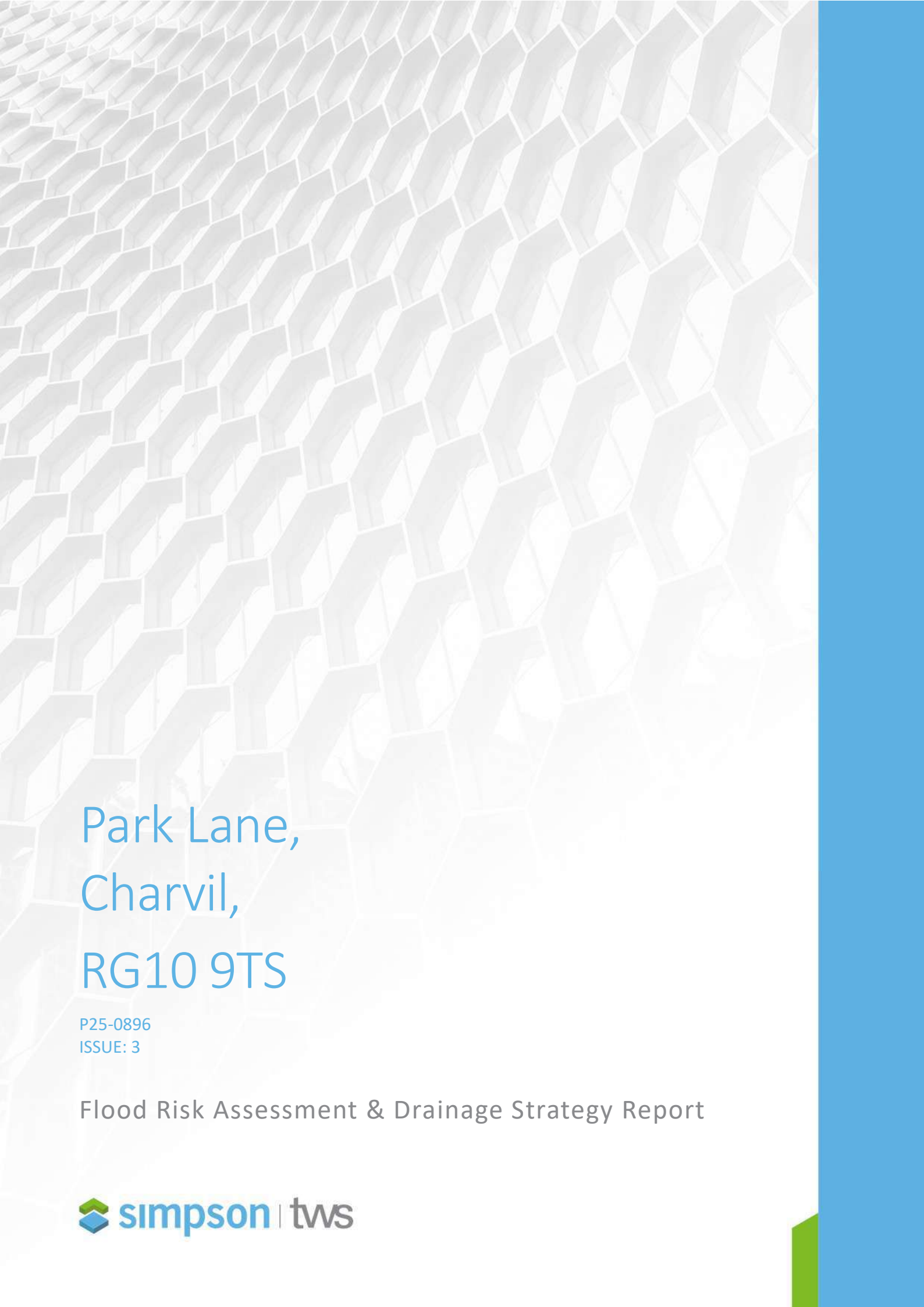




Park Lane, Charvil, RG10 9TS

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Flood Risk Assessment & Drainage Strategy Report

Park Lane, Charvil

Flood Risk Assessment & Drainage Strategy Report

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1 Introduction

1.1 Background

This report has been prepared on behalf of Bellway Homes to accompany a reserved matters planning application for a proposed 75-unit residential development at Park Lane, Charvil, RG10 9TS.

1.2 Objectives

The report assesses flood risk associated with the development proposals and outlines a strategy for the disposal of surface water and foul water runoff from the development, following guidance set out in the following local & national planning policy documents:

- The National Planning Policy Framework (NPPF) & associated Planning Practice Guidance 2024
- Wokingham Borough Council Local Plan/Core Strategy 2010-2026
- Wokingham Borough Council Managing Development Delivery (MDD) 2014
- Wokingham Borough Council Level 1 Strategic Flood Risk Assessment May 2023 – Final Report
- Wokingham Borough Council Sustainable Drainage Systems (SuDS) Strategy January 2017

1.3 Planning History

The proposed site previously received outline planning under ref: 232704 for Outline application for the proposed erection of up to 75 dwellings with only access to be considered via Park Lane. Appearance, Landscaping, Layout and Scale to be matters reserved.

Within the outline planning consent, condition 28 & 29 relates to the surface water drainage & SuDS strategy and sets out the following,

28. Drainage

No development shall take place until full details of the drainage system for the site have been submitted to and approved in writing by the LPA. The details shall include:

- 1. BRE 365 test results demonstrating whether infiltration is achievable or not.*
- 2. Use of SuDS following the SuDS hierarchy, preferably infiltration*
- 3. Full calculations demonstrating the performance of soakaways or capacity of attenuation features to cater for 1 in 100-year flood event with a 40% allowance for climate change and runoff controlled at the QBar rate of 3.83l/s/ha, or preferably better.*
- 4. Separate drainage systems for any proposed adopted highways and residential dwellings.*
- 5. A description of how the proposed development will deal with surface water overland flows.*
- 6. Groundwater monitoring confirming seasonal high groundwater levels in the area.*
- 7. A drainage strategy plan indicating the location and sizing of SuDS features, with the base of any SuDS features located at least 1m above the seasonal high water table level.*
- 8. Details demonstrating how any SuDS for this development would be managed throughout the lifespan of the development and who will be responsible for maintenance.*

29. Sustainable drainage

No building hereby permitted shall be occupied until surface water drainage works have been implemented in accordance with details that have been submitted to and approved in writing by the local planning authority. Before these details are submitted an assessment shall be carried out of the potential for disposing of surface water by means of a sustainable drainage system in accordance with the principles set out in Annex F of PPS25 (or any subsequent government guidance), and the results of the assessment provided to the local planning authority. Where a sustainable drainage scheme is to be provided, the submitted details shall:

i) provide information about the design storm period and intensity, the method employed to delay and control the surface water discharged from the site and the measures taken to prevent pollution of the receiving groundwater and/or surface waters;

ii) include a timetable for its implementation; and,

iii) provide a management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public authority or statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime.

2 Site Locations & Characteristics

2.1 Site Location

2.1.1. The site is located on land west of Park Lane, Charvil, Berkshire, RG10 9TS as shown on *Figure 2.1*, below.

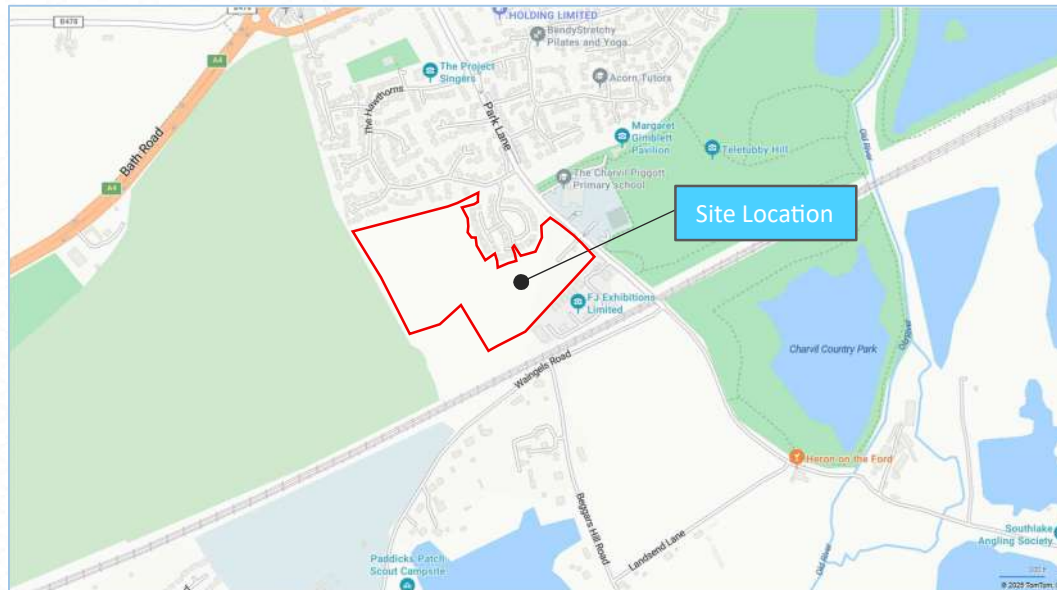


Figure 2.1 Site Location

2.1.2. The site is centred on Ordnance Survey grid reference SU 77633 75200 and co-ordinates X: 477633, Y: 175200. The nearby post code is RG10 9TS.

2.2 Site Description

2.2.1. The subject site currently comprises of greenfield land. To the north is a small residential development and to the south is a small industrial site and woodland as well as the Great Western Main Line railway.

2.2.2. The site's measured area is approximately 7 hectares.

2.3 Topography

2.3.1. A topographical survey of the site is included in *Appendix A*. The survey shows the site to have a gentle fall from north-west to south-east from respective levels of approximately 49.00m AOD to 38.00m AOD. The survey identifies two spoil heaps at heights of 3.0-3.5m located on the eastern and western sides of the site.

2.4 Existing Ground Conditions

2.4.1. British Geological Survey (BGS) online mapping indicates the site to have underlain bedrock as Seaford Chalk Formation and Newhaven Chalk Formation – Chalk to the southeast of the site and Lambeth Group to the northwest of the site. Sedimentary bedrock formed between 89.8 and 72.1 million years ago during the Cretaceous period and notes the superficial deposits as River Terrace Deposits, Sand and gravel. Sedimentary superficial deposit formed between 2.588 million years ago and the present during the Quaternary period.

2.4.2. A Site Investigation was undertaken by Geo-Integrity ref: 25-07-12 which provides further details of the underlying ground conditions. The results of the investigation works are included in *Appendix B* which identifies the test locations with soils encountered, areas of contamination and soakage tests locations / rates.

2.4.3. Topsoil underlies the majority of the site with localised made ground that exists underlying the builder's yard and a small pocket at the centre of the site – maximum thickness 0.70mbgl. River Terrace Deposits underlie the near-surface soils down to depths of 8.00mbgl in the west and 0.95m in the east (thinning in a south-east direction). These deposits vary but are predominantly granular sand and gravel (non-shrinkable). Whilst significant layers of cohesive soil were encountered, laboratory testing proved this material to be of medium shrinkability in accordance with NHBC guidelines.

2.4.4. The Lambeth Group was encountered across the site down to proven depths of 8.90m and 13.70m bgl (thinning to the east). This comprised predominantly soft to firm and firm to stiff, dark grey, green, silty clay with shell debris and calcareous horizons, and dense, dark grey, green, very sandy clayey silt with shell debris. Laboratory testing has proven this material contains layers of highly shrinkable soil in accordance with NHBC guidelines. The Lambeth Group is underlain by The White Chalk Subgroup at depths below 8.90m bgl, proven down to depths in excess of 25.00m bgl (the maximum depth achieved by the ground investigation).

2.4.5. Groundwater was encountered at significant depths ranging between 7.90m and 13.00m bgl, recorded to be at similar depths to the interface between the Lambeth Group and the underlying chalk strata. In addition, minor perched water levels were recorded within the River Terrace Deposits at depths of 1.50m and 2.80m bgl, respectively. Subsequent groundwater monitoring also recorded perched water levels within CT5 at depths of 3.36m bgl.

2.4.6. Winter groundwater monitoring was undertaken between November 2025 and March 2026 at existing standpipes CT2 & CT5 which were installed as part of the previous phase 1 and 2 ground investigations. The results are included in *Appendix B* and included in *Figure 2.2* below.

Depth to Groundwater – metres below ground level (mbgl)					
Installation	Visit 1 (28/11/2025)	Visit 2 (09/12/2025)	Visit 3 (06/01/2026)	Visit 4 (02/02/2026)	Visit 5 (03/03/2025)
CT5	4.35	4.40	3.27	0.33	0.30
CT2	4.07	2.99	4.50	0.62	1.21

Figure 2.2 Winter Groundwater Monitoring Results

2.4.7. 4 no. soakage tests to BRE 365 were undertaken within the variable near-surface soils of the River Terrace Deposits. The tests were completed 3 times at each location yielding varying rates across the locations and tests. The lowest recorded rate of 1.97×10^{-6} m/s was recorded at SA3 whilst the highest recorded rate was 3.03×10^{-4} m/s at SA4.

2.4.8. Given the information gathered from this intrusive investigation, the chalk strata were proven to be overlain by a significant overburden comprising River Terrace Deposits and Lambeth Group soils. Therefore, the risk of dissolution features is less than if it was present nearer surface. No evidence of dissolution features was recorded during this investigation however, only two boreholes (BH1 and BH2) identified chalk at depth. Therefore, as a precaution, it is recommended that soakaways should be sited at least 10m away from foundations for structures, roads and railways.

2.4.9. The site investigation identified the risk of contamination to construction workers, end users and surrounding residents from the proposed development at this site is very low, and as such, no further works or remedial measures are considered necessary prior to development.

2.5 Existing Drainage Arrangements

2.5.1. An Existing Drainage Characteristics Plan is included in *Appendix C*. The plan shows fall arrows and contours generated by a digital terrain model created from the topographical survey of the site. The fall arrows are representative of the topography discussed in section 2.3.

2.5.2. Thames Water is the incumbent sewerage utility provider for the area. A review of the Thames Water's Records confirms that there is a surface water sewer running west to east along The Hawthorns to the north of the site and north to south down Park Lane to the east of the site. There is a foul water sewer that runs parallel to the surface water sewer along The Hawthorns. Not shown on the Thames Water plan is a surface water and foul water sewer that has been installed running south to north along Canberra Lake Way that has recently been built as part of an adjacent development. *Figure 2.2* below shows an extract of Thames Water's sewer records for the site.

2.5.3. There is a tributary for the old river and the river Loddon, which runs perpendicular to the southeast of the site. The Old River lies approximately 700 to 750 meters to the south east of the site; this is the closest main river to the site and receives all the surface water bodies on-site and near the site. Approximately 50 to 100 meters to the south of the site there is an ordinary watercourse feeding into the Old River. Further to the south east of the site there is another river which is roughly 1 mile away, this is the river Loddon. To the east and the south of the site, there are small lakes, the one to the east is approximately 450 meters away while the lake to the south is 550 meters away from the site.



Figure 2.2: Thames Water Sewer Records

3 Proposed Scheme

3.1 Development Details

3.1.1. The proposed development includes the construction of seventy-five residential dwellings, including a range of two-bed, three-bed, four-bed, and five-bed dwellings. The red line area shown on the development proposal plan totals 7ha. The proposed dwellings include private gardens and driveways. There will also be access roads constructed, public open space and soft landscaping. It is proposed to construct attenuation basins for drainage, and there is a flood zone limit along the southern boundary. The main access will remain the same via Park Lane to the east.

3.2 Development Layout

3.2.1. A plan showing the development layout is included in *Appendix D*.

4 Flood Risk Planning Policy & Guidance

4.1 National Planning Policy Framework (NPPF) 2024

4.1.1. At a national level, the NPPF and the Planning Practice Guidance (PPG) to the NPPF seek to ensure flood risk is considered at all stages of the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development towards areas at lowest flood risk. The NPPF retains a risk-based approach to the planning process and uses the Flood Zones as the basis for applying the sequential test, as well as flood risk vulnerability classifications, which define the type of development that is considered appropriate within each zone. It advises local planning authorities to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.

4.1.2. The NPPF establishes the Flood Zones as the starting point for assessment with the overarching aim to steer new development to areas with the lowest probability of flooding. Flood Zone maps are available on the GOV.UK website and the definitions of the Flood Zones extracted from the National Planning Policy Framework (NPPF) are described below:

- Flood Zone 1 – Low probability. This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- Flood Zone 2 – Medium probability. This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%) in any year.
- Flood Zone 3a – High probability. This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- Flood Zone 3b – The functional floodplain. This zone comprises land where water must flow or be stored in times of flood. Typically, land which would flood with an annual probability of 1 in 20 (0.5%) or greater in any year or is designed to flood in an extreme (0.1%) flood.

4.1.3. In areas at risk of river flooding, the NPPF advises that preference be given to new development in Flood Zone 1. If there are no reasonably available sites in Flood Zone 1 the flood vulnerability of the development can be considered in locating development in Flood Zone 2 and then Flood Zone 3. Within each flood zone new development should be directed to sites at the lowest probability of flooding from all sources.

4.1.4. The NPPF advises that when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment with development only to be allowed in areas at risk of flooding where, in the light of the assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- within the site, the most vulnerable development is in areas of lowest flood risk, unless there are overriding reasons to prefer a different location.
- the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment.
- it incorporates Sustainable Drainage Systems (SuDS), unless there is clear evidence that this would be inappropriate.
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

4.2 Wokingham Borough Council Level 1 Strategic Flood Risk Assessment 2023

4.2.1. The Strategic Flood Risk Assessment provides details of flood risk within the local area which was completed in 2023 by JBA. The SFRA reports identified several sources of flood risk in the study area, which include:

- Fluvial flooding
- Surface water flooding
- Groundwater flooding
- Sewer flooding
- Artificial sources of flooding

4.3 Wokingham Borough Council Core Strategy 2010 - 2026

4.3.1. The Wokingham Borough Council Local Plan/Core Strategy covers the timeframe between 2010 and 2026. The plan includes a number of policies relating to flood risk and surface water, which guide design, planning and development decisions. The following Wokingham Borough Council Local Plan/Core Strategy policies should be considered when assessing flood risk and surface water management of the site:

- Policy CP1 - Sustainable Development
 1. Maintain or enhance the high quality of the environment;
 2. Minimise the emission of pollutants into the wider environment;
 3. Limit any adverse effects on water quality (including ground water);
 4. Ensure the provision of adequate drainage;
 5. Minimise the consumption and use of resources and provide for recycling;
 6. Incorporate facilities for recycling of water and waste to help reduce per capita water consumption;
 7. Avoid areas of best and most versatile agricultural land;
 8. Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;
 9. Avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater);
 10. Provide attractive, functional, accessible, safe, secure and adaptable schemes;
 11. Demonstrate how they support opportunities for reducing the need to travel, particularly by private car in line with CP6; and
 12. Contribute towards the goal of reaching zero-carbon developments⁴¹ as soon as possible by:
 - a) Including appropriate on-site renewable energy features; and
 - b) Minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form

4.4 Wokingham Borough Council Managing Development Delivery (MDD) 2014

4.4.1. The Wokingham Borough Council Managing Development Delivery local plan builds on the strategy set out in the Core Strategy and sets out more detailed policies for managing development, with the following policies in respect to flood risk and drainage.

- Policy CC09 - Development and Flood Risk
 1. 1. All sources of flood risk, including historic flooding, must be taken into account at all stages and to the appropriate degree at all levels in the planning application process to avoid inappropriate development in areas at risk of flooding. Proposals must be consistent with the guidance in paragraphs 99-104 of the National Planning Policy Framework (NPPF); the Technical Guidance to the NPPF and demonstrate how they have used the Strategic Flood Risk Assessment (SFRA) to determine the suitability of the proposal.
 2. Development proposals in Flood Zones 2 or 3 must take into account the vulnerability of proposed development.
 3. Development must be guided to areas of lowest flood risk by applying the sequential approach taking into account flooding from all sources and shall ensure flood risk is not worsened for the application site and elsewhere, and ideally that betterment of existing conditions is achieved. The sequential test will not be required if at least one of the following applies:
 - a) Replacement of an existing single residential property. However, the replacement property should, where possible, be located on the part of the site at lowest risk
 - b) Conversions and change of use unless it involves a change to a more vulnerable class
 - c) Minor development, as defined in footnote 10 of the Technical Guidance Note to the NPPF.
 4. In exceptional circumstances, new development in areas of flood risk will be supported where it can be demonstrated that:
 - a) The development provides wider sustainability benefits to the community that outweigh flood risk
 - b) The development will:
 - i. Be safe for its lifetime, taking account of the vulnerability of its users
 - ii. Not increase flood risk in any form elsewhere and, where possible, will reduce flood risk overall

- iii. Incorporate flood resilient and resistant measures into the design
 - c) Appropriate evacuation and flood response procedures are in place to manage the residual risk associated with an extreme flood event.
- 5. Where required, suitable and appropriately detailed flood risk information will need to accompany a planning application. A Flood Risk Assessment (FRA) is required for:
 - a) All proposals in areas of known historic flooding from all sources
 - b) Where there is evidence of a risk from all sources of flooding identified in the Strategic Flood Risk Assessment
 - c) Those proposals set out in footnote 20 to paragraph 103 of the NPP
- Policy CC10 – Sustainable Drainage
 - 1. All development proposals must ensure surface water arising from the proposed development including taking into account climate change is managed in a sustainable manner. This must be demonstrated through
 - a) A Flood Risk Assessment, or
 - b) Through a Surface Water Drainage Strategy.
 - 2. All development proposals must,
 - a) Reproduce greenfield runoff characteristics and return run-off rates and volumes back to the original greenfield levels, for greenfield sites and for brownfield sites both run-off rates and volumes be reduced to as near greenfield as practicably possible.
 - b) Incorporate Sustainable Drainage Systems (SuDS), where practicable, which must be of an appropriate design to meet the long term needs of the development and which achieve wider social and environmental benefits
 - c) Provide clear details of proposed SuDS including the adoption arrangements and how they will be maintained to the satisfaction of the Council [as the Lead Local Flood Authority (LLFA)]
 - d) Not cause adverse impacts to the public sewerage network serving the development where discharging surface water to a public sewer.

5 Sources of Flooding

5.1 Summary

5.1.1. The following section summarises only the fluvial and surface water flooding for the site due to recent updates to the flood zone mapping by the EA in March 2025. For all other flooding sources such as Groundwater, Sewer and Artificial sources, the approved outline planning FRA prepared by Campbell Reith for outline planning ref: 13923-CRH-ZZ-XX-RP-C-0001-F1_FRA Park Lane should be referred to.

5.2 Fluvial Flooding

5.2.1. The Level 1 SFRA defines fluvial flooding as 'Flooding resulting from water levels exceeding the bank level of a river (main river or ordinary watercourse).'

5.2.2. The EA's Flood Map for Planning is the initial dataset used for identifying the location and extent of fluvial and tidal flooding. Figure 5.1 – 5.4 below shows the flood map, which identifies that whilst the site is predominately located within Flood Zone 1 with areas to the south shown as Flood Zones 2 & 3. Flood Zone 1 would be representative of land at low probability of fluvial flooding, with less than 1 in 1,000 annual probability of river flooding (<0.1%).

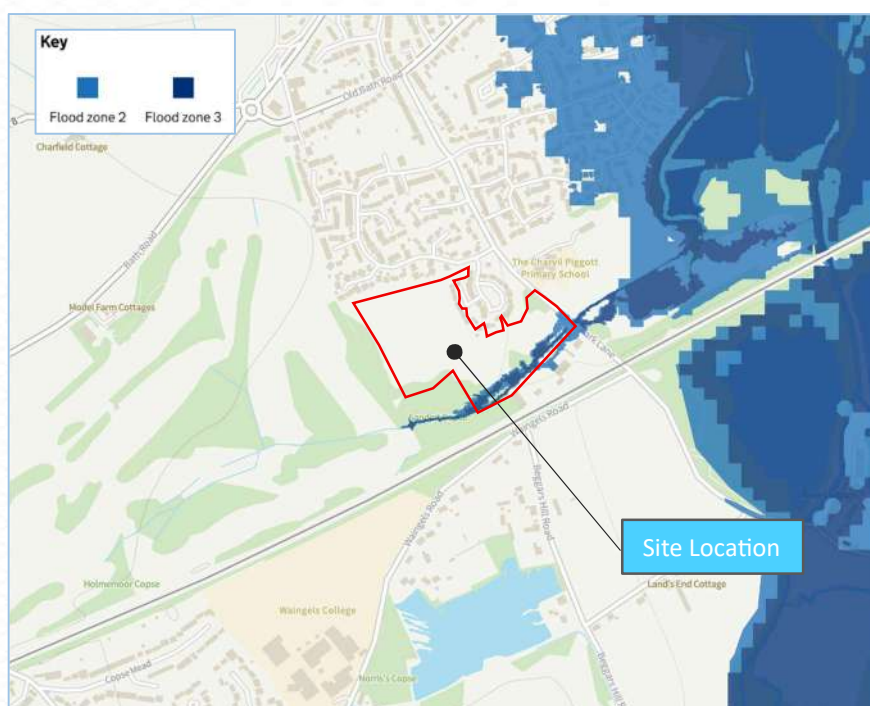


Figure 5.1: EA Flood Zone Map



Figure 5.2: EA Flood Zone Map (Climate Change)



Figure 5.3: EA Risk of Flooding from Seas / Rivers

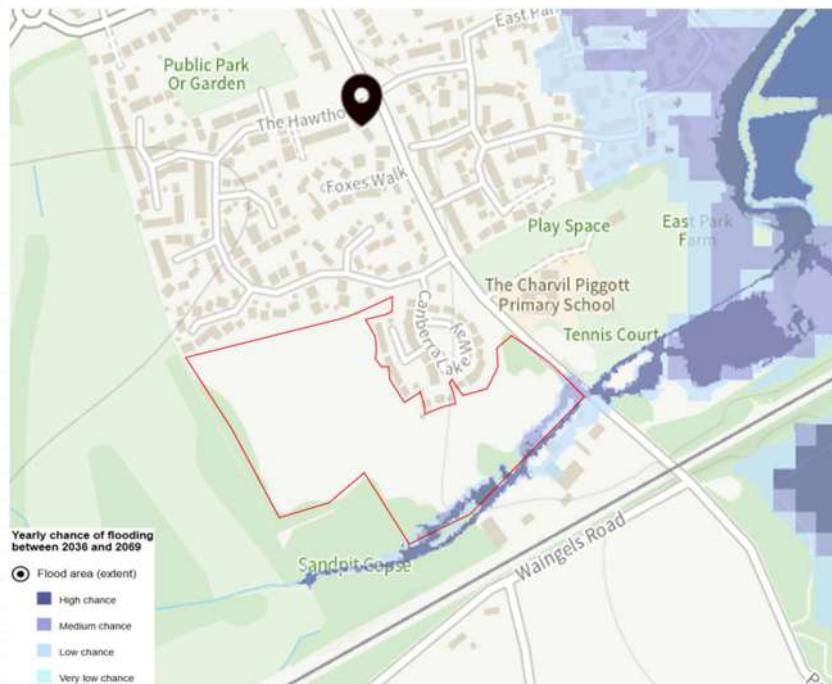


Figure 5.4: EA Risk of Flooding from Seas / Rivers (Climate Change)

5.2.3. Based on the review of mapping relating to fluvial flooding from information sources outlined above, the site overall is assessed to be at very low risk from fluvial flooding with the sections to the south shown to be at medium to high.

5.3 Surface Water Flooding

5.3.1. The Level 1 SFRA defines surface water flooding as ‘*Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.*’

5.3.2. The EA’s risk of flooding from surface water mapping provides an understanding of the areas which may be at greater risk of surface water flooding, with the maps showing critical flow paths and areas situated in topographic depressions that could flood following an extreme rainfall event. The mapping is produced using hydrological (rainfall) modelling in combination with a digital terrain model. The mapping only indicates where surface water flooding could occur due to local rainfall. It does not fully represent flooding that occurs from; ordinary watercourses, drainage systems or public sewers caused by catchment-wide rainfall events, rivers, or groundwater.

5.3.3. The surface water flood risk map from the EA’s website is shown in *Figure 5.2* below. Within the surface water flood mapping, you can view flood extents for the 1 in 30, 1 in 100, and 1 in 1000-year return periods; the below mapping displays the worst-case flood extents of 1 in 1000 year. The mapping shows there to be no areas of the site that are at risk of surface water flooding.

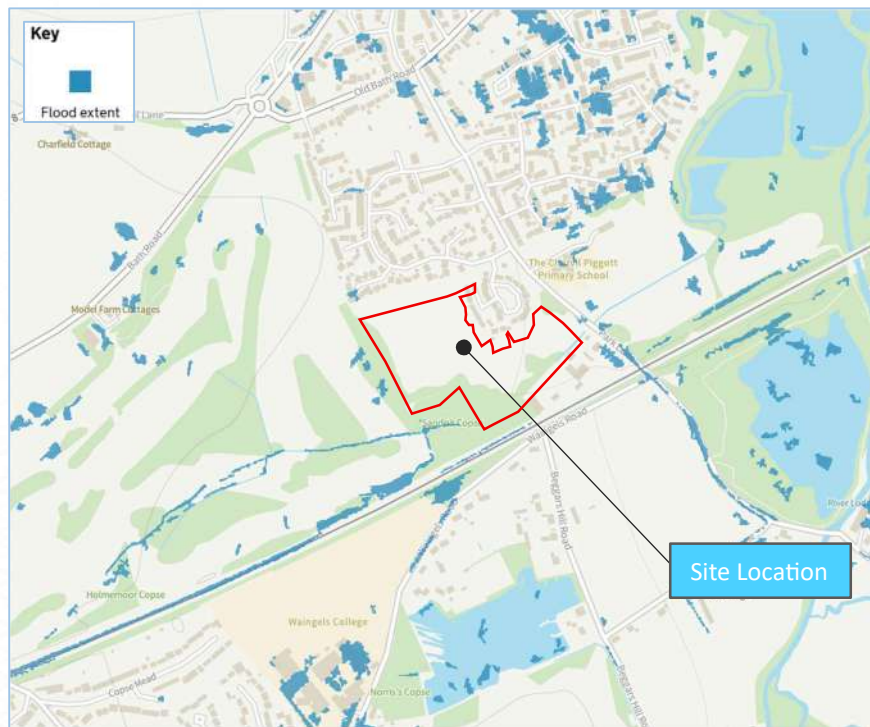


Figure 5.2: EA Risk of Surface Water Flooding Map

5.3.4. Based on the review of mapping relating to surface water flooding from information sources outlined above, the site is not assessed to be at risk from surface water flooding.

6 Managing the Risk of Flooding

6.1 The National Planning Policy Framework (NPPF)

6.1.1. The National Planning Policy Framework (NPPF) Planning Practice Guidance for Flood risk and coastal change National Planning Policy Framework (NPPF) advises that the objectives of a site-specific flood risk assessment are to establish whether:

- a proposed development is likely to be affected by current or future flooding from any source.
- it will increase flood risk elsewhere.
- the measures proposed to deal with these effects and risks are appropriate.
- the evidence for the local planning authority to apply (if necessary) the Sequential Test.
- the development will be safe and pass the Exception Test, if applicable.

6.1.2. *Figure 6.1* below provides a summary of the probability of flooding from each assessed source in Section 5, along with proposed measures to deal with the effects and risks posed by the development.

Source	Probability	Management Measures
Fluvial Flooding	Low	• All development will take place outside the areas defined as Flood Zone 2 & 3, with no works proposed to interact with these areas. Sections through the proposed development and Flood Zones are included in Appendix C for further reference. It is therefore considered this risk is managed and no further measures would be required.
Surface Water Flooding	Low	• Not applicable however SuDS would be used to minimise the rate of discharge, volume, and environmental impact of surface water runoff from the development. Further details of the SuDS approach are provided in Section 7 of this report. • Floor levels of dwellings would be set above road and surrounding landscaping levels for further protection from overland surface water flooding, whilst roads would be designed with falls to direct overland flows away from dwellings as shown on the finished levels plan in <i>Appendix F</i>.

Figure 6.1: Summary of Sources of Flooding and recommended Management Measures

6.1.3. In Section 5 it was established that the developed site predominantly lies in Flood Zone 1. The NPPF and Local Policy of Wokingham Borough Council advise that all land uses are appropriate in Flood Zone 1. Therefore, the proposed development is considered appropriate in terms of the sequential test, with it not necessary to apply the exception test.

6.1.4. The provision of a surface water drainage system as part of the proposed development would reduce the risk of surface water flooding in comparison to the existing situation, whilst the inclusion of Sustainable Drainage System's (SuDS) as part of a surface water drainage strategy would further reduce surface water flood risk to the site and surrounding area as they could be designed to minimise the rate of discharge, volume, and environmental impact of surface water runoff in comparison to the existing situation. The following section of this report outlines an approach for the disposal and management of surface water runoff from the development using SuDS.

7 Surface Water Management & Drainage Strategy

7.1 Introduction

7.1.1. This section of the report outlines an approach for the disposal and management of surface water runoff from the development, with it expected that any further details of the strategy would be provided in accordance with Condition detailed design information and construction drawings are available for the development.

7.2 Surface Water Drainage Policy & Guidance

7.2.1. At a national level, the Flood and Water Management Act 2010 (FWMA) was introduced with the specific aim of reducing the risk of flooding in England and Wales and improving water management. The Act states that Lead Local Flood Authorities (LLFA's), must act within the Environment Agency's (EA) national strategy and co-operate with neighbouring authorities to address flood risk in their area and contribute towards the achievement of sustainable development.

7.2.2. The FWMA states that Sustainable Drainage System's (SuDS) should manage rainwater with the following aims:

- reducing damage from flooding
- improving water quality
- protecting and improving the environment
- protecting health and safety
- ensuring the stability and durability of drainage systems

7.2.3. This has been incorporated into the NPPF and associated PPG, which recommends SuDS are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible to provide opportunities to:

- reduce the causes and impacts of flooding
- remove pollutants from urban run-off at source
- combine water management with green space with benefits for amenity, recreation, and wildlife

7.2.4. SuDS encompass a wide range of drainage techniques intended to minimise the rate of discharge, volume, and environmental impact of runoff and include; blue / green roofs; rainwater harvesting; soakaways / infiltration systems / infiltration trenches / permeable paving; swales / basins / ponds / wetlands / below ground attenuation tanks.

7.2.5. The PPG goes on to advise that generally, the aim should be to discharge surface run off as high up the as high up the following hierarchy of drainage options as reasonably practicable:

- into the ground (infiltration)
- to a surface water body
- to a surface water sewer, highway drain, or another drainage system
- to a combined sewer

7.2.6. The March 2015 DEFRA report "Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems" sets out the generic requirements for design of SuDS. It provides requirements for: flood risk outside the development; peak flow control; volume control; flood risk within the development; structural integrity; designing for maintenance considerations; and construction.

7.2.7. The July 2025 National Standards for sustainable drainage systems (SuDS) are intended for application in the design of surface water drainage systems for new infrastructure and development, whether on greenfield or brownfield sites and currently act as an addendum to the Non-statutory technical standards.

7.3 Wokingham Borough Council Sustainable Drainage Systems (SuDS) Strategy (Jan 2017)

4.4.1. The Wokingham Borough Council Sustainable Drainage Systems (SuDS) Strategy was developed in January 2017 to guide the implementation of SuDS in the Borough. The strategy aims to ensure that SuDS are integrated into the planning and design of new developments and retrofitting of existing sites to manage surface water runoff and improve water quality, biodiversity, and amenity.

The SuDS Strategy identifies the following key principles for the effective implementation of SuDS:

- SuDS should be used as the primary means of managing surface water runoff;
- SuDS should be designed to mimic natural drainage systems and manage water at source;
- SuDS should be designed to provide multiple benefits, such as flood risk management, water quality improvement, and biodiversity enhancement;
- SuDS should be designed to be sustainable, low maintenance, and have a long lifespan;
- SuDS should be integrated into the design and planning of new developments and retrofitting of existing sites;
- SuDS should be designed in a way that maximizes the use of available space and minimizes their impact on the built environment; and
- SuDS should be designed and maintained in a way that encourages community involvement and engagement.

7.4 Method of Discharge

7.4.1. In accordance with the hierarchy of drainage disposal options, *Figure 7.1* below provides an assessment of each methods suitability.

System	Assessment	Suitability
Store rainwater for later use.	Rainwater harvesting is the collection of rainwater runoff for use. Runoff can be collected from roofs and then used in place of mains water for certain applications. With the nature of development comprising residential dwellings it is likely that rainwater butts could be used to collect roof water for the purposes of irrigating domestic gardens.	✓
Discharge to ground by infiltration.	In Section 2, it was noted that soakage tests to BRE 365 were undertaken across the site. The recorded rates ranged between $\times 10^{-4}$ in the west and $\times 10^{-6}$ in the east. Whilst the infiltration rates permit the use of infiltration, winter groundwater monitoring confirmed elevated levels across the site between 0.33-0.62mbgl. In accordance with WBC standards, 1m from the base of infiltration systems is required to the highest recorded level could not be achieved and therefore discharge to ground is not considered feasible. The site investigation also identified the risk of pollution features known to be prevalent in the area limiting the potential use of infiltration to the be solely relied on and recommending a minimum of 10m from any foundations for structures, roads and railways.	✗
Discharge rainwater direct to a watercourse	In Section 2 it was identified that approximately 50 to 100 meters to the south of the site there is an ordinary watercourse feeding into the Old River. Whilst this watercourse lies predominantly in third party land, a small section attached to it is within highways land. It is feasible to discharge to the watercourse at no more than QBAR Greenfield runoff rate.	✓

Discharge rainwater to a surface water sewer / drain	In Section 2, a Thames Water surface water sewer was identified to exist along Park Lane to the east of the site which would be suitable to discharge surface water runoff to however it has been established that it would be possible to discharge runoff directly to a water course.	✗
Discharge rainwater to the combined sewer.	It has been established that it would be possible discharge of runoff directly to a water course, therefore it is not necessary to consider discharge to a combined sewer system.	✗

Figure 7.1: Surface Water Runoff Discharge Method

7.4.2. Based on the assessment in *Figure 7.1* above discharge of surface water to the existing drainage ditch adjacent the site and along Park Lane would be the most suitable method for disposal of surface water runoff from the development.

7.5 Runoff Management

7.5.1. The development would be provided with a new surface water drainage system that would discharge to the existing drainage ditch situation along the eastern boundary. The system should meet requirements set out in the March 2015 DEFRA report “*Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems*” and the July 2025 National standards for sustainable drainage systems (SuDS).

7.5.2. The site is predominately greenfield with it considered the following policies from the DEFRA report are considered relevant in connection with runoff management.

- S2: For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.”
- S4: Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event.
- S6: Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

7.5.3. Greenfield runoff rates and volumes for a variety of storm events up to the 1 in 100-year return period were calculated as part of the approved outline planning flood risk assessment ref: 13923-CRH-ZZ-ZZ-RP-Z-001 and included in *Figure 7.2* for reference.

Return Period	Greenfield Runoff 1 Ha	
	Rate (l/s)	Volume (m3)
2 (QBAR)	3.83	81
30	8.8	206
100	12.21	275

Figure 7.2: Greenfield Runoff Rates & Volumes

7.5.4. The CIRIA SuDS Manual 2015 recommends FEH methods as the preferred approach for developing runoff estimates for use in surface water. Pre and post development runoff rates and volumes have been estimated for a variety of storm events up to the 1 in 100-year return period based on the existing measured drained area taken from the drained areas plan included in *Appendix E*. The drained areas plan shows the areas of existing hardstanding and the proposed catchments, which include a 10% allowance for creep for future increases in the roof area of houses. Runoff rates and volumes have been estimated using the Modified Rational Method Formula based on 360-

minute rainfall profiles generated using FEH rainfall data. The calculations are included in *Appendix E*, with the results shown in *Figure 7.3* below.

Return Period	Brownfield Runoff (Post-development) 1.7 Ha	
	Rate (l/s)	Volume (m3)
2	78.5	435.9
30	172.3	957.0
30 + 35%	232.6	1291.9
100	223.2	1239.6
100 + 40%	312.5	1735.4

Figure 7.3: Post Development Brownfield Runoff Rates & Volumes

7.5.5. The global climate is changing as a result of human activity. For the UK, projections of future climate change indicate that more frequent short duration high intensity rainfall and more frequent periods of long-duration rainfall could be expected. The NPPF identifies that increased rainfall affects surface water flood risk and how drainage systems should be designed. It advises that development lifetime guidance should be used to determine appropriate climate change allowances for development with residential development to have a minimum lifetime of a 100 years. For flood risk assessments it advises that upper end allowances should be assessed with this done for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125). The site is identified to fall within the Loddon and tributaries Management Catchment. *Figure 7.4* below shows the climate change allowances for the catchment taken from the peak rainfall allowances map. The climate change allowances for the 1% and 3.3% annual exceedance probability events are shown to be 40% and 35%, which have been applied to these events in *Figure 7.3* above.

Loddon and tributaries Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	25%	35%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	40%
2070s	25%	40%

*Use '2050s' for development with a lifetime up to 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

Figure 7.4: Climate Change Allowances from Peak Rainfall Allowances Map
(<https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall>)

7.5.6. Figure 7.5 below compares runoff rates and volumes estimated for the greenfield situation and post development situation from Figure 7.2 and Figure 7.3. For true comparison purposes adjusted greenfield runoff rates and volumes are shown, which are based on the measured drained area in the post development situation.

Return Period	Greenfield		Post-Development		Difference	
	1.7 Ha		1.7 Ha			
	Rate (l/s)	Volume (m ³)	Rate (l/s)	Volume (m ³)	Rate (l/s)	Volume (m ³)
2 (QBAR)	6.5	137	78.5	435.9	72	+298.9
30	14.96	305.2	172.3	957.0	26.3	+651.8
30+35	14.96	305.2	232.6	1291.9	217	+986.7
100	20.76	467.5	223.2	1239.6	202.4	+772.1
100+40	20.76	467.5	312.5	1735.4	291.74	+1267.9

Figure 7.5: Runoff Assessment Summary Catchment B

7.5.7. Figure 7.5 shows that surface water discharge rates and volumes would be potentially significantly greater in the post development situation than runoff rates and volumes for the greenfield situation. This is linked to the proposed impermeable areas associated with the development and allowance for potential increases in rainfall intensities due to climate change over the development lifetime.

7.5.8. The SuDS Manual C753 (2015) advises that the difference in runoff volume between the development state and the equivalent greenfield (or possibly pre-development state where this is considered to be acceptable) is termed the Long-Term Storage Volume. It is this volume that should be prevented from leaving the site (via rainwater harvesting and / or infiltration) or, where this is not possible, controlled so that it discharges at very low rates that will have negligible impact on downstream flood risk. Only the greenfield (or pre-developed) runoff volume should be allowed to discharge at greenfield (or pre-developed) rates.

7.5.9. It would not be feasible to prevent the Long-Term Storage Volume from leaving site due to the expected underlying ground conditions known elevated groundwater levels and due to the development's potential limited demand for recycled rainwater.

7.5.10. Policy S2 & S4 of the March 2015 DEFRA Report advises that where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer, or surface water body in accordance with Policy S6, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

7.5.11. The SuDS Manual C753 advises that where there is extra volume generated by the development that has to be discharged (because there are no opportunities for it to be infiltrated and/or used on site), this volume should be released at a very low rate (e.g. < 2 l/s/ha or as agreed with the local drainage approving body and/or environmental regulator) and the 1:100 year greenfield allowable runoff rate reduced to take account of this extra discharge. The SuDS Manual C753 also advises an alternative approach to managing the extra runoff volumes from extreme events separately from the main drainage system is to release all runoff (above the 1-year event) from the site at a maximum rate of 2 l/s/ha or QBAR, whichever is the higher value (or as agreed with the drainage approving body and/or environmental regulator). This avoids the need to undertake more detailed calculations and modelling. Figure 7.6 below shows maximum allowable discharge rates for the developments drained catchment areas based on 2 l/s/ha and QBAR.

2 l/s/ha / QBAR	Maximum allowable discharge rate (l/s)
	Catchment B 1.7 Ha
2 l/s/ha	3.4
QBAR	6.5

Figure 7.6: Comparison of maximum allowable discharge rate at 2 l/s/ha & QBAR

7.5.12. Figure 7.6 identifies QBAR derives a higher value. Therefore, it is deemed appropriate in this instance to select QBAR values as the maximum allowable discharge rate for surface water runoff from the development.

7.5.13. SuDS that are able to control and attenuate the estimated surface water storage volumes identified in Figure 7.7 would need to be considered as part of the developments surface water drainage strategy

7.6 Sustainable Drainage Systems (SuDS)

7.6.1. SuDS should be used across the development to control surface water flows to required levels and to address other aims of surface water management, which are water quantity (flooding), water quality (pollution), biodiversity (wildlife and plants) and amenity. Figure 7.7 below provides an assessment of a range of SuDS techniques that can be used to minimise the rate of discharge, volume and environmental impact of runoff.

System	Assessment	Suitability
Rainwater Harvesting	Rainwater harvesting is the collection of rainwater runoff for use. Runoff can be collected from roofs and then used in place of mains water for certain applications. With the nature of development comprising residential dwellings, it is likely that rainwater butts could be used to collect roof water for the purposes of irrigating domestic gardens.	✓
Infiltration Systems	In Section 2, it was noted that ground conditions at the site are in part considered suitable for disposal of surface water to ground by infiltration systems however winter Groundwater monitoring confirmed elevated levels across the site and in accordance with the LLFA's requirement for 1m minimum to the base of infiltration features on this basis the use of infiltration systems is not considered appropriate for the site.	✗
Blue / Green Roofs	Green roofs are areas of living vegetation, installed on the top of buildings, for a range of reasons including visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. They can be adapted to incorporate blue roof systems beneath, which comprise of a cellular system used to provide further attenuation and storage of surface water. No units with flat roofs such as apartment blocks are proposed. The sites dwellings are all residential buildings, comprising of pitched roof profiles.	✗
Filter Strips	Filter strips are uniformly graded and gently sloping strips of grass or other dense vegetation that are designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration, and infiltration. They are often used as a pre-treatment facility before swales, bioretention systems and trenches and are generally located in landscaping and open space alongside roads and parking areas. They tend	✗

to demand significant land-take, which normally restricts their use, with it also not desirable for these systems to be in areas where trees or structures will cause shade conditions that limit grass growth. The use of filter strips is unlikely to be necessary for the development with these systems normally used on commercial / industrial developments where there is a higher risk of pollution and need for pre-treatment of surface water.

Filter Drains

Filter drains are shallow trenches filled with stone / gravel that create temporary subsurface storage for the attenuation, conveyance, and filtration of surface water runoff. Generally, these systems are located alongside roads and parking areas and used in conjunction with other systems. It is likely that filter drains could be used for the collection and conveyance of surface water, as well as in combination with other SuDS systems such as swales and permeable paving systems.



