Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust

Wollam Park, St Albans

Flood Risk Assessment and Drainage Strategy

December 2024

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Purpose

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The conclusions and recommendations contained herein are limited by the availability of background information and the planned use for the Site.

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CDM

The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force in April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust, is made aware of their duties under the CDM Regulations.

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1 Executive Summary

1.1.1 PJA has been commissioned by Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust to prepare a Flood Risk Assessment (FRA) and Drainage Strategy to support a planning permission to be sought for the following development:

(1) Relocation and replacement of existing playing fields and erection of pavilion annex; and

(2) Construction of up to 1000 new homes (Use Class C3) to include a mix of market housing, affordable housing, age restricted specialist accommodation for the elderly, adult disability service units; a care home (Use Class C2); a local centre (Use Classes E and F); a primary school (Use Class F); the laying out of green infrastructure including habitat creation; drainage infrastructure; earthworks; pedestrian and cycle routes; new means of access and alterations to existing accesses.

1.1.2 The application is submitted as a "hybrid" application. Part (1) is submitted as a full application. Part (2) is submitted as an outline application with approval of means of access sought at the present time, and all other reserved matters to be approved at a later date.

1.1.3 The application will be submitted in "outline" with all matters reserved for future consideration save for:

- The proposed means of "access" on to Harpenden Road (A1081), Sandridgebury Lane and Valley Road;
- The proposed "access", "appearance", "landscaping", "layout" and "scale" (TBC) of the proposed playing fields on land to the east of the existing Woollam Playing Fields.

Table 1-1: Executive Summary Table

Overview	
Site Location	Woollam Park, Land off Harpenden Road, St Albans
Development Proposal	Residential-led development
Environment Agency Flood Zone(s)	Flood Zone 1
Vulnerability Classifications(s)	More Vulnerable and Less Vulnerable
Fluvial Flood Risk	Very Low
Tidal Flood Risk	Very Low
Surface Water Flood Risk	Medium
Groundwater Flood Risk	Low to Medium
Sewer Flood Risk	Low
Canal Flood Risk	Very Low
Reservoir Flood Risk	Very Low
Surface Water Drainage	The surface water drainage strategy will sustainably manage all storm events up to and including the 1 in 100-year plus 40% climate change event. This will be achieved via a network of sustainable drainage systems (SuDS), before discharging via infiltration at a rate of $1.88x10^{-5}$ m/s.

Overview	
Foul Water Drainage	Foul water flows will drain via gravity to the proposed pumping station within the Site. Foul water will then be pumped from the proposed Type 3 pumping station to the north west of the Site into Thames Water Manhole MH8702.

2 Introduction

2.1 Terms of Reference

2.1.1 PJA has been commissioned by Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust to prepare a Flood Risk Assessment (FRA) and Drainage Strategy for a proposed residential-led development at *Woollam Park, St Albans* (herein referred to as 'the Site').

2.2 Scope of works

Flood Risk Assessment (FRA)

2.2.1 This FRA provides information on the nature of identified potential flood risk at the Site and follows government guidance regarding development and flood risk in line with the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG).

Drainage Strategy

2.2.2 The surface water drainage strategy aims to sustainably manage surface water from the Site and has been developed largely in accordance with current sustainable development best practices and the specific requirements of Hertfordshire County Council as the Lead Local Flood Authority (LLFA).

2.2.3 A high-level foul water drainage strategy has also been developed for the proposed development Site which aims to address the requirements of Thames Water as the sewerage undertaker.

2.3 Information Sources

2.3.1 This report comprises a review of readily available public information and other relevant information obtained from the following sources:

- Environment Agency (EA);
- British Geological Survey (BGS);
- Cranfield Soil and Agrifood Institute Soilscapes;
- DEFRA Magic Mapping;
- St Albans City & District Council;
- Hertfordshire County Council;
- Thames Water

3 Site Details

3.1 Site Description

3.1.1 The Site, which is the focus of this FRA, is mostly greenfield (undeveloped) in nature and is currently used for agricultural purposes. A small percentage of the site, adjacent to Harpenden Road, is currently used as Rugby Football playing fields.

3.1.2 The Site is bound to the A1081 (Harpenden Road) to the west, beyond which lies existing residential development. Agricultural fields bound the Site to the north of the proposed development, with an existing railway line running along the northeastern boundary of the Site. Furthermore, existing commercial development is situated to the south of the Site, beyond which lies existing residential development.

3.1.3 The Site's OS co-ordinates are 515676, 210075.

3.1.4 A Site location plan is available in Figure 3-1 and Table 3-1.

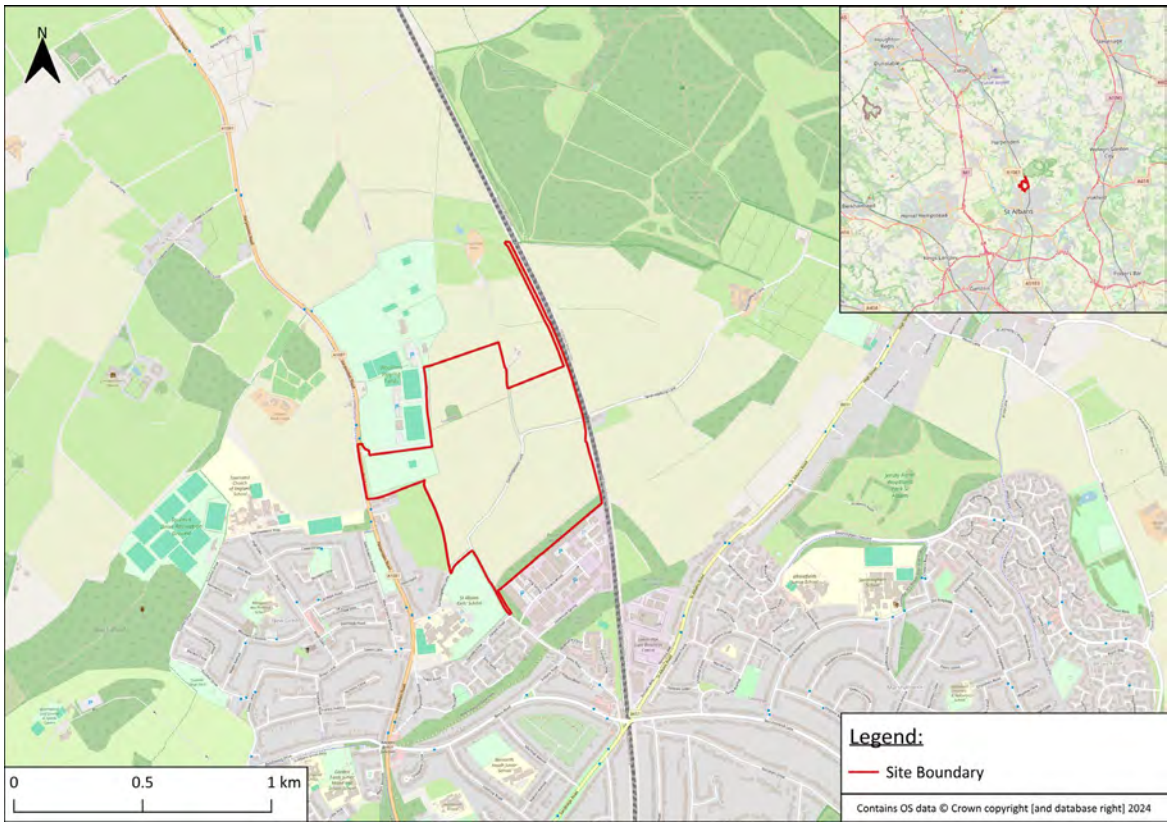


Figure 3-1:Site Location

Table 3-1: Summary of Site

Site Address	Woollam Park, St Albans
Existing Land use	Greenfield
Proposed Development Type	Residential-led Development
Site Area	50.17ha
OS Co-ordinates	515676, 210075
County	Hertfordshire
Local Planning Authority	St Albans City and District Council
Lead Local Flood Authority	Hertfordshire County Council
Local Water Authority	Thames Water

3.2 Site Topography

3.2.1 From a review of publicly available Site Topographic Survey, the Site generally falls from north west to south east, ponding in a localised depression. The highest elevation within the Site is approximately 124.9mAOD and is situated to the north west of the development. The lowest elevation within the Site is approximately 102.45mAOD and is situated to the southeast of the development.

3.2.2 The Site Topographic Survey is available in Appendix A.

3.2.3 A representation of the Site topography is illustrated in Figure 3-2, utilising the publicly available 1m DTM LiDAR.

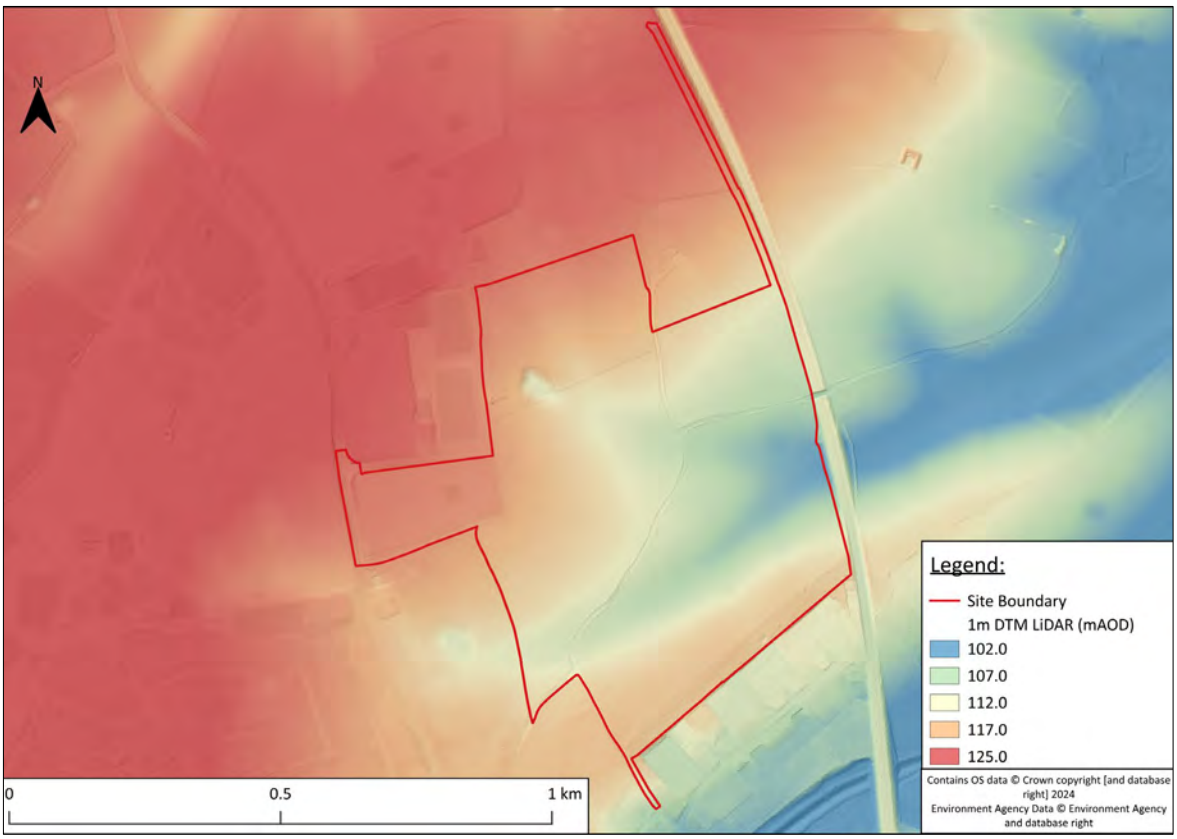


Figure 3-2: 1m DTM LiDAR

3.3 Ground Conditions

BGS Mapping

3.3.1 From a review of the publicly available Geological Survey (BGS) Geology of Britain Viewer[1], the Site is identified to be underlain by a bedrock geology of Lewes Nodular Chalk Formation and Seaford Chalk Formation (Undifferentiated) – Chalk.

3.3.2 Furthermore, the Site is underlain by two types of superficial deposits. Kesgrave Catchment Subgroup – Sand and Gravel is situated to the north, west and south of the Site, with Clay with Flints Formation - Clay, Silt, Sand and Gravel situated to the north west.

3.3.3 An extract of the BGS Superficial Geology is illustrated within Figure 3-3.

[1]British Geological Survey. Geology of Britain Viewer.
https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html

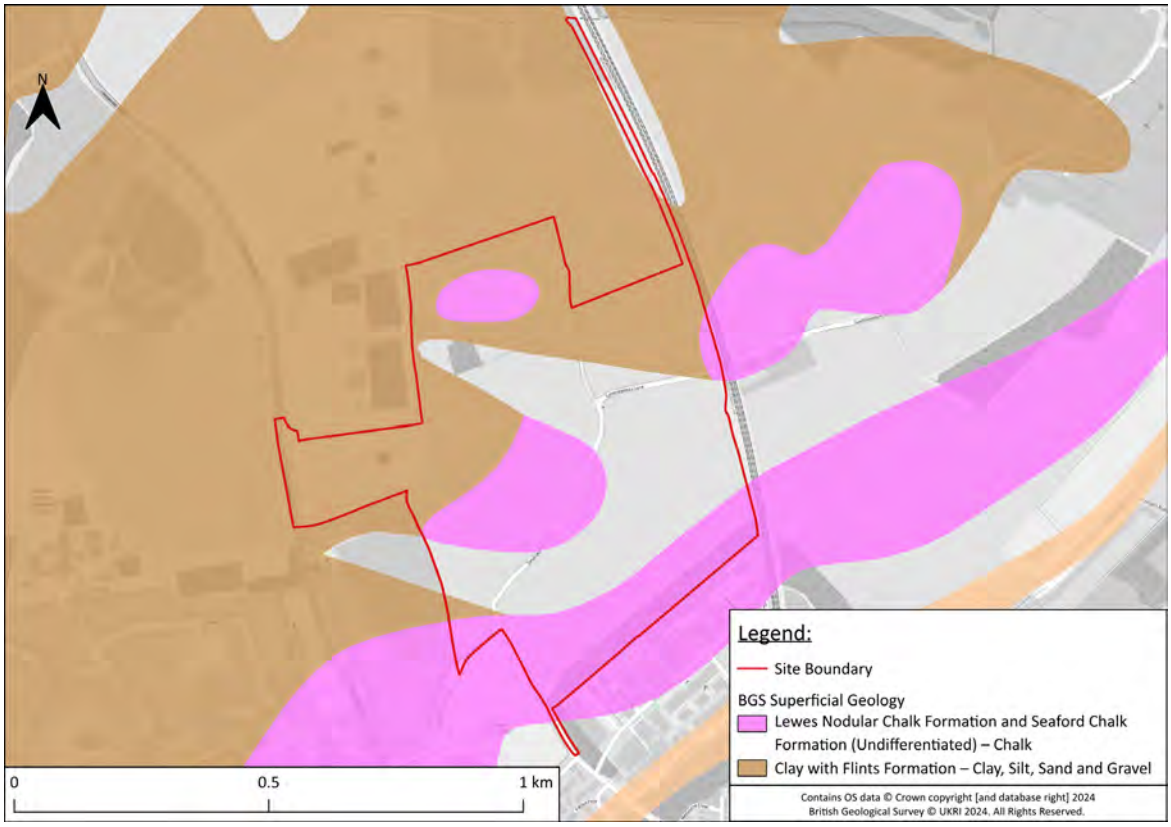


Figure 3-3: BGS Superficial Geology

Cranfield Soilscape Viewer

3.3.4 The Cranfield University Soilscape viewer[2] describes the soils as *'Slightly acid loamy and clayey soils with impeded drainage.'*

Hydrogeology

3.3.5 The publicly available DEFRA Magic Mapping[3], Bedrock Aquifer Designation Map shows that the Site is underlain by a Principal Aquifer which is defined as *"Aquifers which provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands."*

3.3.6 The publicly available DEFRA Magic Mapping, Superficial Aquifer Designation Map shows that the Site is underlain by a Secondary A Aquifer which is defined as *"Aquifers comprising of permeable layers that can support local water supplies, and may form an important source of base flow to rivers."*

[2]Cranfield Soil and Agrifood Institute. Soilscape Viewer. http://www.landis.org.uk/soilscapes/
[3] DEFRA Magic Map https://magic.defra.gov.uk/MagicMap.aspx

3.3.7 The Site is situated within a 'Total Catchment, Groundwater Source Protection Zone (III)', denoting that the groundwater underlying the Site supports a nearby abstraction point. Given this, the Environment Agency may apply certain conditions on the water quality of surface water discharge to ground.

Site Specific Ground Investigation

3.3.8 Preliminary infiltration testing at the Site was undertaken by Geo Environmental Group in July 2024 to understand whether an infiltration-led surface water drainage strategy could be utilised.

3.3.9 Seven trial pits across the Site were explored to understand infiltration rates. The preliminary infiltration results at IT01 to IT07 are shown in Table 3-2 and are available in Appendix B.

Table 3-2: Summary of Preliminary Infiltration Test Results

Location	Depth Range of Test (m)	Time (Mins)	Infiltration Rate (m/s)
IT01	1.30-2.40	115	$2.96X10^{-5}$
	1.05-2.08	132	$2.63X10^{-5}$
	1.01-1.82	119	$2.97X10^{-5}$
IT02	1.00-2.00	217	N/A
IT03	1.45-2.75	194	N/A
IT04	1.20-2.00	105	$2.60X10^{-5}$
	1.00-1.75	165	$1.88X10^{-5}$
IT05	1.40-2.40	201	N/A
IT06	1.80-2.80	195	N/A
IT07	1.40-2.50	183	N/A

3.3.10 After a review of the preliminary infiltration results recorded by Geo Environmental Group, no infiltration results could be recorded at trial pits IT02, IT03, IT05, IT06 and IT07. It was noted that infiltration was viable on-Site at test locations IT01 and IT04.

3.3.11 As such, the use of traditional soakaways is considered to be a feasible means of surface water drainage at the Site at locations IT01 and IT04 only. This may be subject to any underlying restrictions due to the presence of the aquifer referred to previously.

3.4 Existing Hydrological Regime

3.4.1 From a review of the existing hydrological regime at St Albans, no hydrological features have been recorded within the Site Boundary. It is understood that existing surface water runoff is discharged via infiltration to the east, via the underlying chalk geology.

3.4.2 The River Ver is located approximately 2.80km west of the Site.

3.4.3 The existing hydrological regime is illustrated in Figure 3-4.

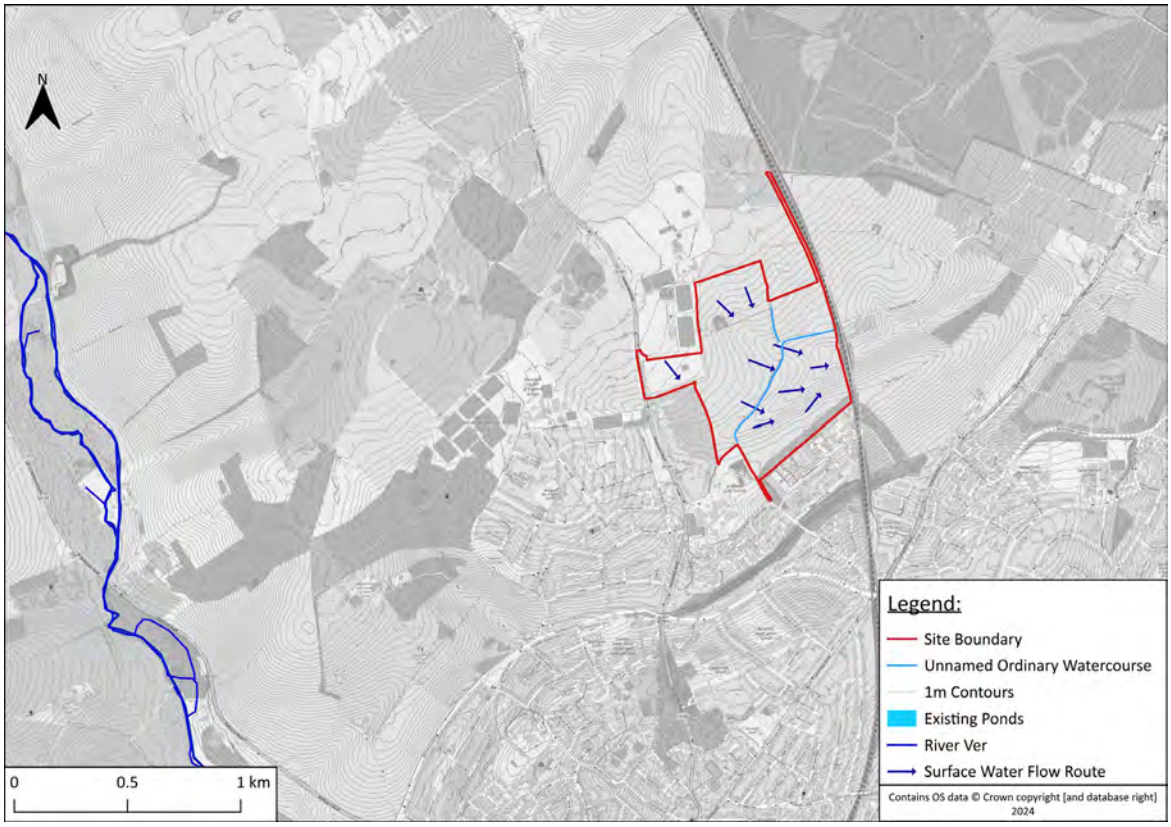


Figure 3-4: Existing Hydrological Regime

3.5 Existing Drainage Assets

3.5.1 From a review of the existing Thames Water sewer asset mapping, a 225mm diameter combined sewer bisects the Site to the north west before flowing south westerly along Harpenden Road see Figure 3-5 overleaf.

3.5.2 Furthermore, an existing 300mm diameter surface water sewer is situated to the west of the Site, along Harpenden Road.

3.5.3 Further utilities surveys have been undertaken to understand any additional existing utilities present on-Site and are included in the Brookbanks report which forms part of the planning submission pack.

3.5.4 Existing Thames Water sewer asset mapping is available within Appendix C and an extract is included within Figure 3-5.

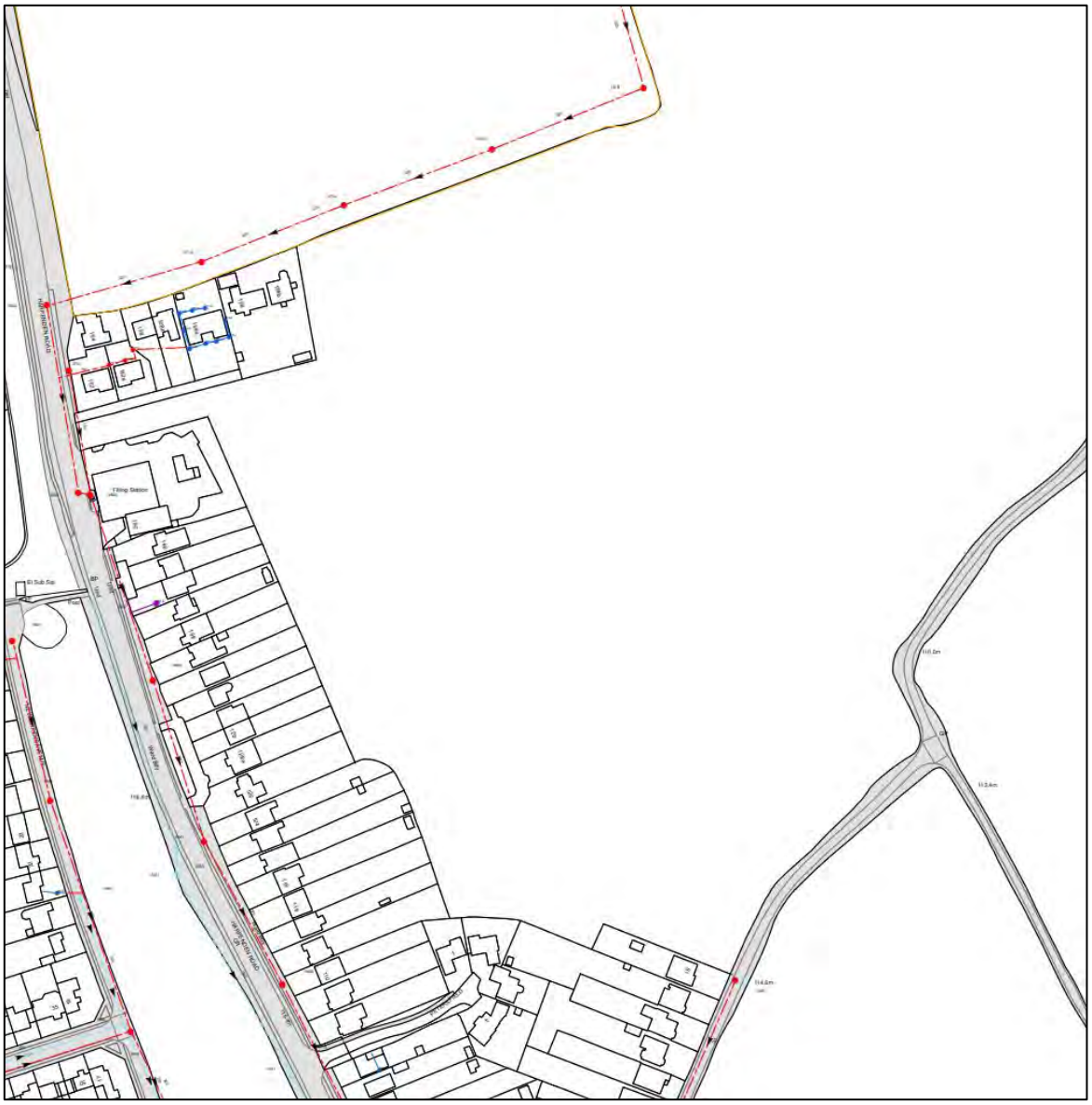


Figure 3-5: Thames Water Asset Mapping Extract

3.6 Site Proposals

3.6.1 The Site proposal consists of a planning application for the following development:

1 Relocation and replacement of existing playing fields and erection of pavilion annex; and

2 Construction of up to 1000 new homes (Use Class C3) to include a mix of market housing, affordable housing, age restricted specialist accommodation for the elderly, adult disability service units; a care home (Use Class C2); a local centre (Use Classes E and F); a primary school (Use Class F); the laying out of green infrastructure including habitat creation; drainage

infrastructure; earthworks; pedestrian and cycle routes; new means of access and alterations to existing accesses.

3.6.2 The application is submitted as a “hybrid” application. Part (1) is submitted as a full application. Part (2) is submitted as an outline application with approval of means of access sought at the present time, and all other reserved matters to be approved at a later date.

3.6.3 It is noted that the Site has been allocated within the Draft St Albans City & District Council (Regulation 19) Local Plan 2041 under Strategic Policy SP1-B1.

3.6.4 The Proposed Landscape Framework Plan is available in Appendix D and an extract is shown in Figure 3-6 below.

Figure 3-6: Woollam Park, North St Albans Proposed Landscape Framework Plan

4 Planning Context

4.1 National Planning Policy Framework

4.1.1 The revised National Planning Policy Framework (NPPF) was published by the Ministry of Housing, Communities and Local Government and most recently updated in December 2023. The NPPF's Planning Practice Guidance (PPG) supports the Framework and is an online resource that is frequently updated.

4.1.2 Paragraph 173 of the NPPF identifies that Local Planning Authorities should ensure that flood risk is not increased elsewhere by development and where appropriate, applications should be supported by a Site-specific Flood Risk Assessment. Development should only be allowed where it can be demonstrated that:

a within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b 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;

c it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d any residual risk can be safely managed; and

e safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

4.1.3 Further to this, paragraph 175 of the NPPF sets out that major development should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a take account of advice from the lead local flood authority;

b have appropriate proposed minimum operational standards;

c have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d where possible, provide multifunctional benefits.

4.1.4 A sequential approach has been taken to the proposed development in relation to flood risk which is set out in Section 5.11 of this report. Flood risk from all sources is reviewed in Section 5 and the approach to surface water management in Section 6.

1.1.1

4.2 Local Policy & Guidance

4.2.1 St Albans City District Council Plan 1994

4.2.2 The St Albans City District Council Local Plan was adopted in 1994 and includes strategic policies and proposals on where new development will be provided by the district.

4.2.3 A revised Local Plan is currently being developed by the council to replace the adopted 1994 Plan for St Albans City. It should be noted that Local Plans "expired" after 27th September 2007 unless "saved", in whole or in part. As such, St Albans City District Council saved specific policies from the existing 1994 Adopted Local Plan, to ensure development was saved across the council boundary. The Adopted Local Plan was revised in July 2020, demonstrating the saved policies, direction and correction which will drive the revised Local Plan which is currently at Regulation 19 status.

4.2.4 Policy 84 details the requirements for Flooding and River Catchment Management, stating new development should be steered towards low risk areas and not increase the risk of flooding to third-party land. A protective strip should be provided along the watercourse to ensure maintenance of the hydrological feature can be undertaken. Furthermore, it should be noted that if works to a watercourse need to be undertaken due to the proposed development, culverting of the hydrological feature should be avoided as far as possible.

4.2.5 Policy 84A details the requirements of Drainage Infrastructure, stating new development will not be permitted in areas which are considered to be at risk of flooding from sewers or may increase the risk of sewerage flooding to third-party land. A detailed drainage strategy should be provided as part of the planning submission.

4.2.6 To demonstrate compliance with the requirements set out in local policy, new development will be situated outside of high flood risk areas, ensuring a suitable surface water drainage strategy has been developed alongside the masterplan.

St Albans City & District Council Draft Local Plan (Regulation 19) 2041

4.2.7 The St Albans City & District Council Draft Local Plan (Regulation 19) was published in September 2024 and sets out requirements for development within the district up to 2041.

4.2.8 Policy NEB8 details the requirements of Managing Flood Risk within the district. New development needs to meet the requirements of the Sequential and Exception Tests in accordance with national policy, with a Flood Risk Assessment undertaken in accordance with advice from the Environment Agency (if applicable) or Lead Local Flood Authority.

4.2.9 Where the Sequential and Exception Tests have been applied, proposals located within areas identified as being at risk of flooding will not be permitted unless the following is demonstrated:

- That the most vulnerable development within the site is located in areas of lowest risk;
- That all sources of flood risk are considered, including fluvial and surface water flood risk;
- The development is appropriately flood resistant and resilient and incorporates appropriate infrastructure to address the increasing potential for flood events due to Climate Change;
- The flood risk will not be increased elsewhere and, where possible, reduce flood risk offsite;
- How the proposal incorporates sustainable drainage systems;
- How any residual risk can be safely managed; and
- That safe access and egress routes are included where appropriate and have an agreed emergency plan.

4.2.10 Furthermore, the policy states that all major new development should incorporate sustainable drainage systems (SuDS) and manage surface water runoff to achieve greenfield runoff rates. Management and maintenance plans for the proposed SuDS, with appropriate contributions sought where necessary will need to be provided.

4.2.11 Given this, a detailed review of flood risk and drainage at the Site is set out in Section 5 and 6 of this report.

South West Hertfordshire Level 1 Strategic Flood Risk Assessment (October 2018)

4.2.12 A Level 1 Strategic Flood Risk Assessment (SFRA) was published in October 2018 by South West Hertfordshire Councils (Dacorum Borough Council, St Albans City and District Council, Three Rivers District Council and Watford Borough Council) and was created with the purpose of providing a comprehensive and robust evidence to support the production of Local Plans for the four councils.

4.2.13 Appendix A of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east.

4.2.14 The Level 1 SFRA states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode.

4.2.15 Given this, a detailed review of flood risk at the Site is set out in Section 5 of this report.

South West Hertfordshire Level 1 Strategic Flood Risk Assessment Addendum (July 2024)

4.2.16 A Level 1 Strategic Flood Riks Assessment Addendum was published by South West Hertfordshire Councils (Dacorum Borough Council, St Albans City and District Council, Three Rivers District Council

and Watford Borough Council) in July 2024 to support the revised St Albans City & District Council Local Plan and associated Planning Policy documents.

4.2.1 The Level 1 SFRA Addendum states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode.

4.2.2 Appendix K of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east.

4.2.3 Given this, a detailed review of flood risk at the Site is set out in Section 5 of this report.

St Albans Level 2 Strategic Flood Risk Assessment (July 2024)

4.2.4 A Level 2 Strategic Flood Risk Assessment (SFRA) was published in July 2024 by St Albans City and District Council and was created with the purpose of supporting the production of the St Albans City and District Local Plan.

4.2.5 The Site is not identified within the Level 2 Strategic Flood Risk Assessment even though the Site has been draft allocated under the St Albans City & District Council Draft Local Plan (Regulation 19) 2041.

4.2.6 As such, a detailed review of flood risk at the Site is set out in Section 5 of this report.

Hertfordshire County Council Local Flood Risk Management Strategy 2 (LFRMS2)

4.2.7 The Hertfordshire County Council Local Flood Risk Management Strategy was approved by the county council in February 2013 following the establishment of the Lead Local Flood Authority in May 2010. As such, the LLFA have published the Hertfordshire Local Flood Risk Management Strategy 2 to include updated information in relation to flood risk.

4.2.8 The Hertfordshire Local Flood Risk Management Strategy 2 states that 3,667 properties are at high flood risk (1 in 30-year even) from surface water flooding in St Albans, with 7,661 properties being at medium risk (1 in 100-year event). It should be noted that the exact location of these properties is unknown.

4.2.9 To further understand flood risk to the Site, a detailed assessment is available in Section 5 of this report.

4.3 Consultation

4.3.1 Pre-application consultation has been undertaken with key stakeholders in relation to flood risk and drainage. A summary of their responses has been provided below and full responses included within Appendix E

Hertfordshire County Council Lead Local Flood Authority

4.3.2 Hertfordshire County Council were consulted in their role as the Lead Local Flood Authority (LLFA) to determine if there was any flood risk information available for the Site. Pre-Application advice was received on the 20th August 2024, detailing historic flood risk information and Site-specific comments for the draft allocation of North St Albans, and are as follows;.

4.3.3 The Site is at high flood risk from surface water in the high-risk scenario (more than 3.33% chance of flooding each year) showing 30cm-90cm of flooding from two distinct surface water flow paths travelling west to east. As such, a sequential test will be needed at the Site to consider all sources of flood risk.

4.3.4 Surface water flow route modelling should be undertaken to inform development areas available at the Site and enhance the proposed surface water drainage strategy. The drainage from the railway line should be considered at the Site as whilst on an embankment, a drainage channel may exist along the toe of it. The existing roads should be considered at 100% impermeable area and assume to have no drainage, in a surface water model, to show if this creates its own flood risk.

4.3.5 Furthermore, groundwater monitoring (at least covering February, March and April) and an overview of the long-term maximum regional groundwater level should be included within the provided Flood Risk Assessment submitted via planning.

4.3.6 Access roads will need to be located outside any flood extent and where this is not possible, it will need to be demonstrated in accordance with the flood risk assessment guidance for new developments and the hazard calculations in FD2320. (NPPF PPG Paragraph 005).

4.3.7 The type and location of SuDS should be considered at an early stage of the planning process and include any urban spatial typologies that may be developed such as tree pits. The proposed surface water drainage strategy should comply with the four pillars of sustainable urban drainage systems (SuDS) of Water Quality, Water Quantity, Amenity and Biodiversity.

4.3.8 The regulations of the Source Protection Zone (SPZ III) is required to be considered in the proposed drainage for the Site and additional treatment steps be implemented where necessary (refer to the EA guidance if required). This would include how unknown pollution potential from off-site runoff

may need to be treated. Accepting runoff generated offsite may affect the adopting bodies of the SuDS. This should be explored at an early stage.

4.3.9 The LLFA expect investigation into infiltration to be undertaken in accordance with the BRE 365 methods (or equivalent) as not all the previous tests were undertaken to this standard. The worst infiltration rate calculated must be used in all drainage supporting calculations. Groundwater monitoring will be required to demonstrate the seasonally high groundwater level in the area and at least 1m of unsaturated zone be provided to the base of the infiltration structure.

4.3.10 Management and Maintenance easements should be included for all SuDS features – an overview of the land take required to provide maintenance access should be considered at an outline stage (e.g. maintenance strips around ponds).

4.3.11 *To demonstrate compliance with the requirements set out in local policy, SuDS have been incorporated within the surface water drainage strategy, taking into account water quality, water quantity, amenity and biodiversity. The worst case infiltration rate has been utilised for the Site-wide strategy, with groundwater monitoring proposed to be undertaken throughout the winter months.*

Environment Agency

4.3.12 The Environment Agency were consulted regarding flood risk to the Site via a Product 4, 5, 6 and 7 request. A response was received in January 2024, with the Environment Agency stating that no detailed hydraulic modelling information was available due to the Site not being situated within an area at risk from fluvial flooding.

4.3.13 Furthermore, the Environment Agency were contacted in May 2024 in regard to the Site being situated within Groundwater Source Protection Zone III. The provided guidance suggested that rainfall draining from roofs and areas of hardstanding could discharge via infiltration, assuming the following:

- Infiltration sustainable drainage systems (SuDS) are suitably designed.
- Infiltration SuDS meet the Government's non-statutory technical guidance for SuDS Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (publishing.service.gov.uk). The CIRIA SuDS manual is (C753) is also a useful resource and is available via the CIRIA website (ciria.org);
- The surface water drainage scheme incorporates a SuDS management treatment train – that is, use drainage components in series to achieve a robust surface water management system that does not pose an unacceptable risk of pollution to groundwater;

- The surface water originates from areas where no potentially contaminative activities have occurred and is free from hazardous substances as per the current list of confirmed hazardous substances to groundwater (2018 01 31 Confirmed hazardous substances list_0.pdf (wfduk.org)). Please note that surface water discharges from heavily trafficked areas and areas where vehicles are stored may contain hazardous substances and the expectation is that the SuDS scheme for the site will incorporate pollution control features that would prevent hazardous contaminants entering the infiltration point (see bullet point above).
- The discharge point cannot be direct to groundwater (i.e. via a borehole that penetrates to water table). The applicant will need to provide confidence that the infiltration point has been designed to be as shallow as possible to retain the beneficial filtration effects of soils in the unsaturated zone above the permanent water table and present no risk to aquifers.

4.3.14 Given that the above can be satisfied, the Environment Agency do not feel that an environmental permit for infiltration of surface water would be required at the Site.

4.3.15 Affinity Water

4.3.16 Affinity Water are the local water supplier and as such were consulted in regard to the Site being situated within Groundwater Source Protection Zone III. A response was received on the 19th June 2024, confirming that the location of the Site is situated outside of Source Protection Zone 2, and therefore no particular requirements on water abstraction and supply will be provided specifically. It is recommended that best practice is undertaken to protect the water quality in the environment and the Environment Agency are contacted.

4.3.17 Thames Water

4.3.18 Thames Water were consulted in regard in foul water drainage at the Site. A response was received via a pre-planning enquiry dated 7th October 2024 stating that the existing sewerage network will not have enough capacity for full development at the Site. As such, sewerage hydraulic modelling will need to be undertaken to understand the existing capacity available and the upgrades required to facilitate the development.

5 Assessment of Flood Risk

5.1.1 The flood risk to and from the Site has been assessed based on a review of publicly available information (e.g., Environment Agency flood data). A summary of the flood risk at the Site is provided in Table 5-1 and discussed in more detail in the chapter below.

Table 5-1: Potential Sources of Flood Risk

Source of Flooding	On Site Presence
Fluvial	×
Surface Water	✓ *(section 5.5)*
Tidal	×
Groundwater	×
Sewers	×
Reservoirs	×
Canal	×

5.2 Historic Flooding

5.2.1 Appendix A of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east.

5.2.2 The Level 1 SFRA states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode.

5.2.3 The Environment Agency's Historic Flood Mapping shows no historical flood events recorded within the vicinity of the Site.

5.3 Fluvial Sources

5.3.1 The Environment Agency, through the publicly available Flood Map for Planning service, categorises potential fluvial flood risk into Flood Zones, assuming no flood defences, which provides the basis for the assessment of flood risk and development suitability under the NPPF.

5.3.2 The Site is identified in the publicly available Flood Map for Planning as located wholly within Flood Zone 1, demonstrating that the fluvial flood risk is considered to have a less than 0.1% Annual Exceedance Probability (AEP) (1 in 1,000-Year Event).

