



Dee Park Open Space Drainage Strategy Report

For Reading Borough Council

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1. Introduction

1.1 Scope of The Report

Hydrock have been appointed to provide a Drainage Strategy report for the approval of Reading Borough Council Lead Local Flood Authority.

The proposed drainage strategy will be in accordance with national guidelines and will incorporate a 'best practise' approach in reducing the impact of the flooding caused by the new development.

The report is based upon sewer asset information provided by the sewerage undertakers Thames Water in relation to assets within the vicinity of the development site.

The report highlights the key stakeholders in terms of ownership and maintenance to ensure the drainage system is kept well maintained and reduce the risk of failure. Should the network fail at any point, clearly defined ownership liabilities will ensure that problems can quickly be rectified, thereby reducing the impact of potential damage caused by flooding.

1.2 Limitations of The Report

This report has been prepared in connection with the scope as described above and considers the instructions and requirements of the client's needs. It is not intended for and should not be relied upon by any third party.

The information received is summarised within this report. In the event that the information is relied upon and is subsequently found to be incorrect, Hydrock Consultants accepts no responsibility for any direct and/or consequential loss that may occur as a result.

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1.3 References / Design Codes

- » BS EN 752 - Drain and Sewer Systems Outside Buildings.
- » Building Regulations Approved Document Part H - Drainage and waste disposals.
- » Sewers for Adoption (where applicable).
- » Local Authority Guidance.
- » CIRIA C753 - SuDS Manual.
- » National Planning Policy Framework (NPPF).
- » DEFRA Non-Statutory Technical Standards for Sustainable Drainage.

2. Site Information

2.1 Site Location

The site is situated on land adjacent to Glenmore Place, Reading, RG30 4EP, occupying a roughly rectangular plot of approximately 1,800m². The central National Grid Reference for the site is 468479, 173632.

Table 2.1: Site Referencing Information

Site Address	
Postcode	RG30 4EP
National Grid Reference	468479, 173632.

Figure 1: Site Location with Approximate Red Line Boundary



2.2 Site Topography

The site is generally level, with ground elevations ranging between approximately 50.7m and 53.0m Above Ordnance Datum (AOD). The existing surface comprises a mix of asphalt hardstanding, woodchip areas for play equipment, and soft landscaping, including grassed areas and mature vegetation along the site boundaries.

Key features of the site include a fenced-off sports court in the centre, a children's play area with woodchip surfacing in the southern section, and a temporary building located in the northern portion.

See **Appendix A** for Topographical Survey

2.3 Geology

The following information is a summary from Phase 2 Site Investigation Report:

"The British Geological Survey Solid and Drift Geology Map for the Reading area (Reading Sheet No. 268) revealed that the northern section of the site was underlain by the Lambeth Group (clay, silt and sand) whilst the southern section was underlain by Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated). Areas of Worked Ground were recorded 1m northeast and 224m south of the site. An inferred bedrock fault was running through the middle of the site, separating the two areas.

A BGS borehole (SU67SE718) located ~290m northeast of the site revealed a 0.10m capping of Topsoil over chalk and clayey chalk fill to 1.20m bgl followed by a brown flinty clay to 1.60m bgl. From here up to 2.20m bgl a remoulded chalk with lumps of intact chalk, clay and flints was identified over remoulded chalk with some intact chalk up to 3.10m bgl. A rubbly chalk with some remoulded chalk and flints was then recorded to the base of the borehole at a depth of 6.0m bgl. No groundwater was recorded."

2.4 Hydrology & Hydrogeology

The following information is a summary from Phase 2 Site Investigation Report:

"A study of the aquifer maps on the DEFRA website revealed the northern section of the site was underlain by a Secondary A Aquifer comprising bedrock deposits of the Lambeth Group whilst the southern section of the site was underlain by a Principal Aquifer comprising bedrock deposits of the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated).

Examination of the Environment Agency records showed that the site did not fall within a Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater.

No surface water features were present within a 250m radius of the site. The nearest surface water feature was identified to be the River Thames ~940m north of the site flowing in an easterly direction.

From analysis of hydrogeological and topographical maps the actual groundwater table was anticipated to be encountered at depth within the Chalk Formation. Some amounts of groundwater however may be present at shallower depths within the Lambeth Group or within Made ground. It was considered that groundwater was flowing in a northern direction toward the River Thames and in line with local topography.

The Groundsure Datasheets revealed the site was at a low risk of flooding from rivers and the sea. The datasheets also revealed the site was at low risk of groundwater flooding. The risk of surface water flooding at the site ranged from low to high."

See **Appendix I** for Phase 2 Site Investigation Report.

2.5 Fluvial Flood Risk

Fluvial flood risk is the risk of flooding from the overbank flow of rivers and watercourses.

Within England, the risk of fluvial flooding is defined by Flood Zones (FZs) which indicate the potential extent of flooding for a given Annual Exceedance Probability (i.e., the potential for of an occurrence within any one year (AEP)) without considering the benefits from flood defences, other manmade structures, or channel improvement works.

The **EA Flood Map for Planning** indicates that the site is located within Flood Zone 1 and is therefore considered to have a low probability of fluvial flooding (see figure 2).

