ground details shown have been identified from above ground without excavation. Survey Solution use electro-magnetic and/or ground penetrating radar (GPR) methods to investigate for underground utilities, services and features. Results using these methods are not infallible and we recommend trial excavations are carried out to confirm any identifications, positions and depths.

Any areas on the drawing where services or features have not been shown are not necessarily clear of services or features but are an indication that no items have been identified during our investigations. All reasonable care and normal good practice should still be employed during design and construction processes.

Certain types of services such as plastic or concrete pipes, some conduit and ducting where direct access can not be achieved for tracing may not be shown and alternative locating methods should be used.

Survey Solutions has used all reasonable care to research available service records but the completeness or use of the service records supplied to or by Survey Solutions cannot be guaranteed. Therefore Survey Solutions cannot be held responsible for any features annotated as 'taken from records' (TFR).

Depths obtained using electro-magnetic or GPR are effected by ground conditions and should be treated as indicative only. Electro-magnetic depths to utilities and services are generally taken to the centre of a feature, GPR depths to the top of a feature and drainage depth shown to inverts, unless otherwise indicated.

Drainage pipe sizes will be obtained without entering the chamber and therefore should be treated as approximate. Pipe dimensions which have not been obtained visually will be taken from records when available.

All services, drainage and utilities routes are assumed straight between access points, unless otherwise stated. The numbers of cables in runs will not be shown unless specifically requested. All services are below ground unless indicated.

Services, utilities and features may not have been surveyed if obstructed or not reasonably visible or accessible at the time of survey.

Survey Solutions accept no responsibility for the completeness or accuracy of either the topographical survey or base mapping on this project.

All critical dimensions and measurements should be checked and verified with any errors or discrepancies notified to Survey Solutions immediately. The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work.

© Land Survey Solutions Limited hold the copyright to all the information contained within this document and their written consent must be obtained before copying or using the data other than for the purpose it was originally supplied.

Do not scale from this drawing.

**DESKTOP UTILITY RECORDS (PAS 128: 2014 SURVEY TYPE D)**  
**PREREQUISITE FOR PAS 128: 2014 SURVEY TYPE B**  
**COMMISSIONED: NO**

UTILITY	AVAILABILITY	UTILITY COMPANY PROVIDER
SEWER	NO	N/A
WATER MAIN	N/A	N/A
GAS MAIN	N/A	N/A
TELECOM	N/A	N/A
CABLE TV	N/A	N/A
ELECTRICITY	N/A	N/A
OIL PIPES	N/A	N/A
OTHER	N/A	N/A

REV	DESCRIPTION	DRAWN	CHECKED	APPR	SURVEY DATE

**SURVEY SOLUTIONS**

LAND SURVEYING  
BUILDING SURVEYING  
UNDERGROUND SURVEYING  
SITE ENGINEERING  
MONITORING

0845 040 5969  
survey-solutions.co.uk

IPSWICH BEDFORD COVENTRY GLASGOW LONDON MANCHESTER NORWICH NOTTINGHAM YEOVL

**PROJECT TITLE**  
COPPER LANE / ALBION ROAD,  
MARDEN, KENT TN12 9DW.

**DRAWING DETAIL**  
SPECIFIC CCTV DRAINAGE SURVEY.  
SHEET 1 OF 1

CLIENT	SCALE
RYDON HOMES LTD	1:250

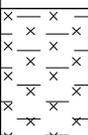
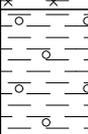
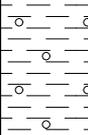
SURVEYOR	SURVEY DATE	CHECKED BY	APPROVED BY	DWG STATUS
GSB	27/05/2022	LJT	GSB	FINAL

DRAWING NUMBER	REVISION	ISSUE DATE
42228BWUG-01		01/06/2022





Contract: <b>Marden</b>		Client: <b>Rydon Homes</b>		Exploratory position: <b>HP1</b>
Contract Ref: <b>52430</b>	Date: <b>23.05.22</b>	Ground Level: <b>31.20</b>	National Grid Co-ordinate: <b>E:574878.6 N:144208.1</b>	Sheet: <b>1 of 1</b>

Depth	Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
0.00-0.20			Dark brown slightly clayey SILT with frequent fine roots. (TOPSOIL)		(0.20)	
0.20-0.60			Light brown slightly gravelly CLAY. Gravel is fine to coarse subrounded claystone. (RIVER TERRACE DEPOSITS)	31.00	0.20	
					(0.40)	
				30.60	0.60	

## General Remarks

1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.
2. No groundwater encountered.
3. On completion, borehole backfilled with arisings.

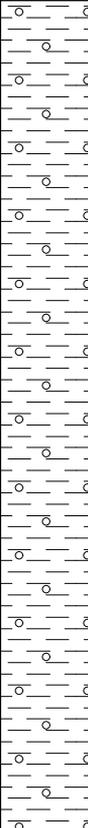
All dimensions in metres

Scale:

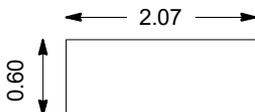
**1:11**

Method Used: <b>Inspection pit + Inspection pit</b>	Plant Used: <b>Hand tools</b>	Logged By: <b>BDrewett</b>	Checked By: <b>BDrewett</b>	
---	-------------------------------	----------------------------	-----------------------------	---

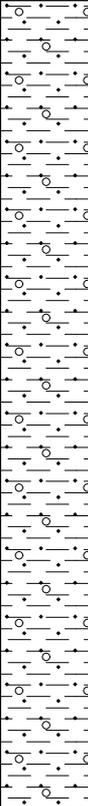
Contract: <b>Marden</b>		Client: <b>Rydon Homes</b>		Trial Pit: <b>TP1</b>
Contract Ref: <b>52430</b>	Start: <b>25.05.22</b> End: <b>26.05.22</b>	Ground Level: <b>---</b>	National Grid Co-ordinate: <b>---</b>	Sheet: <b>1 of 1</b>

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Dark brown slightly clayey SILT with frequent frequent fine roots. (TOPSOIL)		0.20	
						Grey and orange slightly gravelly CLAY. Gravel is fine to coarse subrounded to subangular claystone. (WEALD CLAY FORMATION)		(2.80)	
								3.00	

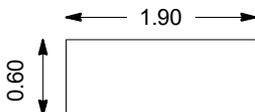
GINT\_LIBRARY\_V10\_01.GLB LibVersion: v8\_07\_001 PrjVersion: v8\_07 | Log TRIAL PIT LOG - A4P | 52430 MARDEN.GPJ - V10\_01. | 08/06/22 - 17:18 | BD2 |

Plan (Not to Scale)		<b>General Remarks</b>		
		<ol style="list-style-type: none"> <li>1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.</li> <li>2. Checks for buried ferrous objects carried out during excavation by specialist unexploded ordnance (UXO) officer using magnetometer.</li> <li>3. Water seepage at 3.00m depth.</li> <li>4. Trial pit backfilled with arisings in reverse order upon completion.</li> </ol>		
		All dimensions in metres		Scale: <b>1:25</b>
Method Used: <b>Inspection pit + Machine dug</b>	Plant Used: <b>JCB-3CX</b>	Logged By: <b>BDrewett</b>	Checked By:	