Bioretention Systems

Bioretention systems (including rain gardens / tree pits) are shallow landscaped depressions that can reduce runoff rates / volumes and treat pollution using engineered soils and vegetation. They are generally used for managing and treating runoff from frequent rainfall events with the main aim of providing interception. They also provide amenity and biodiversity benefits by providing a habitat for local plants and wildlife. Systems could be provided in the form of roadside rain gardens, bioretention swales and tree pits located alongside roads and other paved areas for the collection, treatment and conveyance of surface water runoff.



Permeable Pavements

Permeable pavements provide a pavement suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers. The water is temporarily stored beneath the overlying surface before it soaks into the ground or is collected by a filter drain where ground conditions do not permit infiltration. It is likely that permeable paving could be used to intercept and treat surface water runoff from private drives and parking bays. Utility corridor requirements and complexities associated with adoption of roads and sewer systems would limit potential for permeable paving systems to be used in the developments road network.



Swales

Swales are shallow, flat bottomed, vegetated open channels designed to convey, treat, and store runoff. They are generally suited for managing runoff from roads because they are a linear feature and easily incorporated into the roadside space. They are also suitable for managing runoff from car parks and other impermeable and permeable areas. Swales are normally incorporated into landscape and public open spaces and feature shallow slopes. Swales could be provided in areas of open space alongside the development's road network for the collection, treatment and conveyance of surface water runoff from roads. The systems would also provide amenity and biodiversity benefits by providing a habitat for local plants and wildlife.



Basins / Ponds

Basins are large, landscaped depressions that are normally dry except during and immediately following storm events, while ponds are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. The systems are generally strategically located in areas of open space and are designed to temporarily store runoff associated with extreme rainfall events while it is released at controlled rates.



Attenuation Tanks	Attenuation tanks comprise below ground storage systems that temporarily store runoff associated with extreme rainfall events while it is released at controlled rates. It would normally only be appropriate to consider their use where site constraints preclude the use of other methods or where they offer specific benefits in facilitating the delivery of SuDS design criteria for a site however are not considered required for the scheme.	✗
Proprietary Treatment Systems	Proprietary treatment systems are manufactured products that remove specified pollutants from surface water runoff. It would normally only be appropriate to consider their use where site constraints preclude the use of other methods or where they offer specific benefits in facilitating the delivery of SuDS design criteria for a site. Instances where this would be the case are likely to be limited.	✗

Figure 7.7: SuDS Assessment

7.7 Surface Water Drainage Strategy

7.7.1. The surface water drainage strategy proposes to split the development into 2 catchments in accordance with the site's natural topography. Flows from would be restricted to the maximum allowable discharge rates of 6.5 l/s (QBAR), with the systems designed to attenuate excess runoff on site for all rainfall events up to and including a 1 in 100-year event with 40% allowance for climate change.

7.7.2. The new surface water drainage system would form a surface water management train, using the SuDS selected from *Figure 7.7*, to collectively capture, convey, and store surface water runoff from development, whilst also delivering interception and pollution risk management. The SuDS facilities would also promote other environmental objectives of the development by providing a habitat for local plants and wildlife and wider amenity value.

7.7.3. The surface water drainage strategy approach for the development, based on the above principles, is outlined below and shown on the drainage strategy drawing included in *Appendix F*:

7.7.4. Surface water runoff from the development would be initially intercepted and treated as close to source as possible by the following SuDS.

- Permeable paving as shown in *Figure 7.8* below would be used for the interception and treatment of surface water runoff from parking areas. Permeable paving would allow surface water runoff to filter through a block paved surface into a filter zone of sub-base beneath the bedding layer. As a result of soakage testing and differences in permeability of soils across the site, flows would be collected via a perforated pipe connecting to the proposed below ground network however the system would not be lined with any impermeable membrane to promote infiltration.

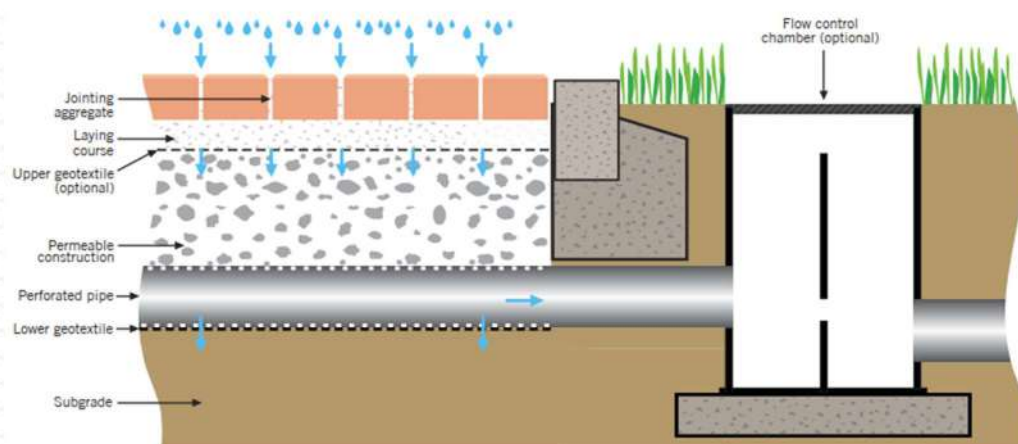


Figure 7.8: Typical partial infiltration permeable paving detail (Interpave)

- A combination of swales and rain gardens would be used alongside the road network and paved areas for interception, treatment and conveyance of road runoff. *Figure 7.9* below shows typical examples of swales and bioretention swales and dry swales. The swales would be designed as shallow features 250mm deep and receive runoff directly from the adjacent roads. The swales would incorporate a road gully situated 25mm above the surface to provide resilience against silt entering the system and promote infiltration. The gully in turn would be connected to the below ground surface water network.
- Rain gardens would operate on a similar basis receiving flows directly from the adjacent roads through which the water would permeate through the engineered porous medium and collected via a perforated pipe connecting to the below ground system.

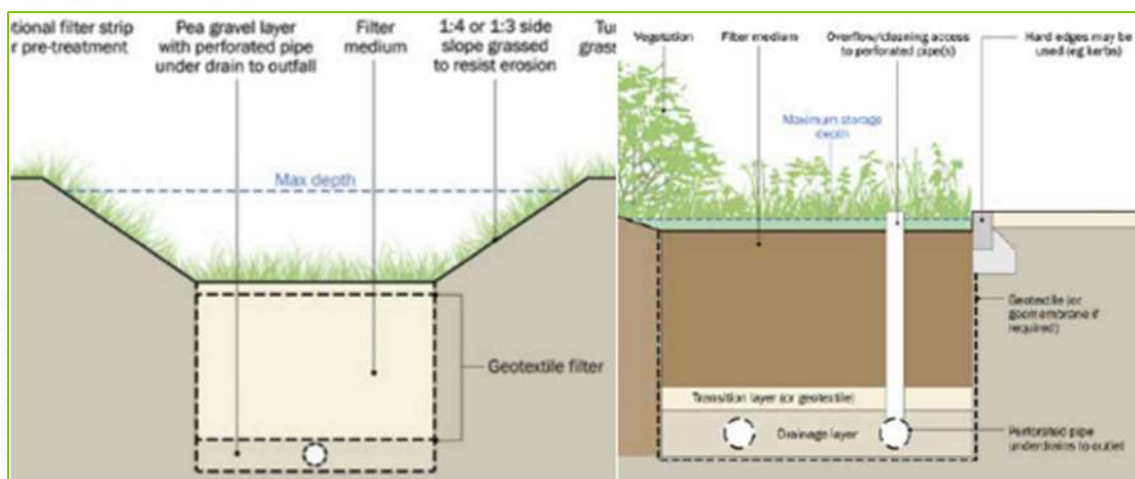


Figure 7.9: Typical swale and bioretention swale details (SuDS Manual)

- The source control systems would discharge to a traditional surface water sewer system located in the developments estate roads. In accordance with the topography of the site, the western parcel would direct flows to a small attenuation basin which would restrict flows before discharging to a downstream network. The surface water sewer systems for the main catchment would discharge to an attention basin located in southeast corner to allow flows to be stored with flows discharging offsite at the maximum design rate.
- As a result of the elevated groundwater levels, the basins would be lined with an impermeable liner to prevent ingress of groundwater and ensure capacity is not reduced.
- The attenuation basin to the southeast has been designed with low flow channels to direct flows to a deepened section with a permanent pool. The basin features a range of slopes comprising of 1 in 4 to the development side and a shallow section to with access through shallow 1 in 6 side slopes. *Figure 7.10* below shows typical example of a detention basin.

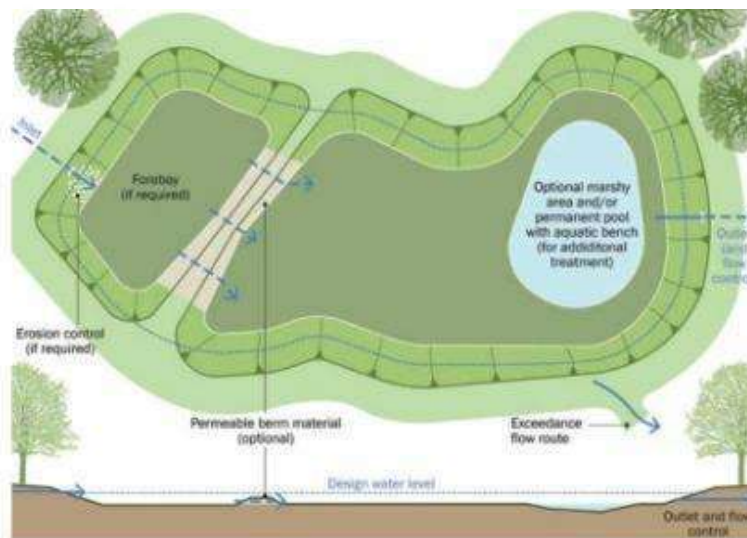


Figure 7.10: Typical examples of detention basin principles (SuDS Manual)

7.7.5. In combination the SuDS would form a surface water management train that collectively captures, conveys, and stores surface water runoff from the development whilst also delivering interception and pollution risk management. The strategy would also promote other environmental objectives of the development by using vegetated facilities that provide new habitats for local plants and wildlife. SuDS construction details have been produced for the proposed features and are included in *Appendix I* and provide further information on the proposed features properties and design.

7.8 Hydraulic Analysis

7.8.1. Causeway Flow software package has been used to analyse the capacity and hydraulic characteristics of the surface water drainage strategy in its entirety for a variety of storm events up to and including the 1 in 100-year storm return period with 40% allowance for climate change utilising FEH 2022 rainfall data.

7.8.2. The results of the analysis are included in *Appendix H* and should be read in conjunction with the pipe numbering shown on the drainage strategy *Appendix F*.

7.8.3. The results show that the system could control surface water runoff from the development to the proposed restricted rate of discharge for all analysed storm return periods up to and including 1 in 100-year event with 40% allowance for climate change.

7.8.4. *Figure 7.11* below compares the post development discharge rates and volumes extracted from the results to the greenfield and brownfield runoff rates and volumes.

Return Period (Year)	Greenfield 1.6 Ha		Post-Development 1.6 Ha	
	Peak Runoff Rate (l/s)	6 hr Runoff Volume (m ³)	Peak Runoff Rate (l/s)	6 hr Runoff Volume (m ³)
2	6.5	137	6.2	435.9
30	14.96	305.2	6.2	957.0
30+35%	14.96	305.2	6.2	1291.9
100	20.76	467.5	6.2	1239.6
100 year + 40%	20.76	467.5	6.4	1735.4

Figure 7.11: Comparison of Runoff Rates & Volumes – Catchment A

7.8.5. Figure 7.11 confirms that the surface water drainage scheme would be limited to the QBAR thus providing significant betterment to the existing situation in comparison to the full range of storm events.

7.8.6. Figure 7.11 show that the surface water drainage scheme would discharge at a greater volume than the greenfield runoff volume for the 1 in 100-year 6 hour rainfall event however, surface water runoff from the development has been limited to QBAR which is deemed to be a rate that does not adversely affect flood risk and provides a significant betterment to the pre-development volumes.

7.9 Exceedance

7.9.1. Overland surface water flows resulting from exceedance of the drainage system's capacity or resulting from a blockage should be managed in a manner that minimises the risks to people and the property. Finished levels for the scheme have been designed with this in mind and are shown on the finished level layout drawings included in Appendix F. The drawing shows proposed levels to be generally set at or above existing ground levels, with floor levels of dwellings raised above road and surrounding landscaping levels. Road design contours on the drawing and exceedance flow arrows show that overland exceedance surface water flood flows would be direct flows away from the proposed dwellings and existing properties.

7.9.2. The finished level design would ensure that people and property would remain protected from flooding in the event of exceedance of the surface water drainage systems capacity. Furthermore, 10% allowance has been made for additional roof area in calculations with the cover level of the storage features at least 300mm below the propose finished floor levels.

7.10 Water Quality

7.10.1. On residential developments, runoff from roads has the most potential to cause pollution of receiving surface water or groundwater sources. The CIRIA C753 SuDS Manual 2015 sets out requirements for delivering appropriate levels of treatment to surface water runoff using SuDS. Figures 7.12 below identify that the SuDS systems proposed in series would have a total pollution mitigation index exceeding the recommended pollution hazard index for sources of surface water runoff on the development, thus confirming the SuDS components would provide suitable treatment of surface water runoff.

Runoff Source	Pollution Hazard Index			SUDS Component	Mitigation Index		
	TSS	Metals	TPH		TSS	Metals	TPH
Residential Roofs (very low)	0.2	0.2	0.05	Rain Garden	0.8	0.8	0.8
				Swales	0.5	0.6	0.6
Driveways & Low Traffic Roads (low)	0.5	0.4	0.4	Permeable Paving	0.7	0.6	0.7
				Detention Basin	0.5	0.5	0.6
Total	0.7	0.6	0.45	Total	2.5	2.5	2.7

Figure 7.12 Pollution Mitigation Assessment

7.11 Amenity / Biodiversity

7.11.1. The development would maximise the opportunity for biodiversity and amenity benefits through areas of proposed open space, soft landscaping, buffer strips and gardens. In addition, vegetated SuDS are proposed for managing surface water runoff from the development in the form of swales, rain gardens and basins.

7.12 Management and Maintenance

7.12.1. Property owners would be responsible for the maintenance of the drainage system serving individual properties. Highway and shared systems would be offered for adoption or would be maintained as part of wider communal infrastructure by a management company funded by a communal service charge.

7.12.2. Management and maintenance plans for the sites drainage system would be finalised as part of the detailed stage design and be provided as part of discharging condition 28 of the Outline Planning Permission ref: 232704.

8 Foul Water Drainage Strategy

8.1.1. This section of the report outlines an approach for the disposal and management of foul water runoff from the development, with it expected that any further details of the strategy could be provided via a condition of the planning permission once detailed design information and construction drawings are available for the development.

8.1.2. Thames Water have been consulted regarding the existing foul sewer systems ability to accommodate foul water flows from the development. The consultation response is included in *Appendix G* and advises that the existing sewer network has insufficient capacity for foul water flows from the development. Consultation with Thames Water is underway for the proposed modelling and upgrade works to the network to accommodate the development. In accordance with Condition 44 of the outline planning permission, these works are required to be completed prior to occupation of the development and therefore would ensure sufficient capacity is made available.

8.1.3. The development would be provided with a new foul water drainage system comprising of a traditional gravity network of below ground pipework which as a result of the site being situated at a lower level than the public sewer would discharge to a proposed Type 3 adoptable pumping station. The foul water drainage strategy approach for the development, based on the above principles, is shown on the drainage strategy drawing included in *Appendix F*.

9 Conclusions

9.1.1. The site is predominantly located in Flood Zone 1, which is land assessed to not be at risk of tidal / fluvial flooding and has been determined to be at low risk of flooding from all other sources of flooding, with it also established that the development would not cause an increase in flood risk to the site or surrounding area as the measures below could be incorporated into the design of the development to deal with the effects and risks posed by the development.

- Use of SuDS to minimise the rate of discharge, volume, and environmental impact of surface water runoff from the development.
- Setting the finished level of development at or above existing ground level.
- Setting floor levels of dwellings above road and surrounding landscaping levels, with the developments roads also designed with falls to direct overland flows away from dwellings.

9.1.2. Discharge of surface water from the development is proposed to discharge directly to the watercourse which is considered to be the most appropriate method for disposal of surface water runoff from the development.

9.1.3. The development would be provided with a new surface water drainage system with flows proposed to be discharged to the existing drainage ditch at a restricted rate equal to QBAR. Winter groundwater monitoring undertaken confirmed elevated groundwater across the site and as such the use of infiltration is not considered appropriate in accordance with WBC requirements.

9.1.4. The surface water drainage systems have been designed to attenuate excess runoff on site for all rainfall events up to and including a 1 in 100-year event with 40% allowance for climate change

9.1.5. A variety of SuDS would be used to manage surface water runoff from the development. The systems could also be arranged in series to form an effective surface water management train that collectively captures, conveys, and stores surface water runoff from the development whilst also delivering interception and pollution risk management. The systems in conjunction with retained open space would also promote other environmental objectives of the development by providing a habitat for local plants and wildlife. The main components would include:

- Permeable paving for interception and treatment of surface water runoff from driveways and parking areas.
- Swales & bioretention rain gardens for interception, treatment and conveyance of road water runoff.
- Detention Basins.

9.1.6. The SuDS systems would suitably protect the development from surface water flooding and reduce surface water flood risk to the surrounding area through a reduction in greenfield runoff rates in comparison to the existing situation. Hydraulic analysis has confirmed that the SuDS systems would store and attenuate surface water runoff from the development for all rainfall events up to and including the 1 in 100-year storm return period with 40% allowance for climate change. Furthermore, 10% allowance has been made for additional roof area in calculations and finished levels are set a minimum of 300mm above any surface SuDS features.

9.1.7. The development would be provided with a new foul water drainage system comprising of a pumped system discharging to the Thames Water sewer located with the Hawthorns Road to the north. Thames Water have confirmed that the existing sewer network has insufficient capacity for foul water flows from the development however reinforcement works are being progressed and would be secured through discharge of Condition 44 of the outline planning.

9.1.8. In terms of flood risk and drainage strategy, it is concluded that the development can be occupied and operated safely and that there will be no increase in the level of flood risk to the site or neighbouring sites because of the proposed development. On this basis, the development would fulfil the aims of national and local planning policy in terms of flood risk and drainage strategy. However, any further details of the foul and surface water drainage strategy could be provided via a condition of the planning permission once detailed design information and construction drawings are available for the development if required.

Appendices

Appendix A	Topographical Survey
Appendix B	Ground Investigation
Appendix C	Existing Drainage Characteristics Plan & Flood Zone Sections
Appendix D	Site Layout
Appendix E	Drained Area Plan & Runoff Calculations
Appendix F	Drainage Strategy Layout & Finished Level Layout
Appendix G	Thames Water Correspondence
Appendix H	Hydraulic Analysis Results
Appendix I	SuDS Construction Details

Appendix A

Topographical Survey



TREE	GRTH	HEIGHT	SPREAD	SPECIES
1	0.6	10.0	2.0	OKM
2	0.6	10.0	2.0	OKM
3	3.0	18.0	7.0	ASH
4	0.6	10.0	2.0	OKM
5	0.6	10.0	2.0	OKM
6	0.6	10.0	2.0	OKM
7	0.6	12.0	2.0	ASH
8	2.6	16.0	5.0	OKM
9	0.6	12.0	3.0	OKM
10	0.6	12.0	3.0	OKM
11	0.6	12.0	2.0	ASH
12	0.6	12.0	3.0	OKM
13	0.6	12.0	3.0	OKM
14	0.6	12.0	2.0	ASH
15	0.6	12.0	2.0	OKM
16	0.6	12.0	2.0	OKM
17	0.6	12.0	3.0	OKM
18	0.6	12.0	3.0	OKM
19	0.6	12.0	3.0	OKM
20	0.6	12.0	3.0	OKM
21	2.6	14.0	6.0	WILLOW
22	2.6	14.0	6.0	WILLOW
23	0.6	12.0	2.0	OKM
24	206.6	12.0	2.0	OKM
25	206.6	12.0	2.0	OKM
26	0.6	12.0	2.0	OKM
27	206.6	12.0	2.0	OKM
28	206.6	12.0	2.0	OKM
29	0.6	12.0	2.0	OKM
30	0.6	12.0	2.0	OKM
31	0.6	12.0	2.0	OKM
32	0.6	12.0	2.0	OKM
33	0.6	12.0	2.0	OKM
34	1.0	10.0	5.0	OKM
35	0.6	12.0	2.0	OKM
36	0.6	12.0	2.0	OKM
37	0.6	12.0	2.0	OKM
38	0.6	14.0	2.0	SILVER BIRCH
39	MB	14.0	3.0	WILLOW
40	2.6	14.0	3.0	WILLOW
41	1.0	14.0	2.0	WILLOW
42	MB	14.0	2.0	WILLOW
43	MB	14.0	2.0	WILLOW
44	2.6	14.0	5.0	WILLOW
45	0.6	12.0	2.0	OKM
46	0.6	12.0	2.0	ASH
47	0.6	12.0	2.0	OKM
48	0.6	14.0	2.0	OKM
49	0.6	12.0	2.0	OKM
50	0.6	12.0	2.0	OKM

TREE	GRTH	HEIGHT	SPREAD	SPECIES
51	0.6	12.0	2.0	OKM
52	0.6	12.0	2.0	OKM
53	206.6	12.0	2.0	OKM
54	0.6	12.0	2.0	OKM
55	0.6	12.0	2.0	OKM
56	0.6	12.0	2.0	OKM
57	0.6	12.0	2.0	OKM
58	0.6	12.0	2.0	OKM
59	1.4	12.0	2.0	OKM
60	0.6	12.0	2.0	OKM
61	0.6	12.0	2.0	OKM
62	0.6	12.0	2.0	OKM
63	0.6	14.0	3.0	OKM
64	0.6	12.0	2.0	OKM
65	0.6	12.0	3.0	OKM
66	0.6	12.0	2.0	OKM
67	0.6	12.0	2.0	OKM
68	4.0	16.0	7.0	OKM
69	0.6	14.0	2.0	ASH
70	0.6	12.0	3.0	OKM
71	0.6	12.0	2.0	POPLAR
72	MB	10.0	3.0	POPLAR
73	0.6/1.4	16.0	5.0	POPLAR
74	1.4	16.0	5.0	POPLAR
75	0.6	12.0	3.0	OKM
76	0.6	12.0	2.0	OKM
77	1.0	14.0	5.0	OKM
78	0.6	12.0	2.0	OKM
79	1.0	14.0	4.0	OKM
80	0.6	12.0	2.0	OKM
81	0.6	12.0	3.0	OKM
82	0.6	14.0	3.0	OKM
83	0.6	12.0	2.0	OKM
84	0.6	16.0	2.0	POPLAR
85	0.6	14.0	2.0	OKM
86	0.6	16.0	3.0	POPLAR
87	0.6	14.0	2.0	POPLAR
88	0.6	14.0	2.0	OKM
89	MB	14.0	4.0	POPLAR
90	400.8	14.0	5.0	POPLAR
91	MB	14.0	5.0	POPLAR
92	MB	14.0	3.0	POPLAR
93	0.6	14.0	3.0	OKM
94	0.6	14.0	2.0	POPLAR
95	206.6	14.0	2.0	POPLAR
96	0.6	10.0	2.0	POPLAR
97	0.6	10.0	2.0	POPLAR
98	206.6	14.0	2.0	POPLAR
99	206.6	14.0	2.0	POPLAR
100	206.6	14.0	2.0	POPLAR

TREE	GRTH	HEIGHT	SPREAD	SPECIES
101	1.0	16.0	3.0	POPLAR
102	3.2	16.0	4.0	POPLAR
103	1.8	18.0	7.0	OKM
104	1.8	18.0	7.0	OKM
105	1.8	18.0	7.0	OKM
106	1.8	20.0	8.0	ASH
107	0.6	8.0	5.0	POPLAR
108	1.4	16.0	7.0	POPLAR
109	0.6	16.0	5.0	POPLAR
110	0.6	16.0	4.0	ASH
111	0.6	16.0	4.0	ASH
112	0.6	16.0	4.0	ASH
113	0.6	8.0	4.0	POPLAR
114	206.6	16.0	4.0	POPLAR
115	0.6/1.0	16.0	4.0	POPLAR
116	0.6/1.0	16.0	5.0	POPLAR
117	0.6	16.0	5.0	POPLAR
118	206.6	16.0	4.0	POPLAR
119	206.6	12.0	3.0	POPLAR
120	0.6	16.0	3.0	POPLAR
121	0.5	13.0	3.0	POPLAR
122	400.8	16.0	4.0	POPLAR
123	1.0	18.0	5.0	SILVER BIRCH
124	601.2	16.0	7.0	WILLOW
125	0.6	16.0	4.0	POPLAR
126	206.6	16.0	4.0	POPLAR
127	201.1	16.0	5.0	POPLAR
128	0.6	8.0	4.0	SURVEY OKM
129	0.6	8.0	4.0	SURVEY OKM
130	1.1	14.0	5.0	SURVEY OKM
131	0.6	14.0	3.0	POPLAR
132	0.6	8.0	4.0	SURVEY OKM
133	1.1	16.0	7.0	POPLAR
134	1.6	20.0	7.0	OKM
135	1.4	16.0	12.0	POPLAR
136	0.6	16.0	3.0	POPLAR
137	1.0	14.0	3.0	POPLAR
138	206.6	16.0	3.0	POPLAR
139	1.6	18.0	6.0	WILLOW
140	0.6	8.0	4.0	WILLOW
141	1.0	8.0	4.0	WILLOW
142	0.6	4.0	4.0	WILLOW
143	0.6	8.0	4.0	BEECH
144	0.6	13.0	3.0	POPLAR
145	1.0	14.0	3.0	POPLAR
146	400.8	16.0	4.0	POPLAR
147	206.6	14.0	3.0	POPLAR
148	1.0	14.0	3.0	POPLAR
149	206.6	10.0	4.0	POPLAR
150	0.6	12.0	3.0	POPLAR

TREE	GRTH	HEIGHT	SPREAD	SPECIES
151	30.0	8.0	4.0	POPLAR
152	0.6	12.0	3.0	POPLAR
153	0.6	16.0	4.0	HORN BEAM
154	1.6	18.0	6.0	HORN BEAM
155	1.6	20.0	8.0	ASH
156	1.6	20.0	8.0	ASH
157	3.2	12.0	8.0	ASH
158	MB	6.0	4.0	HAZEL
159	MB	6.0	4.0	HAZEL
160	0.5	6.0	2.0	OKM
161	0.5	6.0	2.0	OKM
162	MB	5.0	3.0	HAZEL
163	4.0	8.0	6.0	HAZEL
164	3.8	18.0	8.0	OKM
165	3.8	22.0	8.0	ASH
166	0.6	8.0	3.0	ASH
167	0.6	8.0	3.0	OKM
168	0.6	8.0	3.0	OKM
169	1.4	16.0	5.0	OKM
170	1.4	16.0	5.0	OKM
171	0.6	14.0	3.0	POPLAR
172	0.6	14.0	3.0	POPLAR
173	0.6	14.0	3.0	POPLAR
174	0.6	14.0	3.0	POPLAR
175	0.6	14.0	3.0	POPLAR
176	0.6	14.0	3.0	POPLAR
177	0.6	14.0	3.0	POPLAR
178	0.6	14.0	3.0	POPLAR
179	206.6	14.0	3.0	POPLAR
180	1.4	14.0	3.0	POPLAR
181	1.0	14.0	3.0	POPLAR
182	1.4	14.0	3.0	POPLAR
183	1.2	14.0	3.0	POPLAR
184	1.0	14.0	3.0	POPLAR
185	1.2	14.0	3.0	POPLAR
186	1.0	14.0	3.0	POPLAR
187	0.6	14.0	3.0	POPLAR
188	0.6	8.0	3.0	ASH
189	0.6	8.0	3.0	OKM
190	0.6	8.0	3.0	OKM
191	0.6	8.0	3.0	OKM
192	0.6	8.0	3.0	OKM
193	0.5	6.0	5.0	HAZEL
194	1.5	6.0	5.0	POPLAR
195	200.6	14.0	3.0	POPLAR
196	0.6	14.0	3.0	POPLAR
197	0.6	14.0	3.0	POPLAR
198	0.6	14.0	3.0	POPLAR
199	0.6	14.0	3.0	POPLAR
200	0.6	14.0	3.0	POPLAR

TREE	GRTH	HEIGHT	SPREAD	SPECIES
201	0.6	14.0	3.0	POPLAR
202	1.2	16.0	4.0	POPLAR
203	0.6	6.0	3.0	OKM
204	0.6	6.0	3.0	OKM
205	0.6	6.0	3.0	OKM
206	0.6	6.0	3.0	OKM
207	201.8	22.0	10.0	OKM
208	1.2	18.0	8.0	OKM
209	202.0	22.0	10.0	OKM
210	201.8	22.0	10.0	OKM
211	0.6	8.0	4.0	OKM
212	0.6	8.0	3.0	OKM
213	0.6	8.0	3.0	OKM
214	0.6	8.0	3.0	OKM
215	0.6	8.0	3.0	OKM
216	0.6	8.0	3.0	OKM
217	0.6	8.0	3.0	OKM
218	0.6	8.0	3.0	SILVER BIRCH
219	305.0	6.0	3.0	WILLOW
220	1.0	8.0	4.0	OKM
221	0.6	8.0	4.0	OKM
222	0.5	8.0	3.0	OKM
223	0.5	8.0	3.0	OKM
224	0.5	8.0	3.0	OKM
225	1.0	8.0	3.0	OKM
226	1.0	8.0	3.0	OKM
227	1.0	8.0	3.0	OKM
228	1.0	8.0	3.0	OKM
229	1.0	8.0	3.0	OKM
230	1.0	8.0	3.0	OKM
231	1.0	8.0	3.0	OKM
232	1.0	8.0	3.0	OKM
233	1.0	8.0	3.0	OKM
234	1.0	8.0	3.0	OKM
235	1.0	8.0	3.0	OKM
236	1.0	8.0	3.0	OKM
237	1.0	8.0	3.0	OKM
238	1.0	8.0	3.0	OKM
239	1.0	8.0	3.0	OKM
240	1.0	8.0	3.0	OKM
241	1.0	8.0	3.0	OKM
242	1.0	8.0	3.0	OKM
243	1.0	8.0	3.0	OKM
244	1.0	8.0	3.0	OKM
245	1.0	8.0	3.0	OKM
246	1.0	8.0	3.0	OKM
247	1.0	8.0	3.0	OKM
248	1.0	8.0	3.0	OKM
249	1.0	8.0	3.0	ASH
250	0.6	8.0	3.0	OKM

TREE SCHEDULE				
TREE	GRTH	HEIGHT	SPREAD	SPECIES
251	1.0	8.0	3.0	OKM
252	1.0	8.0	3.0	OKM
253	1.0	8.0	3.0	OKM
254	0.6	8.0	3.0	OKM
255	1.0	8.0	3.0	OKM
256	1.0	8.0	3.0	OKM
257	1.0	8.0	3.0	OKM
258	1.0	8.0	3.0	OKM
259	1.0	8.0	3.0	OKM
260	1.0	8.0	3.0	OKM
261	0.6	8.0	3.0	OKM
262	0.6	8.0	3.0	OKM
263	0.6	8.0	3.0	OKM
264	0.6	10.0	5.0	HAWTHORN
265	0.6	10.0	5.0	OKM
266	0.6	10.0	5.0	OKM
267	30.0	10.0	5.0	OKM
268	0.6	10.0	5.0	OKM
269	30.0	10.0	5.0	OKM
270	0.6	10.0	5.0	OKM
271	30.0000	30.0000	30.0000	XXXXXX
272	0.6	10.0	5.0	OKM
273	0.6	10.0	5.0	OKM
274	0.6	10.0	5.0	OKM
275	0.6	10.0	5.0	OKM
276	0.6	10.0	5.0	OKM
277	1.1	10.0	5.0	OKM
278	1.1	10.0	5.0	OKM
279	0.6	10.0	5.0	OKM
280	0.6	10.0	5.0	OKM
281	0.6	10.0	5.0	OKM
282	0.6	10.0	5.0	OKM
283	1.1	10.0	5.0	OKM
284	0.6	10.0	5.0	OKM
285	1.1	10.0	5.0	OKM
286	1.2	10.0	5.0	OKM
287	1.2	10.0	5.0	OKM
288	1.0	10.0	5.0	OKM
289	1.0	10.0	5.0	OKM
290	1.0	10.0	5.0	OKM
291	1.0	10.0	5.0	OKM
292	1.2	10.0	5.0	MAPLE
293	1.2	10.0	5.0	MAPLE
294	MB	8.0	3.0	HAZEL
295	0.6	8.0	3.0	OKM
296	MB	8.0	3.0	HAZEL
297	0.6	8.0	3.0	OKM
298	0.6	8.0	3.0	OKM
299	0.6	8.0	3.0	OKM
300	1.0	8.0	3.0	OKM

Appendix B

Ground Investigation Location Plan & Log Results

DRAFT

Bellway Homes

Phase I Desk Study

&

Phase II

Geotechnical and Geo-Environmental Report

Land Adj. Park Lane

Charvil

Wokingham

RG10 9TR

Report No: 25-07-12

August 2025

DOCUMENT RECORD

Report Title Phase I Desk Study and Phase II Geotechnical and Geo-Environmental Report

Project Address Land Adj. Park Lane, Charvil, Wokingham, RG10 9TR

Project Number 25-07-12

Client Name Bellway Homes (Thames)

Issue No Date	Status	Prepared by	Checked by
1 August 2025	Draft Report	Lee Ashworth B.Sc. M.Sc. F.G.S Engineering Geologist	Fiona White B.Sc. M.Sc. F.G.S. Engineering Geologist
		SIGNATURE 	SIGNATURE 

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APPENDICES

APPENDIX A - PLANS

-  Site Location Plan
-  Development Proposal Plan
-  Exploratory Hole Plan – Existing and Proposed
-  Geological Plan
-  Site Photographs

APPENDIX B – SITE INFORMATION

-  Cable Percussive Borehole Logs
-  Window Sampler Borehole Logs
-  Super Heavy Dynamic Probes
-  Trial Pit Logs
-  Soakaway Results
-  CBR Results
-  Gas Monitoring

APPENDIX C – LABORATORY INFORMATION

-  Geotechnical Testing
-  Geo-Environmental Testing
-  HazWasteOnline Classification Sheets

APPENDIX D – DESK STUDY INFORMATION

-  Groundsure Report
-  Historical OS Maps

EXECUTIVE SUMMARY

Site Location	Land Adj. Park Lane, Charvil, Wokingham, RG10 9TR
OS Grid Reference	477508, 175191
Development Proposals	The proposed development includes the construction of seventy-five residential dwellings, including a range of two-bed, three-bed, four-bed, and five-bed dwellings. The red line area shown on the development proposal plan totals 17.25 acres. The proposed dwellings include private gardens and driveways. There will also be access roads constructed, public open space, including an allotment area and soft landscaping. It is proposed to construct attenuation basins for drainage, and there is a flood zone limit along the southern boundary. The main access will remain the same via Park Lane to the east, and it is proposed to construct pedestrian access to the existing residential estates to the north. (Drawing No. 25.2208.1000, FINC architects Ltd., April 2025)
Published Geology	Reference to the British Geological Survey website and Sheet 268, Reading, 2000, indicates that the site is directly located on superficial deposits from the Quaternary Period, including River Terrace Deposits (4) underlying the western half of the site and the Kempton Park Gravel Member underlying the eastern extreme of the site. There is a space at the centre of the site where superficial deposits are absent. The superficial deposits are underlain by the Lambeth Group from the Paleogene Period. The Lambeth Group is recorded underlying the western half of the site. The eastern half of the site is underlain by the Seaford Chalk Formation and New Haven Chalk Formation (Undifferentiated), part of the White Chalk Subgroup (formerly Upper Chalk) from the Cretaceous Period.
Site History	Historical information indicates the majority of the site remains unaltered from the first historical records, remaining an open, undeveloped field. The exception being a small area to the east of the site, which has been used as a builder's yard by Hicks Development Ltd. The walkover survey indicated this area comprised a part tarmac, part engineered granular fill surface used for storing building materials, including bricks, plastic drains, pallets, and fences. Machinery, including an excavator and telehandler, was also stored in this area. A concrete slab is located to the north, previously used for supporting concrete silos. The remaining area of the site has remained undeveloped fields, which were once used for motocross, with dirt tracks visible on satellite imagery. Spoil heaps comprising topsoil from the builder's yard and the new residential estate to the north are present on site.
Ground Conditions Encountered	This ground investigation has identified that the underlying ground conditions can be summarised as:  Localised Made Ground exists underlying the builder's yard and a small pocket at the centre of the site – maximum thickness 0.70m bgl  Topsoil underlies the majority of the site  River Terrace Deposits underlie the near-surface soils down to depths of 8.00m bgl in the west and 0.95m in the east (thinning in a south-east direction)  River Terrace Deposits were variable but predominantly granular sand and gravel (non-shrinkable). However, significant layers of cohesive soil were encountered within CT5, TP1, TP3, TP6, TP9, and BH1. Laboratory testing proved this material to be of medium shrinkability in accordance with NHBC guidelines  The Lambeth Group was encountered across the site down to proven depths of 8.90m and 13.70m bgl (thinning to the east)  The Lambeth Group comprised predominantly soft to firm and firm to stiff, dark grey, green, silty clay with shell debris and calcareous horizons, and dense, dark grey, green, very sandy clayey silt with shell debris. Laboratory testing has proven this material contains layers of highly shrinkable soil in accordance with NHBC guidelines  The White Chalk Subgroup underlies the Lambeth Group at depths below 8.90m bgl, proven down to depths in excess of 25.00m bgl (the maximum depth achieved by this ground investigation)  The White Chalk Subgroup was encountered as structureless, off-white chalk with layers of Grade Dm and Grade Dc. High SPT 'N' values within this material indicate competent strata, potentially indicating higher chalk grades than Grade D  The southern boundary of the site is situated in a flood risk zone; as such, groundwater levels are expected to vary seasonally. The ground investigation was undertaken within the summer months, when groundwater levels are at their deepest. See section 6.3 for further details  Localised desiccation was encountered as shown on the geological plan within Appendix A (area highlighted blue and a smaller area surrounding TP9)  Given the underlying chalk strata, there is the potential for chalk dissolution features, see section 6.2 for further details

Groundwater Encountered	Groundwater was encountered at significant depths ranging between 7.90m and 13.00m bgl, recorded to be at similar depths to the interface between the Lambeth Group and the underlying chalk strata. In addition, minor perched water levels were recorded within CT1 and TP5 resting within the River Terrace Deposits at depths of 1.50m and 2.80m bgl, respectively. Subsequent groundwater monitoring also recorded perched water levels within CT5 at depths of 3.36m bgl
Contamination	Currently, it is considered that the risk of contamination to construction workers, end users and surrounding residents from the proposed development at this site is very low, and as such, no further works or remedial measures are considered necessary prior to development.
Sulphate Attack on Underground Concrete	The following design sulphate class and aggressive chemical environment classification should be applied: Made Ground: DS-1/AC-1 River Terrace Deposits: DS-1/AC-1 Lambeth Group: DS-4/AC-4 White Chalk Subgroup: DS-1/AC-1
Foundations	Based on the desiccation assessment, deeper foundations will be required in the eastern area of the site, as shown on the geological plan highlighted in blue in Appendix A. The zone of desiccation was proven down to a maximum depth of 6.50m bgl within BH1. The western half of the site is predominantly underlain by granular soils considered to be non-shrinkable, and as such, conventional shallow foundations are considered viable. The only exception applies to the area surrounding TP9, where significant layers of cohesive soils were encountered with a soil sample showing evidence of desiccation. It is considered that further testing should be undertaken to prove the extent of desiccation, which will dictate the required foundation depth. See section 6.5 for further details.
Waste Soil Classification	Currently, the waste soil on site is recommended to be classified as follows: Made Ground (Engineered Fill): 17 01-07 – Non-Hazardous Topsoil: 17 05 04 – Inert Topsoil (Spoil Heaps) 17 05 04 – Inert Natural Soil: 17 05 04 – Inert
Recommendations	We recommend that a watching brief should be undertaken during the construction phase, and if, during development, any previously undiscovered contamination (including visual or olfactory evidence) is found, then site management should be immediately informed and inspection by a suitably qualified person should be undertaken. Given the findings of the desk study, intrusive investigation and laboratory testing, there are complex ground conditions which require further assessment:  The area highlighted blue on the geological plan within Appendix A has found evidence of desiccation down to a proven depth of 6.50m bgl as shown within BH1. Further investigation should be undertaken to prove the ground conditions identified within BH1 are consistent across the area highlighted in blue to suitably design piled foundations  Further investigation incorporating deep boreholes and probes is recommended to provide evidence that dissolution features are not present, which could negatively impact deeper foundations  The western half of the site highlighted yellow on the geological plan in Appendix A is predominantly underlain by granular soils considered to be non-shrinkable, and as such, conventional shallow foundations are considered viable. However, foundations should be reinforced to combat potential differential settlement caused by foundations crossing both granular and cohesive soil  The only exception applies to the area surrounding TP9, where significant layers of cohesive soils were encountered with a soil sample showing evidence of desiccation. It is considered that further testing should be undertaken to prove the extent of desiccation, which will dictate the required foundation depth  Soakaways could be viable at this site; however, given the known flood risk zone along the southern boundary of the site, it is considered that groundwater levels are likely to rise during the wetter winter months. Groundwater monitoring should be undertaken over the winter period to prove potential fluctuations in groundwater; this will likely be required by the LLFA  In addition, as per CIRIA C574, soakaways should be placed at least 10m away from foundations, roads or railways  A small pit filled with wooden sleepers was observed during the walkover survey located along the western boundary of the builder's yard. It is recommended prior to development; the sleepers are removed and the underlying material inspected. Should loose soils indicating potential dissolution features or Made Ground soils be encountered, further assessment should be undertaken by a suitably qualified person.

This executive summary must be read in conjunction with the full report text.

FACTUAL

1.1 INTRODUCTION

Geo-Integrity Ltd were commissioned by Daniel Giles of Bellway Homes Ltd. (Thames Valley), via email dated 29th July 2025, to undertake a Phase I Desk Study and Phase II Factual and Interpretative Geotechnical and Geo-Environmental Report for Land Adj. Park Lane, Charvil, Wokingham, RG10 9TR, in order to inform the design and construction of the proposed development.

This report describes desk-based searches of geological, environmental and historical information, the fieldwork and laboratory testing undertaken and provides an interpretative section of the geotechnical and geo-environmental data from this investigation to inform the proposed development.

The site is located at National Grid Reference 477508, 175191.

The report is likely to be reviewed by the Wokingham Borough Council with reference to the NPPF. Once the redevelopment is completed, and as a minimum, the land must not be capable of being determined as 'contaminated land' under the terms of Part IIA of the Environmental Protection Act 1990. However, it also states that "Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner." As such, the desk study in this report is the first stage in investigating whether the site is likely to be considered "contaminated", in accordance with clause 196 of the NPPF.

The objectives of this phase I and phase II interpretative report are: -

-  To undertake a site walkover to identify any potential pollution sources or geotechnical hazards on the site.
-  To gather historical, geological and environmental information.
-  Briefly summarise the site development proposals and site setting.
-  To describe and report the fieldwork undertaken at the site.
-  To describe and report the geotechnical and chemical laboratory work undertaken on selected samples.
-  To provide an interpretation of the results of this investigation with regards to the geotechnical properties, and geo-environmental and waste disposal implications for the proposed development.

The investigation was performed in accordance with the general requirements of BS 5930:2015, BS EN 1997-2 (2007), BS EN ISO 22475-1 (2006) and other relevant related standards identified below. The fieldwork took place across six days, starting on the 31st of July 2025 and finishing the following week on the 7th of August 2025.

1.2 SOURCES OF INFORMATION

The following sources of information have been used to compile this report: -

-  Extracts of available historical Ordnance Survey (OS) maps covering the period from 1872 to 2025, which are presented in the Appendices.
-  Groundsure Report Ref GS-6CQ-TB2-LMT-5BG included in the Appendices.
-  Geology of the Reading district — brief explanation of the geological map sheet 268 Reading, S J Mathers and N J P Smith, 2000
-  The British Geological Survey (BGS) and Environment Agency (EA) websites.
-  A site reconnaissance visit was undertaken on the 31st of July 2025.
-  Information from various internet sites on site history and environmental setting.

It should be noted that the information provided in the desk study is obtained from independent third-party sources. It is provided in good faith, but no guarantee can be provided as to its accuracy. The desk study information is not necessarily exhaustive, and further information relevant to the site may be available from other sources.

1.3 DEVELOPMENT PROPOSALS

The proposed development includes the construction of seventy-five residential dwellings, including a range of two-bed, three-bed, four-bed, and five-bed dwellings. The red line area shown on the development proposal plan totals 17.25 acres. The proposed dwellings include private gardens and driveways. There will also be access roads constructed, public open space, including an allotment area and soft landscaping. It is proposed to construct attenuation basins for drainage, and there is a flood zone limit along the southern boundary. The main access will remain the same via Park Lane to the east, and it is proposed to construct pedestrian access to the existing residential estates to the north. (Drawing No. 25.2208.1000, FINC architects Ltd., April 2025)

2 PHASE I DESK STUDY

2.1 WALKOVER SURVEY

A site walkover survey was undertaken on the 31st of July 2025. Site location and layout plans are included in Appendix A, along with a selection of photographs taken during the survey.

The site is located at the southern edge of the village of Charvil, Berkshire, England. The site is accessed via Park Lane along the eastern boundary.

At the time of the walkover survey, the site comprised two distinguishable areas:

- 1) A small area at the eastern boundary comprises a tarmacked entrance leading to an area of engineered fill used for storing shipping containers, temporary portable offices, and welfare facilities, as well as various building materials including bricks, wooden pallets, plastic pipes, plastic drainage (tanks, pipes etc.), hedges fencing, chapter 8 barriers, metal skips with used paint jars/tubs. Machinery, including an excavator and telehandler, was stored in this area. A concrete slab was located at the north of the site, and it is understood that this was previously supported by two cement silos. This compound was previously used by Hicks Developments Ltd. for the recent housing development located immediately north of the site. A staff member from Hicks Development provided information on the compound, including known services. A land-drain was installed around the perimeter of the compound, water supply pipes and an electricity supply also enter the site from the east along the southern edge of the tarmac road, which are connected to the shipping containers and the concrete floor slab to the north. An underground surface water tank is located to the south of the compound. Along the western boundary of the builder's yard was a pit filled with wooden sleepers and covered by a heras fence panel.
- 2) The remaining land to the east comprises undeveloped fields with sporadic trees both on site and along the boundaries. There are spoil heaps located immediately west of the existing compound and at the centre of the site, which are understood to comprise topsoil sourced from areas including the area of engineered fill at the east of the site and the recent development immediately north-east of the site. It is understood that this land has previously been used by the land-owner for motocross practice.