Figure 2: EA Flood Map for Fluvial Flooding

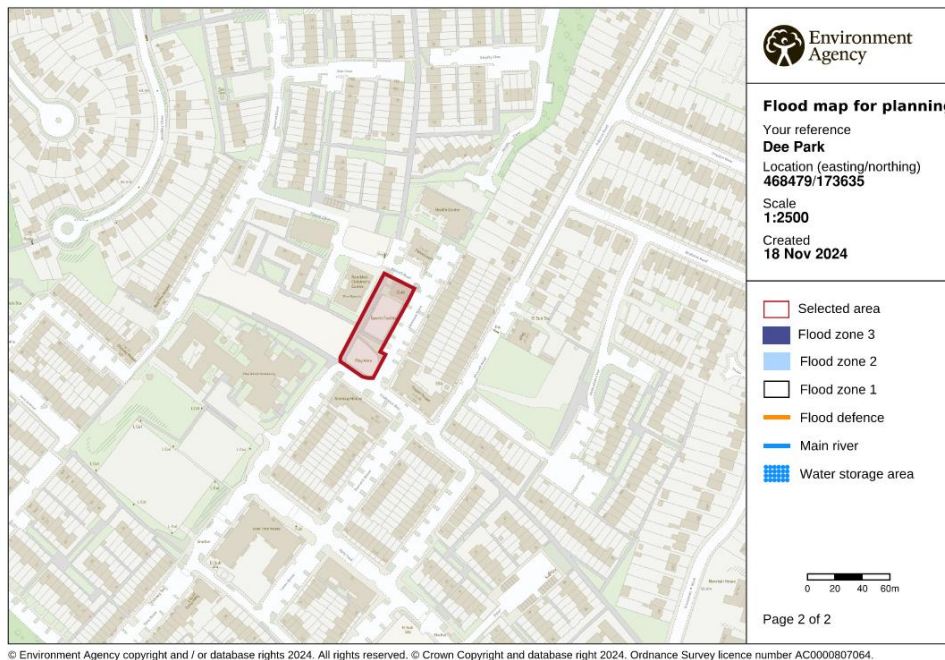


Table 2.2: Flood Zones Probability of Flooding

NPPF - Flood Zones		
Flood Zone 1	Low Probability	Less than 1 in 1000 (< 0.1%) chance of flooding occurring each year
Flood Zone 2	Medium Probability	Between 1 in 100 and 1 in 1000 (1% - 0.1%) chance of flooding occurring each year
Flood Zone 3a	High Probability	Greater than 1 in 100 (> 1%) chance of flooding occurring each year
Flood Zone 3b	Functional Floodplain	Land where water <i>has</i> to be stored in times of flood

2.6 Proposed Development

The proposed project involves the redevelopment of the site into a modernised playground. The plans include upgraded play equipment, resurfaced areas, and improved landscaping to create a safe and accessible recreational space. The site will retain some existing features, such as pathways and soft landscaping, while incorporating new drainage systems to manage surface water effectively.

See **Appendix B** for Architect's Proposed Site Layout.

3. Pre-Development Surface Water Management Strategy

3.1 Existing Surface Water Drainage Network

3.1.1 Existing Public Drainage

Review of Thames Water's sewer asset maps confirm that there are surface water sewers running along the southern and western edge of the site.

See **Appendix C** for the Sewer Asset Map.

3.1.2 Existing Private Drainage

Utilities and CCTV surveys of the site were undertaken in August 2022.

The survey confirmed that the private drainage infrastructure is concentrated near the temporary building and surrounding hardstanding area. The system includes a combined foul and surface water network from the building, discharging off site via a combined sewer. No formal drainage infrastructure was identified within the existing playground or MUGA area, which appear to rely on surface runoff or natural infiltration through the current surfacing.

See **Appendix D** for Existing Drainage Layout.

3.2 Pre-Development Surface Water Catchment Areas

Below is an indication of the pre-development catchment type area.

Table 3.1: Pre-Development Catchment Areas

Catchment	Area (m ²)
<u>Impermeable</u>	
Building / Roof	118
Roads / Hardstanding	571
<u>Permeable</u>	
Permeable surfacing (bark)	402
Soft Landscaping	267
Total Area	1358

See **Appendix E** for Pre-Development Catchment Plans.

3.3 Pre-Development Surface Water Run-Off Rates

In order to determine the post-development surface water flows, an assessment has been carried out on the pre-development to ensure that the run-off from the new development will not adversely affect flood risk either within the site boundary, offsite adjacent properties, or the downstream network.

Soakaway testing in accordance with BRE365 was undertaken within SA1-SA4 (refer to Ground Investigation for locations), with the results tabulated below.

Soakage Testing Results						
Trial Hole	Test Number	Depth (m bgl)	Start Depth (m bgl)	Finish Depth (m bgl)	Time Taken (mins)	Infiltration Rate (m/sec)
SA1*	1	1.50	0.60	0.65	240	6.86×10^{-7}
SA2*	1	1.50	0.60	0.61	240	1.34×10^{-7}
SA3*	1	1.50	0.68	0.71	240	4.40×10^{-7}
SA4	1	1.50	0.79	1.38	6	5.06×10^{-4}
	2	1.38	0.68	1.21	6	4.43×10^{-4}
	3	1.21	0.74	1.19	4	7.24×10^{-4}
*Given the relatively slow infiltration rate encountered, only one test could be undertaken and it did not reach 75% mark.						

It is therefore considered that SA04 was a suitable location for full infiltration techniques.

3.4 Summary of Pre-Development Flows

The pre-development surface water flows for the site have been assessed based on in situ testing with a rate of 4.43×10^{-4} m/s, as per the Phase 2 Site Investigation Report.

3.5 Pre-Development Flood Exceedance

Topographical survey information indicates that, should the existing drainage network fail or otherwise have its capacity exceeded, overland flows would follow the site topography and be directed towards the site's western boundary.

4. Surface Water Management and SuDS Assessment

4.1 Run-off Destinations

An appraisal should be undertaken to confirm the most suitable and sustainable method for managing surface water runoff from the development in accordance with the following hierarchy as highlighted in [Part H of Building Regulations and the National Planning Policy Framework \(NPPF\)](#):

1. Infiltration to the ground using a sustainable drainage system.
2. If this is not feasible, discharge to a watercourse or river; generally, at a controlled rate unless it does not affect flood risk e.g., if to the sea or an estuary.
3. Discharge at a controlled rate to a surface water sewer or drain.
4. Discharge at a controlled rate to a combined sewer system, with the approval from the Water Authority.
5. Only if the above have all been investigated and it has been proved that none of these options are suitable will discharge at a controlled rate to a foul sewer system, with the approval from the Water Authority.

The discharge of surface water run-off has been considered in accordance with the hierarchical approach:

Table 4.1: Review of the Drainage Hierarchy

Method	Reasoning	Suitability
Interception / Reuse	Considered unsuitable due to safety and maintenance requirements	X
Infiltration	As the site has potentially viable infiltration characteristics, it is of a safe assumption that the site would offer soakaway drainage.	✓
Surface Water Body	As infiltration to ground is viable this method has not been explored.	X
Surface Water Sewer	As infiltration to ground is viable this method has not been explored.	X
Combined Sewer	As infiltration to ground is viable this method has not been explored.	X
Foul Water Sewer	As infiltration to ground is viable this method has not been explored.	X

4.2 SuDS Assessment

4.2.1 Overview of SuDS

The design of the surface water drainage system should seek to implement and maximise the use of Sustainable Drainage Systems (SuDS) where possible.