5.3.3 An extract of the Flood Map for Planning is contained in Figure 5-1.

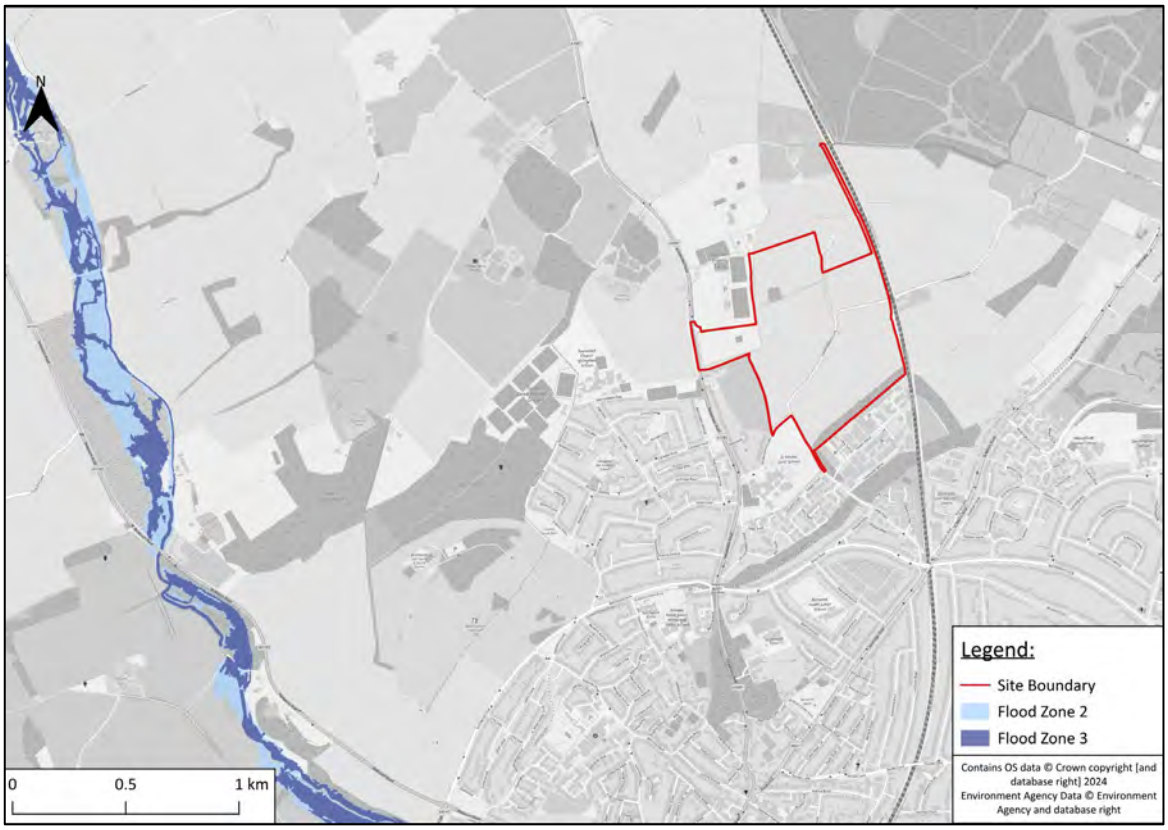


Figure 5-1: Publicly Available Flood Map for Planning Extract

5.4 Tidal Sources

5.4.1 Given the in-land location of the Site, flood risk from this source is considered very low.

5.5 Surface Water Sources

5.5.1 Surface water runoff is likely to occur after heavy rainfall. Currently, there is no formal means of surface water drainage that has been identified to positively drain the Site and as such, water will runoff with the natural topography in a south easterly direction towards the boundaries of the Site.

5.5.2 The Long-Term Flood Risk Information, Flood Risk from Surface Water Map identifies that majority of the Site is at very low risk of surface water flooding. It is noted that low, medium and high surface water flow routes bisect the Site centrally, before ponding along the eastern boundary.

5.5.3 An extract of the Long-Term Flood Risk, Flood Risk from Surface Water mapping is provided in Figure 5-2.

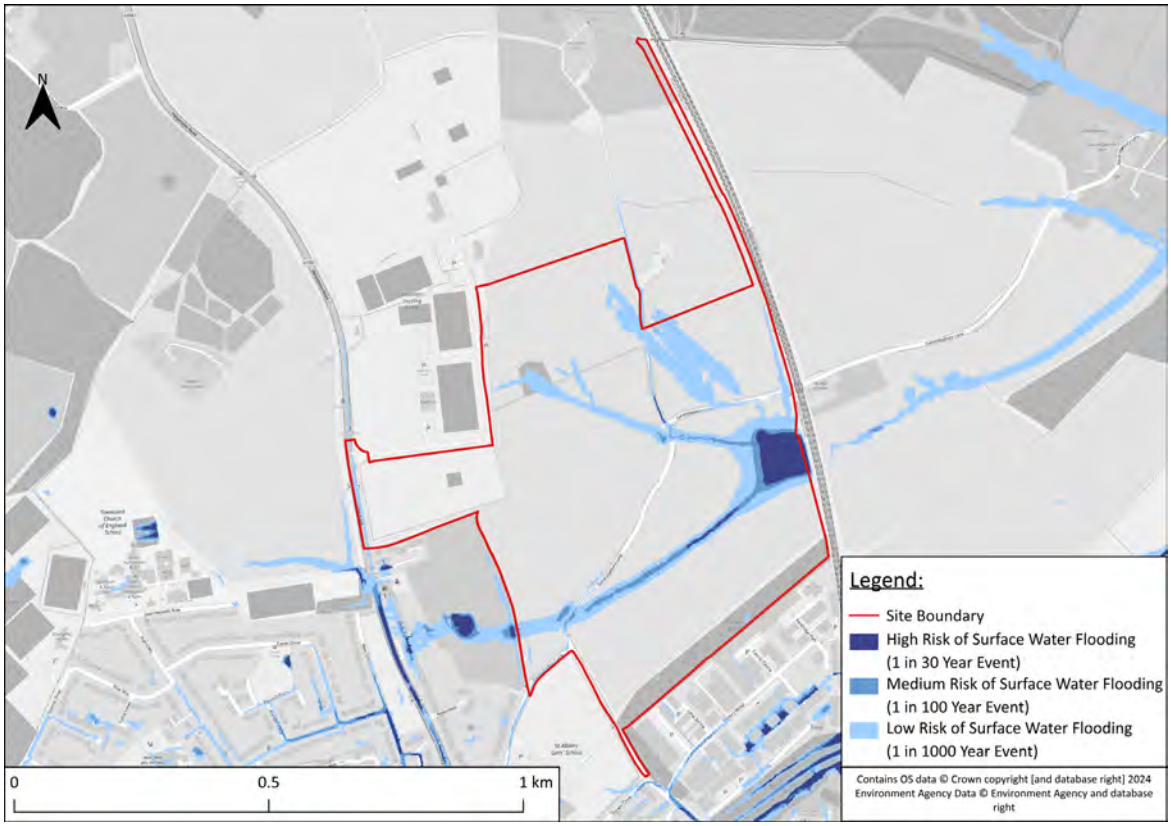


Figure 5-2: Long Term Flood Risk – Surface Water Mapping Extract

5.5.4 The production of this mapping has been undertaken at a national scale to provide the first publicly available generation of surface water flood risk mapping. The two previous generations were primarily developed for regulator use as the approach and risk was refined. For example, the first did not include any allowance for sewers, whilst the second incorporated a national loss coefficient.

5.5.5 Although this generation incorporates local estimates of the sewer infiltration loss, generally at a LLFA level along with various other refinements in runoff estimation, it does not allow for local improvements to the underlying Digital Terrain Model (DTM). This means that local features such as the adjoining highways are represented as determined from the LiDAR without any consideration to surface water drainage features such as culverts or small watercourses which typically provide the associated surface water drainage.

5.5.6 As part of the final Site design, measures will be implemented to ensure there is negligible increase in surface water flood risk on- and off-Site and ensure that exceedance flows will be directed away from property.

5.5.7 Baseline hydraulic modelling has been undertaken to refine the surface water flow path shown on the existing publicly available long term flood risk mapping. The baseline mapping is reflective of the public mapping; however, it does indicate a reduced extent in the 1 in 1000-year event, due to

the greater accuracy available from the utilisation of the topographical survey and ground condition information. Further hydraulic modelling will be undertaken to ensure that flood risk will be retained and controlled within the landscape corridors, public open spaces, and strategic SuDS network throughout the proposed development.

5.6 Groundwater Sources

5.6.1 Groundwater flooding is typically caused by high groundwater levels. It occurs where excess water emerges at the ground surface via springs or within manmade structures such as basements. The risk of groundwater flooding depends on the nature of the geological strata underlying the Site, as well as on the local topography.

5.6.2 Appendix A of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east.

5.6.3 From a review of the BGS Geoindex, there are no public borehole records identified within the Site at St Albans. The nearest trial pit (TL10NW38) is situated approximately 1.3km to the west of the Site and was dug to approximately 2.0m below ground level (bgl). The records demonstrate that no groundwater was encountered at this location as part of the exploration.

5.6.4 Groundwater monitoring is currently being undertaken across the Site to further understand groundwater flood risk and inform the proposed surface water drainage strategy. Groundwater monitoring will be undertaken at the Site until March 2025.

5.6.5 The following table provides a summary of the groundwater levels which have been recorded during the ongoing groundwater monitoring:

Table 5-2: Groundwater Level Monitoring

Date	WS01	WS02	WS03	WS04	WS05	WS06	WS07
09/05/24	Damp at 5.0	Dry	Dry	0.53	Dry	Damp at 5.0	N/A
11/06/24	Damp at 5.0	Dry	Damp at 5.0	1.34	1.20	Dry	N/A
04/07/24	Dry	Dry	5m	1.90	1.58	Dry	N/A
21/08/24	Damp at 5.0	Dry	Dry	Damp at 1.9	Damp at 1.9	Dry	Dry
25/09/24	Damp at 5.0	Dry	Dry	0.00	0.00	Damp at 5.0	N/A
23/10/24	Dry	Dry	1.01	0.52	0.52	Dry	N/A

5.6.6 Given the results from the ongoing groundwater monitoring, flood risk from groundwater may be considered to be at low to medium risk.

5.7 Sewer Sources

5.7.1 As set out in Section 3.5, the Thames Water asset mapping indicates that an existing 225mm diameter foul water sewer bisects the Site to the north west before flowing south westerly along Harpenden Road.

5.7.2 Sewer asset mapping indicates an existing 300mm diameter surface water sewer is situated to the west of the Site along Harpenden Road.

5.7.3 The Level 1 SFRA states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode. The exact locations of these recordings is unknown due to confidentiality.

5.7.4 Thames Water were consulted in regard in foul water drainage at the Site. A response was received via a pre-planning enquiry dated 7th October 2024 stating that the existing sewerage network will not have enough capacity for full development at the Site. As such, sewerage hydraulic modelling will need to be undertaken to understand the existing capacity available and the upgrades required.

5.7.5 As a result of the review of the of the existing sewer sources currently within the area, the Site may be considered to be at low risk of sewer flooding.

5.8 Sources of Reservoir Failure

5.8.1 The publicly available Long-Term Flood Risk, Information, Flood Risk from Reservoirs Mapping identifies that the Site lies outside the maximum extent of flooding from reservoirs.

5.8.2 Given this, flood risk from reservoirs may be considered to be very low.

5.9 Canal Sources

5.9.1 Flooding from canals is a much less common occurrence than fluvial flooding due to the managed nature of water levels within the artificial waterways. the canal network is designed in such a way so as to direct all additional water beyond the navigation capacity to impounding areas or surrounding watercourses to be conveyed downstream. The risk from canal flooding becomes more of a concern where the structure is elevated on an earth embankment and if there is a rare instance of a catastrophic breach, leading to a sudden drain-down of the pound and resultant overland flow flood risk to development immediately downstream.

5.9.2 There are no canals within the vicinity of the Site.

5.9.3 Given this, flood risk from canals may be considered to be very low.

5.10 Climate Change

5.10.1 In accordance with the NPPF and supporting Planning Practice Guidance an FRA should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account. Climate change will affect peak river flows and, consequently, the extent of fluvial flooding is likely to increase in the future.

5.10.2 On 19th February 2016, the Environment Agency released updated guidance on climate change allowances[4] to support the NPPF, which was later revised for peak river flows in 2021 and for peak rainfall intensity in 2022.

5.10.3 Table 5-3 shows the peak river flows for the Colne Management Catchment Peak River Flow Allowances in which St Albans is situated.

Table 5-3: Colne Management Catchment Peak River Flow Allowances

	Central	Higher	Upper
2020s	10%	16%	30%
2050s	8%	16%	38%
2080s	21%	35%	72%

5.10.4 The peak rainfall intensity allowances for the Colne Management Catchment have also been reviewed, as detailed for the 1% annual exceedance rainfall event within Table 5-4.

Table 5-4: Colne Management Catchment Peak Rainfall Allowances (1% AEP)

	Central	Upper
2050s	20%	40%
2070s	25%	40%

5.10.5 The proposed development and associated surface water drainage scheme has therefore been designed to sustainably manage the run-off from the critical 1 in 100 year storm event with a 40% allowance for climate change.

5.10.6 Consideration to the potential impact of climate change has been given in the proposed development, in particular with regard to locating built development outside of the maximum flood extents in climate change scenarios and exceedance flow routing, therefore potential flood risk from climate change may be considered to be low.

[4] Flood risk assessments: climate change allowances. Environment Agency 2016. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

5.11 Sequential and Exception Test Requirements

National Policy and Guidance

5.11.1 Paragraph 168 of the NPPF states *"The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding".*

5.11.2 The PPG sets out the principles of the Sequential and Exception Tests and what is required to pass them when proposing new development in an area at risk of flooding. The Sequential Test aims to promote development in areas of low flood risk. The Exception Test is triggered when development cannot be located within an area of suitably low risk flood risk.

5.11.3 The Exception Test requires a demonstration that flood risk to people and property can be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable Sites at lower risk of flooding are not available. Essentially, the Exception Test requires the proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will remain safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

Local Policy and Guidance

5.11.4 Paragraph 172 of the NPPF States *"Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the planmaking stage, or if more recent information about existing or potential flood risk should be taken into account".*

5.11.5 The Site has not been reviewed as part of a Sequential Test as part of the Local Plan Evidence Base and as such, the below provides evidence that a sequential approach has been taken to the development Site itself.

5.11.6 Flood Risk Vulnerability & Flood Zone Incompatibility

5.11.7 Table 5-4 summarises the flood risk vulnerability classification for different types of development. The proposed residential development at the Site is classified as More Vulnerable development with the commercial development at the Site classified as Less Vulnerable.

Table 5-5: Vulnerability Classification (Annex 3 NPPF Extract).

Class	Description
More vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • **Buildings used for dwelling houses**, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill* and Sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place. • Car parks
Source: NPPF Annex 3: Flood Risk Vulnerability Classification	

5.11.8 An extract of PPG Table 2 is provided in Table 5-6 which identifies that an Exception Test is not required for More Vulnerable and Less Vulnerable development located within Flood Zone 1.

Table 5-6: Flood Risk Vulnerability and Flood Zone 'Incompatibility' (Flood Risk & Coastal Change PPG Table 2)

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b	Exception Test required*	X	X	X	✓*

Key

✓Exception Test is not required

X Development should not permitted

"†" In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

"" In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:*

- *remain operational and safe for users in times of flood;*
- *result in no net loss of floodplain storage;*
- *not impede water flows and not increase flood risk elsewhere.*

5.12 Site Specific Sequential Assessment of Flood Risk

5.12.1 Table 5-7 provides a breakdown of the percentage of each flood risk type that the Site is identified to be at risk from.

Table 5-7 – Sequential Approach Risk Rating

Flood Risk	% Site at Risk	% Proposed Built Development Area at Risk	Site Specific Assessment
Fluvial			
Flood Zone 2	0%	0%	The Site lies wholly within Flood Zone 1 and as such fluvial flood risk is considered to be very low.
Flood Zone 3	0%	0%	
Tidal	0%	0%	The Site is situated inland and therefore is not at risk from Tidal Flooding.
Surface Water			
1 in 30-year Event	1.69%	0.82%	The proposed development areas at the Site are shown to be at surface water flood risk during the 1 in 30-Year (0.82%), 1 in 100-Year (2.04%), and 1 in 1,000-Year (13.31%) events. A sustainable surface water drainage strategy will be implemented at the Site to alleviate surface water flood risk to the proposed development. It should be noted that further hydraulic modelling will also be undertaken to ensure that flood risk will be retained and controlled within the landscape corridors, public open spaces, and strategic SuDS network throughout the proposed development
1 in 100-year Event	3.22%	2.04%	
1 in 1,000-year Event	13.68%	13.31%	
Groundwater	N/A	N/A	Appendix A of the South West Hertfordshire Level 1 SFRA contains mapping which includes 'Groundwater Flood Risk Mapping'. The Site at St Albans illustrates groundwater flood risk to be at least 5m below ground level to the west and between 0.5-5.0m below ground level to the east. From a review of the BGS Geoindex, there are no public borehole records identified within the Site at St Albans. The nearest trail pit (TL10NW38) is situated approximately 1.3km to the west of the Site and was dug to approximately 2.0m below ground level (bgl). The records demonstrate that no groundwater was encountered at this location as part of the exploration. Groundwater monitoring is currently being undertaken across the Site to further

Flood Risk	% Site at Risk	% Proposed Built Development Area at Risk	Site Specific Assessment
			understand groundwater flood risk and inform the proposed surface water drainage strategy.
Sewer	N/A	N/A	Thames Water asset mapping indicates that an existing 225mm diameter foul water sewer bisects the Site to the north west before flowing south westerly along Harpenden Road. Sewer asset mapping indicates an existing 300mm diameter surface water sewer is situated to the west of the Site along Harpenden Road. The Level 1 SFRA states that historic sewer flooding has been recorded within St Albans. Thames Water sewer records documented within the report shows 4 recorded flood incidents within the AL3 6 (St Albans City) postcode.
Reservoir	0%	0%	The Site is situated outside of the maximum extent of flooding from reservoirs.
Canal	0%	0%	The Site is not situated within the vicinity of a canal.

5.13 Site-Specific Measures

5.13.1 Whilst areas of the Site may be considered to be at surface water flood risk, these will be mitigated through:

- Steering all proposed development to be located outside corridors and areas shown to be affected by surface water flood flooding i.e., proposed surface water drainage channel;
- Raising finished floor levels by a minimum of 150mm above surrounding ground levels;
- Implementation of a surface water drainage strategy which positively and sustainably manages surface water runoff from the Proposed Development to greenfield conditions up to and including the 1 in 100 year +40% climate change event; and
- Managing existing surface water flow routes through green-blue corridors.

5.14 Site-Specific Sequential Test

5.14.1 Wollam Park, St Albans is draft allocated within the Draft St Albans City & District Council (Regulation 19) Local Plan 2041 under Strategic Policy SP1-B1. After a review of the Level 2 Strategic Flood Risk Assessment, it is noted that the Site was not taken forward to the Sequential Test stage by St Albans City & District Council due to the existing surface water flow routes bisecting the Site.

5.14.2 As such, a Site-specific Sequential Test has been undertaken by LRM and PJA to ensure the a sequential risk based approach is followed to steer the new development on-Site to areas within the lowest risk of flooding, taking all sources of flood risk into account.

5.14.3 The Sequential Test has been undertaken utilising existing publicly available data from the South West Hertfordshire Level 1 and Level 2 Strategic Flood Risk Assessments, produced by JBA Consulting. Planning judgement has been applied to the data available on each allocated site to perform the Sequential Test, strategically rating which sites may be the most preferred on a flood risk basis.

5.14.4 Detailed information regarding the sequential test approach, methodology and results are available in the Wollam Park, St Albans, Sequential Test Report.

6 Surface Water Drainage Strategy

6.1.1 A Surface Water Drainage Strategy outlining the means of surface water management and disposal from the proposed development Site has been produced largely in line with the latest guidance as follows:

- CIRIA C753 "The SuDS Manual", (CIRIA, 2015);
- CIRIA document C522 Sustainable Drainage Systems – design manual for England and Wales;
- CIRIA document C635 Designing for exceedance in urban drainage;
- Rainfall Runoff Management for Developments – SC030219 (Environment Agency, 2013);
- Environment Agency's pollution prevention guidelines (PPGs); and
- Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

6.1.2 The proposed Surface Water Drainage Strategy aims to sustainably manage surface water runoff without increasing flood risk to on- or off-Site, nor adversely impacting on water quality through the use of Sustainable Drainage Systems (SuDS).

6.1.3 SuDS aim to mimic the natural processes of surface water drainage by allowing water to flow along natural flow routes ensuring that runoff rates and volumes during storm events are not increased above the Greenfield values. SuDS also aim to provide water treatment, biodiversity, and amenity benefits within blue and green corridors.

6.1.4 There are typically three design storm events which should be considered when designing the SuDS system and managing flows and volumes:

- 1 in 1 year storm event, on sloping Sites without basements, where surcharging above soffits of any surface water drainage pipework is not permitted.
- 1 in 30 year storm event, where surface water flooding of the site does not occur at this frequency.
- 1 in 100 year storm event with allowances for future climate change, where runoff from the site should be controlled to the greenfield rate using SuDS attenuation features to manage flows and volumes within the extents of the development Site.

6.1.5 Further to this, dedicated overland flow routes should be identified through the development to convey any exceedance flows in events greater than the 1 in 100-year plus climate change event or in the event of system failure.

6.2 Existing Surface Water Drainage Features

6.2.1 The Site is currently greenfield in nature, with existing surface water flows assumed to flow overground in accordance with the existing topography from west to east before infiltrating into the ground.

6.3 Discharge Hierarchy

6.3.1 In accordance with SuDS guidance, surface water should be sustainably managed and designed in accordance with the discharge hierarchy; collect for re-use; infiltrate to ground; discharge to watercourse; discharge to surface water sewer, highway drain or another drainage system; and lastly discharge to a combined sewer.

Table 6-1: Drainage Hierarchy

Discharge Location	Suitability	Comments
Collect for Re-Use	✓ / ×	Water butts and rainwater harvesting systems can collect rainwater for non-potable uses e.g. within gardens and other non-potable uses. The potential to incorporate rainwater harvesting and re-use measures may be assessed during the detailed design stage.
Infiltration	✓	Preliminary infiltration testing at the Site was undertaken by Geo Environmental Group in July 2024 to understand whether an infiltration-led surface water drainage strategy could be utilised. After a review of the preliminary infiltration results recorded by Geo Environmental Group, infiltration was viable on-Site at test locations IT01 and IT04, allowing surface water drainage from the proposed residential-led development and sports pitches to discharge via infiltration.
Watercourse	×	There are no ordinary watercourses within the vicinity of the Site.
Surface Water Sewer	×	An existing 300mm diameter surface water sewer is situated to the west of the Site along Harpenden Road. If this were to be utilised, surface water pumping from the east of the Site would need to be undertaken. As such, this has not been proposed.
Combined Sewer	×	There are no existing Thames Water combined sewers situated within the vicinity of the Site.

6.3.2 In accordance with the above search sequence, it is proposed to discharge surface water runoff via infiltration for the proposed residential-led development and sports pitches.

6.4 Infiltration Rates

6.4.1 Preliminary infiltration tests were undertaken in April 2018 by WSP (Ground Risk and Remediation) to inform the drainage strategy. Within the six infiltration tests undertaken, two demonstrated that infiltration was viable and the rate of 1.6×10^{-4} m/s was found at the outfall basin location. However, it is noted that these results are not recent.

6.4.2 Therefore, further infiltration testing at the Site was undertaken by Geo Environmental Group in July 2024 .

6.4.3 Seven trial pits across the Site were explored to understand infiltration rates. The preliminary infiltration results at IT01 to IT07 are shown in Table 3-2 and are available in Appendix B.

Table 6-2: Summary of Preliminary Infiltration Test Results

Location	Depth Range of Test (m)	Time	Infiltration Rate (m/s)
IT01	1.30-2.40	115	2.96X10-5
	1.05-2.08	132	2.63X10-5
	1.01-1.82	119	2.97X10-5
IT02	1.00-2.00	217	N/A
IT03	1.45-2.75	194	N/A
IT04	1.20-2.00	105	2.60X10-5
	1.00-1.75	165	1.88X10-5
IT05	1.40-2.40	201	N/A
IT06	1.80-2.80	195	N/A
IT07	1.40-2.50	183	N/A

6.4.4 After a review of the preliminary infiltration results recorded by Geo Environmental Group, no infiltration results could be recorded at trial pits IT02, IT03, IT05, IT06 and IT07. It was noted that infiltration was viable on-Site at test locations IT01 and IT04.

6.4.5 As such, the use of traditional soakaways are considered to be a feasible means of surface water drainage at the Site at locations IT01 and IT04 only. Please refer to Section 6.6 for further information in relation to the proposed surface water drainage strategy.

6.5 Climate Change Impact

6.5.1 In line with the climate change allowances recommended by the Environment Agency in their February 2016 guidance, updated May 2022, the impact of climate change on the peak rainfall intensities in urban drainage designs should be assessed by Management Catchment and increased accordingly.

6.5.2 The peak rainfall intensity allowances for the Colne Management Catchment has therefore been reviewed, as detailed for the 3.3% annual exceedance rainfall event in Table 6-3 and 1% in Table 6-4.

Table 6-3: 3.3% Peak Rainfall Allowances for the Colne Management Catchment

	Central Allowances	Upper End Allowances
2050s	20%	35%
2070s	25%	35%

6.5.3

Table 6-4: 1% Peak Rainfall Allowances for the Colne Management Catchment

	Central Allowances	Upper End Allowances
2050s	20%	40%
2070s	25%	40%

6.5.4 The proposed development and associated surface water drainage scheme has been designed to sustainably manage the run-off from the critical 1 in 100 year storm event (1%AEP) with a 40% allowance for climate change.

6.5.5 Consideration to the potential impact of climate change has been given in the proposed development, in particular regarding locating built development outside of the maximum flood extents in climate change scenarios and exceedance flow routing.

6.6 Proposed Surface Water Drainage Strategy

6.6.1 The proposed Surface Water Drainage Strategies are shown on the Indicative Surface Water Drainage Strategy drawings (Ref. 05920-WR-0525 and 05920-A-0503), included in Appendix F

6.6.2 In accordance with the drainage hierarchy, as indicated previously, the Site is suitable for soakaway drainage via infiltration at IT01 and IT04, situated to the north and east of the Site.

6.6.3 Surface water runoff from the proposed car parking areas and sports pavilion will be channelled through a swale with an underlying filter trench to enhance water quality. The treated surface water runoff will then be discharged into an infiltration basin located south of the proposed sports pitches.

6.6.4 Furthermore, the proposed sports pitches will be drained via collector drains (designed by TGMS in accordance with Sport England Guidance), discharging into the proposed infiltration basin at a maximum rate of 20l/s. Surface water attenuated within the basin will discharge via infiltration to ground at a worst case scenario rate of $2.63x10^{-5}$ (IT01).

6.6.5 It is proposed that surface water runoff from the proposed residential-led development will be attenuated by multiple detention basins throughout the Site before entering the final infiltration basin to the east, situated at test location IT04 at a worst case scenario rate of $1.88x10^{-5}$.

6.6.6 The proposed Surface Water Drainage Strategy implements SuDS in the form of detention basins, infiltration basins and swales. A summary of the selection of SuDS features has been provided in Table 6-5.

Table 6-5: Summary of SuDS Feature Selection

Feature	Description	Selection
Green Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation.	× Due to the proposed residential nature of the development, green roofs have not been proposed. The ability for the residential dwellings to incorporate green roofs will be limited as a significant proportion of the roof space will be occupied by PV panels.
Filter Strips	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	✓ / × Due to the proposed residential nature of the development and required land take, filter strips have not been proposed at this stage, but may be considered at a later design stage.
Pervious Surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water.	× Due to the proposed residential nature of the development, permeable paving has not been proposed at this stage. Moreover, the current infiltration testing indicates that infiltration rates across the site would not be conclusive to the use of pervious surfaces.
Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff, and can infiltrate the water into the ground (if ground conditions allow).	✓ Conveyance features, such as swales have been incorporated within the surface water drainage strategy to convey water away from properties and towards the attenuation features.
Infiltration Basins	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the ground. They may also be landscaped to provide aesthetic and amenity value.	✓ Infiltration testing has been undertaken and demonstrates that an infiltration-led design is viable at test location IT04 to the east of the Site.
Basins / Ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment whereas basins are usually dry for a larger period of time outside storm events. They provide temporary storage for storm runoff. These features may provide amenity and wildlife benefits.	✓ Attenuation basins and ponds have been proposed for use on-Site. The exact wet / dry nature will be confirmed during the next phase of design.
Underground Attenuation	Underground attenuation structures are below-ground attenuation features. These are typically formed using crates which provide a high void space for attenuation and water quantity control.	× Underground attenuation have not been proposed for use within the proposed development .
Bioretention / raingardens	Bioretention systems or rain gardens are areas of vegetation into which rainwater and runoff can be directed. These are particularly affected at providing water quality improvements.	× Rain gardens have not been proposed for use within the proposed development .
Filter Drains	Filter drains are gravel filled trenches that collect and move water. They also treat pollution. The trench is filled with free draining gravel and often has a perforated pipe in the bottom to collect the water	✓ / × Conveyance features, such as filter drains may be incorporated within the surface water drainage strategy to convey water away from properties and towards the attenuation features. This will be decided at designed

Feature	Description	Selection
		design.
Water Butts	Water butts are water tanks which are used to collect and store rainwater runoff, typically from roof tops via pipes. Overflows will still enter the site surface water drainage system.	✓ / × Water Butts for individual residential dwellings will be considered at a later design stage.

6.6.7 To ensure maximum peak discharge is maintained at greenfield runoff rates, on-Site attenuation will be required. The required storage volume for the attenuation of the 1 in 100 year event plus 40% climate change event has been calculated for each land parcel and discharge location, assuming a proportion of impermeable surfacing based on the illustrative masterplan; the estimated contributing areas, proposed attenuation basins are shown together with their required capacity on the Indicative Surface Water Drainage Strategy drawing in Appendix F. A summary table for the proposed attenuation is provided in Table 6-6 which also identifies the impermeable area which has assumed each residential development parcel is 60% impermeable with an additional 10% for development creep, 80% for mixed-use development, 90% for commercial development, 100% for highways and attenuation basins and 50% for schools.

Table 6-6: SuDS Summary

Assumed Catchment	Proposed Discharge Rate (l/s)	Proposed Impermeable Area Including 10% Urban Creep [ha]	Proposed Attenuation Volume Required [m^3]
A	N/A	2.84	1,785
B	N/A	1.57	1,220
C	N/A	2.78	3,990
D	$1.88X10^{-5}$	2.54	4,695
E	N/A	0.66	1,835
F, G, I and J	N/A	7.45	3,780
H	N/A	1.41	3,425
K	N/A	1.97	2,395
L	N/A	0.75	1,900
Sports Pitches	$2.63x10^{-5}$	0.168 (pavilion and carparking areas)	2,245
TOTAL	N/A	**22.14**	**27,270**

6.6.8 The proposed attenuation basins have been mostly designed as dry features at this stage however, some may be designed to have a permanently wetted pool below the existing drainage invert level, full details of this will be available at the detailed design stage. The proposed attenuation features are located at the natural low points of the proposed Site and sized to provide the required attenuation and treatment.

6.6.9 The SuDS features will aim to provide multiple functions as amenity and biodiversity assets, which may include additional proposed permanent wet features, particularly if such features are required

to improve the Biodiversity Net Gain (BNG) scoring of the development and to provide a carbon store. Other aspects of the proposed strategy which reduce the developments carbon footprint compared to traditional drainage include:

- Reduced surface water pumping, wastewater pumping/treatment, leading to reduced energy use and associated carbon emissions;
- Embodied carbon (avoided) as a result of reduced consumption (e.g., due to rainwater harvesting); and
- Cooling/shading of buildings, leading to reduced energy use and associated carbon emissions.[5]

6.6.10 Water butts may be available for all households to provide an opportunity for water re-use. However, as the attenuation capacity for the water butts cannot be guaranteed during a rainfall event, these have not been accounted for within drainage strategy attenuation calculations.

6.6.11 Surface water run-off from roofs and hard surfaces across the development will drain to a new surface water drainage network incorporating SuDS components to control discharge to the receiving watercourses, provide attenuation storage on-Site and provide treatment to run-off. The surface water drainage system will be designed to convey the run-off from the critical 1 in 100 year (+40% climate change allowance) storm event without flooding. The proposed attenuation ponds are located at the natural low points of the proposed Site and sized to provide the required attenuation and treatment.

6.6.12 The proposed SuDS features have been sized in Flow to ensure that the proposed system will be capable of conveying run-off from the design storm event without flooding. Refer to Appendix G for the Flow model output.

6.6.13 The design calculations confirm that the proposed surface water drainage system is capable of attenuating, and discharging in a controlled manner, the run-off from the design 1 in 100 year storm with a 40% allowance for climate change without flooding of the development.

6.6.14 The surface water drainage strategy is based upon the site masterplanning details at the time of production. Changes to the site development profile, impermeable areas across the site or other such aspects of the scheme will result in the need to revise the calculations.

[5] https://www.susdrain.org/delivering-suds/using-suds/benefits-of-suds/Carbon-reduction-and-sequestration

6.7 Development Creep

6.7.1 Over the lifetime of a development, it is possible that the overall impermeable area within the Site could increase by as much as 10% through the house buyers undertaking activities such as property extensions and introducing paved gardens.

6.7.2 Table 6-7 identifies the potential increase in impermeable area as a result of urban creep over the lifetime of the development.

Table 6-7: Development Creep Assessment

Catchment	Impermeable Area (ha)	Residential Only Impermeable Area (ha)	10% Creep (ha)	Total Impermeable Area (ha)
A	2.65	1.90	0.19	2.84
B	1.57	0.00	0.00	1.57
C	2.59	1.96	0.196	2.78
D	2.37	1.67	0.167	2.54
E	0.63	0.31	0.031	0.66
F, G, I and J	7.07	3.83	0.383	7.45
H	1.41	0.00	0.00	1.41
K	1.83	1.38	0.138	1.97
L	0.71	0.44	0.044	0.75
Sports Pitches	0.22	0.00	0.00	0.22
TOTAL	**21.05**	**11.49**	**1.149**	**22.19**

6.8 Water Quality

Principles of Water Quality Assessment

6.8.1 The general principles are to mitigate against adverse impacts on water quality in the receiving water environment is described in the CIRIA C753 "The SuDS Manual" (2015). This document recommends the following steps to determine the required water quality management for discharges to surface waters and groundwaters based on the risk posed:

3 Interception: Prevent runoff and associated pollutants from the Site to receiving surface waters for the majority of small rainfall events;

4 Determine the pollution hazard level associated with the given type of development;

5 Select a risk assessment approach based on receiving water environment and the pollution hazard level; and

6 Undertake a detailed risk assessment for each outfall or discharge point taking into account the pollution hazard level, the status of the receiving water environment and effectiveness of the proposed SuDS techniques.

6.8.2 The extent of the treatment required will depend on the water quality status of receiving watercourses, land use, the level of pollution prevention in the catchment and for groundwater,

the natural protection afforded by underlying soil layers. The pollution hazard level of the development type should be identified.

6.8.3 Residential roofs are noted as having 'very low' pollution hazard level and require removal of gross solids and sediments only. Residential car parks, access roads, driveways and non-residential car parking with infrequent change (e.g., schools) are shown to present 'low' pollution hazard level.

6.8.4 Low pollution hazard levels require application of a 'simple index approach' for water quality risk assessment for discharges to surface and ground waters.

Existing Water Quality of the Proposed Receiving Watercourses

6.8.5 The proposed works fall into the Environment Agency's Thames River Basin District (RBD) which covers an area of 16,200km^2. It encompasses all of Greater London and extents from North Oxfordshire southwards to Surrey and from Gloucester in the west to the Thames Estuary, as well as Kent in the east.

6.8.6 The Thames River Basin has been divided into 20 Management Catchments, of which the Site falls into the Colne Management Catchment and then on a smaller scale, the Colne Operational Catchment.

6.8.7 Within the Colne Operational Catchment, the Site falls into the Upper Colne and Ellen Brook Water Body. This is identified not to be a designated artificial or heavily modified watercourse. The 2022 Classification Cycle identifies it has a 'Poor' ecological status and 'Fail' chemical status in 2019.

6.8.8 Reasons for not achieving 'good' status include:

- Groundwater Abstraction;
- Misconnections;
- Urbanisation;
- Transport drainage;
- Poor Soil Management;
- Reservoir / Impoundment.

6.8.9 As such the Environment Agency will be seeking improvements to the water quality of the local watercourse system to achieve a status of Good by 2027.

6.8.10 The principles of the SuDS Management Train should be incorporated into the proposed surface water drainage schemes for new development, to reduce the risk of further pollutants entering watercourses via run-off from roofs and paved areas.

6.8.11 SuDS components can reduce pollution in run-off through filtering out pollutants or reducing flow rates to encourage deposition of any contaminants. Suitable components could include:

- filter drains;
- swales;
- attenuation basins;
- wetlands; and
- proprietary treatment systems.

6.8.12 To protect biodiversity and amenity assets, polluted surface water run-off should not be discharged directly into permanent ponds but treated through an appropriate treatment train. Where possible, interception storage should be included as part of the treatment train to manage pollutants at source. Later stages of treatment in the train should incrementally reduce the level of pollution in run-off before discharge to the receiving water body.

6.9 Contamination and Water Quality

6.9.1 The proposed development will utilise SuDS Management Trains across each network to ensure treatment of run-off and removal of pollutants prior to discharge.

6.9.2 This is likely to include a mixture of components across the Site, specified according to the opportunities/constraints presented by:

- the likely pollution hazard of the run-off;
- the available surface space; and
- the proposed ground levels/falls across areas of hardstanding.

6.9.3 Treatment components within each SuDS Management Train may include:

- channel drains;
- catchpits;
- trapped gullies;
- attenuation basins incorporating pre-treatment (such as a sediment forebay) and low flow channels;
- bioretention areas in greenspace around the Site;
- swales and linear wetlands;
- filter drains bordering paved areas such as roads and yards; and
- proprietary treatment systems (such as downstream defenders).

6.9.4 The arrangement and composition of each management train will be confirmed at the detailed design stage.

6.9.5 The proposed uses at the Site will comprise residential roofs and individual driveways. Roofs are classified as a 'very low' pollution risk and individual driveways are classed as a 'low' pollution risk level in Table 26.2 of CIRIA C753 The SuDS Manual. 'Low' hazard pollution levels require application of a 'simple index approach' for water quality risk assessment for discharge to surface and groundwaters. The "pollution hazard indices" for a low pollution hazard Site are given in Table 6-8 below.

Table 6-8: Pollution Hazard Indices for a Low Pollution Hazard Site

Total Suspended Solids (TSS)	Metals	Hydrocarbons
0.5	0.4	0.4

6.9.6 The surface water drainage system should provide a sufficient level of water quality treatment to prevent pollution of the receiving waterbodies.

6.9.7 Table 6-9 provides the indicative SuDS mitigation indices for the proposed SuDS features for the Site. It demonstrates that the mitigation index for the basins are greater than the "*pollution hazard index*" for each pollutant type. Therefore, the strategy is deemed to comply with the water quality requirements of the SuDS standards.

Table 6-9: Indicative SuDS Mitigation Indices

SuDS component	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Detention basin	0.5	0.5	0.6
Swale	0.5	0.6	0.6
Filter Strip	0.4	0.4	0.4

6.10 Designing for Exceedance

6.10.1 During a rainfall event with a return period well in excess of that for which the surface water drainage system was designed (in this case a 1 in 100 year plus 40% climate change allowance), or in the event of a blockage, the capacity of the surface water drainage system may be exceeded, resulting in localised flooding in the areas affected. This is considered to be a residual risk.

6.10.2 However, the layout and landscaping of the proposed development should be designed and will be developed to ensure that exceedance flood flow paths are routed away from vulnerable development and toward landscaped areas, areas of open attenuation or surrounding green infrastructure.

6.10.3 In line with Building Regulations the finished floor levels of the properties will be set at least 150mm above the surrounding ground levels to prevent surface water ingress through doorways. Location of buildings in ground depressions will be avoided to prevent water ponding around dwellings.

6.10.4 Minor modifications to topography, the profile of the access road, footpath or kerb and strategically placed green infrastructure will be developed to ensure that exceedance flood flows are managed and there is little or no risk of property flooding or unacceptable ponding within the highway.

7 Foul Water Drainage Strategy

7.1.1 Thames Water are the statutory water authority for foul drainage in the area. Sewer asset mapping has been reviewed to understand the existing foul drainage network within the vicinity of the Site.

7.1.2 From a review of the existing Thames Water sewer asset mapping, an existing 225mm diameter foul water sewer bisects the Site to the north west before flowing south westerly along Harpenden Road.

7.1.3 A foul water drainage strategy has been prepared (Ref. 05920-WR-0526) which implements measures for foul flows to drain via gravity to the proposed pumping station within the Site. Foul water will be pumped from the proposed Type 3 pumping station (typically more than twenty dwellings), to the north west of the Site into Manhole MH8702.

7.1.4 Furthermore, a secondary foul water drainage strategy has been prepared (Ref. 05920-A-0503) for the proposed sports pavilion facilities which implements measures for foul flows to drain via gravity to the existing Thames Water foul water sewer at Manhole 101A.

7.1.5 A developer enquiry has been submitted to Thames Water to determine whether the existing public sewer network has capacity for the proposed development at St Albans. A response was received on the 5th April 2024 and states that the existing sewerage network will not have enough capacity for full development at this time.

7.1.6 Thames Water suggests that the Site should look to utilise Manhole 8702 situated to the north west of the Site at a pumped flow rate of 21.19 litres/second. In order to make the appropriate upgrades, modelling work will need to be undertaken to provide a design solution and to provide the necessary improvements. Once modelling has begun, Thames Water may need to contact the developer to discuss changing the proposed connection point for capacity reasons.

7.1.7 The cost of any upgrades to the surrounding Thames Water infrastructure will be covered by Thames Water and will be planned and delivered following approval of the outline planning permission. ption & Management

7.2 Surface Water Drainage System

7.2.1 Responsibility for the maintenance of the main surface water drainage networks and SuDS features may be offered to Thames Water for adoption under S104 of the Water Industry Act 1991. To meet the requirements for adoption, the proposed infrastructure must be designed and constructed according to Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

7.2.2 Alternatively, it is common for SuDS features to be operated and maintained by a third-party private maintenance company. Should this be necessary, a third-party management company would be established to maintain the features in perpetuity and an adoption agreement between the final Site developer and Maintenance Company would be largely based upon the CIRIA ICoP MA2 SuDS Maintenance Framework Agreement.

7.2.3 Drainage serving new roads to be offered for adoption by the Local Highway Authority will become highway drains, adopted as part of Section 38 agreements (Highways Act 1980).

7.2.4 In England it also appears increasingly likely that Schedule 3 of the Flood and Water Management Act will be enacted in England, with DEFRA currently recommending implementation of this in 2024. This legislation, when enacted, will require SuDS Approval Bodies (SABs) to be formed in England who will review the design of SuDS and will likely be responsible for the future operation and maintenance. As the layout of the development evolves it is recommended that the surface water drainage design seeks to comply with this legislation when it comes forward ensuring that the SuDS proposed are designed and built in accordance with the SAB's requirements and may be offered for adoption to the SAB if required.