The site boundaries were generally marked by fences and trees/hedges. A small woodland exists to the south-west, known as Sandpit Copse. Residential dwellings are located immediately north, The Charvil Piggott Primary School is located immediately east, a small commercial estate is located to

the south, and Sonning Golf Club is located immediately west. The commercial estate houses a gym, static caravans, a domestic and commercial waste water service, and a mobile valeting service. A train line located south of the commercial estate trends north-east to south-west.

The walkover survey was undertaken to identify potential sources of contamination to aid the human-health risk assessment. No significant sources of contamination were recorded during the walkover survey; however, the existing compound has likely introduced Made Ground soils to the site, which may locally contain levels of contamination, and the storage of materials and machinery may have introduced contaminants via accidental leakages and spillages such as oil/fuel. There are also spoil heaps located on site, which are understood to comprise topsoil from areas within and outside the investigation area, but may locally comprise extraneous material, given the reworked nature.

2.2 GEOLOGY

2.2.1 *Published Geology*

Reference to the British Geological Survey website and Sheet 268, Reading, 2000, indicates that the site is directly located on superficial deposits from the Quaternary Period, including River Terrace Deposits (4) underlying the western half of the site and the Kempton Park Gravel Member underlying the eastern extreme of the site. There is a space at the centre of the site where superficial deposits are absent. The superficial deposits are underlain by the Lambeth Group from the Paleogene Period. The Lambeth Group is recorded underlying the western half of the site. The eastern half of the site is underlain by the Seaford Chalk Formation and New Haven Chalk Formation (Undifferentiated), part of the White Chalk Subgroup (formerly Upper Chalk) from the Cretaceous Period.

A fault trending north-north west to south-south east passes ~60m from the western edge of the site, with the site located on the downthrow side.

The BGS maps indicate significant areas of Worked Ground (>300m east) located along the River Loddon. The areas of Worked Ground reflect historic extraction of sand and gravel deposits, which at present have been flooded and form nature reserves. In addition, there are also areas of infilled ground 600m to the south associated with landfilling activity.

2.2.2 *Superficial*

The **Kempton Park Gravel Member** is generally described by the BGS as a sand and gravel, locally with lenses of silt, clay or peat. The gravel clasts are predominantly angular and rounded flint. This

unit is a low-level terrace deposit of the Thames system. The average thickness of this unit is recorded to be in the region of 6m bgl.

The **Fourth River Terrace Deposits** are generally described by the BGS as sand and gravel, locally with lenses of silt, clay or peat. Furthermore, information obtained from the memoir indicates the fifth, fourth and third Terrace Deposits occur as patches throughout the Loddon-Blackwater Valley, in which the site is located. These deposits are flint-rich gravels and up to 5m thick.

2.2.3 *Bedrock*

The **Lambeth Group** is generally described by the BGS as “vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels, minor limestones, lignite and occasional sandstone and conglomerate. The Lambeth Group was deposited in fluvial, estuarine, lagoonal or proximal marine environments.” The thickness of this unit in the site area ranges between 6m and 27m; however, with the geological boundary between the Lambeth and the underlying White Chalk Subgroup located through the centre of the site, it is possible that the thickness will be significantly less, if at all present. The Lambeth Group is well known for causing the following engineering problems:

-  Rapid changes in lithology
-  Clay with irregular water-bearing sand bodies
-  Perched water tables
-  Hard bands that obstruct boring, drilling, excavations and piling
-  Flint-gravel beds, which are water-bearing and may restrict boring progress and increase wear of cutting equipment
-  Lignite, which may provide differential settlement
-  Deposits infilling dissolution features in the underlying chalk
-  Fissuring of clay, potentially leading to instability in cuts
-  De-oxygenation of the atmosphere in tunnels cut into the Upnor Formation sandstones

The **White Chalk Sub Group** (Seaford Chalk Formation and New Haven Chalk Formation Undifferentiated) is generally described by the BGS as chalk with flint seams and discrete marl seams. The thickness of this unit is recorded as between 90m to 130m in the site area.

2.2.4 *Historical Borehole Records*

The BGS holds records of historical exploratory holes, including boreholes of which there is one recorded 160m east of the site (ref. SU77NE41). This borehole records gravel down to 2.60m bgl (interpreted to be the Kempton Park Gravel Member), underlain by brown clay down to the base of the borehole in excess of 3.04m bgl (interpreted to be a clay lens within the Kempton Park Gravel Member).

There is also a deeper borehole located 290m south of the site (ref. SU77SE59). The borehole records 'drift deposits' down to a depth of 3.35m bgl, underlain by 'mottled clay Reading Beds' (Lambeth Group) down to a depth of 11.80m bgl, underlain by chalk down to the base of the borehole in excess of 15.24m bgl.

2.2.5 Solution Features

Chalk, as a calcium-carbonate-rich rock, is highly susceptible to dissolution by water containing carbon dioxide. This dissolution can create three common types of features within the chalk, grouped together under the generic term 'dissolution features'. These features include:

-  Sinkholes: Depressions at the ground surface caused by the collapse of overlying chalk or superficial deposits into underground voids created by dissolution. Shape and size are dependent on the underlying void feature
-  Solution pipes: A feature in the surface of the Chalk caused by increased dissolution in an area of closely spaced discontinuities. These features may or may not have a ground surface expression. Up to 20 metres in diameter, though commonly much smaller
-  Swallow Holes: A void within the surface of the Chalk where a stream is 'swallowed' by the Chalk to flow underground. Often occur at the junction of impermeable strata and Chalk. Infilled ancient swallow holes do exist where streams used to flow and may not have any surface expression. Up to 14m in diameter, though commonly a few metres.

The desk study information records two sinkholes within the surrounding area.

The first is located 25m north-east of the site. Internet searches indicate a 2m deep cavity opened up in the East Park Farm Car Park. The cause of the sinkhole is currently unknown. This may have occurred due to an underlying dissolution feature, or other causes may include leaking drains, washing away finer sediment associated with poor construction of the car park.

The second recorded sinkhole is located significantly further away at a distance of >600m north of the site. No further information is available regarding this sinkhole.

2.2.6 Natural Cavities Risk Assessment

A natural cavities risk assessment has been undertaken following the paper written by Clive Edmonds in 2001, “Predicting natural cavities in chalk”. This gives a score to various factors, including the type of chalk, topography, groundwater level, strata overlying the chalk, and periglacial and glacial history. The score for this site was 640, which correlates to a very high subsidence hazard category (with a 50.9% occurrence). The natural cavities risk assessment can be found in Appendix A.

The known factors which increase the risk of encountering dissolution features at this site, based on the desk study information, include:

- 📦 Chalk strata is part of the White Chalk Subgroup (formerly known as the Upper Chalk), which has an increased weathered profile (low-density chalk), commonly associated with a greater number of solution features
- 📦 Tertiary Cover Present (Lambeth Group) and a feathered margin between the Lambeth and Chalk is known to correlate with an unusually high density of sinkholes. This relates to the effects of drainage and acidity of water moving down through the cover deposits to the chalk.
- 📦 Tertiary deposits are likely to infill dissolution features if present, creating metastable soils
- 📦 Quaternary Deposits also present: Low-level terrace gravels (RTD 4) associated with recent drainage pathways (Modern day River Thames Route)
- 📦 Outside the proto Thames Valley, however, it is located along the Loddon-Blackwater Valley (therefore considered to be within a significant paleo valley). Literature states that factors which appear to be particularly significant in terms of sinkhole formation are the presence of a paleo valley and the nature and distribution of the Lambeth Group within the valley. Particularly important is the presence of a basal layer of sand within the Tertiary, presenting channel deposits which focus drainage of water down to the chalk.

2.3 PREVIOUS INVESTIGATIONS

2.3.1 Previous Geophysical Survey (Ref. R4277/21/10/2024)

It is understood that a geophysical survey was requested by the current land-owner (Hicks Development Ltd.) following the opening of the sinkhole at East Park Farm Car Park (25m east of the site). The following report was undertaken by Zetica Ltd., dated July 2024:

- 📖 Potential Associated Risks with Ground Dissolution Features undertaken by Earth Environmental & Geotechnical Ltd. Report Ref. R4277/21/10/2024, October 2024.

It is understood that the client does not yet have reliance on the report; however, they have been provided the report by Hicks Development Ltd. The geophysical survey covers the same site boundary as this ground investigation.

The previous geophysical report should be referred to in full; however, a summary of the findings is provided below.

- 📖 Low conductivity region across the western part of the site
- 📖 High conductivity found in the eastern sector, which may represent localised changes in clay content or highly weathered chalk bedrock
- 📖 Two areas of highest apparent ground conductivity within the chalk have been annotated on the map, interpreted as areas with the highest potential to represent dissolution features – should be targeted during future investigations
- 📖 Area of no superficial deposits mapped by the BGS may be further west, responsible for the observed low conductivity feature – should be a key feature for future investigation
- 📖 The Eastern area in general should be targeted as the Geophysical surveys do not support the geology indicated by the BGS maps, i.e. BGS maps indicate geology should show low conductivity. However, shallow groundwater could influence the high conductivity

The previous geophysical survey recommended that ground investigation works will need to confirm the presence and location of different superficial and bedrock geologies beneath the site, and be used to investigate the potential for dissolution features. If evidence of dissolution features is found, additional ground investigation works targeting such features will be required.

2.4 HISTORY OF THE SITE

The history of the site has been established by the review of old Ordnance Survey (OS) maps going back to 1884. The maps and any other relevant information are included in Appendix D and indicate the following.

2.4.1 Ordnance Survey

Historical Publication Data		
Date	Features On Site	Features Off-Site
1872	- The site is recorded to be an open, undeveloped field - Sporadic trees are located along the site boundaries	- Park Lane is located to the east of the site boundary - A small, unspecified building is located immediately east of the site - Sandpit Copse (woodland) is located immediately south - East Park Farm, comprising agricultural buildings and fields, is located 100m north-east - A railway line (Great Western Railway) trends north-east to south-west 60m south of the site - A gravel pit is recorded 300m north-west - Old River and tributaries are recorded 250m north-east of the site
1899	No significant changes are recorded to the site	The gravel pit located 300m north-west expands in area
1914	No significant changes are recorded to the site	No significant changes are recorded in the surrounding area
1932	No significant changes are recorded to the site	- Minor residential development is recorded 250m – 500m north of the site - Sonning Golf Course is located immediately west of the site - Gravel pit to the northwest is no longer recorded
1966	The site is divided into four fields with a track trending north-south through the eastern half of the site	- Drains are recorded along the eastern, southern, and western boundaries - A residential dwelling (The Homestead) is constructed 40m south-east of the site - Agricultural barns and silos are constructed 40m south-east of the site - Areas of Worked Ground are recorded 300m to >750m south of the site associated with the extraction of sand and gravel
1972	No significant changes are recorded to the site	- Significant areas of worked ground, including sand and gravel pits, are recorded along the western bank of the Old River, 250m – 750m east of the site - Significant residential development is recorded 500m north of the site - The areas of worked ground to the south are recorded as a bird sanctuary

1981	No significant changes are recorded to the site	Further residential development is recorded 400m north of the site as the village of Charvil expands southwards
1985	No significant changes are recorded to the site	A residential estate is developed immediately north of the site
2001	No significant changes are recorded to the site	Further residential development is recorded 100m north of the site
2010	No significant changes are recorded to the site	No significant changes are recorded in the surrounding area
2025	No significant changes are recorded to the site	- An education facility is recorded immediately east of the site - Further commercial units are constructed immediately south of the site

2.4.2 Freely Available Satellite Imagery

Freely available satellite imagery records the site from 2003. The satellite imagery shows that a motocross track (dirt track) is present at the centre of the site. Sandpit Copse is shown immediately south, commercial units are recorded to the south-east, Sonning Golf Course is recorded to the west and a residential estate to the north. Imagery from 2009 shows no change to the site; however, a car park and tennis courts are recorded east of the site. Imagery dated between 2013 and 2014 shows that the car park to the east is being redeveloped with the construction of a new car park. The motocross dirt track is no longer recorded on site. Imagery dated between 2018 and 2022 shows the eastern limit of the site is developed into a builder's yard, matching the compound seen during the walkover associated with the development of a residential estate located immediately north of the site. The spoil heaps of topsoil recorded during the walkover survey are also seen on site.

2.4.3 Unexploded Ordnance and Bomb Sites

Reference to the site-specific unexploded bomb risk map (UXO) produced by Zetica indicates that the site is located in an area where there is a low risk of unexploded ordnance. Low-risk regions are those with a bombing density of up to 15 bombs per 1000 acres or less.

Care is, however, required when assessing the risk for specific sites where the risk may be higher because of local wartime activity, such as munitions factories, pivotal infrastructure, airfields, and dummy airfields, many of which were removed from historical maps in the interest of national security.

2.5 HYDROLOGY

The desk study information indicates a drainage channel located along the site boundaries. Old River is located >500m east of the site.

There is a WFD (Water Framework Directive) surface water body catchment located on-site associated with the Loddon and Trib.

There are no surface water abstraction licenses recorded within 1000m of the site.

2.6 HYDROGEOLOGY

Reference to the Environment Agency website indicates that the site is located on the following Aquifers:

-  Secondary A Aquifer – associated with the underlying Fourth River Terrace Deposits and the Kempton Park Gravel Member
-  Secondary A Aquifer – associated with the Lambeth Group
-  Principal Aquifer – associated with the White Chalk Subgroup

The aquifer designation data is based on geological mapping provided by the British Geological Survey. The maps are divided into two different types of aquifer designation:

Superficial (Drift) - permeable, unconsolidated (loose) deposits. For example, sand and gravel.

Bedrock - solid permeable formations, e.g., sandstone, chalk and limestone.

For each type, there are four designations: - Principal, Secondary A, Secondary B and Unproductive Strata, ranked by importance.

The site is located within a source protection zone (SPZ3), Total Catchment.

A Source Protection Zone (SPZ) is a designated area around a well or abstraction borehole.

There are records of groundwater abstraction licenses within 1000m of the site. The nearest is recorded as a historical license located 301m north-west of the site used for spray irrigation purposes. The nearest active license is located 572m west of the site for spray irrigation purposes.

There is one potable water abstraction license recorded within 1000m of the site. This relates to a historical record located 404m north of the site previously operated by Mr Hunt for domestic supply.

2.7 WASTE TREATMENT AND LANDFILL SITES

2.7.1 Landfills

There are three historical records of landfill sites from the Local Authority records located within 500m of the site. These include:

-  Wee Waif Public House, located 414m north of the site
-  Strathmore Drive, located 431m north of the site, operated by Wokingham District Council
-  Tippings Lane, Woodley, located 486m south-east of the site

There are six historical records of landfill sites from the EA/NRW records. These include:

-  Tippings Lane, located 257m south of the site, waste type inert, industrial, last operated in 1980
-  Behind Village Hall, located 267m north of the site, waste type inert, last operated in 1979
-  East Park Farm, located 348m north-east, waste type inert, last operated in 1962
-  Wee Waif, located 394m north of the site, waste type inert, industrial, commercial, last operated in 1979
-  Strathmore, located 414m north of the site, waste type inert, industrial, commercial, last operated in 1962
-  Ashenbury Park, located 499m south-east of the site, waste type inert, industrial, commercial and household, last operated in 1980

The historical landfills listed above relate to the landfilling of historic sand and gravel pits in the surrounding area.

2.7.2 Other Licensed Waste Sites

There is one record of other historical waste sites associated with Land to the North of Waingels Road, which was a waste pumping station located 179m south-west of the site, dated 2021.

2.7.3 Waste Exemptions

There are three records of waste exemptions within 250m of the site. These include:

-  The Homestead, located 36m south-east of the site, relates to non-agricultural waste only, the use of waste in construction
-  The Homestead, located 38m south-east, relating to the use of waste in construction
-  Unspecified Site, located 238m south of the site relating to the use of waste in construction

2.8 ENVIRONMENTAL PERMITTING AND INCIDENTS

There are no historic IPC authorisations within 500m of the site.

There are no records of Part A(1) licensed industrial activities within 500m of the site.

There is one record of a Part A(2)/B licensed pollutant release within 500m of the site. This record relates to the unloading of petrol into storage at a service station (Co-op Petrol, Charvil) located 428m north-west.

There have been two licensed discharges to controlled waters recorded within 500m of the site. These discharges were recorded 372m north of the site, relating to sewage discharges.

There is one record of a pollution incident within 250m, situated 16m south-east of the site. This relates to oil and fuel release, which caused a significant water impact dated 2023. Given the significant impact and proximity to the site, this could be a potential source of contamination affecting the south-east corner of the site.

2.9 INDUSTRIAL USAGE SITES

There are records of past or present potentially contaminative industrial sites recorded within 250m of the site.

The past potentially contaminative industrial sites include an unspecified works recorded 37m east of the site, and unspecified tanks located 176m south-east and 225m south-east.

The recent potentially contaminative industrial site includes a publishing goods located 38m south-east, and two electricity substations located 108m north-east and 204m north of the site.

2.9.1 Historical Site Usage

Historical information indicates the majority of the site remains unaltered from the first historical records, remaining an open, undeveloped field. The exception being a small area to the east of the site, which has been used as a builder's yard by Hicks Development Ltd. The walkover survey indicated this area comprised a part tarmac, part engineered granular fill surface used for storing building materials, including bricks, plastic drains, pallets, and fences. Machinery, including an excavator and telehandler, was also stored in this area. A concrete slab is located to the north, previously used for supporting concrete silos. The remaining area of the site has remained undeveloped fields, which were once used for motocross, with dirt tracks visible on satellite imagery.

Spoil heaps comprising topsoil from the builder's yard and the new residential estate to the north are present on site.

2.10 WORKED OUT GROUND/MADE GROUND

The desk study information records areas of Worked Ground and Infilled Ground within 500m of the site relating to the extraction of sand and gravel deposits and subsequent landfilling.

There are no recorded areas of Worked Ground or Made Ground beneath the site from the desk study information. However, Made Ground is expected at the eastern side of the site associated with the builder's yard. There are also spoil heaps of topsoil (Reworked Ground) located on site, sourced from the builder's yard and the adjacent residential development.

2.11 GROUND GASES

2.11.1 Radon

Information obtained from the BGS and the National Geoscience Information Service indicates that the site lies within an area where less than 1% and 3% of homes exceed the action level of 200Bq/m³ for radon gas. Therefore, no radon protection measures are necessary in the construction of new dwellings.

2.11.2 Landfill Gasses

In accordance with BS8576:2013, the site has been provisionally assessed for the risk of ground gases. This has been done with reference to "A pragmatic approach to ground gas risk assessment for the 21st Century" Card and Wilson, 2011.

-  Some credible sources or pathways for landfill gas migration have been identified from nearby landfills and records, Infilled Ground
-  The site has not been a registered landfill
-  The Made Ground is not expected to be 5m deep or an average of 3m in thickness.
-  The site is directly located on a carbonate-rich rock that can produce very small amounts of carbon dioxide
-  No radon protection measures are recommended for this site
-  The site is not directly located on potentially naturally organic soil

It is considered that there is a potential risk of ground gas affecting this site associated with off-site sources, including landfills and records of Infilled Ground. Therefore, ground gas monitoring will be undertaken as part of this site investigation.

2.12 POTENTIAL GEOTECHNICAL HAZARDS

2.12.1 Mining

The desk study information identified that the site does not lie within an area affected by coal mining activities.

However, the site is located within an area potentially affected by non-coal mining activities associated with chalk, with localised small-scale underground mining possible.

There are three British Pits recorded within 500m of the site. The nearest is recorded 342m north-west of the site and relates to a gravel pit as seen on the historical OS maps. The second is located 413m south of the site, also relating to the extraction of sand and gravel. The third is located 440m east of the site known as the Twyford Pits, also relating to the extraction of sand and gravel.

2.12.2 Mineral Planning Areas

There are records of a historical mineral planning area recorded on site; however, this was refused in 1962. There are multiple records of historic mineral planning areas recorded in the surrounding area associated with the extraction of sand and gravel.

2.12.3 Natural Cavities

The desk study information indicates there are two records of natural cavities within the surrounding area. The nearest cavity is recorded 25m east of the site. Internet searches indicate a 2m deep cavity (1m in width) opened up in the East Park Farm Car Park. The cause of the sinkhole is currently unknown. This may have occurred due to an underlying dissolution feature, or other causes may include leaking drains, washing away finer sediment associated with poor construction of the car park.

The second recorded sinkhole is located significantly further away at a distance of >600m north of the site. No further information is available regarding this sinkhole.

A natural cavities risk assessment has been undertaken following the paper written by Clive Edmonds in 2001, "Predicting natural cavities in chalk". This gives a score to various factors, including the type of chalk, topography, groundwater level, strata overlying the chalk, and periglacial

and glacial history. The score for this site was 640, which correlates to a very high subsidence hazard category (with a 50.9% occurrence). The natural cavities risk assessment can be found in Appendix A.

The known factors which increase the risk of encountering dissolution features at this site, based on the desk study information, include:

-  Chalk strata is part of the White Chalk Subgroup (formerly known as the Upper Chalk), which has an increased weathered profile (low-density chalk), commonly associated with a greater number of solution features
-  Tertiary Cover Present (Lambeth Group) and a feathered margin between the Lambeth and Chalk is known to correlate with an unusually high density of sinkholes. This relates to the effects of drainage and acidity of water moving down through the cover deposits to the chalk.
-  Tertiary deposits are likely to infill dissolution features if present, creating metastable soils
-  Quaternary Deposits also present: Low-level terrace gravels (RTD 4) associated with recent drainage pathways (Modern day River Thames Route)
-  Outside the proto Thames Valley, however, it is located along the Loddon-Blackwater Valley (therefore considered to be within a significant paleo valley). Literature states that factors which appear to be particularly significant in terms of sinkhole formation are the presence of a paleo valley and the nature and distribution of the Lambeth Group within the valley. Particularly important is the presence of a basal layer of sand within the Tertiary, presenting channel deposits which focus drainage of water down to the chalk.

2.12.4 Groundsure Geotechnical Hazard Assessment

The risk of naturally occurring geotechnical hazards at the site is recorded in the Groundsure report as follows:

Ground Stability Hazard	Maximum Hazard Potential Rating
Shrinking and Swelling Clays	Negligible to Moderate
Landslides	Negligible to Very Low
Ground Dissolution of Soluble Rocks	Negligible to Low
Compressible Deposits	Negligible
Collapsible Deposits	Very Low
Running Sand	Negligible to Very Low

The maximum hazard potential rating has been attributed to shrinking and swelling clays. A moderate risk has been attributed to the Lambeth Group, where it is considered that the cohesive layers may

comprise a medium to high shrinkability. Therefore, the effects of any trees or hedgerows within desiccation influencing the distance of the development (as described in the NHBC Standards, Chapter 4.2) should also be considered during design and construction. Where such vegetation is within the influence of new buildings, then foundations will need to extend to depths where soils are moisture/volume stable and appropriate precautionary foundation and floor slab design measures adopted in accordance with the NHBC Building Near Trees protocol.

As previously discussed, there is a potential risk of dissolution features at this site. The Groundsure report has indicated a low risk; however, based on the natural cavities risk assessment, it is considered that the risk could be higher due to the points highlighted in 2.12.3. Furthermore, the previous geophysical survey highlighted two areas of highest apparent ground conductivity within the chalk, interpreted as areas with the highest potential to represent dissolution features. These will be targeted as part of the intrusive works. It was also stated that the areas where no superficial deposits are mapped by the BGS may be further west, responsible for the observed low conductivity feature and should be a key feature for ground investigation.

The site is also recorded to be underlain by River Terrace Deposits, which are likely to be predominantly granular. Therefore, there is a potential risk of running sand, which causes instability when excavating trenches.

Furthermore, the Lambeth Group is well known to cause the following engineering problems:

-  Rapid changes in lithology
-  Clay with irregular water-bearing sand bodies
-  Perched water tables
-  Hard bands that obstruct boring, drilling, excavations and piling
-  Flint-gravel beds, which are water-bearing and may restrict boring progress and increase wear of cutting equipment
-  Lignite, which may provide differential settlement
-  Deposits infilling dissolution features in the underlying chalk
-  Fissuring of clay, potentially leading to instability in cuts
-  De-oxygenation of the atmosphere in tunnels cut into the Upnor Formation sandstones

Given the potential for complex ground conditions, the intrusive investigation will incorporate trial pits, shallow window sampling boreholes and deep cable percussive boreholes to confirm the underlying ground conditions.

As recommended by the previous geophysical survey, the ground investigation works will need to confirm the presence and location of different superficial and bedrock geologies beneath the site and will be used to investigate the potential for dissolution features. If evidence of dissolution features is found, additional ground investigation works targeting such features will be required.

A small pit filled with wooden sleepers was observed during the walkover survey located along the western boundary of the builder's yard. It is recommended, prior to development, the sleepers are removed and the underlying material inspected. Should loose soils indicating potential dissolution features or Made Ground soils be encountered, further assessment should be undertaken by a suitably qualified person.

2.13 POTENTIALLY SENSITIVE LAND USES

The Groundsure Report has indicated there is designated ancient woodland on site associated with the Sandpit Copse located to the south of the proposed development. Exploratory holes will therefore be positioned a suitable distance away to protect tree roots. It is also understood that there are tree protection orders on two trees located along the northern boundary, which will also apply here.

The site is located within a nitrate vulnerable zone known as Sheeplands (Groundwater NVZ).

3 INITIAL GEO-ENVIRONMENTAL CONCEPTUAL SITE MODEL

In accordance with the Environment Agency guidance LCRM *Land Contamination: Risk Management*, (EA, 2019), this desk study and site reconnaissance report constitutes a preliminary risk assessment in order to establish the potential presence of pollutant linkages. The diagram below illustrates the potential linkages.

Historical information indicates the majority of the site remains unaltered from the first historical records dated 1872, remaining an open, undeveloped field. The exception being a small area to the east of the site, which has been used as a builder's yard by Hicks Development Ltd. The walkover survey indicated this area comprised a part tarmac, part engineered granular fill surface used for storing building materials, including bricks, plastic drains, pallets, and fences. Machinery, including an excavator and telehandler, was also stored in this area. A concrete slab is located to the north, previously used for supporting concrete silos. The remaining area of the site has remained undeveloped fields, which were once used for motocross, with dirt tracks visible on satellite imagery. Spoil heaps comprising topsoil from the builder's yard and the new residential estate to the north are present on site. Therefore, the majority of the site is likely to be underlain by natural soils and, therefore, unlikely to pose any risk to receptors.

The main sources of contamination are considered to be Made Ground soils associated with the builder's yard to the east, which may contain local elevations of a range of contaminants, given their unknown origin, and the storage of materials and machinery may have introduced contaminants via accidental leakages and spillages such as oil/fuel.

There is one record of a pollution incident within 250m, situated 16m south-east of the site. This relates to oil and fuel release, which caused a significant water impact dated 2023. Given the significant impact and proximity to the site, this could be a potential source of contamination affecting the south-east corner of the site.

The surrounding area to the east and south has experienced significant quarrying associated with the extraction of sand and gravel. The majority are now flooded, forming nature reserves; however, there are records of landfilling, which could be potential sources of ground gas.

There are spoil heaps located on site, comprising predominantly topsoil from the surrounding developments. It is considered unlikely these will contain elevated levels of contamination, but given their reworked nature, it is possible they may contain anthropogenic material.

Therefore, currently, it is considered that the following potential source/pathway/receptors may be present at and around the site;

Potential Source	Potential Pathway	Potential Receptor	Considered Risk
Builder's yard at the east of the site – introduction of Made Ground soils and potential for storing materials/machinery which may have leaked oils/fuels	Ingestion, inhalation, or absorption from direct contact with soil.	End Users	Low to Moderate Risk
	Leaching through the ground	Controlled Waters	Low to Moderate Risk
	Possible contact during the work phase	Construction Workers	Low to Moderate Risk
Pollution incident located 16m south-east of the site (hydrocarbons)	Ingestion, inhalation, or absorption from direct contact with soil.	End Users	Low Risk
	Leaching through the ground	Controlled Waters	Low Risk
	Possible contact during the work phase	Construction Workers	Low Risk
Spoil Heaps (Majority Topsoil, but may contain anthropogenic material given the reworked nature.)	Ingestion, inhalation, or absorption from direct contact with soil.	End Users	Very Low Risk
	Leaching through the ground	Controlled Waters	Very Low Risk
	Possible contact during the work phase	Construction Workers	Very Low Risk
Ground gas from nearby Landfills	Inhalation	End Users	Low to Moderate Risk
Potential off-site sources – adjacent commercial estate	Ingestion, inhalation, or absorption from direct contact with soil.	End Users	Very Low Risk
	Leaching through the ground	Controlled Waters	Very Low Risk
	Possible contact during the work phase	Construction Workers	Very Low Risk

4 PHASE II INTRUSIVE INVESTIGATION

4.1 SITE WORK AND SAMPLING STRATEGY

The fieldwork was undertaken in accordance with BS 5930:2015, BS EN 1997-2 (2007) and BS EN ISO 22475-1 (2006), with the exploratory locations being selected by Geo-Integrity Ltd. The exploratory hole locations can be seen in the Appendices.

The fieldwork was undertaken across six working days between the 31st of July and the 7th of August 2025 and consisted of two deep cable percussive boreholes (BH1 and BH2), seven window sampler boreholes (CT1 – CT7), thirteen machine-excavated trial pits (TP1 – TP13), four soakaway tests following the methods set out within BRE365 Digest, and nine dynamic cone penetrometer (equivalent CBR) tests (CBR1 – CBR9).

A standpipe was also installed within CT2 and CT5 to monitor the groundwater and confirm the gas regime at the site.

The table below provides a list of exploratory holes and the location reasoning:

Exploratory Hole	Location Reasoning
BH1 and BH2	BH1 was positioned within the area of recorded low conductivity identified during the previous Geophysical Survey to understand the ground conditions to the east of the site and investigate potential solution features. In addition, it was located adjacent to the pit identified during the walkover survey. BH2 was positioned in the western half of the site to understand the deep ground conditions in this area. The deeper boreholes will also aid pile design, should this be required by obtaining soil parameters at depth. Given the likelihood of cohesive soils being present beneath the site and the presence of woodland to the south and along the boundaries, the deeper boreholes will be used to investigate the depth of potential zones of desiccation.
CT1 – CT7	CT1 – CT3 were undertaken at the east of the site – CT2 was positioned within the second area of recorded low conductivity. The boreholes were positioned here to log the ground conditions and to investigate potential dissolution features. Dynamic probes were undertaken at the base of CT1 and CT2 to investigate potential dissolution features at depth. CT2 and CT3 were positioned in close proximity to trees to investigate potential desiccated soils. CT4 – CT7 were positioned at the western half of the site to log the ground conditions, given that the published data indicates the underlying geology varies across the site. Standpipes were installed within CT2 and CT5 to monitor the groundwater and confirm the ground gas regime.

TP1 – TP13	Trial pits were undertaken to provide suitable coverage of the site, with samples taken for laboratory analysis. TP1 was undertaken within the existing builder's yard to confirm the make-up of the engineered fill and collect samples for chemical analysis. TP2 and TP13 were undertaken within the spoil heaps to confirm the make-up and collect samples for chemical analysis. TP4, TP9 and TP10 were positioned adjacent to trees along the boundaries to investigate potential zones of desiccation.
SA1 – SA4	To undertake infiltration testing following the methods set out within BRE365 Digest to aid soakaway design
CBR1 – CBR9	Undertaken to provide CBR values to aid road design

Disturbed samples were taken at selected depths down to the base of the exploratory holes for subsequent laboratory testing and inspection. On completion, all exploratory holes were carefully backfilled with arisings in thin layers, ensuring that the excavated material was replaced in the same order as it had been removed.

4.2 GROUND CONDITIONS

4.2.1 Summary

The site and laboratory test work revealed that the general succession of strata can be represented by localised Made Ground soils (in the area of the builder's yard) and Topsoil, overlying the River Terrace Deposits, overlying the Lambeth Group, overlying the White Chalk Subgroup. Spoil heaps of Topsoil were also recorded on site. Descriptions of the strata encountered are given on the exploratory hole records and are summarised below. Further information is provided on the exploratory hole logs within the Appendices.

4.2.2 Spoil Heaps of Reworked Topsoil

Encountered locally immediately west of the builder's yard and at the centre of the site. Trial pits TP2 and TP13 were undertaken on top of the spoil heaps, excavating down to depths in excess of 2.80m bgl. The material was consistent throughout, comprising loose, brown, organic, slightly sandy, gravelly silt, gravels being fine to coarse sub-angular flint.

4.2.3 Topsoil

Encountered in the majority of the holes except those undertaken within the builder's yard (TP1, CT1, TP3) and a localised area situated at the centre of the site within TP12. Topsoil was encountered down to depths ranging between 0.15m and 0.65m bgl. The material was encountered as loose, organic, light brown, gravelly silt.

4.2.4 Made Ground

Encountered in exploratory holes TP1, TP3, CT1 and TP12 located within the area of the builder's yard and a small localised area at the centre of the site from ground level down to depths ranging between 0.30m and 0.70m bgl. The Made Ground soils forming the engineered fill underlying the builder's yard comprised (medium dense), brown, silty, sandy gravel, gravel is fine to coarse brick rubble, flint aggregate, concrete, metal, tile and wood with a geo-membrane at the base.

The Made Ground encountered within TP12, situated at the centre of the site, was described as reworked natural topsoil with anthropogenic material including wood, plastic (motorcycle parts), and metal. It is interpreted that this material was buried as part of the motocross dirt track.

4.2.5 River Terrace Deposits

Encountered within each of the exploratory holes, except those undertaken within the spoil heaps TP2 and TP13, underlying the Made Ground and Topsoil down to depths ranging between 0.95m and 8.00m bgl. The River Terrace Deposits were thicker at the north-west of the site, thinning to the south-east.

The material was variable across the site, but predominantly loose to medium dense, slightly clayey sand and gravel with local layers of firm silty clay.

Significant layers of cohesive soils were encountered within CT5, TP1, TP3, TP6, TP9, and BH1.

SPT tests undertaken within this material recorded 'N' values ranging between 6 and 50. The large value range reflects the variability of the material. Lower SPT values indicating loose granular soil were encountered at near surface levels at the east of the site. Whereas very dense granular soils were encountered at the south-west side of the site at near surface levels.

Laboratory testing undertaken on representative cohesive soil samples revealed a moisture content ranging between 14% and 19% and a modified plasticity index ranging between 11% and 34%. The above testing proves the cohesive layers range between low-shrinkable and medium shrinkable soil in accordance with NHBC guidelines.

Particle size distribution tests undertaken on representative granular soil samples revealed the following grain size percentages: Fines (clay and silt):- 4% to 27%; Sand:- 25% to 90%; Gravel:- 0% to 71%. The results indicate the granular layers comprise predominantly sand and gravel.

4.2.6 Lambeth Group

Encountered within exploratory holes BH1, BH2, CT2, CT3, TP1, TP4 underlying the River Terrace Deposits down to proven depths (within BH1 and BH2) ranging between 8.90m and 13.70m bgl, thinning to the south-east.

The material was encountered as layers of soft to firm and firm to stiff, dark grey, green, silty clay with shell debris and calcareous horizons, dense, dark grey, green, very sandy clayey silt with shell debris.

SPT tests undertaken within this material recorded 'N' values ranging between 6 and 50. Softer soils were encountered at the east of the site within BH1 and CT2, however the remaining area of the site recorded competent 'N' values.

Laboratory testing undertaken within this material revealed a moisture content ranging between 15% and 30% and a modified plasticity index ranging between 12% and 45. The above testing proves the Lambeth Group comprises significant layers of highly shrinkable soil in accordance with NHBC guidelines.

Triaxial tests were undertaken on two samples BH1 at a depth of 4.60m bgl which recorded an undrained shear strength of 55kPa and BH2 at a depth of 11.00m bgl which recorded an undrained shear strength of 114kPa.

4.2.7 White Chalk Subgroup

Encountered within exploratory holes BH1 and BH2, underlying the Lambeth Group down to depths in excess of 25.00m bgl where the boreholes terminated.

The material was encountered as structureless, off-white chalk comprising both gravelly silt (Grade Dm) and silty gravel (Grade Dc). Gravels were encountered as very weak, medium density, white chalk. Locally seams of flint were also encountered.

SPT tests undertaken within this material recorded 'N' values ranging between 14 and 50. The SPT 'N' values indicate competent strata with no evidence of soft zones or voids which may indicate dissolution features.

Laboratory testing undertaken on gravels taken within this material revealed an intact dry density of 1.58 and 1.59Mg/m³, indicating a medium density.

4.2.8 Super Heavy Dynamic Probes

Dynamic probes were undertaken within CT1 and CT2 at the base of the borehole to investigate the competency of the material below the maximum sampling depth, to investigate potential solution features. However, given the findings of the deep borehole BH1, a substantial thickness of overburden exists above the chalk strata with the Lambeth Group encountered down to a depth of 8.90m bgl.

The probes undertaken at the base of CT1 and CT2 correlate with this. CT1 probe encountered an increasing strength profile from 4.00m to 8.00m bgl, with a more consistent strength profile from 8.00m to 10.00m bgl. CT2 probe encountered an increase in strength from 5.00m to 6.00m bgl with a consistent strength between 6.00m and 9.50m, increasing again between 9.50m and 10.00m bgl.

No significant weak zones or voided ground over extended depths were encountered from the probes data and it can be interpreted the Lambeth Group exists down to similar depths encountered within BH1.

4.2.9 Sulphate and pH Tests

Water soluble sulphate, pH, were carried out on samples recovered from the Made Ground, River Terrace Deposits, Lambeth Group and the White Chalk Subgroup. The Made Ground soils and the Lambeth Group were also tested for acid soluble sulphate and total sulphur tests. These recorded values as shown in the table below:

Parameter	Range			
	Made Ground	River Terrace Deposits	Lambeth Group	White Chalk Subgroup
Soluble Sulphate (mg/l)	120	21 - 26	13 - 610	13 - 25
pH units	10.9	8.4 – 8.5	7.6 - 8.5	8.4 – 8.7
Acid Soluble Sulphate	1.28	-	<0.01 - 0.18	-
Total Sulphur	0.44	-	<0.01 – 0.86	-

4.2.10 Groundwater

Groundwater was encountered as strikes within exploratory holes BH1, BH2, and CT1 at depths ranging between 1.50m and 13.90m bgl.

BH1 encountered a standing level at a depth of 7.90m bgl within dense silt of the Lambeth Group

BH2 encountered a water strike at a depth of 13.90m bgl within the White Chalk Subgroup which rose to a depth of 13.00m bgl within the Lambeth Group, considered to reflect minor artesian water pressure.

CT1 encountered a standing water level at a depth of 1.50m bgl within the granular River Terrace Deposits. Potentially reflecting perched water levels.

Groundwater monitoring is currently ongoing. Currently two monitoring visits have been undertaken on the 14/08/2025 and 20/08/2025 within the standpipes installed within CT2 and CT5.

CT2 recorded dry conditions on both visits. CT5 recorded standing groundwater levels at 3.36m and 3.40m bgl within the River Terrace Deposits likely reflect perched water levels within the granular layers.

4.2.11 Infiltration Tests

Infiltration tests were undertaken within SA1 – SA4 within the variable near-surface soils of the River Terrace Deposits.

SA1 was located at the south-east corner (proposed location of attenuation pond) of the site and excavated down to a depth of 0.70m bgl within the granular River Terrace Deposits.

SA2 was located at the north-west of the site and excavated down to a depth of 1.30m bgl within the granular River Terrace Deposits.

SA3 was located along the southern boundary of the site (proposed attenuation pond) and excavated down to a depth of 0.90m bgl within the granular River Terrace Deposits.

SA4 was located at the south-west corner of the site (predominantly gravel) and excavated down to a depth of 0.75m bgl.

The results are included in the table below.

Trial Pit	Infiltration Rates (m/s)			
	Test 1	Test 2	Test 3	Average
SA1	2.44×10^{-5}	1.64×10^{-5}	9.88×10^{-6}	1.69×10^{-5}
SA2	2.12×10^{-6}	2.37×10^{-6}	Insufficient time to start third test	-
SA3	2.77×10^{-6}	2.58×10^{-6}	1.97×10^{-6}	2.44×10^{-6}
SA4	3.03×10^{-4}	1.50×10^{-4}	1.48×10^{-4}	2.00×10^{-4}

The graphs are included in Appendix B.

4.2.12 California Bearing Ratio

Nine TRL DCP (equivalent CBR) tests (CBR1 – CBR9) were undertaken from ground level across the site within areas of proposed roads and pavements. Equivalent CBR values ranged between 5% and 120%.

4.2.13 Gas Monitoring

Gas monitoring is currently ongoing alongside groundwater monitoring within the standpipes installed within CT2 and CT5. The two gas monitoring visits currently undertaken recorded methane below detectable limits, carbon dioxide levels between 0.6% and 1.4%, oxygen levels between 19.8% and 20.5% with hexane levels recorded below detectable limits. Peak flow was recorded at 0l/h, and atmospheric pressure was recorded between 1010mbar and 1013mbar.

4.2.14 Evidence of Contamination

No obvious or significant contamination was identified within the localised near-surface Made Ground soils and underlying natural soils encountered during the fieldwork. Locally anthropogenic material was encountered within the Made Ground soils located at the east of the site and at the centre of the site; however, this was limited to construction materials including brick, plywood and plastic.

5 GEOENVIRONMENTAL TESTING

Geo-environmental laboratory testing was scheduled by Geo-Integrity on ten soil samples recovered during the fieldwork. The testing was carried out at an MCERTS and UKAS-accredited laboratory. The results are presented in the Appendices.

Ten soil samples were tested for a varied suite containing the following

-  Metals and inorganic substances
-  Speciated Polycyclic Aromatic Hydrocarbons (PAH)
-  Benzene, Toluene, Ethylbenzene and Xylene (BTEX)
-  Total Petroleum Hydrocarbons (TPH), with eight band split
-  Asbestos Screen

Additionally, UKWIR testing was undertaken on three soil samples, which included a range of banded hydrocarbons, VOCs and SVOCs, BTEX and polyaromatic hydrocarbons, to assess the risk to water pipes.

WAC testing was undertaken on a representative soil sample taken from a spoil heap located on site, and one sample recovered from the engineered fill underlying the builders' yard, recovered from CT1, to aid waste classification of the soils.

6 GEOTECHNICAL INTERPRETIVE SECTION

6.1 GENERAL GROUND CONDITIONS INTERPRETATION

The exploratory fieldwork undertaken during this investigation has identified that the underlying geology differs significantly from published geological records. This ground investigation has identified that the underlying ground conditions can be summarised as:

-  Localised Made Ground exists underlying the builder's yard and a small pocket at the centre of the site – maximum thickness 0.70m bgl
-  Topsoil underlies the majority of the site
-  River Terrace Deposits underlie the near-surface soils down to depths of 8.00m bgl in the west and 0.95m in the east (thinning in a south-east direction)
-  River Terrace Deposits were variable but predominantly granular sand and gravel (non-shrinkable). However, significant layers of cohesive soil were encountered within CT5, TP1, TP3, TP6, TP9, and BH1, with laboratory testing proved this material to have medium shrinkability in accordance with NHBC guidelines
-  The Lambeth Group was encountered across the site down to proven depths of 8.90m and 13.70m bgl (thinning to the east)
-  The Lambeth Group comprised predominantly soft to firm and firm to stiff, dark grey, green, silty clay with shell debris and calcareous horizons, dense, dark grey, green, very sandy clayey silt with shell debris. Laboratory testing has proven this material contains layers of highly shrinkable soil in accordance with NHBC guidelines
-  The White Chalk Subgroup underlies the Lambeth Group at depths below 8.90m bgl, proven down to depths in excess of 25.00m bgl (the maximum depth achieved by this ground investigation)
-  The White Chalk Subgroup was encountered as structureless, off-white chalk with layers of Grade Dm and Grade Dc. High SPT 'N' values within this material indicate competent strata, potentially indicating higher chalk grades than Grade D
-  Groundwater was encountered at significant depths ranging between 7.90m and 13.00m bgl, recorded to be at similar depths to the interface between the Lambeth Group and the underlying chalk strata. In addition, perched water levels were recorded within CT1 and TP5 resting within the River Terrace Deposits at depths of 1.50m and 2.80m bgl, respectively. Subsequent groundwater monitoring also recorded perched water levels within CT5 at depths of 3.36m bgl

- The southern boundary of the site is situated in a flood risk zone; as such, groundwater levels are expected to vary seasonally. The ground investigation was undertaken during the summer months, when groundwater levels are at their lowest

The difference between the findings of this ground investigation and the published geology is as follows:

- Superficial Deposits are present across the entire site (thinning to the east) in the form of River Terrace Gravel Deposits. The published data indicated superficial deposits were absent from the centre of the site, which is not the case.
- Similarly, the published geology indicates the Lambeth Group is only present at the western side of the site. This was not the case as the Lambeth Group was encountered within BH1 (located at the east of the site) down to a depth of 8.90m bgl, indicating a significant thickness of overburden above the chalk strata exists.
- As such, the feathered margins previously indicated on the published data are not present beneath the site.

6.2 DISSOLUTION FEATURES

The desk study information, including the natural cavities risk assessment, identified a potentially high risk of encountering dissolution features based on the published geology.

This ground investigation has identified that the actual underlying ground condition differs significantly from the published records. These differences reduce the likelihood that dissolution features exist below the site. These include:

- A significant overburden (River Terrace Deposits and Lambeth Group) has been above the chalk, indicating the site is not located along a feathered margin
- High conductivity areas previously identified by the geophysical survey to the east of the site were interpreted to potentially reflect highly weathered chalk and an increased risk of encountering dissolution features. This is not the case as the Lambeth Group was encountered at depths in excess of 8.90m bgl. Therefore, the high conductivity previously recorded likely reflects the clay soils of the Lambeth Group and not weathered chalk
- The low conductivity previously recorded across the western half of the site reflects the increased granular content associated with the proven thicker River Terrace Deposits

Feathered margins of the Lambeth Group, where surface run-off is concentrated, present a high concentration of dissolution features. Given the significant thickness of the Lambeth underlying the site, it is considered that the feathered edge is located further east of the site.

Currently, one 25m deep borehole (BH1) has been undertaken at the eastern side of the site, which has proven the depth to the underlying chalk. Given the limited data, further investigation incorporating boreholes and probes should be undertaken to confirm that the ground conditions encountered within BH1 are consistent across this area.