The primary purpose of a SuDS system is to manage surface water run-off within a development via mimicking natural methods, attenuating additional water volume generated by the introduction of impermeable areas whilst providing a degree of water treatment to run-off alongside amenity and biodiversity benefits to the local community.

The suitability and benefits of the various potential SuDS systems for the proposed development should be considered, which will aim to maximise the 4 pillars of SuDS:

- » Water Quantity (Controlling runoff);
- » Water Quality (Managing quality of runoff);
- » Amenity (Create and sustain better places for people);
- » Biodiversity (Create and sustain better places for nature).

The implementation of SuDS can be divided into the management of sources and of the wider site and even region, with preference given to source control.

4.2.2 Suitability of SuDS Elements

The drainage design should adopt the principles of SuDS where appropriate taking into consideration the site context and location. The principals of SuDS are that they should be designed to maximise the opportunities and benefits that can be secured surface water run-off management in terms of quality, quantity, flood risk, and amenity. The implementation and selection of SuDS techniques is largely dependent on the site layout and context. Some SuDS techniques may be more appropriate than others.

The suitability of SuDS components has been assessed as follows:

Table 4.2: Suitability of SuDS Components

Hierarchy	System	Description	Suitability
Source Control	Green Roofs 	A planted soil layer on the roof of a building: stores water in the soil layer to be absorbed by vegetation. Reduces runoff and treats pollutants.	No. Considered unsuitable due to maintenance requirements
	Rainwater Harvesting 	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an over ground or underground tank for treatment and reuse locally.	No. Considered unsuitable due to maintenance requirements
	Permeable Surfaces 	Surfaces that allow water to penetrate into underlying layers to be stored, collected or made to infiltrate to groundwater.	Yes Permeable surfacing will be used across the site
	Bioretention Area 	A vegetated area with gravel and sand layers below designated to channel, filter and cleanse water vertically, to then be stored, collected or made to infiltrate to groundwater.	No. Not deemed suitable for this site due to space constraints and potential conflicts with

			its primary recreational use.
Hierarchy	System	Description	Suitability
Site and Regional Control	Filter Strip 	Grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	No. Not deemed suitable for this site due to space constraints and potential conflicts with its primary recreational use.
	Soakaway 	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	Yes. As the site has potential viable infiltration characteristics, soakaways have been utilised
	Swale 	Shallow depressions to convey and filter water. May be 'wet' with above ground attenuation or 'dry' with a gravel layer. Can be made to infiltrate to groundwater.	No. Not deemed suitable for this site due to space constraints in the playground and potential conflicts with its primary recreational use.
	Hardscape Storage 	Hardscape water features can be used to store runoff above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	No. Not deemed suitable
	Pond / Basin 	Store and treat water. Ponds have a level of standing water whereas basins are generally dry. Can be made to infiltrate to groundwater.	No. Not deemed suitable for this site due

Wetland 	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	to space constraints No. Not deemed suitable for this site due to space constraints in the playground and potential conflicts with its primary recreational use.
Underground Storage 	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	No. Not required due to use of attenuating sub-base and soakaway.

4.2.3 Interception Storage

Interception can be defined as the capture and retention on site of the first 5mm of the majority of all rainfall events. Interception mechanisms have been assessed to show the site is compliant for zero run-off from the first 5mm for 80% of events during the summer and 50% in winter. (Ciria)

Table 4.3: Interception Storage Systems

System	Reasoning	
Green Roofs	All surfaces that have green / blue roofs	X
Rainwater Harvesting	All surfaces drained to RWH systems designed whether for surface water management or just water supply, provided the RWH system design is based on regular daily demand for non-potable water	X
Soakaways / Infiltration	Areas of the site drained to systems that are designed to infiltrate run-off for events greater than a 1 month return period.	✓
Permeable Pavements	All permeable pavements, whether lined or not, can be assumed to comply, provided there is no extra area drained to the permeable pavement.	✓
Filter Strips / Swales	Roads drained by filters strips / swales, where the longitudinal gradient of the vegetated area is less than 1:100, are suitable for interception delivery for impermeable areas up to 5 times the base of the vegetated surface area receiving the runoff.	X
Infiltration Trenches	Roads drained by infiltration trenches can be considered to provide interception	X
Detention Basins	Areas of the site drainage to detention basin with a flat base can be assumed to comply. The area of the basin that is assumed to contribute to interception of run-off should be below the outlet of the basin.	X
Bioretention / Rain Gardens	Areas of the site drainage to unlined bioretention components can be assume to comply where the impermeable area is less than 5 times the vegetated surface area receiving run-off/ They can be designed to deliver interception for larger areas, where suitable infiltration capacity is available.	X
Ponds	Areas drained by ponds (with a permanent water pool that is effectively maintained by the outlet structure) are not assumed to deliver interception	X

5. Post-Development Surface Water Management Strategy

5.1 Proposed Surface Water Drainage Strategy

The proposed surface water drainage system has been designed to manage rainfall across all hard landscaped areas of the site, collecting and then directing water to a strategically located soakaway in the northern area of the site. The design incorporates a combination of permeable surfacing across the playground and path areas to reduce surface water runoff and filter out pollutants before it is discharged to ground.

Southern Area: Partial Infiltration System (System B)

In the southern areas of the site, it has been determined that infiltration is less viable due to the presence of clay-rich soils (Lambeth Group), which have significantly lower permeability than chalk. To address this, a partial infiltrating sub-base (System B) has been implemented. This system provides storage for surface water runoff within open-graded crushed rock (OGCR) layers while partially infiltration into low-permeability ground beneath but also convey to a more suitable location within the site. The system ensures water is collected, stored, and conveyed towards the northern the northern area.

Northern Area: Partial Infiltration System (System B)

In the northern areas of the site, it has been determined that infiltration is more viable due to the presence of chalk formation, which have higher permeability than clay, however, still has the presence of clay-rich soils. To address this, a partial infiltrating sub-base (System B) with a local deeper soakaway (System A) has been implemented. This system provides storage for surface water runoff within open-graded crushed rock (OGCR) layers while partially infiltration into low-permeability ground beneath but also convey to a more suitable location within the site. The system ensures water is collected, stored, and conveyed towards the deeper soakaway.