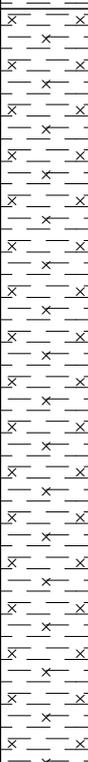
Contract: <b>Marden</b>		Client: <b>Rydon Homes</b>		Trial Pit: <b>TP2</b>
Contract Ref: <b>52430</b>	Start: <b>25.05.22</b> End: <b>26.05.22</b>	Ground Level: <b>---</b>	National Grid Co-ordinate: <b>---</b>	Sheet: <b>1 of 1</b>

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Dark brown slightly gravelly SILT. Gravel is fine to coarse subrounded to subangular claystone. (TOPSOIL)		0.20	
						Reddish orange gravelly sandy CLAY. Gravel is fine to coarse subrounded to subangular flint and claystone. (RIVER TERRACE DEPOSITS)		(2.72)	
								2.92	

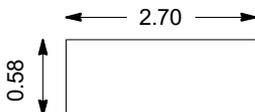
GINT\_LIBRARY\_V10\_01.GLB LibVersion: v8\_07\_001 PrjVersion: v8\_07 | Log TRIAL PIT LOG - A4P | 52430 MARDEN.GPJ - V10\_01.  
| 08/06/22 - 17:18 | BD2 |

Plan (Not to Scale)		<b>General Remarks</b>		
		<ol style="list-style-type: none"> <li>1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.</li> <li>2. Checks for buried ferrous objects carried out during excavation by specialist unexploded ordnance (UXO) officer using magnetometer.</li> <li>3. Water seepage at 2.92m depth.</li> <li>4. Trial pit backfilled with arisings in reverse order upon completion.</li> </ol>		
		All dimensions in metres		Scale: <b>1:25</b>
Method Used: <b>Inspection pit + Machine dug</b>	Plant Used: <b>JCB-3CX</b>	Logged By: <b>???</b>	Checked By:	

Contract: <b>Marden</b>		Client: <b>Rydon Homes</b>		Trial Pit: <b>TP3</b>
Contract Ref: <b>52430</b>	Start: <b>25.05.22</b> End: <b>26.05.22</b>	Ground Level: <b>---</b>	National Grid Co-ordinate: <b>---</b>	Sheet: <b>1 of 1</b>

Samples and In-situ Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results						
						Dark brown silty CLAY with frequent fine rootlets. (TOPSOIL)		0.15	
						Orangish grey slightly silty CLAY. (WEALD CLAY FORMATION)		(2.55)	
								2.70	

GINT\_LIBRARY\_V10\_01.GLB LibVersion: v8\_07\_001 PrjVersion: v8\_07 | Log TRIAL PIT LOG - A4P | 52430 MARDEN.GPJ - V10\_01. | 08/06/22 - 17:18 | BD2 |

Plan (Not to Scale)		<b>General Remarks</b>		
		<ol style="list-style-type: none"> <li>1. Position checked with Ground Penetrating Radar, CAT and Genny prior to excavation.</li> <li>2. Checks for buried ferrous objects carried out during excavation by specialist unexploded ordnance (UXO) officer using magnetometer.</li> <li>3. No Groundwater encountered.</li> <li>4. Trial pit backfilled with arisings in reverse order upon completion.</li> </ol>		
		All dimensions in metres		Scale: <b>1:25</b>
Method Used: <b>Inspection pit + Machine dug</b>	Plant Used: <b>JCB-3CX</b>	Logged By: <b>???</b>	Checked By:	





# WINDOW SAMPLE LOG

Contract: <b>Marden</b>		Client: <b>Rydon Homes</b>		Window Sample: <b>WS2</b>
Contract Ref: <b>52430</b>	Start: <b>23.05.22</b> End: <b>23.05.22</b>	Ground Level: <b>31.65</b>	National Grid Co-ordinate: <b>E:574951.7 N:144267.6</b>	Sheet: <b>1 of 1</b>

Progress Window Run	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
	Depth	No	Type	Results						
0.30-0.40	ES1	ES	Tubx1+VL+J			Grass over brown sandy slightly gravelly SILT with frequent fine rootlets. Gravel is rare fine subangular mudstone. (TOPSOIL)		(0.60)		
0.50-0.60	D1	D					31.05	0.60		
0.70-0.80	ES2	ES	Tubx1+VL+J			Orangey brown sandy slightly silty GRAVEL. Gravel is fine to coarse subrounded to subangular claystone and flint. (RIVER TERRACE DEPOSITS)	30.85	0.80		
1.00-1.45	1	SPT	N=8			Greyish orangey CLAY. (RIVER TERRACE DEPOSITS)				
1.30-1.40	D2	D						(1.80)		
2.00-2.45	2	SPT	N=12							
2.30-2.40 2.30	D3	D V	 c <sub>u</sub> =32			. . . @2.30m bgl: Becomes firm and slightly sandy.	29.05	2.60		
2.70-2.80	D4	D				Orangey brown very gravelly SAND. Gravel is fine to coarse subangular to subrounded flint and claystone. (RIVER TERRACE DEPOSITS)		(0.80)		
3.00-3.45	3	SPT	N=13				28.25	3.40		
3.40-3.50	D5	D				Orangey brown sandy slightly silty CLAY. (RIVER TERRACE DEPOSITS)	28.15	3.50		
3.70-3.90	D6	D				Orangey brown very gravelly SAND. Gravel is fine to coarse subangular to subrounded flint and claystone. (RIVER TERRACE DEPOSITS)	27.85	3.80		
4.00-4.45	4	SPT	N=19			Orangey brown very gravelly silty SAND. Gravel is fine to coarse subrounded to subangular claystone and flint. (RIVER TERRACE DEPOSITS)	27.20	4.45		

GINT\_LIBRARY\_V10\_01\_GLB LibVersion: v8\_07\_001 PrjVersion: v8\_07 | Log WINDOW SAMPLE LOG - A4P | 52430 MARDEN.GPJ - V10\_01\_08/06/22 - 17:20 | BD2

Drilling Progress and Water Observations						General Remarks	
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)		
						1. Checks for buried ferrous objects carried out during excavation by specialist unexploded ordnance (UXO) officer using magnetometer. 2. No groundwater encountered. 3. 40mm diameter standpipe piezometer (complete with upstanding protective cover) installed to 4.00m depth on completion. Response zone 0.5m to 4.00m depth. 4. SPT hammer 110RP-2022 (E <sub>r</sub> = 73.00%) used.	
Method Used: <b>Hand tools + Tracked window</b>						All dimensions in metres	
Plant Used: <b>Premier 110</b>						Scale: <b>1:28</b>	
Drilled By: <b>???</b>						Logged By: <b>BDrewett</b>	
						Checked By:	

# WINDOW SAMPLE LOG

Contract: <b>Marden</b>		Client: <b>Rydon Homes</b>		Window Sample: <b>WS3</b>
Contract Ref: <b>52430</b>	Start: <b>23.05.22</b> End: <b>23.05.22</b>	Ground Level: <b>26.36</b>	National Grid Co-ordinate: <b>E:575071.7 N:144138.2</b>	Sheet: <b>1 of 1</b>

Progress	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results						
	0.20-0.30	ES1	ES	Tubx1+VL+J			Grass over dark brown silty CLAY with frequent fine rootlets. (TOPSOIL)	26.06	(0.30)	
	0.50-0.60	D1	D				Orangish grey slightly silty CLAY. (WEALD CLAY FORMATION)			
	0.60-0.70	ES2	ES	Tubx1+VL+J						
	1.00-1.45	1	SPT	N=7			... @ 2.00m bgl: Becomes Stiff			
	1.00		V	c <sub>v</sub> =40						
	1.40-1.50	D2	D							
	2.00-2.45	2	SPT	N=21			... @ 3.00m bgl: Becomes Firm			
	2.00		V	c <sub>v</sub> =130						
	2.60-2.70	D3	D							
	2.60		V	c <sub>v</sub> =68						
	3.00-3.45	3	SPT	N=58						
								22.91	3.45	