6.3 DESICCATION ASSESSMENT

Information obtained from the walkover survey undertaken as part of this investigation and the desk study indicates there are sporadic areas where significant layers of cohesive soils are present at near-surface levels located to the east of the site and to the north-west. These areas are also located in close proximity to mature and immature trees, including the woodland along the south of the site and trees located along the boundaries of the site. Given the above findings and the fact that the underlying cohesive soils have been proven to be moderately to highly shrinkable, a desiccation assessment has been undertaken. The majority of the site was underlain by predominantly granular soils; therefore, there is not anticipated risk of desiccation for the majority of the site.

Selected samples from boreholes BH1, CT2 and CT3, where significant layers of cohesive soil were encountered, were tested for moisture content and Atterberg classification tests. Graphs are presented in Appendix C showing the moisture profiles alongside index properties with notes on desiccation analysis. The findings of the desiccation assessment are summarised below.

Firstly, all the samples have been weighed before and after oven drying to measure the gravimetric moisture content. Equivalent moistures, factored to take account of the “% passing” value, have been used throughout. The line of the equivalent M_c has been superimposed against depth. The graphs are attached. Moisture content in uniform soil should display a generally linear relationship, decreasing gradually with depth as natural in-situ earth pressures increase. If there is a negative bulge, this indicates a zone of desiccation. From the three moisture profiles, a negative bulge was not observed.

The second method was proposed by Richard Driscoll (Driscoll R. (1983) “Influence of Vegetation on Clay Soils” Geotechnique. Vol. 33). The method seeks to establish a relationship between the moisture content and index properties of the soil. Driscoll suggested that soil might be desiccated if the moisture content is less than (a) $0.4 \times LL$ or (b) $2\% + PL$. Driscoll preferred the LL test as the

more reliable of the two and recommends that this assessment be always used in conjunction with other forms of testing. In addition, if the soil is highly desiccated, the tests perform better and become less clear and confusing as the level of desiccation diminishes, as stated by Plante, S., Rollit, E. and Nazareth, C. (2007) "Site Investigation and Soil Testing" The Clay Research Group, Pg. 18.

It can be seen from the BH1 that the equivalent moisture content is significantly lower than (a) $0.4 \times LL$ and (b) $PL+2\%$ down to the base of the assessment in excess of 6.00m bgl.

It can be seen from CT2 that the equivalent moisture content is below (a) $0.4 \times LL$ at 0.95m bgl, but equalises at 2.50m bgl and is higher at 4.50m bgl. This is similar to the equivalent moisture content vs (b) $PL+2\%$

It can be seen from CT3 that the equivalent moisture content is above (a) $0.4 \times LL$. However, when compared to (b) $PL+2\%$ the equivalent moisture content is below at a depth of 1.20m bgl, but is greater from a depth of 3.00m bgl.

The final method is the comparison of the Liquidity Indices of the soil with depth. The Liquidity (or Consistency) Index is the normalised value of the moisture content on a scale between $PL = 0$ and $LL = 1$. Such that:

$$LI = (Mc - PL) / (LL - PL) \quad - \quad \text{normalisation formula}$$

When using this method of interpretation, a value below '0' suggests a desiccated soil and '1' a fully saturated soil; a result of '0.5' may be considered as a nominal soil value. The results shown within the lab results indicate negative values are present.

Furthermore, a single sample taken from TP9 at a depth of 1.50m bgl also shows that the equivalent moisture content is significantly lower than the index properties.

Given the findings of the desiccation assessment, the cohesive soils within BH1, CT2, CT3 and TP9 show evidence of desiccation down to depths in excess of 6.00m bgl, as shown in BH1. BH1 proved that non-shrinkable soil exists below 6.50m bgl; therefore, it is considered that the zone of desiccation ends at 6.50m bgl.

It is considered that the eastern area of the site, as highlighted on the geological plan in Appendix A, comprises locally desiccated soil as proven within the three exploratory holes (CT2, CT3 and BH1). This entire area recorded significant layers of cohesive soils, with the exception of CT1, and as such, given the information currently available, this area should be considered at risk of shrinking

and swelling down to depths of 6.50m bgl, as proven within BH1. Foundations will therefore require deepening past this zone of desiccation (>6.50m bgl).

The majority of the western half of the site, highlighted yellow on the geological plan in Appendix A, is underlain predominantly by granular soils considered to be non-shrinkable and therefore unaffected by the risks of desiccation. However, a localised area of cohesive soil was encountered within TP9 and CT5 at the north-west corner of the site. A single sample taken from TP9 recorded evidence of desiccation, but samples taken from CT5 recorded no such evidence of desiccation. There is a small ground of mature trees and bushes at the north-west corner of the site, which could be the reason for desiccation within TP9. The zone of desiccation has been zoned to the area surrounding TP9; however, the full depth of desiccation has not been proven. As such, further investigation should be undertaken in this area to prove the extent of desiccation. See the geological plan in Appendix A for visual aid.

6.4 EXCAVATIONS

Conventional plant should be sufficient for the excavation of the underlying soils at the site. Excavations are likely to remain stable in the short term. However, granular layers containing minor perched water levels could be encountered locally, as seen within CT1 and TP5, which may become unstable in the short term, requiring trench support.

Excavations are likely to remain dry down to depths in excess of 1.50m bgl. Minor water strikes may be encountered above 2.80m bgl as seen within TP5 and 1.50m bgl as seen within CT1. The ground investigation was undertaken during a significantly dry period during the summer months, and as such, groundwater levels may become significantly shallower during the wetter winter months. The proposed development indicates a flood zone along the southern boundary, which proves the possibility of seasonal changes to the groundwater levels.

6.5 FOUNDATIONS

The proposed development includes the construction of seventy-five residential dwellings, including a range of two-bed, three-bed, four-bed, and five-bed dwellings. Given the findings of this intrusive investigation, the foundation design will comprise both shallow foundations and deeper foundations. Based on the desiccation assessment, deeper foundations will be required in the eastern area of the site, as shown on the geological plan highlighted in blue in Appendix A. The zone of desiccation was proven down to a maximum depth of 6.50m bgl within BH1, where non-shrinkable silt deposits are encountered.

The western half of the site is predominantly underlain by granular soils considered to be non-shrinkable, and as such, conventional shallow foundations are considered viable.

The only exception applies to the area surrounding TP9, where significant layers of cohesive soils were encountered with a soil sample showing evidence of desiccation. It is considered that further testing should be undertaken to prove the extent of desiccation, which will dictate the required foundation depth.

6.5.1 Shallow Foundations (Area Highlighted Yellow on the Geological Plan)

The Topsoil and localised Made Ground are considered unsuitable as a bearing stratum due to its variability and potential for unacceptable total and differential settlement under applied foundation loadings.

The underlying granular River Terrace Deposits at a depth of 0.75m bgl or 0.20m into the stratum, whichever is the deeper (could be as deep as 1.20m, as per TP12), may be suitable for conventional shallow foundations. At this depth, a net allowable bearing pressure of 150kPa may be adopted for strip foundations not exceeding 1m in width. This allows for a factor of safety of three against shear failure and for settlements generally not to exceed 25mm, taking place over a number of years.

Foundations should be suitably reinforced to combat differential settlement, given the possibility of foundations crossing both granular and cohesive soils.

6.5.2 Piled Foundations (Area Highlighted Blue on the Geological Plan)

The underlying River Terrace Deposits and Lambeth Group down to a depth of 6.50m bgl in the area highlighted blue show evidence of desiccation, and as such, shallow foundations are considered unviable. Therefore, it is anticipated that deeper foundations such as piles will be required.

Should piles be the chosen method of foundation, the advice of a specialist piling contractor should be sought to formulate a suitable piling technique and type for the ground conditions encountered at this site, before commencement of the works.

It is anticipated that a CFA pile system will be appropriate on this site, given the ground conditions. Piles would extend through the Topsoil, Made Ground, and desiccated soils of the Lambeth Group proven to a depth of 6.50m bgl and terminate in the underlying non-shrinkable dense silt deposits within the Lambeth Group and the underlying White Chalk Sub-group. Piles extending through the desiccated soils of the Lambeth Group should be sleeved. In line with NHBC guidelines it is

recommended sufficient anchorage should be provided below the depth of desiccated soil. Slip liners may be used to reduce uplift, although this reduction is small.

A preliminary assessment of working loads has been based on the skin friction and base resistance within the underlying Lambeth Group (below 6.50m bgl) and the underlying White Chalk Subgroup. An overall factor of safety of 3 has been applied. Further investigation should be undertaken to prove that ground conditions within BH1 are representative of the area highlighted in blue. As such, the estimate of working loads should not be relied upon for design purposes.

Depth of the pile (m bgl)	Assumed founding stratum	Anticipated Working load (kN) for piles of the following diameters	
		Pile diameter 300 mm	Pile diameter 450 mm
7.50	Lambeth Group	<100	<200
10	White Chalk Subgroup	60	100
15	White Chalk Subgroup	200	300

The Lambeth Group has been proven to extend to a depth of 8.90m bgl; however, this could vary across the area highlighted in blue. Therefore, an estimation of the anticipated working loads where piles are founded within the Lambeth Group is given as less than (<). Further investigation should be undertaken to prove the ground conditions identified within BH1 are consistent across the area highlighted in blue to suitably design piled foundations.

6.5.3 Foundations (North-West Corner Surrounding TP9)

The area surrounding TP9 encountered significant layers of cohesive soils, with a soil sample showing evidence of desiccation. It is considered that further testing should be undertaken to prove the extent of desiccation, which will dictate the required foundation depth.

6.6 FLOOR SLAB DESIGN

Floor slabs at the site in the area highlighted yellow can be ground bearing, provided the Topsoil/Made Ground is stripped and removed and is based on a blanket of good quality, free-draining, well-compacted granular material, placed prior to the construction of the floor slab, in order to make up the level.

Floor slabs in the areas where there is evidence of desiccated soils, and where piled foundations are the chosen method of foundation, will need to be suspended. The advice of the NHBC should be followed.

6.7 SULPHATE ATTACK ON UNDERGROUND CONCRETE

Water soluble sulphate, pH, was carried out on samples recovered from the Made Ground, River Terrace Deposits, Lambeth Group and the White Chalk Subgroup. The Made Ground soils and the Lambeth Group were also tested for acid soluble sulphate and total sulphur tests to give an indication of the aggressivity of the ground in relation to buried concrete, as set out in the Building Research Establishment (BRE) Special Digest 1 (2005) Concrete in Aggressive Ground, Part 1: Assessing the aggressive chemical environment.

Therefore, in accordance with the BRE Special Digest, these results have been given in the table below, in relation to strata type and required Design Sulphate Class and site Aggressive Chemical Environment Classification (ACEC).

Strata	Design Sulphate Class	Aggressive Chemical Environment Classification
Made Ground	DS-1	AC-1
River Terrace Deposits	DS-1	AC-1
Lambeth Group	DS-4	AC-4
White Chalk Subgroup	DS-1	AC-1

The classification for the Lambeth Group of DS-4 and AC-4 has been restricted from a classification of DS-5/AC-5 respectively, in accord with Fig. C5 of the BRE Special Digest.

The recommendations given in the above digest, with respect to suitable concrete design and other associated precautions against sulphate attack, should be followed for all below-ground-level concrete.

6.8 INFILTRATION MEASURES

Appropriately designed sustainable drainage systems (SuDS) are more sustainable than using piped drainage to local sewer systems. However, infiltration measures close to buildings may result in undermining of foundations and softening of soils, leading to instability. Attenuation measures should be located at suitable distances from foundations and infrastructure. Infiltration testing was undertaken in four locations across the site, SA1 – SA4, within the River Terrace Deposits.

Three repeat tests were achieved within test locations SA1, SA3 and SA4. Two repeat tests were completed within SA2; however, due to low infiltration rates time a third test could not be completed within the time allowed.

The best rates were recorded within SA4, as shown in the table below:

Trial Pit	Infiltration Rates (m/s)			
	Test 1	Test 2	Test 3	Average
SA1	2.44×10^{-5}	1.64×10^{-5}	9.88×10^{-6}	1.69×10^{-5}
SA2	2.12×10^{-6}	2.37×10^{-6}	Insufficient time to start the third test	-
SA3	2.77×10^{-6}	2.58×10^{-6}	1.97×10^{-6}	2.44×10^{-6}
SA4	3.03×10^{-4}	1.50×10^{-4}	1.48×10^{-4}	2.00×10^{-4}

CIRIA C574 states that: “Concentrated ingress of water into the chalk can initiate new dissolution features, particularly in low-density chalk, and destabilise the loose backfill of existing ones. For this reason, any soakaways should be sited well away from foundations for structures, roads or railways, as indicated below:

-  In areas where dissolution features are known to be prevalent, soakaways should be avoided if at all possible, but, if unavoidable, should be sited at least 20m away from any foundations.
-  Where the chalk is of low density, or its density is not known, soakaways should be sited at least 10m away from any foundations.”

Given the information gathered from this intrusive investigation, the chalk strata were proven to be overlain by a significant overburden comprising River Terrace Deposits and Lambeth Group soils; therefore, the risk of dissolution features is less than if it was present nearer surface. No evidence of dissolution features was recorded during this investigation; however, only two boreholes (BH1 and BH2) identified chalk at depth. Therefore, as a precaution, it is recommended that soakaways should be sited at least 10m away from foundations for structures, roads and railways. Water pipes and foul and surface water drains should be constructed with flexible pipes and joints.

6.9 ACCESS ROADS AND PAVEMENT DESIGN

TRL DCP (Equivalent CBR) Tests were undertaken on the underlying sub-grade material, including Made Ground soils, and revealed an equivalent CBR value range of 5% and 120%. In addition, to avoid uneven and excessive settlement in hard-standing areas, it is recommended that the following precautions be taken: -

-  Heavy proof-rolling of the exposed sub-grade strata

-  Excavation of soft spots encountered and replacement with well-compacted granular material
-  The usage of a geo-textile separator layer above the sub-grade
-  A 5% design CBR value is considered in line with the Highways Department document HD 25-94 Road foundations and results of the CBR tests undertaken during this investigation

Additionally, the soils on site are likely to be frost susceptible. Road and pavement construction on frost-susceptible soils is required to be 450mm deep to extend below the frost zone.

6.10 GAS PROTECTION

The risk of ground gases impacting the site was assessed by reference to the paper “A pragmatic approach to ground gas risk assessment for the 21st Century” Card and Wilson, 2011.

Four monitoring visits were undertaken at the site, and recorded methane gas below detectable limits and carbon dioxide levels between 0.6% and 1.4%. A peak flow rate of 0l/h was also recorded. Therefore, the worst-case gas screening value (GSV) is 0l/h due to no flow recorded. Based on the conditions measured during the monitoring visits carried out to date, in accordance with BS8485:2015 and CIRIA C665, 2007, this would be considered as a Characteristic Situation 1 (CS1) and therefore no further action is required. Full details of gas concentrations and gas flow data recorded during the monitoring visits are given in the Appendices.

The site is located in an area where between 1% and 3% of homes exceed the action level of 200Bq/m³ for radon gas, and therefore, no radon protection measures are necessary in the construction of new dwellings or extensions.

Two additional gas monitoring visits are scheduled; therefore, the findings will conclude the level of risk.

7 GEO-ENVIRONMENTAL INTERPRETATIVE SECTION

7.1 RISKS TO HUMAN HEALTH

7.1.1 Introduction

Environment Agency guidance LCRM *Land Contamination: Risk Management*, (EA, 2019), states that human health risk assessment should be undertaken by a tiered approach using the source-pathway-receptor principle. A desk study constitutes the first tier, and this has been undertaken as part of this investigation. The conclusions of this phase were that: -

“Historical information indicates the majority of the site remains unaltered from the first historical records dated 1872, remaining an open, undeveloped field. The exception being a small area to the east of the site, which has been used as a builder’s yard by Hicks Development Ltd. The walkover survey indicated this area comprised a part tarmac, part engineered granular fill surface used for storing building materials, including bricks, plastic drains, pallets, and fences. Machinery, including an excavator and telehandler, was also stored in this area. A concrete slab is located to the north, previously used for supporting concrete silos. The remaining area of the site has remained undeveloped fields, which were once used for motocross, with dirt tracks visible on satellite imagery. Spoil heaps comprising topsoil from the builder’s yard and the new residential estate to the north are present on site. Therefore, the majority of the site is likely to be underlain by natural soils and, therefore, unlikely to pose any risk to receptors.

The main sources of contamination are considered to be Made Ground soils associated with the builder’s yard to the east, which may contain local elevations of a range of contaminants, given their unknown origin, and the storage of materials and machinery may have introduced contaminants via accidental leakages and spillages such as oil/fuel.

There is one record of a pollution incident within 250m, situated 16m south-east of the site. This relates to oil and fuel release, which caused a significant water impact dated 2023. Given the significant impact and proximity to the site, this could be a potential source of contamination affecting the south-east corner of the site.

The surrounding area to the east and south has experienced significant quarrying associated with the extraction of sand and gravel. The majority are now flooded, forming nature reserves; however, there are records of landfilling, which could be potential sources of ground gas.

There are spoil heaps located on site, comprising predominantly topsoil from the surrounding developments. It is considered unlikely these will contain elevated levels of contamination, but given their reworked nature, it is possible they may contain anthropogenic material.”

Therefore, it is considered that there are some potential source/pathway/receptor linkages at the site, and as such, chemical testing has been undertaken.

Results are analysed under the second tier, known as a Generic Quantitative Risk Assessment (GQRA), which uses generic guideline values to compare site chemical data against, and the final tier would be a Detailed Quantitative Risk Assessment (DQRA), which uses data derived from the ground investigation to assess risks to identified receptors.

The assessment included in this report comprises a GQRA, which is undertaken by comparing soil contaminant concentrations from this investigation with conservative Generic Assessment Criteria (GAC). GACs for various land use and exposure scenarios have been selected from the following sources:

-  CL:AIRE Category 4 Screening Levels (C4SL);
-  LQM Suitable for Use Levels (S4UL);
-  CL:AIRE/EIC/AGS GAC

The GAC have been derived using the Environment Agency Contaminated Land Exposure Assessment (CLEA) model, for a range of land uses and exposure scenarios, including:

-  Residential with the consumption of home-grown produce;
-  Residential without the consumption of home-grown produce;
-  Commercial;
-  Allotments;
-  Public Open Space near residential housing (POS_{resi}); and
-  Public Open Space public park scenario (POS_{park})

Given that the proposed development is to construct residential dwellings with private gardens, a “residential with the consumption of home-grown produce” land-use scenario has been selected for this assessment.

7.2 RESULTS OF CHEMICAL TESTING

Ten soil samples were screened as part of this investigation.

Made Ground samples:

-  TP1 at a depth of 0.20m bgl
-  CT1 at a depth of 0.10m to 0.70m bgl
-  TP12 at a depth of 0.30m bgl
-  TP3 at a depth of 0.20m bgl

Spoil Heap Samples:

-  TP2 at a depth of 0.50m bgl
-  TP2 at a depth of 2.50m bgl
-  TP13 at a depth of 0.20m bgl
-  TP13 at a depth of 2.80m bgl

Natural Soil Sample:

-  TP9 at a depth of 0.30m bgl
-  CT4 at a depth of 0.30m to 0.85m bgl

The above soil samples were screened against the relevant GAC for a “Residential with the consumption of home-grown produce” land-use scenario as described above, and recorded no significantly elevated levels of contaminants with the exception of marginally elevated levels of polycyclic aromatic hydrocarbons within the Made Ground sample recovered from TP1 at a depth of 0.20m bgl.

7.2.1 Asbestos

Screening for the presence of asbestos did not reveal any asbestos-containing material (ACM) or fibres.

7.2.2 Polycyclic Aromatic Hydrocarbons

A marginally elevated concentration of dibenz(a,h)anthracene was encountered within one Made Ground soil sample (TP1 at a depth of 0.20m bgl). The concentration recorded was 0.38mg/kg with the relevant GAC being 0.24mg/kg.

Due to the conservative approach to calculating the S4ULs, we have decided to use the C4SLs for Benzo(a)pyrene (BaP) as a surrogate marker for the PAH on-site. In order to do this, the three criteria below need to be met:-

-  The SM (BaP) must be present in all soil samples.
-  The profile of the different PAH relative to BaP should be similar in all samples.
-  The PAH profile in the soil samples should be similar to that used in the pivotal toxicity study on which HBGV was based, i.e. the Culp study.

This was the case within all the samples where PAHs were encountered, and the soil concentration of BaP did not exceed the relevant C4SL of 5mg/kg. Therefore, it is considered that the risk to end users of the site was below the C4SL level, which is defined as “there is no risk that land poses a significant possibility of significant harm”, therefore in line with DEFRA authorised guidance, we consider that the PAHs do not cause a risk to end users across the site. The BaP Surrogate Marker calculation sheets are included in Appendix C.

7.3 RISK TO END USERS

Given the findings of the desk study, walkover survey, intrusive investigation and laboratory testing, it is considered that the risk of contamination to construction workers, end users and surrounding residents from the proposed development at this site is very low, and **as such, NO further works or remedial measures are necessary prior to development.**

We recommend that the conclusions of this report be agreed with the relevant Local Authority at the earliest stage, to reduce potential delays to the development.

7.4 RISK TO CONTROLLED WATERS

None of the metals and inorganic contaminants tested for within the total soil chemical tests recorded significantly elevated values. It is therefore considered that there is no risk of Controlled Waters pollution from this site.

The Environment Agency is the regulatory body charged with the protection of controlled waters and may be a consultee in the planning process. We recommend that the conclusions of this report be agreed with the relevant Local Authority at the earliest stage, to reduce potential delays to the development.

7.5 RISK TO UNDERGROUND WATER SUPPLY PIPES

Based upon the guidance document from the UK Water Industry Research (UK WIR), 'Contaminated Land Assessment Guidance', February 2014, and the results of the samples tested specifically for the UKWIR suite from the site, it is considered that conventional PE water pipes would be suitable for the majority of the site including all-natural soils and Topsoil.

However, a marginally elevated level of Bis(2-ethylhexyl) phthalate (SVOC) was recorded within the sample recovered from CT1 at a depth of 0.10m to 0.70m bgl taken from the engineered fill underlying the builder's yard. The value was recorded at 3.1mg/kg with the limit value for SVOC being 2mg/kg. Furthermore, a marginally elevated level of Total TPH C12-C16 was recorded at 11mg/kg in TP 1 at 0.20m bgl, with the limit value for band C10 – C16 being 10mg/kg. Therefore, water pipes crossing the engineered fill underlying the builder's yard will require a barrier pipe.

This should be confirmed with the local water company, as not all authorities use this guidance.

8 WASTE DISPOSAL CLASSIFICATION

8.1 INTRODUCTION

Excavation for foundations or services will produce waste soil and possibly other waste streams. As a waste producer, you have a duty of care under section 34 of the Environmental Protection Act 1990 to ensure, amongst other things, that these wastes are:

-  Correctly stored
-  Correctly classify
-  Handed only to an authorised person
-  Disposed of properly

To aid with these obligations, we have used HazWasteOnline to undertake the Hazard Assessment Screen as part of this investigation, to establish whether the sampled soils should be considered as either hazardous or non-hazardous waste. This classification process is in line with the Environment Agency's guidance WM3 "Guidance on the classification and assessment of waste", Version 1.2, October 2021.

8.2 RESULTS OF HAZARD ASSESSMENT

The samples analysed for human health listed in section 7.2 have been classified using HazWasteOnline.

The full results of the HazWasteOnline Stage-One analyses can be seen in the Appendices.

The HazWasteOnline classification summary sheet from this investigation provides a waste classification of Non-Hazardous for all samples tested.

No visible pieces of asbestos were detected by the naked eye or identified in the chemical testing. Therefore, asbestos was not considered further from a waste perspective.

8.3 WASTE ACCEPTANCE CRITERIA (WAC) TESTING RESULTS

To further classify the waste soil for landfill disposal, Waste Acceptance Criteria (WAC) testing has been carried out on Made Ground (engineered fill underlying the builder's yard) sample taken from CT1 at a depth of 0.10m to 0.70m bgl and a sample taken from the topsoil spoil heap from sample TP2 at a depth of 0.50m bgl.

The results show that the sample passes the inert waste criteria for the Topsoil spoil heap material and a Non-Hazardous waste criterion for the Made Ground (engineered fill underlying the builder's

yard) due to marginally elevated levels of sulphate. Sulphate was recorded at 1200mg/kg, with the limit value being 1000mg/kg.

It is considered that the underlying natural soils, including the Topsoil beneath the site, qualify in accordance with EU Council Decision 2003/33/EC para. 2.1.1. “uncontaminated soil can be classified as Inert without testing”.

As such, given the testing results, currently the underlying soils from the site are considered likely to be classified as follows:

Strata	Classification	Description of Material	EWC Code	Recommended Landfill Tax Rate
Topsoil	Inert	“Naturally occurring soils and stones containing”	17 05 04	Standard Rate
Topsoil Spoil Heaps	Inert	“Naturally occurring soils and stones containing”	17 05 04	Standard Rate
Made Ground (Engineered fill underlying the builder’s yard)	Non-Hazardous	“Mixtures of concrete, bricks, tiles and ceramics”	17 01 07	Lower Rate
Natural Soil	Inert	“Naturally occurring soils and stones”	17 05 04	Lower Rate

Under section 63(2) of the Finance Act 1996, it states that where a disposal to landfill consists mainly of qualifying material(s), but includes a small amount of standard-rated material, the whole load is taxable at the lower rate. As such, the Made Ground (engineered fill) soils (excluding any Topsoil) are considered to be taxable at the lower rate. The natural soils are taxable at the lower rate.

We recommend that analytical results relevant to the materials being disposed of should be provided to the landfill operators or waste management contractors to confirm whether it meets their licence agreements and to confirm tipping costs.

All wastes removed from the site should be consigned, transported and disposed of in full accordance with all relevant UK legislation.

9 RECOMMENDATIONS

9.1.1 *Watching Brief*

We recommend that a watching brief should be undertaken during the construction phase, and if, during development, any previously undiscovered contamination (including visual or olfactory evidence) is found, then site management should be immediately informed and inspection by a suitably qualified person should be undertaken.

9.1.2 *Geo-Environmental Recommendations*

Given the findings of the desk study, walkover survey, intrusive investigation and laboratory testing, it is considered that the risk of contamination to construction workers, end users and surrounding residents from the proposed development at this site is very low, and **as such, NO further works or remedial measures are necessary prior to development.**

Barrier water pipes will be required where crossing the Made Ground (Engineered Fill) underlying the builder's yard due to marginally elevated levels of TPH and SVOC when compared to the limit values for water pipe classification.

9.1.3 *Geotechnical Recommendations*

Given the findings of the desk study, intrusive investigation and laboratory testing, there are complex ground conditions which require further assessment:

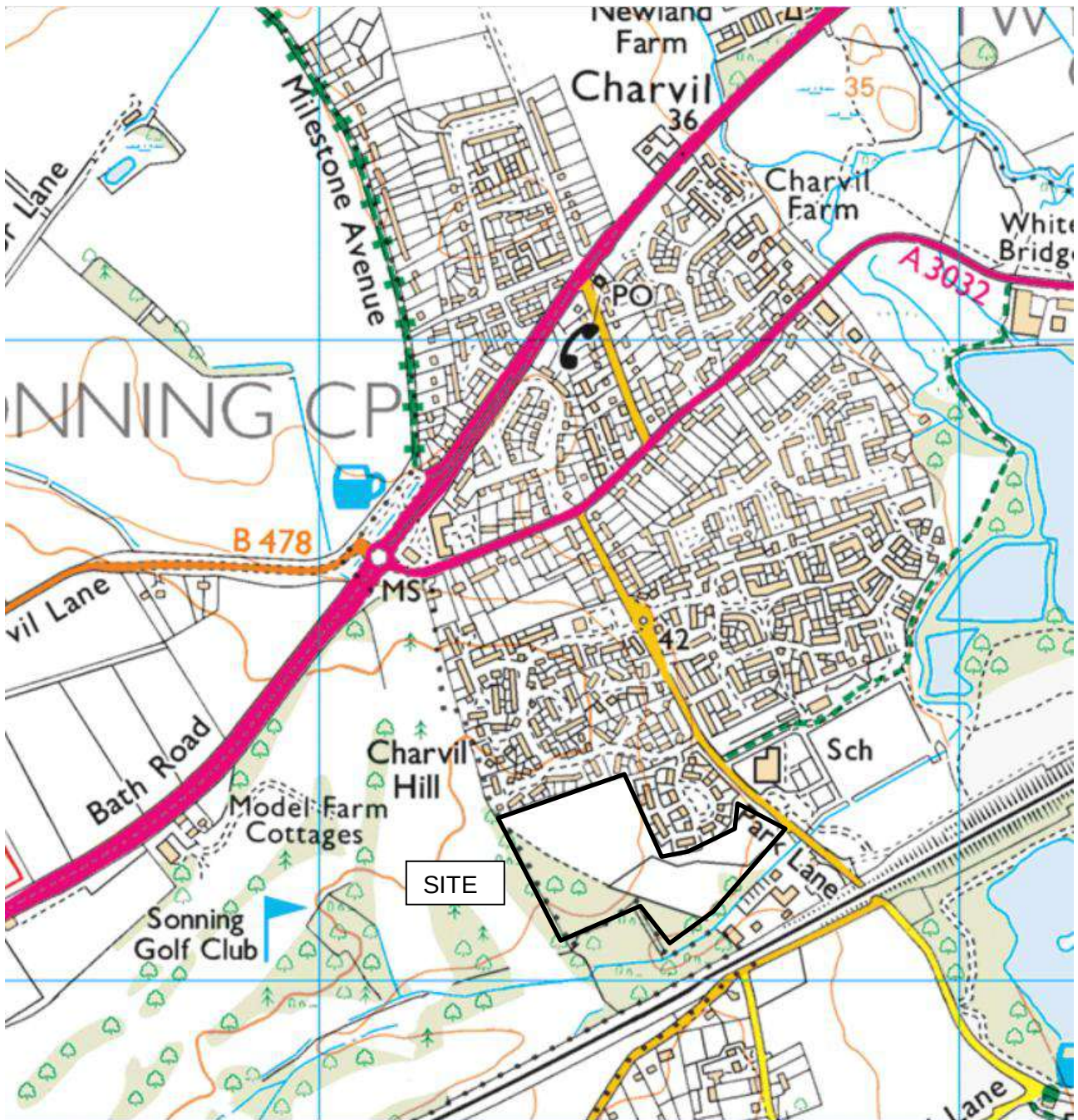
-  The area highlighted blue on the geological plan within Appendix A has found evidence of desiccation down to a proven depth of 6.50m bgl as shown within BH1. Further investigation should be undertaken to prove the ground conditions identified within BH1 are consistent across the area highlighted in blue to suitably design piled foundations
-  Further investigation incorporating deep boreholes and probes is recommended to provide evidence that dissolution features are not present, if present, these could negatively impact deeper foundations
-  The western half of the site highlighted yellow on the geological plan in Appendix A is predominantly underlain by granular soils considered to be non-shrinkable, and as such, conventional shallow foundations are considered viable. However, foundations should be reinforced to combat potential differential settlement caused by foundations crossing both granular and cohesive soil

- The only exception applies to the area surrounding TP9, where significant layers of cohesive soils were encountered with a soil sample showing evidence of desiccation. It is considered that further testing should be undertaken to prove the extent of desiccation, which will dictate the required foundation depth
- Soakaways could be viable at this site; however, given the known flood risk zone along the southern boundary of the site, it is considered that groundwater levels are likely to rise during the wetter winter months. Groundwater monitoring should be undertaken over the winter period to prove potential fluctuations in groundwater; this will likely be required by the LLFA
- In addition, as per CIRIA C574, soakaways should be placed at least 10m away from foundations, roads or railways
- A small pit filled with wooden sleepers was observed during the walkover survey located along the western boundary of the builder's yard. It is recommended prior to development; the sleepers are removed and the underlying material inspected. Should loose soils indicating potential dissolution features or Made Ground soils be encountered, further assessment should be undertaken by a suitably qualified person.

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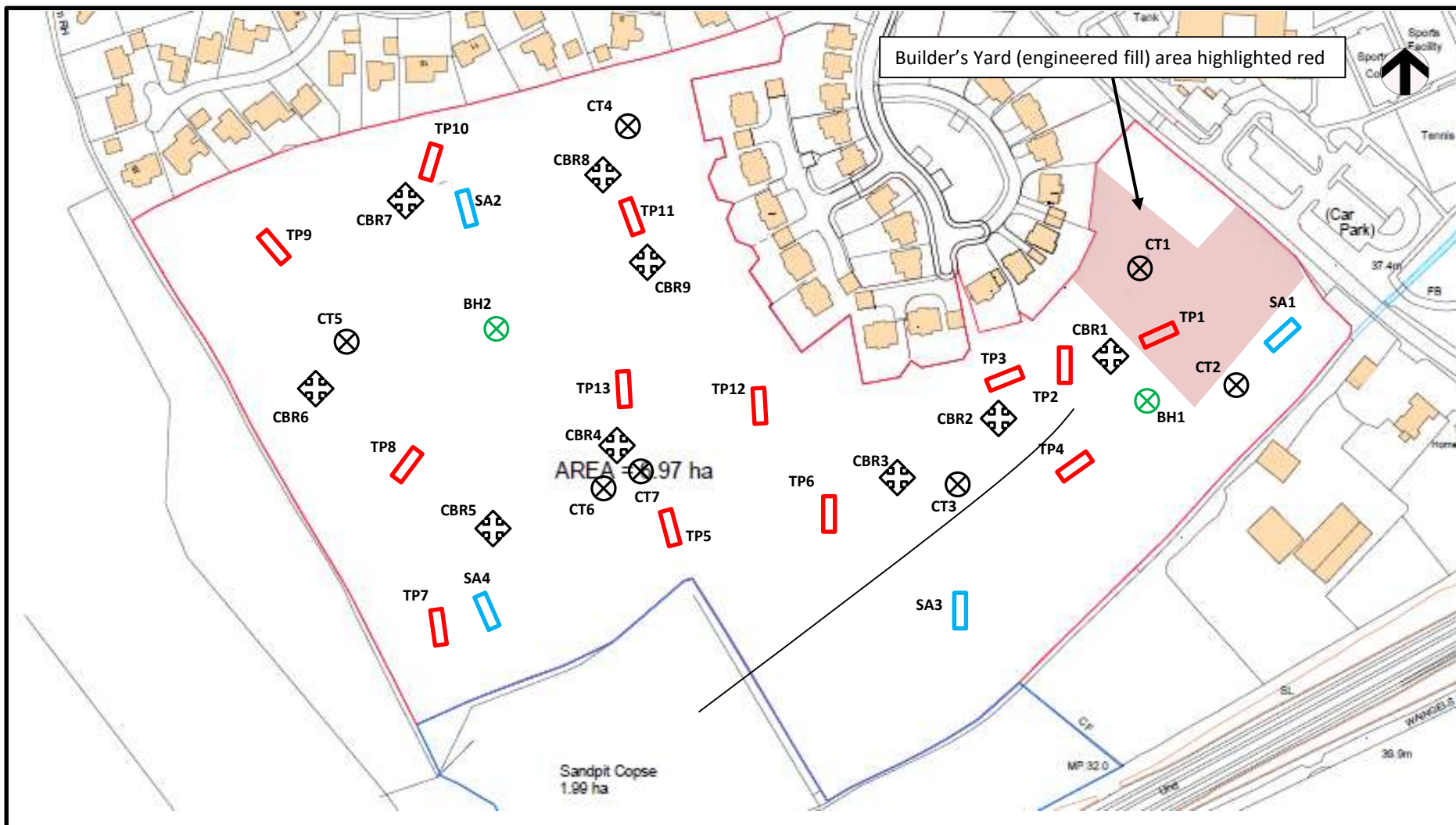
APPENDIX A



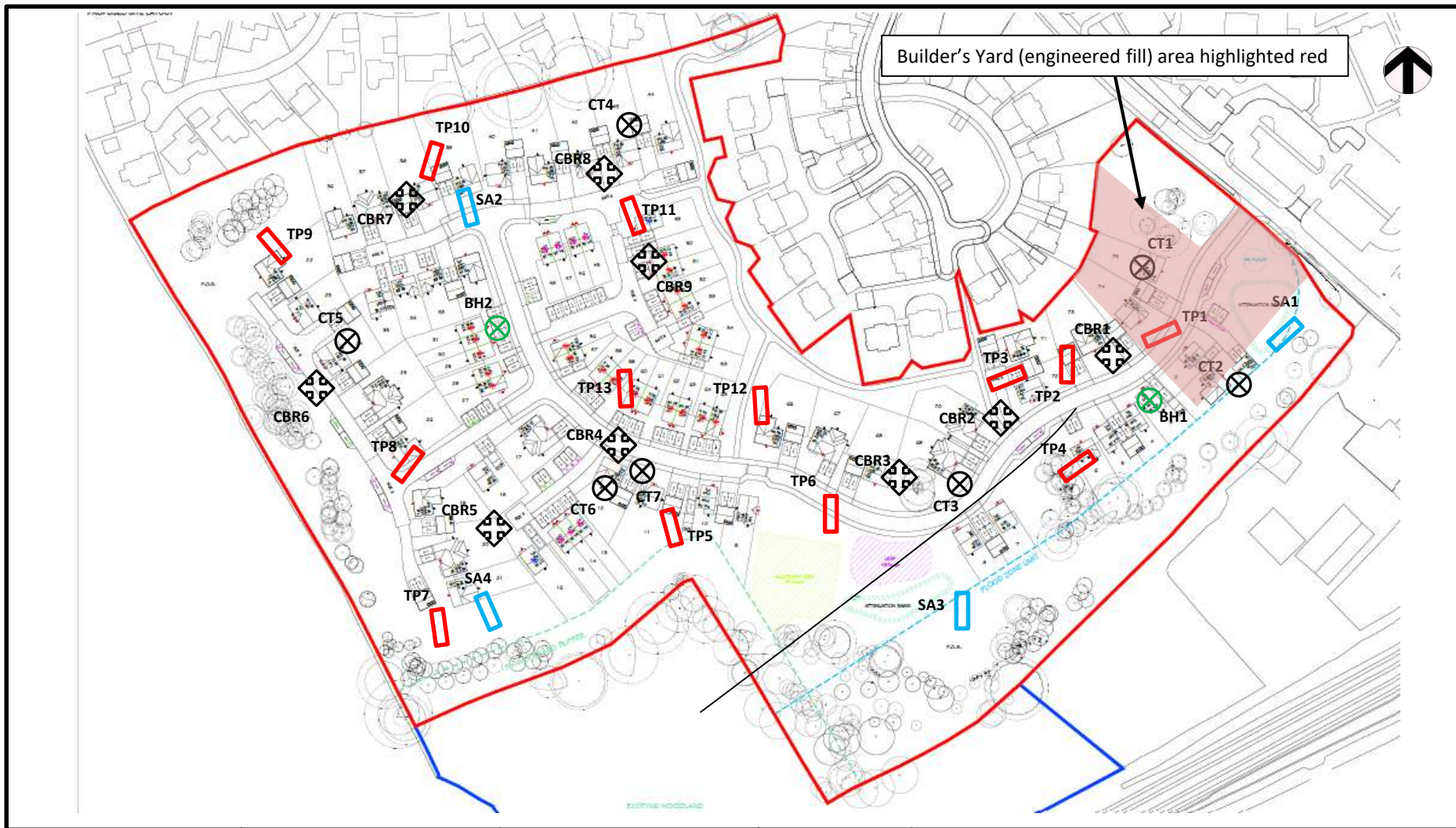
August 2025

SITE LOCATION PLAN

Report No:- 25-07-12



Key Trial Pit Continuous Tube Borehole Soakaway Pit CBR Test Cable Percussive BH	Exploratory Hole Location Plan	SITE:- Park Lane, Charvil	Drawn EM	
	JOB NO.:-25-07-12	CLIENT:- Bellway Thames	Checked LA	
	Tel:- 01280 816409 Mob:- 07858 367 125 www. geo-integrity.co.uk	4 Church Street Maids Moreton MK18 1QE	Scale: Not To Scale, for indicative purposes only	



Key Trial Pit Continuous Tube Borehole Soakaway Pit CBR Test Cable Percussive BH	Exploratory Hole Location Plan	SITE:- Park Lane, Charvil	Drawn EM	
	JOB NO.:-25-07-12	CLIENT:- Bellway Thames	Checked LA	
	Tel:- 01280 816409 Mob:- 07858 367 125 www. geo-integrity.co.uk	4 Church Street Maids Moreton MK18 1QE	Scale: Not To Scale, for indicative purposes only	

The area west of the dashed line comprised significant layers of cohesive soil

The area highlighted yellow was predominantly underlain by granular soils and therefore considered to be non-shrinkable

CT1 encountered granular non-shrinkable soil down to the base of the borehole in excess of 4.00m bgl. Therefore, the risks posed by desiccation do not apply here

TP9 also recorded evidence of desiccated soils. CT5 to the south also recorded cohesive soils however these displayed no significant evidence of desiccation and the soils within TP10 were found to be entirely granular therefore the zone of desiccation can be zoned to the north-west corner. Further investigation should be undertaken to prove the zone of desiccation.

Yellow star indicates the small pit encountered during the walkover survey

The area highlighted blue is considered to comprise locally desiccated soil as proven within the three exploratory holes (CT2, CT3 and BH1). This entire area recorded significant layers of cohesive soils with the exception of CT1 and as such given the information currently available this area should be considered at risk of shrinking and swelling down to depths of 6.50m bgl as proven within BH1.

Flood risk zone

Key

-  Trial Pit
-  Continuous Tube Borehole
-  Soakaway Pit
-  CBR Test
-  Cable Percussive BH

Geological Plan

SITE:- Park Lane,
Charvil

Drawn
LA

JOB NO:-25-07-12

CLIENT:- Bellway
Thames

Checked
FW

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APPENDIX B

					www.geo-integrity.co.uk info@geo-integrity.co.uk 01280 816409		Site Park Lane, Charvil, North Wokingham, RG10 9TR		Borehole Number BH1		
Machine : Dando 3000 Method : Cable Percussion		Casing Diameter			Ground Level (mOD) 39.93		Client Bellway Thames			Job Number 25-07-12	
		Location (Handheld GPS) 477656.309 E 175189.397 N			Dates 01/08/2025		Engineer Lee Ashworth			Sheet 1/3	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description			Legend	Water
0.20-0.60	B					(0.60)	TOPSOIL - Loose light brown clayey sandy slightly gravelly SILT. Gravel is fine to coarse subrounded flint				
0.60-1.00	B				39.33	0.60 (0.40)	RIVER TERRACE DEPOSITS Very loose orange brown very clayey moist silty gravelly SAND. Gravel is fine to coarse subangular to subrounded flint and quartzite				
1.00-1.45	SPT N=6			1,1/1,1,2,2	38.93	1.00	RIVER TERRACE DEPOSITS Soft to firm grey brown orange silty slightly gravelly CLAY. Gravel is fine to medium flint, quartzite, and chalk. Becoming less gravelly past 1.5m				
1.20-1.65	D					(1.00)					
2.00-2.45	SPT N=8			1,1/2,2,2,2	37.93	2.00	LAMBETH GROUP Firm grey brown silty slightly gravelly CLAY. Gravel is fine subangular chalk with rare horizons of red silty gravel				
2.00	D										
2.00-2.45	D										
2.00-2.50	B										
3.00-3.45	SPT N=12			1,1/2,3,3,4		(2.50)					
3.00	D										
3.00-3.45	D										
4.00	D										
4.00-4.45	UT				35.43	4.50	LAMBETH GROUP - Firm to stiff dark grey silty CLAY				
4.60-5.00	B					(0.70)					
5.00-5.45	SPT N=16			1,2/2,4,5,5	34.73	5.20	LAMBETH GROUP - Stiff dark grey silty CLAY				
5.00	D										
5.00-5.45	D										
6.00	D					(1.30)					
6.50-6.95	UT				33.43	6.50	LAMBETH GROUP - Dense dark grey green very sandy slightly clayey SILT with shell debris				
7.00	D					(2.40)					
8.00	D			Water strike(1) at 7.90m, no rise after 20 mins. 3,5/6,6,5,5							
8.00-8.45	D										
8.00-8.45	SPT N=22										
9.00	D				31.03	8.90 (0.60)	WHITE CHALK SUBGROUP - Structureless off-white CHALK composed of silty GRAVEL. Gravel is very weak white chalk (Grade Dc)				
9.50-9.95	SPT N=14			1,2/2,3,4,5	30.43	9.50	WHITE CHALK SUBGROUP - Structureless off-white CHALK composed of gravelly SILT. Gravel is very weak white chalk (Grade Dm)				
9.50-9.95	D										
Remarks							Scale (approx) 1:50		Logged By LA		
									Figure No. 25-07-12.BH1		
											



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Site
Park Lane, Charvil, North Wokingham, RG10 9TR

Borehole
Number
BH1

Machine : Dando 3000 Method : Cable Percussion		Casing Diameter		Ground Level (mOD) 39.93		Client Bellway Thames		Job Number 25-07-12	
		Location (Handheld GPS) 477656.309 E 175189.397 N		Dates 01/08/2025		Engineer Lee Ashworth		Sheet 2/3	

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00	D				29.43	(1.00)	WHITE CHALK SUBGROUP - Structureless off-white CHALK composed of silty GRAVEL. Gravel is very weak medium dense white chalk (Grade Dc)		
11.00-11.45 11.00 11.00-11.45	SPT N=17 D D			3,3/3,4,5,5		10.50			
12.00	D								
12.50-12.95 12.50-12.95	SPT N=15 D			2,2/3,4,4,4					
13.00	D								
14.00-14.45 14.00 14.00-14.45	SPT N=17 D D			3,3/4,4,4,5					
15.00	D								
15.50-15.95 15.50-15.95	SPT N=32 D			4,5/7,7,9,9					
16.00	D								
17.00-17.39 17.00 17.00-17.39	SPT 50/240 D D			8,9/11,11,22,6			Flint gravel at 17m		
18.00 18.00	D D					(14.50)			
18.50-18.95 18.50-18.95	SPT N=32 D			4,6/6,6,9,11					
19.00	D								
20.00-20.45	SPT N=36			7,7/8,8,9,11					

Remarks

Scale (approx)
1:50

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Figure No.
25-07-12.BH1





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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

Borehole
Number
BH1

Machine : Dando 3000

Method : Cable Percussion

Casing Diameter

Ground Level (mOD)

39.93

Client

Bellway Thames

Job
Number
25-07-12

Location (Handheld GPS)

477656.309 E 175189.397 N

Dates

01/08/2025

Engineer

Lee Ashworth

Sheet
3/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.00 20.00-20.45	D D						Significant flint seam between 20m - 21m		
21.00	D								
21.50-21.73 21.50-21.73	SPT 50/80 D			7,8/22,28,0,0					
22.00	D								
23.00-23.45 23.00	SPT N=50 D			7,9/10,16,10,14					
23.50-23.95	D								
					14.93	25.00	Complete at 25.00m		

Remarks

Scale
(approx)

1:50

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Figure No.