Northern Area: Full Infiltration System (System A).

Surface water from both the northern and southern areas of the site will ultimately be directed to a stone soakaway located in the southern portion of the site. This soakaway is strategically positioned within the highly permeable chalk geology, with an infiltration rate of 4.43×10^{-4} m/s. The base of the soakaway has been designed to sit on the chalk geology using depths taken from the log for the site

The soakaway, is designed to accommodate a 1 in 100-year storm event plus 40% climate change, ensuring sustainable infiltration into the chalk while preventing surface water runoff or flooding.

Where applicable, the surface water management strategy has incorporated the recommendations of the 'Non-Technical Standards for Sustainable Drainage' and general 'good practice' in terms of providing a Sustainable Drainage System (SuDS) that does not adversely impact flood risk either within the site or beyond the development boundary.

Thames Water Easement: Restrictions and Alternative Solutions

Within the Thames Water sewer easement, located along the western boundary of the site, tanked permeable paving sub-base systems are not permitted. However, as the site will utilise infiltration techniques (partial and full) the porous system can encroach within the easement.

See **Appendix G** for Drainage Strategy.

See **Appendix E** for Calculations

5.2 Post-Development Surface Water Catchment Areas

Below is an indication of the post-development catchment type area.

Table 5.1: Pre vs Post-Development Catchment Areas

Catchment	Area (m ²)
<u>Impermeable</u>	
Building / Roof	0
Roads / Hardstanding	0
<u>Permeable</u>	
Soft Landscaping	303
Permeable surfacing (wet pour/ Permeable paving)	1055
Total Area	1358

5.3 Post-Development Surface Water Run-Off Rates

In order to determine the post-development surface water flows an assessment has been carried out to ensure that the flows from the new development will not adversely affect flood risk either within the site boundary, offsite adjacent properties, or the downstream network:

The drainage strategy has been designed based on an infiltration rate of 4.43×10^{-4} m/s, which is within the typical range for chalk geology, as identified in the Phase 2 Site Investigation Report and supported by borehole logs. The rate conducted through in-situ infiltration testing is confirmed to be in accordance with BRE 365 – Soakaway Design.

5.3.1 Allowance for Climate Change and Urban Creep

In accordance with EA guidance, an allowance for climate change has been incorporated into the design to ensure that the proposed surface water network has a suitable degree of resilience. These allowances vary with the expected lifetime of the development.

Urban Creep Factor (UCF) is defined as any increase in the impervious area that is drained to an existing drainage system without planning permission being required, such as the construction of patios, small extensions, etc.

As the footprint of the site will remain majority impervious, this factor is not applied.

5.3.2 Post-Development Surface Water Storage

In line with the [Non-Statutory Technical Standard for Sustainable Drainage S7 & S8 \(Flood Risk\)](#), all storm events up to and including the 1 in 30 AEP storm event will be retained within the proposed surface water drainage network and exceedance volumes from all other storm events up to and including the 1 in 100 AEP plus 40% allowance for climate change will be retained within the site and managed to minimise the risk to people and property.

Attenuation flood storage will be distributed across the development with the use of attenuating sub-base systems and a stone soakaway, all attenuating at source. In the event that one part of the system fails through blockage the remainder of the system will still be able to function effectively.

Expected attenuation requirements are shown below:

Table 5.2: Attenuation Requirements

Type of Storage Structure	Dimensions	Void Ratio	Total Attenuation Volume
Attenuating Sub-Base (System B) -AS-01	467m ² x 0.3m deep	30%	43m³
Attenuating Sub-Base (System B) -AS-02	565m ² x 0.3m deep	30%	59m³
Stone Soakaway - SS-01	4m x 5m x 0.5m	30%	3m³

5.4 Post-Development Flood Exceedance

In line with the **Non-Statutory Technical Standard for Sustainable Drainage Sg (Flood Risk)**, in the event that there is a failure of the surface water drainage network beyond the design storm or through other circumstances, exceedance flows will be directed away from buildings and critical infrastructure.

See **Appendix F** for Overland Flow Routes

5.5 Summary of Post-Development Flows

It has been determined that the post-development surface water flow rates are in accordance with national guidelines and non-statutory technical standards to not adversely impact downstream flooding of the site as a result of the new development.

See **Appendix G** for the Drainage Strategy Layout.

5.6 Water Quality

Consideration must be given both during construction and post-development to ensure that water quality is not negatively impacted.

Playgrounds typically represent a low-pollution hazard environment, as defined in CIRIA C753 – The SuDS Manual, due to the absence of hydrocarbons and limited risks of heavy metals or high sediment loads.

The proposed drainage design incorporates different permeable surfacing types across the site. These SuDS components provide an effective first stage of treatment by allowing water to infiltrate and naturally filter through the surfacing and sub-base, removing suspended solids and pollutants.

The pollution mitigation provided by these SuDS elements exceeds the required levels for low-pollution land uses, ensuring compliance with water quality criteria outlined in CIRIA C753. The system is designed to provide sustainable and effective water treatment appropriate for the low-risk nature of the site.

5.6.1 Quality of Surface Water Run-off: Post-Development

In line with the SuDS suitability, the design should seek to provide an appropriate level of water treatment to effectively mitigate the pollution risk associated with the site and not affect the quality of water downstream.

The permeable surfacing utilised across the site, will act as a pre-treatment mechanism, allowing for initial filtration of surface water before it enters the drainage system.

In addition, the attenuating sub-base systems will help further filter and slow water flow, reducing the risk of pollutants being transported into the underlying chalk or downstream areas. These measures collectively ensure the water quality is maintained while supporting the functionality and sustainability of the drainage system.

5.6.2 Quality of Surface Water Run-off: During Construction

It is anticipated that the during construction adequate provisions will be put in place to ensure the existing drainage is protected to prevent material which could have a negative impact on water quality entering the system.