7.2.5 A typical maintenance schedule of the attenuation basins, infiltration basins, swales and flow control devices proposed on Site are shown in Table 7-1 to Table 8-4.

Table 7-1: Attenuation Basin Indicative Maintenance Schedule

FREQUENCY	ACTION
Monthly	• Litter and debris removal. • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only). • Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)) (for 12 months following installation). • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)).
Annually	• Remove all dead growth prior to the start of growing season. • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required. • Inspect and document the presence of wildlife. • Remove sediment from inlets, outlets and forebay. • Manage wetland plants, where required.
As Required	• Prune and trim trees and remove cuttings. • Remove sediment from forebay, when 50% full and from micropools if volume reduced by more than 25%.

FREQUENCY	ACTION
	• Repair erosion or other damage by re-turfing or reseeding. • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period). • Remove and dispose of oils or petrol residues using safe standard practices.
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order.

Table 7-2: Infiltration Basin Indicative Maintenance Schedule

FREQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only) • Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)) (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015))
Annually	• Remove all dead growth prior to the start of growing season • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife
As Required	• Prune and trim trees and remove cuttings • Remove sediment from forebay, when 50% full and from micropools if volume reduced by more than 25% • Repair erosion or other damage by re-turfing or reseeding • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove sediment from pre-treatment system (e.g. forebays) when 50% full • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

Table 7-3: Swale Indicative Maintenance Schedule

FREQUENCY	ACTION
Monthly	• Litter and debris removal • Mow grasses (where required to promote lateral runoff inflow) and remove resultant clippings (during growing season only)

FREQUENCY	ACTION
	• Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015)) (for 12 months following installation) • Inspect / check all inlets, outlets, surface and overflows (where required) to ensure that they are in good condition, free from blockages and operating as designed. Take action where required.
Six Monthly	• Remove nuisance and invasive vegetation (as listed in section 29.6.2 of the CIRIA SuDS Manual (2015))
Annually	• Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where required • Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, where required • Inspect and document the presence of wildlife
As Required	• Repair erosion or other damage by re-turfing, reseeding or replacing filter materials. • Re-level uneven surfaces and re-instate design levels (typically once every 60 month period) • Remove and replace top 300 – 500mm of gravel, clean and replace where required (typically every 60 month period) • Remove and dispose of oils or petrol residues using safe standard practices
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return feature to full working order

Table 7-4: Flow Control (e.g. Hydrobrake) Indicative Maintenance Schedule

FREQUENCY	ACTION
Monthly	• Inspect and identify any areas that are not operating correctly. If required, take remedial action (for three months following installation).
Six Monthly	• Inspect and identified ant area that are not operating correctly. If required, take remedial actions. • Remove sediment from any pre-treatment structures.
Annually	• N/A
Following All Significant Storm Events	• Inspect and carry out essential recovery works to return the feature to full working order.

7.2.6 The proposed maintenance regimes for the devices should be largely in accordance with The SuDS Manual (CIRIA C753) and other best practice guidelines and in accordance with manufacturer's recommendations. This will ensure the design performance, structural integrity and where applicable- appearance of each feature is maintained throughout its lifetime.

7.2.7 Further details will be provided on the maintenance requirements of the proposed SuDS components across the development as the detailed design is developed. The details of the party

responsible for maintenance of each feature should be confirmed prior to occupation of the proposed development.

7.3 Foul Water Drainage System

7.3.1 It is anticipated that the proposed foul sewer network may be offered to Thames Water for adoption under Section 104 of the Water Industry Act 1991. To meet the requirements for adoption, the proposed infrastructure must be designed and constructed according to Sewerage Sector Guidance – Design & Construction Guidance v2.2 (Water UK, June 2022).

8 Conclusion & Recommendations

8.1 Conclusion

8.1.1 PJA has been commissioned by Hallam Land Management Limited, St Albans School and St Albans School Woollam Trust to prepare a Flood Risk Assessment and Drainage Strategy for the proposed residential-led development of up to 1,000 dwellings with two form entry primary school, neighbourhood centre, recreational space, green infrastructure and 80 bed care home at Woollam Park, St Albans.

8.1.2 This Flood Risk Assessment has been undertaken in accordance with current national and local flood risk policy requirements. This report assesses the existing and future flood risk at the Site, including an assessment of the potential effects of the proposed development on flood risk on- and off-Site.

8.1.3 The assessment concludes that the Site is considered at either very low or low risk of flooding from fluvial, tidal, reservoirs, canals, and sewers.

8.1.4 It should be noted that high, medium and low surface water flood risk is present on-Site, however further proposed development hydraulic modelling is currently being undertaken to understand how these extents can be refined.

8.1.5 Furthermore, it is possible that there is low to medium groundwater flood risk at the Site. As such, it should be noted that groundwater monitoring is currently being undertaken at the Site, with final recordings due to be undertaken in March 2025.

8.1.6 In addition to the NPPF, the proposed surface water drainage strategy complies with local policy and Site-specific requirements.

8.1.7 A Surface Water Drainage Strategy has been prepared to demonstrate that a sustainable drainage solution can be provided for the proposed development. The Surface Water Drainage Strategy has been designed largely in accordance with current sustainable development best practice and meets the requirements of Hertfordshire County Council (as the LLFA).

8.1.8 The proposed surface water drainage systems aim to mimic the hydrological regime of the existing Site by infiltrating run-off to the north (Sports Pitches) and east (Residential-led Development) of the proposed development. Attenuation storage will be provided in the form of open SuDS features such as attenuation basins, infiltration basins, filter trenches, underground geocellular storage and swales. Water butts may be used to store water for re-use within feasible locations, but these have not been included within attenuation calculations as the capacity availability cannot be guaranteed.

8.1.9 SuDS Management Trains will provide suitable treatment of run-off by removing pollutants prior to discharge.

8.1.10 A foul water drainage strategy has been prepared (Ref. 05920-WR-0526) which implements measures for foul flows to drain via gravity to the proposed pumping station within the Site. Foul water will be pumped from the proposed Type 3 pumping station to the north west of the Site into Manhole MH8702.

8.1.11 Furthermore, a secondary foul water drainage strategy has been included on drawing Ref. 05920-WR-A-0503-P02 for the proposed sports pavilion facilities which implements measures for foul flows to drain via gravity to the existing Thames Water foul water sewer located within the rugby club access road.

8.1.12 A developer enquiry has been submitted to Thames Water to determine whether the existing public sewer network has capacity for the proposed development at St Albans. A response was received on the 5th April 2024 and states that the existing sewerage network will not have enough capacity for full development at this time.

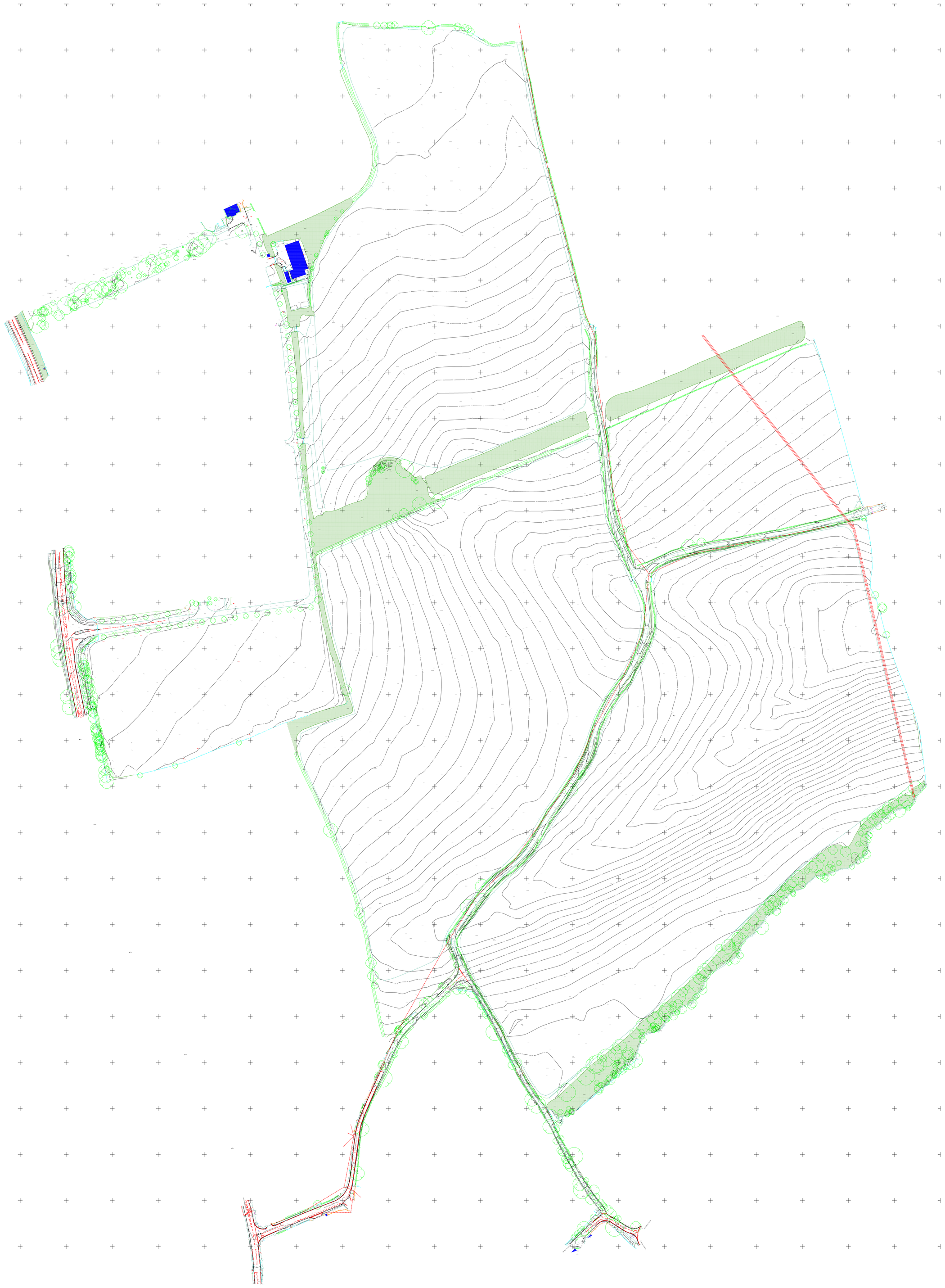
8.1.13 Thames Water suggests that the Site should look to utilise MH8702 situated to the north west of the Site at a pumped flow rate of 21.19 litres/second. In order to make the appropriate upgrades, modelling work will need to be undertaken to provide a design solution and to provide the necessary improvements. Once modelling has begun, Thames Water may need to contact the developer to discuss changing the connection point for capacity reasons.

8.1.14 Safe access and egress will be available to and from the Site for events up to and including the 1 in 100 year plus climate change flood events

8.1.15 The responsibility for the operation and maintenance of each SuDS feature will be confirmed prior to the commencement of construction. The SuDS used on Site should be maintained in accordance with manufacturer's recommendations and current best practice and guidelines to ensure routine operation.

8.1.16 This report demonstrates that the proposed development may be undertaken in a sustainable manner without increasing the flood risk either at the Site or to any third-party land in line with NPPF requirements.

Appendix A Topographic Survey



Symbol & Abbreviation Key.

- BARBED WIRE FENCE
- POST & RAIL FENCE
- CLOSE BOARD FENCE
- RAILINGS
- CHAIN LINK FENCE
- OTHER FENCE
- KERB
- DROPPED KERB
- GULLY CHANNEL
- TOP / BOTTOM OF BANK
- FOLIAGE
- DITCH
- VERGE
- OVERHEAD CABLES
- GATE
- HEDGE
- TREE - BROAD LEAVED
- TREE - CONIFEROUS
- BUSH
- BUILDING
- BOREHOLE
- SURVEY STATION
- ORDNANCE SURVEY BENCH MARK

A/C	AIR CONDITIONING UNIT	KO	KERB OFFLET
AV	AIR VALVE	LC	LIGHTING COLUMN
BOL	BOLLARD	LP	LAMP POST
BH	BOREHOLE	NP	NAME PLATE
BL	BED LEVEL	NB	NOTICE BOARD
BM	BENCH MARK	PR	PIPE RISER
BT	BRITISH TELECOM	RP	RODDING POINT
CTV	CABLE TV	RS	ROAD SIGN
CL	COVER LEVEL	SP	SIGN POST
CR	CABLE RISER	SV	STOP VALVE
DP	DOWN PIPE	TL	TRAFFIC LIGHT
ER	EARTH ROD	TP	TELEGRAPH POLE
EP	ELECTRICITY POLE	TOF	TOP OF FENCE
EM	ELECTRICITY MARKER	TOH	TOP OF HEDGE
FB	FUSE BOX	TOR	TOP OF RAILINGS
FH	FIRE HYDRANT	TOS	SERVICE LEVEL
FP	FENCE POST	TOW	TOP OF WALL
FL	FLOOR LEVEL	UTL	UNABLE TO LIFT
GV	GAS VALVE	VM	VALVE MARKER
GM	GAS MARKER	VP	VENT PIPE
GU	GULLY	WL	WATER LEVEL
HM	HYDRANT MARKER	WM	WATER MARKER
IL	INVERT LEVEL	WO	WASH OUT

General.

This survey has been prepared with a scaling accuracy for a plot at a scale of 1:200.

All tree heights and spreads are approximate. We have tried to identify tree types, however if tree species are critical specialist advice should be gained.

Drainage pipe sizes have been measured from the surface. Chamber access has not been gained for safety reasons, therefore sizes should be regarded as approximate.

Some detail may have been omitted due to parked vehicles.

Notes.

Coordinates related to OS National Grid from ST10 by GPS.
Levels related to GPS. Scale factor: 0.99976403

INDICATIVE ONLY

Rev	Details of Revision	Drawn	Date
B	Road detail added.	AA	01/08/19
A	Additional area around school/field added.	AS	31/07/19

Surveyed	Drawn	Date	Checked	Date	Approved	Date
GD	AS	24/07/19	APK	24/07/19	APK	24/07/19

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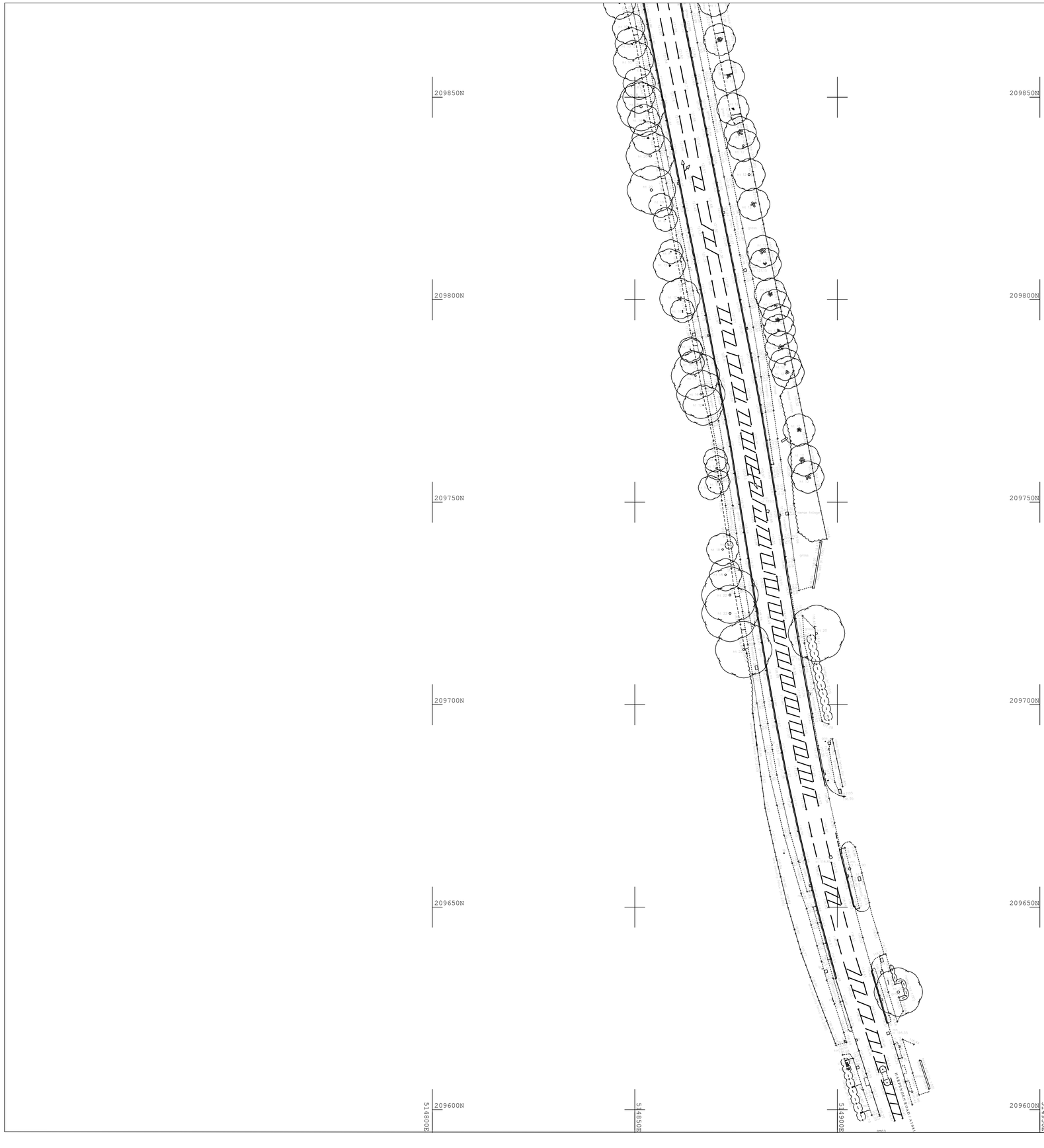
Title.

TOPOGRAPHICAL SURVEY

ST ALBANS
HERTFORDSHIRE
AL3 6JE

Dwg No. **190296** Sheet **1 of 1**

Scale NTS A0 Sheet Rev. B



NORTH

NOTES

GENERAL NOTES :-

ALL LEVELS ARE IN METRES DERIVED FROM GPS TRANSFORMATION.

GRID COORDINATES ARE ORDNANCE SURVEY NATIONAL GRID DERIVED FROM GPS TRANSFORMATION. GPS COORDINATES AND LEVELS SET AT ST01 (NO SCALE FACTOR APPLIED)

THIS DRAWING HAS BEEN PRODUCED WITH A PLOT SCALE ACCURACY OF 1:500

SERVICE COVERS INDICATED WHERE VISIBLE. PIPE INVERTS / DETAILS SURVEYED FROM SURFACE INSPECTION ONLY. GENERALLY DAMAGED COVERS AND COVERS WITHIN HIGHWAYS WILL NOT BE LIFTED

TREE SPECIES SHOULD BE CONFIRMED BY TREE SPECIALIST IF CRITICAL.

OVERHEAD CABLES ARE INDICATED USING REMOTE SURVEY METHODS AND ARE SUBJECT TO SEASONAL VARIATION, AND SHOULD BE TREATED AS APPROXIMATE.

SERVICE COVERS LOCATED UNDER PARKED VEHICLES/MOBILE STRUCTURES MAYBE OMITTED.

BURIED SERVICE COVERS WILL NOT BE INDICATED.

TOPOGRAPHICAL SURVEY/UTILITY KEY :-

(ht) – height
ø – diameter
⬤ – pea trap
a/g – above ground
a/r – assumed route
av – air valve
bb – bellsha beacon
bd – back drop
bl – bed level
boll – bollard
bos – bottom of shaft
bt – telecom
c/b fence – closeboard fence
c/box – control box
catv – cable television
cl – cover level
con – conifer
cr – cable riser
cws – combined water sewer
d/chan – drainage channel
ejb – electric junction box
elec – electric
eol – end of trace
ep – electric pole
er – earth rod
f/bed – flower bed
fh – fire hydrant
fl – floor level
fs – fire switch
fws – foul water sewer
g – gully
g/run – gully run
gr – gas riser
h/chestnut – horse chestnut
h/thorn – hawthorn
ic – inspection cover
il – invert level
ill – illuminated
int – interceptor
lp – lamp post
mh – manhole cover
mkr – marker
o/h – over head
ol – off let
osa – off survey area
OSBM – ordnance survey bench mark
p & r fence – post & rail fence
pd – pit depth
pr – pipe riser
ptg – pipe to ground
pts – pipe to surface
re – rodding eye
ret wall – retaining wall
rs – road sign
rwp – rain water pipe
s/birch – silver birch
s/p – safety paving
sap – sapling
sec fence – security fence
sfc – soil filled chamber
sl – spot light
sp – soil pipe
st – stop tap
sv – stop valve
svp – soil vent pipe
sws – storm water sewer
TBM – temporary bench mark
tfr – taken from records
ti – threshold level
toc – top of cap
top – top of pipe
tot – top of tank
tp – telecom pole
ts – traffic signal
t/s – trench scar
u/s – underside
utl – unable to lift
utr – unable to rod
uts – unable to survey
utt – unable to trace
vp – vent pipe
wfc – water filled chamber
wl – water level
wm – water meter
wp – waste pipe
wr – water riser

SURVEY CONTROL :-

STATION	EASTINGS	NORTHINGS	LEVEL
ST01	514841.565	210113.742	125.979
ST02	514842.239	209913.817	122.601
ST03	514910.816	209593.557	116.439

0 5 10 20 30 40 50

TAG SURVEYS
UNIT 1, ACCESS HOUSE,
SHERWOOD ROAD,
BROMSGROVE, B60 3DR
WWW.TAGSURVEYS.CO.UK
INFO@TAGSURVEYS.CO.UK

Client	PJA
Project	OLD ALBANIAN RFC, A1081, HARPENDEN ROAD, STALBANS
Title	TOPOGRAPHICAL SURVEY
Date	AUG 2023
Scale	1:500@A1
Dwg No	T0446 – 2
Surveyor	MA
Checked	SMc

Revisions

TOPOGRAPHICAL (LAND) SURVEYORS / UTILITY SURVEYORS
BUILDING MEASUREMENT SURVEYORS / 3D LASER SCANNING

Accredited Contractor
smas WORKSAFE

Appendix B Infiltration Testing

GEG | Geo Environmental Group
Geotechnical, Environmental & Ecological Consultants

GEG House, 17 Graham Road, Malvern, WR14 2HR
Tel. 01684 212526 Fax 01684 576917 www.g-eg.co.uk

INFILTRATION TESTING & GROUNDWATER MONITORING

LAND AT CHEAPSIDE
HARPENDEN ROAD
ST ALBANS, HERTFORDSHIRE
AL3 6BB

JULY 2024 (REV01)

Prepared for:

Hallam Land Management

PJA

Registered Company - GEG Ltd
Registered in England No 6469985
Registered Office: Granta Lodge, 71 Graham Rd, Malvern, WR14 2JS

Report Title:

INFILTRATION TESTING & GROUNDWATER MONITORING REPORT

Site Address:

Land at Cheapside
Harpenden Road
St Albans
Hertfordshire
AL3 6BB

Performed By:
Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

On Behalf of:
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c/o PJA
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Project Reference: GEG-24-821

Report Reference: GEG-24-821/IT

Issue Status: FINAL

Date of Issue: Rev. 00: 23rd May 2024
Rev. 01: 22nd July 2024

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Title *Appendix*

1. INTRODUCTION

1.1 General

Geo Environmental Group (GEG) were commissioned by PJA on behalf of their client, Hallam Land Management (HLM), to undertake staged infiltration testing and groundwater monitoring at a site known as 'Land at Cheapside, St Albans,' for the purpose of determining infiltration rates of the underlying shallow strata and hence the suitability of the site for soakaway drainage.

1.2 Available Information

The following drawings was supplied by PJA:

- 'Potential GI Locations Plan,' PJA on behalf of HLM, Drawing No. 0100, Rev. P01, dated 27th September 2023.
- 'Indicative Surface Water Drainage Strategy – GI Plan,' PJA on behalf of HLM, Drawing No. 05920-GR-0534, Rev. P01, June 2024.
- 'Master Utilities Map,' WSP on behalf of HLM, Drawing No. 70039336, Rev. P01, dated January 2018.

1.3 Proposed Site Development

The site is being considered for residential development.

1.4 Scope

The works performed by GEG included:

- Trial pitting with infiltration testing in accordance with a specification supplied by PJA.
- Window sample boreholes with installation of standpipes.
- Calculation of infiltration rates, subject to ground conditions encountered.
- Groundwater monitoring of standpipes.

Limitations to the scope of the report are outlined in Section 7.

2. SITE SETTING

2.1 Site Location

The site is located on land approximately 3 km north of St Albans city centre, at the approximate National Grid Reference 515461E, 209983N. It lies on land adjacent to the west of Harpenden Road (A1081) and is bisected by Sandridgebury Lane, and covers an area of approximately 48 ha.

A section of the 1:25,000 Ordnance Survey (OS) map identifying the site location is shown in Figure 1 of Appendix A and a photographic record is provided in Appendix B.

2.2 Site Description

The site, which fell gently to the south east, comprised agricultural land across the majority with sports fields associated with the Old Albanian Rugby Club in the far eastern section.

3. GEOLOGY & HYDROGEOLOGY

3.1 Published Geology

Reference to the 1:50,000 scale British Geological Survey digital mapping of the area (solid and drift) indicates that the solid geology beneath the site comprises the Lewes Nodular Chalk and Seaford Chalk Formations (of the White Chalk Subgroup) of the Cretaceous period. The formations, which were formerly part of the Upper Chalk, are described individually as follows:

- Lewes Nodular Chalk Formation: *hard to very hard nodular chalks and hardgrounds with interbedded soft to medium hard chalks and marls. Nodular chalks are typically lumpy and iron-stained. Brash is rough and flaggy or rubbly, and tends to be dirty.*
- Seaford Chalk Formation: *firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Some flint nodules are large to very large.*

The solid geology is conjectured to be overlain by superficial deposits locally of Clay-with-Flints Formation across the north western margins, and the Kesgrave Catchment Subgroup is present locally centrally and along the south eastern margins of the site. The superficial deposits are described as follows:

- The Clay-with-Flints Formation: *a residual deposit formed from the dissolution, decalcification and cryoturbation of bedrock strata of the Chalk Group and Palaeogene formations. It is unbedded and heterogenous. The dominant lithology is orange-brown and red-brown sandy clay with abundant nodules and rounded pebbles of flint. The deposit locally includes bodies of yellow fine- to medium- grained sand, reddish brown clayey silt, and sandy clay with beds of well-rounded flint pebbles.*
- The Kesgrave Catchment Subgroup: *mainly gravels characterised by quartz and quartzite.*

No significant faults are conjectured to intersect the site at the surface.

3.2 Hydrogeology

3.2.1 Groundwater Designation

Environment Agency data indicates that the solid geology beneath the site is designated as a Principal Aquifer.

Principal Aquifers as assigned where geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers.

The superficial deposits of the Clay-with-Flints Formation are characterised as Unproductive strata and the Kesgrave Catchment Subgroup as a Secondary A Aquifer.

Secondary A Aquifers are defined as permeable layers capable of supporting water supplies at a local rather than a strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Unproductive Strata - are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

3.3 Potential Water Infiltration Properties of the Strata

The Clay-with-Flints Formation is considered unlikely to be sufficiently permeable for soakaway drainage. Therefore, the solid geology chalk formations or the soils of the Kesgrave Catchment Subgroup were targeted for the soakaway testing (where encountered).

3.4 Groundwater Source Protection Zone

The site lies within the Total Catchment (Zone 3) of a currently defined Groundwater Source Protection Zone (GWSPZ), as such it is recommended that any specific Environment Agency requirements with respect to soakaways etc. are adhered to.

3.5 Surface Water Flooding

According to the Environment Agency online 'Flood Map for Planning', the site lies within Flood Zone 1, being land that lies outside the 1 in 1000 year (0.1%AEP) flood risk area and hence has a low probability of flooding.

4. INTRUSIVE INVESTIGATION

The following section outlines the scope of the intrusive investigation undertaken by GEG and details the ground conditions encountered and the infiltration testing carried out.

4.1 Site Works Overview

All works were carried out in accordance with current British Standard guidance (BS: 5930 and BS: 10175) and infiltration testing in general accordance with BRE Digest 365 (Soakaway Design).

The ground conditions were logged by an experienced geo-environmental engineer from GEG. The strata encountered, groundwater levels/seepages, and stability of excavations are recorded on the exploratory hole logs presented in Appendix C.

The locations of the exploratory holes are shown on Figure 2 presented in Appendix A.

4.2 Scope of Works – Stage 1

The Stage 1 intrusive investigation was undertaken from 10th and 11th April 2024 and comprised window sample boreholes, machine-excavated trial pitting, and infiltration testing.

4.2.1 Window Sample Holes

6 No. window sample boreholes (WS01-WS06) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 5.00 m. Continuous sampling was undertaken using a liner system.

All boreholes were installed with 50 mm diameter standpipes to the depth detailed on the exploratory hole log for subsequent groundwater monitoring.

4.2.2 Trial Pits

3 No. trial pits (IT01-IT03) were excavated using a JCB-3CX to depths of between 2.00 and 2.75 m to facilitate investigation of the near surface soils and undertake infiltration testing.

4.3 Scope of Works – Stage 2

The Stage 2 intrusive investigation was undertaken on 4th July 2024 and comprised additional window sample boreholes, machine-excavated trial pitting, and infiltration testing.

4.3.1 Window Sample Holes

4 No. window sample boreholes (WS07-WS10) were drilled using a Competitor Dart dynamic sampling rig to a maximum depth of 6.00 m. Continuous sampling was undertaken using a liner system.

WS07 was installed with a 50 mm diameter standpipe to the depth detailed on the exploratory hole logs for subsequent groundwater monitoring.

4.3.2 Trial Pits

4 No. trial pits (IT04-IT07) were excavated using a JCB-3CX to depths of between 2.20 and 2.80 m to facilitate investigation of the near surface soils and undertake infiltration testing.

4.4 Strata Encountered

The ground conditions encountered are described below and broadly confirmed the published geology.

4.4.1 Made Ground

Made Ground of reworked topsoil was encountered at 1 No. location (IT03) to a depth of 0.20 m and comprised soft to firm CLAY with occasional gravel-sized fragments of quartzite and ceramic.

4.4.2 Topsoil

Natural topsoil of soft to firm CLAY was encountered in the remaining locations to depths of between 0.20 and 0.30 m.

4.4.3 Kesgrave Catchment Subgroup

The Kesgrave Catchment Subgroup was not encountered during the investigation.

4.4.4 Clay-with-Flints Formation

The Clay-with-Flints Formation was encountered underlying the topsoil and Made Ground at all locations to depths (where proven) of between 1.35 and 5.50 m. It typically comprised firm to very stiff variably sandy gravelly CLAY and locally medium dense to dense clayey gravelly to very gravelly SAND.

4.4.5 Lewes Nodular & Seaford Chalk Formations

The Lewes Nodular & Seaford Chalk Formations were encountered underlying the Clay-with-Flints Formation at 9 No. locations (IT01, IT04, IT07, WS01-WS03, WS06, WS08, WS10) from depths of between 1.35 and 5.50 m to the base of the exploratory holes. It typically comprised structureless CHALK composed of variably gravelly SILT (Grades Dm to Dc).

It is noted that discernment of chalk grade from disturbed borehole samples is inherently difficult as drilling disrupts the natural structure of the chalk. As such, chalk grade boundaries may vary from those interpreted.

4.4.6 Groundwater

Groundwater was not encountered in any of the exploratory holes during the intrusive investigation.

Groundwater levels recorded in the boreholes during the subsequent monitoring visits to date are summarised in Table 1.

Table 1. Groundwater Levels Recorded During the Monitoring Visits

Borehole	Date	Depth of Installation (m)	Groundwater Depth (m)
WS01	09/05/24	5.00	(Damp at 5.00)
	11/06/24		(Damp at 5.00)
	04/07/24		Dry

Borehole	Date	Depth of Installation (m)	Groundwater Depth (m)
WS02	09/05/24	5.00	Dry
	11/06/24		Dry
	04/07/24		Dry
WS03	09/05/24	5.00	Dry
	11/06/24		(Damp at 5.00)
	04/07/24		5.00
WS04	09/05/24	2.00	0.53
	11/06/24		1.34
	04/07/24		1.90
WS05	09/05/24	1.80	Dry
	11/06/24		1.20
	04/07/24		1.58
WS06	09/05/24	5.00	(Damp at 5.00)
	11/06/24		Dry
	04/07/24		Dry

It should be noted that groundwater levels may vary due to seasonal and other effects.

4.4.7 Falling Head Permeability Tests

2 No. falling head tests were undertaken in borehole WS06. Clean water was dispensed from containers at a rapid rate to fill each borehole as quickly as possible.

4.4.7.1 Calculated Permeability Rates

The falling head test data and soakage rates were calculated based on guidance given in the Kent County Council Soakaway Design Guide (2000) and are presented in Appendix E.

The soakage rate calculated is summarised in Table 2 below.

Table 2. Borehole Soakage Rate

Location	Test No.	Date	Borehole Soakage Rates (l/m²/min)
WS06	1	09/05/24	2.65 [1]
	2	11/06/24	4.08 [1]
	3	-	-

[1] Approximately 75 litres of water was poured into the standpipe (at a rapid rate) in order to conduct the test at the depth indicated.

Please note that this value is considered relatively high and indicates that potential soakage within the chalk is a likely occurrence.

4.4.8 Stability of Trial Pits

The sides of the trial pit excavations were typically stable with the exception of slight instability below 2.20 m in IT03, below 1.50 m in IT04, below 0.40 m in IT05, and below 0.30 m in IT06.

4.4.9 Reinstatement

On completion of the measurements, the infiltration pits were emptied of residual water and backfilled with arisings.

4.5 Infiltration Tests

A total of 10 No. infiltration tests were undertaken in the 7 No. trial pits (IT01 to IT07). The tests were undertaken in general accordance with BRE Digest 365.

Clean water was dispensed from a bowser at a rapid rate to fill each excavation as quickly as possible to the proposed depth of the invert levels and/or the most permeable strata. The excavations took less than 5 minutes to fill. Each test pit was filled to give a head of water of approximately 1.00m.

Measurements were then taken of the fall of water at suitable time increments to allow the infiltration rate to be calculated from the time taken for the water level to drop from 75% to 25% effective depth (where possible). If there was sufficient time, the tests were repeated a maximum of three times in accordance with BRE Digest 365.

On completion of the measurements, the infiltration pits were backfilled with arisings.

The water level measurements from the infiltration tests are tabulated and graphically depicted on Figures F-1 to F-5 in Appendix D.

4.6 Calculated Infiltration Rates

The effective depths reached during the tests and associated times are summarised in Table 3 below.

Table 3. Infiltration Test Results

Location	Depth Range of Test (m)	Test No.	Strata [1]	Effective Depth Reached	Time (mins)	Infiltration Rate (m/s)
IT01	1.30 – 2.40	1	CwF (C) / CHK	25%	115	2.96×10^{-5} [2]
	1.05 – 2.08	2			132	2.63×10^{-5}
	1.01 – 1.82	3			119	2.97×10^{-5} [2]
IT02	1.00 – 2.00	1	CwF (C)	97%	217	N/A
IT03	1.45 – 2.75	1	CwF (C) / CwF (G)	104%	194	N/A
IT04	1.20 – 2.00	1	CwF (C) / CHK	25%	105	2.60×10^{-5}
	1.00 – 1.75	2			165	1.88×10^{-5}
IT05	1.40 – 2.40	1	CwF (G)	95%	201	N/A
IT06	1.80 – 2.80	1	CwF (C/G)	101%	195	N/A
IT07	1.40 – 2.50	1	CwF (C) / CHK	96%	183	N/A

N/A=Not Applicable
[1] CwF=Clay with Flints Formation; CHK=Lewes Nodular and Seaford Chalk Formations; C=Cohesive; G=Granular.
[2] Based on extrapolated data (due to partial collapse of trial pit during the test).

5. CONCLUSIONS

The infiltration tests undertaken in IT01, which was extended into the underlying chalk, yielded infiltration rates of 2.63×10^{-5} to 2.97×10^{-5} m/s, albeit based on some extrapolated data (due to partial collapse of trial pit during the tests). Infiltration tests in IT04 (also onto the underlying chalk) yielded rates of 2.60×10^{-5} and 1.88×10^{-5} m/s. The falling head tests undertaken in the chalk strata of WS06 yielded a borehole soakage rate of 2.65 and 4.08 l/m²/min.

The water levels did not reach the 25% effective depth for infiltration tests in IT02, IT03 and IT05 to IT07, which were taken primarily within the typically cohesive strata of the Clay-with-Flints Formation, and consequently no infiltration rates could be calculated. However, the granular strata in IT03 and IT05 to IT07 (and the chalk encountered in IT07) proved relatively impermeable to infiltration, potentially due to the presence of a significant fines fraction clogging the pores.

Design and positioning of soakaways in chalk will require careful consideration to mitigate risks associated with potential erosion of infilled solution features (if present). All soakaways should be designed and constructed in accordance with BRE 365. Further guidance is also given by documents provided by Kent County Council (July 2000).

6. REFERENCES

1. British Standard Institute, BS 1377-Parts 1-9: 1990-2016. Methods of Tests for Soils for Civil Engineering Purposes.

2. British Standard Institute, BS 5930:2015 + A1:2020. Code of Practice for Site Investigations.

3. BRE Digest 365, 2016. Soakaway Design.

4. Kent County Council, 2000. The Soakaway Design Guide.

7. LIMITATIONS

As with all intrusive site investigations, there is a possibility that there are local variations in ground conditions not identified by the current investigation.

The conclusions and recommendations stated herein are based on information available at the time of production. These may not necessarily apply if the site is to be utilised for a more or less sensitive purpose in the future, or if operational procedures or management alter over time.

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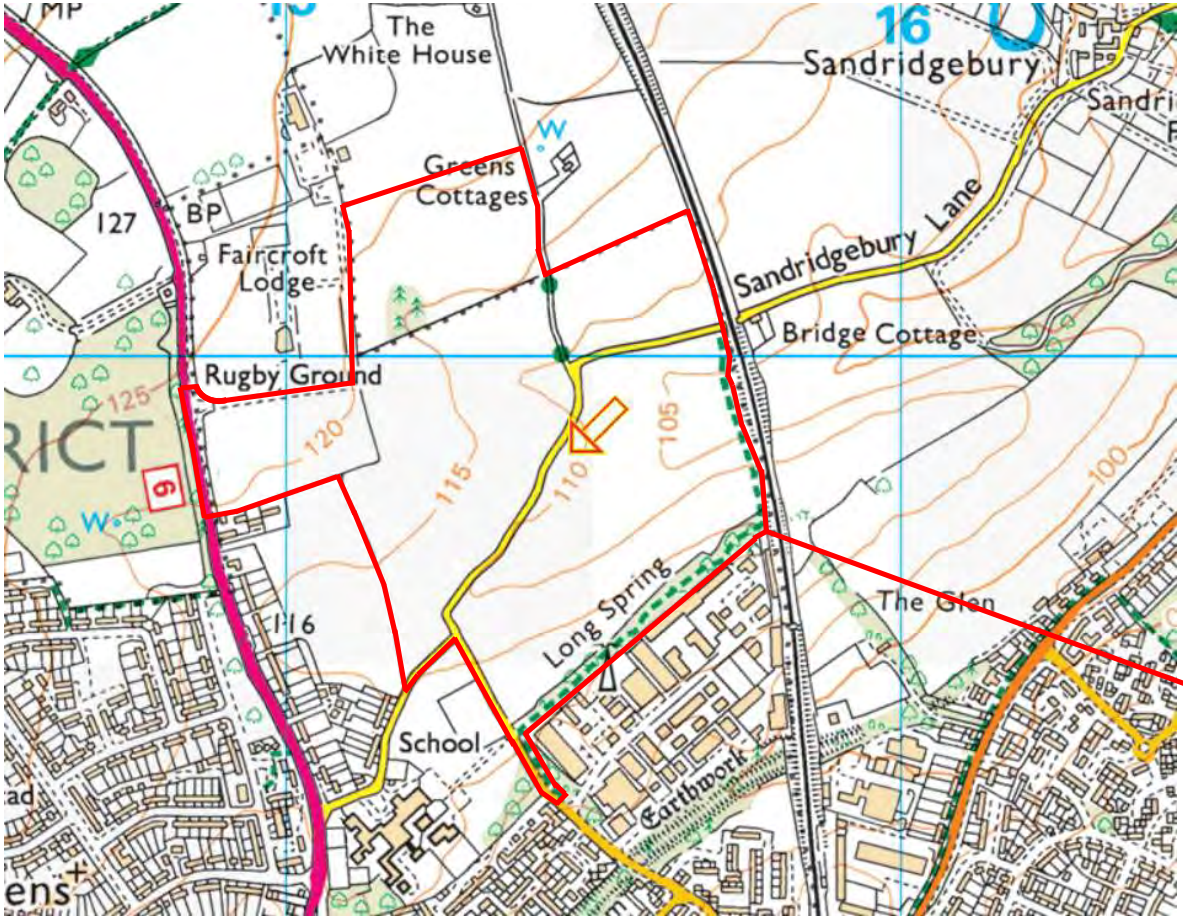
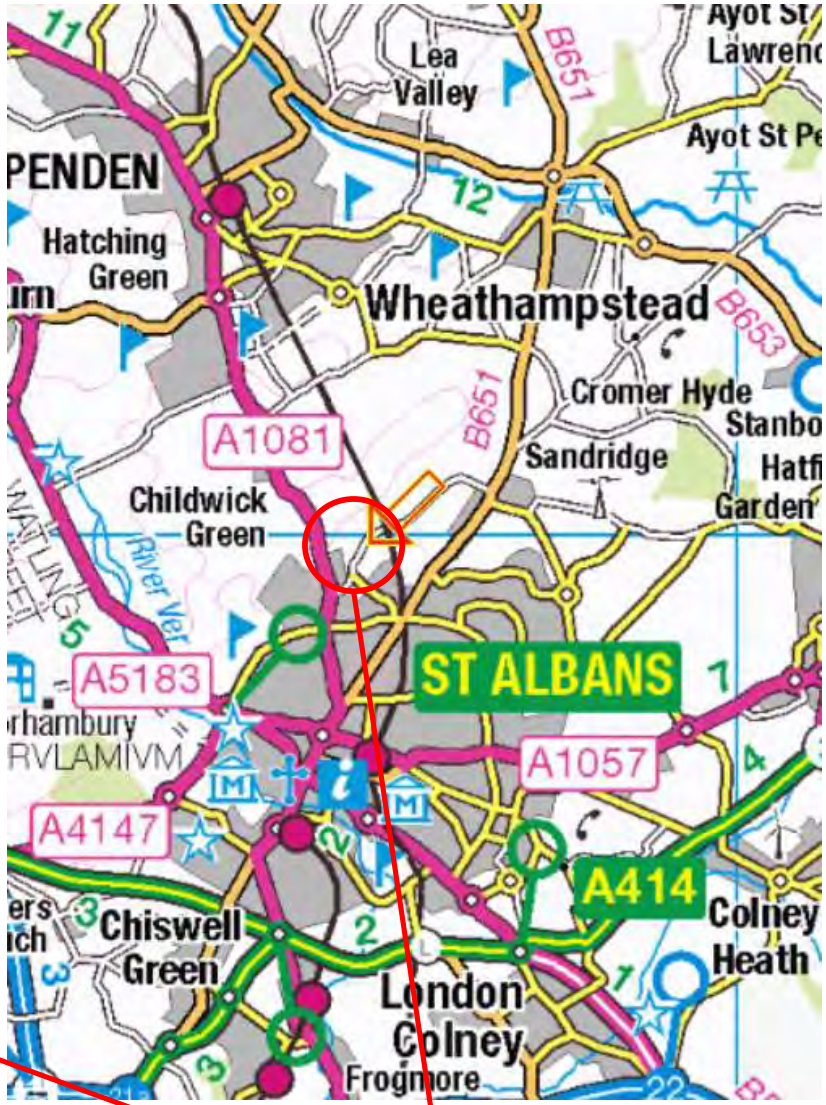
Whilst GEG may identify the presence of potential invasive plant species during the standard geo-environmental walkover and/or investigations, the Client should be aware that ecological issues including an invasive species surveys etc. are beyond the scope of the works and as such no associated liability is accepted by GEG.