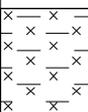
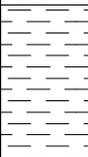
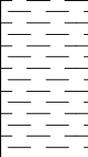
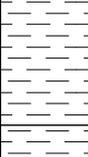
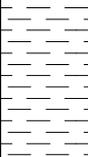
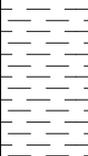
GINT\_LIBRARY\_V10\_01.GLB LibVersion: v8\_07\_001 PrjVersion: v8\_07 | Log WINDOW SAMPLE LOG - A4P | 52430 MARDEN.GPJ - V10\_01. | 08/06/22 - 17:20 | BD2

Drilling Progress and Water Observations						General Remarks	
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)		
						1. Checks for buried ferrous objects carried out during excavation by specialist unexploded ordnance (UXO) officer using magnetometer. 2. No groundwater encountered. 3. 40mm diameter standpipe piezometer (complete with upstanding protective cover) installed to 3.00m depth on completion. Response zone 0.5m to 3.00m depth. 4. SPT hammer 110RP-2022 (E <sub>r</sub> = 73.00%) used.	
Method Used: <b>Hand tools + Tracked window</b>						All dimensions in metres	
Plant Used: <b>Premier 110</b>						Scale: <b>1:28</b>	
Drilled By: <b>???</b>						Logged By: <b>BDrewett</b>	
						Checked By: 	



# WINDOW SAMPLE LOG

Contract: <b>Marden</b>		Client: <b>Rydon Homes</b>		Window Sample: <b>WS5</b>
Contract Ref: <b>52430</b>	Start: <b>23.05.22</b> End: <b>23.05.22</b>	Ground Level: <b>25.05</b>	National Grid Co-ordinate: <b>E:575179.7 N:144153.0</b>	Sheet: <b>1 of 1</b>

Progress Window Run	Samples / Tests				Water	Backfill	Description of Strata	Reduced Level	Depth (Thickness)	Material Graphic Legend
	Depth	No	Type	Results						
	0.20-0.30	ES1	ES	Tubx1+VL+J			Grass over dark brown slightly clayey SILT with frequent fine rootlets. (TOPSOIL)	24.65	(0.40)	
	0.60-0.70	ES2	ES	Tubx1+VL+J			Light yellowish cream CLAY. (WEALD CLAY FORMATION)			
	0.80-0.90 0.80	D1	D V	$c_u=72$						
	1.00-1.45	1	SPT	N=8					(1.60)	
	1.50-1.60	D2	D							
	2.00-2.45 2.10-2.20 2.10	2 D3	SPT D V	N=27 $c_u=70$			Greyish brown CLAY. (WEALD CLAY FORMATION)	23.05	2.00	
	2.60-2.70 2.60	D4	D V	$c_u=118$			... @ 2.60m bgl: Becomes Stiff		(1.45)	
	3.00-3.45	3	SPT	N=56				21.60	3.45	

GINT\_LIBRARY\_V10\_01.GLB LibVersion: v8\_07\_001 PrjVersion: v8\_07 | Log WINDOW SAMPLE LOG - A4P | 52430 MARDEN.GPJ - V10\_01. | 08/06/22 - 17:20 | BD2

Drilling Progress and Water Observations						General Remarks	
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)		
						1. Checks for buried ferrous objects carried out during excavation by specialist unexploded ordnance (UXO) officer using magnetometer. 2. No groundwater encountered. 3. 40mm diameter standpipe piezometer (complete with upstanding protective cover) installed to 3.00m depth on completion. Response zone 0.5m to 3.00m depth. 4. SPT hammer 110RP-2022 ( $E_r = 73.00\%$ ) used.	
Method Used: <b>Hand tools + Tracked window</b>						All dimensions in metres	
Plant Used: <b>Premier 110</b>						Scale: <b>1:28</b>	
Drilled By: <b>???</b>						Logged By: <b>BDrewett</b>	
						Checked By:	





# FULL SCALE SOAKAWAY TEST

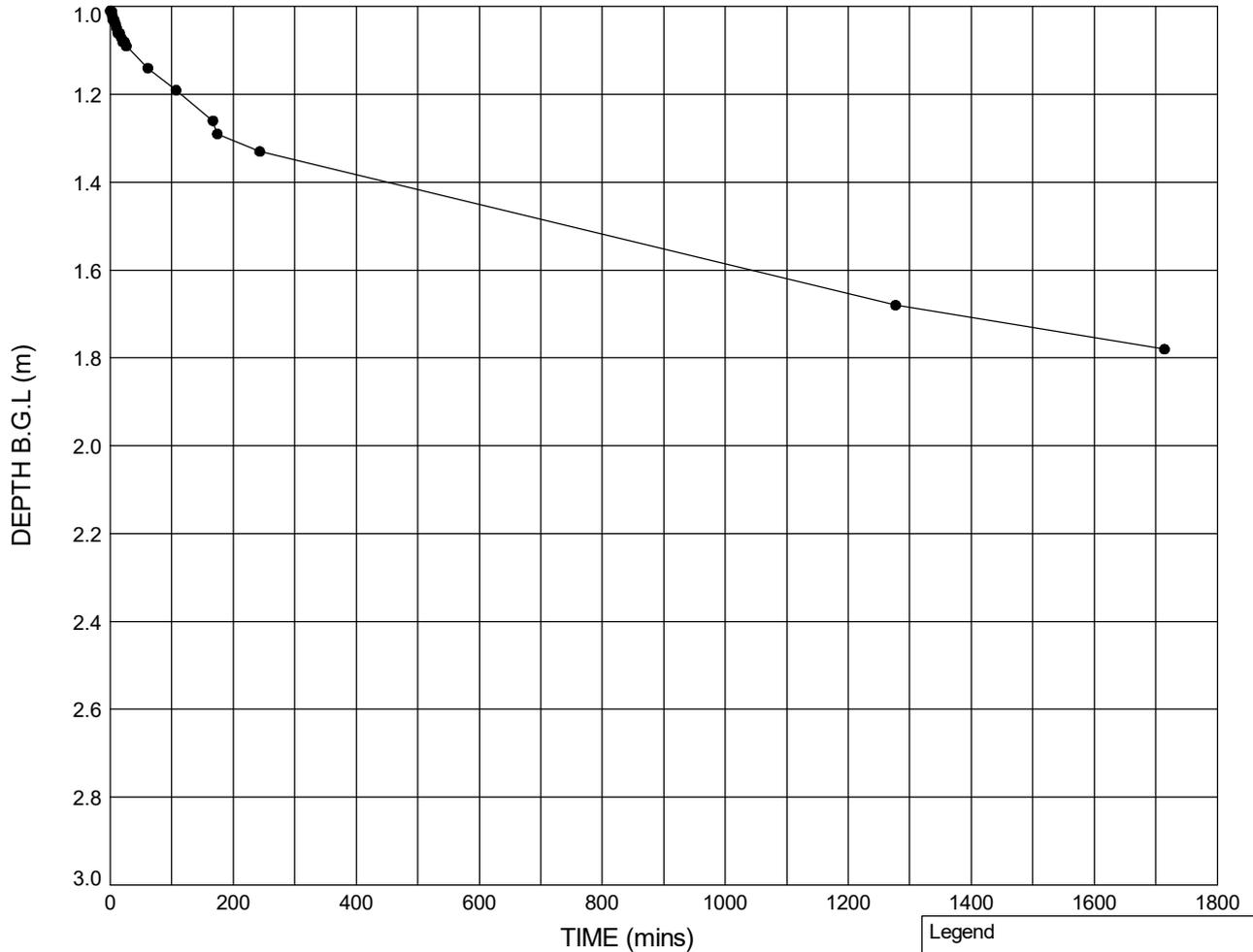
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP1**