Some pollution mitigation techniques that are to be considered include:

- » Monitoring and managing disposal of site waste. Make sure all waste is correctly dealt with to stop it from spreading.
- » Keeping materials such as sand and cement secure. Materials should be located where there isn't risk of them being washed into the drainage system.
- » Covering up all drains to prevent waste from ending up in the system.
- » Keep the road and paths to the site clean at all times. This will prevent silt and other pollutants from running off into any bodies of water.
- » Properly collect and treat any wastewater that is produced.
- » Temporary installation of screens within manholes to capture any debris.

5.7 Design Standards for Surface Water Drainage

The surface water drainage strategy for the new development should aim to deliver a safe, functional, cost effective and, as far as possible, sustainable drainage system (SuDS) which considers the following design principles to ensure:

- » That natural drainage features are protected;
- » That public health and safety risks are taken into account and managed;
- » The constructability of the surface water system;
- » The maintainability of the surface water system;
- » The long-term economic viability of the system;
- » That sustainability issues are taken into account;
- » That the information requirements of stakeholders are adequately addressed;
- » That the potential value of the surface water system, in enhancing the rural and urban environment is recognized and optimized.

The surface water below ground gravity drainage system is to provide connections from all new rainwater pipes, channels, gullies and road gullies at ground floor level. The locations of the drainage components are to be fully coordinated with all relevant architectural, landscaping and services drawings. All materials and products relating to the below ground drainage system shall be specified in accordance with their intended use and meet all relevant British Standards and BBA accreditations.

In accordance with best practice storm drainage will be designed to the following performance criteria:

1 in 2-year storm return period:	Pipes running under full conditions with no surcharge.
1 in 30-year storm return period:	No flooding.
1 in 100-year storm:	Extreme flooding to be retained on site.

6. Ownership and Maintenance

The key elements of the surface water drainage system will require periodic maintenance to prevent failure of the system and/or a reduction in capacity of the networks as a whole and the following matrix therefore sets out the various drainage items to be maintained, identifies who is responsible and the frequency of maintenance.

6.1 Post Development SuDS Features

The proposed SuDS features will require maintenance including litter and debris removal, sediment removal, vegetation maintenance and remediation to any damaged structures.

The maintenance requirements will be the responsibility of a private maintenance company. All inspection and maintenance works should take into consideration the implications of 'lone working'. An assessment should be carried out and the risks mitigated accordingly.

Table 6.1: Proposed Schedule of Maintenance for Below Ground Drainage

Permeable Paving - Operation and maintenance requirements in accordance with CIRIA C753 - The SuDS Manual		
<u>Maintenance Schedule</u>	<u>Required Action</u>	<u>Frequency</u>
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface).	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surfaces from adjacent impermeable areas as this area is most likely to collect the most sediment.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying.	As required – once per year on less frequently used pavements.
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required.

	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging).
Monitoring	Initial inspection.	Monthly for three months after installation.
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action.	Three-monthly, 48 h after large storms in first six months.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chambers.	Annually.

Reference should be made to the manufacturer recommendations where applicable

Soakaways - Operation and maintenance requirements in accordance with CIRIA C753 - The SuDS Manual

<u>Maintenance Schedule</u>	<u>Required Action</u>	<u>Frequency</u>
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings.	Annually.
	Trimming any roots that may be causing blockages.	Annually (or as required).
Occasional maintenance	Remove sediment and debris	As required, based on inspections.
Remedial actions	Reconstruct soakaway and / or replace or clean void fill, if performance deteriorates or failure occurs.	As required.
	Replacements of clogged geotextile (will require reconstruction of soakaway).	As required.
	Inspect silt traps and note rate of sediment accumulation.	Monthly in the first year and then annually.
	Check soakaway to ensure emptying is occurring.	Annually.

6.2 Post Development Drainage System

All drainage systems should be inspected at regular intervals then, if necessary, cleaned and repaired to ensure that system performance is maintained.

This guide includes recommendations on the methods and frequency of the inspection and cleaning but local factors may influence this, therefore this manual should be appended to include any revises or additional requirements determined during the life of the development.

6.3 Inspection And Cleaning of Surface Water Drainage

Inspection chambers, gullies and channels should be fully inspected regularly, at least annually, by removing covers and checking for obstructions, silt and damage.

The following should be carried out when cleaning a drainage system:

- » Covers of inspection chambers and manholes should be removed and the sides, benching and channels cleaned.
- » Main and branch drains should be cleaned and should be flushed with clean water afterwards. Any obstructions found should be removed and not flushed into the system.
- » Periodically, accumulated deposits in gullies should be removed. The traps should then be plunged and thoroughly flushed out with clean water.
- » Covers of inspection chambers and gullies should be replaced, bedded in suitable grease or other sealing material and/or bolted down as appropriate to the type. Missing bolts and broken items should be renewed.

6.4 Methods Of Cleaning

The drainage system should be cleaned, as appropriate, using one or more of the following methods:

6.4.1 Rodding

Appropriate cleaning tools and techniques should be chosen to avoid damage to the pipework during the cleaning process. A set of rods with appropriate ends is basic useful equipment.

It is important that correctly designed propriety ends are used on the rods. Makeshift devices attached to the ends of rods should be avoided, as they are not effective as the correctly designed article and could become detached and create a blockage which would be difficult to remove. Furthermore, is it possible that such devices could cause damage to the pipeline.

If the rods have brass ferrules, they should be checked to ensure that their fastenings are secure and that there are no protruding shoulders or fastenings, as these can cause damage to drain lines, especially when entering through rodding eyes.

6.4.2 Jetting

High pressure jetting techniques are suitable for use with all currently available pipe materials and should also be considered.

6.4.3 Hydraulic Rams, Compressed Air or Other Gases

Equipment is available for use with all sizes of drain likely to be encountered in building drainage and is suitable for use with all currently available pipe materials. The principle of operation is that a shock wave is induced and is transmitted by water to the point of blockage and the technique is effective where the pipe is surcharged or can be filled with water from the blockage to a point where the equipment can be used.

Table 2: Drainage Items - Ownership & Maintenance Responsibility Matrix

Drainage Items - Ownership & Maintenance Responsibility Matrix		
Feature	Maintenance	Frequency
Private Drains	Inspection	CCTV survey every 5-10 years.
	Regular Maintenance	Jet clean system fully every 5-10 years. (Recommend prior to CCTV drainage survey is)
	Remedial / Occasional Maintenance	Carry out remedial works as identified in CCTV survey.
Gully / Drainage Channels	Inspection	Quarterly
	Regular Maintenance	Remove silt and debris as necessary to prevent build up.