APPENDIX A

FIGURES AND PLANS





SITE LOCATION

TITLE: FIGURE 1: SITE LOCATION PLAN	**CLIENT:** PJA / HLM		**DRAWN/CHECKED:** EW / MP		GEG House, 17 Graham Road Malvern, WR14 2HR Tel. 01684 212526 Fax 01684 576917 admin@g-eg.co.uk, www.g-eg.co.uk Geo Environmental Group
SITE: LAND AT CHEAPSIDE, ST ALBANS	**PROJECT No.:** GEG-24-821	**SCALE:** NTS	**DATE:** 16/05/24	**REVISION:** A	

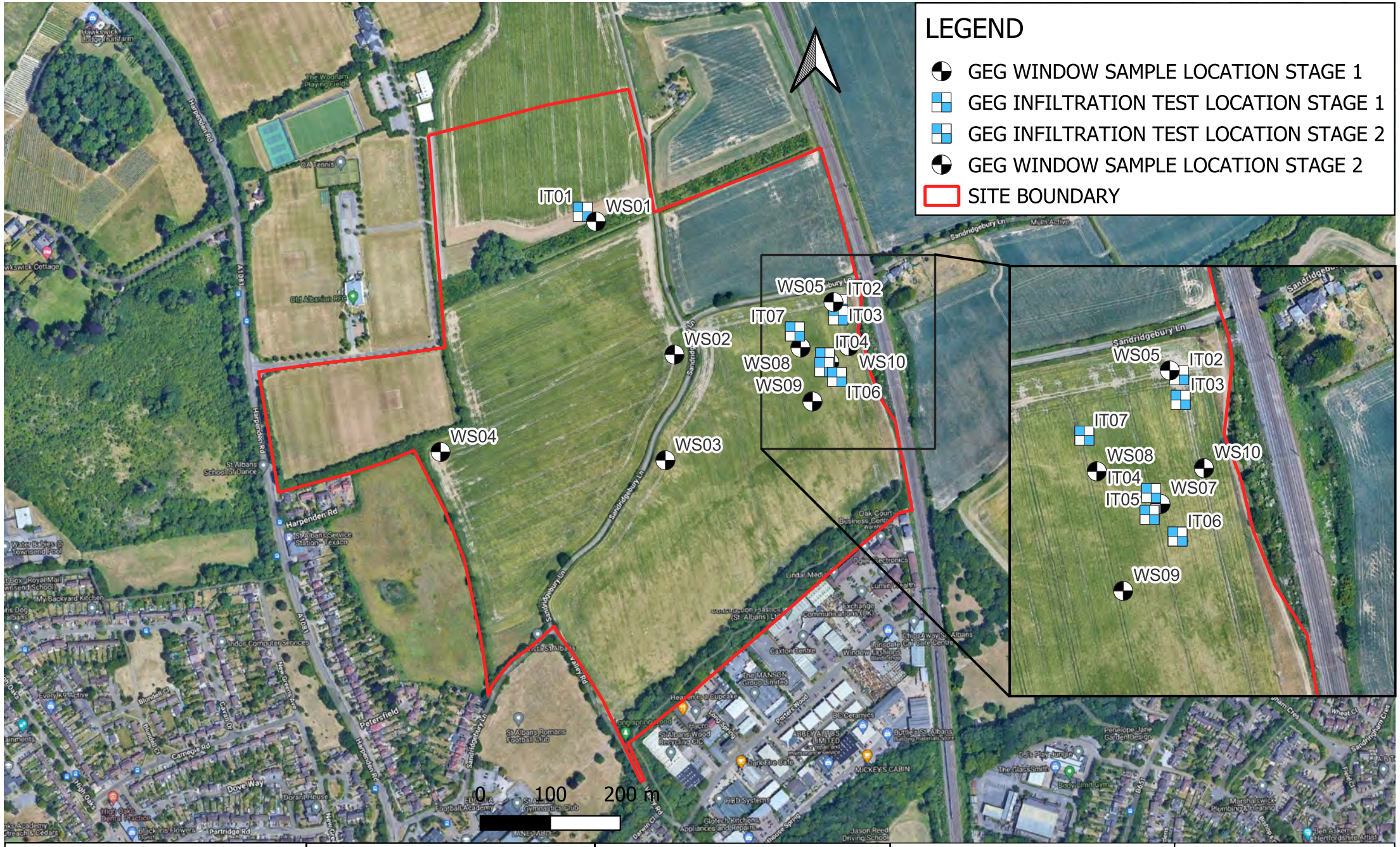


FIGURE 2 EXPLORATORY HOLE LOCATION PLAN	CLIENT: HALLAM LAND MANAGMENT / PJA		DRAWN/CHECKED: EW / MP		GEG House, 17 Graham Road Malvern, WR14 2HR Tel. 01684 212516 Fax. 01684 576917 admin@g-eg.co.uk, www.g-eg.co.uk
SITE: LAND AT CHEAPSIDE, ST ALBANS	PROJECT NUMBER: GEG-24-821	SCALE: AS SHOWN	DATE: 30/07/24	REVISION: 2	Geo Environmental Group

APPENDIX B

PHOTOGRAPHIC RECORD

Photo 1: Excavation of trial pit IT01.

Photo 2: Arisings from trial pit IT01.

Photo 3: Excavation of trial pit IT02.

Photo 4: Arisings from trial pit IT02.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: PJA / HLM

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

Photo 5: Excavation of trial pit IT03.

Photo 6: Arisings from trial pit IT03.

Geo Environmental Group
Geotechnical, Environmental &
Ecological Consultants

Geo Environmental Group
GEG House
17 Graham Road
Malvern
WR14 2HR

Client: PJA / HLM

Project: Land At Cheapside, St Albans

Project No.: GEG-24-821

APPENDIX C

EXPLORATORY HOLE LOGS

EXPLORATORY HOLE LOG RECORDS:
Symbols & Abbreviations Legend

Geo Environmental Group

Sampling

B	Bulk disturbed sample.
BLK	Block sample.
C	Core run.
CR	Core cutter sample.
CS	Core sample taken from rotary core.
D	Small disturbed sample.
ES	Composite environmental soil sample.
EW	Environmental water sample.
L	Continuous percussive sample (plastic liner).
LB	Large disturbed sample.
U	Undisturbed driven tube sample (100 mm diameter, 450 mm long). No. of blows indicated in brackets.
W	Water sample.

In-situ Testing

HVP	Hand Vane Measurement. Value given as shear strength Su (in kPa).
PP	Pocket Penetrometer (Unconfined Compressuve Strength measured in kPa).
SPT	Standard Penetration Test using a split spoon sampler.
SPTC	Standard Penetration Test using a solid 60 degree cone.
N	The 'N' value is the No. of blows required to complete a test drive of 300 mm after a seating drive of 150 mm or 25 blows.
N = 50	Where the full test drive is not completed. A linearly extrapolated 'N' value can be derived.
PID	Photo Ionisation Detector reading in ppm.

Drilling Records

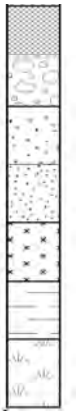
W	Water flush returns.
TCR	Total Core Recovery (%).
SCR	Solid Core Recovery (%).
RQD	Rock Quality Designation (% of intact core >100 mm).
FI	Fracture Index (Fractures/m).
NI	Non-intact core.
NR	No core recovery.

Water Column Symbols

Standing groundwater strike

Initial groundwater Level

Strata - Soil Legends



MADE GROUND

COBBLES & BOULDERS

GRAVEL

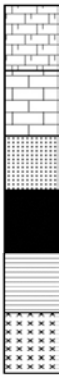
SAND

SILT

CLAY

PEAT

Strata - Rock Legends



CHALK

LIMESTONE

SANDSTONE

COAL

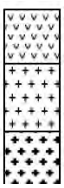
MUDSTONE

SILTSTONE

METAMORPHIC (Fine-grained)

METAMORPHIC (Medium-grained)

METAMORPHIC (Coarse-grained)



IGNEOUS (Fine-grained)

IGNEOUS (Medium-grained)

IGNEOUS (Coarse-grained)

Instrumentation & Backfilling

Plain standpipe.

Slotted standpipe.

Piezometer.

Granular filter (response zone).

Bentonite seal.

Backfill (arisings).

Backfill (cement grout).

Concrete.

NOTES:

[1] The logging of soils and rocks has been carried out in general accordance with BS 5930:2015.

[2] All lengths used to determine rock core mechanical propertoes taken along the centre line of the core. Obvious induced fractures have been ignored.

[3] All logs are avaiable in the AGS format.

Borehole Log

Geo Environmental Group

Borehole No. **WS01**

Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515345E - 210128N	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client:	HLM / PJA		Dates: 10/04/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.00			Soft to firm dark brown slightly sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint. (TOPSOIL)	
					0.30			Firm to stiff orangish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse flint. (CLAY WITH FLINTS FORMATION)	0.5
		1.20	SPT	N=17 (2,3/4,5,4,4)					1.0
					1.35			Structureless CHALK composed of firm creamy white slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are sub-angular extremely weak low density and white and occasionally flint. (Grade Dm) (LEWES NODULAR & SEAFORD CHALK FORMATION)	1.5
		2.00	SPT	N=17 (3,3/4,4,4,5)					2.0
									2.5
		3.00	SPT	N=19 (3,4/5,4,5,5)	3.00			Structureless CHALK composed of stiff creamy white with yellow to brown thin vein discolourations slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are sub-angular extremely weak creamy low to medium density chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)	3.0
		4.00	SPT	N=14 (3,2/3,3,4,4)					3.5
									4.0
									4.5
		5.00	SPT	N=18 (3,4/5,4,4,5)					5.0
					5.45			End of Borehole at 5.450m	5.5

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS02**

Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515457E - 209938N	Hole Type WS
Location: Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client: HLM / PJA		Dates: 11/04/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.00			Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
					0.30			Firm to stiff orangish brown very sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-angular flint. (CLAY WITH FLINTS FORMATION)
		1.20	SPT	N=17 (3,4/5,4,4,4)				*1.20-2.10m Becoming stiff.*
		2.00	SPT	N=22 (3,5/5,6,5,6)	2.10			Structureless CHALK composed of soft creamy white with yellow and brown veins slightly gravelly with occasional cobbles. Gravel and cobble clasts are sub-angular extremely weak chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		3.00	SPT	N=8 (2,3/1,2,3,2)				*2.85m 7cm Band of grey flint.*
		4.00	SPT	N=11 (3,2/2,2,3,4)				
		5.00	SPT	N=19 (4,3/4,5,5,5)				
					5.45			End of Borehole at 5.450m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS03**

Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515444E - 209787N	Hole Type WS
Location: Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client: HLM / PJA		Dates: 11/04/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.00			Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
					0.30			Stiff orangish brown slightly sandy slightly gravelly with low boulder content CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.20	SPT	N=12 (2,3/2,3,3,4)				
		2.00	SPT	N=15 (3,4/4,4,3,4)	1.95			Structureless CHALK composed of firm to stiff creamy white with yellow and brown veins slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are fine to coarse sub-angular extremely weak low density chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		3.00	SPT	N=19 (4,5/4,5,6,4)				
		4.00	SPT	N=21 (4,5/5,5,5,6)				
		5.00	SPT	N=23 (3,4/6,6,5,6)				
					5.45			End of Borehole at 5.450m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No.
WS04
Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515123E - 209799N	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client:	HLM / PJA		Dates: 10/04/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.00			Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
					0.30			Firm to stiff orangish brown slightly sandy slightly gravelly low boulder content CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.20	SPT	N=17 (3,4/5,4,4,4)				*1.20-2.40m Becoming stiff.*
		2.00	SPT	N=50 (10,10/50 for 245mm)				*2.00-2.40m Becoming very stiff.*
								2.40m Flint boulder.
					2.40			End of Borehole at 2.400m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 2.00m. Response zone 1.00-.200m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Refusal on flint boulder.

Geo Environmental Group

Borehole Log

Borehole No. **WS05**

Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515684E - 210013N	Hole Type WS
Location: Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client: HLM / PJA		Dates: 11/04/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.00			Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
					0.30			Firm to stiff orangish brown with light grey webbed discolourations sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.20	SPT	N=39 (3,4/10,10,9,10)				*1.20-1.45m Becoming very stiff.*
					1.45			Dense reddish to orangish brown very clayey very gravelly SAND. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
		1.80	SPT	50 (10,10/50 for 205mm)				*1.80m Becoming very dense.*
					2.16			End of Borehole at 2.155m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 1.80m. Response zone 1.00-1.80m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Refusal on very dense sand.

Borehole Log

Geo Environmental Group

Borehole No. **WS06**

Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515414E - 210159N	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client:	HLM / PJA		Dates: 10/04/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.00			Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (TOPSOIL)
					0.30			Stiff orangish brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint. (CLAY WITH FLINTS FORMATION)
					1.00			Stiff orangish brown slightly sandy slightly gravelly CLAY with dark organic discolouration. Gravel is fine to coarse sub-angular to sub-rounded flint with rare sub-angular boulders up to 15cm diameter. (CLAY WITH FLINTS FORMATION)
		1.20	SPT	N=23 (3,5/6,5,6,6)				
		2.00	SPT	N=29 (4,7/6,8,8,7)	2.00			Firm to stiff orangish brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded flint and rare sub-angular boulders up to 15cm diameter. (CLAY WITH FLINTS FORMATION)
		3.00	SPT	N=12 (3,4/3,4,2,3)	2.90			Structureless CHALK composed of firm creamy white with yellow and brown veins slightly gravelly SILT with occasional cobbles. Gravel and cobble clasts are fine to coarse sub-angular low density chalk and flint. (Grade Dm - Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		4.00	SPT	N=4 (1,2/1,1,1,1)				
		5.00	SPT	N=9 (2,3/2,2,3,2)				
					5.45			End of Borehole at 5.450m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS07**

Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515678E - 209927N	Hole Type WS
Location: Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client: HLM / PJA		Dates: 04/07/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
					0.20			Firm to stiff yellowish brown sandy gravelly CLAY with low boulder content, common gravel lenses and rare dark possible fossilised rootlets after 2.00m. Gravel and boulders are rounded to sub-angular to angular greyish flint with rare quartzite. (CLAY WITH FLINTS FORMATION)
		1.20	SPT	N=20 (3,4/4,5,6,5)				
		2.00	SPT	N=11 (3,3/3,4,2,2)				
		3.00	SPT	N=18 (4,4/8,4,3,3)				
								Dense yellowish clayey SAND. 3.45-3.50m.
		4.00	SPT	N=15 (4,4/4,4,3,4)				
		5.00	SPT	N=15 (1,2/3,3,4,5)				
					5.45			End of Borehole at 5.450m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Remarks

1. No groundwater encountered. 2. 50mm standpipe installed to 5.00m. Response zone 1.00-5.00m, bentonite seal 1.00-0.30m, concrete cover 0.30-0.00m. 3. Equipment used: Competitor Dart WS rig. 4. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS08**

Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515637E - 209948N	Hole Type WS
Location: Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client: HLM / PJA		Dates: 04/07/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
					0.20			Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
		1.20	SPT	N=25 (4,6/6,8,6,5)				
		2.00	SPT	N=17 (3,4/5,4,3,5)				
		3.00	SPT	N=10 (2,3/2,3,2,3)				
		4.00	SPT	N=8 (2,2/2,2,2,2)				
		5.00	SPT	N=5 (1,1/1,1,2,1)				
					5.50			Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
					6.00			End of Borehole at 6.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Remarks

1. No groundwater encountered. 2. Equipment used: Competitor Dart WS rig. 3. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Borehole Log

Borehole No. **WS09**

Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515654E - 209871N	Hole Type WS
Location: Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client: HLM / PJA		Dates: 04/07/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
					0.20			Firm and stiff yellowish brown sandy gravelly CLAY with low boulder content, common gravel lenses and rare dark possible fossilised rootlets after 2.00m. Gravel and boulders are rounded to sub-angular to angular greyish flint with rare quartzite and common dark sand sized discolouration after 1.5m. Possible small chalk cobble at 4.95m could be flint fragments. (CLAY WITH FLINTS FORMATION)
		1.20	SPT	N=17 (3,3/4,5,4,4)				
		2.00	SPT	N=12 (3,3/3,3,3,3)				
		3.00	SPT	N=15 (2,2/2,3,5,5)				
		4.00	SPT	N=30 (2,7/8,9,8,5)				
		5.00	SPT	N=18 (1,2/6,5,4,3)				
					5.45			End of Borehole at 5.450m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Remarks

1. No groundwater encountered. 2. Equipment used: Competitor Dart WS rig. 3. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Borehole Log

Geo Environmental Group

Borehole No. **WS10**

Sheet 1 of 1

Project Name:	Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515706E - 209950N	Hole Type WS
Location:	Land at Cheapside, St Albans, AL3 6BB		Level:	Scale 1:31
Client:	HLM / PJA		Dates: 04/07/2024	Logged By KT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
					0.20			Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
		1.20	SPT	N=8 (1,1/2,2,2,2)				
		2.00	SPT	N=7 (2,2/1,1,2,3)				
					2.40			Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
		3.00	SPT	N=10 (3,1/1,1,4,4)				
		4.00	SPT	N=6 (1,2/1,2,1,2)				
		5.00	SPT	N=8 (2,1/1,2,2,3)				*Flinty gravel band.*
					5.45			End of Borehole at 5.450m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5

Remarks

1. No groundwater encountered. 2. Equipment used: Competitor Dart WS rig. 3. Discernment of chalk grade is inherently difficult where drilling disrupts the natural structure of the chalk.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT01
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515326.00 - 210142.00 Level:	Date 10/04/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.50 × 0.60 Depth 2.40	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Soft to firm dark brown slightly sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint. (TOPSOIL)
				0.30			Firm orangish brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint, with rare sub-angular boulders up to 15cm diameter. (CLAY WITH FLINTS FORMATION)
				2.10			Structureless CHALK composed of firm creamy white very gravelly sandy SILT. Gravel clasts are sub-angular very weak low density and white. (Grade Dm) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.40			End of Pit at 2.400m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT02
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515690.00 - 210010.00 Level:	Date 10/04/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.70 × 0.60 Depth 2.00	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Soft to firm dark brown slightly sandy slightly gravelly low cobble content CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint. (TOPSOIL)
				0.30			Stiff orangish brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint, with frequent sub-angular boulders up to 20cm diameter. (CLAY WITH FLINTS FORMATION)
				2.00			End of Pit at 2.000m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable

Geo Environmental Group

Trial Pit Log

TrialPit No
IT03
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515691.00 - 209994.00 Level:	Date 10/04/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.65 × 0.60 Depth 2.75	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			MADE GROUND - Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse sub-rounded to sub-angular flint and occasional ceramic. (REWORKED TOPSOIL)
				0.20			Stiff orangish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded flint, with frequent sub-angular boulders up to 20cm diameter. (CLAY WITH FLINTS FORMATION)
				1.00			Medium dense reddish and orangish brown clayey gravelly SAND. Gravel is sub-angular to sub-rounded flint, with frequent sub-angular boulders up to 20cm diameter. (CLAY WITH FLINTS FORMATION)
							2.20m Becoming very gravelly.
				2.75			End of Pit at 2.750m

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slightly unstable below 2.20m

Geo Environmental Group

Trial Pit Log

TrialPit No
IT04
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515672.00 - 209934.00 Level:	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.80 × 0.50 Depth 2.20	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint. (TOPSOIL)
				0.25			Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
				1.40			Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.20			End of Pit at 2.200m

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slight collapse in chalk after 1.50m.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT05
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515671.00 - 209920.00 Level:	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.80 × 0.50 Depth 2.40	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint. (TOPSOIL)
				0.20			Medium dense yellowish brown gravelly clayey SAND with low boulder content. Gravel and boulders are rounded to sub-angular to angular greyish flint and with rare quartzite. (CLAY WITH FLINTS FORMATION)
							Becoming very clayey. 1.60-2.40m.
				2.40			End of Pit at 2.400m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slight collapse in sand repeatedly after 0.40m.

Geo Environmental Group

Trial Pit Log

TrialPit No
IT06
Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515689.00 - 209906.00 Level:	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.60 × 0.50 Depth 2.80	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint. (TOPSOIL)
				0.25			Medium dense yellowish brown gravelly clayey SAND with low boulder content. Gravel and boulders are rounded to sub-angular greyish flint and quartzite. (CLAY WITH FLINTS FORMATION)
				1.20			Firm orangish sandy gravelly CLAY. Gravel is rounded to sub-angular greyish flint and quartzite. (CLAY WITH FLINTS FORMATION)
				2.40			Medium dense reddish orangish brown gravelly clayey SAND with low cobble content. Gravel and cobbles are sub-rounded yellowish flint and quartzite. (CLAY WITH FLINTS FORMATION)
				2.80			End of Pit at 2.800m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Slight collapse in sand repeatedly after 0.30m.

Geo Environmental Group

Trial Pit Log

TrialPit No **IT07** Sheet 1 of 1

Project Name: Land at Cheapside, St Albans	Project No. GEG-24-821	Co-ords: 515629.00 - 209971.00 Level:	Date 04/07/2024
Location: Land at Cheapside, St Albans, AL3 6BB		Dimensions (m): 2.70 × 0.50 Depth 2.50	Scale 1:25
Client: HLM / PJA			Logged KT

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm dark brown slightly sandy gravelly CLAY. Gravel is fine to cobbles of angular to sub-rounded greyish yellowish flint and greyish reddish sub-rounded quartzite cobbles. (TOPSOIL)
				0.20			Stiff reddish brown sandy very gravelly CLAY with low boulder content. Gravel and boulders are sub-rounded to angular greyish flint. (CLAY WITH FLINTS FORMATION)
				2.10			Structureless CHALK composed of firm slightly gravelly to gravelly clay. Clasts are sub-rounded to sub-angular flint and low to medium density chalk. (GRADE Dm-Dc) (LEWES NODULAR & SEAFORD CHALK FORMATION)
				2.50			End of Pit at 2.500m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5

Remarks: 1. No groundwater encountered. 2. Infiltration test carried out in pit. 3. On completion backfilled with arisings. 4. Equipment used: JCB 3CX.

Stability: Stable.

APPENDIX D

INFILTRATION TEST DATA

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	240	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	130	
Trial Pit:	**IT01**	Date of Test:	10 April 2024	
Test No.:	**Test 1 of 3**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	130	100.0%
1	129	100.9%
2	130	100.0%
3	132	98.2%
4	135	95.5%
5	136	94.5%
8	140	90.9%
39	167	66.4%
103	205	31.8%
115	212.5	25.0%
End of Test		

With Reference to: **Graph F-1**

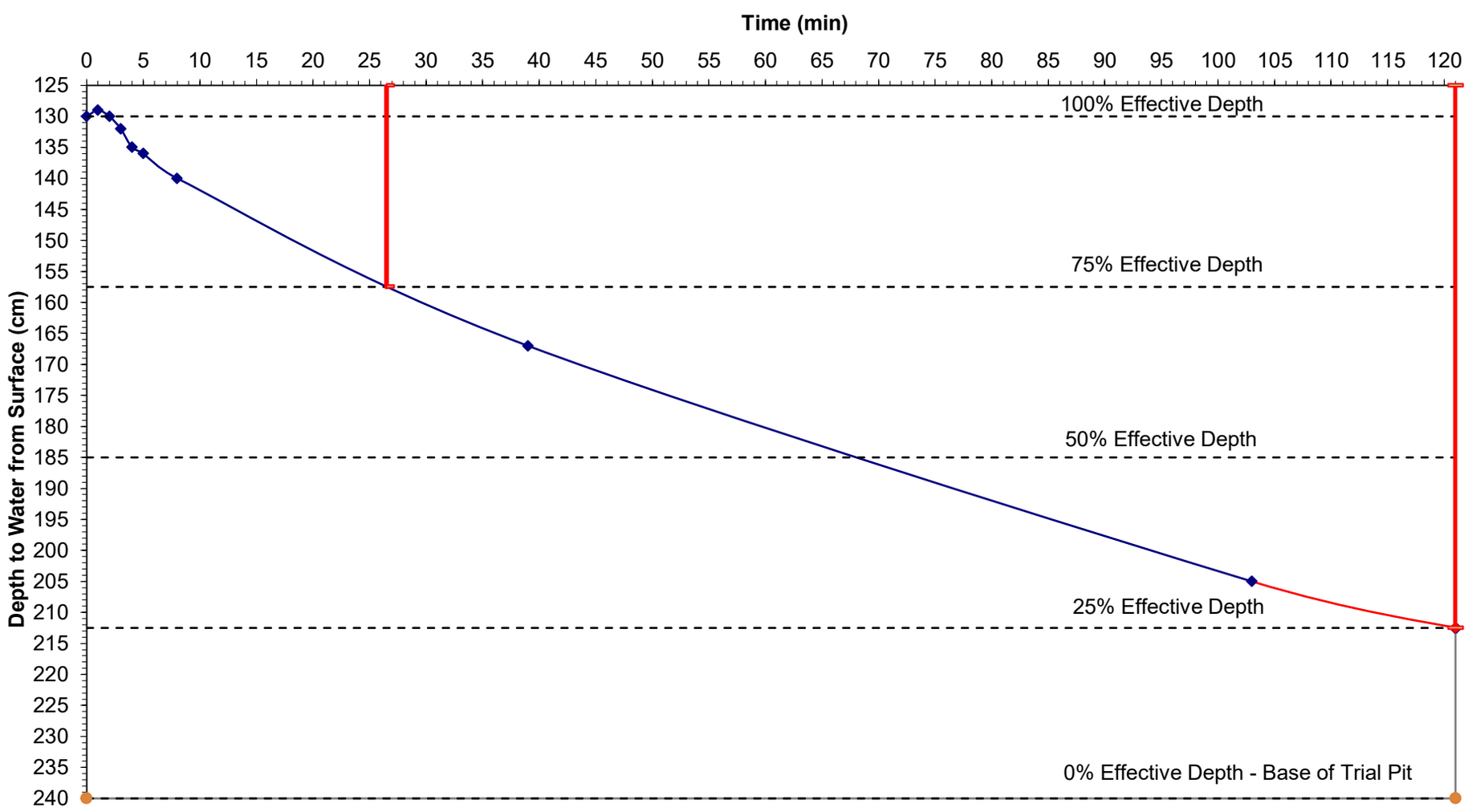
Notes:

[1] Base of trial pit collapsed to 2.08 m during the test; as such last data point extrapolated.

Parameter	Symbol	Calculation	Units	IT01
Effective Depth of Trial Pit	d_p		m	1.10
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.65
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.825
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.91
Time to reach 75% Effective Depth	$T_{p75\%}$		min	26.50
Time to reach 25% Effective Depth	$T_{p25\%}$		min	121.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	94.50
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.96E-05**

*To 50% Effective Depth (including base)

Graph F-1 **GEG-24-821 Land at Cheapside, St. Albans IT01 Test 1 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	208	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	105	
Trial Pit:	**IT01**	Date of Test:	10 April 2024	
Test No.:	**Test 2 of 3**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	105	100.0%
1	108	97.1%
2	110	95.1%
7	115	90.3%
14	120	85.4%
19	125	80.6%
23	128	77.7%
47	142	64.1%
74	155	51.5%
115	169	37.9%
132	182	25.2%
End of Test		

With Reference to: **Graph F-2**

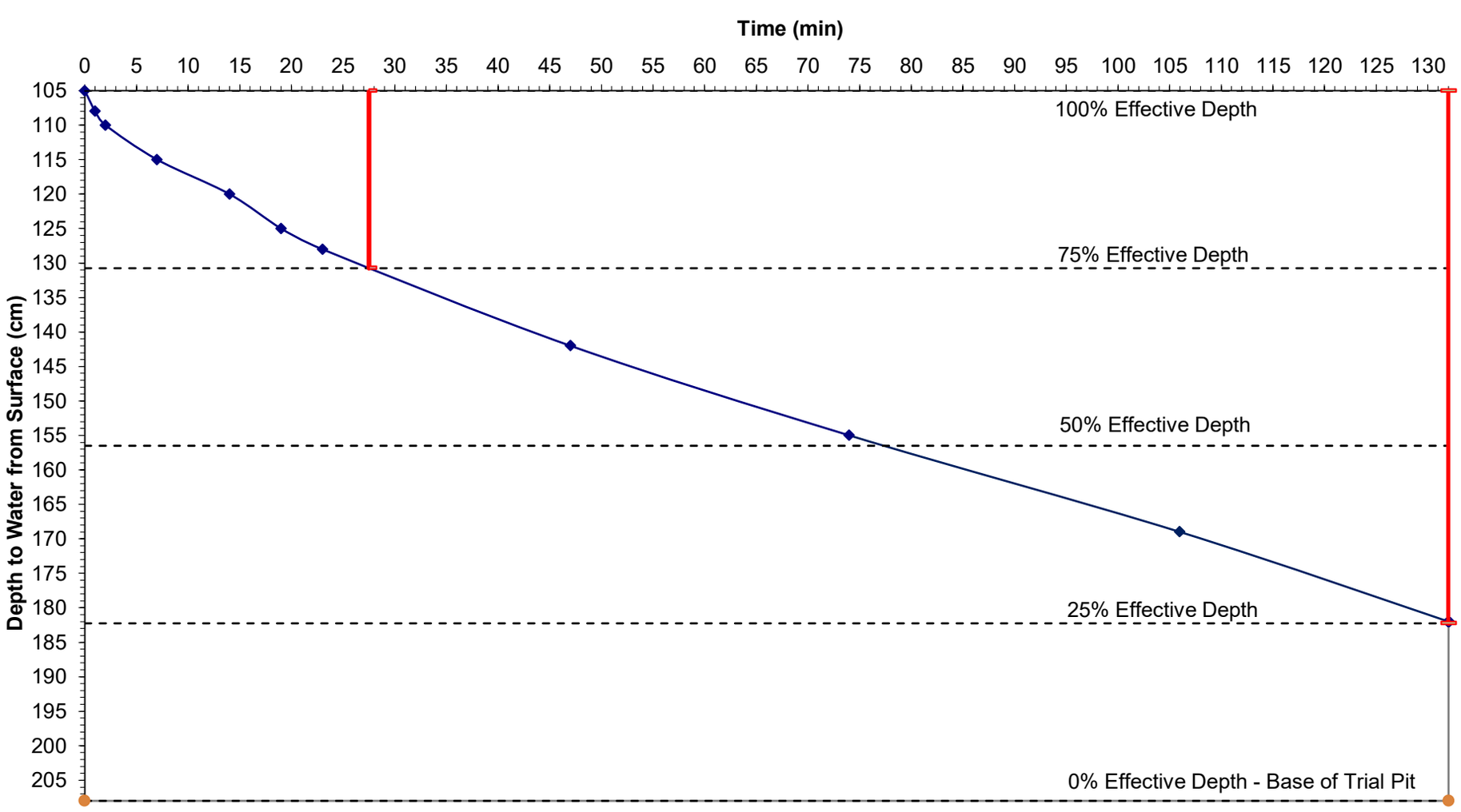
Notes:

[1] Base of pit at 2.08 m following slight collapse during Test 1.

Parameter	Symbol	Calculation	Units	IT01
Effective Depth of Trial Pit	d_p		m	1.03
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.55
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7725
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.69
Time to reach 75% Effective Depth	$T_{p75\%}$		min	27.50
Time to reach 25% Effective Depth	$T_{p25\%}$		min	132.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	104.50
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.63E-05**

*To 50% Effective Depth (including base)

Graph F-2 **GEG-24-821 Land at Cheapside, St. Albans IT01 Test 2 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	182	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	101	
Trial Pit:	**IT01**	Date of Test:	10 April 2024	
Test No.:	**Test 3 of 3**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	101	100.0%
2	103	97.5%
43	126	69.1%
62	134	59.3%
81	144	46.9%
101	155	33.3%
119	162	24.7%
End of Test		

With Reference to: **Graph F-3**

Notes:

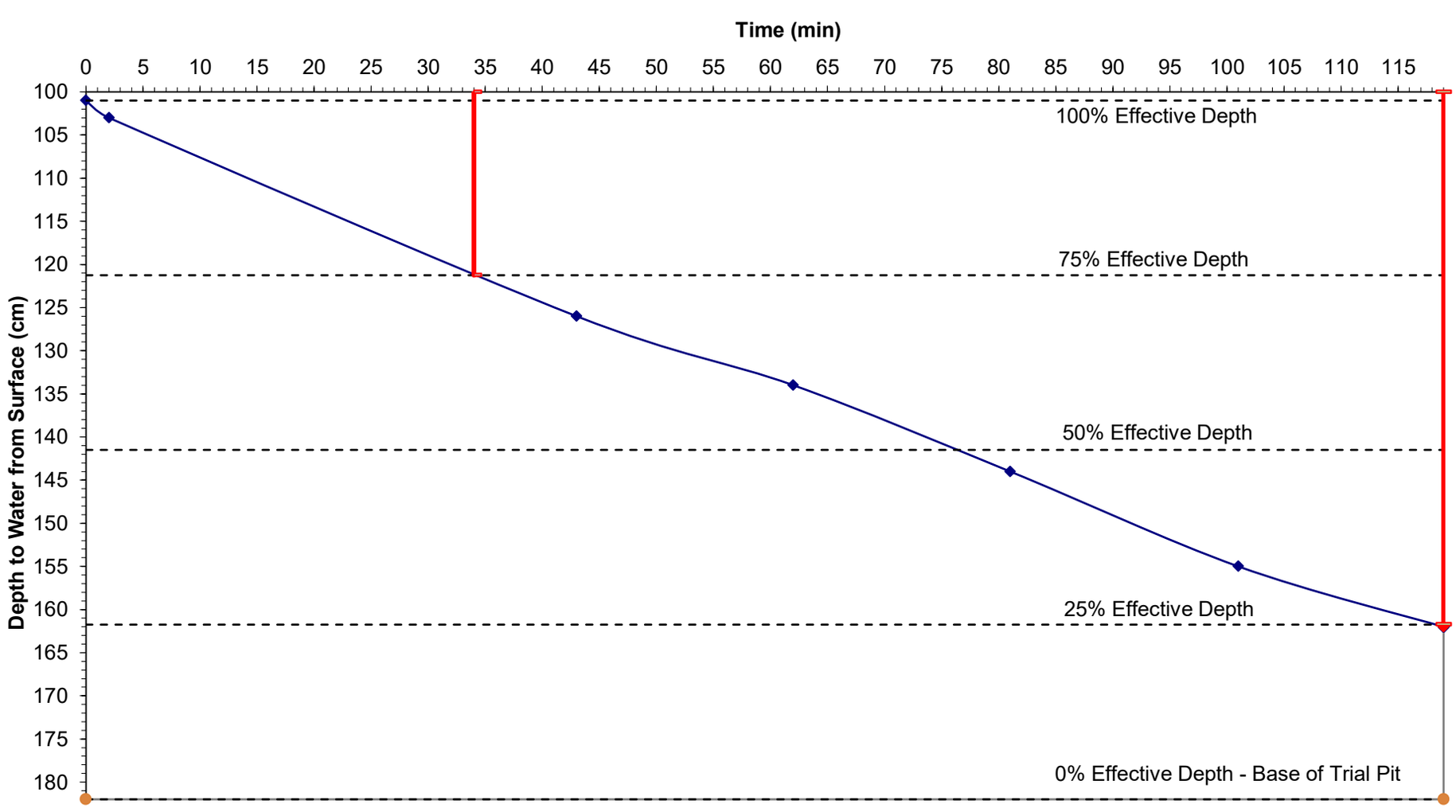
[1] Base of pit at 1.82 m following slight collapse during Test 2.

[2] Base of trial pit collapsed to 1.62 m during the test; as such last data point extrapolated.