25-07-12.BH1





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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

Borehole

Number
BH2

Machine : Dando 2000

Method : Cable Percussion

Casing Diameter**Ground Level (mOD)**

46.17

Client

Bellway Thames

Job

Number

25-07-12

Location (Handheld GPS)

477429.291 E 175221.091 N

Dates

01/08/2025

Engineer

Lee Ashworth

Sheet

1/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.50 0.30 0.50-1.00	B D B				45.97	(0.20) 0.20	TOPSOIL - Loose light brown slightly gravelly SILT		
						(0.80)	RIVER TERRACE DEPOSITS Medium dense light brown gravelly SILT. Gravel is fine to coarse subangular to subrounded flint and quartzite		
1.00	D			2,3/6,8,8,8	45.17	1.00	RIVER TERRACE DEPOSITS Very dense orange brown slightly gravelly SAND. Gravel is fine to coarse subangular to subrounded flint		
1.20-1.65 1.20-1.65 1.50-2.00	SPT N=30 D B					(1.50)			
2.00	D			2,7/7,10,14,16					
2.20-2.65 2.20-2.65	SPT N=47 D				43.67	2.50	RIVER TERRACE DEPOSITS Dense orange brown coarse GRAVEL. Gravel is fine to coarse subrounded flint		
2.70	D								
3.20-3.51	SPT(C) 50/160			3,14/20,22,8,0		(2.30)			
4.20-4.65	SPT(C) N=32			3,5/5,7,8,12					
4.80	D				41.37	4.80	RIVER TERRACE DEPOSITS Very dense slightly clayey silty gravelly SAND. Gravel is fine to medium subangular flint and quartzite		
5.20-5.65 5.20-5.65	SPT N=31 D			3,4/6,7,8,10		(1.20)			
6.00	D				40.17	6.00	RIVER TERRACE DEPOSITS Very dense light brown fine to medium SAND		
6.50-6.95 6.50-6.95	SPT N=40 D			5,7/7,10,11,12		(2.00)			
8.00-8.36 8.00-8.36	SPT 50/210 D			3,4/10,22,18,0	38.17	8.00	LAMBETH GROUP Stiff dark grey green silty CLAY with shell debris and calcerous horizons		
9.50-9.95 9.50-9.95 9.60	SPT N=28 D D			3,5/5,8,6,9					

Remarks

Scale (approx)

1:50

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Figure No.

25-07-12.BH2





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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

Borehole

Number
BH2

Machine : Dando 2000

Method : Cable Percussion

Casing Diameter**Ground Level (mOD)**

46.17

Client

Bellway Thames

Job

Number
25-07-12

Location (Handheld GPS)

477429.291 E 175221.091 N

Dates

01/08/2025

Engineer

Lee Ashworth

Sheet

2/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00	B								
10.45-10.60	D					(5.70)			
11.00-11.45	UT								
11.45-11.50	D								
12.50-12.95	SPT N=39			5,7/8,9,11,11					
12.50	D								
13.70	D				32.47	13.70	WHITE CHALK SUBGROUP - Structureless off-white CHALK composed of gravelly SILT with rare fine parts of brown silt (Grade Dm)		▽1
14.00-14.45	UT			Water strike(1) at 13.90m, rose to 13.00m in 20 mins.					
14.45-14.50	D					(2.30)			
14.45-14.60	D								
14.50-15.00	B								
15.50-15.95	SPT N=23			4,5/6,7,5,5	30.17	16.00	WHITE CHALK SUBGROUP - Structureless off-white CHALK composed of silty GRAVEL. Gravel is weak medium dense white chalk and rare flint (Grade Dc)		
15.50-15.95	D								
17.00-17.45	UT					(2.50)			
17.45-18.00	D								
18.00	D								
18.50-18.88	SPT 53/230			4,5/8,13,22,10	27.67	18.50	WHITE CHALK SUBGROUP - Structureless off-white CHALK composed of gravelly SILT with rare fine parts of brown silt (Grade Dm)		
18.50-18.88	D								
19.50	D								

Remarks

Scale (approx)

1:50

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Figure No.

25-07-12.BH2





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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

Borehole
Number
BH2

Machine : Dando 2000

Method : Cable Percussion

Casing Diameter

Ground Level (mOD)

46.17

Client

Bellway Thames

Job
Number
25-07-12

Location (Handheld GPS)

477429.291 E 175221.091 N

Dates

01/08/2025

Engineer

Lee Ashworth

Sheet
3/3

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
20.00-20.45	UT								
21.00	D								
21.50-21.95 21.50-21.95	SPT N=49 D			7,14/9,12,12,16		(6.50)			
22.50	D								
23.00-23.38 23.00-23.38	SPT 50/230 D			8,11/12,16,18,4					
24.50-24.92 24.50-24.92	SPT 56/270 D			9,12/12,16,16,12					
25.00	D				21.17	25.00	Complete at 25.00m		

Remarks

Scale
(approx)

1:50

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By

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Figure No.

25-07-12.BH2





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Site
Park Lane, Charvil, North Wokingham, RG10 9TR

Number
CT1

Machine : Window Sampler
Method : Drive-in Windowless Sampler

Dimensions
87mm to 3.0m
77mm to 4.0m

Ground Level (mOD)
40.10

Client
Bellway Thames

Job Number
25-07-12

Location (Handheld GPS)
477661.62 E 175235.966 N

Dates
06/08/2025

Engineer
Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	D				(0.70)	MADE GROUND - Medium dense brown fine to medium SAND AND GRAVEL with brick and concrete cobbles. Gravel is fine to coarse angular		
0.70	D			39.40	0.70	RIVER TERRACE DEPOSITS Medium dense orange brown and light grey fine SAND with thick bands of light grey silt		
1.00-1.45 1.00	SPT N=15 D	1.50	2,2/2,2,5,6					
1.50	D		Water strike(1) at 1.50m, no rise after 20 mins.					
2.00-2.45 2.00	SPT N=25 D		4,4/5,6,7,7		(2.80)			
2.50	D							
3.00-3.45 3.00	SPT N=7 D		1,1/3,2,1,1					
3.50	D			36.60	3.50	RIVER TERRACE DEPOSITS Loose light grey fine SAND with black organic fine sand inclusions		
					(0.50)			
				36.10	4.00	Borehole collapsed in to 3.10m, then collapsed in to 1.50m on removal of casing Continued with probe (P1) Complete at 4.00m		

Remarks

Scale (approx)
1:25

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Figure No.
25-07-12.CT1



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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

Number
CT2

Machine : Window Sampler

Method : Drive-in Windowless Sampler

Dimensions

87mm to 2.0m 57mm to 5.0m
77mm to 3.0m
67mm to 4.0m

Ground Level (mOD)

39.61

Client

Bellway Thames

Job
Number
25-07-12

Location (Handheld GPS)

477690.746 E 175194.834 N

Dates

06/08/2025

Engineer

Lee Ashworth

Sheet
1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.10	D				(0.50)	TOPSOIL - Loose dark brown sandy slightly gravelly TOPSOIL. Gravel is fine to medium angular			
0.50	D			39.11	0.50 (0.45)	RIVER TERRACE DEPOSITS Loose orange brown and brown slightly silty slightly gravelly fine SAND. Gravel is fine to coarse angular			
0.95 1.00 1.00-1.45	D PP 125kPa SPT N=6		2,2/2,1,1,2	38.66	0.95	LAMBETH GROUP Soft orange brown and light grey silty CLAY			
1.50 1.50	PP 50kPa D				(1.05)				
2.00 2.00-2.45 2.00	PP 37.5kPa SPT N=11 D		1,2/2,3,2,4	37.61	2.00	LAMBETH GROUP Soft to firm light grey and occasional brown silty CLAY			
2.50	D								
3.00 3.00-3.45 3.00	PP 50kPa SPT N=13 D		2,2/3,3,3,4		(2.50)				
3.50 3.50	PP 75kPa D								
4.00 4.00-4.45 4.00	PP 87.5kPa SPT N=16 D		2,3/4,4,4,4						
4.50 4.50	PP 87.5kPa D			35.11	4.50 (0.50)	LAMBETH GROUP Firm to stiff dark grey CLAY			
5.00	PP 112.5kPa								
Remarks							Scale (approx)	Logged By	
							1:25	LA	
							Figure No. 25-07-12.CT2		



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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

Number
CT2

Machine : Window Sampler

Method : Drive-in Windowless Sampler

Dimensions

87mm to 2.0m	57mm to 5.0m
77mm to 3.0m	
67mm to 4.0m	

Ground Level (mOD)

39.61

Client	
---------------	--

Bellway Thames

**Job
Number**
25-07-12

Location (Handheld GPS)

477690.746 E 175194.834 N

Dates

06/08/2025

Engineer

Lee Ashworth

Sheet
2/2

Depth
(m)

Sample / Tests

Water
Depth
(m)

Field Records

Level
(mOD)Depth
(m)
(Thickness)

Description

Legend

Water	
-------	--

Instr

34.61

5.00

Continued with probe (P2)

Complete at 5.00m

Remarks

Scale (approx)

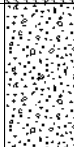
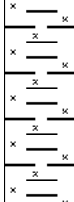
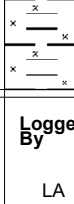
1:25

Logged
By

LA

Figure No.

25-07-12.CT2

 www.geo-integrity.co.uk info@geo-integrity.co.uk 01280 816409					Site Park Lane, Charvil, North Wokingham, RG10 9TR		Number CT3			
Machine : Window Sampler Method : Drive-in Windowless Sampler		Dimensions 87mm to 1.0m 57mm to 5.0m 77mm to 2.0m 67mm to 3.0m		Ground Level (mOD) 43.03		Client Bellway Thames		Job Number 25-07-12		
		Location (Handheld GPS) 477581.9 E 175176.166 N		Dates 06/08/2025		Engineer Lee Ashworth		Sheet 1/1		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water	
0.10	D		9,9/5,4,3,3	42.33	(0.70)	TOPSOIL - Loose dark brown sandy gravelly TOPSOIL. Gravel is fine to medium angular				
0.70	D				0.70	RIVER TERRACE DEPOSITS Medium dense brown fine to medium SAND AND GRAVEL. Gravel is fine to medium angular of flint				
1.00-1.45	SPT N=15				(0.50)					
1.20	D				1.20	LAMBETH GROUP Firm to stiff orange brown and light grey silty slightly gravelly CLAY. Gravel is medium sub-angular of flint				
1.50 1.50	PP 112.5kPa D		1,2/3,3,3,4	41.83	(2.80)					
2.00 2.00-2.45 2.00	PP 100kPa SPT N=13 D									
2.50 2.50	PP 87.5kPa D									
3.00 3.00-3.45 3.00	PP 125kPa SPT N=20 D					2,3/4,4,6,6				
3.50 3.50	PP 125kPa D		3,3/4,4,4,6	39.03	4.00	LAMBETH GROUP Stiff light grey and occasional brown silty CLAY				
4.00 4.00-4.45 4.00	PP 75kPa SPT N=18 D									
4.50	D							(1.00)		
5.00 5.00-5.45	PP 87.5kPa SPT N=21					3,4/4,4,6,7		38.03		5.00
Remarks								Scale (approx) 1:25	Logged By LA	
								Figure No. 25-07-12.CT3		



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Site
Park Lane, Charvil, North Wokingham, RG10 9TR

Number
CT4

Machine : Window Sampler Method : Drive-in Windowless Sampler	Dimensions 87mm to 2.0m 77mm to 2.5m 67mm to 3.0m	Ground Level (mOD) 45.33	Client Bellway Thames	Job Number 25-07-12
	Location (Handheld GPS) 477467.194 E 175288.582 N	Dates 06/08/2025	Engineer Lee Ashworth	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	D				(0.30)	TOPSOIL - Loose dark brown sandy slightly gravelly TOPSOIL. Gravel is fine to medium angular		
0.30	D			45.03	0.30 (0.55)	RIVER TERRACE DEPOSITS - Medium dense brown slightly gravelly fine SAND with fine roots. Gravel is fine to medium angular		
0.85 1.00 1.00-1.45	D PP 250kPa SPT N=16		4,4/3,3,4,6	44.48	0.85 (0.55)	RIVER TERRACE DEPOSITS Very stiff brown sandy gravelly CLAY. Gravel is fine to medium angular of flint		
1.40	D			43.93	1.40	RIVER TERRACE DEPOSITS Very dense becoming very dense light brown slightly gravelly fine SAND. Gravel is fine to medium angular		
2.00-2.45 2.00	SPT N=56 D		8,8/12,13,14,17		(1.60)			
2.50	D							
3.00-3.45	SPT N=107		14,15/30,24,26,27	42.33	3.00	Very little penetration Complete at 3.00m		

Remarks	Scale (approx) 1:25		Logged By LA
	Figure No. 25-07-12.CT4		



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Site
Park Lane, Charvil, North Wokingham, RG10 9TR

Number
CT5

Machine : Window Sampler
Method : Drive-in Windowless Sampler

Dimensions
87mm to 2.0m 57mm to 5.0m
77mm to 3.0m
67mm to 4.0m

Ground Level (mOD)
46.00

Client
Bellway Thames

Job
Number
25-07-12

Location (Handheld GPS)
477392.326 E 175171.3 N

Dates
06/08/2025

Engineer
Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.05	D				(0.20)	TOPSOIL - Loose dark brown sandy TOPSOIL			
0.20	D			45.80	0.20 (0.30)	RIVER TERRACE DEPOSITS Medium dense orange brown and light brown clayey gravelly fine SAND. Gravel is fine to medium angular of flint			
0.50	D			45.50	0.50	RIVER TERRACE DEPOSITS Firm orange brown and light grey silty slightly gravelly CLAY with occasional pockets of fine sand. Gravel is fine to medium angular			
1.00 1.00-1.45 1.00	PP 50kPa SPT N=12 D		1,2/2,2,4,4		(1.50)				
1.50 1.50	PP 87.5kPa D								
2.00 2.00-2.45 2.00	PP 112.5kPa SPT N=22 D		3,3/5,5,6,6	44.00	2.00 (0.60)	RIVER TERRACE DEPOSITS Firm light grey and occasional brown silty sandy CLAY			
2.60	D			43.40	2.60 (0.50)	RIVER TERRACE DEPOSITS Medium dense orange brown and light grey fine SAND			
3.00-3.45 3.10	SPT N=16 D		3,4/4,3,4,5	42.90	3.10	RIVER TERRACE DEPOSITS Stiff orange brown and light grey silty CLAY			
3.50 3.50	PP 150kPa D								
4.00 4.00-4.45 4.00	PP 162.5kPa SPT N=20 D		3,4/4,4,6,6		(1.90)				
4.50 4.50	PP 125kPa D								
5.00 5.00-5.45	PP 150kPa SPT N=20		4,4/4,4,5,7	41.00	5.00				

Remarks

Scale (approx)
1:25

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Figure No.
25-07-12.CT5



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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

Number
CT6

Machine : Window Sampler

Dimensions

87mm to 1.0m

Ground Level (mOD)

44.96

Client

Bellway Thames

Job
Number
25-07-12

Method : Drive-in Windowless
Sampler

Location (Handheld GPS)

477463.416 E 175163.728 N

Dates

07/08/2025

Engineer

Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	D			44.76	(0.20) 0.20	TOPSOIL - Loose dark brown sandy gravelly TOPSOIL. Gravel is fine to medium angular		
0.50	D				(0.80)	RIVER TERRACE DEPOSITS Dense becoming very dense brown fine to medium SAND AND GRAVEL. Gravel is fine to coarse angular of flint		
				43.96	1.00	Very little penetration, Borehole collapsed in to 0.40m Complete at 1.00m		

Remarks

Scale
(approx)

1:25

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Figure No.

25-07-12.CT6



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Site
Park Lane, Charvil, North Wokingham, RG10 9TR

Number
CT7

Machine : Window Sampler
Method : Drive-in Windowless Sampler

Dimensions
87mm to 1.0m

Ground Level (mOD)
44.94

Client
Bellway Thames

Job Number
25-07-12

Location (Handheld GPS)
477463.406 E 175163.806 N

Dates
07/08/2025

Engineer
Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	D				(0.40)	TOPSOIL - Loose dark brown and brown sandy gravelly TOPSOIL. Gravel is fine to medium angular		
0.40	D			44.54	0.40 (0.60)	RIVER TERRACE DEPOSITS Very dense brown fine to medium SAND AND GRAVEL. Gravel is fine to coarse angular of flint		
1.00-1.38	SPT 127/230		14,14/31,46,50	43.94	1.00	Complete at 1.00m		

Remarks

Scale (approx)
1:25
Logged By
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Figure No.
25-07-12.CT7

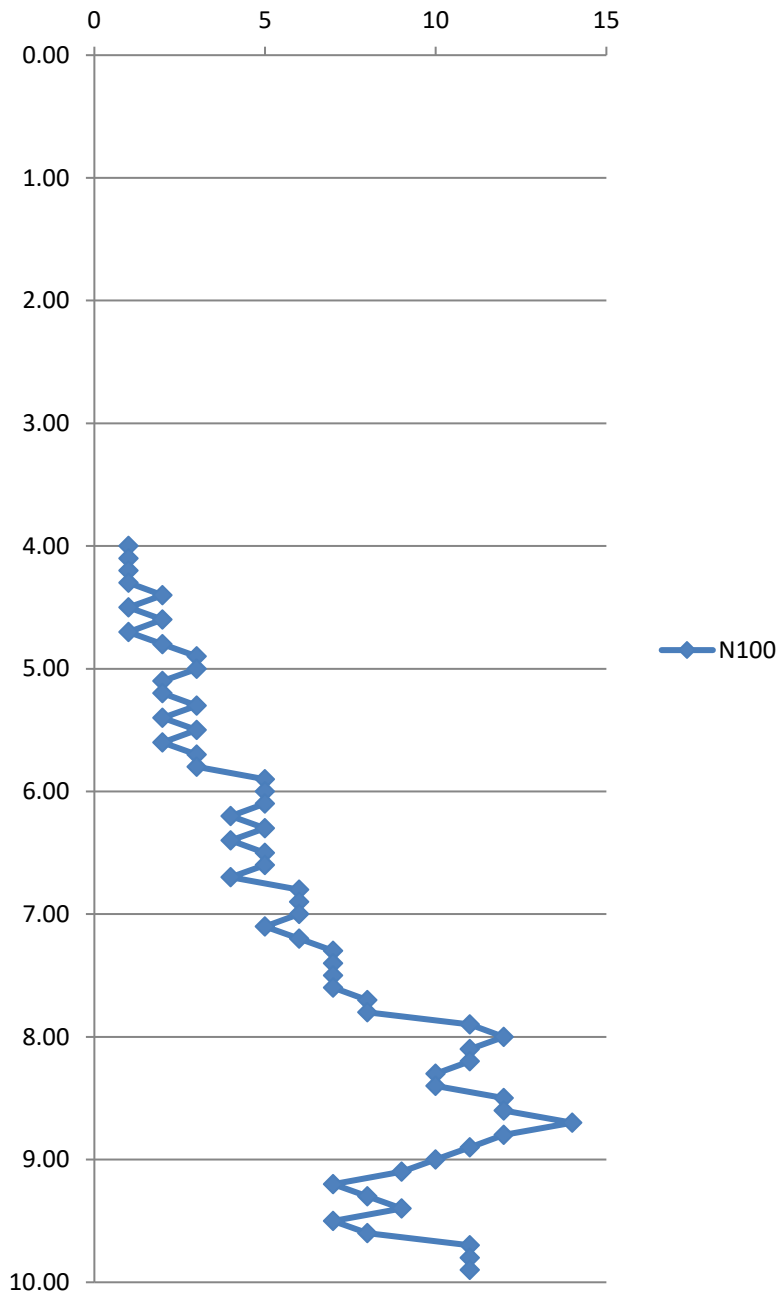


SUPER HEAVY DYNAMIC PROBE - P1 (CT1)

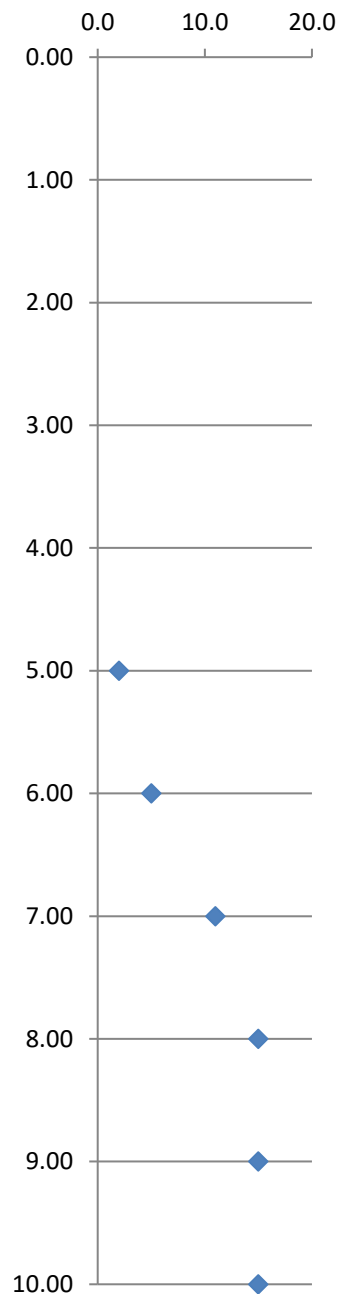
PROJECT NUMBER ,25-07-12
PROJECT NAME Park Lane, Charvil
CLIENT Bellway Thames
DRILLING DATE 06/08/2025

EASTINGS 477661.6
NORTHINGS 175236.0
HAMMER WEIGHT 63.5KG
HAMMER DROP 0.76m

N100



Torque



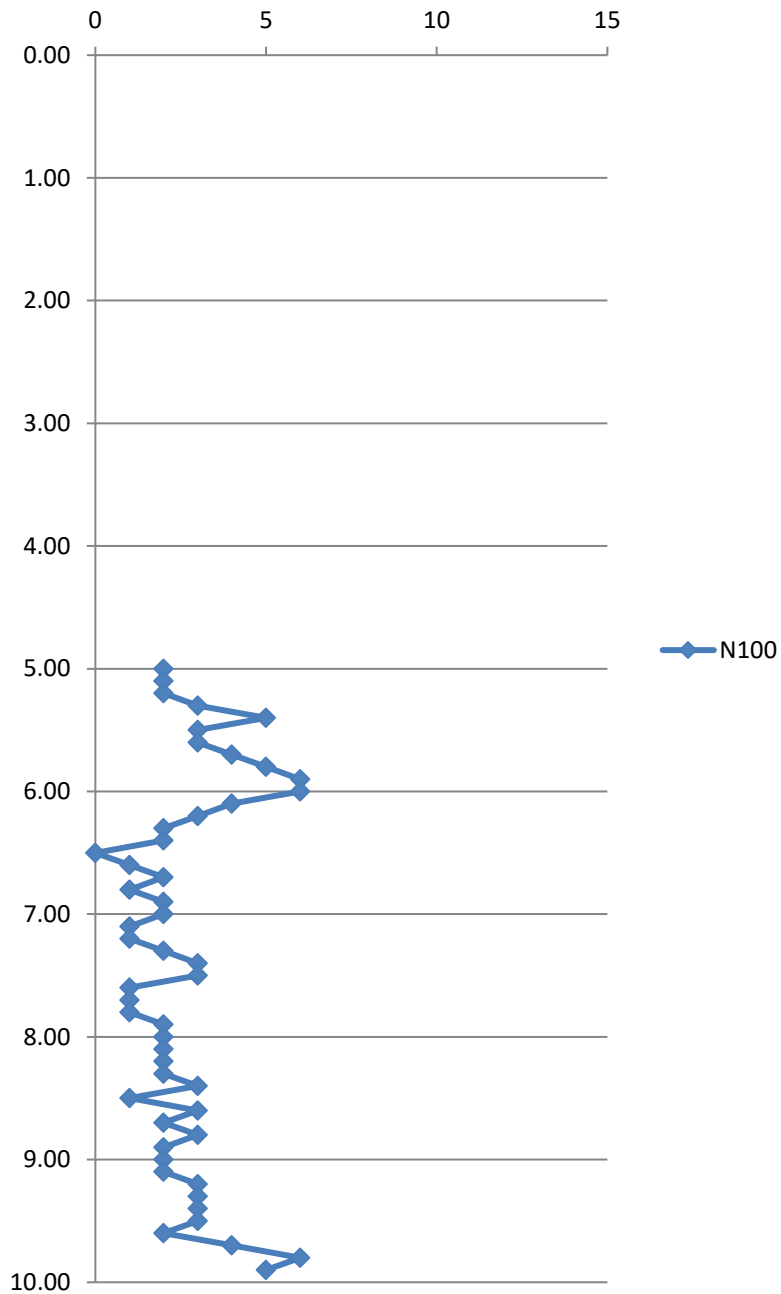


SUPER HEAVY DYNAMIC PROBE - P2 (CT2)

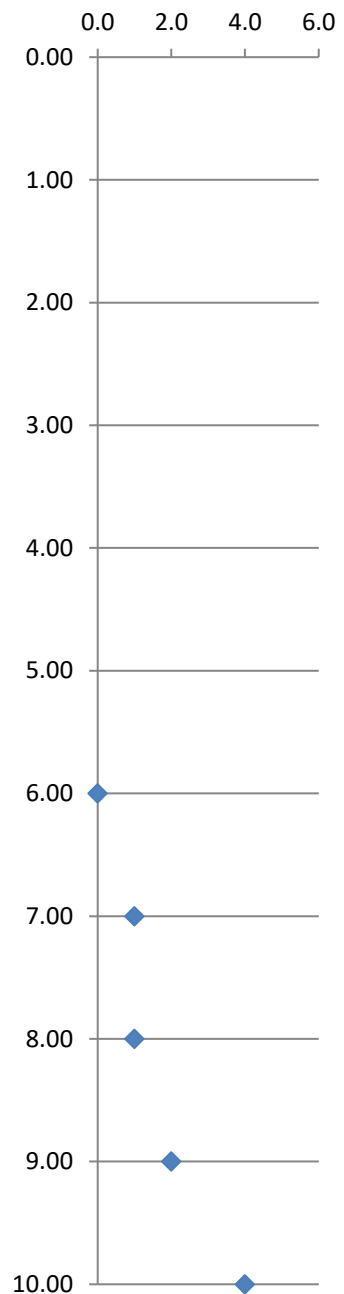
PROJECT NUMBER ,25-07-12
PROJECT NAME Park Lane, Charvil
CLIENT Bellway Thames
DRILLING DATE 06/08/2025

EASTINGS 477690.7
NORTHINGS 175194.8
HAMMER WEIGHT 63.5KG
HAMMER DROP 0.76m

N100



Torque





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Site
Park Lane, Charvil, North Wokingham, RG10 9TR

Trial Pit Number
TP2

Machine : Mini Digger Method : Trial Pit		Dimensions		Ground Level (mOD) 43.70		Client Bellway Thames		Job Number 25-07-12	
		Location (Handheld GPS) 477632.783 E 175205.073 N		Dates 06/08/2025		Engineer Lee Ashworth		Sheet 1/1	

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D					REWORKED TOPSOIL - Loose brown organic slightly sandy gravelly SILT. Gravel is fine to coarse subangular flint		
2.50	D			41.20	2.50	Complete at 2.50m		

Plan					Remarks			
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					Scale (approx) 1:25		Logged By LA	
							Figure No. 25-07-12.TP2	



Site

Park Lane, Charvil, North Wokingham, RG10 9TR

**Trial Pit
Number**
TP3

Machine : Mini Digger

Method : Trial Pit

Dimensions

Location (Handheld GPS)

477609.726 E 175203.475 N

Ground Level (mOD)

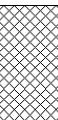
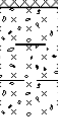
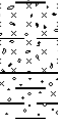
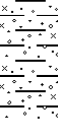
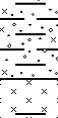
42.38

Client	
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Bellway Thames

Job Number
25-07-12

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	D				(0.40)	MADE GROUND - (Medium dense) grey brown silty SAND AND GRAVEL. Gravel is fine to coarse subangular to subrounded brick, concrete, plywood, and flint		
				41.98	0.40	RIVER TERRACE DEPOSITS Loose dark grey clayey gravelly SILT		
0.75	D				(0.60)			
				41.38	1.00	RIVER TERRACE DEPOSITS Soft to firm light brown orange silty sandy gravelly CLAY. Gravel is fine to medium subangular flint and quartzite		
					(0.80)			
1.50	D							
				40.58	1.80	RIVER TERRACE DEPOSITS Loose light grey clayey SILT		
2.00	D				(0.40)			
				40.18	2.20	Complete at 2.20m		

Plan

Remarks

Scale (approx)

1:25

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Figure No.

25-07-12.TP3



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Site
Park Lane, Charvil, North Wokingham, RG10 9TR

Trial Pit Number
TP4

Machine : Mini Digger Method : Trial Pit	Dimensions	Ground Level (mOD) 40.82	Client Bellway Thames	Job Number 25-07-12
	Location (Handheld GPS) 477627.227 E 175174.01 N	Dates 06/08/2025	Engineer Lee Ashworth	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	D			40.52	(0.30) 0.30	TOPSOIL - Loose light brown gravelly SILT		
0.75	D			39.52	(1.00) 1.30	RIVER TERRACE DEPOSITS (Loose to medium dense) orange brown SAND AND GRAVEL. Gravel is fine to coarse subangular to subrounded flint and quartzite		
2.00 2.00	SV 150kPa D		130,140,180/Av. 150.00	38.72	(0.80) 2.10	LAMBETH GROUP Firm grey green brown slightly sandy silty CLAY		
						Complete at 2.10m		

Plan					Remarks		
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					Scale (approx) 1:25	Logged By LA	Figure No. 25-07-12.TP4



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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

**Trial Pit
Number**
TP5

Machine : Mini Digger

Method : Trial Pit

Dimensions

Ground Level (mOD)

44.10

Client

Bellway Thames

Job Number
25-07-12

Location (Handheld GPS)

477479.502 E 175145.032 N

Dates

06/08/2025

Engineer

Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	D				(0.30)	TOPSOIL - Loose light brown gravelly SILT		
				43.80	0.30	RIVER TERRACE DEPOSITS (Dense) light brown very silty SAND AND GRAVEL. Gravel is fine to coarse subangular to subrounded flint and quartzite		
0.75	D				(0.60)			
				43.20	0.90	RIVER TERRACE DEPOSITS Medium dense orange brown slightly clayey slightly silty SAND AND GRAVEL Damp		
						Saturated		
					(1.70)			
2.00	D							
				41.50	2.60 (0.20)	RIVER TERRACE DEPOSITS Loose green grey SAND		
				41.30	2.80	Wet at base		
						Complete at 2.80m		

Plan

Remarks



Scale (approx)

1:25

Logged By

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Figure No.

25-07-12.TP5



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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

**Trial Pit
Number**
TP6

Machine : Mini Digger

Method : Trial Pit

Dimensions

Ground Level (mOD)

43.10

Client

Bellway Thames

Job Number
25-07-12

Location

477533.962 E 175162.215 N

Dates

06/08/2025

Engineer

Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40	D			42.90	(0.20)	TOPSOIL - Loose light brown gravelly SILT		
					0.20	SUBSOIL - Loose light brown silty gravelly SAND		
1.00	D			42.50	(0.40)	RIVER TERRACE DEPOSITS Firm orange grey very silty slightly gravelly CLAY. Gravel is medium subrounded flint		
					0.60			
					(1.20)			
2.00	D			41.30	1.80	RIVER TERRACE DEPOSITS Loose grey orange brown (moist) silty clayey gravelly SAND. Gravel is fine to coarse subangular to subrounded flint		
					(0.40)			
				40.90	2.20	Complete at 2.20m		

Plan

Remarks



Scale (approx)

1:25

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Figure No.

25-07-12.TP6



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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

**Trial Pit
Number**
TP7

Machine : Mini Digger

Method : Trial Pit

Dimensions

Ground Level (mOD)

44.27

Client

Bellway Thames

Job Number
25-07-12

Location (Handheld GPS)

477390.713 E 175117.054 N

Dates

06/08/2025

Engineer

Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	D			44.12	(0.15) 0.15	TOPSOIL - Loose light brown gravelly SILT		
0.50	D				(0.55)	RIVER TERRACE DEPOSITS (Medium dense) brown sandy GRAVEL. Gravel is fine to coarse subangular to subrounded flint and quartzite		
				43.57	0.70 (0.30)	RIVER TERRACE DEPOSITS Loose orange brown gravelly SAND. Gravel is fine to coarse subangular to subrounded flint and quartzite		
2.00	D			43.27	1.00	RIVER TERRACE DEPOSITS (Medium dense) orange brown (moist) SAND AND GRAVEL. Gravel is fine to coarse subangular to subrounded flint and quartzite		
				41.47	2.80	Complete at 2.80m		

Plan

Remarks



Scale (approx)

1:25

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Figure No.

25-07-12.TP7



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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

**Trial Pit
Number**
TP8

Machine : Mini Digger

Method : Trial Pit

Dimensions

Ground Level (mOD)

46.30

Client

Bellway Thames

Job Number
25-07-12

Location (Handheld GPS)

477391.946 E 175171.465 N

Dates

06/08/2025

Engineer

Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	D				46.15 (0.15)	TOPSOIL - Loose light brown gravelly SILT		
					0.15	SUBSOIL - Loose light brown silty gravelly SAND		
					(0.45)			
					45.70 0.60	RIVER TERRACE DEPOSITS (Very dense) orange brown sandy GRAVEL. Gravel is fine to coarse subangular to subrounded flint and quartzite. Some boulder fragments of flint		
					(1.20)			
					44.50 1.80	RIVER TERRACE DEPOSITS (Medium dense) orange brown SAND AND GRAVEL. Gravel is fine to coarse subangular to subrounded flint and quartzite		
					(0.40)			
					44.10 2.20	Complete at 2.20m		

Plan

Remarks



Scale (approx)

1:25

Logged By

LA

Figure No.

25-07-12.TP8



Park Lane, Charvil, North Wokingham, RG10 9TR

Trial Pit Number
TP9

Dimensions

Ground Level (mOD)

Bellway Thames

Job Number
25-07-12

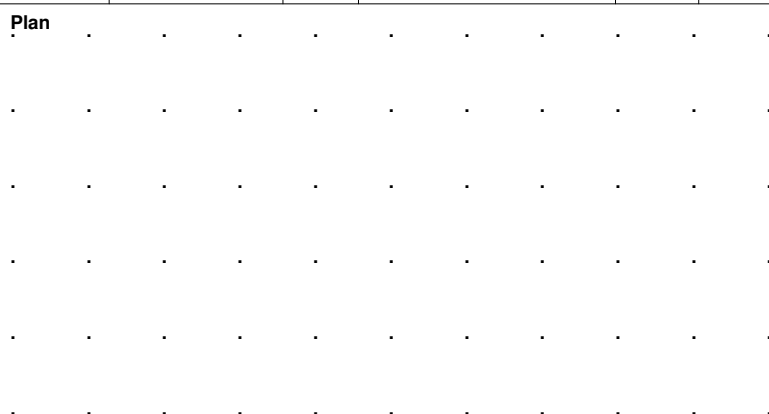
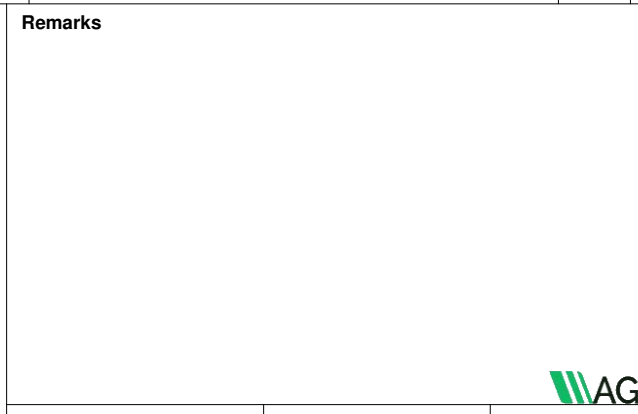
Location (Handheld GPS)

Dates	06/08/2025
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Sheet
1/1

477361.941 E 175249.484 N

Plan 	Remarks 		
	Scale (approx) 1:25	Logged By LA	Figure No. 25-07-12.TP9



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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

**Trial Pit
Number
TP10**

Machine : Mini Digger

Method : Trial Pit

Dimensions

Ground Level (mOD)

47.57

Client

Bellway Thames

Job Number
25-07-12

Location (Handheld GPS)

477412.34 E 175277.546 N

Dates

06/08/2025

Engineer

Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	D			46.92	0.65	TOPSOIL / SUBSOIL - Loose light brown organic slightly clayey gravelly SILT. Gravel is fine to coarse subangular flint and quartzite		
					0.65	RIVER TERRACE DEPOSITS (Very dnese) orange brown SAND AND GRAVEL. Gravel is fine to coarse subangular to subrounded flint and quartzite with cobbles/boulders of flint		
1.50	D			46.27	1.30	RIVER TERRACE DEPOSITS (Loose to medium dense) orange grey brown slightly clayey gravelly SAND with lenses of green grey very silty clay		
					(0.65)			
					(1.00)			
					2.30	Complete at 2.30m		

Plan

Remarks



Scale (approx)

1:25

Logged By

LA

Figure No.

25-07-12.TP10



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Site

Park Lane, Charvil, North Wokingham, RG10 9TR

**Trial Pit
Number**
TP11

Machine : Mini Digger

Method : Trial Pit

Dimensions

Ground Level (mOD)

44.73

Client

Bellway Thames

Job Number
25-07-12

Location (Handheld GPS)

477471.445 E 175255.959 N

Dates

06/08/2025

Engineer

Lee Ashworth

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	D				(0.50)	TOPSOIL / SUBSOIL - Loose light brown organic slightly clayey gravelly SILT. Gravel is fine to coarse subangular flint and quartzite		
				44.23	0.50 (0.50)	RIVER TERRACE DEPOSITS (Loose to medium dense) light brown very silty gravelly SAND. Gravel is fine to coarse subangular to subrounded flint		
				43.73	1.00	RIVER TERRACE DEPOSITS (Loose to medium dense) orange brown gravelly SAND		
1.50	D				(1.20)			
				42.53	2.20	Complete at 2.20m		

Plan

Remarks



Scale (approx)

1:25

Logged By

LA

Figure No.

25-07-12.TP11



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Machine : Mini Digger
Method : Trial Pit

Dimensions

Location (Handheld GPS)
477508.257 E 175193.704 N

Ground Level (mOD)
44.32

Dates
06/08/2025

Site
Park Lane, Charvil, North Wokingham, RG10 9TR

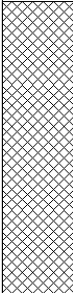
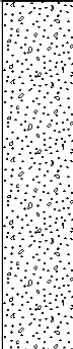
Client
Bellway Thames

Engineer
Lee Ashworth

Trial Pit Number
TP12

Job Number
25-07-12

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.50	D			43.32	(1.00)	MADE GROUND / REWORKED GROUND - Loose light brown organic slightly clayey gravelly SILT. Gravel is fine to coarse subangular flint and quartzite, with wood, plastic molds (possible motorcycle parts), and metal		
					1.00	RIVER TERRACE DEPOSITS Medium dense orange brown slightly silty SAND AND GRAVEL. Gravel is fine to coarse subangular to subrounded flint and quartzite		
2.40	D			42.12 41.92	(1.20)			
					2.20 (0.20)	RIVER TERRACE DEPOSITS Medium dense black slightly silty GRAVEL (Possibly organic)		
					2.40	Complete at 2.40m		

Plan

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Remarks



Scale (approx)
1:25

Logged By
LA

Figure No.
25-07-12.TP12

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Trial Pit Infiltration Testing to BRE Digest 365

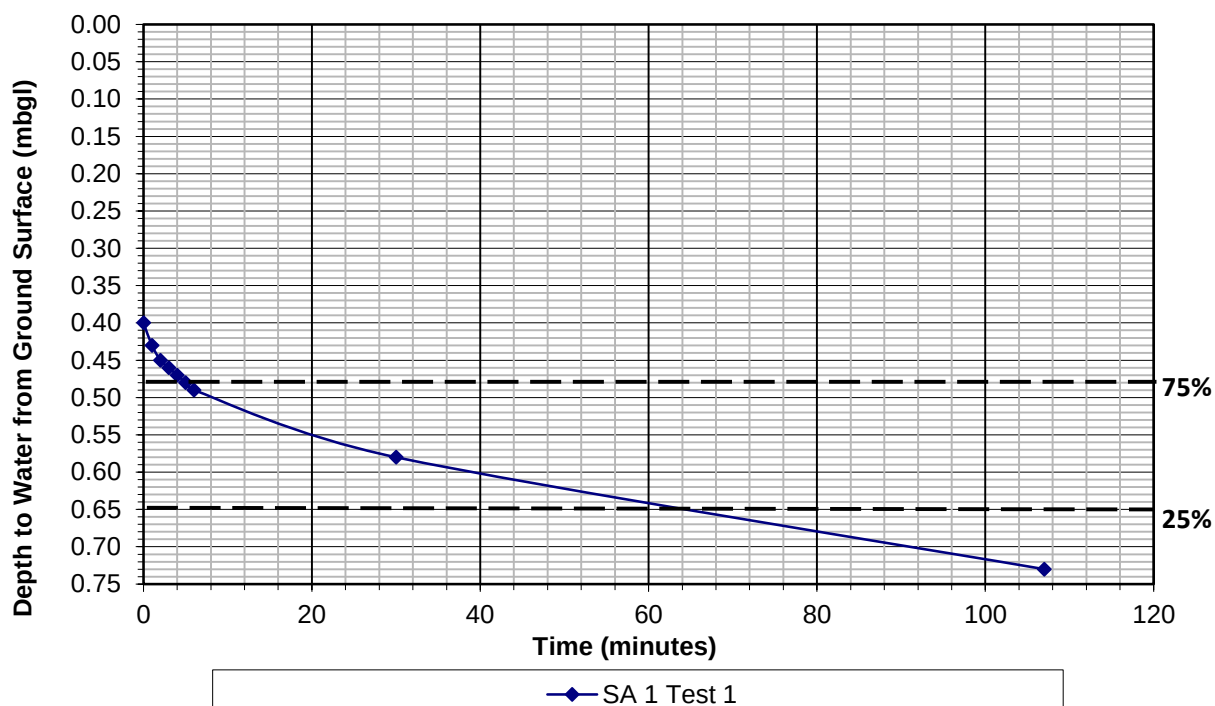
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.50m x 0.73m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6-7/8/25
Test Location: SA1

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.40	30	0.58		
1	0.43	107	0.73		
2	0.45				
3	0.46				
4	0.47				
5	0.48				
6	0.49				

Soil Infiltration Rate: 2.44×10^{-5} m/s



Trial Pit Infiltration Testing to BRE Digest 365

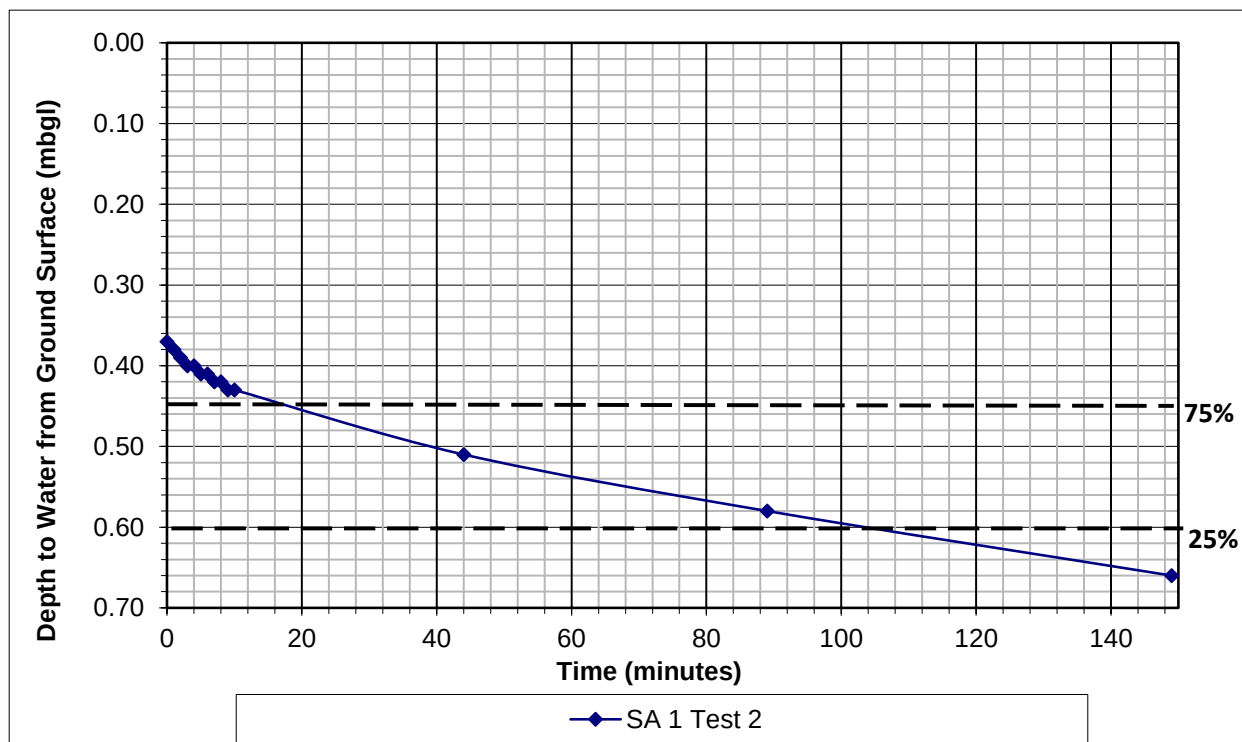
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.50m x 0.68m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6-7/8/25
Test Location: SA1

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.37	7	0.42		
1	0.38	8	0.42		
2	0.39	9	0.43		
3	0.40	10	0.43		
4	0.40	44	0.51		
5	0.41	89	0.58		
6	0.41	149	0.66		