A formal review of the risks should be undertaken on an annual basis:

Table 3: Proposed Operational Schedule for Below Ground Drainage

Operation	Risks	Mitigating Measures
Access to manholes for Inspection and Maintenance.	1. Confined spaces	1. Entry to confined space to be minimised and, where unavoidable, to be carried out by appropriately trained personnel
Removal of silt from drainage channel	1. Risk to members of the public	1. Access to hazardous areas by members of the public to be prohibited

All inspection and maintenance works should take into consideration the implications of 'lone working'. An assessment should be carried out and the risks mitigated accordingly.

7. Consent / Planning

Summary of expected consents required:

- » Ordinary Watercourse Consent – No
- » Sewerage Undertaker Consent – No
- » Section 104 / 106 Drainage Adoption - No
- » Build Over / Build Near - No

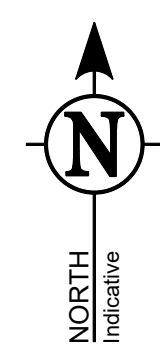
In addition to the above it is anticipated that details of the drainage scheme will need to be approved by Reading Borough Council Lead Local Flood Authority (LLFA) through a formal planning application.

8. Conclusions

This report concludes that the surface water drainage strategy for the development will be designed in accordance with both national and local standards and best practice. The following key items have been summarised below:

- » The surface water drainage systems for the new development will be designed to accommodate the required flows for the lifetime of the development, utilising permeable surfacing to promote infiltration.
- » It has been determined that the post-development surface water flow rates can be effectively managed using a measured infiltration rate of 4.43×10^{-4} m/s for the chalk strata in the northern portion of the site, in accordance with national guidelines and technical standards, ensuring no adverse impact on downstream flooding.
- » All surface water run-off from storm events up to and including the 100-year plus 40% climate change will be retained within the overall site.
- » Attenuation is provided "at source" through the use of attenuating sub-base systems in areas with low permeability, with surface water conveyed to a stone soakaway in the northern area for final discharge into the permeable chalk.
- » In the event that flows from rainfall exceed the 1 in 100-year rainfall event or system failure through lack of maintenance, surface water run-off will be directed via exceedance routes away buildings and/or critical infrastructure.
- » The use of permeable surfacing ensures that water quality meets the criteria outlined in CIRIA C753 – The SuDS Manual, minimising pollution risks.
- » Ownership and maintenance liabilities for the surface water drainage system will be clearly defined so that in the event of failure the drainage system appropriate action can be taken to ensure that the drainage system continues to work efficiently.

Appendix A Topographical Survey



ABBREVIATIONS & SYMBOLS

AS	Arch Head Height	ER	Earth Road	RS	Roller Shutter Door
AB	Ar Brick	ET	Exp-Transformer	RSJ	Roller Steel Joist
AD	Arch Deck	EV	Exp-Valve	SS	Stainless Steel
AV	Ar Valve	FBD	Flow Board Direction	SP	Arch Spring Point Height
BA	Bolt Anchor	FL	Flow	SV	Stop Valve
BH	Bore Hole	FLD	Flow Level	SW	Stop Water
BD	BD Level	FP	Flag Pole	SY	Cable Stay
BO	Bolt	FO	Flow	T	Tie
BP	Brace Post	GC	Gully Grate	Ta	Tackle Paving
BS	BS Stop	GV	Gate Valve	TH	Trail Pole
BU	Bulk	HG	Hinge	TI	Tie
BAW	Barbed Wire Fence	IC	Inspection Cover	TL	Traffic Light
CB	CB (Circuit)	IR	Investment	TW	Tow of Water
CIS	Cable Chain Fence	IO	Investment	TP	Top of Pole
CL	Chain Link	KO	Kent Outlet	TS	Top of Signal
CL	Chain Link Fence	MB	Manhole	UB	Under Beam
C-LE	Celling Level	MP	Master Post	UC	Unknown Cover
GO	Gate	MS	Master	UK	Unknown Town
CP	Crested Paving Fence	MS	Master	UN	Unknown Town
CR	Cable Rail	OS	Overhead Line (UK)	US	Underground
CW	Cable Wall	PA	Parking Place	USB	Under Side Beam
CO	Cable	PM	Parking Meter	USL	Under Side Lift
DC	Drainage Channel	PM	Parking Meter	UTS	Unable To Survey
CH	Chain Height	PR	Pole	VP	Vent Pipe
D	Dilapidated	PR	Post & Rail Fence	WH	Water Hole
DP	Down Pipe	PW	Post & Wire Fence	WH	Water Hole
DE	Drainage	RL	Rolling Level	WH	Water Hole
EB	Electric Box	RE	Rolling Eye	WO	Water Out
ES	Electric Supply Cover	RL	Rolling Level	WO	Water Out
EL	Electric Pole	RS	Rolling Sign	WC	Water Ceiling Height
EP	Electric Pole	RS	Rolling Sign	FO	Flow of Falling Ceiling H

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including: sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

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Do not scale from this drawing

SURVEY CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
S501	468477.933	173643.433	50.936	PK Nail
ST01	468479.581	173602.881	52.143	PK Nail
ST02	468508.853	173644.154	52.998	PK Nail
ST03	468511.207	173671.220	52.810	PK Nail
ST04	468487.952	173676.171	50.781	PK Nail
ST05	468454.621	173611.548	51.476	PK Nail

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid north with a scale factor of 1,000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies any coordinated data used in conjunction with this survey must be derived directly from this control data.