Ground Level: ---

National Grid Co-ordinates: ---

## PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

Pit start depth: = 3.00 m

Pit final depth: = 3.00 m

Effective depth,  $D_e$  = 1.99 m

Effective storage volume,  $V_{p75-25}$  = 1.2358 m<sup>3</sup>

Surface area,  $a_{p50}$  = 6.5553 m<sup>2</sup>

Time,  $t_{p75-25}$  = 246236 secs

Infiltration rate,  $f$  =  $7.66 \times 10^{-7}$  m/s

Please note test data was extrapolated to obtain tp75-tp25.

Legend

● Test 1 (25.05.22)

Plan (Not to scale)

← 2.07 →

0.60 ↑

↓

No Bearing Taken

GINT\_LIBRARY\_V10\_01.GLB LibVersion: v8\_07\_001 PjVersion: v8\_07 | Graph 1 - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 52430 MARDEN.GPJ - v10\_01\_ | 08/06/22 - 13:30 | EOR1 |

	Compiled By	Date	Checked By	Date
		08/06/22		
	Contract		Contract Ref:	
	<b>Marden</b>		<b>52430</b>	

# FULL SCALE SOAKAWAY TEST

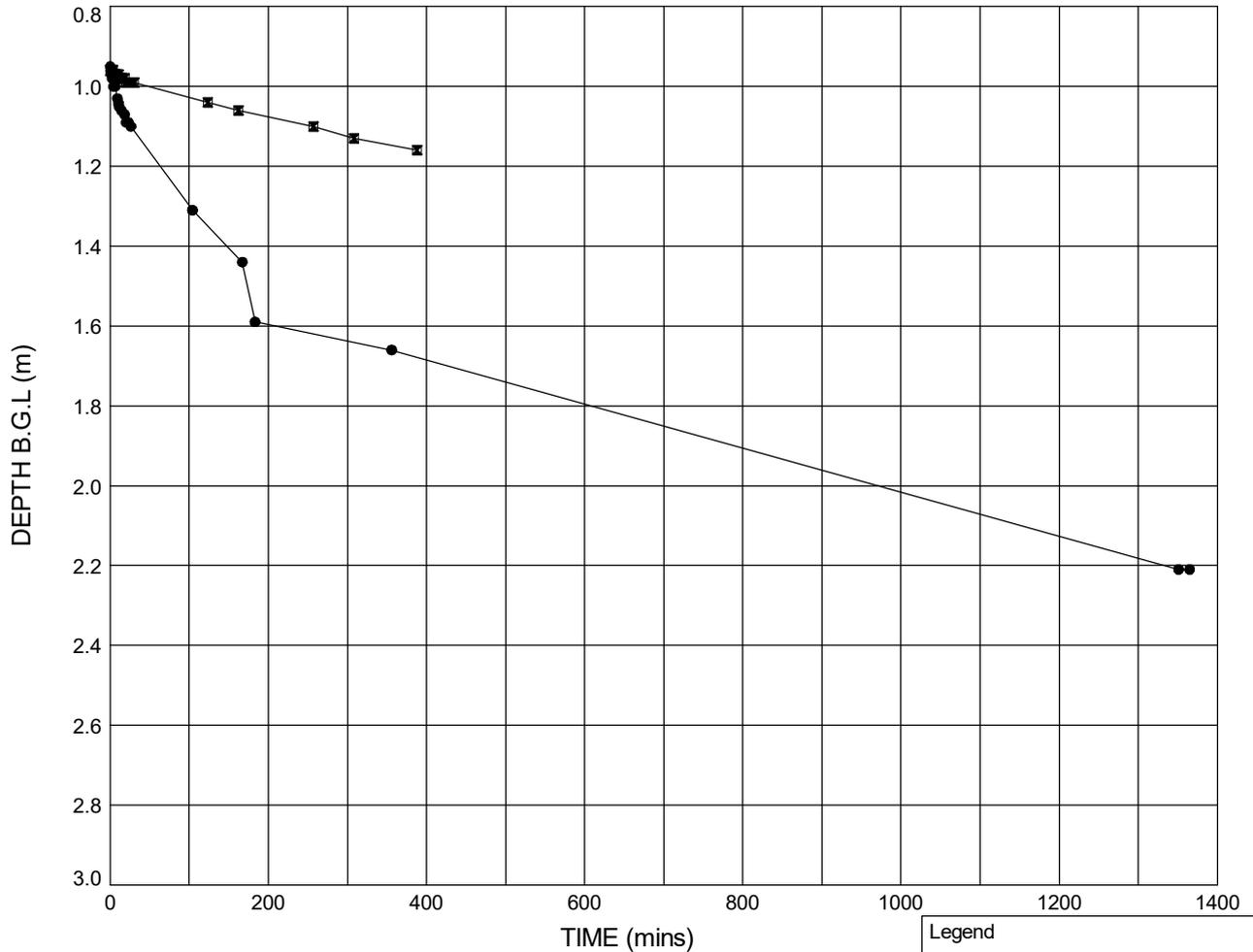
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP2**

Ground Level: ---

National Grid Co-ordinates: ---

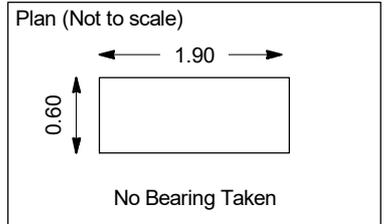
## PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



	Test 1	Test 2	
Pit start depth:	= 2.92	<b>2.21</b>	m
Pit final depth:	= 2.92	<b>2.21</b>	m
Effective depth, $D_e$	= 1.97	<b>1.25</b>	m
Effective storage volume, $V_{p75-25}$	= 1.8434	<b>0.7125</b>	$m^3$
Surface area, $a_{p50}$	= 7.6239	<b>4.2650</b>	$m^2$
Time, $t_{p75-25}$	= 95805	<b>71250</b>	secs
Infiltration rate, $f$	= $2.52 \times 10^{-6}$	<b><math>2.34 \times 10^{-6}</math></b>	m/s

Please note test data was extrapolated to obtain  $t_{p75-25}$ .