Soil Infiltration Rate: 1.64×10^{-5} m/s



Trial Pit Infiltration Testing to BRE Digest 365

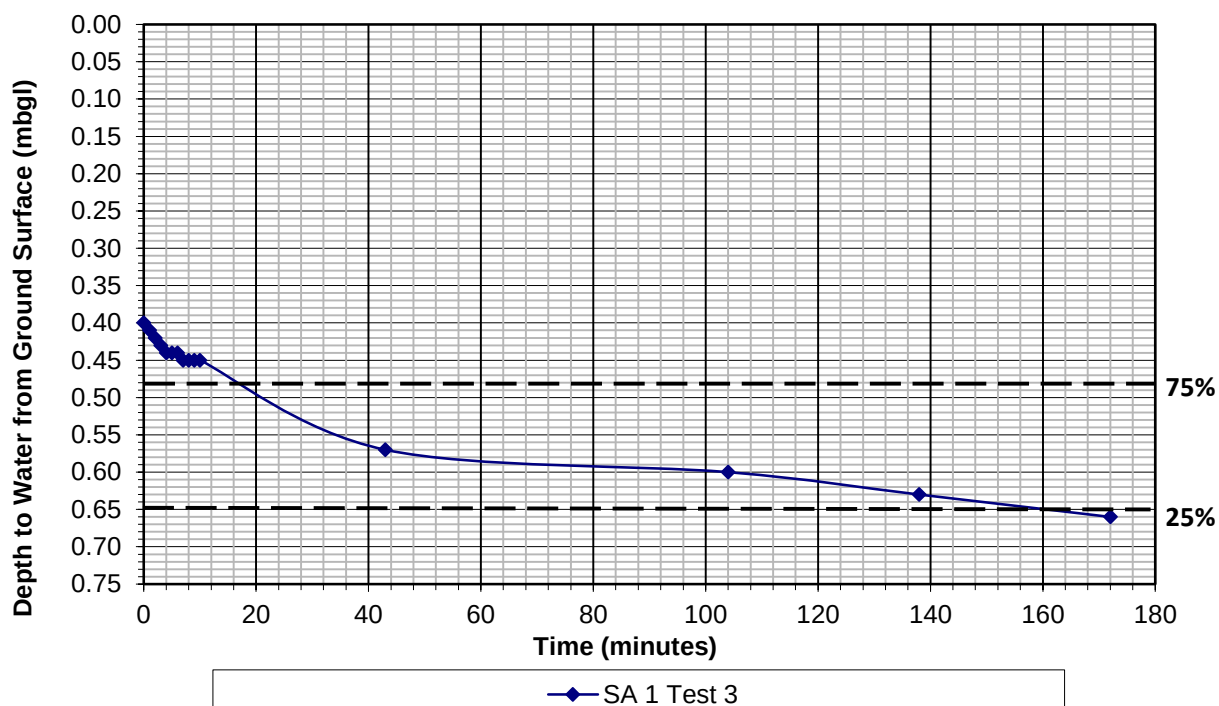
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.50m x 0.73m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6-7/8/25
Test Location: SA1

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.40	7	0.45	172	0.66
1	0.41	8	0.45		
2	0.42	9	0.45		
3	0.43	10	0.45		
4	0.44	43	0.57		
5	0.44	104	0.60		
6	0.44	138	0.63		

Soil Infiltration Rate: 9.88×10^{-6} m/s



Trial Pit Infiltration Testing to BRE Digest 365

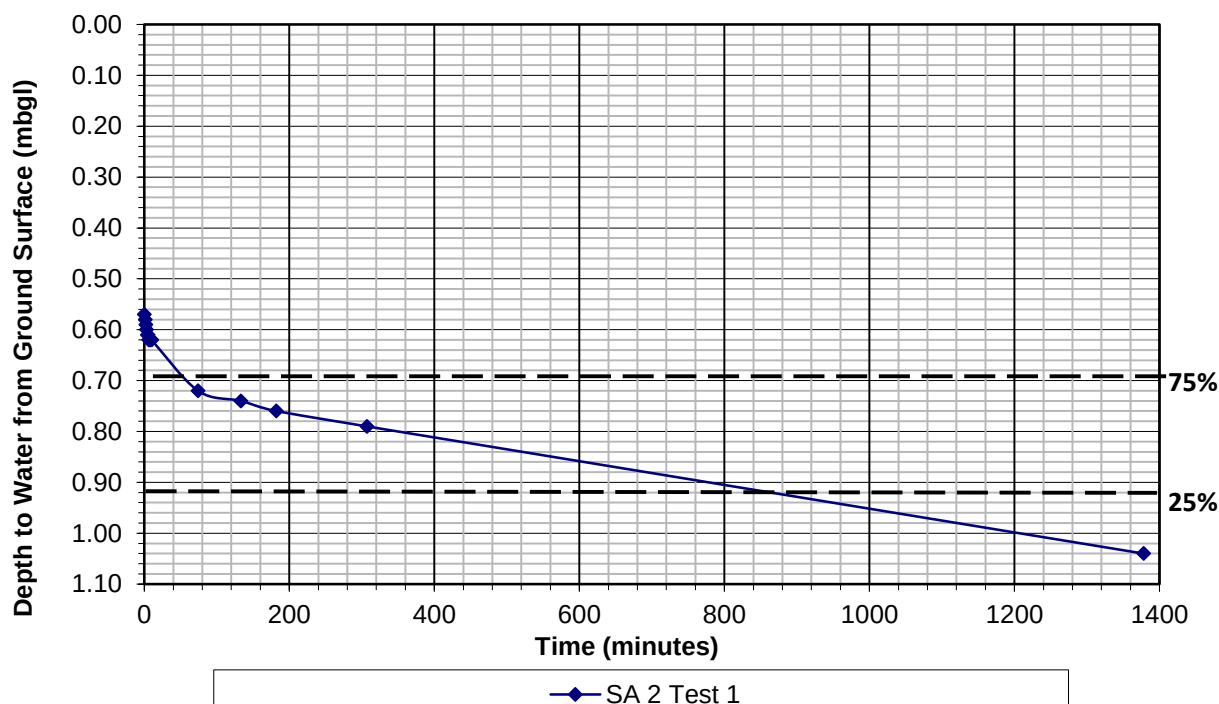
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.50m x 1.04m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6-7/8/25
Test Location: SA2

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.57	7	0.62	307	0.79
1	0.58	8	0.62	1378	1.04
2	0.59	9	0.62		
3	0.60	10	0.62		
4	0.61	74	0.72		
5	0.61	133	0.74		
6	0.62	182	0.76		

Soil Infiltration Rate: 2.12×10^{-6} m/s



Trial Pit Infiltration Testing to BRE Digest 365

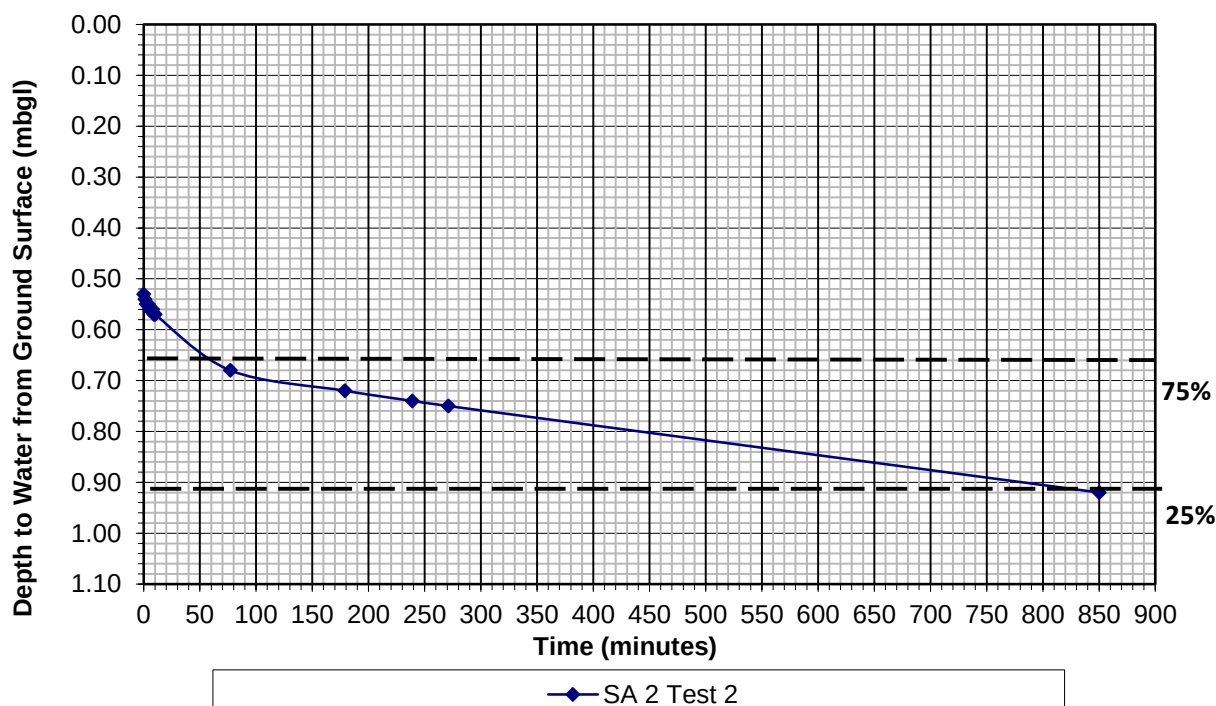
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.50m x 1.04m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6-7/8/25
Test Location: SA2

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.53	7	0.56	271	0.75
1	0.54	8	0.56	850	0.92
2	0.55	9	0.57		
3	0.55	10	0.57		
4	0.55	77	0.68		
5	0.56	179	0.72		
6	0.56	239	0.74		

Soil Infiltration Rate: 2.37×10^{-5} m/s



Trial Pit Infiltration Testing to BRE Digest 365

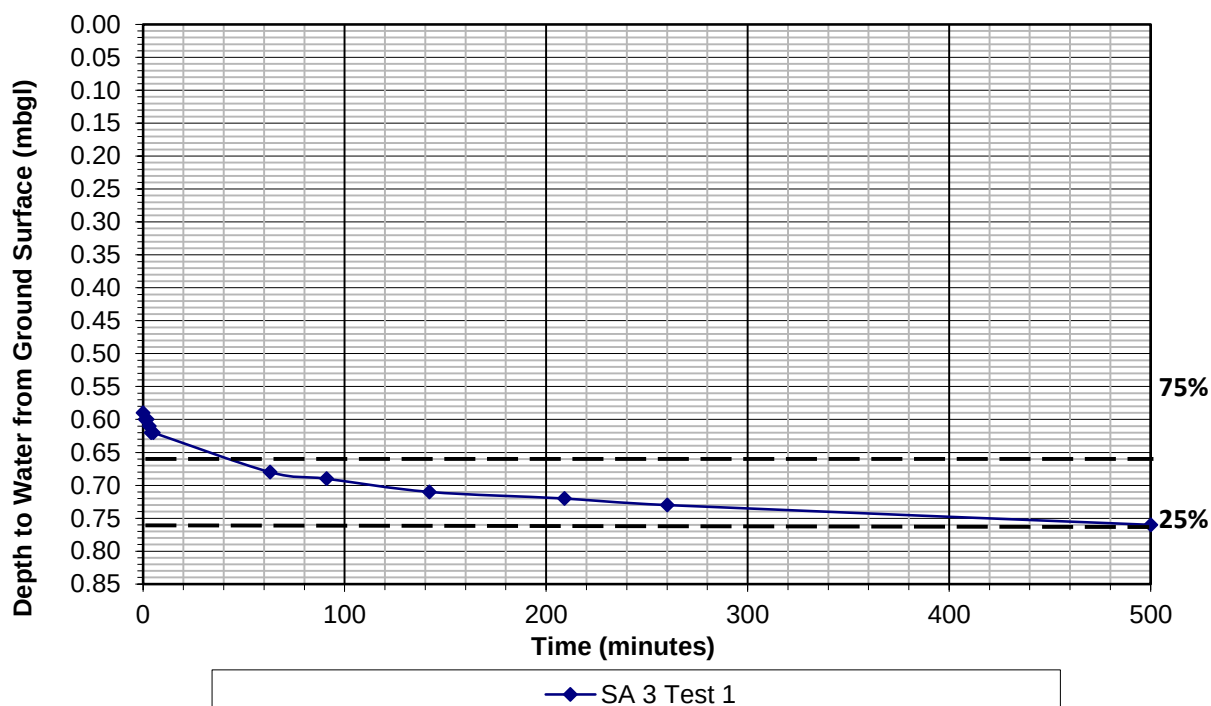
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.45m x 0.85m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6-7/8/25
Test Location: SA3

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.59	91	0.69		
1	0.60	142	0.71		
2	0.60	209	0.72		
3	0.61	260	0.73		
4	0.62	500	0.76		
5	0.62				
63	0.68				

Soil Infiltration Rate: 2.77×10^{-6} m/s



Trial Pit Infiltration Testing to BRE Digest 365

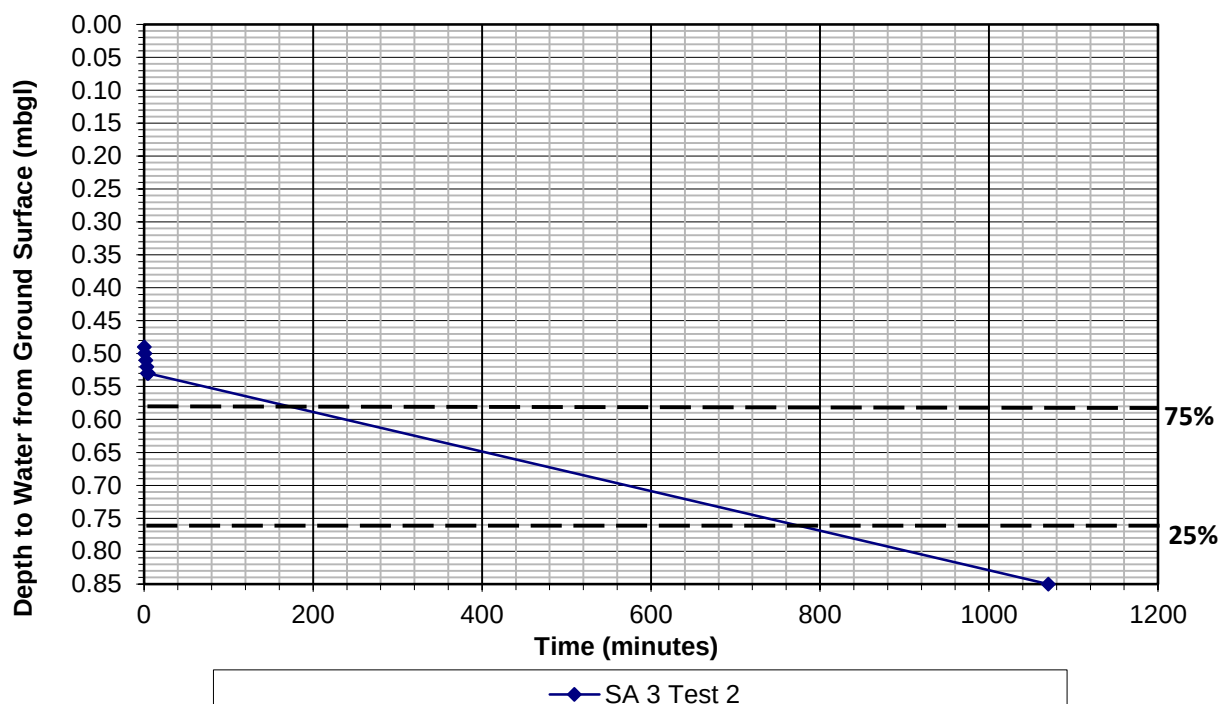
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.45m x 0.85m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6-7/8/25
Test Location: SA3

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.49				
1	0.50				
2	0.51				
3	0.52				
4	0.53				
5	0.53				
1070	0.85				

Soil Infiltration Rate: 2.58×10^{-6} m/s



Trial Pit Infiltration Testing to BRE Digest 365

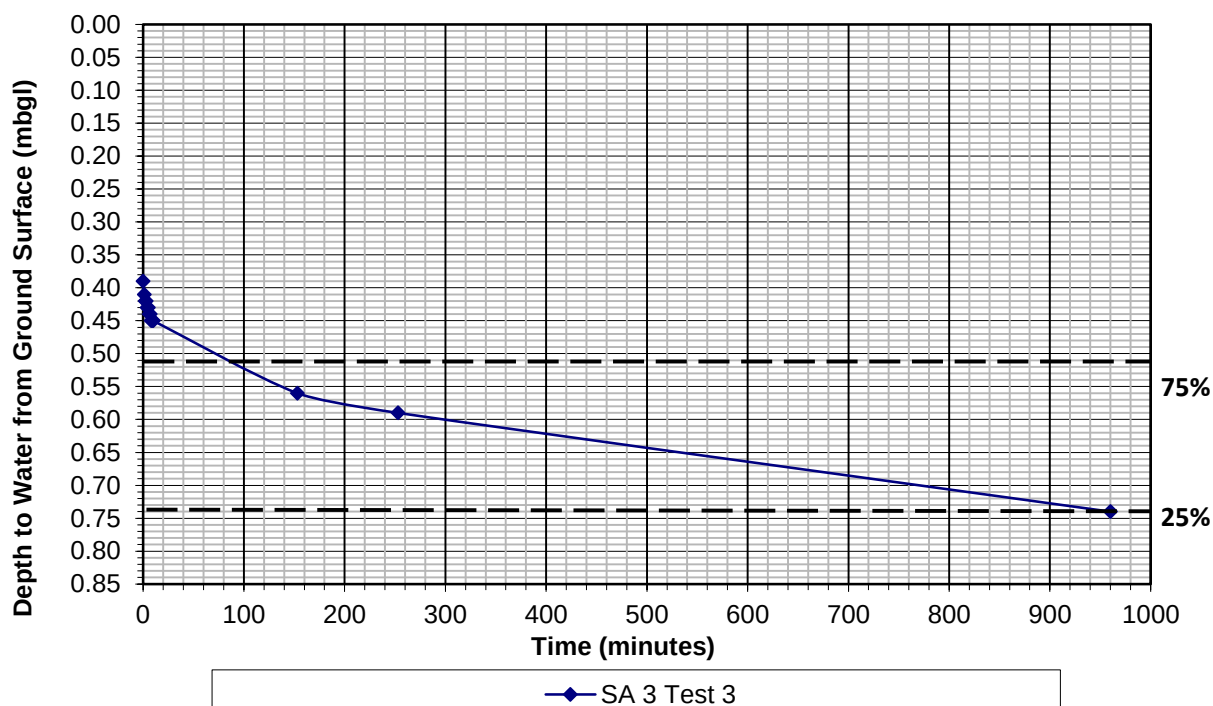
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.45m x 0.85m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6-7/8/25
Test Location: SA3

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.39	7	0.44		
1	0.41	8	0.45		
2	0.42	9	0.45		
3	0.42	10	0.45		
4	0.43	153	0.56		
5	0.43	253	0.59		
6	0.44	960	0.74		

Soil Infiltration Rate: 1.97×10^{-6} m/s



Trial Pit Infiltration Testing to BRE Digest 365

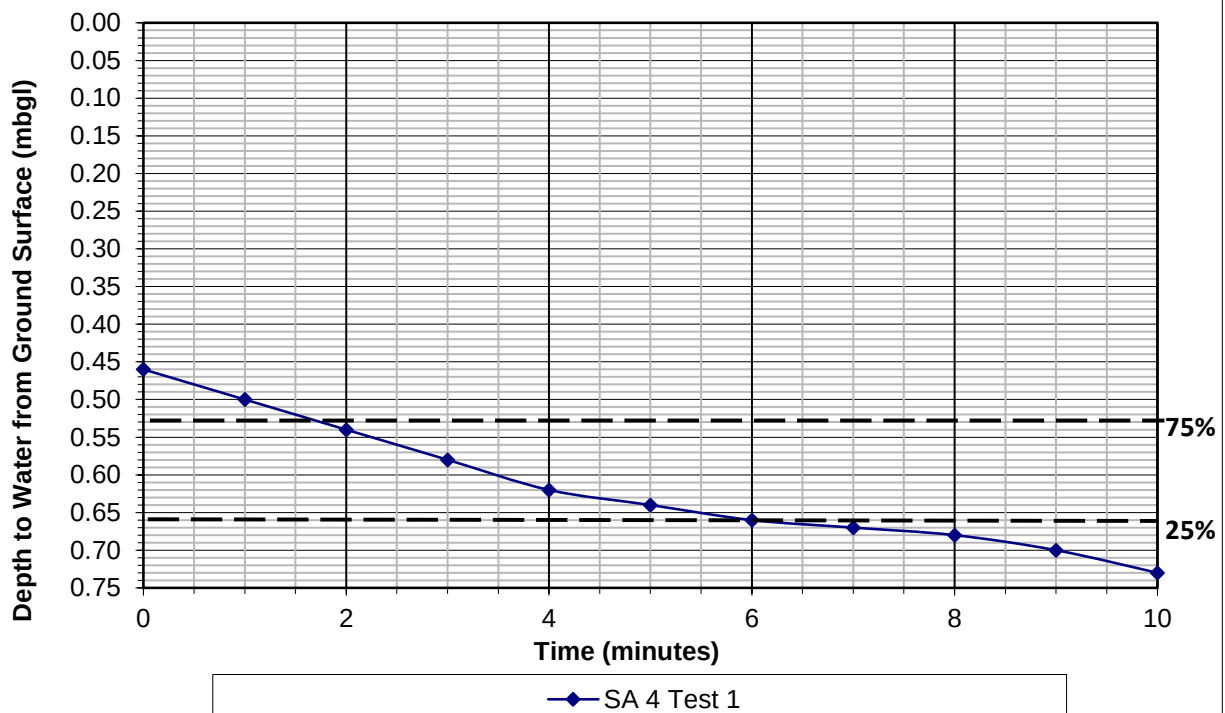
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.30m x 0.73m
 (width x length x depth)

Report No: 25-07-12
Date Tested: 6/8/25
Test Location: SA4

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.46	7	0.67		
1	0.50	8	0.68		
2	0.54	9	0.70		
3	0.58	10	0.73		
4	0.62				
5	0.64				
6	0.66				

Soil Infiltration Rate: 3.03×10^{-4} m/s



Trial Pit Infiltration Testing to BRE Digest 365

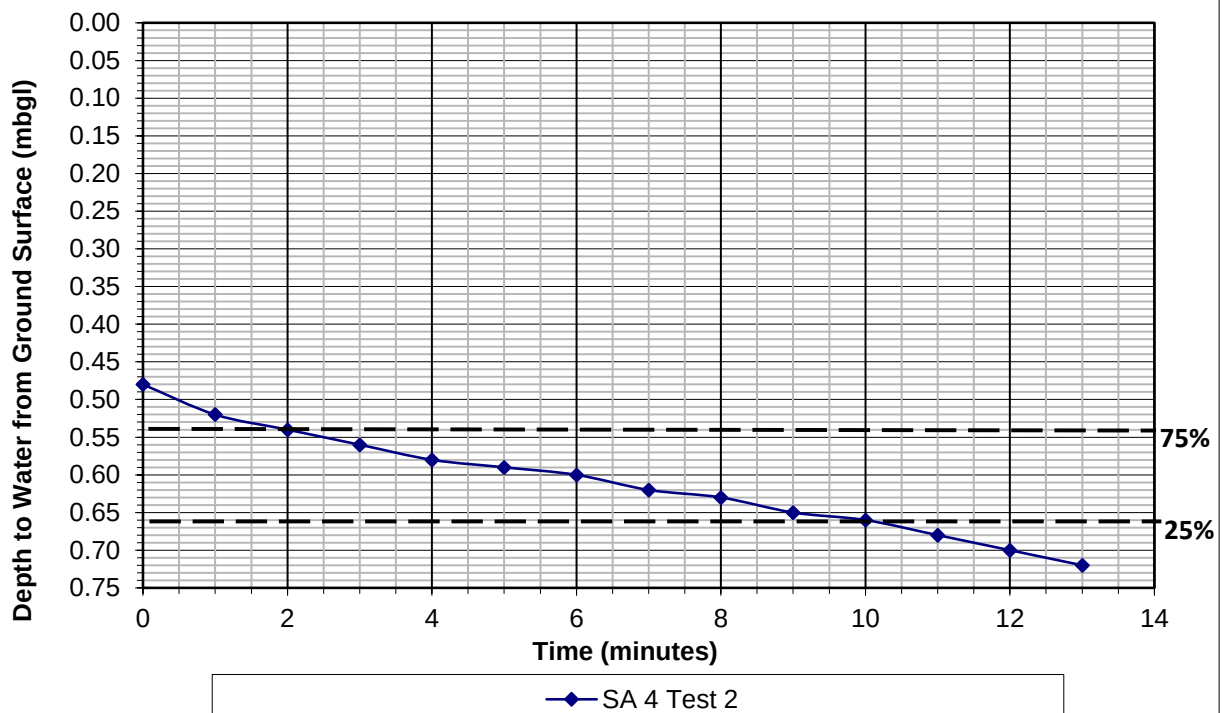
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.30m x 0.72m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6/8/25
Test Location: SA4

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.48	7	0.62		
1	0.52	8	0.63		
2	0.54	9	0.65		
3	0.56	10	0.66		
4	0.58	11	0.68		
5	0.59	12	0.70		
6	0.60	13	0.72		

Soil Infiltration Rate: 1.50×10^{-4} m/s



Trial Pit Infiltration Testing to BRE Digest 365

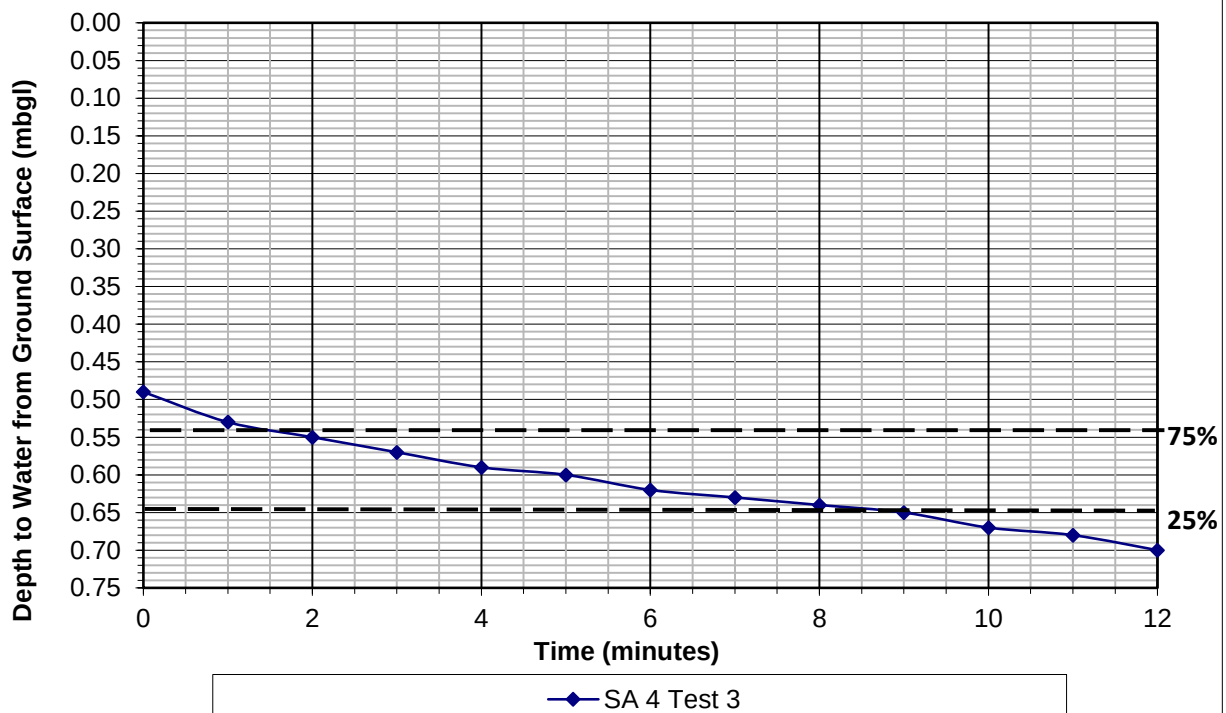
Client: Bellway Thames
Site: Park Lane, Charvil
Dimensions: 0.50m x 1.30m x 0.70m
(width x length x depth)

Report No: 25-07-12
Date Tested: 6/8/25
Test Location: SA4

Test Response Zone Description - : River Terrace Deposits

Time	Depth BGL	Time	Depth BGL	Time	Depth BGL
0	0.49	7	0.63		
1	0.53	8	0.64		
2	0.55	9	0.65		
3	0.57	10	0.67		
4	0.59	11	0.68		
5	0.60	12	0.70		
6	0.62				

Soil Infiltration Rate: 1.48×10^{-4} m/s



TRL DYNAMIC CONE PENETROMETER RECORD

Job No:- 25-07-12

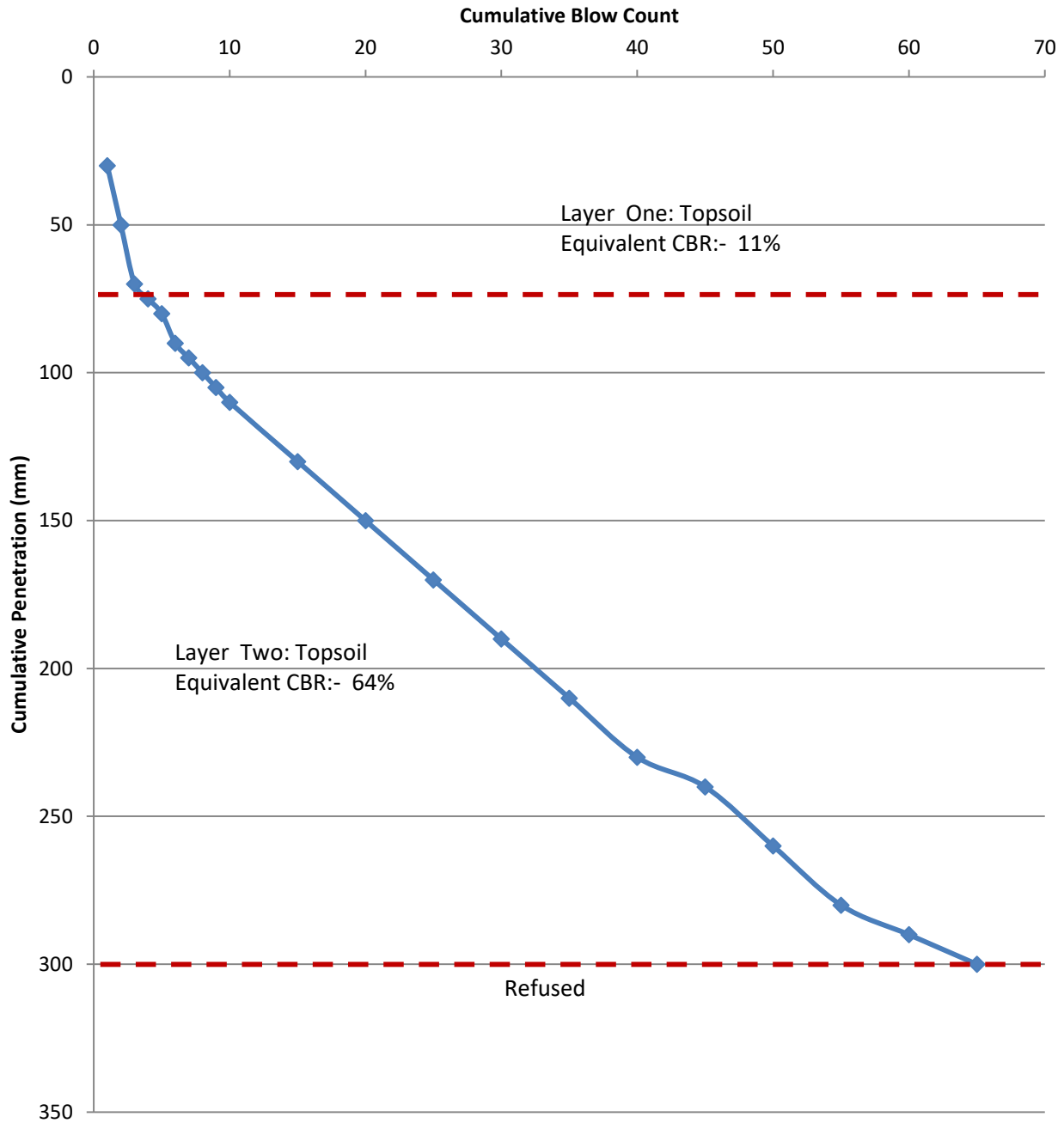
Job Name:- Park Lane, Charvil

Equivalent CBR:- 11% - 64%

Position:- CBR1

Depth below ground level at start of test:- 0.0m

Cumulative Blows Vs Penetration (mm)



TRL DYNAMIC CONE PENETROMETER RECORD

Job No:- 25-07-12

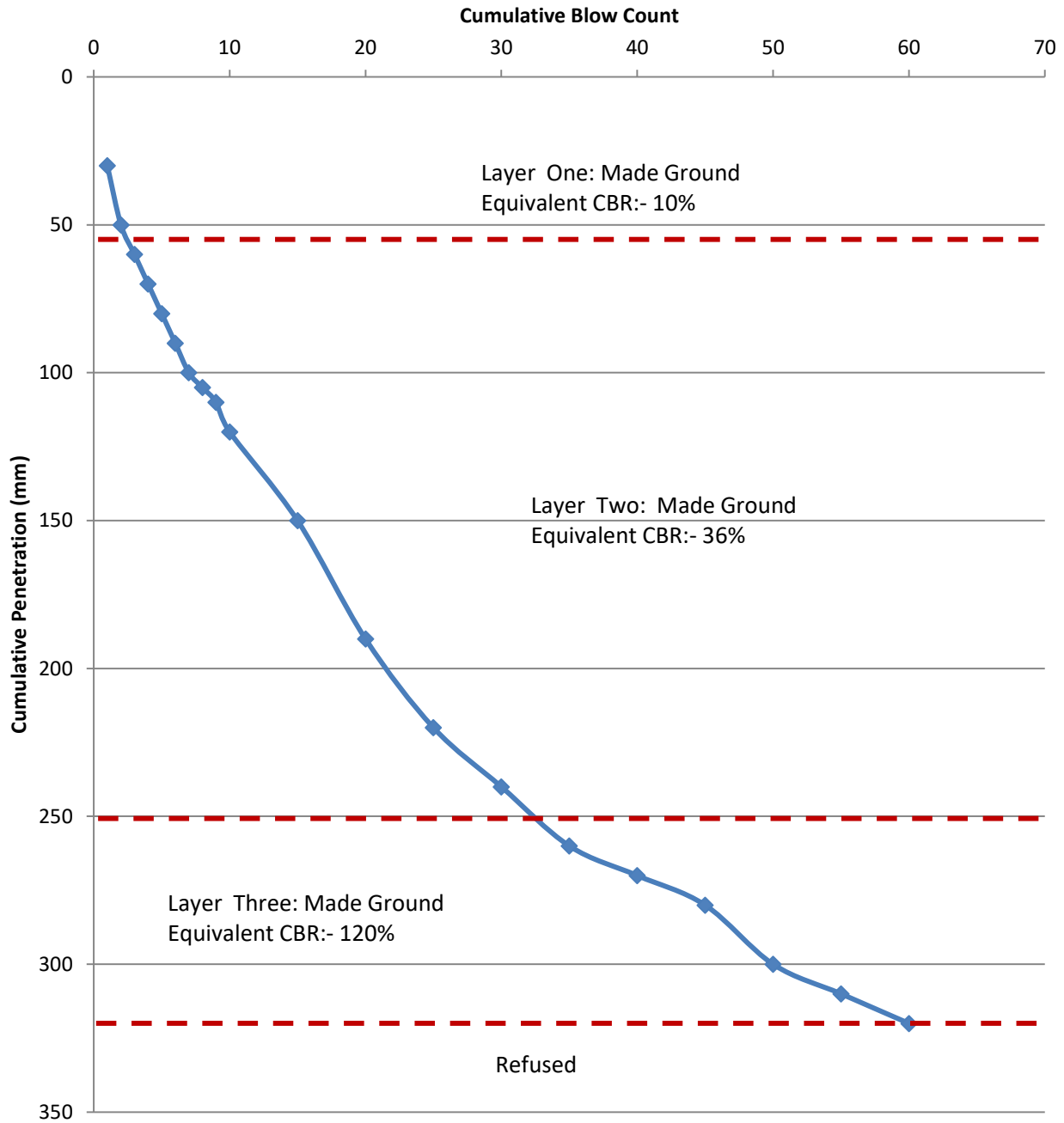
Job Name:- Park Lane, Charvil

Equivalent CBR:- 10% - 120%

Position:- CBR2

Depth below ground level at start of test:- 0.0m

Cumulative Blows Vs Penetration (mm)



TRL DYNAMIC CONE PENETROMETER RECORD

Job No:- 25-07-12

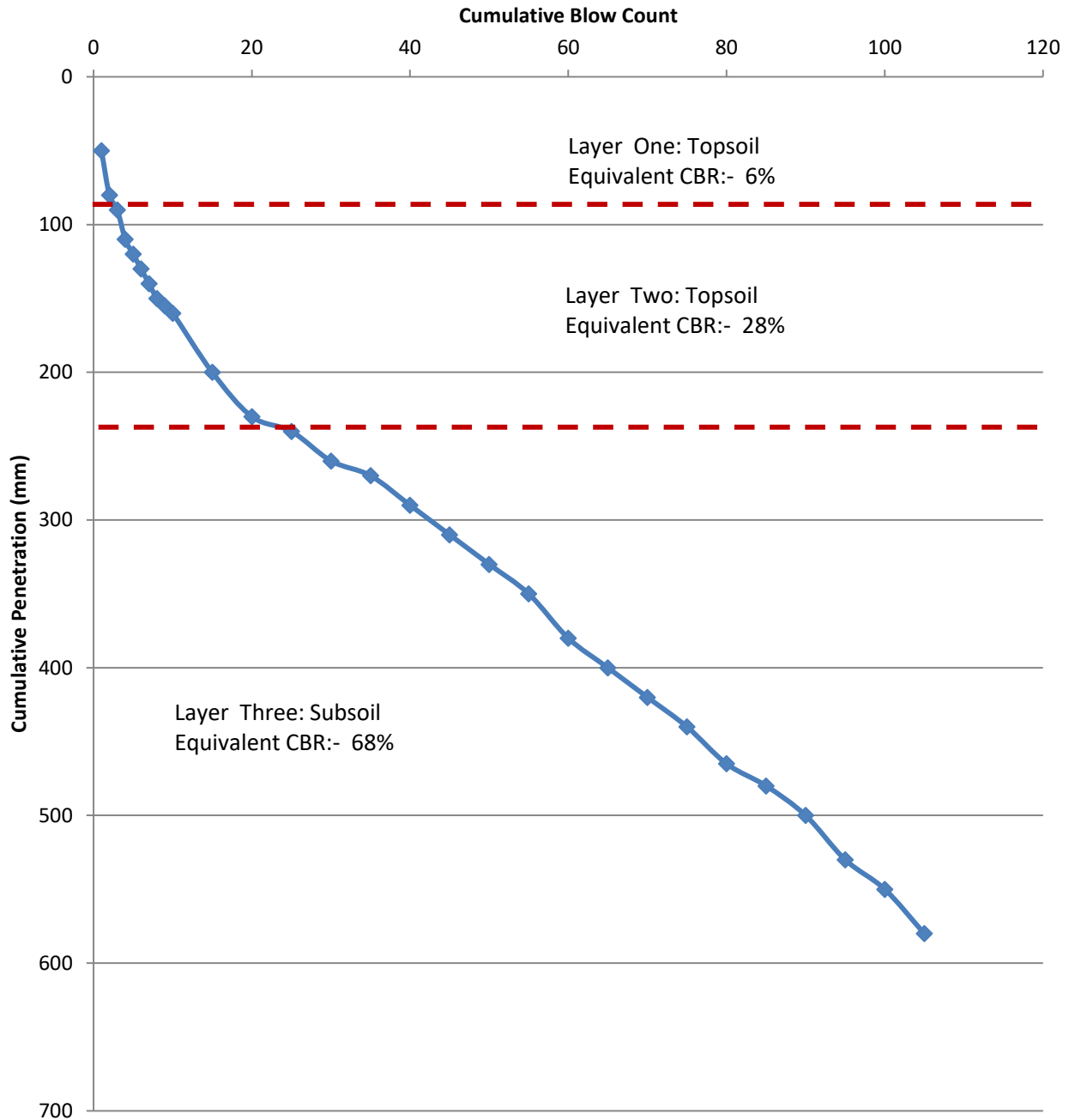
Job Name:- Park Lane, Charvil

Equivalent CBR:- 6% - 68%

Position:- CBR3

Depth below ground level at start of test:- 0.0m

Cumulative Blows Vs Penetration (mm)



TRL DYNAMIC CONE PENETROMETER RECORD

Job No:- 25-07-12

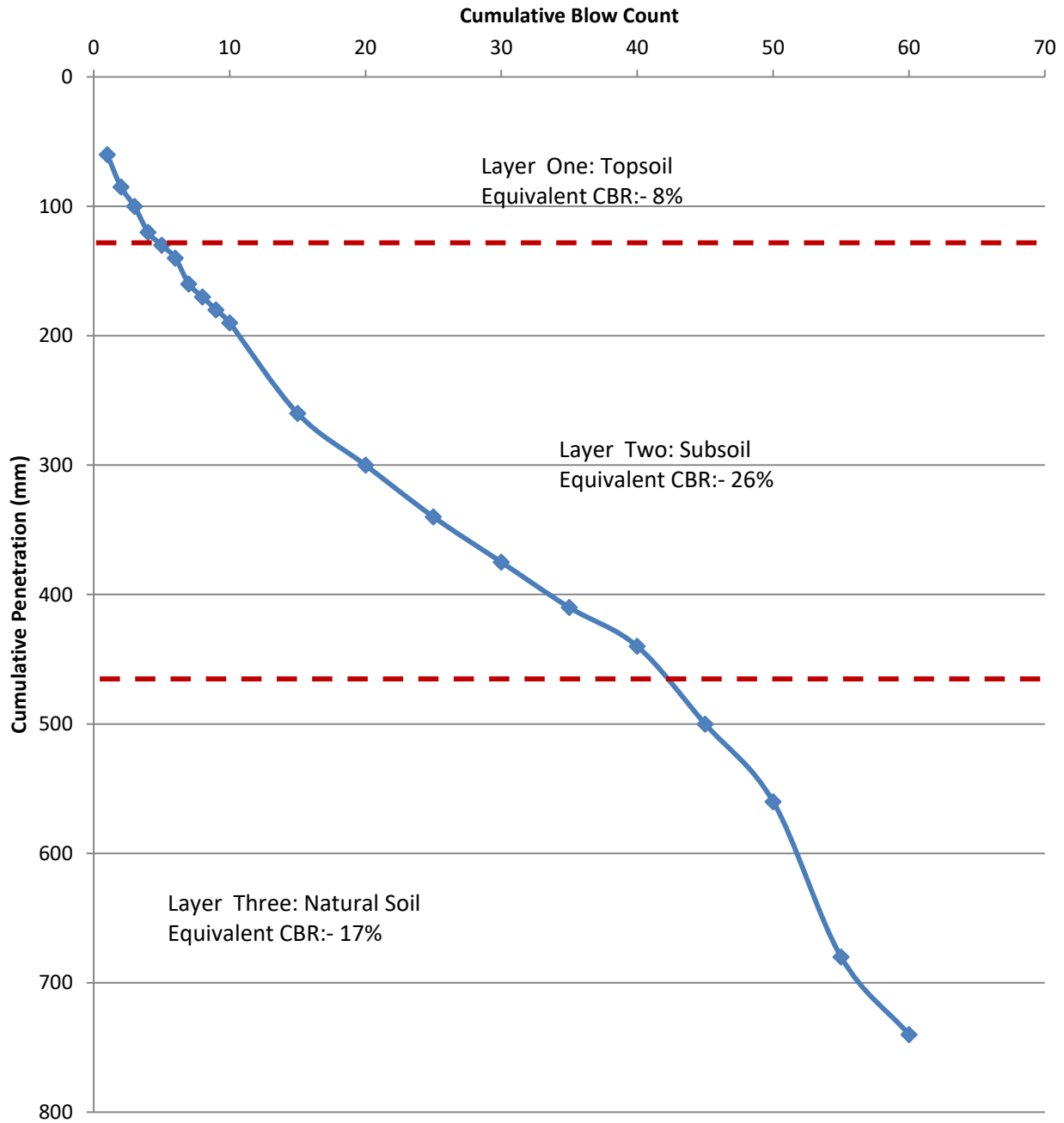
Job Name:- Park Lane, Charvil

Equivalent CBR:- 8% 0 26%

Position:- CBR4

Depth below ground level at start of test:- 0.0m

Cumulative Blows Vs Penetration (mm)



TRL DYNAMIC CONE PENETROMETER RECORD

Job No:- 25-07-12

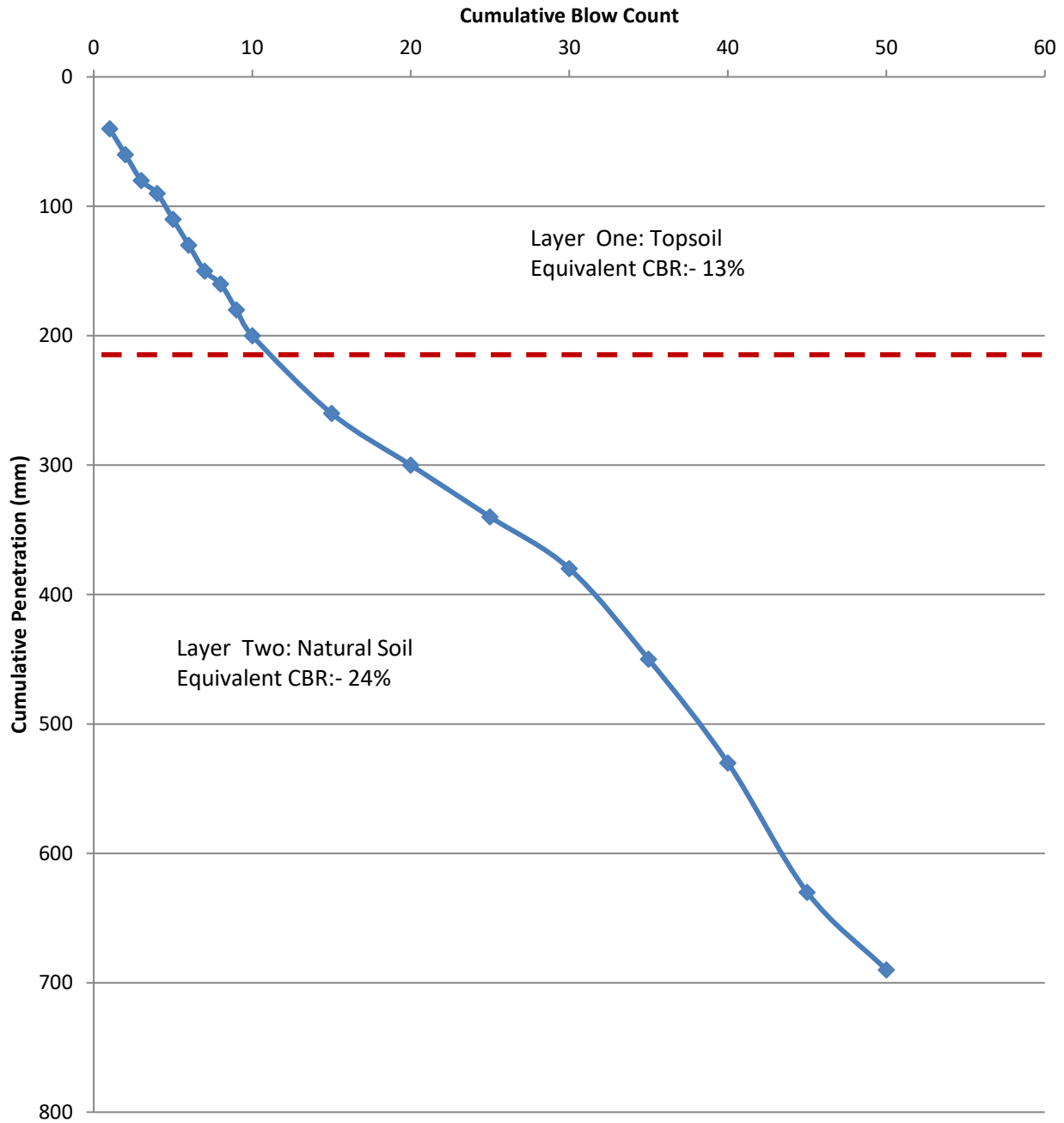
Job Name:- Park Lane, Charvil

Equivalent CBR:- 13% - 24%

Position:- CBR5

Depth below ground level at start of test:- 0.0m

Cumulative Blows Vs Penetration (mm)