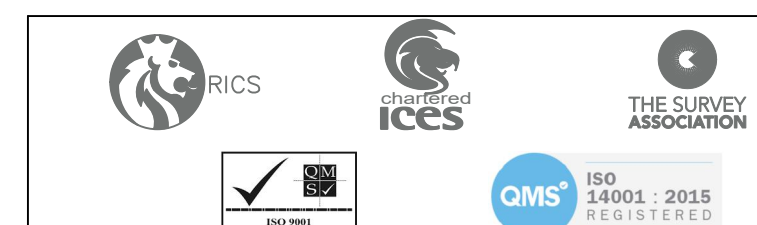
REV	DESCRIPTION	DRAWN	APPR	DATE
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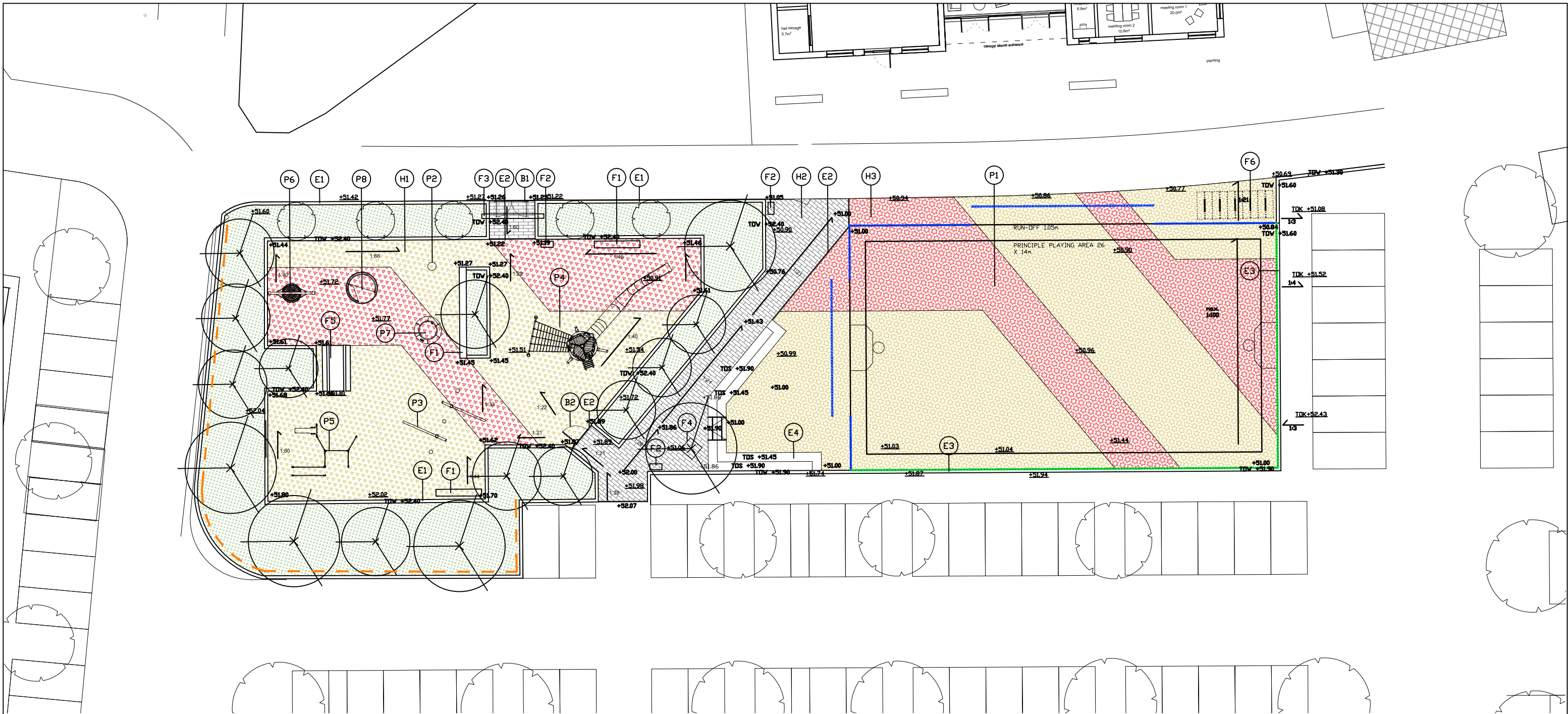
PROJECT TITLE
RANNOCH STREET, READING,
BERKSHIRE. RG30 4FU

DRAWING DETAIL
TOPOGRAPHICAL SURVEY
Sheet 1 of 1

CLIENT GLEEDS MANAGEMENT SERVICES LTD				SCALE 1:200
SURVEYOR JK	SURVEY DATE 07/07/22	CHECKED BY JPH	APPROVED BY RG	DWG STA FINAL
DRAWING NUMBER 43004CVLS-01			REVISION	ISSUE DA 14/07/22



Appendix B Proposed Site Layout



Legend

Levels

- Existing level retained
- Proposed level
- Proposed fall/ gradient

Surface Finishes & Edges

- H1 A/B wetpour/ tigermulch surfacing (porous)
- H2 Porous pre-cast concrete block paving (brick style)
- H3 Polymeric surfacing to ball sports area (porous)
- E1 Timber sleeper retaining wall - grade A European Oak
- E2 Flat Top edging 50mm wide
- E3 Brick retaining wall
- E4 Natural stone seating steps

Boundary Treatments

- B1 Double metal gate (gate to open inwards into park)
- B2 Single metal gate (gate to open inwards into park)
- B3 Metal fence to playground 1.1m high
- B4 Rebound fence to ball sports area 3m high
- B5 Rebound fence to ball sports area 4m high
- Play
 - P1 MUGA - Sport England size for basketball
 - P2 Spinning bowl
 - P3 Trapeze swing
 - P4 Climbing structure
- P5 Outdoor gym
- P6 Nursery swing
- P7 Playground trampoline
- P8 Roundabout

Furniture

- F1 Timber bench
- F2 Litter bin
- F3 Reclaimed metal arch
- F4 Tree grille
- F5 Picnic table and bench
- F6 Bicycle stands

Planting

- Shade mix- groundcover structure planting with bulbs
- Specimen tree - (ms) multi-stem form, height 3m minimum with raised stems.
- Specimen shrub
- Refer to softworks schedule for details.
- Existing trees to be retained.

NOTE: All play equipment and materials are as described 'or similar'. The final design and material specification could be subject to minor changes as a result of stage 4 coordination, subject to client approval.