Legend		
●	Test 1	(25.05.22)
■	Test 2	(25.05.22)



GINT\_LIBRARY\_V10\_01\_GLB LibVersion: v8\_07\_001 PjVersion: v8\_07 | Graph 1 - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 52430 MARDEN GPJ - v10\_01\_ | 08/06/22 - 13:31 | EOR1 |

	Compiled By	Date	Checked By	Date
		08/06/22		
	Contract		Contract Ref:	
	<b>Marden</b>		<b>52430</b>	

# FULL SCALE SOAKAWAY TEST

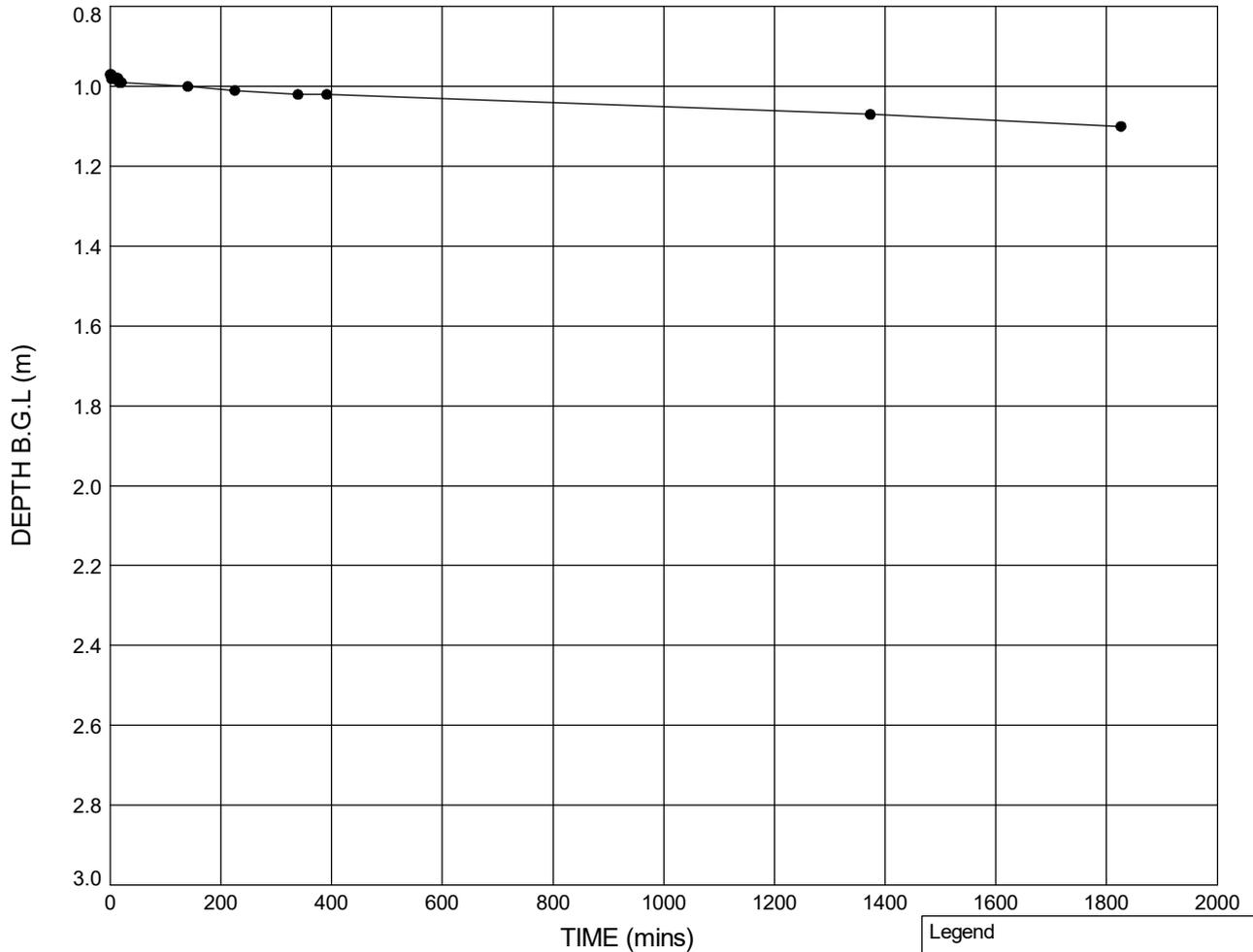
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP3**

Ground Level: ---

National Grid Co-ordinates: ---

## PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

Pit start depth: = 2.70 m

Pit final depth: = 2.70 m

Effective depth,  $D_e$  = 1.73 m

Effective storage volume,  $V_{p75-25}$  = 1.1037 m<sup>3</sup>

Surface area,  $a_{p50}$  = 6.0854 m<sup>2</sup>

Time,  $t_{p75-25}$  = 790610 secs

Infiltration rate,  $f$  =  $2.29 \times 10^{-7}$  m/s

Please note test data was extrapolated to obtain tp75-tp25.

Legend

● Test 1 (25.05.22)

Plan (Not to scale)

← 2.20 →

0.58 ↑

↓

No Bearing Taken

GINT\_LIBRARY\_V10\_01\_GLB LibVersion: v8\_07\_001 PjVersion: v8\_07 | Graph 1 - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 52430 MARDEN.GPJ - v10\_01 | 08/06/22 - 13:32 | EOR1 |

	Compiled By	Date	Checked By	Date
		08/06/22		
	Contract	Contract Ref:		
	<b>Marden</b>		<b>52430</b>	