Parameter	Symbol	Calculation	Units	IT01
Effective Depth of Trial Pit	d_p		m	0.81
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.50
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.22
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.6075
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.01
Time to reach 75% Effective Depth	$T_{p75\%}$		min	34.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	119.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	85.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.97E-05**

*To 50% Effective Depth (including base)

Graph F-3 **GEG-24-821 Land at Cheapside, St. Albans IT01 Test 3 of 3**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	200	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	100	
Trial Pit:	**IT02**	Date of Test:	10 April 2024	
Test No.:	**Test 1 of 1**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	100	100.0%
1	100	100.0%
2	100	100.0%
4	100	100.0%
26	100	100.0%
62	102	98.0%
157	102	98.0%
217	103	97.0%
End of Test		

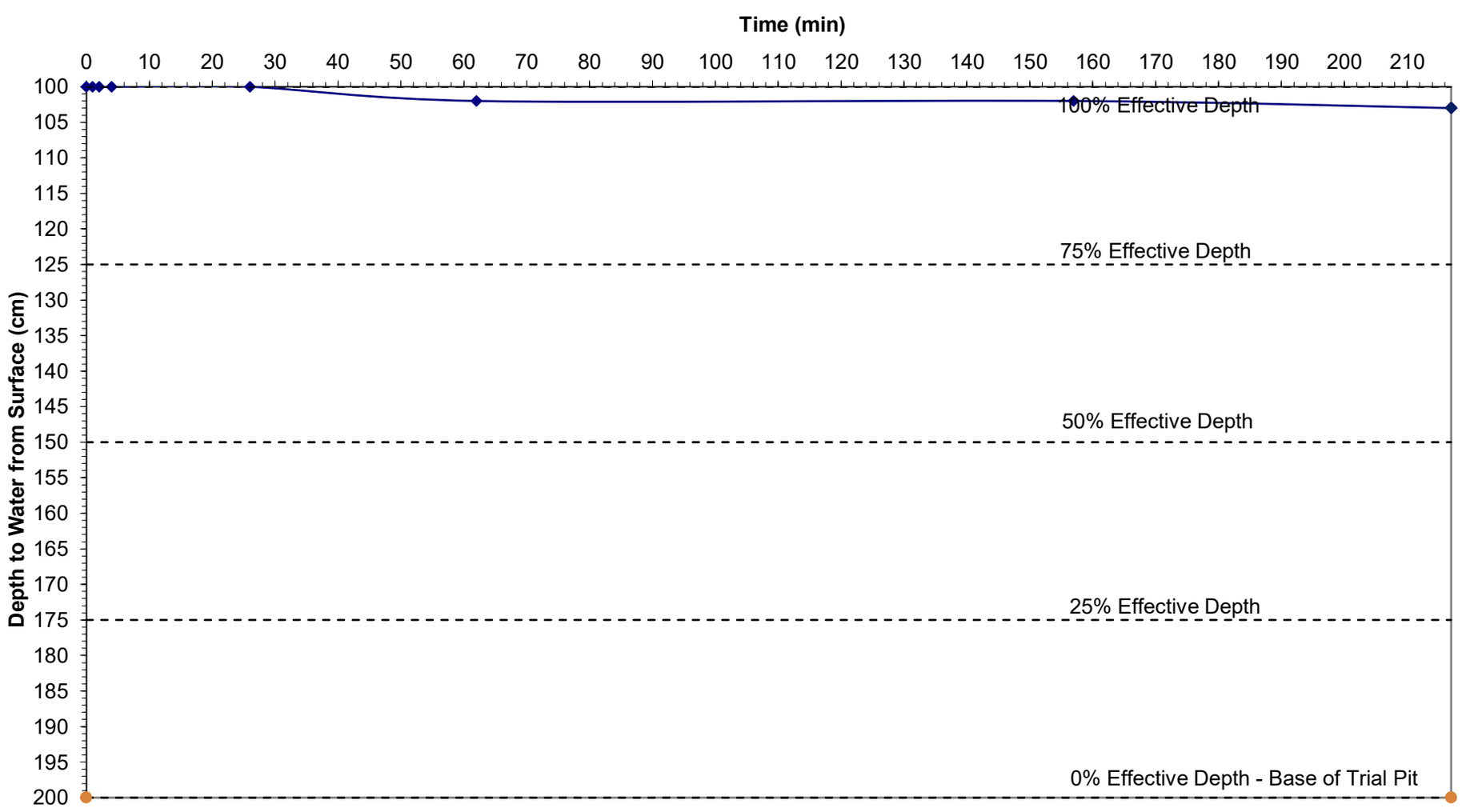
With Reference to: **Graph F-4**

Notes:

Parameter	Symbol	Calculation	Units	IT02
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.70
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.62
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.81
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.92
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-4 **GEG-24-821 Land at Cheapside, St. Albans IT02 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	275	Geo Environmental Group
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	145	
Trial Pit:	**IT03**	Date of Test:	10 April 2024	
Test No.:	**Test 1 of 1**	Site Engineer:	KT	
		Drafted by:	KT	

Time (min)	Depth from Surface (cm)	% Effective Depth
0	145	100.0%
1	145	100.0%
2	143	101.5%
5	140	103.8%
41	145	100.0%
135	140	103.8%
194	140	103.8%
End of Test		

With Reference to: **Graph F-5**

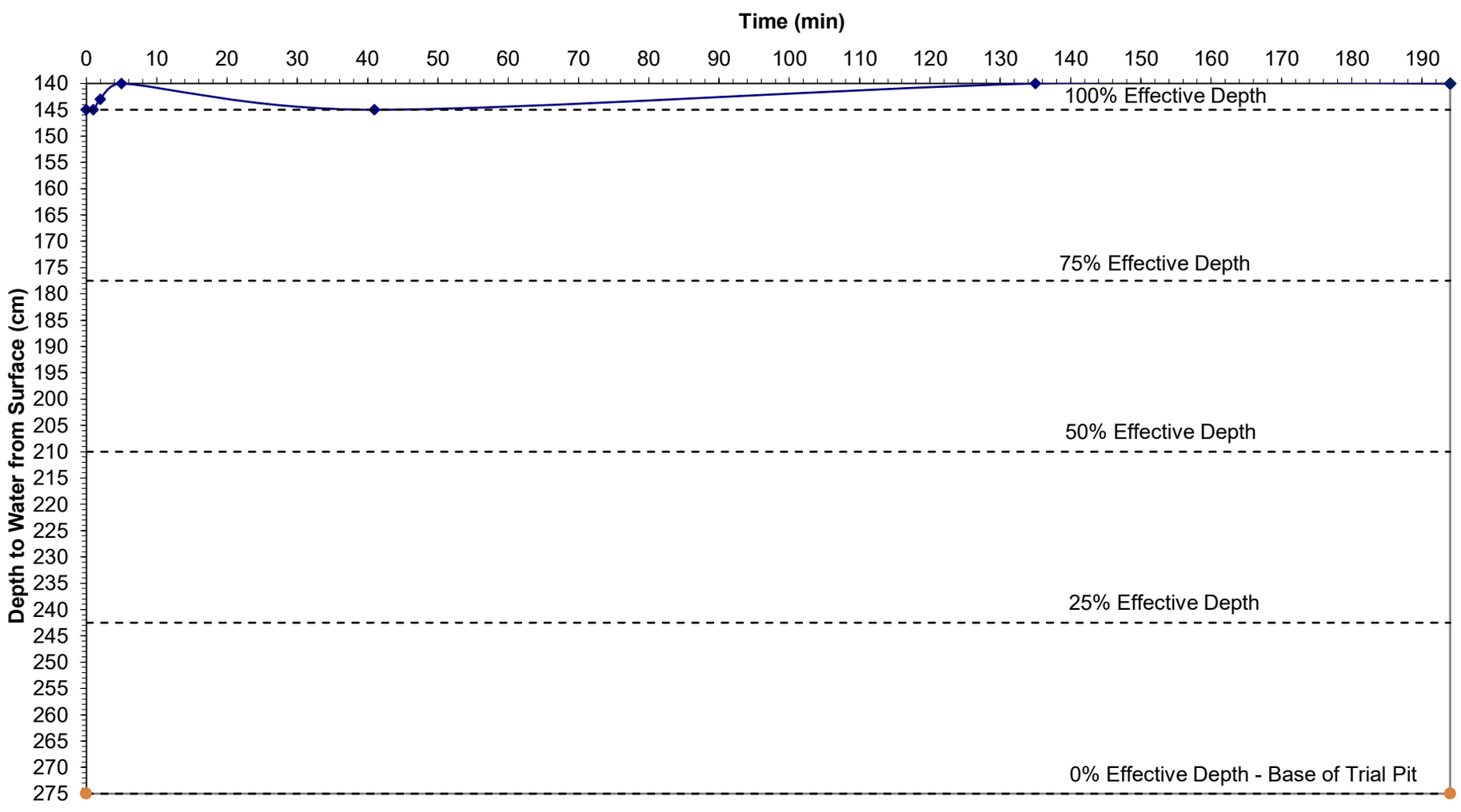
Notes:

[1] Groundwater level rose during test potentially due to instability of the trial pit sides.

Parameter	Symbol	Calculation	Units	IT03
Effective Depth of Trial Pit	d_p		m	1.30
Width of Trial Pit	w		m	0.60
Length of Trial Pit	l		m	2.65
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	2.07
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	1.0335
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	5.82
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-5 **GEG-24-821 Land at Cheapside, St. Albans IT03 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	200
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	120
Trial Pit:	**IT04**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 2**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	120	100.0%
1	125	93.8%
2	126	92.5%
3	130	87.5%
10	136	80.0%
29	148	65.0%
35	154	57.5%
45	160	50.0%
67	170	37.5%
81	175	31.3%
87	176	30.0%
118	183	21.3%
123	187	16.3%
129	190	12.5%
End of Test		

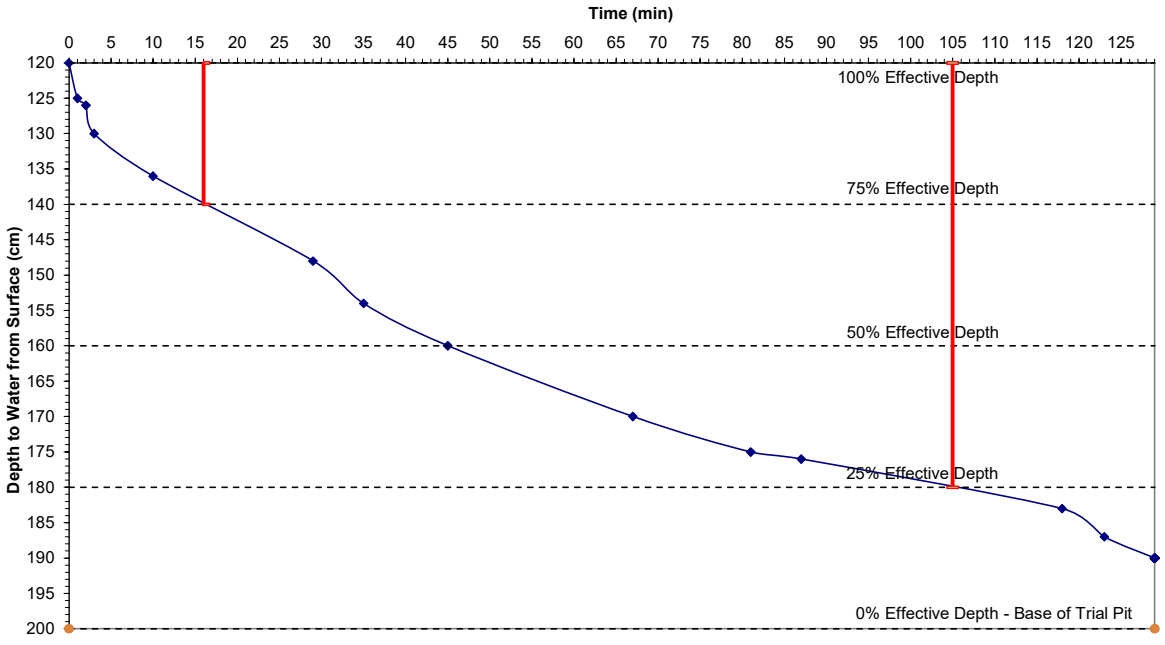
With Reference to: **Graph F-6**

Notes:

Parameter	Symbol	Calculation	Units	IT04
Effective Depth of Trial Pit	d_p		m	0.80
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.80
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.12
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.56
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.04
Time to reach 75% Effective Depth	$T_{p75\%}$		min	16.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	105.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	89.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**2.60E-05**

*To 50% Effective Depth (including base)

Graph F-6 **GEG-24-821 Land at Cheapside, St. Albans IT04 Test 1 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	175
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	100
Trial Pit:	**IT04**	Date of Test:	04 July 2024
Test No.:	**Test 2 of 2**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	100	100.0%
1	100	100.0%
6	103	96.0%
74	130	60.0%
105	140	46.7%
134	147	37.3%
160	155	26.7%
181	160	20.0%
End of Test		

With Reference to: **Graph F-7**

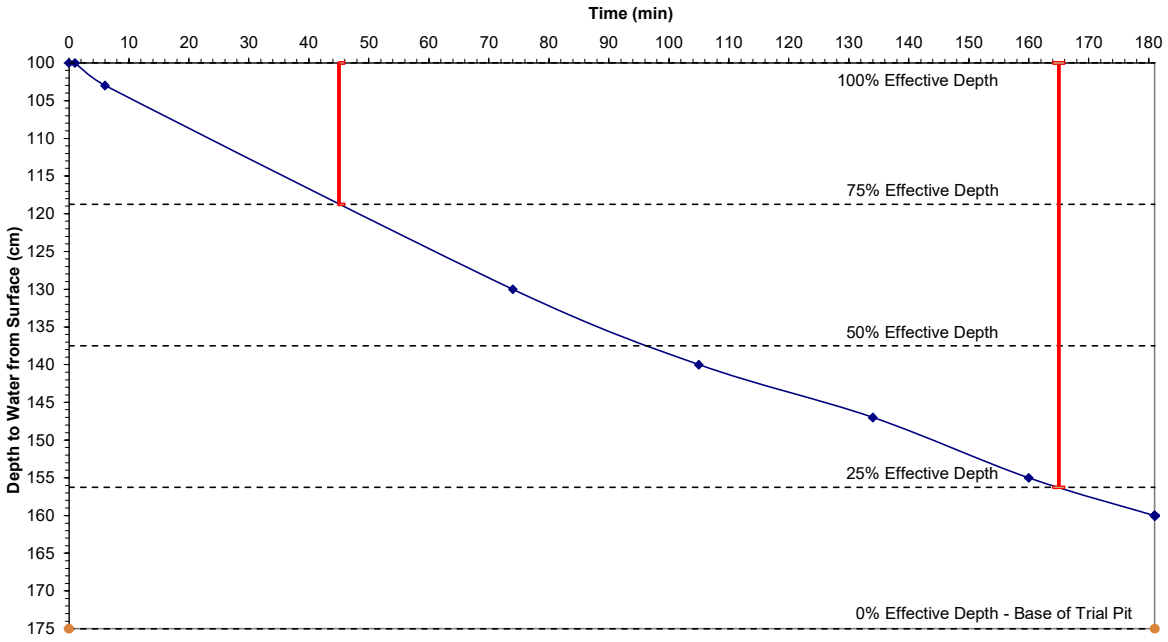
Notes:

[1] Base of pit at 1.75 m following slight collapse during Test 1.

Parameter	Symbol	Calculation	Units	IT04
Effective Depth of Trial Pit	d_p		m	0.75
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.80
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.05
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.525
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	3.88
Time to reach 75% Effective Depth	$T_{p75\%}$		min	45.00
Time to reach 25% Effective Depth	$T_{p25\%}$		min	165.00
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	120.00
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**1.88E-05**

*To 50% Effective Depth (including base)

Graph F-7 **GEG-24-821 Land at Cheapside, St. Albans IT04 Test 2 of 2**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	240
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	140
Trial Pit:	**IT05**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	140	100.0%
1	143	97.0%
2	144	96.0%
4	146	94.0%
9	145	95.0%
29	146	94.0%
41	146	94.0%
82	146	94.0%
98	146	94.0%
171	145	95.0%
201	145	95.0%
End of Test		

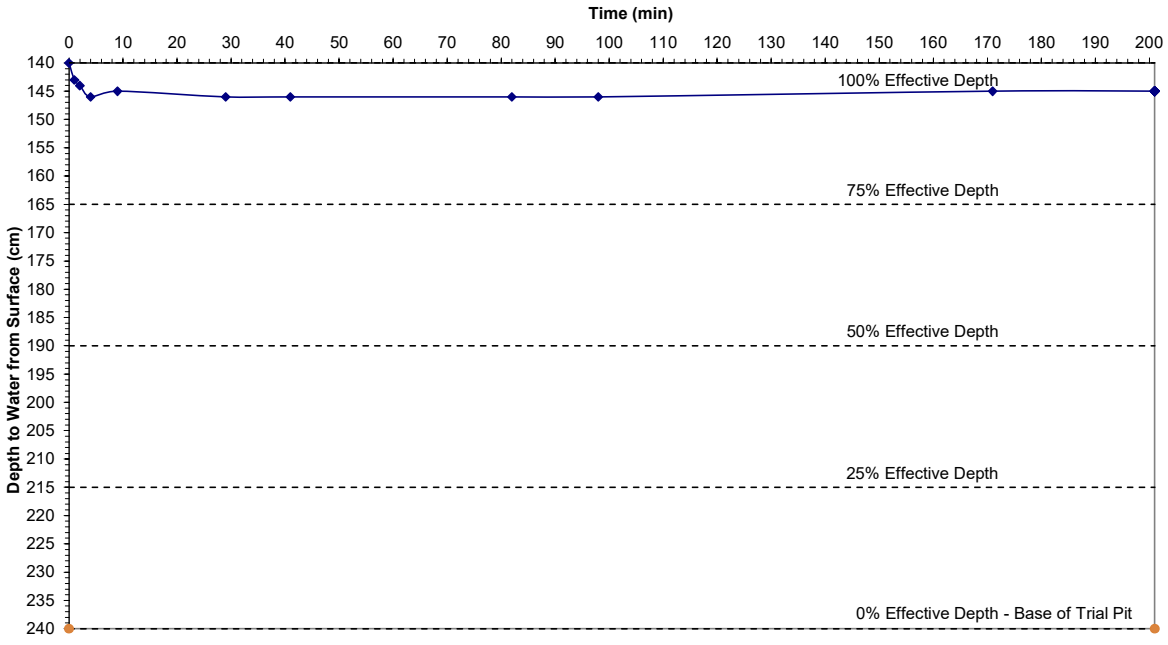
With Reference to: **Graph F-8**

Notes:

Parameter	Symbol	Calculation	Units	IT05
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.80
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.40
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.70
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-8 **GEG-24-821 Land at Cheapside, St. Albans IT05 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	280
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	180
Trial Pit:	**IT06**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	180	100.0%
1	180	100.0%
2	181	99.0%
3	181	99.0%
49	180	100.0%
64	179	101.0%
136	179	101.0%
166	179	101.0%
195	179	101.0%
End of Test		

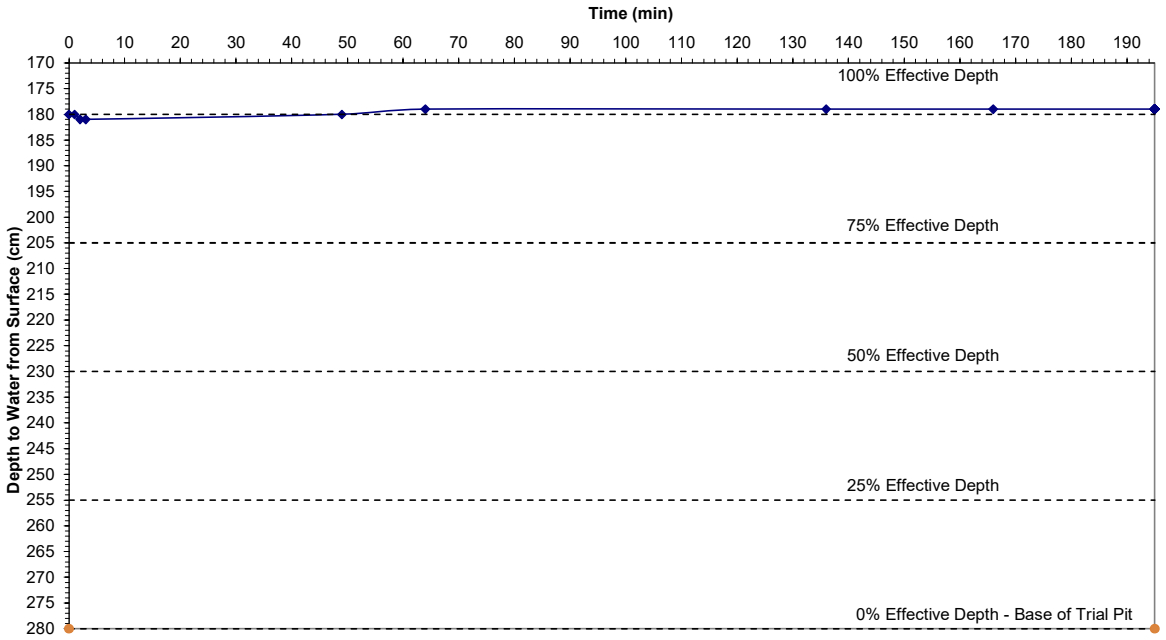
With Reference to: **Graph F-9**

Notes:

Parameter	Symbol	Calculation	Units	IT06
Effective Depth of Trial Pit	d_p		m	1.00
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.60
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.30
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.65
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.40
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-9 **GEG-24-821 Land at Cheapside, St. Albans IT06 Test 1 of 1**



Checked by: MP

GEG Infiltration Test Sheet

Project Name:	**Land at Cheapside, St. Albans**	Depth of Pit (cm):	250
Project Ref.:	**GEG-24-821**	Depth of Water at start of test (cm):	140
Trial Pit:	**IT07**	Date of Test:	04 July 2024
Test No.:	**Test 1 of 1**	Site Engineer:	KT
		Drafted by:	EW

Geo Environmental Group

Time (min)	Depth from Surface (cm)	% Effective Depth
0	140	100.0%
1	141	99.1%
13	142	98.2%
26	142	98.2%
78	140	100.0%
119	143	97.3%
183	145	95.5%
End of Test		

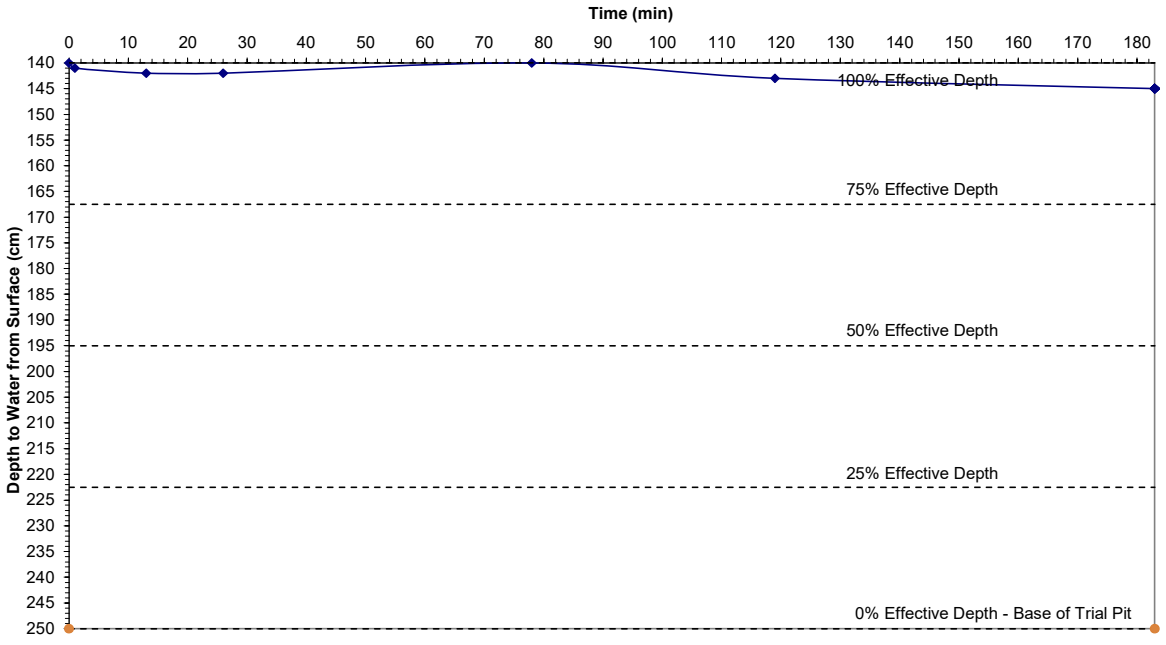
With Reference to: **Graph F-10**

Notes:

Parameter	Symbol	Calculation	Units	IT07
Effective Depth of Trial Pit	d_p		m	1.10
Width of Trial Pit	w		m	0.50
Length of Trial Pit	l		m	2.70
Volume of Trial Pit	V	$= d_p \times w \times l$	m^3	1.49
Volume of Trial Pit at 50% Effective Depth	$V_{50\%}$	$= V \times 0.5$	m^3	0.7425
Internal Surface Area of Trial Pit*	$a_{p50\%}$	$= l \times w + d_p \times (w + l)$	m^2	4.87
Time to reach 75% Effective Depth	$T_{p75\%}$		min	N/A
Time to reach 25% Effective Depth	$T_{p25\%}$		min	N/A
Time 25% - 75%	$T_{p75\%-25\%}$	$= T_{p25\%} - T_{p75\%}$	min	N/A
Infiltration Rate	f	$= V_{50\%} / a_{p50\%} \times (T_{p75\%-25\%})$	m/s	**N/A**

*To 50% Effective Depth (including base)

Graph F-10 **GEG-24-821 Land at Cheapside, St. Albans IT07 Test 1 of 1**



Checked by: MP

APPENDIX E

FALLING HEAD TESTS

Falling Head Soakage Test Calculations - GEG-24-821

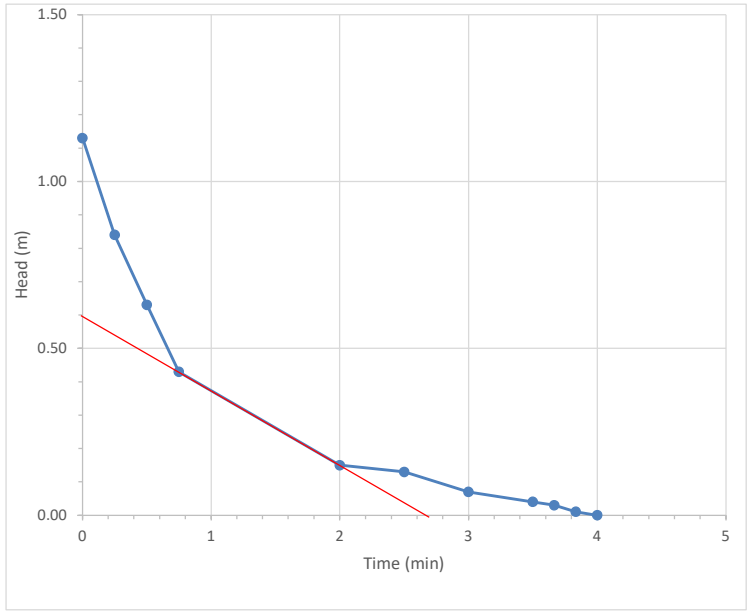
WS06 (Test 1 of 1)

Depth of borehole (m): 5.00

Time (sec)	Time (min)	Depth from Surface (m)	Hp
0	0	3.87	1.13
15	0.3	4.16	0.84
30	0.5	4.37	0.63
45	0.8	4.57	0.43
120	2.0	4.85	0.15
150	2.5	4.87	0.13
180	3.0	4.93	0.07
210	3.5	4.96	0.04
220	3.7	4.97	0.03
230	3.8	4.99	0.01
240	4.0	5.00	0.00

Date of Test: 09/05/2024

End of Test *KT / MP*



Notes:

Approximately 75 litres of water was poured into the standpipe (at a rapid rate) in order to conduct the test at the depth indicated.

WS06 (Test 1 of 1)

With Reference to Kent County Council - The Soakaway Design Guide, 2000

d	*Diameter of borehole*	0.10	m
D	*Diameter of base of borehole*	0.10	m
L	*Length of response zone*	2.10	m
Hp	*y intercept of tangent*	0.60	m
t_h	*x intercept of tangent*	2.70	min

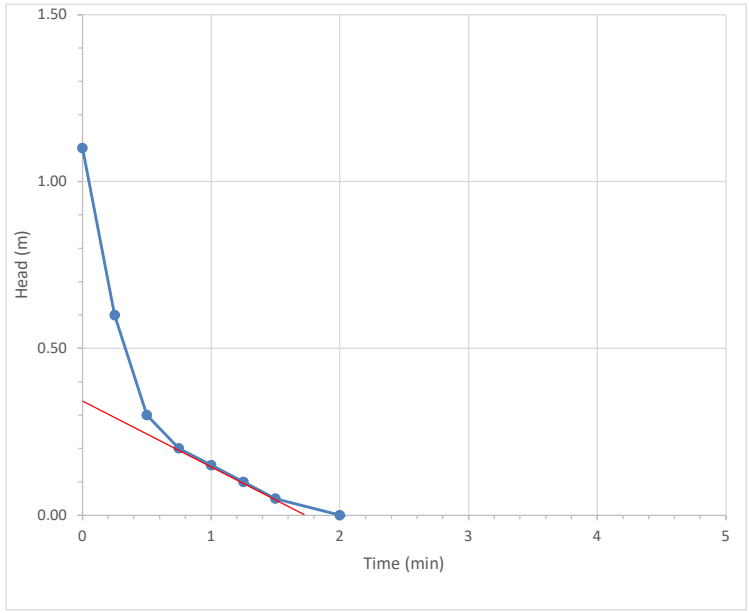
Soakage = 250 Hp d^2 /D L t_h **2.65E+00** **l/m²/min**

Falling Head Soakage Test Calculations - GEG-24-821

WS06 (Test 2 of 2)			11/06/2024
Depth of borehole (m):			5.00
Time (sec)	**Time (min)**	**Depth from Surface (m)**	**Hp**
0	0	3.90	1.10
15	0.3	4.40	0.60
30	0.5	4.70	0.30
45	0.8	4.80	0.20
60	1.0	4.85	0.15
75	1.3	4.90	0.10
90	1.5	4.95	0.05
120	2.0	5.00	0.00
150	2.5	5.10	-0.10
160	2.7	5.12	-0.12

Date of Test: 09/05/2024

End of Test *KT / MP*



Notes:

Approximately 75 litres of water was poured into the standpipe (at a rapid rate) in order to conduct the test at the depth indicated.

WS06 (Test 2 of 2)

With Reference to Kent County Council - The Soakaway Design Guide, 2000

d	*Diameter of borehole*	0.10	m
D	*Diameter of base of borehole*	0.10	m
L	*Length of response zone*	2.10	m
Hp	*y intercept of tangent*	0.60	m
t_h	*x intercept of tangent*	1.75	min

Soakage = 250 Hp d^2 /D L t_h **4.08E+00** **l/m²/min**

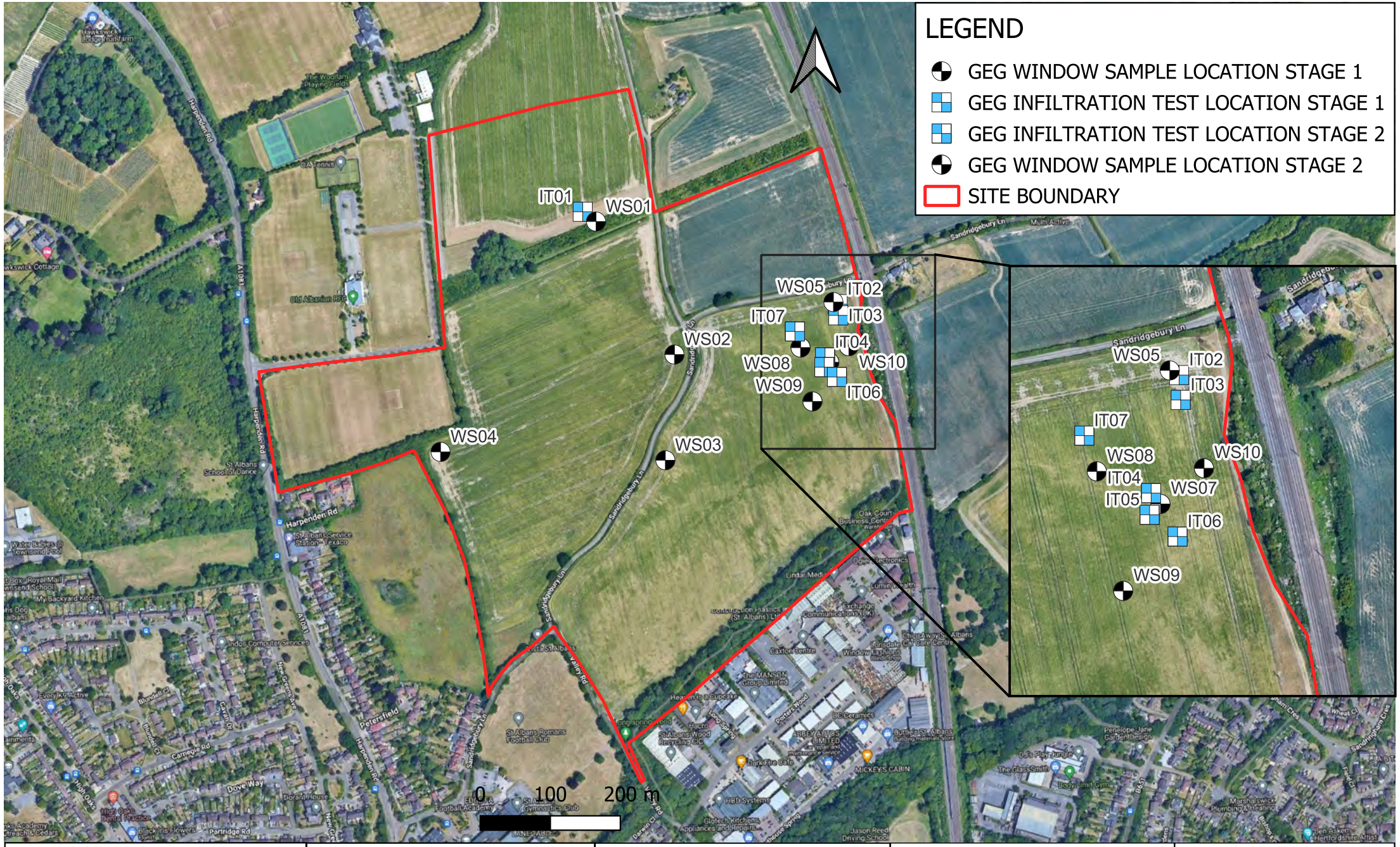


FIGURE 2 EXPLORATORY HOLE LOCATION PLAN	CLIENT: HALLAM LAND MANAGMENT / PJA		DRAWN/CHECKED: EW / MP		GEG House, 17 Graham Road Malvern, WR14 2HR Tel. 01684 212516 Fax. 01684 576917 admin@g-eg.co.uk, www.g-eg.co.uk
SITE: LAND AT CHEAPSIDE, ST ALBANS	PROJECT NUMBER: GEG-24-821	SCALE: AS SHOWN	DATE: 30/07/24	REVISION: 2	Geo Environmental Group

Appendix C Thames Water Asset Mapping

Asset location search

Property Searches

PJA Engineering
LONGBRIDGE
B31 2UQ

Search address supplied

O A Sports
Old Albanian Sports Club
160
Harpenden Road
St. Albans
AL3 6BB

Your reference 05920 - St Albans

Our reference ALS/ALS Standard/2023_4892519

Search date 10 October 2023

Notification of Price Changes

From 1st April 2023 Thames water Property Searches will be increasing the prices of its CON29DW, CommercialDW Drainage & Water Enquiries and Asset Location Searches. Historically costs would rise in line with RPI but as this currently sits at 14.2%, we are capping it at 10%.

Customers will be emailed with the new prices by January 1st 2023.

Any orders received with a higher payment prior to the 1st April 2023 will be non-refundable. For further details on the price increase please visit our website at www.thameswater-propertysearches.co.uk

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Asset location search

Property Searches

Search address supplied: O A Sports, Old Albanian Sports Club, 160, Harpenden Road, St. Albans, AL3 6BB

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset location search

Thames Water Property Searches

Waste Water Services

Please provide a copy extract from the public sewer map.

Following examination of our statutory maps, Thames Water has been unable to find any record of public sewerage within this area. However, there may be other sewerage pipework within the area that is not owned by the company. You may be able to obtain records of such pipework from the building control department of your local authority, from property deeds or from neighbouring landowners.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Following examination of our statutory maps, Thames Water has been unable to find any plans of water mains within this area. If you require a connection to the public water supply system, please write to:

New Connections / Diversions
Thames Water
Network Services Business Centre
Brentford
Middlesex
TW8 0EE

Tel: 0845 850 2777
Fax: 0207 713 3858
Email: developer.services@thameswater.co.uk

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.

- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

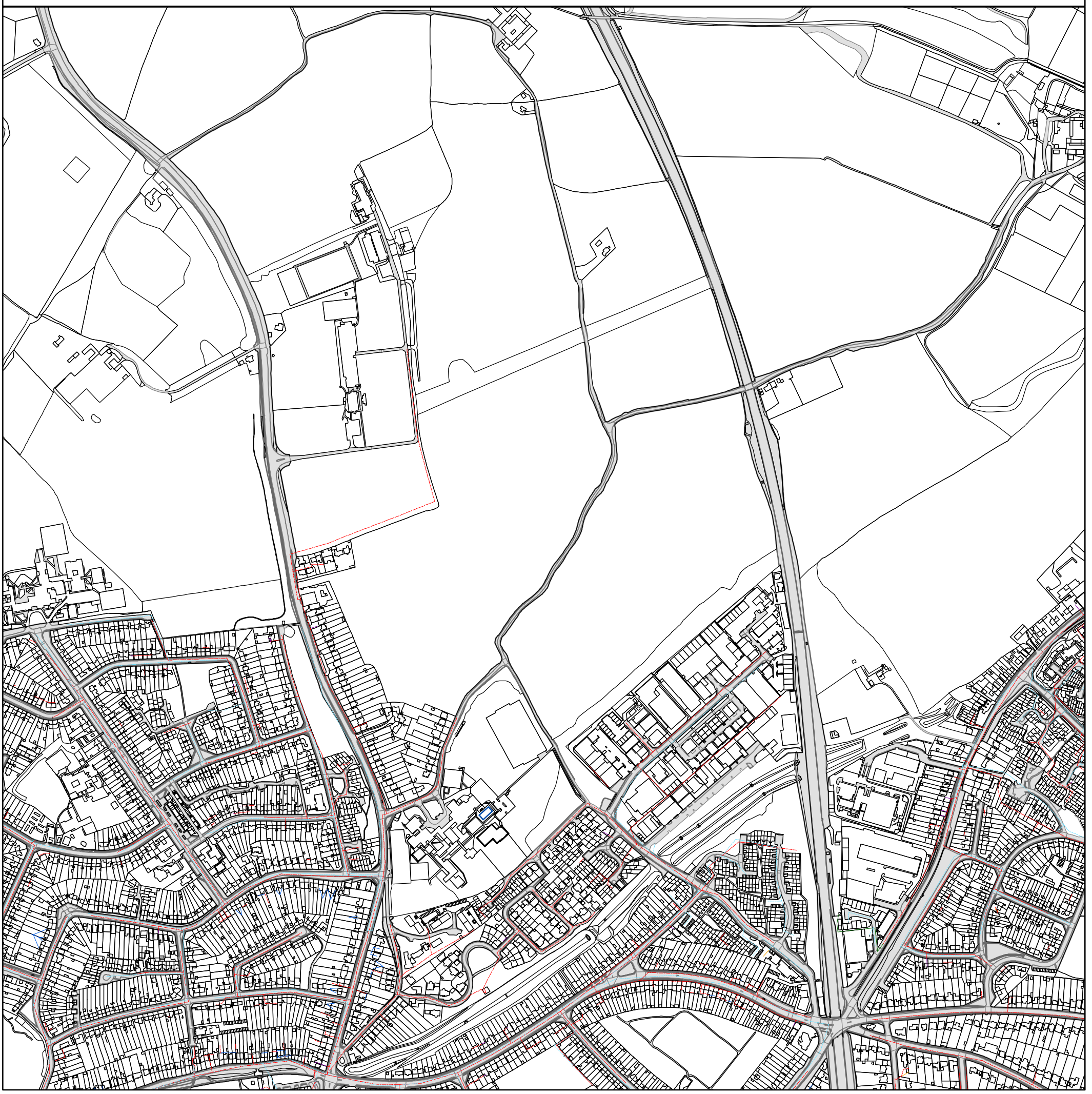
Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



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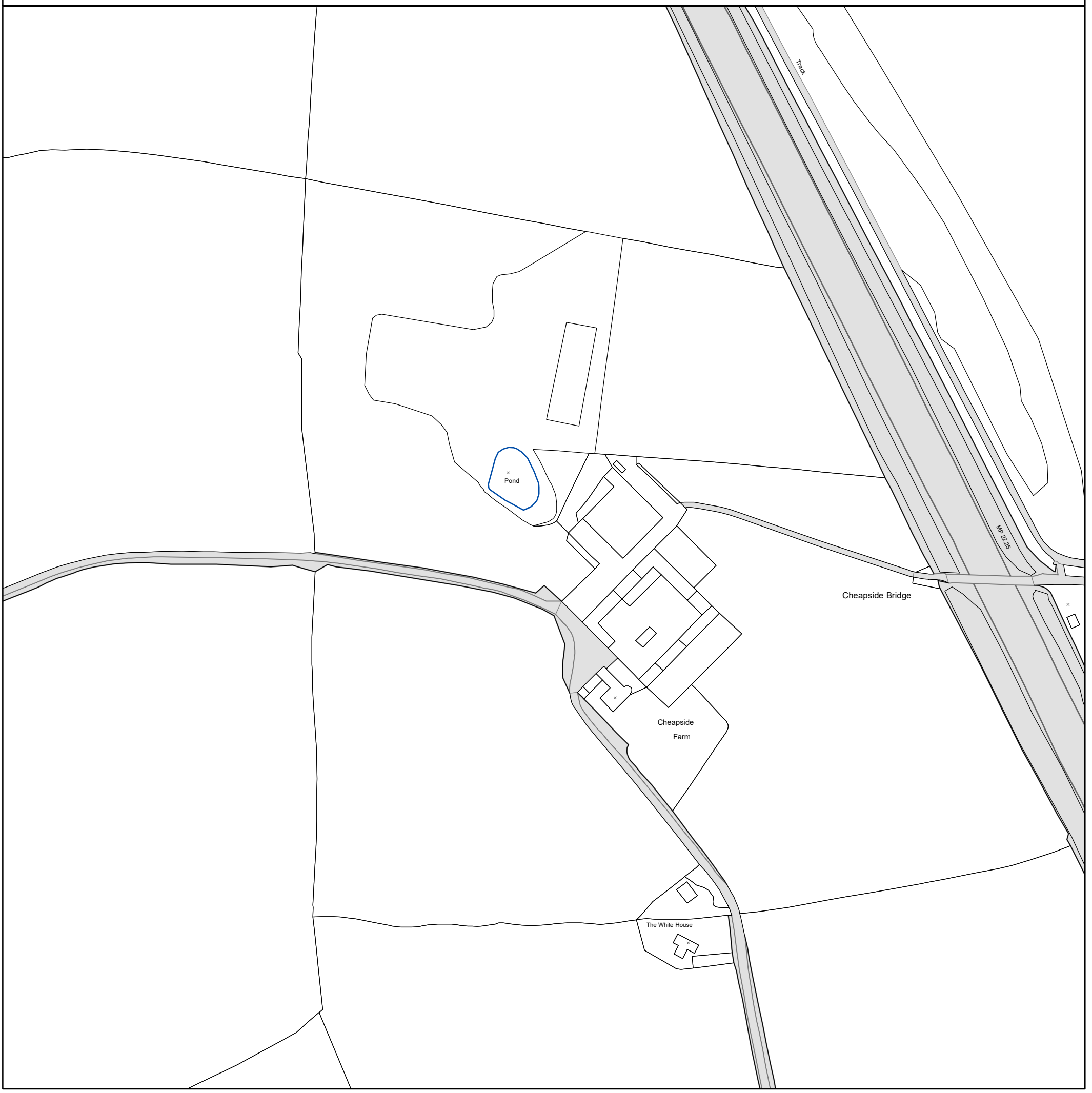
Print Date:	10/10/2023
Map Centre:	515353,209754
Grid Reference:	TL1509NW

Comments:

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



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Print Date:	20/10/2023
Map Centre:	515250,210750
Grid Reference:	TL1510NW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

0 10 20 40 60 80
Meters

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515750,210750
Grid Reference:	TL1510NE

Comments:

ALS/ALS Standard/2023_4892519

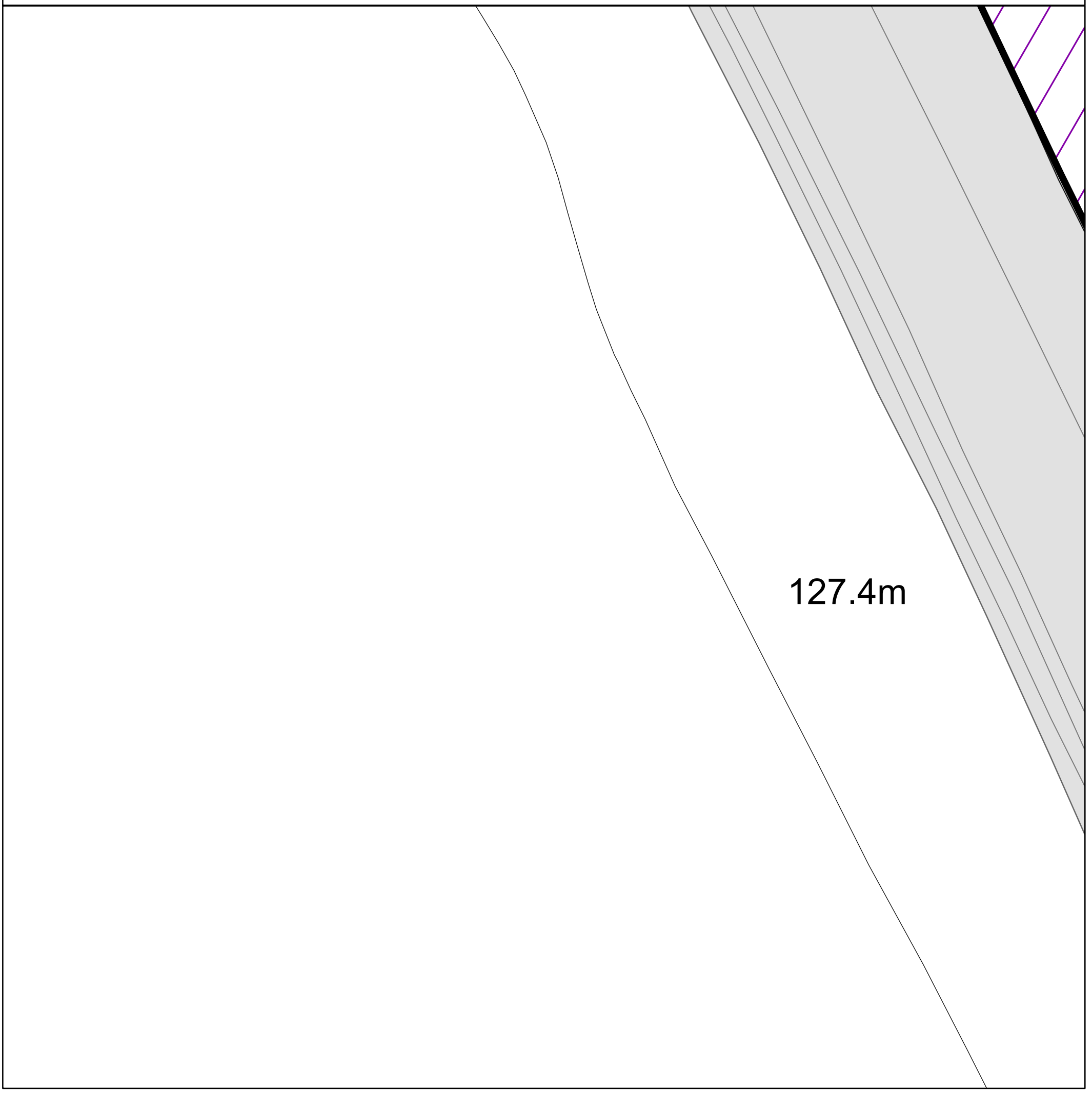
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



0 2 4 8 12 16
Meters

Scale:	1:324
Width:	91m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	514750,210250
Grid Reference:	TL1410SE

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

0 10 20 40 60 80
Meters

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515250,210250
Grid Reference:	TL1510SW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
111A	120.89	119

REFERENCE	COVER LEVEL	INVERT LEVEL
101A	119.91	118.18

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

0 10 20 40 60 80
Meters

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515750,210250
Grid Reference:	TL1510SE

Comments:

ALS/ALS Standard/2023_4892519

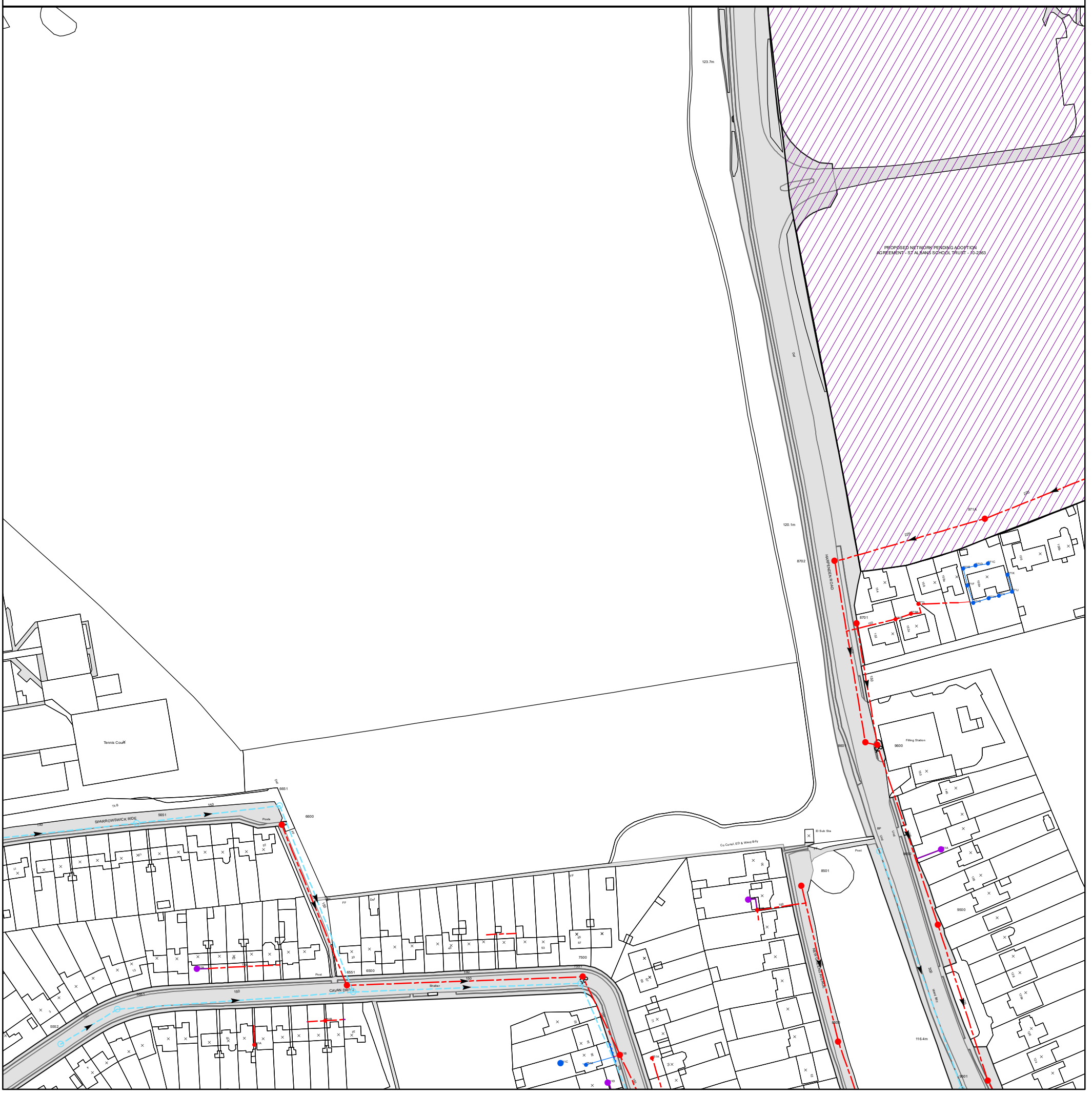
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL

REFERENCE	COVER LEVEL	INVERT LEVEL

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
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Print Date:	20/10/2023
Map Centre:	514750,209750
Grid Reference:	TL1409NE

Comments:

ALS/ALS Standard/2023_4892519

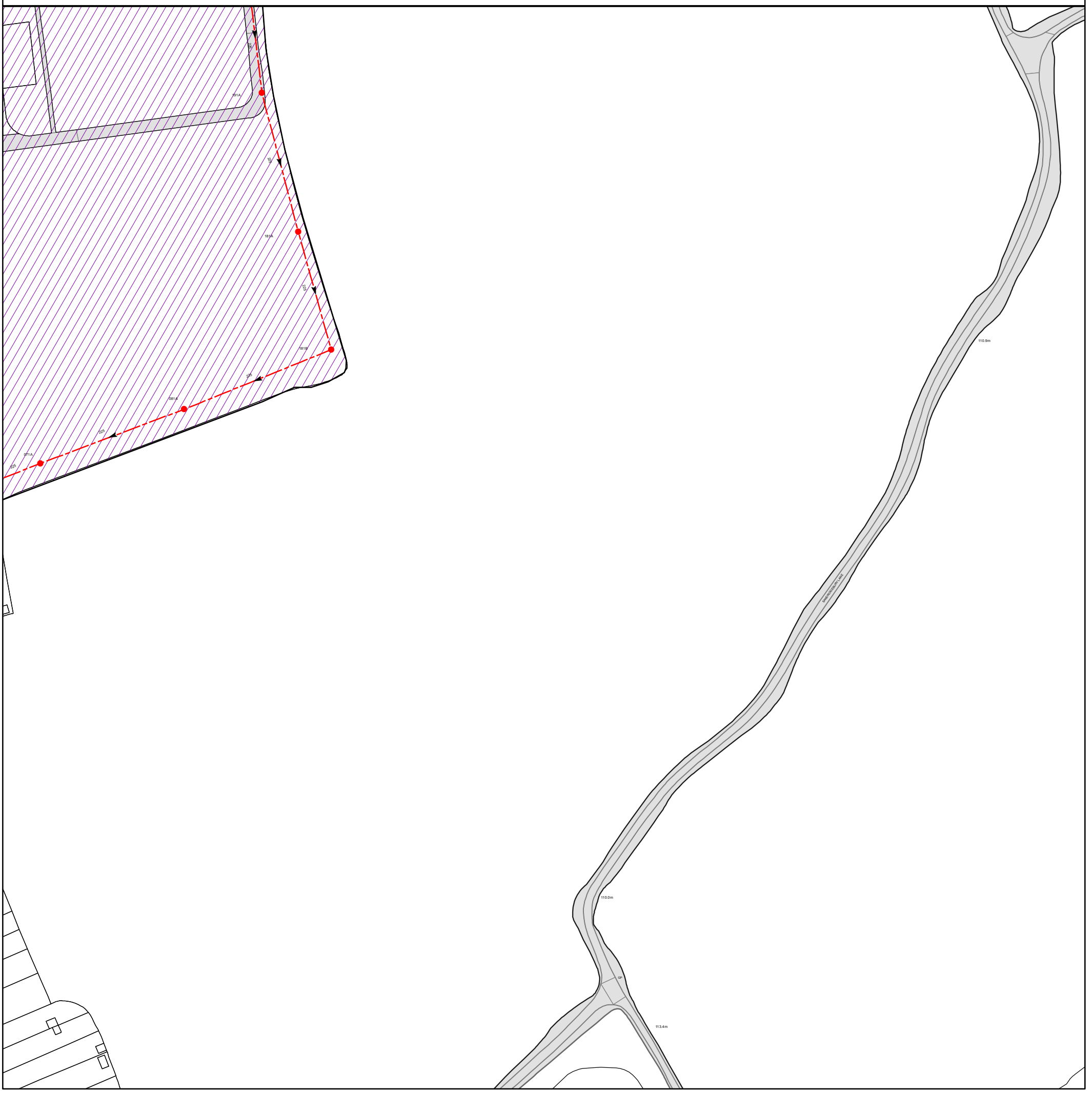
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
6551	123.77	122.13
5552	126.4	124.95
5651	125.51	124.07
9501	116.41	113.6
9550	116.54	114.82
8500	118.12	116.34
8601	116.93	114.55
7551	121.29	119.79
8701	119.64	114.93
6600	124.03	122.91
9500	116.47	114.01
961A		
751A		
751C		
851B		
971C		
971E		
971D		
971M		
971J		
971H		
651B		

REFERENCE	COVER LEVEL	INVERT LEVEL
971A	120.2	115.35
6500	123.8	121.91
6651	123.99	122.89
8501	118.15	117.17
9600	116.78	114.42
9650	116.49	115.17
8702	119.61	115.26
7500	121.3	119.5
5551	125.98	124.6
971B		
851A		
551A		
751B		
651A		
851C		
971K		
971F		
971L		
971I		
971G		
751D		

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



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Grid Reference:	TL1509NW

Comments:

ALS/ALS Standard/2023_4892519

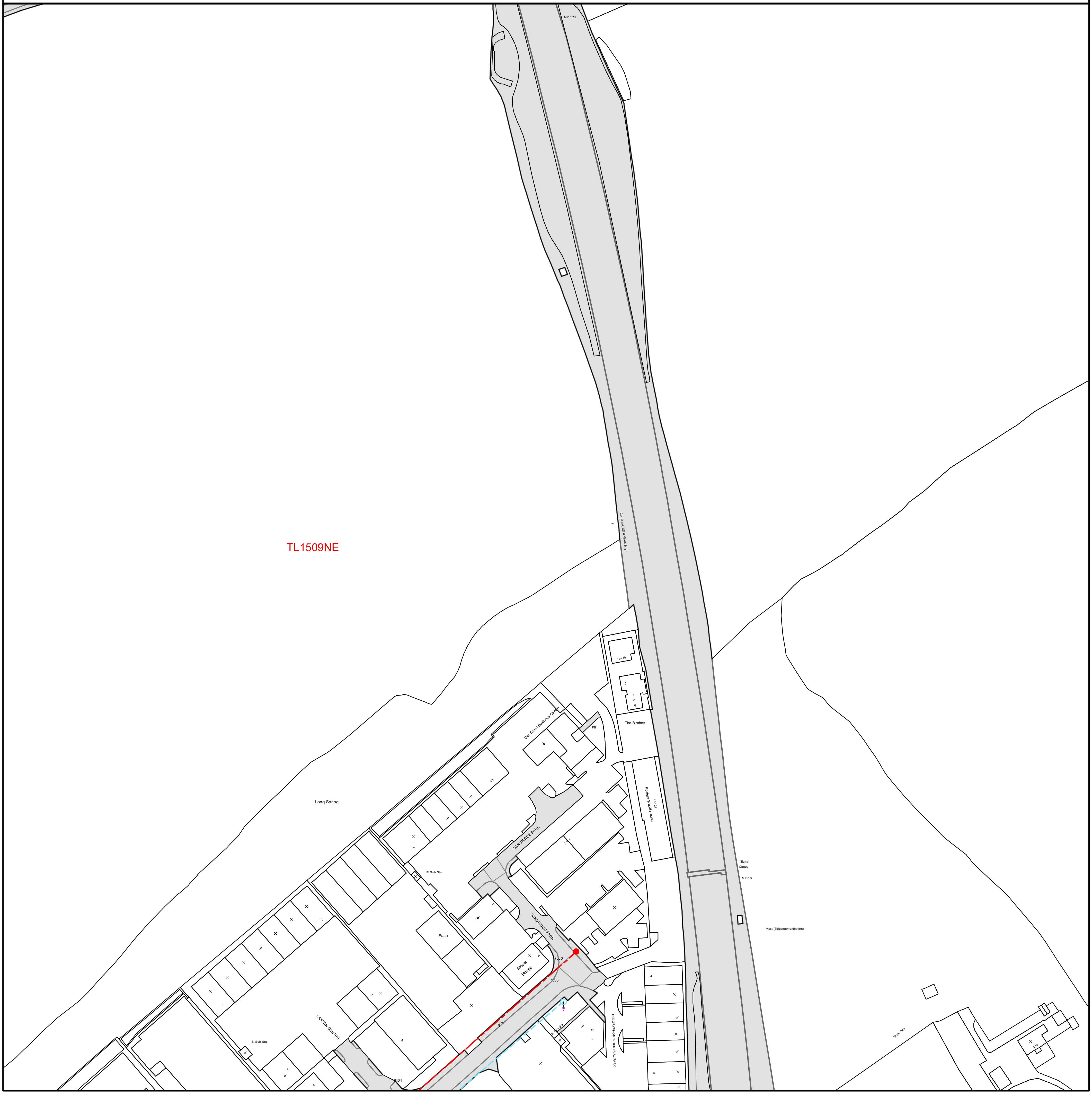
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
071A	120	116.2
081A	119.2	116.55
181A	119.25	117.55

REFERENCE	COVER LEVEL	INVERT LEVEL
181B	118.5	116.9
191A	120.14	117.86

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



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Scale: 1:1789
Width: 500m
Printed By: ASuji
Print Date: 20/10/2023
Map Centre: 515750,209750
Grid Reference: TL1509NE

Comments:

ALS/ALS Standard/2023_4892519

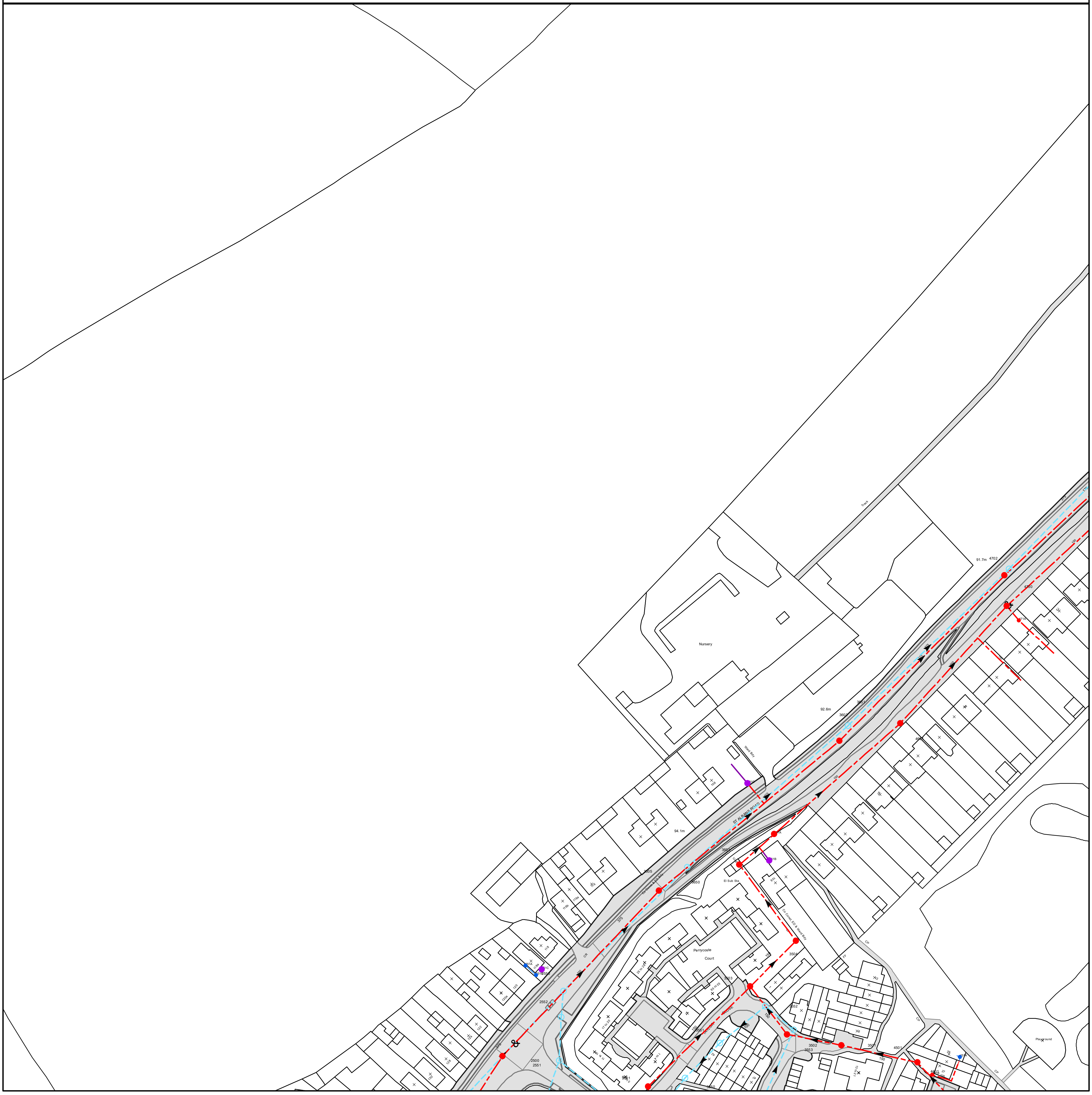
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
7500	110.33	108.87

REFERENCE	COVER LEVEL	INVERT LEVEL
7550	110.01	108.47

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



0 10 20 40 60 80
Meters

Scale: 1:1789
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Print Date: 20/10/2023
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Grid Reference: TL1609NW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
4501	104.6	102.67
2551	96.34	94.79
2501	100.37	97.95
3650	94.36	92.53
2552	95.45	94.67
4750	91.75	89.98
3501	102.75	100.45
3502	101.94	99.25
3504	99.97	96.9
3601	97.23	96.48
4601	96.25	94.78
3602	92.98	91.27
471A		
251B		
361B		
451B		

REFERENCE	COVER LEVEL	INVERT LEVEL
4702	91.82	90.09
2500	95.93	94.13
3550	100.49	97.79
3551		
2550	95.42	93.59
3505	94.57	92.83
3503	100.19	97.23
3553	101.76	99.64
3552	100.73	98.71
361A		
3651	92.84	91.03
4701	94.59	92.85
251A		
251C		
451A		
361C		

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified before any works are undertaken. Crown copyright Reserved

Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	514750,209250
Grid Reference:	TL1409SE

Comments:

ALS/ALS Standard/2023_4892519

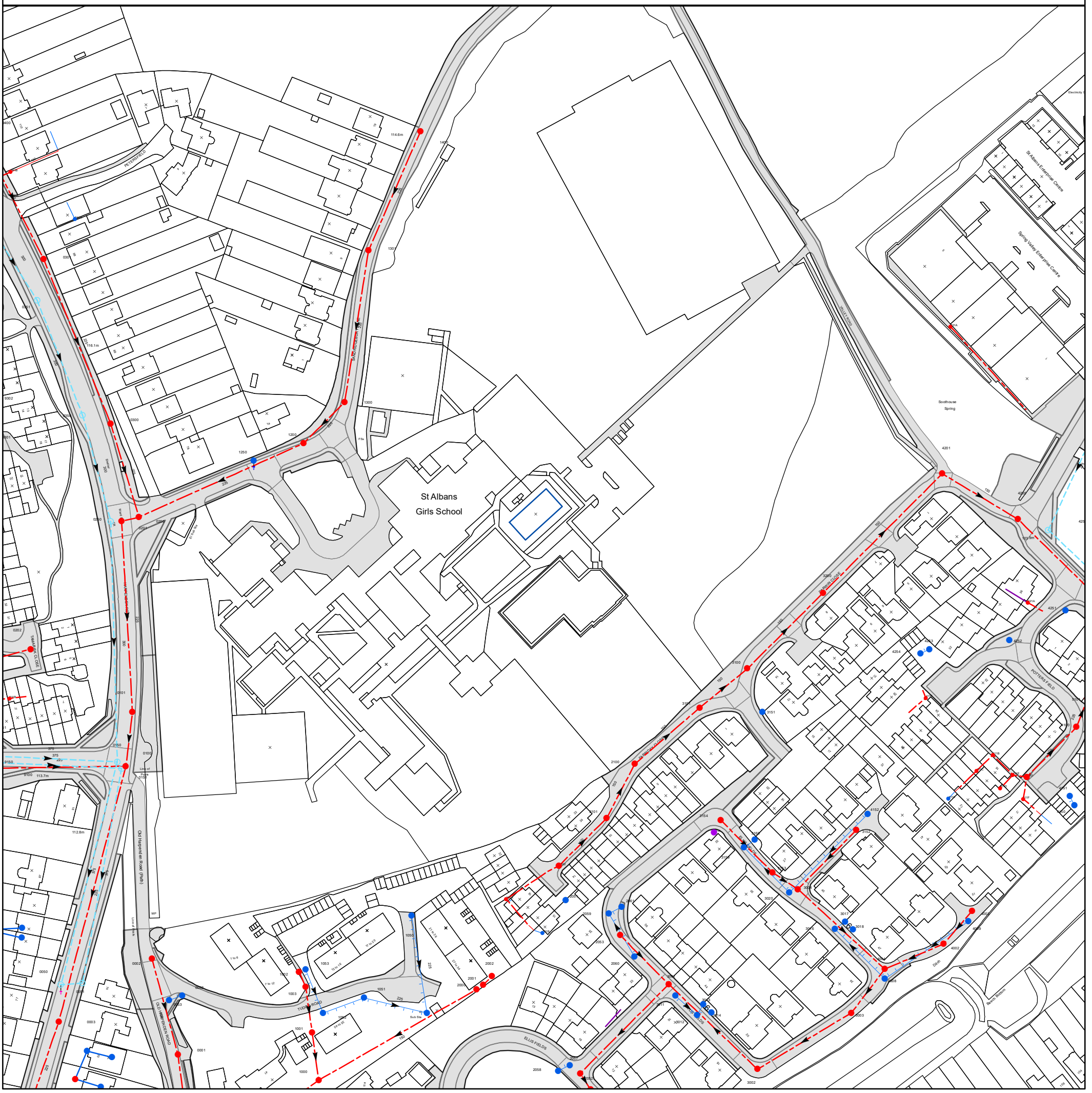
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
7250	120.42	
7300	122.22	120.38
5400	126.83	123.83
5051	118.45	116.77
5052	120.35	
5000	118.56	116.48
5100	123.96	121.67
6250	122.99	121.2
5300	125.78	122.97
7051	114.09	112.54
81AB		
9201	115.88	113.93
7050	114.39	112.26
81AC		
70AC		
91AD		
81BA		
9350	117.56	115.83
9300	117.54	114.61
9401	117.64	115.23
91AF		
9152	111.01	109.07
9101	112.27	110.24
91AC		
70AD		
9200	114.93	112.7
9450	117.69	116.11
9202	115.6	113.92
8450	120.28	118.82
8300	119.72	117.64
81AD		
9301	115.81	114.07
9302	116.22	114.5
9203	115.51	113.37
9100	111.6	108.56
831A		
7001	114.1	111.39
5150	123.96	122.21
9151	111.52	109.35
721A		
5450	126.82	125
6200	123.06	120.51
841B		
911A		
931B		
931C		
641B		
841D		
721C		
841E		
701B		
701D		
511A		
701F		
701G		
701J		
921A		

REFERENCE	COVER LEVEL	INVERT LEVEL
6001	112.38	110.19
7100	119.5	117.32
6350	123.47	121.99
6300	124.67	122.35
7350	122.16	120.68
5001	120.26	
6000	114.5	111.69
6051	114.47	
7150	119.43	117.7
8250	118.72	117.21
8350	119.78	118.29
6450	122.94	121.5
7000	114.42	111.08
8151	114.5	111.79
81AJ		
8200	118.09	115.82
8152	114.52	112.03
9451		
91AH		
81AI		
7400	120.47	118.37
8101	114.55	110.7
8451	117.95	116.59
70AB		
9250	114.93	113.18
91AE		
9251	115.6	114.26
7450		
8150	113.65	111.63
8000	107.71	105.35
9000	107.91	105.53
9102	112.51	110.55
9400	116.69	113.22
9303	116.64	114.9
9351		
8100	113.85	110.25
5350	125.75	124.08
91AG		
9103	111.06	108.71
541A		
9150	111.52	108.93
841A		
9001		
601A		
931A		
641A		
841C		
721B		
721D		
701A		
701C		
701E		
821A		
701I		
701H		
741A		

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



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Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515250,209250
Grid Reference:	TL1509SW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
3020		
4152		
0002	109.15	107.55
2052		
4002		
0201	115.48	
0101	114.49	
3101	111.41	108.31
3013		104.5
2053		
0003	108.93	
0001	107.51	
2059		
4200	104.71	102.29
09BH		
4151	103.32	102.28
3154		
0200	115.57	112.21
3011		
2060		
4253	104.94	103.87
4008		
4250	104.18	102.51
0202	113.21	111.45
00AF		
0350	115.78	114.08
00AE		
1003	112.69	110.34
1001	110.81	108.37
4003		
3159		
2057		
00BA		
0250	115.72	113.87
00AC		
4251		
2058	105.98	104.27
3014	105.33	104.25
3018	104.7	102.75
3151		
4254		
0150	113.26	
2101	111.32	109.14
1054		
3012		
2000	109.79	107.97
431A		
411C		
411B		
411E		
201A		
201B		
041B		

REFERENCE	COVER LEVEL	INVERT LEVEL
3003		
4100	102.96	101.96
1400	114.6	113.74
4201	106.68	104.68
0151	113.25	
0100	113.26	
0052	109.36	108.03
1250	116.36	
3152		
00BB		
0050	108.93	106.52
3016		
2002	109.75	108.05
3002		
1301	115.6	113.44
3017		103
3153		
3001		
0301	116.4	112.83
2100	111.6	108.85
3200	108.18	106.23
4004		
1000	110.3	106.86
0351	115.95	114.95
0051	109	
1050	113.25	112
1200	116.23	112.95
1053	112.68	111.15
4009		
2001	109.73	108.04
3100	110.57	107.74
1051	111.42	110.05
1300	116.06	113.07
0300	115.81	112.43
041A		
4150		
4252		
2051		
3160	107.68	103.8
2061	109.22	105.84
0053		
3004		
1002	112.92	110.52
421A		
1052	111.62	110.53
011B		
411A		
4101	103.58	102.13
411D		
411F		
2102	110.99	109.32
411F		
311A		

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

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Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515750,209250
Grid Reference:	TL1509SE

Comments:

ALS/ALS Standard/2023_4892519

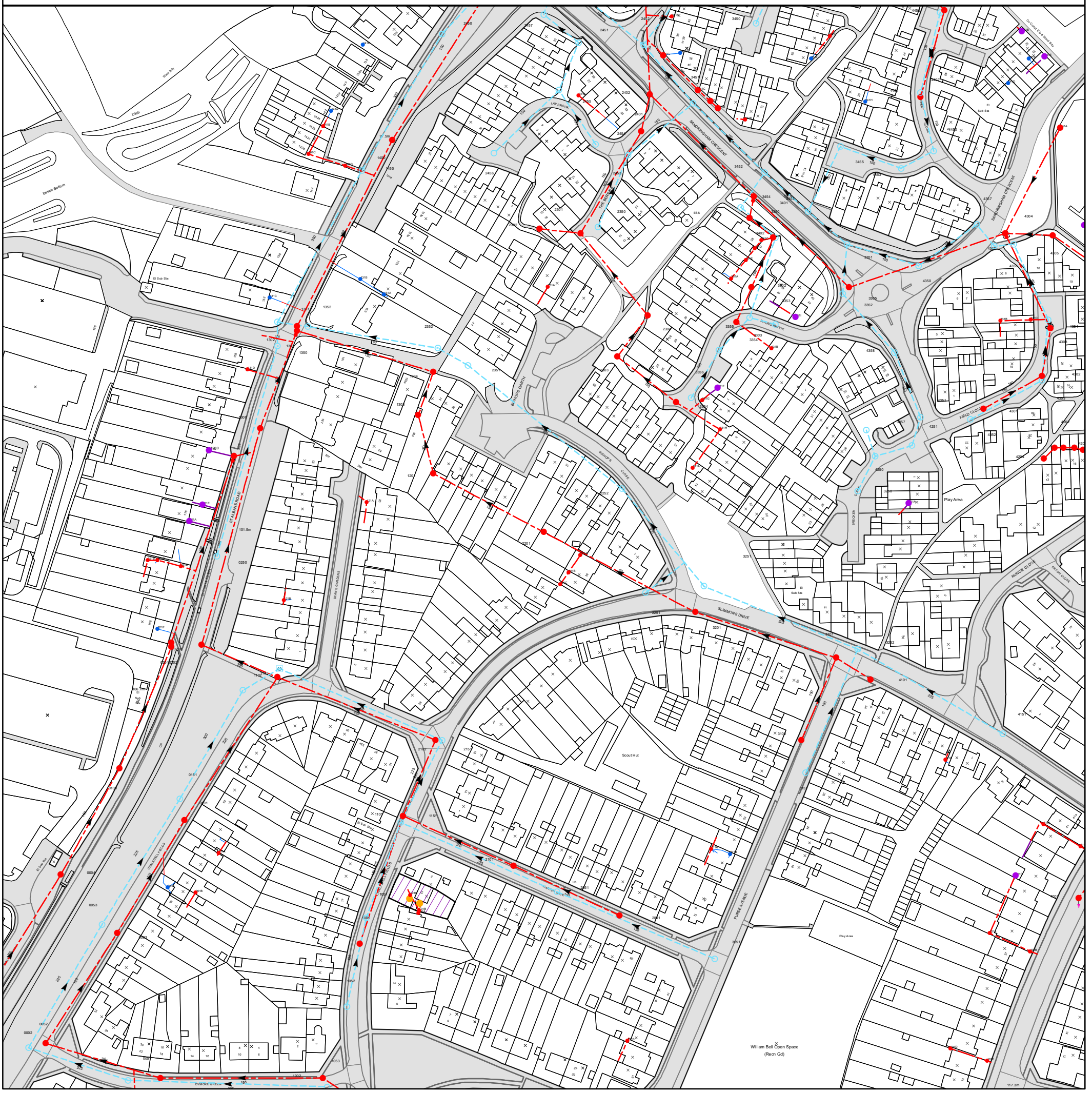
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
6054		
5203		
7152	108.48	
5100	102.77	101.31
8050	112.18	111.29
7400		
6152	103.12	
6450	108.98	107.5
7155	104.7	103.01
7202	104.31	102.8
7056	111.63	110.77
6100	104.12	101.8
7151	108.89	106.79
5002	103.92	101.85
5000	104.59	101.23
7052	110.79	108.71
7201	103.23	101.58
5400	112.76	111.25
5351	106.64	105.11
7252	102.98	101.98
7200	102.91	101.51
7055	111	109.85
5200	103.13	101.69
6401	109.4	107.65
5301	107.7	105.83
6153	103.4	101.75
5101	103.14	101.91
6400	108.54	106.43
7250	104.23	102.56
9055	112.4	111.73
9053	112.31	111.37
9054		
5202	103.32	101.83
6300		
5001	103.65	100.66
501F		
501B		
801A		
901B		
801C		
711A		
601E		
601F		

REFERENCE	COVER LEVEL	INVERT LEVEL
5051	103.6	101.33
5151	102.45	101.98
6051	104.3	103.12
6052	104.3	103.12
7051	108.62	106.88
7050	108.24	
6101	103.23	101.03
6155	102.58	101.89
5250	103.47	
7000	111.34	108.66
8051	110.92	107.93
7401		
7153	107.28	105.56
5201		
5350	107.39	105.91
7251	103.14	102.19
5153		
6053	103.76	102.6
6151	104.15	
7154	103.86	102.43
7001	108.23	105.44
6451	108.05	106.54
5300	107.57	105.54
5152	103.05	102.07
6103	102.79	101.26
6102	103.54	101.23
6154	102.73	101.81
8100	105.57	104.43
9050	112.37	111.64
9051	112.34	111.66
9056		
9052		
7053	111	110.23
501D		
501A		
501E		
501C		
801B		
901C		
9000	111.73	110.21
601D		
601C		

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



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Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	516250,209250
Grid Reference:	TL1609SW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
1153		
3454	106.01	102.48
4350	107.94	106.47
4402	106.69	105.32
4201	112.66	111.1
2454	101.7	100.18
2351	102.45	101.2
2101	113.09	111.38
2455	101.52	98.87
3051	116.16	114.97
3402	106.6	103.84
3401	104.4	101.42
2151	110.1	108.74
4151	116.08	114.28
0201	105.69	104.56
2302	102.41	100.77
2452	99.29	96.75
2304	105.35	102.88
0052	112.56	111.23
1304		
2453	102.73	100.24
3250	112.62	110.96
3355	107.53	106.12
0101	107.48	105.76
1300	99.74	98.09
3151	115.07	113.13
3352	107.49	105.74
0151	107.26	106.16
1053	114.22	113.47
1151	110.93	109.72
2252	108.12	106.27
1350	99.03	97.69
1200	101.19	98.69
4353	111.46	109.91
4204	112.65	111.38
3351	106.41	104.63
2303	105.77	104.21
2457	99.78	96.94
0053	109.89	108.63
3455	106.32	103.89
4303	110.78	109.31
4200	112.67	111.01
0004	109.53	108.17
2451	100.39	97.55
1001	111.33	109.51
3452	104.02	102.25
3350	107.23	103.93
4452	105.55	104.53
1302	98.95	96.53
0100	107.38	106.46
0250	101.19	99.42
3301	107.19	104.28
021D		
231A		
3303	107.38	105.31
4354	110.74	109.3
141A		
401B		
411A		
1101	111.03	108.6
4101	113.7	111.83
131A		
421A		
341A		
331C		
401E		
341B		
241A		
141B		
341J		
021B		
3305	107.26	105.19
121B		
311A		
131D		
331A	10	9.4
1301	98.89	96.49
141E		
431C		
331F		
321A		

REFERENCE	COVER LEVEL	INVERT LEVEL
3201	110.91	109.56
4251	112.03	110.06
4351		
4451	106.6	104.19
4001	117.29	113.76
2350	102.85	101.09
4202	112.63	111.14
2051	113.96	112.9
3450	102.84	100.95
3354	107.47	104.75
3302	107.42	104.86
4358		
2450	96.46	95.06
0202	105.82	104.66
2456	100.73	98.88
2402	102.23	99.38
2251	110.28	108.73
2401	100.81	98.32
1201	103.69	101.81
2102	110.18	108.22
3252	113.64	111.83
0002	112.33	110.67
3357	112.43	111.29
0200	102.92	100.9
3102	114.35	112.74
3453	105.2	103.34
4301	111.71	110.03
1002	114	111.86
3251	110.75	109.04
2001	115.2	112.56
1102	105.92	104.25
0001	114.05	111.24
1152	105.75	103.69
4302	111.49	109.63
3304	107.48	105.41
1352	99.05	98.17
2201	105.27	103.39
4352	111.68	110.51
3356	107.15	105.34
4250	112.12	110.67
4203	112.62	111.22
1052	112.19	110.69
3101	113.09	111.55
2301	102.52	100.42
1450	97.7	96.03
3353	108.96	105.41
2352		
4401	105.36	103.5
0003	109.97	108.15
0051	113.84	112.44
441B		
021C		
1351	98.98	
4450	107.66	104.06
1051	111.14	110.22
4453	107.23	103.92
401A		
401C		
411B		
3451	101.45	99.6
1303		
131B		
121A		
021A		
401D		
341D		
341C		
141D		
141C		
341H		
201B		
131C		
311B		
331B		
021E		
1400	97.43	95.64
331E		
431B		
331D		
331G		
331H		

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
4356	109.41	108.13
4304	109.33	106.32
4305	110.15	108.06
431A		
341I		
021F		
341M		
221A		
221C		
011A		
411D		
101C		
101A		
441D		

REFERENCE	COVER LEVEL	INVERT LEVEL
4357	109.16	107.62
4355	110.06	108.3
441A		
341K		
021G		
341L		
441C		
221B		
001A		
001B		
331I		
101B		
441E		

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519

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Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	514750,208750
Grid Reference:	TL1408NE

Comments:

ALS/ALS Standard/2023_4892519

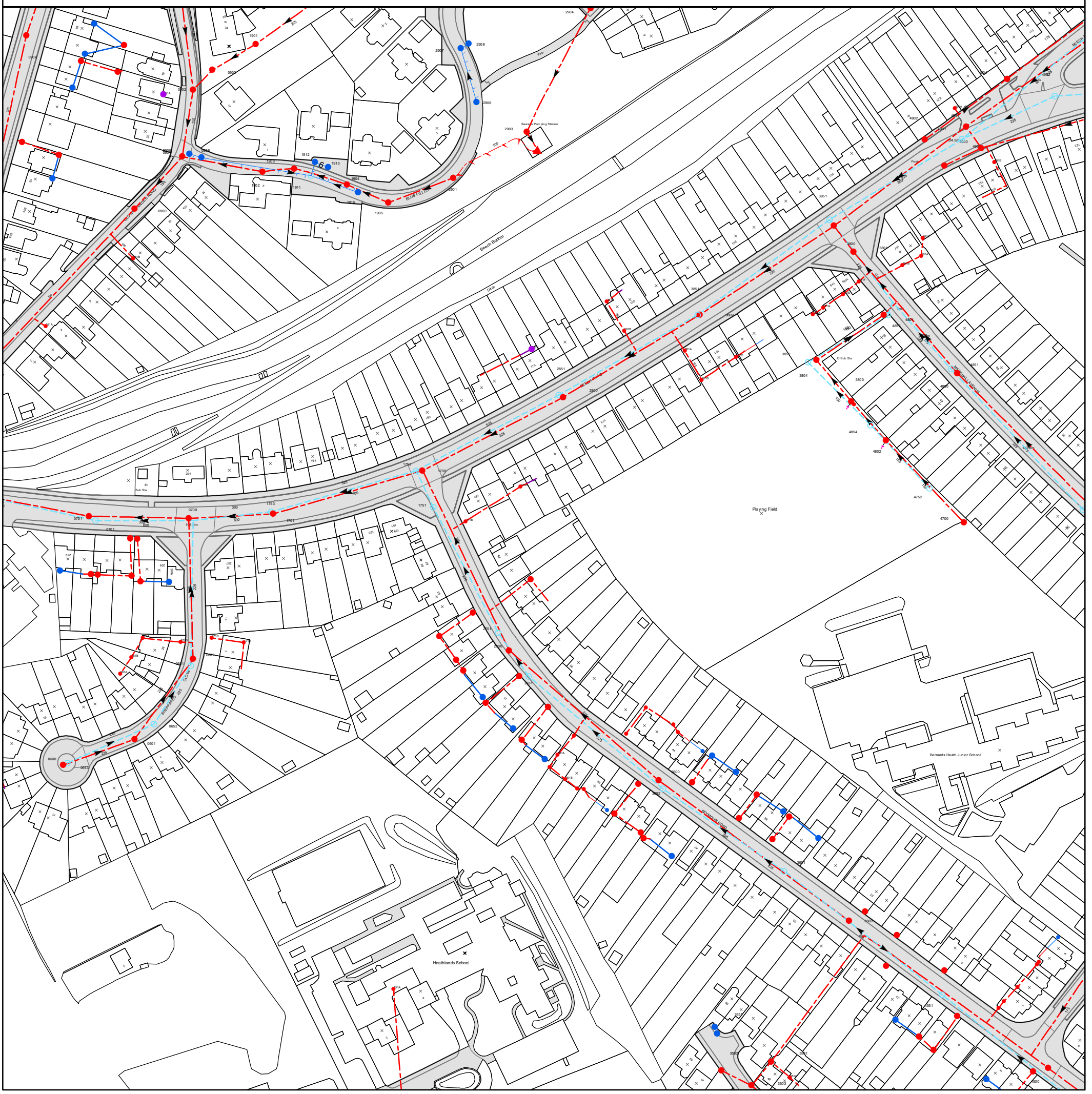
NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
6552	111.98	110.67
6901	109.93	108.34
55AC		
6902	111.79	109.54
56AB		
5851	107.05	104.38
5951		
57AE		
5552	109.75	106.45
7801	100.59	99.1
6500	113.24	110.91
7800	100.16	98.74
7700	99.46	95.88
5500	108.49	106.49
6800	107.38	103.52
6953	106.4	104.89
5800		
57AF		
6900	110.12	108.28
5651	101.19	100.51
7951	106.07	103.87
57AC		
9752	102.44	
98AB		
78AH		
8651	105.07	104.07
98BC		
8851	101.79	97.58
9751	102.18	97.78
7752	100.48	97.03
99BF		
9800	102.37	100.31
7952	105.8	103.83
99AI		
78AD		
7900	105.94	103.39
88AB		
9951	103.94	101.95
8750	101.13	99.72
891A		
5751	97.61	94.92
6502	105.31	102.9
98BD		
6651	101.48	99.29
6951	111.63	109.44
9651	104.98	103.6
891B		
891E		
99BH		
57AD		
751A		
981A		
781A		
78BJ		
77AB		
78CA		
561A		
651A		
561B		
661A		
981B		
98AG		
791A		
98AI		
88BA		
88BG		
88AI		
781B		
561C		
871A		
881C		
891I		
971B		
971C		
961B		
961C		
561D		

REFERENCE	COVER LEVEL	INVERT LEVEL
6700	98.43	94.97
6904	106.4	104.31
57BE		
5700	97.17	93.86
57AG		
5501	109.4	104.87
6501	111.61	109.74
6600	101.43	99.26
57BD		
6553	113.55	111.69
5551	108.91	107.57
7802	102.67	101.5
7751	99.46	96.6
6903	111.91	109.79
6952	109.67	108.08
57CC		
57CD		
57BB		
5502		
6551	105.73	103.97
55AD		
99BA		
99AJ		
7953	108.01	106.4
78AF		
9753	102.15	99.96
98AC		
9701	103.24	101.34
7701		
99BE		
9851	102.86	100.2
9702	102.73	
8800	101.89	97.07
9700	102.06	100.31
9900	104.07	
78AC		
7901	105.76	103.08
9852		
99BG		
8951	105.07	102.88
57CA		
99AH		
7902	106.67	104.37
9754	103.24	102.18
8900	104.91	102.06
57CB		
891D		
57AB		
88BH		
751B		
751C		
971A		
78AE		
78BI		
7702	100	98.15
78AG		
891G		
651B		
681A		
99AD		
981C		
98AH		
981D		
881A		
88AJ		
88BJ		
88BI		
7803	100.86	99.31
57BC		
881B		
891H		
891C		
981E		
061C		
961A		
561E		

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

ALS/ALS Standard/2023_4892519



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Scale:	1:1789
Width:	500m
Printed By:	ASuji
Print Date:	20/10/2023
Map Centre:	515250,208750
Grid Reference:	TL1508NW

Comments:

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
1911		
26DC		
35AG		
26AI		
4800	108.92	107.03
0906		
1752	104.82	
27AC		
1753	104.12	98.9
2651	110.73	109.29
2904		
45AF		
09BD		
0601	107.22	105.05
07BC		
0700	103.76	97.93
3802	105.4	99.08
1901	108.46	
2907		
3852		
09BJ		
1905		
45AJ		
1903		
26EB		
45BC		
36BC		
07BD		
07BE		
3803	107.92	106.17
3501	122.34	120.65
07AJ		
45CD		
36BI		
4802	109.57	108.45
0602	105.41	103.25
09BI		
3951	105.15	
4500	122.47	119.77
09AF		
09BC		
4903	104.64	99.78
2851	105.07	99.33
26BB		
4900	104.64	101.84
45CE		
1751	105.27	103.29
2906		
36BD		
2800	105.12	
4751	114.98	113.23
09CA		
0904	106.09	
0600	108.33	106.55
1913	105.06	102.75
26CG		
3800	105.17	99.47
45AB		
36BB		
45BB		
3552		
4902	104.49	102.93
351A		
381B		
061B		
071A		
4854		
2901		
3651	120.36	118.21
281A		
081A		
481B		
091A		
381D		
381F		
271B		
261A		
26BJ		
26CA		
151A		
45DC		

REFERENCE	COVER LEVEL	INVERT LEVEL
2700	109.68	107.45
36AF		
4752		
26BA		
0701	103.15	97.84
0652	107.21	105.47
26CH		
45BA		
2903		
2752		
4551	122.33	120
4901	104.55	102.98
07BA		
0900	103.61	102.13
0901	104.51	103.04
0905		
09AH		
26CI		
3851	105.35	
3801	105.5	103.04
07BG		
4853		
45BH		
26DJ		
4851	108.76	107.15
36CA		
4952	104	100.7
09BB		
3500	121.67	120.43
1700	104.9	98.42
36AG		
36DD		
3502	122.44	121.38
3804	106.8	105.72
0651	105.55	103.74
0902	105.45	103.91
36AE		
1902		
0653	108.29	106.78
09AG		
3600	116.61	114.54
1912		103.04
1915		
3652	116.73	115.09
36BJ		
26BC		
27AB		
26DD		
3503	122.69	121.22
4700		
0903	107.93	
1904		
1701	104.13	98.1
07BF		
2908	105.36	103.86
3551	122.2	121.02
26DE		
4951	104.55	
2751	108.87	107.26
26EA		
4904	104.85	102.21
491A		
381A		
381C		
061A		
071B		
07BB		
0751	103.14	
4801	106.81	105.42
281B		
481A		
481C		
491B		
381E		
381G		
261B		
26CD		
26CC		
26CB		
45DD		
45DB		

ALS/ALS Standard/2023_4892519

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
45CI		
45DA		
26AB		
36CG		
081B		
281C		
071C		

REFERENCE	COVER LEVEL	INVERT LEVEL
45CJ		
26AC		
36CI		
36CF		
271A		
171A		

Asset Location Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

A feature in a sewer that changes or divects the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Inlet
- Outfall
- Undefined End

Other Symbols

Symbols used on maps which do not fall under other general categories.

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Casement — Ducts may contain high voltage cables. Please check with Thames Water.
- Conduit Bridge
- Subway
- Tunnel

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement.

If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

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2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment within 14 days of the date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service or will be held to be invalid.
4. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
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Appendix D Proposed Landscape Framework Plan

HERTFORDSHIRE WAY

HERTFORDSHIRE WAY

RAILWAY LINE

RELOCATED OLD ALBANIAN SPORTS PITCHES

SANDRIDGEBURY LANE

PROPOSED SEWELL PARK DEVELOPMENT

HARPENDEN ROAD

NEW GREENS AVENUE

CARNEGIE ROAD

PARTRIDGE ROAD

HIGH OAKS

GREEN LANE

HARPENDEN ROAD

VALLEY ROAD

VALLEY ROAD

Legend

- Site Boundary
- Existing trees and hedgerow
- Existing trees to be removed
- Existing trees root protection area (For further details, please see tree survey)

Hard Landscape Proposals

- Standard road surface
- Built form
- Existing private road
- Pedestrian priority, footpath/plaza
- Segregated cycle route

Soft Landscape Proposals

- Woodland planting
- Native shrub/scrub planting
- Wildflower/meadow
- Amenity mown grass
- Semi native ground cover planting mix
- Attenuation - See PJA drainage strategy drawings for more information
- Street trees and parkland specimens
- Native tree and shrub specimen planting
- Fruiting tree specimens
- Native hedgerow

Other

- Play Areas - NEAP, LEAP and LAP *with required buffer zone from dwellings and walking distances, as per FiT guidance*

Define.

B Plan amended to reflect HLM comments 03.12.24

SCALE 1:2500

0m 20 50 100

Scale	1:2,500@A1
Date	03/12/2024
Drawn By	KE
Revision	B

Client	Hallam Land Management Limited
Project	Woollam Park, North St Albans
Title	Landscape Framework Plan
Ref.	DE_565_102

Appendix E Pre-Application Correspondence

From:	Chalk, Laurence
To:	Samantha Furey; Charlotte Turner
Cc:	Rumble, John; Marsili, Alessandro; Planning
Subject:	RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration
Date:	19 June 2024 16:36:30
Attachments:	image001.png image002.png image004.png image006.png image007.png image008.png image009.png image011.png

Good Afternoon Samantha and Charlotte,

We appreciate you getting in contact with us.

Due to the location of the proposal outside of SPZ2, we would have no particular requirements to advise on from our own water abstraction for supply perspective. We would only recommend best practice to protect the water quality in the environment and suggest you contact the Environment Agency for further advise and specifications on this, if you haven't done so already.

Thank you again for checking.

Kind regards

Laurence Chalk
Catchment Adviser
Catchment Management

Affinity Water Limited
Tamblin Way, Hatfield, Hertfordshire AL10 9EZ
Email: laurence.chalk@affinitywater.co.uk
For Catchment Management: catchmentmanagment@affinitywater.co.uk
For Planning Applications: planning@affinitywater.co.uk
www.affinitywater.co.uk || www.facebook.com/affinitywater || www.twitter.com/affinitywater || www.linkedin.com/company/affinity-water

From: Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>
Sent: Wednesday, June 19, 2024 4:25 PM
To: Chalk, Laurence <Laurence.Chalk@affinitywater.co.uk>; Planning <planning@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>; Rigby, Alex <alex.rigby@affinitywater.co.uk>; Rumble, John <john.rumble@affinitywater.co.uk>
Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

@Chalk, Laurence,

As discussed

From: Samantha Furey <samantha.furey@pja.co.uk>
Sent: Wednesday, June 19, 2024 4:23 PM
To: Charlotte Turner <Charlotte.turner@pja.co.uk>; Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>;

Planning <planning@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>; Rigby, Alex <alex.rigby@affinitywater.co.uk>; Rumble, John <john.rumble@affinitywater.co.uk>
Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Good afternoon,

Would you be able to advise when this request will be investigated as we would be grateful if a response could be provided as soon as possible.

If you have any queries, please do not hesitate to contact me.

Best wishes,
Samantha

PJA
transport • engineering • placemaking

Samantha Furey
Senior Engineer
T. 0121 387 4004
Park Point, High Street, Longbridge, Birmingham, B31 2UQ, UK
www.pja.co.uk

From: Charlotte Turner <Charlotte.turner@pja.co.uk>
Sent: Thursday, June 6, 2024 8:20 AM
To: Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>; Planning <planning@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>; Rigby, Alex <alex.rigby@affinitywater.co.uk>; Rumble, John <john.rumble@affinitywater.co.uk>; Samantha Furey <samantha.furey@pja.co.uk>
Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Hi Alessandro,

Thank you very much for passing our query onto the planning team.

Would you be able to advise when this request will be investigated as we would be grateful if a response could be provided as soon as possible.

If you have any queries, please do not hesitate to contact me.

Kind regards,

Charlotte Turner

PJA
transport • engineering • placemaking

Charlotte Turner
Flood Risk & Drainage Engineer
T. 0121 387 7923
Park Point, High Street, Longbridge, Birmingham, B31 2UQ, UK
www.pja.co.uk

From: Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>
Sent: Tuesday, May 28, 2024 7:12 AM
To: Charlotte Turner <Charlotte.turner@pja.co.uk>; Planning <planning@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>; Rigby, Alex <alex.rigby@affinitywater.co.uk>; Rumble, John <john.rumble@affinitywater.co.uk>

Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Hello Charlotte,

Thank you for reaching us regarding the proposal to infiltrate (via soakaway?) surface water in the detailed development. I cc the planning team who will advise about the condition for infiltrations.

Kind regards

Alessandro Marsili
MSc FGS CGeol
Senior Asset Manager – Hydrogeology Team
Asset Strategy and Capital Delivery Directorate

Affinity Water Limited
Registered Office Tamblin Way, Hatfield, Herts, AL10 9EZ
m +44 (0)7557 579431
alessandro.marsili@affinitywater.co.uk
www.affinitywater.co.uk

From: Asset Information Team Mailbox <ait@affinitywater.co.uk>
Sent: Friday, May 24, 2024 1:30 PM
To: Marsili, Alessandro <Alessandro.Marsili@affinitywater.co.uk>; Pagonas, Michail <michail.pagonas@affinitywater.co.uk>
Cc: Asset Information Team Mailbox <ait@affinitywater.co.uk>
Subject: RE: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Hi Alessandro & Michail,

Is this enquiry from PJA re groundwater protection something you could take on and reply to please?

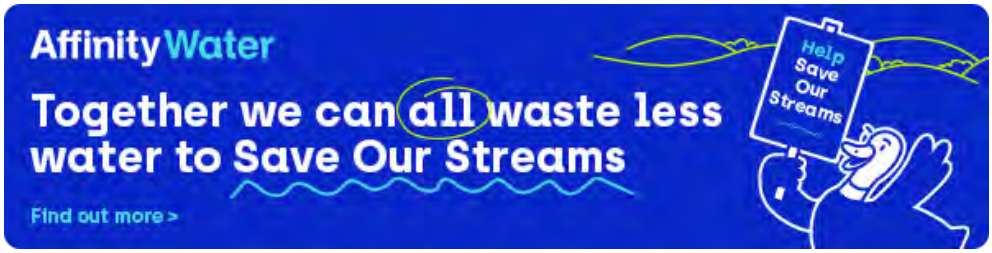
Or should it go to the Planning Team and then to Catchment Protection to respond to? Thanks.

Regards

Alex Rigby
Asset Manager GIS
Asset Information Team

Affinity Water Limited
Tamblin Way, Hatfield, Hertfordshire AL10 9EZ
Mobile: 07725 069389

Email: alex.rigby@affinitywater.co.uk www.affinitywater.co.uk || www.facebook.com/affinitywater || www.twitter.com/affinitywater || www.linkedin.com/company/affinity-water



From: Development Experience (inbox) <dx@affinitywater.co.uk>
Sent: Friday, May 24, 2024 12:04 PM
To: Asset Information Team Mailbox <ait@affinitywater.co.uk>
Cc: Development Experience (inbox) <dx@affinitywater.co.uk>
Subject: FW: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Good morning, Asset Management team,

Please could you assist with a response to the email below?

I'm not certain if this needs to be addressed to Thames Water for surface water infiltration.

Kind Regards

Maya Fernandes

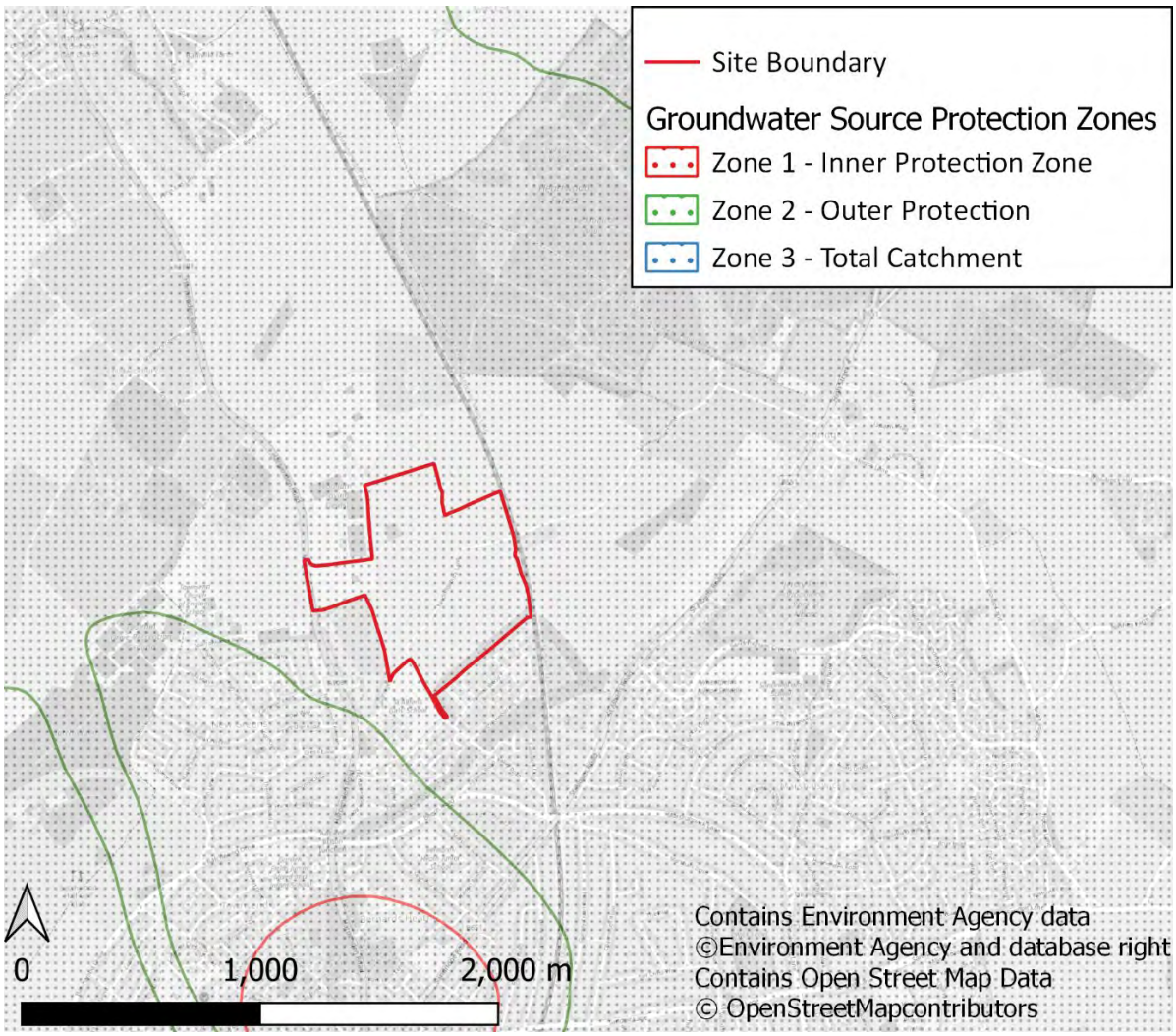
Contact Centre Support Agent
Development Experience

_____
Affinity Water Limited
Tamblin Way, Hatfield, Hertfordshire AL10 9EZ
Tel: 03453 572 428
Email: dx@affinitywater.co.uk
www.affinitywater.co.uk | | www.facebook.com/affinitywater | | www.twitter.com/affinitywater | | www.linkedin.com/company/affinity-water

From: Charlotte Turner <Charlotte.turner@pja.co.uk>
Sent: Thursday, May 23, 2024 4:03 PM
To: Development Experience (inbox) <dx@affinitywater.co.uk>
Cc: Samantha Furey <samantha.furey@pja.co.uk>
Subject: [PJA: 05920] - Information Request - Water Extraction and Infiltration

Hello,

PJA have been appointed to provide flood risk and drainage advice in relation to a development at St Albans. OS Co-ordinates: 515288 , 209785. Please find a Site Location Plan below:



It is our understanding that the Site is situated within Zone 3 – Total Catchment, assumed to be associated with the Principal Aquifer underlying the Site within the bedrock geology.

Infiltration testing in accordance with BRE Digest 365 Design Guidance has been undertaken at the Site, demonstrating that surface water attenuated on-Site could be discharged via infiltration methods. As the Site is situated within a source protection zone, we would be grateful if Affinity Water could advise on the level of treatment required to the attenuated surface water on-Site before discharging via infiltration.

Furthermore, it is our understanding that Affinity Water currently extract water from the Principal Aquifer underlying the Site. As such, we would welcome any additional thoughts or comments you may have in relation to surface water discharging from the Site via infiltration.

If you have any queries, please do not hesitate to contact me.

Kind regards,

Charlotte Turner

Charlotte Turner
Flood Risk & Drainage Engineer
T. 0121 387 7923
Park Point, High Street, Longbridge, Birmingham, B31 2UQ, UK
www.pja.co.uk

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Hertfordshire

Samantha Furey – PJA
Park Point
17 High Street
Birmingham
B31 2UQ

Lead Local Flood Authority
Post Point CHN 215
Hertfordshire County Council
County Hall, Pegs Lane
HERTFORD SG13 8DN
www.hertfordshire.gov.uk

Contact Flood Risk Management Team
Email FRMConsultations@hertfordshire.gov.uk

Date 20 August 2024

Dear Ms Furey,

PRE/2024/SADC/02 – Land North of St Albans (Woollam Park), East of Harpenden Road, St Albans

Thank you for your request for pre application advice, received 24 June 2024, relating to the proposed development of around 1000 dwellings on Greenfield Land to the North of St Albans.

We would like to offer some guidance in relation to the flood risk and surface water drainage that may concern the proposed site.

- The site is at high flood risk from surface water in the high-risk scenario (more than 3.33% chance of flooding each year) showing 30cm-90cm of flooding from two distinct surface water flow paths travelling west to east (see Figure 1). It is unknown if there is a risk of groundwater flooding. We assume that a sequential test has been undertaken at this location that considers all sources of flooding.
- We expect the application to provide a suitable Flood Risk Assessment, in proportion to the risks of flooding at this location. The FRA will be required to include surface water flow path modelling to inform development areas available and how the drainage strategy should be developed. Groundwater monitoring (at least covering February, March and April) and overview of the long-term regional groundwater level maximum should be included in an FRA. The FRA should also consider the drainage from the railway line, whilst on an embankment, a drainage channel may exist along the toe of it. The existing roads should be considered at 100% impermeable area and assume to have no drainage, in a surface water model, to show if this creates its own flood risk.
- The current outline drainage strategy for the surface water runoff from the proposed development (Technical Note dated 31 May 2024), identifies the surface water flow

path but does not include the risk of flooding into the drainage strategy for the development of the site. The SuDS discharge hierarchy must be explored fully, and an evidenced sustainable drainage solution provided. Shallow infiltration must be explored first over proposed deep infiltration systems. An assessment of ground stability and potential subsidence may also need to be required, although the Local Planning Authority would need to have a specific professional to assess any potential solution features and subsidence (the LLFA cannot technically assess this issue). Any deep infiltration boreholes must be assessed to make sure they will not create an artificial spring line further downgradient in the site.

Figure 1: Overlay of the development preliminary surface water drainage strategy (May 2024) and the long term risk from surface water flooding (Environment Agency).

- We are aware that the site to the west of this one is yet to be completed but has planning permission to manage the surface water flow path through the site and exiting onto this application site boundary at the same location as shown on the Environment Agency Surface Water Flood Risk Map. It should be noted that the 0.1% AEP flood outline is a proxy for the 1% plus 40% climate change flood outline until site specific modelling is provided. All development must be removed from the areas at risk of flooding and safe access and egress provided at all design flood events, to show how the development will be safe for its lifetime. This may include assessment of how proposals will not increase the number of people living and working in areas of

flood risk and if there is any additional burden placed on the emergency services (see www.adeptnet.org.uk for guidance on development, flood risk and the emergency services).

- The development access roads will need to be located outside any flood extent and where this is not possible, it will need to be demonstrated in accordance with the flood risk assessment guidance for new developments and the hazard calculations in FD2320. (NPPF PPG Paragraph 005). If roads or footways are crossing or located with the flow paths or crossing watercourses, it will need to be demonstrated that these will not increase food risk to the site itself or the surrounding area through the loss of flood storage or through causing a blockage to the flow of surface water across the site or within the channel.
- The drainage strategy and the type / location of SuDS should be considered at an early stage of the planning process and included in any urban spatial typologies that may be developed (e.g., inclusion of enhanced tree pits). The drainage system is expected to comply with the four pillars of sustainable urban drainage systems (SuDS) of Water Quality, Water Quantity, Amenity and Biodiversity.
- We understand that infiltration testing has been undertaken in 2018 and the results are variable across the site. Whilst one location has been proven to infiltrate well (SK106), the use of one trial pit result to BRE365 standard must be expanded to locations needed for infiltration structures (at the proposed location and depth of the structures).
- If the intention is to manage all surface water flow paths within the site drainage infrastructure, then modelling of the proposed drainage network must be sized accordingly to accept the volume of water from the whole offsite catchment (even at an outline planning stage). If the flow paths are to be managed separately, then evidence must be provided to show how it will be avoided in the first instance and development kept out of these areas. Development must be shown to be safe for its lifetime.
- The site is in the Environment Agency Source Protection Zones III, Total Catchment. The regulations of the Source Protection Zone (SPZ III) is required to be considered in the proposed drainage for the site and additional treatment steps be implemented where necessary (refer to the EA guidance if required). This would include how unknown pollution potential from off-site runoff may need to be treated. Accepting runoff generated offsite may affect the adopting bodies of the SuDS. This should be explored at an early stage.
- We would expect that investigation into infiltration to be undertaken in accordance with the BRE 365 methods (or equivalent) as not all the previous tests were undertaken to this standard. The worst infiltration rate calculated must be used in all drainage supporting calculations. Groundwater monitoring will be required to demonstrate the seasonally high groundwater level in the area and at least 1m of unsaturated zone be provided to the base of the infiltration structure.
- If infiltration is not favourable or there is high groundwater levels, the submitted surface water drainage discharge should not exceed the predevelopment greenfield

QBAR rate for all storms (or provide a complex control with long term storage). It should be noted that we do not see another possible discharge location as there are no ordinary watercourses or surface water sewers downgradient of this site. Source control SuDS must be included in any drainage design to limit the reliance on regional attenuation / infiltration basins.

- A detailed surface water drainage assessment should be carried out to demonstrate that the proposed development will not create an increased risk of flooding from surface water to the development site and surrounding area for the critical storm up to and including the 1% AEP plus climate change event. This should be done in accordance with the national Planning Policy Framework (NPPF) and Planning Policy Guidelines (PPG) along with the Hertfordshire LLFA guidance.
- 1% AEP rainfall events plus climate change shall not leave the application boundary or flood any part of a building, utility plant susceptible to water within the development boundary.
- 3.33 % AEP rainfall event plus climate change shall not flood outside the drainage network which is designed to hold water.
- FEH rainfall data should be used in calculations and CV values of 1 should be applied. Urban creep should be applied to storage volume calculations where applicable.
- The site is located within the Upper and Bedford Ouse Management Catchments Environment Agency Climate Change Allowances) and therefore the Peak rainfall allowances that should be used for the 1 in 30 (3.33%) and the 1 in 100(1% AEP) are 35% and 40% retrospectively.
- Exceedance flow paths need to be submitted as part of the application and these should take into consideration the layout of the development and any ground levels to ensure these events are safely managed and minimise impacts for flooding.
- It appears that this large site will be phased, it should be made clear how phasing would work alongside any drainage strategy, i.e. each phase must be able to connect to the drainage outfall and each parcel have its own drainage layout / strategy that can be completed independently from each other. The proposal must include source control rather than propose a single regional sized attenuation structure. Temporary flow controls may be required alongside other temporary measures during the duration of the build out. A temporary drainage strategy should be included in any masterplan of the site.
- The school site may not be developed by the same team as the rest of the site. Allowance must be made for the school site to connect to the wider drainage network and have a positive drainage outfall from the site if infiltration is not proven to be possible within the school outline boundary. The school site must also be shown that above ground SuDS can be incorporated but still provide essential educational needs e.g. play space. Source control and multifunction SuDS such as permeable surfaces may need to be included.
- We would highlight that the greenfield runoff rates that have been provided rely on a user defined BFI value. As the area is likely to be groundwater dominated, we would

request how this value (0.6) has been derived. QBAR of 1.7l/s/ha may need to be reduced down as far as 1/l/s/ha in line with the SUDS Manual guidance.

- Management and Maintenance easements should be included on all SuDS features – an overview of the land take required to provide maintenance access should be considered at an outline stage (e.g. maintenance strips around ponds).

Informative

For further advice on what we expect to be contained within the FRA to support an planning application, please refer to our information and checklists on our website https://www.hertfordshire.gov.uk/services/recycling-waste-and-environment/water/surface-water-drainage/surface-water-drainage.aspx This link also includes HCC's policies on SuDS in Hertfordshire.

The summary above contains a note of the issues discussed at the pre app / urban design meeting with the LPA / LLFA and applicant on the 20 August 2024. If there is further information or meetings required please contact the Flood Risk Management Team. We would welcome the LPA's suggestion of including SuDS land requirements, for e.g. swales along roads, on parameter plans.

This pre application advice will only be valid for 12 months or unless there is a major update of policy, guidance or technical standards during that time.

Yours sincerely,

Elaine

Elaine Simpson

SuDS and Watercourses Support Officer
Growth and Environment

Annex

The following documents have been reviewed, which have been submitted to support the application;

- Technical Note – Preliminary Surface Water Drainage Strategy for the proposed development at Land North of St Albans, Harpenden Road, prepared by PJA, 31 May 2024, REF 05920-P0-SF-AC version P0.
- Drawing: Local Centre Location Options including the preferred option
- Document: Woollam Park Spatial Typologies
- Drawing: Placemaking Plan – dated 15 August 2024 (by Define reference: DE-565_029)
- Drawing: Tree Hedgerow Plan - dated 15 August 2024 (by Define reference: DE-565_L_400)
- Drawing: Landscape Framework and Illustrative Site Sections (By Define reference: DE_565_NSA_L_100 to 104.

From:	NET Enquiries
To:	Charlotte Turner
Subject:	HNL 363800 JH - RE: 240603/msr05 - [PJA: 05920] - Groundwater Source Protection Zone and Aquifer Information Request
Date:	20 June 2024 15:34:45

Dear Charlotte,

Enquiry regarding: [PJA: 05920] - Groundwater Source Protection Zone and Aquifer Information

Thank you for your enquiry which was received on 23 May 2024.

We respond to requests for information that we hold under the Freedom of Information Act 2000 (FOIA) and Environmental Information Regulations 2004 (EIR).

Please find below our technical teams response:

You have correctly identified that the site is located within groundwater source protection zone 3 (SPZ3) and that it is underlain by the Chalk Principal Aquifer. SPZ3, also referred to as “total catchment” is the area around abstraction points where it is presumed that infiltrated water will ultimately end up at the abstraction. More information about source protection zones can be found:

Groundwater source protection zones (SPZs) - GOV.UK (www.gov.uk)

The SPZ are periodically updated and the current SPZ mapping can be found on the DEFRA Magic website:

Magic Map Application (defra.gov.uk)

The SPZ mapping and drinking water safeguard zones can be found under: Designations -> land-based designations -> non-statutory

With respect to the infiltration of surface water at this location. We note that no details regarding the development or the site history have been provided, the soil horizon where the infiltration tests were conducted, or what form of infiltration the applicant had in mind so, we can only provide general guidance. But assuming that the surface water is predominantly rainfall draining from roofs and areas of hardstanding, and that the site does not have a history of contaminative land use, we would not object to proposals for surface water infiltration at this location assuming the following:

- Infiltration sustainable drainage systems (SuDS) are suitably designed.
- Infiltration SuDS meet the Governments non-statutory technical guidance for SuDS Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (publishing.service.gov.uk). The CIRIA SuDS manual is (C753) is also a useful resource and is available Item Detail (ciria.org)
- The surface water drainage scheme incorporates a SuDS management treatment train - that is, use drainage components in series to achieve a robust surface water management system that does not pose an unacceptable risk of pollution to groundwater
- The surface water is from areas where no potentially contaminative activities have occurred and is free from hazardous substances as per the current JAGDAG list

of confirmed hazardous substances to groundwater (2018 01 31 Confirmed hazardous substances list_0.pdf (wfduk.org)). Please note that surface water discharges from heavily trafficked areas and areas where vehicles are stored may contain hazardous substances and the expectation is that the SuDS scheme for the site will incorporate pollution control features that would prevent hazardous contaminants entering the infiltration point (see bullet point above).

- **The discharge point cannot be direct to groundwater** (i.e. via a borehole that penetrates to water table). The applicant will need to provide confidence that the infiltration point has been designed to be as shallow as possible to retain the beneficial filtration effects of soils in the unsaturated zone above the permanent water table.

Given that the above can be satisfied we do not feel that an environmental permit for infiltration of surface water would be required at this location.

We do note that the geological mapping for the area (available GeoIndex - British Geological Survey (bgs.ac.uk)) indicates the potential for "clay with flints" beneath the site that may prevent the use of some forms of infiltration drainage. Please note our final bullet point above – if a borehole soakaway is to be proposed it cannot penetrate the water table and the applicant must ensure that infiltration point is as shallow as possible and that pollution at the water table cannot occur.

Please refer to the Open Government Licence which explains the permitted use of this information.

Most of our data is being made available to the public via the Defra Data Services Platform. You will need to register to obtain access.
If you are not satisfied you can contact us within 2 calendar months to ask for our decision to be reviewed.
If you require any further assistance please contact me.
Kind regards

James Hammett
Customers and Engagement Officer
Direct dial 0203 0259058 / 9210
Mobile 07769 365347
Direct email HNLenquiries@environment-agency.gov.uk

Address: Environment Agency, Hertfordshire and North London
Alchemy, Bessemer Road, Welwyn Garden City, Hertfordshire, AL7 1HE

Pronouns: he/him/his (why is this here?)

From:	NET Enquiries
To:	Charlotte Turner
Subject:	HNL343550/AS - [PJA: 05920] - St Albans Product 4 Request TL 15256 09761
Date:	24 January 2024 13:27:21
Attachments:	image014.png image016.png image017.png image018.png image019.png

---

Dear Charlotte

Thank you for your enquiry which was received on 16 January 2024.

Please note that this information is already freely available online at the links below.

The information on Flood Zones in the area relating to site in St Albans at NGR 515256,209761 is as follows:

The property is in an area located within Flood Zone 1 shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named site is in and is not specific to the property/proposed development itself.

Because this site does not fall within an area at risk of flooding from rivers or the sea, we do not hold any detailed flood modelling data that would impact your site. As such we are unable to provide a flood risk product.

This address is within an area at High risk of surface water flooding.

Following the Flood and Water Management Act 2010, Lead Local Flood Authorities are responsible for the management of groundwater and surface water flooding. They also maintain a register of property flooding incidents. You may want to seek further advice from the Lead Local Flood Authority Hertfordshire County Council, who may have further information.

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments

https://www.gov.uk/planning-applications-assessing-flood-risk
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

You can also view and print surface water flood maps online at:
http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=ufmfsw#x=357683&y=355134&scale=2

Here is the link to the climate change allowances:
https://www.gov.uk/government/publications/peak-river-flow-climate-change-allowances-by-management-catchment

This information is provided subject to the Open Government Licence, which you

should read.

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

Data Available Online

Many of our flood datasets are available online:

- **You can view and download flood risk maps from our website at:** http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=357683&y=355134&scale=2

- **Flood Map For Planning** (Flood Zone 2, Flood Zone 3, Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)

- Here is the link to the climate change allowances: https://www.gov.uk/government/publications/peak-river-flow-climate-change-allowances-by-management-catchment
- Risk of Flooding from Rivers and Sea

- Historic Flood Map

- Assets and Defences

- Current Flood Warnings

- Open data

- Groundwater data Hydrology Data Explorer

- Reservoir flood risk Reservoir flood maps: when and how to use them - GOV.UK (www.gov.uk)

- Details of aquifers are online - https://data.gov.uk/search?q=aquifer&filters%5Bpublisher%5D=Environment+Agency&filters%5Btopic%5D=&filters%5Bformat%5D=&sort=best

Please use the following link for details of reports for known problems regarding groundwater flooding issues https://www.gov.uk/government/collections/groundwater-current-status-and-flood-risk If there is not one for your site then we have no reports of any problems there in our records.

Groundwater level data can be found as open data here: https://data.gov.uk/search?q=groundwater+levels alternatively a public database is available from https://www.bgs.ac.uk/information-hub/borehole-records/

I hope that we have correctly interpreted your request. If you are not satisfied with our response to your request for information you can contact us within 2 calendar

months to ask for our decision to be reviewed.

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 and the associated Environmental Information Regulations 2004.

This information is provided subject to the Open Government Licence, which you should read.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely

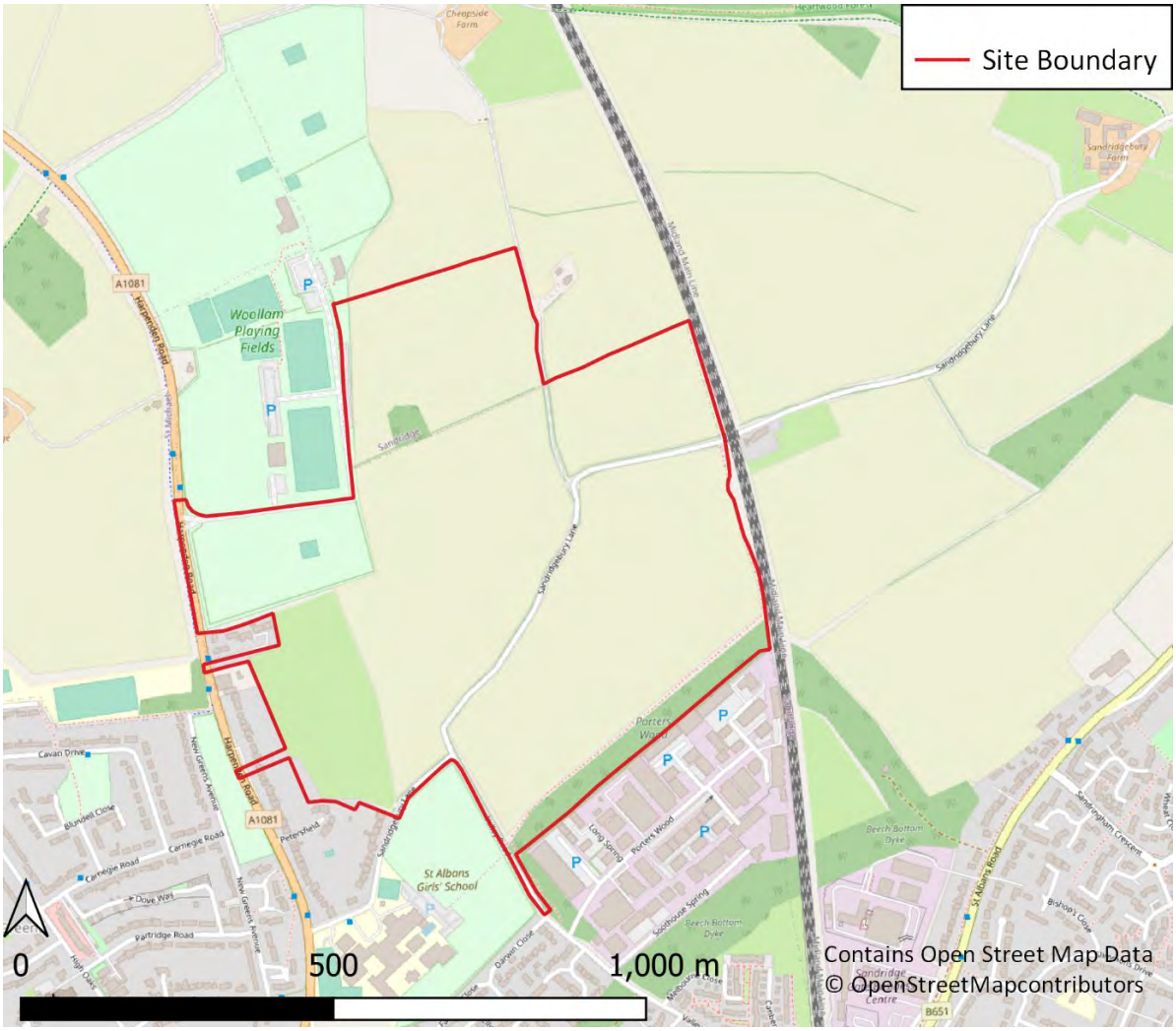
Annette Smith
Customers and Engagement Officer
Environment Agency, Hertfordshire and North London
Alchemy, Bessemer Road, Welwyn Garden City, Hertfordshire, AL7 1HE
Direct dial 0203 0258975
Direct email HNLenquiries@environment-agency.gov.uk

My usual working hours are 8.30am to 3pm, Mondays to Wednesdays

From: Charlotte Turner <Charlotte.turner@pja.co.uk>
Sent: 16 January 2024 09:14
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Cc: Samantha Furey <samantha.furey@pja.co.uk>
Subject: 240117/AG07 [PJA: 05920] - St Albans Product 4 Request TL 15256 09761

Hello,

PJA have been appointed to provide flood risk and drainage advice for a proposed development at St Albans. OS Co-ordinates: 515256 , 209761. A Site Location Plan is available below:



We are aware that the Site is situated within Flood Zone 1 after a review of the Flood Map for Planning.