TRL DYNAMIC CONE PENETROMETER RECORD

Job No:- 25-07-12

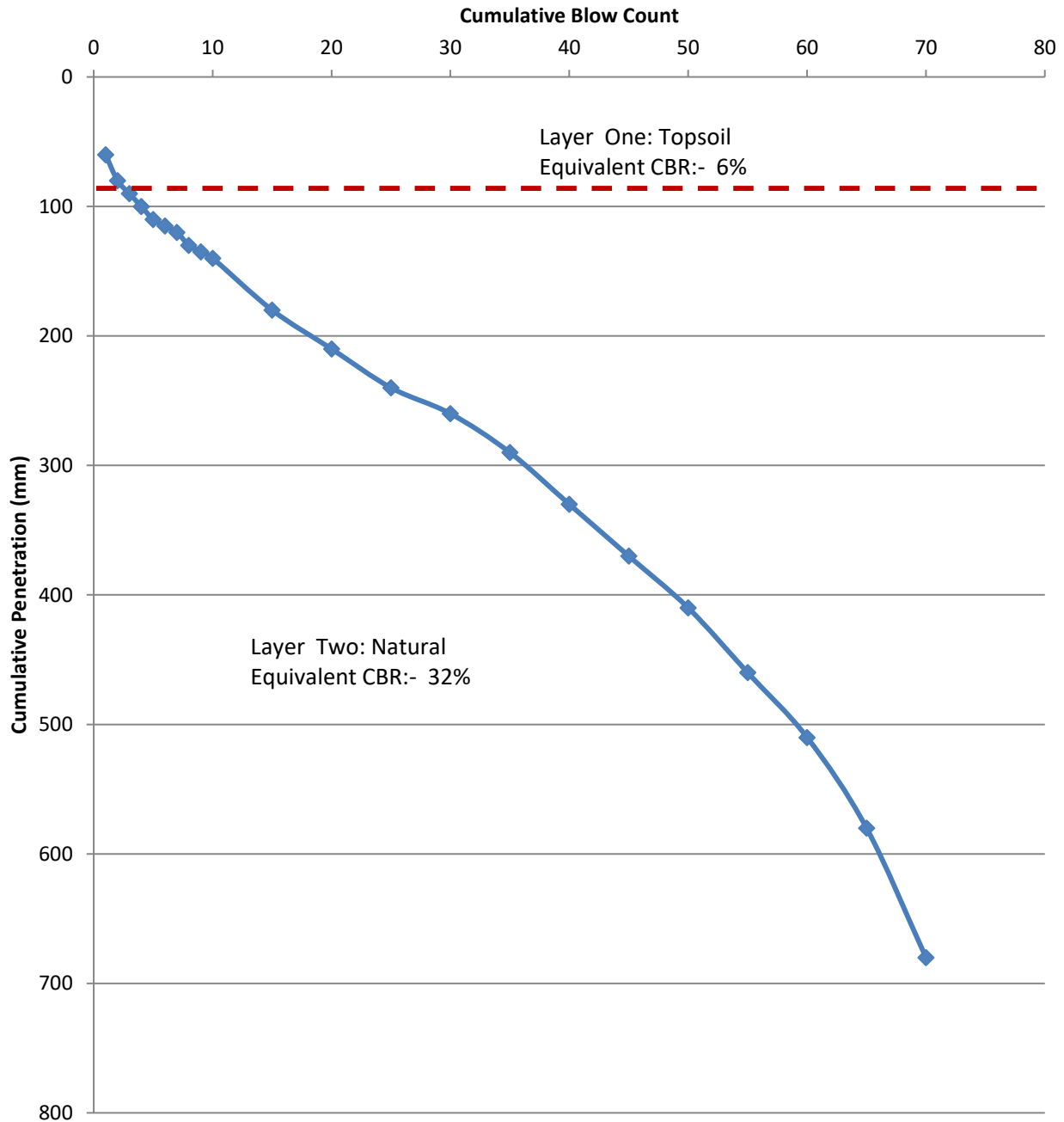
Job Name:- Park Lane, Charvil

Equivalent CBR:- 6% - 32%

Position:- CBR6

Depth below ground level at start of test:- 0.0m

Cumulative Blows Vs Penetration (mm)



TRL DYNAMIC CONE PENETROMETER RECORD

Job No:- 25-07-12

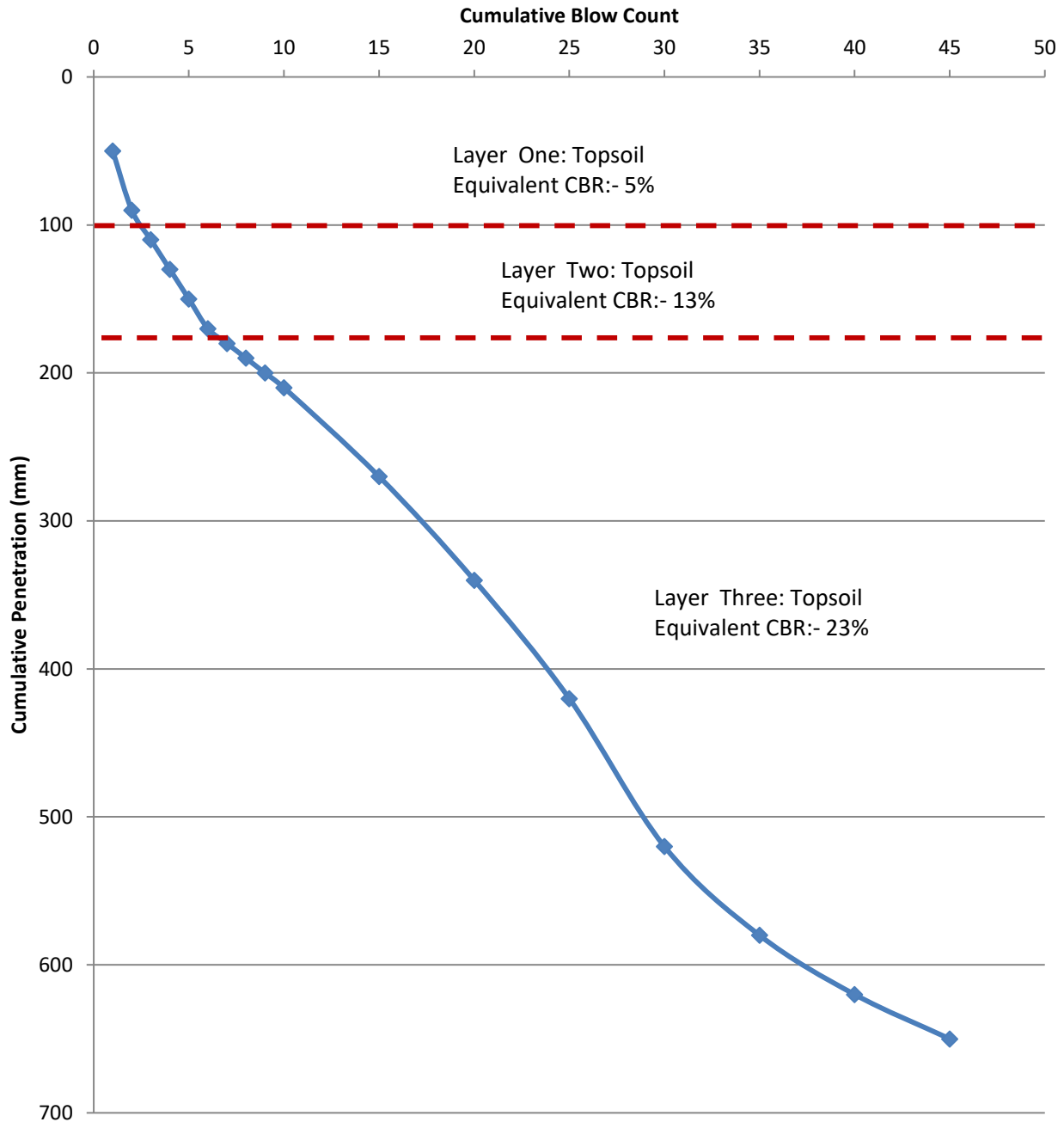
Job Name:- Park Lane, Charvil

Equivalent CBR:- 5% - 23%

Position:- CBR7

Depth below ground level at start of test:- 0.0m

Cumulative Blows Vs Penetration (mm)



TRL DYNAMIC CONE PENETROMETER RECORD

Job No:- 25-07-12

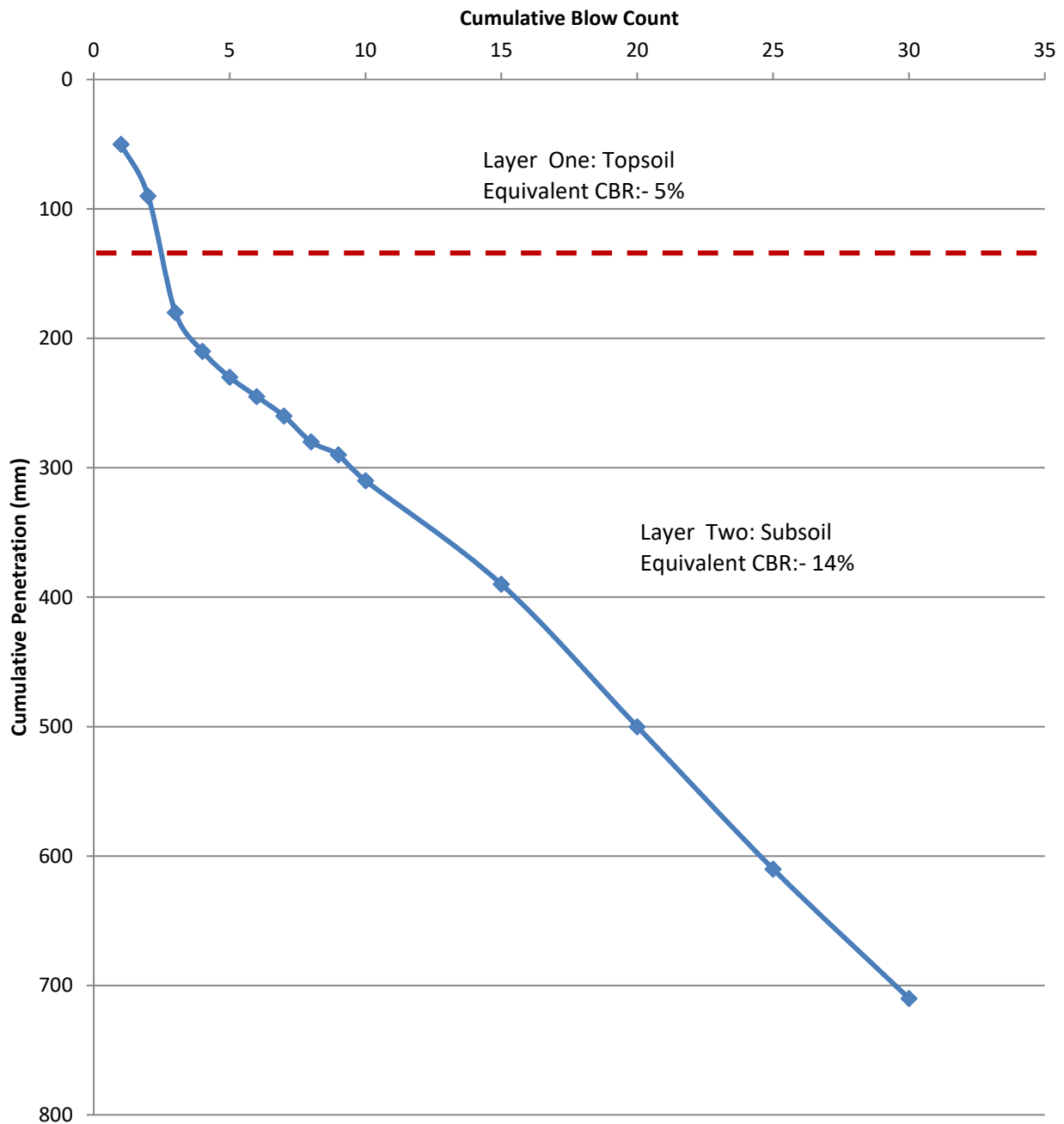
Job Name:- Park Lane, Charvil

Equivalent CBR:- 5% - 14%

Position:- CBR8

Depth below ground level at start of test:- 0.0m

Cumulative Blows Vs Penetration (mm)



TRL DYNAMIC CONE PENETROMETER RECORD

Job No:- 25-07-12

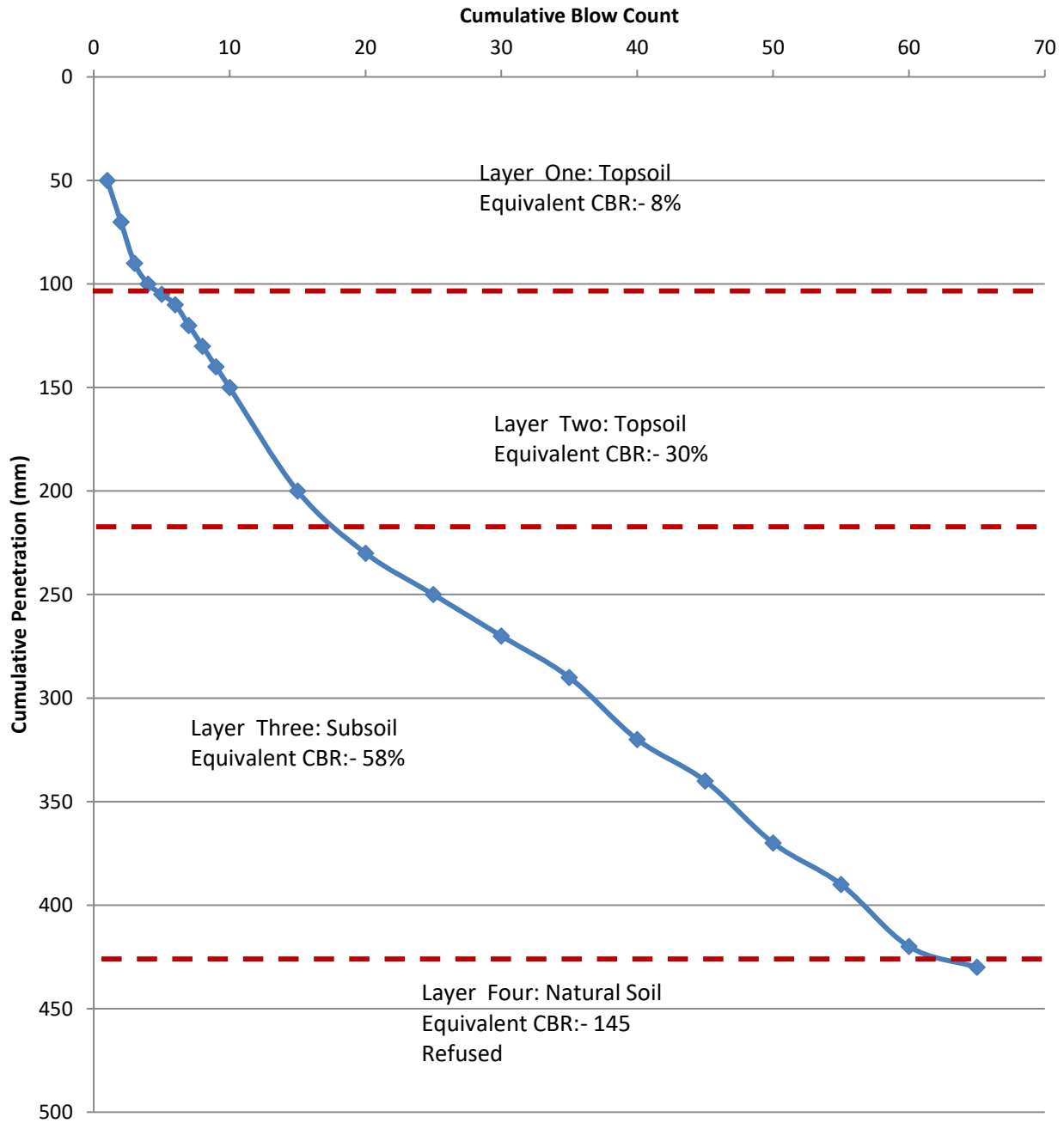
Job Name:- Park Lane, Charvil

Equivalent CBR:- 8% - 145%

Position:- CBR9

Depth below ground level at start of test:- 0.0m

Cumulative Blows Vs Penetration (mm)





Date	Job No.	BH	CH4(%)	LEL(%)	CO2(%)	O2(%)	H2S (ppm)	CO (ppm)	Hex(%)	PIDCf()	PkFlw (lh)	AP (mbar)	GW (m bgl)	Pmp (s)	Bal(%)
14/08/25	,25-07-12	CT2	0	0	1.4	19.9	0	0	0	1	0	1013	Dry	61	83.3
14/08/25	,25-07-12	CT5	0	0	0.7	20.5	0	0	0	1	0	1012	3.36	67	79.4
20/08/25	,25-07-12	CT2	0	0	1.3	19.8	0	0	0	1	0	1011	Dry	62	79.1
20/08/25	,25-07-12	CT5	0	0	0.6	20.3	0	0	0	1	0	1010	3.4	63	79.2
Ongoing															
Ongoing															
Ongoing															
Ongoing															

Our Ref: LA/25-11-12

Belway Homes Ltd. (Thames Valley)
Imperium
Imperial Way
Reading
Berkshire
RG2 0TD

4 Church Street
Maids Moreton
Bucks
MK18 1QE

www.geo-integrity.co.uk
01280 816409

17th March 2026

For the attention of Pippa Paton,

Groundwater Monitoring Report – Park Lane, Charvil, Wokingham, RG10 9TR

Following acceptance from Pippa Paton of Bellway Homes Ltd. (Thames Valley) for our proposal, reference E03492, via email on the 21st of November 2026, we have pleasure in providing you with our Groundwater Monitoring Letter Report for the site situated at Park Lane, Charvil, Wokingham, RG10 9TR, at OS Reference 477476, 175192.

1 Objectives

The objective of this investigation required ongoing long-term groundwater monitoring at the site, over the traditionally wetter winter months (November to March) where groundwater levels are likely to be at their annual highest ranges. The existing standpipes (CT2 and CT5) were put down during the previous Phase I and Phase II Ground Investigation (ref. 25-07-12).

2 Groundwater Monitoring Results

Five monthly monitoring visits were undertaken between November 2025 and March 2026, the results are presented in the table below:

Depth to Groundwater – metres below ground level (m bgl)					
Installation	Visit 1 (28/11/2025)	Visit 2 (09/12/2025)	Visit 3 (06/01/2026)	Visit 4 (02/02/2026)	Visit 5 (03/03/2026)
CT5	4.35	4.40	3.27	0.33	0.30
CT2	4.07	2.99	4.50	0.62	1.21

We trust this information is satisfactory to you. In the event of any queries please contact us.

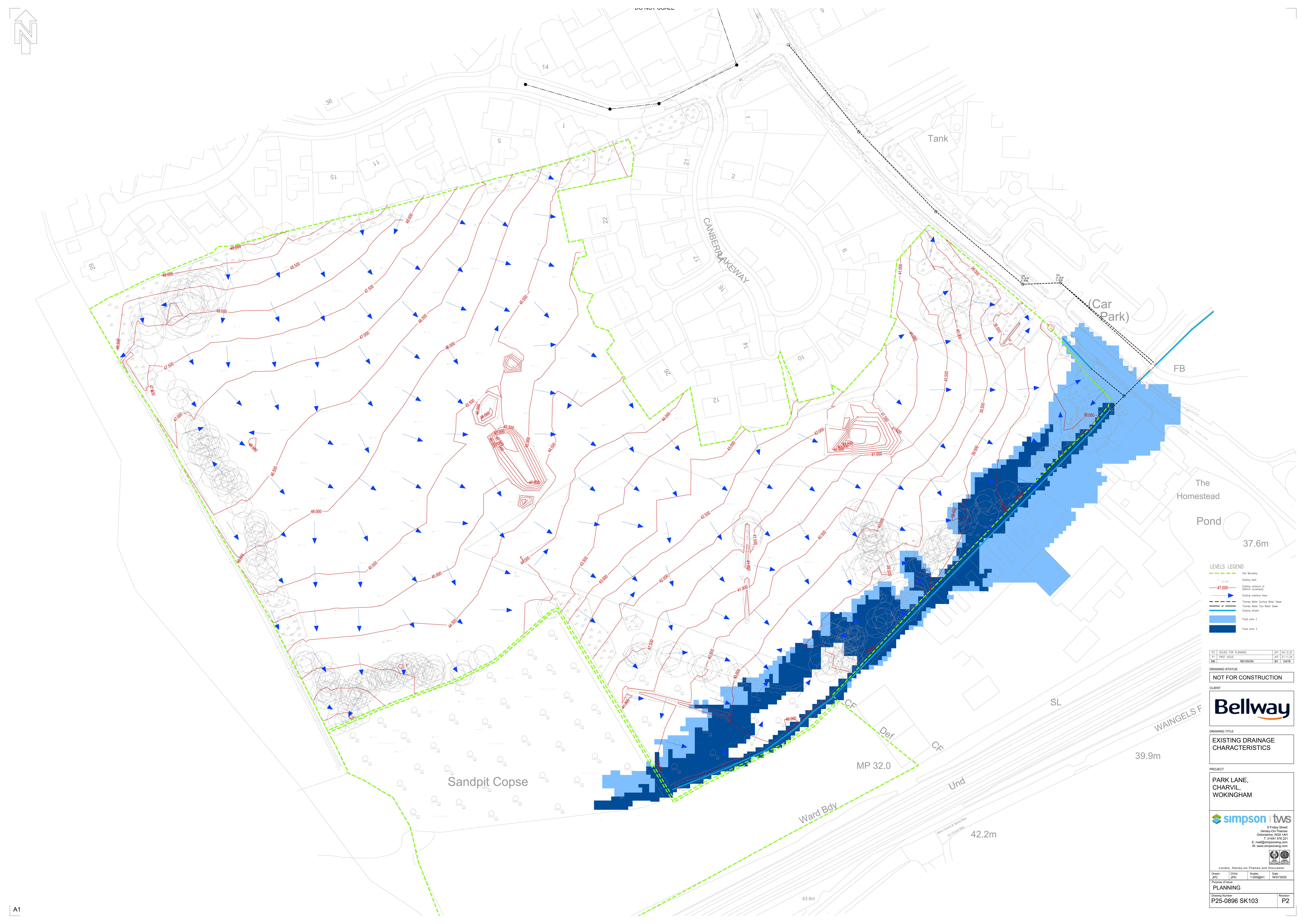
Yours sincerely



Lee Ashworth
Engineering Geologist
Geo-Integrity Ltd.

Appendix C

Existing Drainage Characteristics & Flood Zone Sections



Site

+ 45.96

—47.000—

Ex

Ex

— — —

B



Fig.

3	ISSUED FOR DUNBAR
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2	ISSUED FOR FLOWING.
1	FIRST ISSUE.
1	

REVISION STATUS

NOT FOR CC

NOT FOR CC

JENT

D. I.

Rep

BCI

DRAWING TITLE

EXISTING D

CHARACTER

0.1503

PROJECT _____

PARK LANE

CHARVIL,
MOLINOLA

WOKINGHAM

London: Herley-o

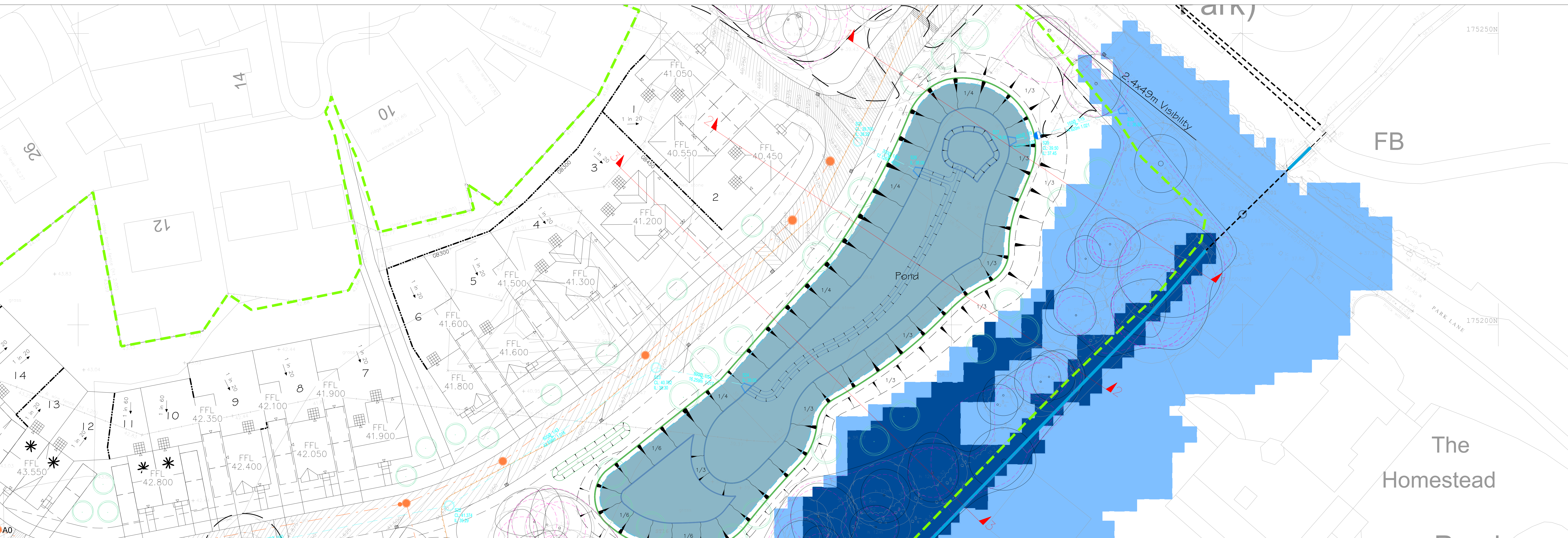
Drawn	Child
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PC	JPH
Purpose of Issue	

PLANNING

Drawing Number
P25-0896 SK

20-0000 01



P2	UPDATED TO SUIT REVERSED SITE LAYOUT	JPH	28.04.20
P1	FIRST ISSUE	JPC	19.01.21
SW	REVISION	BY	DATE

DRAWING STATUS

NOT FOR CONSTRUCTION

CIENT

Bellway

DRAWING TITLE

FLOOD ZONE SECTIONS

PROJECT

**PARK LANE,
CHARVIL,
WOKINGHAM**

 **simpson** | **tws**

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Henley-On-Thames
Oxfordshire, RG9 1AA
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E: info@simpsoneng.com
W: www.simpsoneng.com

London, Henley-on-Thames and Gloucester

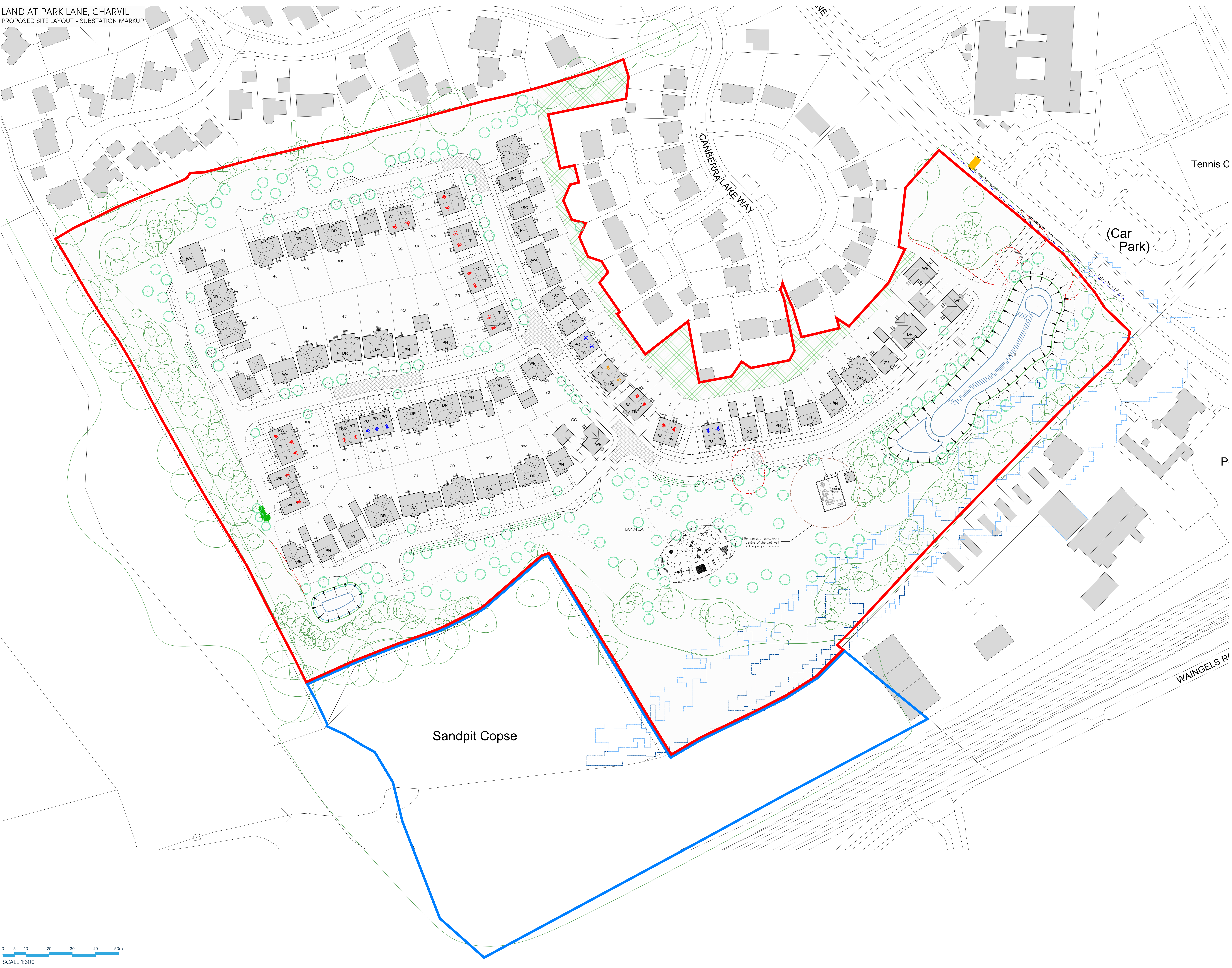
Drawn: JPC	Ck'd: JPH	Scales: AS SHOWN	Date: JAN 2026
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Purpose of Issue
PLANNING

Drawing Number P25-0896 SK106	Revision P2
---	-----------------------

Appendix D

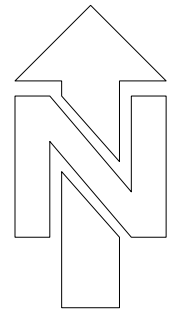
Site Layout



- 50m
- Proposed Site Boundary
 - 1.5m Exclusion Zone from Centre of the Well for the Pumping Station
 - Proposed 2.4m/3m Visibility at the Site Entrance
 - Indicative Tree Planting
 - Landscape Buffer Planting
 - Existing Trees & associated RPA to be retained
 - Existing Trees / Vegetation to be Removed or Reduced
 - Proposed Affordable Accommodation
 - Proposed First Home Accommodation
 - Proposed Shared Ownership Accommodation
 - Flood Zone -2
 - Flood Zone -3

Appendix E

Drained Area Plan & Runoff Calculations



DRAINED AREA LEGEND

- Site Boundary
- 10m Exclusion Zone (A & B)
- Drained area = 16,371m² (0.170ha)
- Total
- Surface Water Sewer
- Surface water manhole
- Surface water flow control
- Trapped road gully
- Proposed highway rain garden

P4	UPDATED TO SUIT REVISED LAYOUT	JPH	24.06.24
P3	UPDATED TO SUIT REVISED LAYOUT	JPH	28.04.24
P2	ISSUED FOR PLANNING	JPC	04.12.23
P1	FIRST ISSUE	JPC	22.11.23
MC	REVISION	BY	DATE

DRAWING STATUS

NOT FOR CONSTRUCTION

CLIENT

Bellway

DRAWING TITLE

DRAINED AREAS

PROJECT

**PARK LANE,
CHARVIL,
WOKINGHAM**

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W: www.simpsoning.com

London, Henley-on-Thames and Gloucester

Drawn	Check	Scale	Date
JPC	JPH	1:500/A1	NOV 2025

Proposed offtake:

PLANNING

Drawing Number	Revision
P25-0896 SK104	P4

P25-0896 -Park Lane, Charvil - Modified Rational Method Runoff Estimate (Post Development)

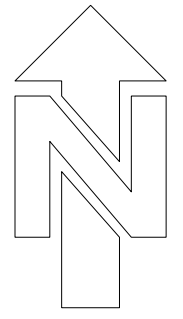
Peak Runoff Rate = $2.78 \times \text{Volume Runoff Coefficient (Cv)} \times \text{Area (A)} \times \text{Peak Rainfall Intensity (I}_{\text{peak}})$

Runoff Volume = $2.78 \times \text{Volume Runoff Coefficient (Cv)} \times \text{Area (A)} \times \text{Peak Rainfall Intensity (I}_{\text{avg}}) \times \text{Storm Duration}$

Return Period	Cv	I _(peak) (mm)	I _(ave) (mm)	A (Ha)	Peak Runoff Rate (l/s)	Runoff Volume (m ³)
2	1.0	16.610	4.274	1.700	78.5	435.9
30	1.0	36.459	9.382	1.700	172.3	957.0
30+35	1.0	49.220	12.666	1.700	232.6	1291.9
100	1.0	47.228	12.153	1.700	223.2	1239.6
100+40	1.0	66.119	17.014	1.700	312.5	1735.4

Appendix F

Drainage Strategy Layout & Finished Level Layout



LEGEND

- Site Boundary
- Proposed Highway Sewer
- Proposed Attenuation Basin
- Proposed Highway rain garden
- Surface Water Sewer
- Land Drain
- Foul Water Sewer
- Foul Water Rising Main
- Thames Water Surface Water Sewer
- Thames Water Foul Water Sewer
- Existing stream/ditch
- Surface water manhole
- Surface water flow control
- Foul water manhole
- Trapped road gully
- Surface water headwall
- Exceedance flows
- Indicative Street lighting
- Service trench
- Denotes extent of Flood Zone 3
- Denotes extent of Flood Zone 2



P4	UPDATED TO SUITE REVISED LAYOUT	JPH	24.06.24
P3	UPDATED TO SUITE REVISED LAYOUT & WATER GROUNDWATER MONITORING	JPH	28.04.24
P2	ISSUED FOR PLANNING	JPH	04.12.23
P1	FIRST ISSUE	JPH	22.11.23
MC		BY	DATE

DRAWING STATUS
NOT FOR CONSTRUCTION

CLIENT

Bellway

DRAWING TITLE
DRAINAGE STRATEGY

PROJECT
PARK LANE, CHARVIL, WOKINGHAM

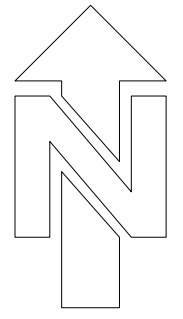
simpson | tws
8 Friday Street
Henley-on-Thames
Oxfordshire, RG9 1AH
T: 01494 538 221
E: mail@simpsoning.com
W: www.simpsoning.com

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Drawn	CHD	Scales	Date
JPC	JPH	1:500@A1	NOV2025

Proposed of Issue
PLANNING

Drawing Number	Revision
P25-0896 SK100	P4



LEVELS LEGEND	
	Site boundary
	Proposed finished floor level
	Steeper gradient
	Gravel board
	Retaining wall
	Existing level
	Proposed Road contours at 25mm increments
	Proposed back - max gradient 1/3
	Root Protection Area

P4	UPDATED TO SUIT REVISED LAYOUT	JPH	24.06.24
P3	UPDATED TO SUIT REVISED LAYOUT	JPH	28.04.24
P2	ISSUED FOR PLANNING	JPH	04.12.23
P1	FIRST ISSUE	JPH	22.11.23
REV	REVISION	BY	DATE

DRAWING STATUS	
NOT FOR CONSTRUCTION	

CLIENT

DRAWING TITLE

PRELIMINARY LEVELS LAYOUT

PROJECT

PARK LANE, CHARVIL, WOKINGHAM

8 Friday Street
Henley-on-Thames
Oxfordshire, RG9 1AH
T: 01491 538 221
E: mail@simpsoning.com
W: www.simpsoning.com

London, Henley-on-Thames and Gloucester

Drawn	Checked	Scales	Date
JPH	JPH	1:500/A1	NOV 2025

Proposed of use: **PLANNING**

Drawing Number	Revision
P25-0896 SK101	P4

Appendix G

Thames Water Correspondence



Matthew Welsh

Simpson TWS
8 Friday Street
Henley On Thames
Oxfordshire
RG9 1AH



27 November 2025

Pre-planning enquiry: Capacity concerns

Site Address: Park Lane, Charvil, Wokingham, Berkshire, RG10 9TR

Dear Matthew

Thank you for providing information on your development.

Proposed site: The proposed construction of up to 75 residential units.

Proposed foul water: The foul water to be pumped at 3.8 l/s discharging to MH5355.

Proposed surface water: The surface water to be discharged to watercourse as does not form part of this application.

We have completed the assessment of the foul water flows and surface water run-off based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

Foul Water

We've assessed your foul water proposals and concluded that our sewerage and unfortunately, we're unable to meet the needs of your full development at this time.

In order to ensure we make the appropriate upgrades – or 'off-site reinforcement' – to serve the remainder of your development, we'll need to carry out modelling work, design a solution and build the necessary improvements. This work is done at our cost.

Once we've begun modelling, we may need to contact you to discuss changing the connection point for capacity reasons. Please note that we'll pay the cost of covering any extra distance if the connection needs to be made at a point further away than the nearest practicable point of at least the same diameter.

How long could modelling and reinforcement take?

Typical timescales for a development of your size are:

Modelling: 9-12 months

Design: 6 months

Construction: Up to 18 months*

Total: Up to 36 months

*(dependent on Traffic Management, Local Authority and Third-Party Landowners)

If the time you're likely to take from planning and construction through to first occupancy is longer than this, we'll be able to carry out the necessary upgrades in time for your development. If it's shorter, we may seek planning conditions, please contact me on the number below to discuss the timing of our activities.

What do you need to tell us before we start modelling?

We will only carry out modelling once we're confident that your development will proceed. In order to have this confidence, we'll need to know that you **own the land and have either outline or full planning permission**. Please email this information to us as soon as you have it.

If the modelling shows we need to carry out reinforcement work, then before we start construction, we'll need you to supply us with notification that you've confirmed your F10 – Notification of construction project - submission to the Health and Safety Executive.

Surface Water

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.

The disposal hierarchy being:

- 1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
- 2) rainwater infiltration to ground at or close to source
- 3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
- 4) rainwater discharge direct to a watercourse (unless not appropriate)
- 5) controlled rainwater discharge to a surface water sewer or drain
- 6) controlled rainwater discharge to a combined sewer.

Where connection to the public sewerage network is required to manage surface water flows, we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

Capacity at STW?

The receiving network is served by Wargrave STW and there isn't a known performance issue which may cause the EA to object to the development.

What do I need to do next?

If you've satisfied the points above, then you should compare your own timeline with the typical timescales we've suggested for our activities. If the time you're likely to take from planning and construction through to first occupancy is **more** than the total time we're likely to take, we'll be able to carry out the necessary upgrades in time for your development.

Yours sincerely

A handwritten signature in black ink that reads "Steve Knight". The script is cursive and fluid, with the first letters of "Steve" and "Knight" being capitalized and prominent.