# FULL SCALE SOAKAWAY TEST

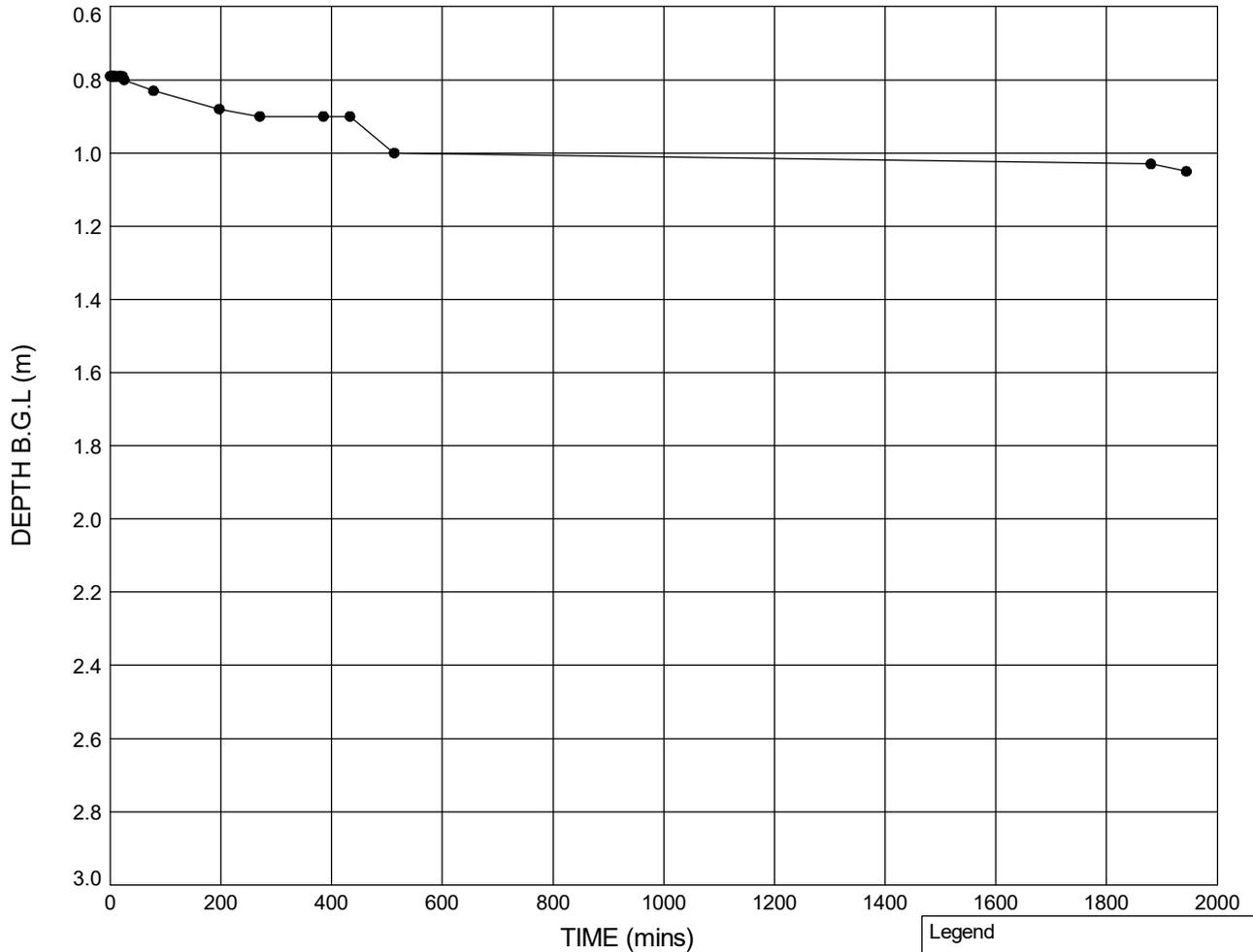
In accordance with BRE Digest 365

Soakaway Test - Position ID : **TP4**

Ground Level: ---

National Grid Co-ordinates: ---

## PLOT OF DEPTH OF WATER BELOW GROUND LEVEL AGAINST TIME



Test 1

Pit start depth: = 2.90 m

Pit final depth: = 2.90 m

Effective depth,  $D_e$  = 2.11 m

Effective storage volume,  $V_{p75-25}$  = 1.1329 m<sup>3</sup>

Surface area,  $a_{p50}$  = 6.1589 m<sup>2</sup>

Time,  $t_{p75-25}$  = 510528 secs

Infiltration rate,  $f$  =  $3.60 \times 10^{-7}$  m/s

Please note test data was extrapolated to obtain tp75-tp25.

Legend

● Test 1 (25.05.22)

Plan (Not to scale)

← 1.82 →

0.59 ↑

↓

No Bearing Taken

GINT\_LIBRARY\_V10\_01.GLB LibVersion: v8\_07\_001 PjVersion: v8\_07 | Graph 1 - TP SOAKAWAY - 2 - FINAL REPORT - A4P | 52430 MARDEN.GPJ - v10\_01 | 08/06/22 - 13:33 | EOR1 |

	Compiled By	Date	Checked By	Date
		08/06/22		
	Contract	Marden		Contract Ref: 52430

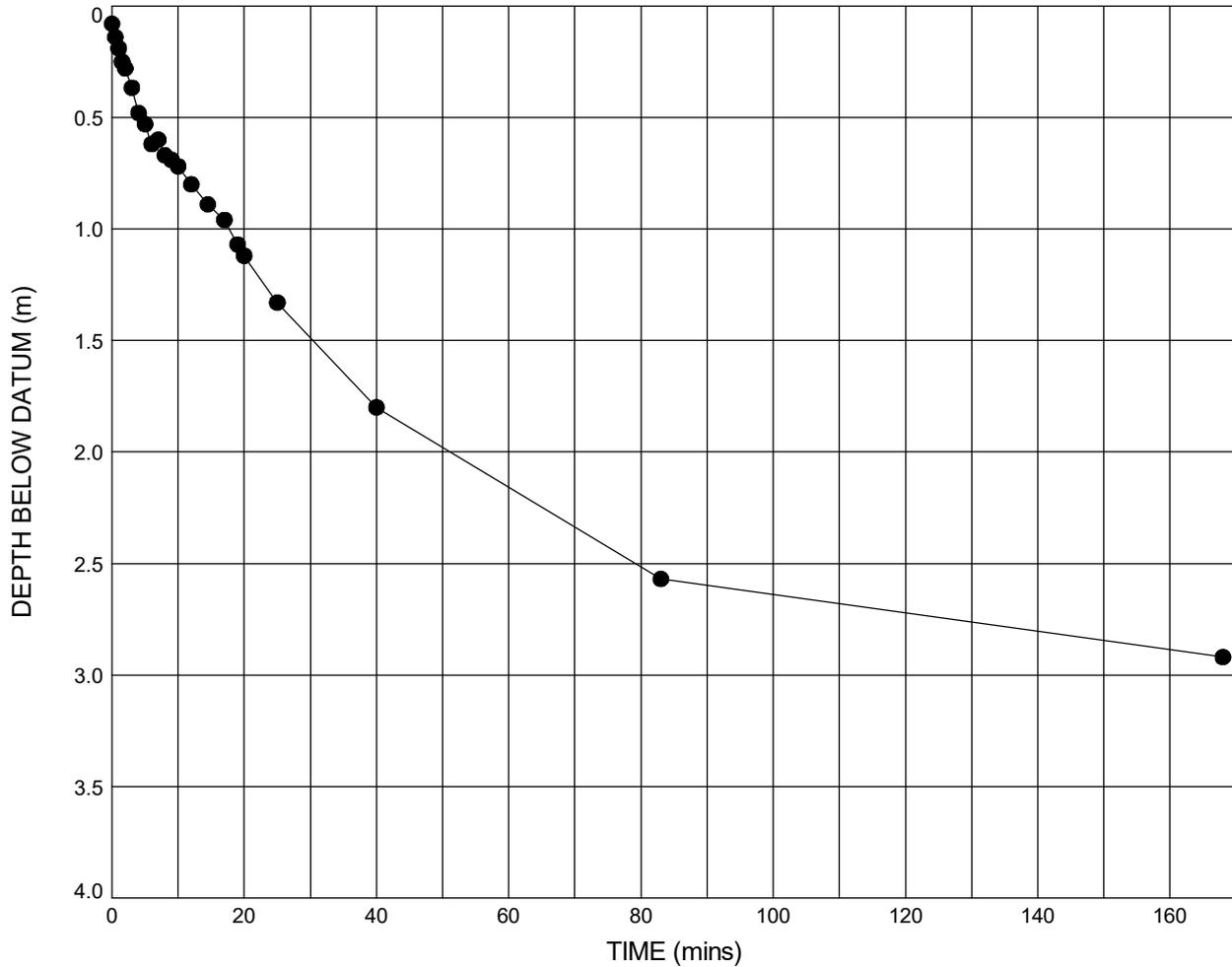
# BOREHOLE SOAKAWAY TEST

Test position: **WS2**

Ground Level: **31.65**

British National Grid Co-ordinates:---

## PLOT OF DEPTH OF WATER BELOW DATUM AGAINST TIME



Effective depth,  $D_e$  = **3.36** m

Effective storage volume,  $V_{p75-25}$  = **0.002111** m<sup>3</sup>

Surface area,  $a_{p50}$  = **0.212372** m<sup>2</sup>

Time,  $t_{p75-25}$  = **4483** secs

Infiltration coefficient,  $f$  =  **$2.22 \times 10^{-6}$**  m/s

Notes : The drop in water level during the test did not reach the 25% full point required for calculation of a test result. The time at which the test water level should have reached this point has been determined by extrapolation.