As such, we would be grateful if you could provide Product 4 data that is associated with this.

In addition, we would be grateful for any data you hold on flood defences, surface water, ground water or reservoir flood risk within the vicinity of the Site.

Furthermore, we would be grateful if you could provide any information or comments in relation to the Principal Aquifer situated within the vicinity of the Site.

We would welcome any additional thoughts or comments you may have in relation to this.

Kind regards,

Charlotte Turner

Charlotte Turner
Flood Risk & Drainage Engineer
T. 0121 387 7923
Park Point, High Street, Longbridge, Birmingham, B31 2UQ, UK
www.pja.co.uk

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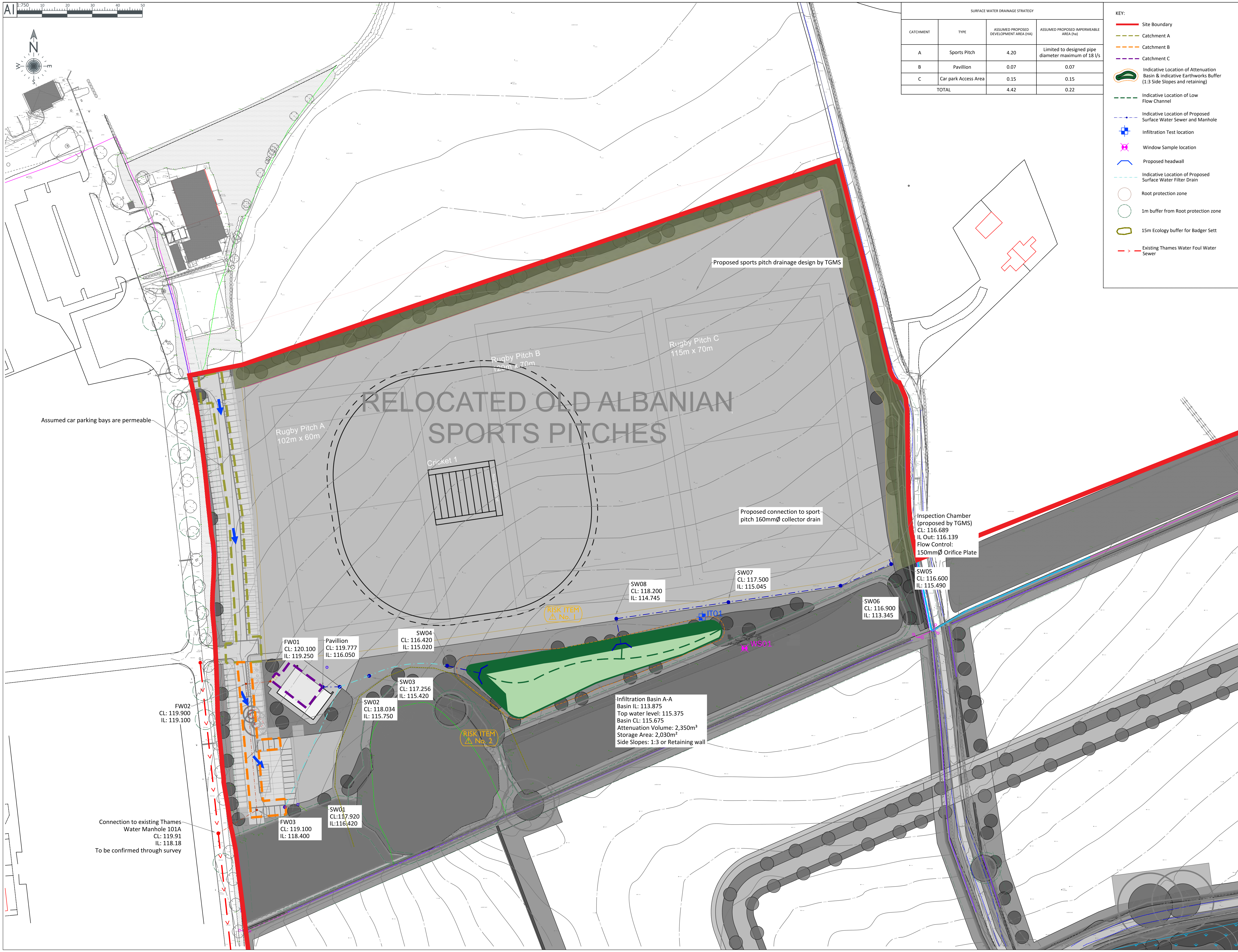
Appendix F Drainage Strategy Drawings



SURFACE WATER DRAINAGE STRATEGY			
CATCHMENT	TYPE	ASSUMED PROPOSED DEVELOPMENT AREA (HA)	ASSUMED PROPOSED IMPERMEABLE AREA (ha)
A	Sports Pitch	4.20	Limited to designed pipe diameter maximum of 18 l/s
B	Pavillion	0.07	0.07
C	Car park Access Area	0.15	0.15
TOTAL		4.42	0.22

KEY:

- Site Boundary
- Catchment A
- Catchment B
- Catchment C
- Indicative Location of Attenuation Basin & indicative Earthworks Buffer (1:3 Side Slopes and retaining)
- Indicative Location of Low Flow Channel
- Indicative Location of Proposed Surface Water Sewer and Manhole
- Infiltration Test location
- Window Sample location
- Proposed headwall
- Indicative Location of Proposed Surface Water Filter Drain
- Root protection zone
- 1m buffer from Root protection zone
- 15m Ecology buffer for Badger Sett
- Existing Thames Water Foul Water Sewer

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

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2. No assessment of earthworks has been undertaken at this stage.
3. No utilities, ecological and arbor-cultural consideration.
4. Drawing should be read in conjunction with all other relevant scheme drawings.
5. Drawing Includes:
   - 5.1. Masterplan provided by Define in December 2024 (Drawing No: DE-565-102).
   - 5.2. Contour lines (0.5m) taken from Topographic Survey (not formally issued)
   - 5.3. Contour lines (1m) produced using 1m DTM LiDAR from the Environment Agency April 2022.
   - 5.4. OS Mapping (not formally issued)
   - 5.5. An infiltration rate of $2.63x10^{-5}$m/s from location IT01 was used from the 2024 Geo Environmental Group Infiltration testing and ground water monitoring report.
6. Surface Water Drainage Strategy based on:
   - 6.1. Attenuation Basin is 1.8m deep.
   - 6.2. Attenuation features to have a minimum 300mm freeboard.
   - 6.3. Volume within conveyance features has not been included within attenuation calculations at this stage.
   - 6.4. Drainage for sports pitches designed by others.
   - 6.5. Maximum capacity within collector drain determined as 18l/s discharging into attenuation pond.
   - 6.6. Assumed 100% impermeable for car park access areas and Pavillion..
   - 6.7. Assumed permeable surfacing for car park bays, to be made from material such as gravel or grasscrete.
   - 6.8. FEH-22 Rainfall Data used with CV 1.0 for Summer and Winter.
7. Woolams Playing field Proposed levels drawings [Ref:TGMS1284.4-1] provided by specialist consultant TGMS. Received 11th July 2024.
8. Tree Survey Plan [Ref:8575-T-01 Tree Survey Plan.pdf] and subsequent Root Protection zone (RPZ) indicatively shown on plan received from Hallam Land on 22nd January 2024.

RISK ITEM ⚠ No.

Risk Item 1: No allowance for additional inflow from sports pitch to enter proposed drainage network into the attenuation feature has been given.

Risk Item 2: Proposed location of attenuation feature is in close proximity to existing Root Protection Zones (RPZ) and Ecology Buffer zone. The basin dimensions required to attenuate surface water are based on the accuracy of Topographical survey data.

REV	DATE	REVISION NOTE	BY
P03	04/12/2024	UPDATING RED LINE BOUNDARY	JJG
P02	15/11/2024	REVISED DRAINAGE STRATEGY	SF
P01	23/08/2024	DRAFT FOR COMMENT	NER

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CLIENT
Hallam Land

PROJECT
Wollam Park, St Albans

DRAWING TITLE
Indicative Surface Water Drainage Strategy Sports Pitch Area

DRAWING ISSUE STATUS
INFORMATION

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05920	A	0503	P03

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@750	NER	GD	AUG 2024

A1 1:2000 0 20 40 60 80 100 120 140

Basin	Developable Area [ha]	Assumed Impermeable Area [ha]	Assumed Impermeable Area including 10% Urban Creep [ha]	Indicative Attenuation Volume [m3]
Catchment A	3.35	2.65	2.84	1,785
Catchment B	2.41	1.57	1.57	1,220
Catchment C	3.46	2.59	2.78	3,990
Catchment D	3.00	2.37	2.54	4,825
Catchment E	0.62	0.63	0.66	1,835
Catchment F, I, G and J	9.63	7.07	7.45	3,770
Catchment H	1.11	1.41	1.41	3,375
Catchment K	2.42	1.83	1.97	2,360
Catchment L	0.75	0.71	0.75	1,920
Total	**26.75**	**20.83**	**21.97**	**25,080**

KEY:

- Site Boundary
- Catchment A
- Catchment B
- Catchment C
- Catchment D
- Catchment E
- Catchment F
- Catchment G
- Catchment H
- Catchment I
- Catchment J
- Catchment K
- Catchment L
- Indicative Location of Attenuation Basin with 3m maintenance strip
- Indicative Location of Infiltration Basin with 3m maintenance strip
- Location of Infiltration Testing Location IT04
- Indicative Location of Low Flow Channel
- Indicative Location of Conveyance Feature
- Indicative Location of Headwall
- Indicative Location of Railway Line
- Indicative Easement of 21m from the Railway Line (TBC)
- Indicative Location of Proposed Surface Water Sewer
- Indicative Surface Water Flow Route
- Indicative Location of Proposed Foul Water Pumping Station with and Storage Compound
- Indicative Location of Proposed Surface Water Flow Routing Channel (0.5m deep with 1:3 side slopes - 3.5m wide)
- Indicative Location of Proposed Surface Water Swale (1.0m deep, 0.5m base width with 1:4 side slopes)
- Indicative Location of Proposed Orifice Plate
- Indicative Location of Proposed Flow Control

RELOCATED OLD ALBANIAN SPORTS PITCHES

Proposed sports pitch drainage to be designed by others

Proposed SuDS feature to provide attenuation for sports pitch drainage in separate drainage strategy (Ref. 05920-A-0503)

Catchment A:
CL: 117.25mAOD
IL: 115.95mAOD
Depth: 1.3m
Side Slopes: 1:4
Indicative Attenuation Storage Area: 2,465m²
Indicative Storage Volume: 1,785m³
Discharge Rate: 70.0l/s

Catchment B - Swale 1.001 and Swale 1.002:
Depth: 1.0m (including 300mm freeboard)
Side Slopes: 1:4
A check dam will be integrated within the feature to slow the flow of water.

Catchment B - Swale 1.004 and 1.005:
Depth: 1.0m (including 300mm freeboard)
Side Slopes: 1:4
A check dam will be integrated within the feature to slow the flow of water

Catchment B - Basin 3:
CL: 111.00mAOD
IL: 109.50mAOD
Depth: 1.5m
Side Slopes: 1:4
Indicative Storage Area: 1,615m²
Indicative Storage Volume: 1,220m³
Discharge Rate: 80.0 l/s

Catchment E:
CL: 107.50mAOD
IL: 106.00mAOD
Depth: 1.5m
Side Slopes: 1:4
Indicative Storage Area: 2,130m²
Indicative Storage Volume: 1,835m³
Discharge Rate: 60.5 l/s

Catchment C:
CL: 106.50mAOD
IL: 105.00mAOD
Depth: 1.5m
Side Slopes: 1:4
Indicative Storage Area: 4,305m²
Indicative Storage Volume: 3,990m³
Discharge Rate: 50.0 l/s

Catchment D:
CL: 104.01mAOD
IL: 101.81mAOD
Depth: 2.2m (including Platform)
Side Slopes: 1:4 / 1:5
Indicative Storage Area: 4,000m²
Attenuation Storage: 4,825m³
Infiltration Rate: 1.88x10⁻⁵

IT04

Catchment L:
CL: 106.025mAOD
IL: 104.225mAOD
Depth: 1.8m
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 2,480m²
Attenuation Storage Volume: 1,920m³
Discharge Rate: 97.0 l/s

Catchment K:
CL: 107.00mAOD
IL: 104.70mAOD
Depth: 2.3m (including Platform)
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 3,245m²
Attenuation Storage Volume: 2,360m³
Discharge Rate: 103.0 l/s

Catchment H:
CL: 108.00mAOD
IL: 105.70mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1:5
Attenuation Storage Area: 3,950m²
Attenuation Storage Volume: 3,375m³
Discharge Rate: 108.5 l/s

Catchment F, I, G and J:
CL: 108.525mAOD
IL: 106.225mAOD
Depth: 2.3m
Side Slopes: 1:3 / 1.5
Attenuation Storage Area: 3,095m²
Attenuation Storage Volume: 3,770m³
Discharge Rate: 340.0 l/s

RISK ITEM No. 1

RISK ITEM No. 2

P5

NOTES

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2. No assessment of earthworks has been undertaken at this stage.
3. No assessment of surcharged outfall has been undertaken at this stage.
4. No utilities and arbor-cultural consideration has been undertaken at this stage.
5. Drawing should be read in conjunction with all other relevant scheme drawings.
6. Drawing Includes:
   - 6.1. Strategic Landscaping Plan provided by Define in December 2024 (Drawing No: DE_565_102 Hallam St Albans Landscape Framework Plan).
   - 6.2. Topographic Survey produced by Interlock Surveys dated September 2023 (Ref. 190296)
   - 6.3. Tree Survey provided by FPCR dated December 2023 (8575-T-01)
   - 6.4. An infiltration rate of $1.88x10^{-5}$m/s from location IT04 was used from the 2024 Geo Environmental Group Infiltration Testing.
7. Indicative Surface Water Drainage Strategy based on:
   - 7.1. Attenuation Basin A is 1.3m deep with 1:4 side slopes (including 300mm freeboard)
   - 7.2. Attenuation Basins B3, C, and E are 1.5m deep with 1:4 side slopes (including 300mm freeboard).
   - 7.3. Attenuation Basins FIGJ, H, and K are 2.3m deep with platform to facilitate planting. Staged basin is 1m deep with 1:3 side slopes. From the proposed platform, the basin utilises 1:5 side slopes and is 1.3m in depth.
   - 7.4. Attenuation Basin L is 1.8m deep with platform to facilitate planting. Staged basin is 0.8m deep with 1:3 side slopes. From the proposed platform, the basin utilises 1:5 side slopes and is 1m in depth.
   - 7.5. Attenuation Basin D is 2.2m deep with platform to facilitate planting. Staged basin is 1.2m deep with 1:4 side slopes.From the proposed platform, the basin utilises 1:5 side slopes and is 1m in depth.
   - 7.6. Volume within conveyance features has not been included within the attenuation calculations at this stage.
   - 7.7. Discharge limited to an infiltration rate of $1.88x10^{-5}$m/s in accordance with the Geo Environmental Group Infiltration Testing.
   - 7.8. FEH 22 Data.
   - 7.9. Cv Values of 1.
8. Impermeable Area Assumptions:
   - 8.1. 60% impermeable for all residential development with an additional 10% for urban creep.
   - 8.2. 100% impermeable for all highways.
   - 8.3. 100% impermeable for all attenuation basins.
   - 8.4. 50% for all educational facilities.
   - 8.5. 80% for mixed used development
   - 8.6. 90% for commercial development.
9. Further consideration of utilities, arboricultural and ecological constraints should be undertaken prior to detailed design.
10. Indicative surface water drainage design based on masterplanning at the time of production and impermeable areas may result in changes to the drainage strategy.
11. Further ground investigation to confirm infiltration rates, seasonal groundwater levels and detail of the underlying chalk solubility is required.

RISK ITEMS:

Risk Item 1: Indicative Surface Water Drainage Strategy is subject to proposed development hydraulic modelling to refine surface water flood extents across the Site.

Risk Item 2: Indicative Surface Water Drainage Strategy is subject to a detailed earthworks and levels assessment.

REV	DATE	REVISION NOTE	BY
P09	04/12/2024	UPDATING RED LINE BOUNDARY	JJG
P08	04/11/2024	REVISED DRAINAGE STRATEGY	CT
P07	23/10/2024	LANDSCAPE STRATEGY UPDATED	GD
P06	16/10/2024	REVISED DRAINAGE STRATEGY	CT
P05	15/10/2024	REVISED DRAINAGE STRATEGY	CT
P04	07/10/2024	REVISED DRAINAGE STRATEGY	CT
P03	20/09/2024	REVISED DRAINAGE STRATEGY	CT
P02	19/08/2024	REVISED DRAINAGE STRATEGY	CT
P01	27/11/2023	DRAFT FOR COMMENT	GD

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CLIENT

Hallam Land Management Limited and St Albans School

PROJECT

Woollam Park, St Albans

DRAWING TITLE

Surface Water Drainage Strategy

DRAWING ISSUE STATUS

PLANNING

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05920	-WR-	0525	-P09

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@2,000	CT	GD	APR 2022

A1 1:2000 0 20 40 60 80 100 120 140

RELOCATED OLD ALBANIAN SPORTS PITCHES

Proposed Connection
Location - Manhole 8702:
Cover Level: 119.61mAOD
Invert Level: 115.26mAOD
RISK ITEM No. 1

Location of Proposed Foul Water Pumping Station (Type 3) with Deep Wet Well (Depth TBC)
Indicative Pumping Rate:28.6l/s

RISK ITEM No. 1

Indicative Additional Foul Water Storage: 174m³

KEY:

- Site Boundary
- Indicative Easement of 21m from the Railway Line (TBC)
- Indicative Foul Water Flow Route
- Existing Severn Trent Water Foul Water Sewer
- Indicative Route of Proposed Foul Water Rising Main
- Indicative Location of Proposed Foul Water Pumping Station with 20m Cordon Sanitaire and Storage Compound

NOTES

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2. No assessment of earthworks has been undertaken at this stage.
3. No assessment of surcharged outfall has been undertaken at this stage.
4. No utilities and arbor-cultural consideration has been undertaken at this stage.
5. Drawing should be read in conjunction with all other relevant scheme drawings.
6. Drawing Includes:
   - 6.1. Landscaping Plan provided by Define in December 2024 (Drawing No: DE_565_102).
   - 6.2. Topographic Survey produced by Interlock Surveys dated September 2023 (Ref. 190296)
   - 6.3. Tree Survey provided by FPCR dated December 2023 (8575-T-01)
7. Foul Water Drainage Strategy is indicative and subject to agreement with Thames Water.
8. Exact details of pumping station to be confirmed at the detailed design stage, including the depth of the wet well. Access to pumping station to be achieved by adoptable highway.
9. Foul Water Drainage Strategy based on information available at the time of writing and is subject to masterplanning information and Thames Water Correspondence.

RISK ITEMS: RISK ITEM No. 1

Risk Item 1: A gravity-led solution is proposed to the foul water pumping station situated to the south west of the Site. Foul water will then be pumped to the existing Thames Water foul water sewer, situated along Harpenden Road at Manhole 8702 in accordance with pre-development enquiry guidance (ref. DS6111499 - October 2024). It should be noted that modelling work will need to be undertaken by Thames Water to ensure there is enough capacity within the existing network.

REV	DATE	REVISION NOTE	BY
P1	04/12/2024	REVISED RED LINE BOUNDARY	JJG
P0	08/10/2024	DRAFT FOR COMMENT	CT

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CLIENT
Hallam Land Management Limited and St Albans School

PROJECT
Woollam Park, St Albans

DRAWING TITLE
Indicative Foul Water Drainage Strategy

DRAWING ISSUE STATUS
DRAFT

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05920	- WR -	0526	- P01

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@2,000	CT	GD	OCT 2024

Appendix G Surface Water Drainage Calculations

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)	0.200
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	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
Catchment D	2.540	5.00	104.010	98.253	80.022	2.200
Catchment A	2.840	5.00	117.250	13.925	56.994	1.300
Catchment B3	0.785	5.00	111.000	58.332	72.719	1.500
Catchment E	0.660	5.00	107.500	77.143	83.971	1.500
Catchment C	2.780	5.00	106.500	88.721	82.792	1.500
Catchments F, I, G and J	7.450	5.00	108.525	57.010	39.556	2.300
Catchment H	1.410	5.00	108.000	69.595	51.442	2.300
Catchment k	1.970	5.00	107.000	80.954	63.623	2.300
Catchment L	0.750	5.00	106.025	96.320	64.984	1.800
1	0.000	5.00	103.000	105.085	80.027	2.500
Swale 1A	0.000	5.00	116.500	24.494	59.275	1.000
Swale 1.1			115.575	31.329	60.532	1.000
Swale 1.2			114.650	38.399	61.973	1.000
Swale 2	0.785	5.00	113.575	45.634	63.546	1.000
Swale 2.1			112.650	49.186	65.155	1.000
Swale 2.2			111.725	53.172	67.234	1.000

Links

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)
1.007	Catchment B3	Catchment E	75.000	0.600	109.500	106.000	3.500	21.4	900	7.31	43.8
1.008	Catchment E	Catchment C	30.000	0.600	106.000	105.000	1.000	30.0	900	7.40	43.6
1.009	Catchment C	Catchment D	25.000	0.600	105.000	101.810	3.190	7.8	900	7.44	43.5
2.000	Catchments F, I, G and J	Catchment H	25.000	0.600	106.225	105.700	0.525	47.6	750	5.10	50.0
2.003	Catchment L	Catchment D	30.000	0.600	104.250	101.810	2.440	12.3	750	5.37	50.0
1.010	Catchment D	1	10.000	0.600	101.810	100.500	1.310	7.6	1725	7.45	43.5
2.001	Catchment H	Catchment k	25.000	0.600	105.750	104.700	1.050	23.8	750	5.18	50.0
2.002	Catchment k	Catchment L	30.000	0.600	104.750	104.225	0.525	57.1	750	5.31	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.007	6.783	4315.4	698.8	0.600	0.600	4.410	0.0
1.008	5.731	3645.9	798.7	0.600	0.600	5.070	0.0
1.009	11.225	7141.3	1233.6	0.600	1.300	7.850	0.0
2.000	4.061	1794.0	1346.2	1.550	1.550	7.450	0.0
2.003	8.004	3536.3	2092.5	1.025	1.450	11.580	0.0
1.010	16.942	39593.4	3450.1	0.475	0.775	21.970	0.0
2.001	5.748	2539.5	1601.0	1.500	1.550	8.860	0.0
2.002	3.706	1637.2	1957.0	1.500	1.050	10.830	0.0

Links

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	Catchment A	Swale 1A	36.000	0.600	115.950	115.500	0.450	80.0	450	5.26	50.0
1.001	Swale 1A	Swale 1.1	37.000	0.035	115.500	114.575	0.925	40.0	500	5.48	50.0
1.002	Swale 1.1	Swale 1.2	37.000	0.035	114.575	113.650	0.925	40.0	500	5.69	49.3
1.003	Swale 1.2	Swale 2	43.000	0.035	113.650	112.575	1.075	40.0	450	6.37	46.9
1.004	Swale 2	Swale 2.1	37.000	0.035	112.575	111.650	0.925	40.0	500	6.58	46.2
1.005	Swale 2.1	Swale 2.2	37.000	0.035	111.650	110.725	0.925	40.0	500	6.79	45.5
1.006	Swale 2.2	Catchment B3	35.000	0.035	110.725	109.500	1.225	28.6	750	7.13	43.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	2.274	361.7	513.2	0.850	0.550	2.840	0.0
1.001	2.901	13053.0	513.2	0.000	0.000	2.840	0.0
1.002	2.901	13053.0	506.4	0.000	0.000	2.840	0.0
1.003	1.053	167.4	481.4	0.550	0.550	2.840	0.0
1.004	2.901	13053.0	605.0	0.000	0.000	3.625	0.0
1.005	2.901	13053.0	595.6	0.000	0.000	3.625	0.0
1.006	1.751	773.6	563.3	0.250	0.750	3.625	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	75.000	21.4	900	Circular	111.000	109.500	0.600	107.500	106.000	0.600
1.008	30.000	30.0	900	Circular	107.500	106.000	0.600	106.500	105.000	0.600
1.009	25.000	7.8	900	Circular	106.500	105.000	0.600	104.010	101.810	1.300
2.000	25.000	47.6	750	Circular	108.525	106.225	1.550	108.000	105.700	1.550
2.003	30.000	12.3	750	Circular	106.025	104.250	1.025	104.010	101.810	1.450
1.010	10.000	7.6	1725	Circular	104.010	101.810	0.475	103.000	100.500	0.775
2.001	25.000	23.8	750	Circular	108.000	105.750	1.500	107.000	104.700	1.550
2.002	30.000	57.1	750	Circular	107.000	104.750	1.500	106.025	104.225	1.050
1.000	36.000	80.0	450	Circular	117.250	115.950	0.850	116.500	115.500	0.550
1.001	37.000	40.0	500	Swale	116.500	115.500	0.000	115.575	114.575	0.000
1.002	37.000	40.0	500	Swale	115.575	114.575	0.000	114.650	113.650	0.000
1.003	43.000	40.0	450	Circular	114.650	113.650	0.550	113.575	112.575	0.550
1.004	37.000	40.0	500	Swale	113.575	112.575	0.000	112.650	111.650	0.000

Link	US Node	Node Type	MH Type	DS Node	Node Type	MH Type
1.007	Catchment B3	Junction		Catchment E	Junction	
1.008	Catchment E	Junction		Catchment C	Junction	
1.009	Catchment C	Junction		Catchment D	Junction	
2.000	Catchments F, I, G and J	Junction		Catchment H	Junction	
2.003	Catchment L	Junction		Catchment D	Junction	
1.010	Catchment D	Junction		1	Junction	
2.001	Catchment H	Junction		Catchment k	Junction	
2.002	Catchment k	Junction		Catchment L	Junction	
1.000	Catchment A	Junction		Swale 1A	Manhole	Adoptable
1.001	Swale 1A	Manhole	Adoptable	Swale 1.1	Junction	
1.002	Swale 1.1	Junction		Swale 1.2	Manhole	Adoptable
1.003	Swale 1.2	Manhole	Adoptable	Swale 2	Manhole	Adoptable
1.004	Swale 2	Manhole	Adoptable	Swale 2.1	Junction	

Pipeline Schedule

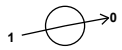
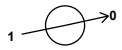
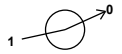
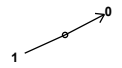
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.005	37.000	40.0	500	Swale	112.650	111.650	0.000	111.725	110.725	0.000
1.006	35.000	28.6	750	Circular	111.725	110.725	0.250	111.000	109.500	0.750

Link	US Node	Node Type	MH Type	DS Node	Node Type	MH Type
1.005	Swale 2.1	Junction		Swale 2.2	Manhole	Adoptable
1.006	Swale 2.2	Manhole	Adoptable	Catchment B3	Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
Catchment D	98.253	80.022	104.010	2.200	1	2.003	101.810	750
					2	1.009	101.810	900
					0	1.010	101.810	1725
Catchment A	13.925	56.994	117.250	1.300	0	1.000	115.950	450
Catchment B3	58.332	72.719	111.000	1.500	1	1.006	109.500	750
					0	1.007	109.500	900
Catchment E	77.143	83.971	107.500	1.500	1	1.007	106.000	900
					0	1.008	106.000	900
Catchment C	88.721	82.792	106.500	1.500	1	1.008	105.000	900
					0	1.009	105.000	900
Catchments F, I, G and J	57.010	39.556	108.525	2.300	0	2.000	106.225	750
Catchment H	69.595	51.442	108.000	2.300	1	2.000	105.700	750
					0	2.001	105.750	750
Catchment k	80.954	63.623	107.000	2.300	1	2.001	104.700	750
					0	2.002	104.750	750
Catchment L	96.320	64.984	106.025	1.800	1	2.002	104.225	750
					0	2.003	104.250	750
1	105.085	80.027	103.000	2.500	1	1.010	100.500	1725

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
Swale 1A	24.494	59.275	116.500	1.000	1	1.000	115.500	450
								
					0	1.001	115.500	500
Swale 1.1	31.329	60.532	115.575	1.000	1	1.001	114.575	500
								
					0	1.002	114.575	500
Swale 1.2	38.399	61.973	114.650	1.000	1	1.002	113.650	500
								
					0	1.003	113.650	450
Swale 2	45.634	63.546	113.575	1.000	1	1.003	112.575	450
								
					0	1.004	112.575	500
Swale 2.1	49.186	65.155	112.650	1.000	1	1.004	111.650	500
								
					0	1.005	111.650	500
Swale 2.2	53.172	67.234	111.725	1.000	1	1.005	110.725	500
								
					0	1.006	110.725	750

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	10080	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320
30	120	240	480	720	1440	2880	

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

Node Catchment A Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.000	Sump Available	✓
Replaces Downstream Link	x	Product Number	CTL-SHE-0340-7000-0950-7000
Invert Level (m)	116.000	Min Outlet Diameter (m)	0.375
Design Depth (m)	0.950	Min Node Diameter (mm)	2100
Design Flow (l/s)	70.0		

Node Catchment B3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	109.500	Product Number	CTL-SHE-0357-8000-1200-8000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	80.0	Min Node Diameter (mm)	2100

Node Catchment E Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	106.000	Product Number	CTL-SHE-0317-6050-1200-6050
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	60.5	Min Node Diameter (mm)	2100

Node Catchment C Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	105.000	Product Number	CTL-SHE-0292-5000-1200-5000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.375
Design Flow (l/s)	50.0	Min Node Diameter (mm)	1800

Node Catchments F, I, G and J Online Orifice Control

Flap Valve	x	Invert Level (m)	106.225	Diameter (m)	0.375
Downstream Link	2.000	Design Depth (m)	2.000	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	330.0		

Node Catchment D Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	101.810	Product Number	CTL-SHE-0012-1000-1900-1000
Design Depth (m)	1.900	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.1	Min Node Diameter (mm)	1200

Node Catchment L Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	2.003	Sump Available	✓
Replaces Downstream Link	x	Product Number	CTL-SHE-0383-9700-1500-9700
Invert Level (m)	104.225	Min Outlet Diameter (m)	0.450
Design Depth (m)	1.500	Min Node Diameter (mm)	
Design Flow (l/s)	97.0		

Node Catchment H Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	2.001	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0396-1085-2000-1085
Invert Level (m)	105.700	Min Outlet Diameter (m)	0.450
Design Depth (m)	2.000	Min Node Diameter (mm)	
Design Flow (l/s)	108.5		

Node Catchment k Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	2.002	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0388-1030-2000-1030
Invert Level (m)	104.700	Min Outlet Diameter (m)	0.450
Design Depth (m)	2.000	Min Node Diameter (mm)	
Design Flow (l/s)	103.0		

Node Swale 1.1 Online Orifice Control

Flap Valve	x	Replaces Downstream Link	x	Diameter (m)	0.225
Downstream Link	1.002	Invert Level (m)	114.575	Discharge Coefficient	0.600

Node Swale 1.1 Online Weir Control

Flap Valve	x	Invert Level (m)	115.275	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	4.500		

Node Swale 2.1 Online Orifice Control

Flap Valve	x	Invert Level (m)	111.650	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.750		

Node Swale 2.1 Online Weir Control

Flap Valve	x	Invert Level (m)	112.350	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	4.500		

Node Catchment D Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.06768	Safety Factor	1.5	Invert Level (m)	101.810
Side Inf Coefficient (m/hr)	0.06768	Porosity	1.00	Time to half empty (mins)	600

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1670.0	1670.0	1.200	2614.0	10604.0	1.201	2830.0	10604.0	2.200	4000.0	10604.0

Node Catchment A Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	115.950
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	248

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1510.0	0.0	1.300	2465.0	0.0

Node Catchment B3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	109.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	315

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	625.0	0.0	1.500	1615.0	0.0

Node Catchment E Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	106.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	390

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1150.0	0.0	1.500	2130.0	0.0

Node Catchment C Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	105.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	960

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	2680.0	0.0	1.500	4305.0	0.0

Node Catchments F, I, G and J Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	106.225
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	260

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	1215.0	0.0	1.000	1680.0	0.0	1.001	1850.0	0.0	2.300	3095.0	0.0

Node Catchment H Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	105.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	464

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	520.0	0.0	1.000	970.0	0.0	1.001	2430.0	0.0	2.300	3950.0	0.0

Node Catchment k Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	104.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	510

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	165.0	0.0	1.000	490.0	0.0	1.001	1715.0	0.0	2.300	3245.0	0.0

Node Catchment L Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	104.225
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	420

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	715.0	0.0	0.800	1175.0	0.0	0.801	1380.0	0.0	1.800	2480.0	0.0

Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	1.000
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	2
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	2
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)	1.200	Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	✓
Backdrops	✓	Return Period (years)	30
Minimum Backdrop Height (m)	0.200	Discharge Rates	✓
Maximum Backdrop Height (m)	1.500	Discharge Volume	✓
Full Bore Velocity	✓	100 year 360 minute (m^3)	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
2880 minute winter	Catchment D	3180	103.706	1.896	191.8	4824.4480	0.0000	SURCHARGED
240 minute summer	Catchment A	212	116.909	0.959	625.3	1785.7270	0.0000	SURCHARGED
720 minute winter	Catchment B3	705	110.698	1.198	161.5	1221.7630	0.0000	SURCHARGED
1440 minute winter	Catchment E	1410	107.191	1.191	101.2	1832.6190	0.0000	SURCHARGED
2160 minute winter	Catchment C	2220	106.199	1.199	132.5	3991.3240	0.0000	SURCHARGED
180 minute summer	Catchments F, I, G and J	136	108.222	1.997	1957.0	3767.2970	0.0000	SURCHARGED
480 minute winter	Catchment H	504	107.591	1.891	357.9	3374.2180	0.0000	SURCHARGED
1440 minute winter	Catchment k	1470	106.604	1.904	171.5	2358.0200	0.0000	SURCHARGED
2160 minute winter	Catchment L	2340	105.691	1.466	118.2	1918.5160	0.0000	SURCHARGED
2880 minute winter	1	3180	100.500	0.000	0.1	0.0000	0.0000	OK
120 minute winter	Swale 1A	270	115.602	0.102	70.0	0.0000	0.0000	OK
1440 minute summer	Swale 1.1	900	115.126	0.551	70.0	0.0000	0.0000	OK
600 minute winter	Swale 1.2	645	113.875	0.225	69.9	0.0000	0.0000	OK
15 minute summer	Swale 2	10	112.859	0.284	634.4	0.0000	0.0000	OK
15 minute summer	Swale 2.1	11	112.352	0.701	627.7	0.0000	0.0000	OK
15 minute summer	Swale 2.2	12	111.222	0.497	582.8	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
2880 minute winter	Catchment D	1.010	1	0.1	0.000	0.000	0.0020	21.0
60 minute summer	Catchment D	Infiltration		132.9				
120 minute summer	Catchment A	1.000	Swale 1A	70.0	2.039	0.194	1.2434	
60 minute winter	Catchment B3	1.007	Catchment E	80.0	1.562	0.019	18.7873	
1440 minute summer	Catchment E	1.008	Catchment C	150.0	0.461	0.041	11.3209	
360 minute winter	Catchment C	1.009	Catchment D	49.9	1.749	0.007	8.1077	
30 minute summer	Catchments F, I, G and J	2.000	Catchment H	340.1	1.685	0.190	11.0030	
30 minute winter	Catchment H	Hydro-Brake®	Catchment k	108.3				
1440 minute summer	Catchment k	Hydro-Brake®	Catchment L	102.9				
240 minute winter	Catchment L	2.003	Catchment D	97.1	1.292	0.027	7.0039	
120 minute winter	Swale 1A	1.001	Swale 1.1	70.0	0.250	0.005	29.1904	
1440 minute summer	Swale 1.1	1.002	Swale 1.2	70.0	0.381	0.005	7.4559	
1440 minute summer	Swale 1.2	1.003	Swale 2	70.0	1.322	0.418	2.3921	
15 minute summer	Swale 2	1.004	Swale 2.1	627.7	0.709	0.048	51.3402	
15 minute summer	Swale 2.1	1.005	Swale 2.2	582.8	0.800	0.045	30.9692	
15 minute summer	Swale 2.2	1.006	Catchment B3	575.5	2.176	0.744	10.3743	

Appendix H Thames Water Developer Enquiry

Miss Shannon Warr
Brookbanks Consulting Ltd
6150 Knights Court
Solihull Parkway
Birmingham Business Park
B37 7WY

Wastewater pre-planning
Our ref **DS6110431**

05 April 2024

Pre-planning enquiry: Capacity concerns

Site: Land At St Albans, St. Albans, AL3 6JE – (nearest postcode)

Dear Miss Warr,

Thank you for Pre-planning application for the construction of 683 residential dwellings, 278 residential flats, 14500sqm of Local Centre, 80 bed Care Home, 444 No. of max capacity student Primary School & 8000sqm Retirement Living Facility.

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

We've assessed your foul proposals and concluded that our sewerage network **will not** have enough capacity for full development at this time.

Foul Water

Proposed foul water to discharge via pumped flow at **21.19 litres/sec** into an existing manhole chamber referenced TL1409 **8702** on an existing 225mm foul water sewer.

Surface Water

Site is to follow SuDS therefore no direct or indirect discharge of surface water into a Thames Water sewer.

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: 8 months
Design: 6 months
Construction: 6 months
Total: 20 months

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, please contact me on the number below to discuss the timing of our activities.

Surface Water Hierarchy

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. store rainwater for later use.
2. use infiltration techniques where possible.
3. attenuate rainwater in ponds or open water features for gradual release.
4. attenuate rainwater by storing in tanks or sealed water features for gradual release.
5. discharge rainwater direct to a watercourse.
6. discharge rainwater to a surface water sewer/drain.
7. discharge rainwater to the combined sewer.
8. discharge rainwater to the foul sewer

Where connection to the public sewerage network is still 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.

Please see the attached 'Planning your wastewater' leaflet for additional information.

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.

If it's **less** than this, you might want to ask us to start modelling earlier – in which case we'll require you to underwrite the cost, as noted above. ***- (We currently do not provide this service)***

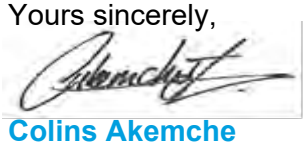
What do you need to tell us before we start modelling?

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.

If you've any further questions, please do not hesitate to contact me.

Yours sincerely,



Colins Akemche
Clean & Waste Pre-Planning Engineer
Adoption Team - Service Delivery

Thames Water - Developer Services - Ground Floor West - Clearwater Court - Vastern Road
Reading -Berkshire - RG1 8DB - Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk - Web: www.developerservices.co.uk

Appendix IFlow Exceedance Plan

A1 1:2000 0 20 40 60 80 100 120 140

RELOCATED OLD ALBANIAN SPORTS PITCHES

Proposed sports pitch drainage to be designed by others

IT04

P5

KEY:

- Site Boundary
- Indicative Location of Attenuation Basin with 3m maintenance strip
- Indicative Location of Infiltration Basin with 3m maintenance strip
- Location of Infiltration Testing Location IT04
- Indicative Location of Low Flow Channel
- Indicative Location of Conveyance Feature
- Indicative Location of Headwall
- Indicative Location of Railway Line
- Indicative Easement of 21m from the Railway Line (TBC)
- Indicative Location of Proposed Surface Water Sewer
- Indicative Surface Water Flow Route
- Indicative Location of Proposed Foul Water Pumping Station with and Storage Compound
- Indicative Location of Proposed Surface Water Flow Routing Channel (0.5m deep with 1:3 side slopes - 3.5m wide)
- Indicative Location of Proposed Surface Water Swale (1.0m deep, 0.5m base width with 1:4 side slopes)
- Indicative Location of Proposed Orifice Plate
- Indicative Location of Proposed Flow Control

NOTES

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. This Drawing is not to be reproduced in any part or form without the consent of PJA Civil Engineering Ltd. All copyright reserved.
2. No assessment of earthworks has been undertaken at this stage.
3. No assessment of surcharged outfall has been undertaken at this stage.
4. No utilities and arbor-cultural consideration has been undertaken at this stage.
5. Drawing should be read in conjunction with all other relevant scheme drawings.
6. Drawing Includes:
   - 6.1. Strategic Landscaping Plan provided by Define in December 2024 (Drawing No: DE_565_Hallam St Albans_Strategic Landscape Plan).
   - 6.2. Topographic Survey produced by Interlock Surveys dated September 2023 (Ref. 190296)
   - 6.3. Tree Survey provided by FPCR dated December 2023 (8575-T-01)
   - 6.4. An infiltration rate of 1.88×10^{-5}m/s from location IT04 was used from the 2024 Geo Environmental Group Infiltration Testing.
7. For water drainage strategy information see drawing reference (05920-WR-A-0525-P09).
8. Further consideration of utilities, arboricultural and ecological constraints should be undertaken prior to detailed design.
9. Indicative flow exceedance plan based on masterplanning at the time of production and impermeable areas may result in changes to the drainage strategy.
10. Further ground investigation to confirm infiltration rates, seasonal groundwater levels and detail of the underlying chalk solubility is required.

RISK ITEMS:

Risk Item 1: Indicative Surface Water Drainage Strategy is subject to proposed development hydraulic modelling to refine surface water flood extents across the Site.

Risk Item 2: Indicative Surface Water Drainage Strategy is subject to a detailed earthworks and levels assessment.

REV	DATE	REVISION NOTE	BY
P0	04/12/2024	DRAFT	JJG

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CLIENT

Hallam Land Management Limited and St Albans School

PROJECT

Woollam Park, St Albans

DRAWING TITLE

Indicative Flow Exceedance Plan

DRAWING ISSUE STATUS

PLANNING

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
05920	- WR -	0527	- P0

Revision Letter : P - Prelim / A - Approval / T - Tender / C - Construction

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE
A1@2,000	JJG	SF	DEC 2024