Steve Knight

Adoption Engineer

Developer Services – Adoptions Engineer, Sewer Adoptions Team

Appendix H

Hydraulic Analysis Results

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	1.000
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
S33	0.064	5.00	47.629	1350	477333.251	175231.764	1.579	46.050
S34	0.026	5.00	47.225	1350	477340.123	175209.402	1.815	45.410
S32	0.013	5.00	46.913	1350	477348.312	175193.621	1.823	45.090
S31	0.082	5.00	46.634	1350	477355.265	175177.308	1.854	44.780
S35			45.510	1350	477371.486	175141.175	1.500	44.010
S36			45.290	1350	477371.842	175131.857	1.360	43.930
S37	0.031	5.00	44.800	1350	477380.544	175106.174	1.200	43.600
S38			45.000		477394.404	175100.859	1.500	43.500
S14		5.00	45.000		477406.629	175105.027	1.500	43.500
S15	0.035	5.00	45.163	1200	477409.548	175116.858	1.903	43.260
S16	0.155	5.00	44.886	1200	477430.457	175125.922	2.036	42.850
S17			44.025	1350	477496.944	175142.946	1.885	42.140
S18	0.049	5.00	43.819	1350	477510.511	175152.950	1.929	41.890
S1	0.075	5.00	48.212	1350	477388.511	175275.565	1.682	46.530
S2	0.028	5.00	47.645	1200	477412.026	175281.452	1.555	46.090
S3	0.049	5.00	46.903	1350	477442.130	175289.355	1.503	45.400
S4			46.756	1350	477452.165	175292.552	1.626	45.130
S5	0.200	5.00	46.612	1350	477458.715	175291.454	1.712	44.900
S6	0.050	5.00	45.188	1350	477481.465	175229.237	2.068	43.120
S7	0.051	5.00	46.395	1350	477383.282	175185.928	1.725	44.670
S8	0.130	5.00	45.987	1350	477416.548	175194.149	1.882	44.105
S9	0.110	5.00	45.811	1350	477430.922	175195.818	1.886	43.925
S10			45.541	1350	477453.171	175201.401	1.986	43.555
S11	0.044	5.00	45.293	1350	477470.104	175206.071	2.038	43.255
S12	0.054	5.00	45.054	1500	477489.471	175216.664	2.444	42.610
S13	0.049	5.00	44.422	1500	477506.759	175192.303	2.332	42.090
S19	0.034	5.00	43.664	1500	477528.125	175169.303	2.264	41.400
S20	0.026	5.00	43.408	1500	477535.183	175162.807	2.128	41.280
S21	0.120	5.00	42.767	1500	477553.894	175156.835	1.967	40.800
S22	0.094	5.00	41.374	1500	477613.726	175168.960	2.084	39.290
S23			40.782	1500	477649.252	175192.645	2.482	38.300
S24			39.500		477665.093	175188.983	1.500	38.000
S25	0.132	5.00	39.700	1350	477683.921	175231.416	1.410	38.290
S26			39.500		477694.826	175226.114	1.500	38.000
S27		5.00	39.500		477709.896	175230.817	1.500	38.000
S29			39.500	1500	477720.647	175233.687	2.050	37.450
S30			36.943	1350	477728.701	175236.573	0.443	36.500

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S33	S34	23.394	0.600	46.050	45.485	0.565	41.4	225	5.19	49.6
1.001	S34	S32	17.780	0.600	45.410	45.090	0.320	55.6	300	5.33	49.1
1.002	S32	S31	17.733	0.600	45.090	44.780	0.310	57.2	300	5.47	48.5
1.003	S31	S35	39.607	0.600	44.780	44.010	0.770	51.4	300	5.77	47.3
1.004	S35	S36	9.324	0.600	44.010	43.930	0.080	116.6	300	5.88	46.9
1.005	S36	S37	27.117	0.600	43.930	43.600	0.330	82.2	300	6.14	45.9
1.006	S37	S38	14.844	0.600	43.600	43.500	0.100	148.4	300	6.33	45.3
1.008	S14	S15	12.133	0.600	43.500	43.260	0.240	50.6	300	5.09	50.0
1.009	S15	S16	22.789	0.600	43.260	42.925	0.335	68.0	225	5.33	49.1
1.010	S16	S17	68.632	0.600	42.850	42.140	0.710	96.7	300	6.05	46.3
1.011	S17	S18	16.856	0.600	42.140	41.965	0.175	96.3	300	6.22	45.7
1.012	S18	S19	24.035	0.600	41.890	41.625	0.265	90.7	375	6.43	45.0
2.000	S1	S2	24.241	0.600	46.530	46.090	0.440	55.1	300	5.19	49.6
2.001	S2	S3	31.124	0.600	46.090	45.400	0.690	45.1	300	5.41	48.8
2.002	S3	S4	10.532	0.600	45.400	45.130	0.270	39.0	300	5.48	48.5
2.003	S4	S5	6.642	0.600	45.130	44.975	0.155	42.9	300	5.53	48.3
2.004	S5	S6	66.246	0.600	44.900	43.120	1.780	37.2	375	5.90	46.8
2.005	S6	S12	14.906	0.600	43.120	42.835	0.285	52.3	375	6.00	46.4
3.000	S7	S8	34.266	0.600	44.670	44.180	0.490	69.9	225	5.36	48.9
3.001	S8	S9	14.471	0.600	44.105	43.925	0.180	80.4	300	5.50	48.4
3.002	S9	S10	22.939	0.600	43.925	43.630	0.295	77.8	300	5.72	47.5
3.003	S10	S11	17.564	0.600	43.555	43.255	0.300	58.5	375	5.84	47.1
3.004	S11	S12	22.075	0.600	43.255	42.835	0.420	52.6	375	5.99	46.5
2.006	S12	S13	29.872	0.600	42.610	42.090	0.520	57.4	600	6.15	45.9
2.007	S13	S19	31.393	0.600	42.090	41.400	0.690	45.5	600	6.30	45.4
1.013	S19	S20	9.592	0.600	41.400	41.280	0.120	79.9	600	6.49	44.8
1.014	S20	S21	19.641	0.600	41.280	40.800	0.480	40.9	600	6.58	44.5
1.015	S21	S22	61.048	0.600	40.800	39.290	1.510	40.4	600	6.84	43.6
1.016	S22	S23	42.698	0.600	39.290	38.300	0.990	43.1	600	7.03	43.0
1.017	S23	S24	16.259	0.600	38.300	38.000	0.300	54.2	600	7.11	42.7
4.000	S25	S26	12.126	0.600	38.290	38.000	0.290	41.8	300	5.08	50.0
1.020	S27	S29	5.051	0.600	38.000	37.450	0.550	9.2	600	5.01	50.0
1.021	S29	S30	14.620	0.600	37.450	36.500	0.950	15.4	150	5.10	50.0

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)
Rainfall Events	Singular	Skip Steady State	✓	Check Discharge Rate(s) x
Summer CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume x
Winter CV	1.000	Additional Storage (m³/ha)	0.0	

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
30	35	0	0
100	0	0	0
100	40	0	0

Node S15 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	43.260	Product Number	CTL-SHE-0069-2500-1440-2500
Design Depth (m)	1.440	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.5	Min Node Diameter (mm)	1200

Node S29 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	37.450	Product Number	CTL-SHE-0108-6500-1750-6500
Design Depth (m)	1.750	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.5	Min Node Diameter (mm)	1200

Node S27 Pond Storage Structure

Invert Level (m)	38.000	Time to half empty (mins)	Analyse flow through structure	x
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Inlets

S24 | S26

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	840.0	0.750	1160.0	0.751	1200.0	1.500	2100.0

Node S14 Pond Storage Structure

Invert Level (m)	43.500	Time to half empty (mins)	728	Analyse flow through structure	x
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Inlets

S38

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	60.0	1.500	275.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S33	10	46.105	0.055	10.4	0.0792	0.0000	OK
15 minute summer	S34	10	45.474	0.064	14.4	0.0920	0.0000	OK
15 minute summer	S32	10	45.157	0.067	16.4	0.0964	0.0000	OK
15 minute summer	S31	11	44.868	0.088	29.7	0.1253	0.0000	OK
15 minute summer	S35	11	44.130	0.120	29.3	0.1714	0.0000	OK
15 minute summer	S36	11	44.031	0.101	29.5	0.1450	0.0000	OK
240 minute summer	S37	188	43.831	0.231	12.1	0.3305	0.0000	OK
240 minute summer	S38	188	43.831	0.331	11.5	0.0000	0.0000	OK
240 minute summer	S14	192	43.827	0.327	9.2	27.4795	0.0000	SURCHARGED
240 minute summer	S15	188	43.828	0.568	5.9	0.6419	0.0000	SURCHARGED
15 minute summer	S16	10	42.951	0.100	27.3	0.1137	0.0000	OK
15 minute summer	S17	11	42.245	0.105	27.1	0.1507	0.0000	OK
15 minute summer	S18	11	41.997	0.107	34.5	0.1532	0.0000	OK
15 minute summer	S1	10	46.588	0.058	12.2	0.0828	0.0000	OK
15 minute summer	S2	10	46.153	0.063	16.7	0.0718	0.0000	OK
15 minute summer	S3	10	45.479	0.079	24.5	0.1133	0.0000	OK
15 minute summer	S4	11	45.216	0.086	24.3	0.1226	0.0000	OK
15 minute summer	S5	10	45.003	0.103	56.6	0.1480	0.0000	OK
15 minute summer	S6	11	43.254	0.134	64.0	0.1916	0.0000	OK
15 minute summer	S7	10	44.726	0.056	8.3	0.0795	0.0000	OK
15 minute summer	S8	10	44.211	0.106	29.2	0.1516	0.0000	OK
15 minute summer	S9	10	44.059	0.134	46.9	0.1912	0.0000	OK
15 minute summer	S10	10	43.667	0.112	46.2	0.1608	0.0000	OK
15 minute summer	S11	11	43.373	0.118	53.2	0.1688	0.0000	OK
15 minute summer	S12	11	42.770	0.160	126.2	0.2819	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S33	1.000	S34	10.3	1.382	0.126	0.1735	
15 minute summer	S34	1.001	S32	14.3	1.257	0.096	0.2031	
15 minute summer	S32	1.002	S31	16.3	1.137	0.111	0.2558	
15 minute summer	S31	1.003	S35	29.3	1.374	0.189	0.8577	
15 minute summer	S35	1.004	S36	29.5	1.253	0.287	0.2198	
15 minute summer	S36	1.005	S37	29.5	1.198	0.241	0.6698	
240 minute summer	S37	1.006	S38	11.5	0.793	0.126	0.9548	
240 minute summer	S14	1.008	S15	-6.4	-0.145	-0.041	0.8544	
240 minute summer	S15	1.009	S16	2.1	0.735	0.034	0.0656	
15 minute summer	S16	1.010	S17	27.1	1.287	0.239	1.4492	
15 minute summer	S17	1.011	S18	26.9	1.276	0.238	0.3555	
15 minute summer	S18	1.012	S19	34.5	1.384	0.164	0.6001	
15 minute summer	S1	2.000	S2	12.1	1.192	0.081	0.2466	
15 minute summer	S2	2.001	S3	16.5	1.290	0.100	0.3997	
15 minute summer	S3	2.002	S4	24.3	1.550	0.136	0.1649	
15 minute summer	S4	2.003	S5	24.3	1.592	0.143	0.1016	
15 minute summer	S5	2.004	S6	55.9	1.892	0.170	1.9850	
15 minute summer	S6	2.005	S12	64.2	1.943	0.231	0.4923	
15 minute summer	S7	3.000	S8	8.1	1.079	0.130	0.2567	
15 minute summer	S8	3.001	S9	29.0	1.107	0.234	0.3802	
15 minute summer	S9	3.002	S10	46.2	1.603	0.366	0.6641	
15 minute summer	S10	3.003	S11	46.4	1.619	0.177	0.5034	
15 minute summer	S11	3.004	S12	53.7	1.892	0.194	0.6264	
15 minute summer	S12	2.006	S13	126.6	2.258	0.139	1.6753	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.02%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	11	42.235	0.145	134.2	0.2556	0.0000	OK
15 minute summer	S19	11	41.627	0.227	174.3	0.4013	0.0000	OK
15 minute summer	S20	11	41.460	0.180	178.2	0.3183	0.0000	OK
15 minute summer	S21	11	40.974	0.174	196.6	0.3079	0.0000	OK
15 minute summer	S22	11	39.475	0.185	210.6	0.3277	0.0000	OK
15 minute summer	S23	11	38.509	0.209	208.6	0.3689	0.0000	OK
480 minute winter	S24	464	38.320	0.320	33.3	0.0000	0.0000	OK
15 minute summer	S25	10	38.372	0.082	21.5	0.1171	0.0000	OK
480 minute winter	S26	480	38.315	0.315	11.3	0.0000	0.0000	OK
480 minute winter	S27	464	38.315	0.315	116.9	287.3501	0.0000	OK
480 minute winter	S29	472	38.346	0.896	135.2	1.5831	0.0000	SURCHARGED
30 minute winter	S30	381	36.537	0.037	6.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	2.007	S19	134.5	1.812	0.132	2.3524	
15 minute summer	S19	1.013	S20	174.2	2.069	0.226	0.8093	
15 minute summer	S20	1.014	S21	178.0	2.562	0.165	1.3644	
15 minute summer	S21	1.015	S22	196.0	2.764	0.181	4.3299	
15 minute summer	S22	1.016	S23	208.6	2.605	0.199	3.4398	
15 minute summer	S23	1.017	S24	209.0	4.495	0.223	0.8596	
15 minute summer	S25	4.000	S26	21.5	2.911	0.125	0.1381	
480 minute winter	S27	1.020	S29	135.2	0.710	0.059	1.0899	
480 minute winter	S29	1.021	S30	6.2	1.776	0.136	0.0510	455.8

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S33	10	46.151	0.101	31.4	0.1451	0.0000	OK
15 minute summer	S34	10	45.528	0.118	43.9	0.1682	0.0000	OK
15 minute summer	S32	10	45.217	0.127	50.0	0.1820	0.0000	OK
15 minute summer	S31	10	44.943	0.163	90.0	0.2333	0.0000	OK
240 minute winter	S35	236	44.281	0.271	16.2	0.3881	0.0000	OK
240 minute winter	S36	236	44.281	0.351	16.2	0.5026	0.0000	SURCHARGED
240 minute winter	S37	236	44.281	0.681	18.9	0.9748	0.0000	SURCHARGED
240 minute winter	S38	236	44.281	0.781	18.4	0.0000	0.0000	OK
240 minute winter	S14	240	44.276	0.776	10.2	90.1234	0.0000	SURCHARGED
240 minute winter	S15	240	44.276	1.016	10.1	1.1486	0.0000	SURCHARGED
15 minute summer	S16	10	43.036	0.186	78.1	0.2099	0.0000	OK
15 minute summer	S17	11	42.341	0.201	77.2	0.2879	0.0000	OK
15 minute summer	S18	11	42.089	0.199	100.1	0.2853	0.0000	OK
15 minute summer	S1	10	46.634	0.104	36.8	0.1489	0.0000	OK
15 minute summer	S2	10	46.202	0.112	50.3	0.1265	0.0000	OK
15 minute summer	S3	10	45.553	0.153	74.0	0.2194	0.0000	OK
15 minute summer	S4	10	45.297	0.167	73.4	0.2383	0.0000	OK
15 minute summer	S5	10	45.088	0.188	171.1	0.2695	0.0000	OK
15 minute summer	S6	11	43.392	0.272	194.5	0.3899	0.0000	OK
15 minute summer	S7	10	44.768	0.098	25.0	0.1402	0.0000	OK
15 minute summer	S8	11	44.479	0.374	88.5	0.5356	0.0000	SURCHARGED
15 minute summer	S9	11	44.353	0.428	136.8	0.6120	0.0000	SURCHARGED
15 minute summer	S10	11	43.773	0.218	136.9	0.3120	0.0000	OK
15 minute summer	S11	11	43.481	0.226	157.5	0.3234	0.0000	OK
15 minute summer	S12	11	42.908	0.298	375.9	0.5273	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S33	1.000	S34	31.1	1.855	0.383	0.3920	
15 minute summer	S34	1.001	S32	43.7	1.617	0.292	0.4800	
15 minute summer	S32	1.002	S31	49.7	1.485	0.338	0.5987	
15 minute summer	S31	1.003	S35	89.4	1.755	0.575	1.9914	
240 minute winter	S35	1.004	S36	16.2	1.084	0.157	0.6407	
240 minute winter	S36	1.005	S37	16.2	0.823	0.132	1.9096	
240 minute winter	S37	1.006	S38	18.4	0.948	0.202	1.0453	
240 minute winter	S14	1.008	S15	9.4	0.212	0.060	0.8544	
240 minute winter	S15	1.009	S16	2.1	0.735	0.034	0.0656	
15 minute summer	S16	1.010	S17	77.2	1.627	0.683	3.2561	
15 minute summer	S17	1.011	S18	77.1	1.638	0.681	0.7933	
15 minute summer	S18	1.012	S19	100.4	1.661	0.478	1.5492	
15 minute summer	S1	2.000	S2	36.5	1.603	0.244	0.5527	
15 minute summer	S2	2.001	S3	49.9	1.663	0.301	0.9357	
15 minute summer	S3	2.002	S4	73.4	1.923	0.411	0.4021	
15 minute summer	S4	2.003	S5	73.0	2.057	0.429	0.2363	
15 minute summer	S5	2.004	S6	169.9	2.404	0.517	4.6584	
15 minute summer	S6	2.005	S12	193.4	2.484	0.698	1.1584	
15 minute summer	S7	3.000	S8	24.8	1.269	0.398	0.9610	
15 minute summer	S8	3.001	S9	85.2	1.283	0.687	1.0190	
15 minute summer	S9	3.002	S10	136.9	1.979	1.085	1.5845	
15 minute summer	S10	3.003	S11	136.9	2.015	0.523	1.1928	
15 minute summer	S11	3.004	S12	157.2	2.439	0.568	1.4222	
15 minute summer	S12	2.006	S13	376.4	2.773	0.414	4.0553	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	11	42.375	0.285	399.4	0.5028	0.0000	OK
15 minute summer	S19	11	41.851	0.451	514.9	0.7969	0.0000	OK
15 minute summer	S20	11	41.633	0.353	526.1	0.6245	0.0000	OK
15 minute summer	S21	11	41.125	0.325	581.7	0.5742	0.0000	OK
15 minute summer	S22	11	39.655	0.365	625.1	0.6443	0.0000	OK
720 minute winter	S23	705	38.743	0.443	50.5	0.7832	0.0000	OK
720 minute winter	S24	705	38.743	0.743	160.2	0.0000	0.0000	OK
720 minute winter	S25	735	38.737	0.447	4.8	0.6396	0.0000	SURCHARGED
720 minute winter	S26	735	38.737	0.737	16.2	0.0000	0.0000	OK
720 minute winter	S27	720	38.738	0.738	111.2	737.3779	0.0000	SURCHARGED
600 minute winter	S29	600	38.742	1.292	126.1	2.2822	0.0000	SURCHARGED
180 minute winter	S30	32	36.537	0.037	6.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	2.007	S19	398.6	2.201	0.390	5.6328	
15 minute summer	S19	1.013	S20	513.9	2.559	0.667	1.9179	
15 minute summer	S20	1.014	S21	525.5	3.213	0.487	3.2253	
15 minute summer	S21	1.015	S22	581.1	3.476	0.536	10.2262	
15 minute summer	S22	1.016	S23	623.6	3.426	0.594	7.7708	
720 minute winter	S23	1.017	S24	160.2	1.634	0.171	4.1043	
720 minute winter	S25	4.000	S26	4.6	1.040	0.027	0.8539	
720 minute winter	S27	1.020	S29	101.7	0.562	0.045	1.4228	
600 minute winter	S29	1.021	S30	6.2	1.774	0.135	0.0510	639.8

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.43%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S33	10	46.172	0.122	42.4	0.1745	0.0000	OK
15 minute summer	S34	10	45.551	0.141	59.2	0.2015	0.0000	OK
15 minute summer	S32	10	45.245	0.155	67.5	0.2217	0.0000	OK
15 minute summer	S31	11	45.017	0.237	121.3	0.3386	0.0000	OK
15 minute summer	S35	12	44.646	0.636	117.3	0.9096	0.0000	SURCHARGED
360 minute winter	S36	352	44.505	0.575	15.5	0.8223	0.0000	SURCHARGED
360 minute winter	S37	352	44.505	0.905	17.3	1.2945	0.0000	FLOOD RISK
360 minute winter	S38	352	44.505	1.005	16.9	0.0000	0.0000	OK
360 minute winter	S14	352	44.499	0.999	9.6	131.9794	0.0000	SURCHARGED
360 minute winter	S15	352	44.498	1.238	9.3	1.4007	0.0000	SURCHARGED
15 minute summer	S16	10	43.083	0.233	104.8	0.2639	0.0000	OK
15 minute summer	S17	11	42.396	0.256	103.0	0.3661	0.0000	OK
15 minute summer	S18	11	42.136	0.246	134.1	0.3527	0.0000	OK
15 minute summer	S1	10	46.653	0.123	49.7	0.1767	0.0000	OK
15 minute summer	S2	10	46.223	0.133	68.0	0.1502	0.0000	OK
15 minute summer	S3	10	45.590	0.190	99.8	0.2719	0.0000	OK
15 minute summer	S4	10	45.335	0.205	99.1	0.2930	0.0000	OK
15 minute summer	S5	10	45.127	0.227	231.2	0.3248	0.0000	OK
15 minute summer	S6	11	43.536	0.416	262.8	0.5948	0.0000	SURCHARGED
15 minute summer	S7	11	45.108	0.438	33.8	0.6261	0.0000	SURCHARGED
15 minute summer	S8	11	44.951	0.846	114.3	1.2103	0.0000	SURCHARGED
15 minute summer	S9	11	44.723	0.798	184.1	1.1416	0.0000	SURCHARGED
15 minute summer	S10	11	43.829	0.274	184.3	0.3923	0.0000	OK
15 minute summer	S11	11	43.537	0.282	212.2	0.4041	0.0000	OK
15 minute summer	S12	11	42.974	0.364	504.3	0.6430	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S33	1.000	S34	42.0	1.992	0.518	0.4931	
15 minute summer	S34	1.001	S32	58.9	1.704	0.394	0.6146	
15 minute summer	S32	1.002	S31	66.9	1.500	0.455	0.8531	
15 minute summer	S31	1.003	S35	117.3	1.813	0.755	2.5750	
15 minute summer	S35	1.004	S36	110.3	1.566	1.072	0.6566	
360 minute winter	S36	1.005	S37	14.7	0.722	0.119	1.9096	
360 minute winter	S37	1.006	S38	16.9	0.881	0.185	1.0453	
360 minute winter	S14	1.008	S15	8.6	0.159	0.055	0.8544	
360 minute winter	S15	1.009	S16	2.3	0.756	0.037	0.0698	
15 minute summer	S16	1.010	S17	103.0	1.704	0.911	4.1676	
15 minute summer	S17	1.011	S18	103.0	1.717	0.910	1.0079	
15 minute summer	S18	1.012	S19	134.4	1.655	0.640	2.2117	
15 minute summer	S1	2.000	S2	49.4	1.720	0.329	0.6959	
15 minute summer	S2	2.001	S3	67.4	1.744	0.406	1.2003	
15 minute summer	S3	2.002	S4	99.1	2.017	0.556	0.5175	
15 minute summer	S4	2.003	S5	98.7	2.191	0.580	0.2992	
15 minute summer	S5	2.004	S6	229.6	2.522	0.698	5.9375	
15 minute summer	S6	2.005	S12	258.2	2.582	0.932	1.4793	
15 minute summer	S7	3.000	S8	33.6	1.224	0.540	1.3628	
15 minute summer	S8	3.001	S9	114.5	1.625	0.923	1.0190	
15 minute summer	S9	3.002	S10	184.3	2.618	1.461	1.5990	
15 minute summer	S10	3.003	S11	184.4	2.103	0.704	1.5401	
15 minute summer	S11	3.004	S12	211.9	2.578	0.766	1.8103	
15 minute summer	S12	2.006	S13	504.3	2.850	0.555	5.3190	

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.43%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	11	42.451	0.361	535.4	0.6386	0.0000	OK
15 minute summer	S19	11	41.976	0.576	686.8	1.0176	0.0000	OK
15 minute summer	S20	11	41.718	0.438	699.9	0.7744	0.0000	OK
15 minute summer	S21	11	41.196	0.396	774.9	0.7005	0.0000	OK
15 minute summer	S22	11	39.751	0.461	835.5	0.8151	0.0000	OK
960 minute winter	S23	945	38.976	0.676	126.4	1.1950	0.0000	SURCHARGED
960 minute winter	S24	945	38.976	0.976	99.3	0.0000	0.0000	OK
960 minute winter	S25	960	38.969	0.679	5.1	0.9719	0.0000	SURCHARGED
960 minute winter	S26	960	38.969	0.969	18.7	0.0000	0.0000	OK
960 minute winter	S27	945	38.970	0.970	126.3	1044.8700	0.0000	SURCHARGED
960 minute winter	S29	945	38.976	1.526	117.7	2.6961	0.0000	SURCHARGED
120 minute summer	S30	20	36.537	0.037	6.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	2.007	S19	530.9	2.264	0.519	7.1460	
15 minute summer	S19	1.013	S20	683.5	2.699	0.887	2.3908	
15 minute summer	S20	1.014	S21	698.9	3.365	0.648	4.1060	
15 minute summer	S21	1.015	S22	775.9	3.622	0.715	13.1271	
15 minute summer	S22	1.016	S23	837.3	3.622	0.797	9.8722	
960 minute winter	S23	1.017	S24	99.3	1.583	0.106	4.5798	
960 minute winter	S25	4.000	S26	5.0	0.991	0.029	0.8539	
960 minute winter	S27	1.020	S29	117.7	0.633	0.052	1.4228	
960 minute winter	S29	1.021	S30	6.2	1.774	0.136	0.0509	810.6

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S33	10	46.169	0.119	40.6	0.1697	0.0000	OK
15 minute summer	S34	10	45.547	0.137	56.7	0.1961	0.0000	OK
15 minute summer	S32	10	45.240	0.150	64.6	0.2149	0.0000	OK
15 minute summer	S31	11	44.992	0.212	116.1	0.3031	0.0000	OK
15 minute summer	S35	12	44.575	0.565	114.5	0.8086	0.0000	SURCHARGED
240 minute winter	S36	236	44.447	0.517	20.2	0.7393	0.0000	SURCHARGED
240 minute winter	S37	236	44.447	0.847	22.6	1.2115	0.0000	SURCHARGED
240 minute winter	S38	236	44.447	0.947	22.1	0.0000	0.0000	OK
240 minute winter	S14	240	44.441	0.941	11.9	120.4348	0.0000	SURCHARGED
240 minute winter	S15	240	44.441	1.181	10.0	1.3353	0.0000	SURCHARGED
15 minute summer	S16	10	43.074	0.224	100.3	0.2537	0.0000	OK
15 minute summer	S17	11	42.385	0.245	98.8	0.3511	0.0000	OK
15 minute summer	S18	11	42.129	0.239	128.4	0.3421	0.0000	OK
15 minute summer	S1	10	46.650	0.120	47.6	0.1723	0.0000	OK
15 minute summer	S2	10	46.219	0.129	65.1	0.1464	0.0000	OK
15 minute summer	S3	10	45.584	0.184	95.6	0.2630	0.0000	OK
15 minute summer	S4	10	45.328	0.198	94.9	0.2839	0.0000	OK
15 minute summer	S5	10	45.120	0.220	221.1	0.3155	0.0000	OK
15 minute summer	S6	11	43.470	0.350	251.3	0.5002	0.0000	OK
15 minute summer	S7	11	44.995	0.325	32.3	0.4652	0.0000	SURCHARGED
15 minute summer	S8	11	44.855	0.750	109.3	1.0732	0.0000	SURCHARGED
15 minute summer	S9	11	44.648	0.723	175.6	1.0344	0.0000	SURCHARGED
15 minute summer	S10	11	43.818	0.263	175.4	0.3763	0.0000	OK
15 minute summer	S11	11	43.525	0.270	201.7	0.3865	0.0000	OK
15 minute summer	S12	11	42.962	0.352	483.1	0.6221	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S33	1.000	S34	40.2	1.972	0.496	0.4767	
15 minute summer	S34	1.001	S32	56.4	1.693	0.377	0.5922	
15 minute summer	S32	1.002	S31	64.1	1.520	0.435	0.7807	
15 minute summer	S31	1.003	S35	114.5	1.813	0.737	2.4475	
15 minute summer	S35	1.004	S36	107.7	1.563	1.047	0.6566	
240 minute winter	S36	1.005	S37	19.2	0.784	0.156	1.9096	
240 minute winter	S37	1.006	S38	22.1	0.976	0.242	1.0453	
240 minute winter	S14	1.008	S15	9.2	0.174	0.059	0.8544	
240 minute winter	S15	1.009	S16	2.3	0.750	0.036	0.0687	
15 minute summer	S16	1.010	S17	98.8	1.694	0.874	4.0085	
15 minute summer	S17	1.011	S18	98.8	1.709	0.872	0.9717	
15 minute summer	S18	1.012	S19	128.7	1.640	0.613	2.1301	
15 minute summer	S1	2.000	S2	47.3	1.704	0.315	0.6729	
15 minute summer	S2	2.001	S3	64.5	1.734	0.389	1.1568	
15 minute summer	S3	2.002	S4	94.9	2.004	0.532	0.4986	
15 minute summer	S4	2.003	S5	94.4	2.172	0.555	0.2890	
15 minute summer	S5	2.004	S6	219.6	2.506	0.668	5.7521	
15 minute summer	S6	2.005	S12	249.8	2.564	0.901	1.4364	
15 minute summer	S7	3.000	S8	33.4	1.213	0.536	1.3628	
15 minute summer	S8	3.001	S9	109.0	1.548	0.879	1.0190	
15 minute summer	S9	3.002	S10	175.4	2.491	1.390	1.5990	
15 minute summer	S10	3.003	S11	175.1	2.090	0.668	1.4714	
15 minute summer	S11	3.004	S12	200.6	2.555	0.725	1.7305	
15 minute summer	S12	2.006	S13	483.3	2.843	0.531	5.0985	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.59%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	11	42.438	0.348	512.9	0.6151	0.0000	OK
15 minute summer	S19	11	41.957	0.557	663.1	0.9833	0.0000	OK
15 minute summer	S20	11	41.708	0.428	678.7	0.7559	0.0000	OK
15 minute summer	S21	11	41.188	0.388	751.3	0.6851	0.0000	OK
15 minute summer	S22	11	39.737	0.447	808.6	0.7904	0.0000	OK
720 minute winter	S23	705	38.913	0.613	166.3	1.0826	0.0000	SURCHARGED
720 minute winter	S24	705	38.913	0.913	181.4	0.0000	0.0000	OK
720 minute winter	S25	735	38.906	0.616	5.9	0.8809	0.0000	SURCHARGED
720 minute winter	S26	735	38.906	0.906	21.4	0.0000	0.0000	OK
720 minute winter	S27	720	38.907	0.907	89.9	954.5720	0.0000	SURCHARGED
720 minute winter	S29	735	38.909	1.459	125.1	2.5785	0.0000	SURCHARGED
15 minute summer	S30	1298	36.537	0.037	6.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	2.007	S19	513.7	2.260	0.502	6.9406	
15 minute summer	S19	1.013	S20	663.0	2.681	0.861	2.3386	
15 minute summer	S20	1.014	S21	678.7	3.348	0.629	4.0021	
15 minute summer	S21	1.015	S22	751.7	3.605	0.693	12.7573	
15 minute summer	S22	1.016	S23	807.8	3.598	0.769	9.5873	
720 minute winter	S23	1.017	S24	181.4	1.712	0.194	4.5798	
720 minute winter	S25	4.000	S26	5.8	1.080	0.033	0.8539	
720 minute winter	S27	1.020	S29	125.1	0.620	0.055	1.4228	
720 minute winter	S29	1.021	S30	6.2	1.776	0.135	0.0509	716.9

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.48%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S33	12	46.203	0.153	56.8	0.2193	0.0000	OK
15 minute summer	S34	12	45.997	0.587	79.3	0.8396	0.0000	SURCHARGED
15 minute summer	S32	12	45.909	0.819	83.6	1.1725	0.0000	SURCHARGED
15 minute summer	S31	12	45.793	1.013	149.9	1.4495	0.0000	SURCHARGED
15 minute summer	S35	12	45.107	1.097	136.2	1.5701	0.0000	SURCHARGED
15 minute summer	S36	12	44.878	0.948	133.0	1.3560	0.0000	SURCHARGED
360 minute winter	S37	352	44.737	1.137	23.4	1.6274	0.0000	FLOOD RISK
360 minute winter	S38	352	44.737	1.237	23.2	0.0000	0.0000	OK
360 minute winter	S14	352	44.730	1.230	12.3	183.1109	0.0000	FLOOD RISK
360 minute winter	S15	352	44.730	1.470	4.7	1.6629	0.0000	SURCHARGED
15 minute summer	S16	11	43.871	1.020	137.5	1.1542	0.0000	SURCHARGED
15 minute summer	S17	12	42.890	0.750	129.2	1.0727	0.0000	SURCHARGED
15 minute summer	S18	12	42.611	0.721	169.0	1.0322	0.0000	SURCHARGED
15 minute summer	S1	10	46.677	0.147	66.6	0.2108	0.0000	OK
15 minute summer	S2	10	46.249	0.159	91.1	0.1803	0.0000	OK
15 minute summer	S3	11	45.810	0.410	133.8	0.5864	0.0000	SURCHARGED
15 minute summer	S4	11	45.594	0.464	131.6	0.6638	0.0000	SURCHARGED
15 minute summer	S5	11	45.434	0.534	305.8	0.7636	0.0000	SURCHARGED
15 minute summer	S6	10	43.856	0.736	332.5	1.0532	0.0000	SURCHARGED
15 minute summer	S7	11	46.087	1.417	45.3	2.0277	0.0000	SURCHARGED
15 minute summer	S8	11	45.851	1.746	151.5	2.4990	0.0000	FLOOD RISK
15 minute summer	S9	11	45.477	1.552	241.5	2.2206	0.0000	SURCHARGED
15 minute summer	S10	11	44.093	0.538	237.4	0.7692	0.0000	SURCHARGED
15 minute summer	S11	11	43.724	0.469	273.2	0.6715	0.0000	SURCHARGED
15 minute summer	S12	12	43.133	0.523	647.6	0.9235	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S33	1.000	S34	56.2	2.117	0.694	0.8021	
15 minute summer	S34	1.001	S32	72.6	1.736	0.486	1.2521	
15 minute summer	S32	1.002	S31	80.6	1.451	0.547	1.2487	
15 minute summer	S31	1.003	S35	136.2	1.934	0.877	2.7891	
15 minute summer	S35	1.004	S36	133.0	1.889	1.293	0.6566	
15 minute summer	S36	1.005	S37	131.9	1.873	1.075	1.9096	
360 minute winter	S37	1.006	S38	23.2	0.981	0.255	1.0453	
360 minute winter	S14	1.008	S15	-6.4	-0.146	-0.041	0.8544	
360 minute winter	S15	1.009	S16	2.5	0.773	0.040	0.0738	
15 minute summer	S16	1.010	S17	129.2	1.835	1.143	4.8330	
15 minute summer	S17	1.011	S18	127.5	1.810	1.126	1.1870	
15 minute summer	S18	1.012	S19	167.3	1.783	0.796	2.6510	
15 minute summer	S1	2.000	S2	66.2	1.834	0.441	0.8779	
15 minute summer	S2	2.001	S3	90.3	1.778	0.544	1.6628	
15 minute summer	S3	2.002	S4	131.6	2.060	0.737	0.7417	
15 minute summer	S4	2.003	S5	135.9	2.155	0.799	0.4677	
15 minute summer	S5	2.004	S6	289.3	2.624	0.880	7.3067	
15 minute summer	S6	2.005	S12	338.4	3.068	1.221	1.6282	
15 minute summer	S7	3.000	S8	46.5	1.197	0.747	1.3628	
15 minute summer	S8	3.001	S9	146.6	2.082	1.182	1.0190	
15 minute summer	S9	3.002	S10	237.4	3.371	1.882	1.6153	
15 minute summer	S10	3.003	S11	235.9	2.139	0.901	1.9373	
15 minute summer	S11	3.004	S12	270.9	2.685	0.980	2.2531	
15 minute summer	S12	2.006	S13	644.9	2.827	0.709	8.0983	

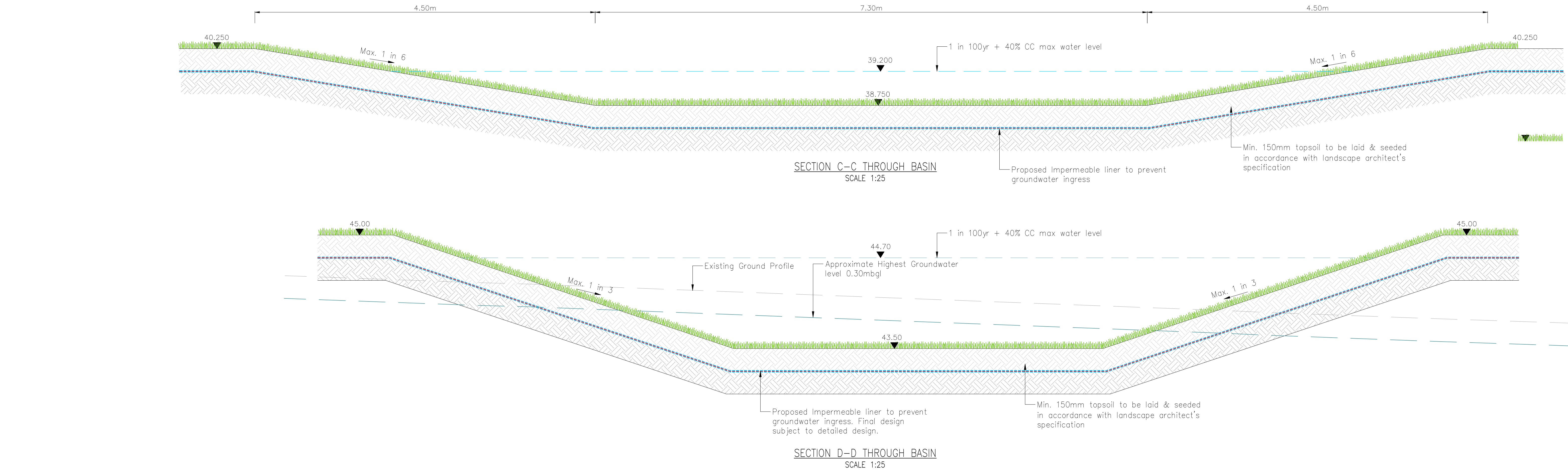
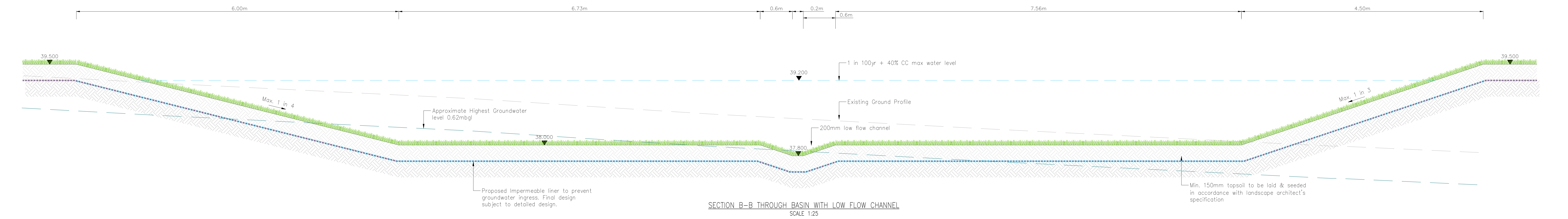
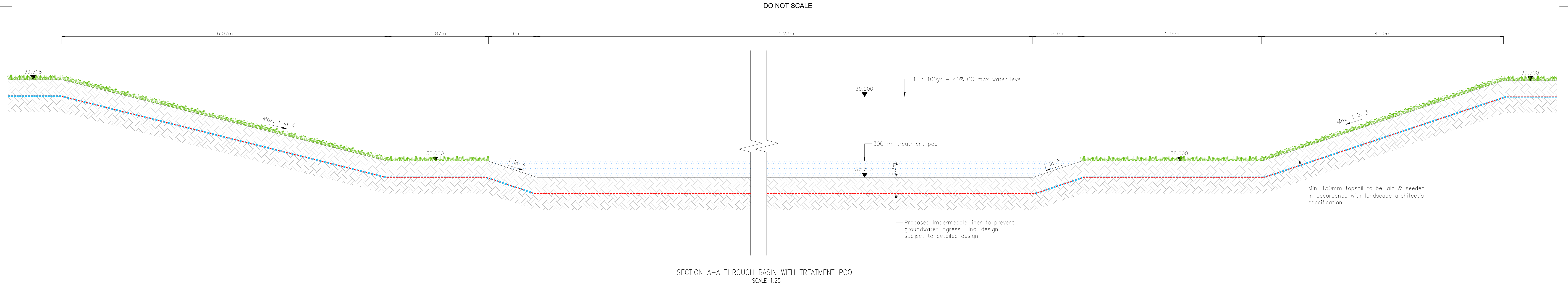
Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.48%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S13	12	42.838	0.748	687.0	1.3208	0.0000	SURCHARGED
15 minute summer	S19	12	42.414	1.014	864.6	1.7920	0.0000	SURCHARGED
15 minute summer	S20	12	42.047	0.767	879.4	1.3545	0.0000	SURCHARGED
15 minute summer	S21	12	41.505	0.705	967.5	1.2454	0.0000	SURCHARGED
15 minute summer	S22	12	40.078	0.788	1008.6	1.3916	0.0000	SURCHARGED
960 minute winter	S23	945	39.203	0.903	125.2	1.5957	0.0000	SURCHARGED
960 minute winter	S24	945	39.203	1.203	174.4	0.0000	0.0000	OK
960 minute winter	S25	975	39.195	0.905	6.5	1.2949	0.0000	SURCHARGED
960 minute winter	S26	975	39.195	1.195	22.5	0.0000	0.0000	OK
960 minute winter	S27	960	39.196	1.196	136.7	1407.0300	0.0000	SURCHARGED
960 minute winter	S29	930	39.200	1.750	133.6	3.0921	0.0000	SURCHARGED
960 minute winter	S30	945	36.538	0.038	6.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S13	2.007	S19	676.2	2.407	0.661	8.8427	
15 minute summer	S19	1.013	S20	857.3	3.044	1.113	2.7018	
15 minute summer	S20	1.014	S21	868.2	3.516	0.805	5.5324	
15 minute summer	S21	1.015	S22	948.3	3.573	0.874	17.1958	
15 minute summer	S22	1.016	S23	1019.8	3.648	0.971	12.0119	
960 minute winter	S23	1.017	S24	174.4	1.672	0.186	4.5798	
960 minute winter	S25	4.000	S26	6.4	1.032	0.037	0.8539	
960 minute winter	S27	1.020	S29	133.6	0.710	0.059	1.4228	
960 minute winter	S29	1.021	S30	6.4	1.794	0.141	0.0525	863.4

Appendix I

SuDS Construction Details



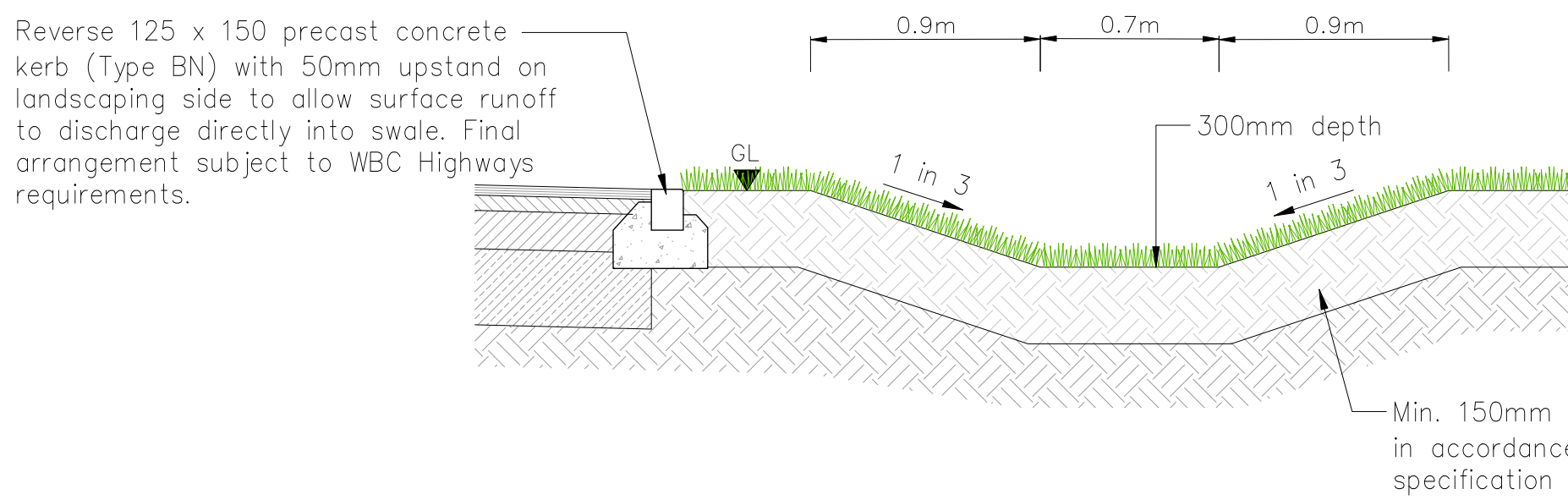
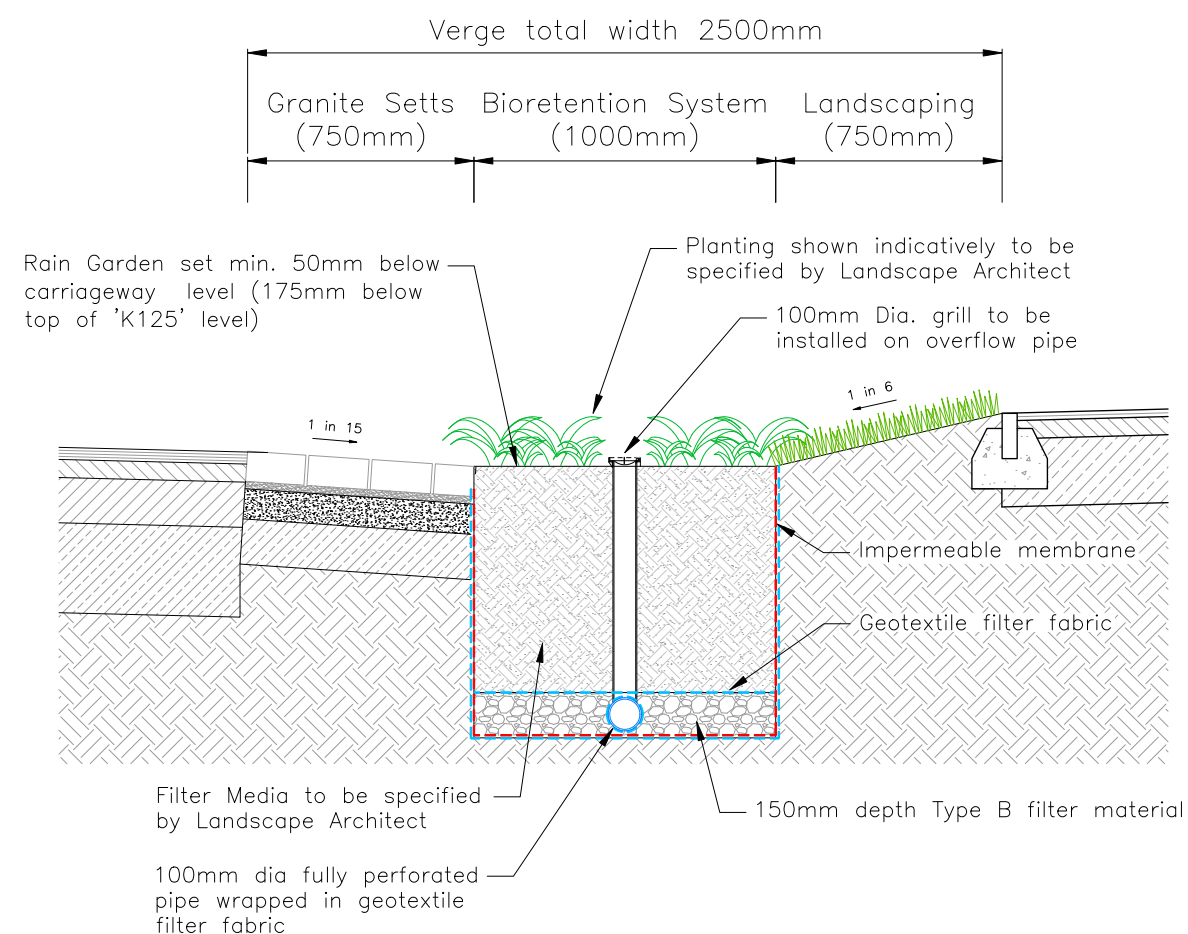
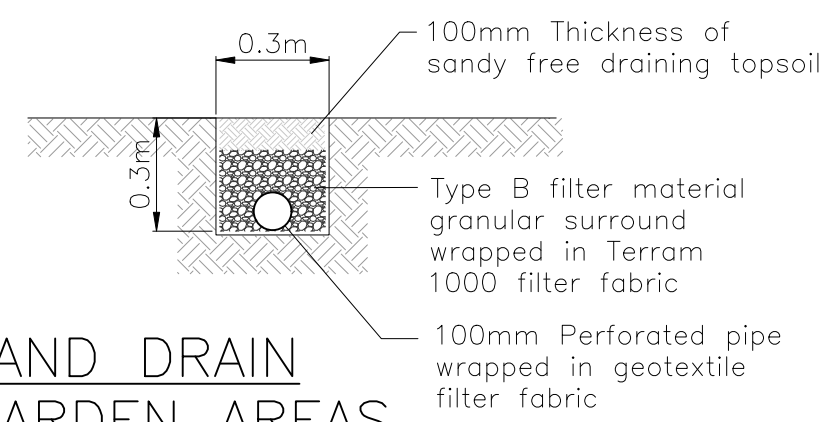
SuDS DESIGN NOTES

- This drawing is to be read in conjunction with all relevant Architects, Engineers and Subcontractors drawings and details.
- All planting is shown indicatively refer landscape architects drawings for planting details / specifications and play equipment.
- All headwalls with pipes >350mm to be fitted with SFA safety grilles.
- Should groundwater be encountered during excavation of SuDS features, engineer should be informed prior to further works proceeding.
- Swale & rain garden kerb entries to be confirmed as part of detailed design in accordance with Wokingham Borough highways requirements for adaption under a Section 38 agreement.
- Refer to drawing P25-0896 SK100 Drainage Strategy for section locations.

Flowtex Protection Fleece by Stormwater Management LTD or similar approved

LLDPE Impermeable Membrane by Stormwater Management LTD or similar approved

NOTE
Membranes to be installed in accordance with manufacturers recommendations



P3	IMPERMEABLE MEMBRANES ADDED FOLLOWING WATER GROUNDWATER MONITORING RESULTS & REMOVAL TOTAL UPDATED	JPH	28.04.26
P2	ISSUED FOR PLANNING	JPC	04.12.25
P1	FIRST ISSUE	GL	21.11.25
REV	REVISION	BY	DATE

DRAWING STATUS
NOT FOR CONSTRUCTION

CLIENT
Bellway

DRAWING TITLE
SUDS CONSTRUCTION DETAILS

PROJECT
PARK LANE, CHARVIL, WOKINGHAM

simpson tws
8 Friday Street Henley-on-Thames Oxfordshire, RG9 1AH T: 01491 516 251 E: mail@simpsoneng.com W: www.simpsoneng.com
London, Henley-on-Thames and Gloucester
Drawn: JPH Checked: JPH Scale: AS SHOWN Date: NOV 2025
Project of Issue PLANNING
Drawing Number P25-0896 SK105
Revision P3