Test hole details:

Hole depth at start of test: **3.44m**

Window sample hole  
(average diameter used): **40mm**

Legend:

● Test 1 (25/05/2022)

Anerley Court  
Half Moon Lane  
Hildenborough  
Tonbridge  
Kent, TN11 9HU

Test Operator

**Becky Drewett**

Checked By

Date

**08/06/22**

Contract

**Marden**

Contract Ref:

**52430**

Client:

**Rydon Homes**

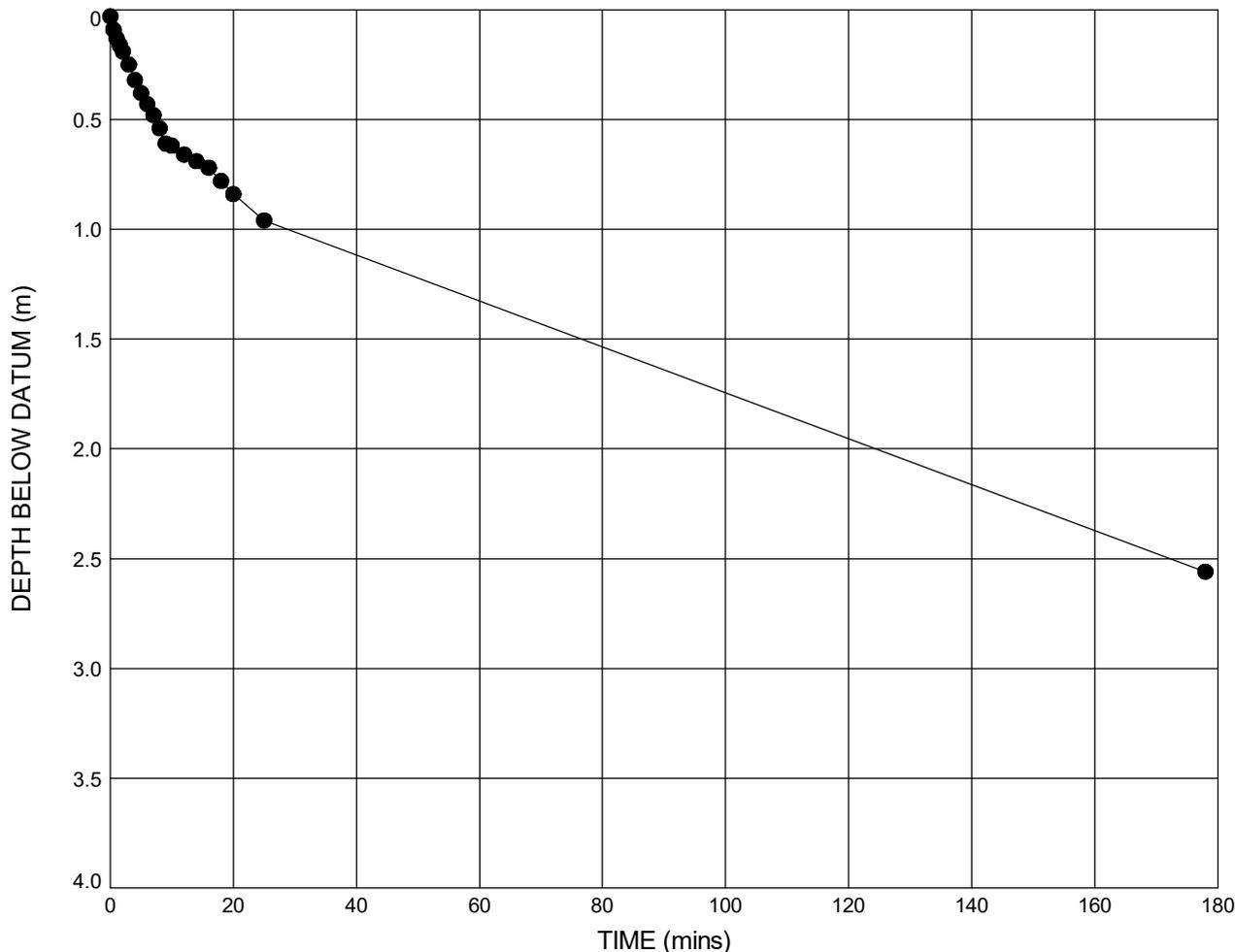
# BOREHOLE SOAKAWAY TEST

Test position: **WS2**

Ground Level: **31.65**

British National Grid Co-ordinates:---

## PLOT OF DEPTH OF WATER BELOW DATUM AGAINST TIME



Effective depth,  $D_e$  = **3.41** m

Effective storage volume,  $V_{p75-25}$  = **0.002143** m<sup>3</sup>

Surface area,  $a_{p50}$  = **0.215513** m<sup>2</sup>

Time,  $t_{p75-25}$  = **9532** secs

Infiltration coefficient,  $f$  =  **$1.04 \times 10^{-6}$**  m/s

Notes : The drop in water level during the test did not reach the 25% full point required for calculation of a test result. The time at which the test water level should have reached this point has been determined by extrapolation.

**Test hole details:**

Hole depth at start of test: **3.44m**

Window sample hole  
(average diameter used): **40mm**

**Legend:**

● Test 2 (25/05/2022)

Anerley Court  
Half Moon Lane  
Hildenborough  
Tonbridge  
Kent, TN11 9HU

Test Operator

**Becky Drewett**

Checked By

Date

**08/06/22**

Contract

**Marden**

Contract Ref:

**52430**

Client:

**Rydon Homes**

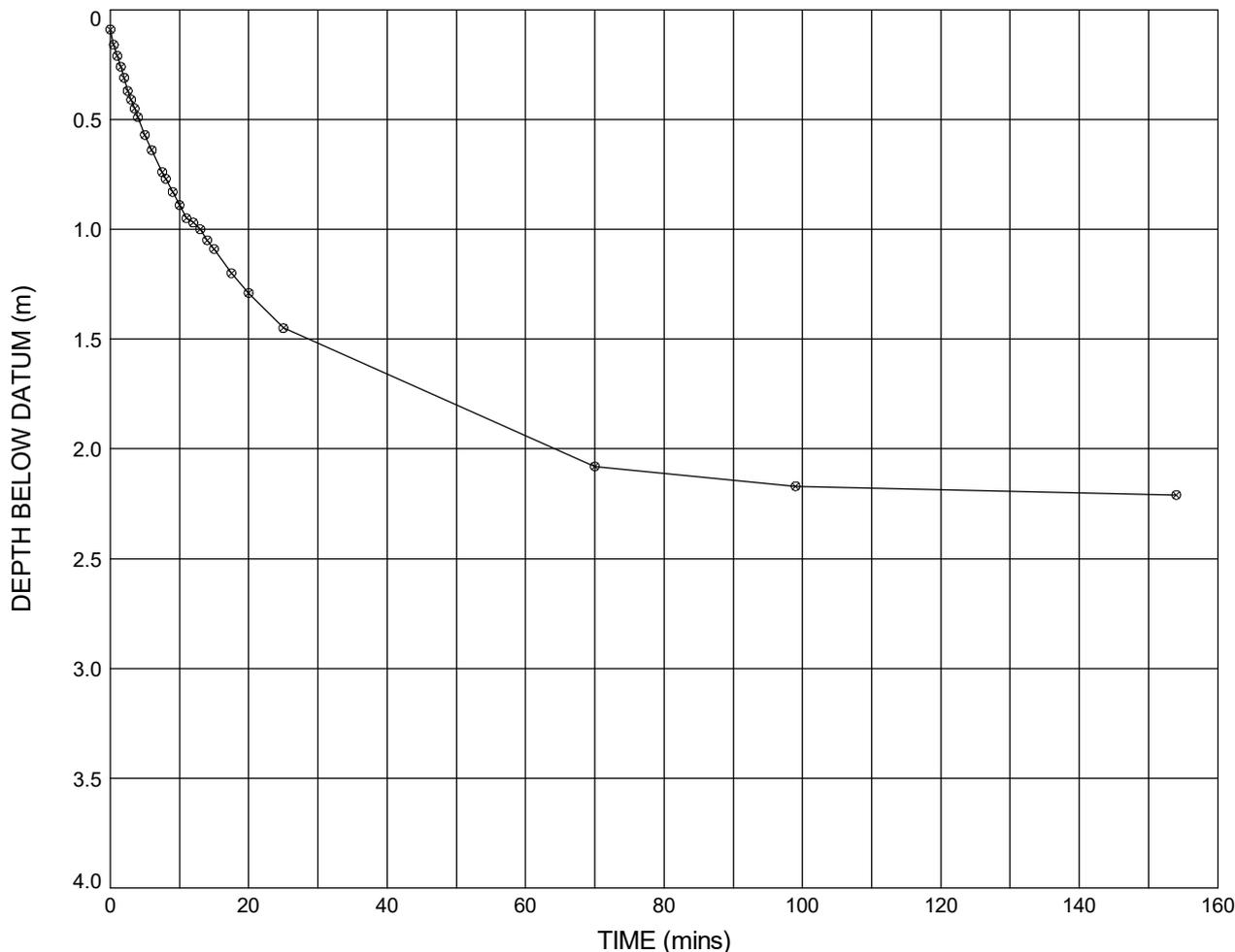
# BOREHOLE SOAKAWAY TEST

Test position: **WS4**

Ground Level: **30.56**

British National Grid Co-ordinates:---

## PLOT OF DEPTH OF WATER BELOW DATUM AGAINST TIME



Effective depth,  $D_e$  = **3.18** m

Effective storage volume,  $V_{p75-25}$  = **0.001998** m<sup>3</sup>

Surface area,  $a_{p50}$  = **0.201062** m<sup>2</sup>

Time,  $t_{p75-25}$  = **30507** secs

Infiltration coefficient,  $f$  =  **$3.26 \times 10^{-7}$**  m/s

Notes : The drop in water level during the test did not reach the 25% full point required for calculation of a test result. The time at which the test water level should have reached this point has been determined by extrapolation.

**Test hole details:**

Hole depth at start of test: **3.27m**

Window sample hole  
(average diameter used): **40mm**

**Legend:**

⊗ Test 1 (25/05/2022)

Anerley Court  
Half Moon Lane  
Hildenborough  
Tonbridge  
Kent, TN11 9HU

Test Operator

**Becky Drewett**

Checked By

Date

**07/06/22**

Contract

**Marden**

Contract Ref:

**52430**

Client:

**Rydon Homes**

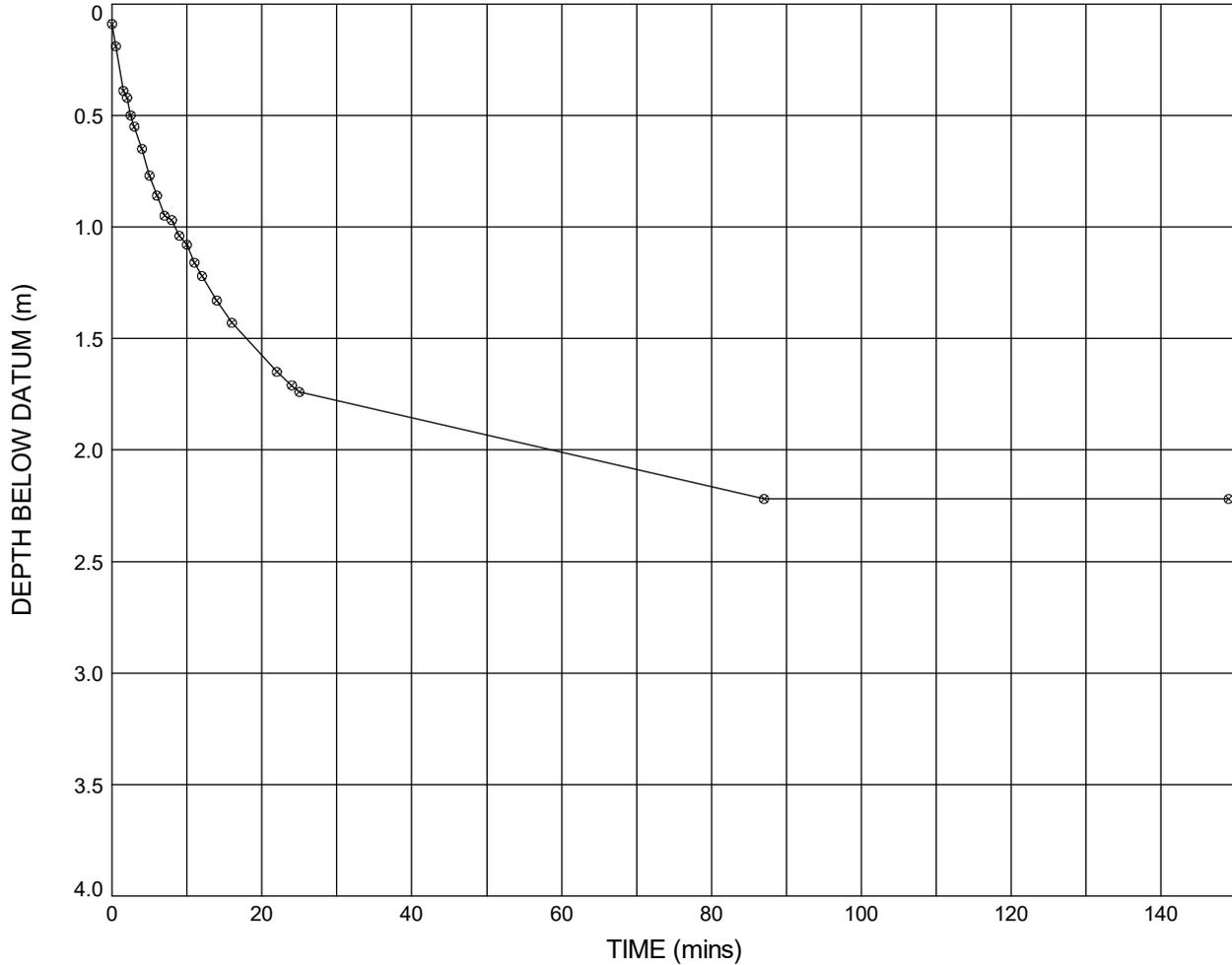
# BOREHOLE SOAKAWAY TEST

Test position: **WS4**

Ground Level: **30.56**

British National Grid Co-ordinates:---

## PLOT OF DEPTH OF WATER BELOW DATUM AGAINST TIME



Effective depth,  $D_e$  = **3.18** m

Effective storage volume,  $V_{p75-25}$  = **0.001998** m<sup>3</sup>

Surface area,  $a_{p50}$  = **0.201062** m<sup>2</sup>

Time,  $t_{p75-25}$  = **N/A** secs

Infiltration coefficient,  $f$  = **N/A** m/s

Notes : The drop in water level during the test did not reach the 25% full point required for calculation of a test result. The time at which the test water level should have reached this point has been determined by extrapolation.

**Test hole details:**

Hole depth at start of test: **3.27m**

Window sample hole  
(average diameter used): **40mm**

**Legend:**

⊗ Test 2 (25/05/2022)

Anerley Court  
Half Moon Lane  
Hildenborough  
Tonbridge  
Kent, TN11 9HU

Test Operator

**Becky Drewett**

Checked By

Date

**07/06/22**

Contract

**Marden**

Contract Ref:

**52430**

Client:

**Rydon Homes**