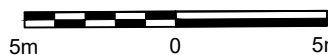
Rev	Date	Drawn	Description
A	03.05.23	KRA	For information
B	22.05.23	RBL	For information
C	25.05.23	RBL	For information
D	04.09.24	RBL	For information
E	12.09.24	RBL	For information
F	08.10.24	RBL	For planning
G	14.10.24	RBL	Note added to legend. For planning
H	20.11.24	RBL	Permeable paving annotated. For planning
I	17.12.24	RBL	Permeable paving removed from highways land. For planning
J	07.01.25	RBL	Block paving removed from highways land. For planning
K	09.05.25	RBL	Redesign following consultation. For coordination.

Notes:
Do not scale from drawings unless by agreement with HTA. Use figured dimensions only. Check all dimensions on site prior to commencing the works. Drawing to be read in conjunction with other relevant consultant information.

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Legend

1:250



Hardworks General Arrangement

Reading Borough Council
Dee Park Open Space

client name

INFORMATION

status

RBC-DPR_HTA-L_DR_0901

drawing number

1:250

scale @ A3

HTA Design LLP
www.hta.co.uk

London | Edinburgh | Manchester | Bristol

RBC-DPR

project number

KRA

originated by

revision

hta

Appendix C Sewer Asset Map

Hydrock
Merchants House North
Wapping Road
BRISTOL
BS1 4RW

Search address supplied 14
Glenmore Place
Tilehurst
Reading
RG30 4EP

Your reference 36064

Our reference ALS/ALS Standard/2024_5084063

Search date 21 November 2024

Notification of Price Changes

From 1st April 2024 Thames Water Property Searches will be increasing the prices of its CON29DW Residential and Commercial searches along with the Asset Location Search. Costs will rise in line with RPI as per previous years, which is sat at 6%.

Customers will be emailed with the new prices by February 28th 2024.

Any orders received with a higher payment prior to the 1st April 2024 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

Search address supplied: 14, Glenmore Place, Tilehurst, Reading, RG30 4EP

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 search provides 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

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

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.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.



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

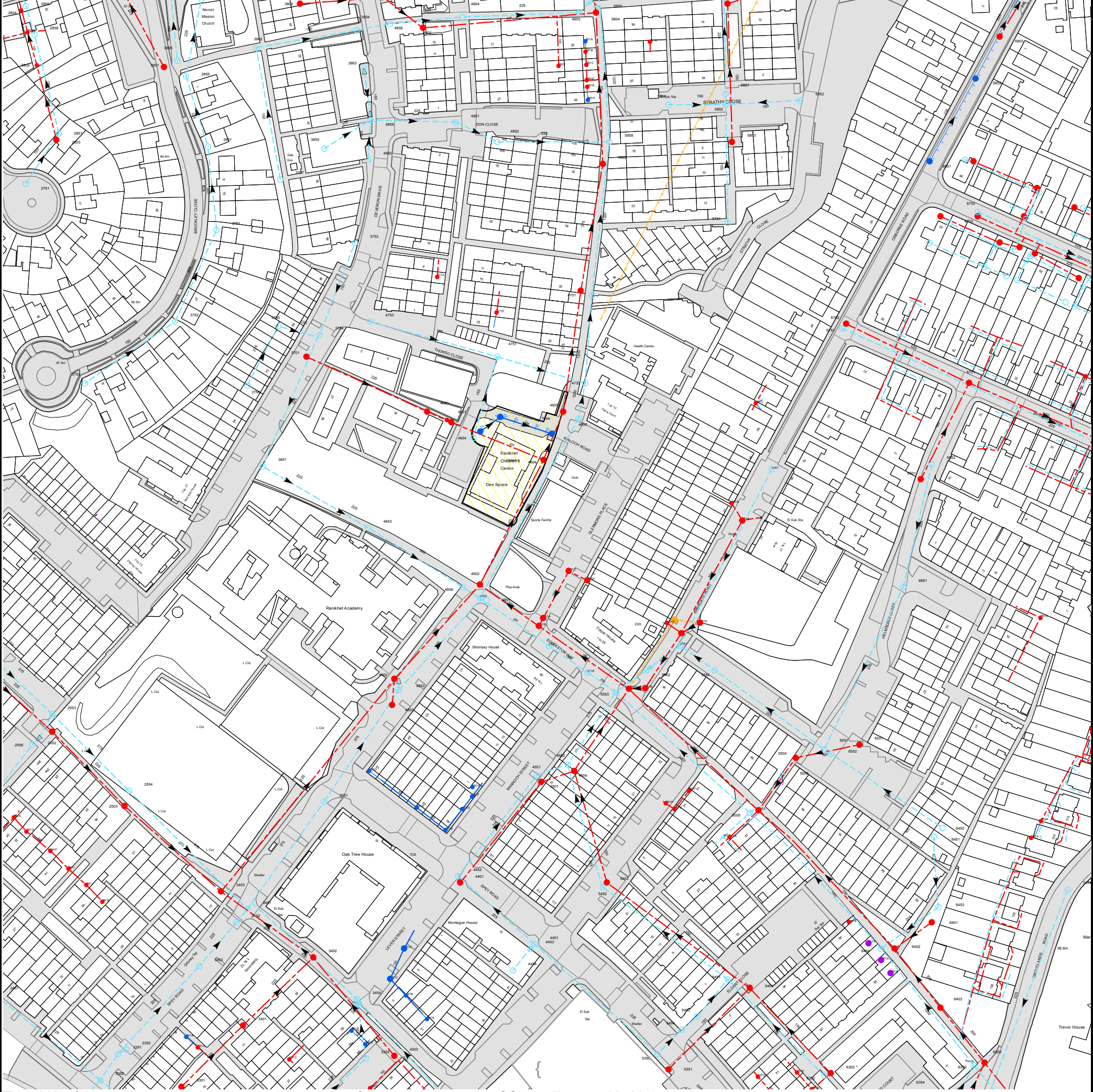
Clean Water queries

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

Asset Location Search Sewer Map - ALS/ALS Standard/2024 5084063



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 468483,173629
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 and established on site before any works are undertaken.

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
67JM	n/a	n/a
77LD	n/a	n/a
67KJ	n/a	n/a
6703	55.71	53.8
67JH	n/a	n/a
6752	55.72	54.13
77KM	n/a	n/a
77HK	n/a	n/a
77FN	n/a	n/a
67KH	n/a	n/a
77LE	n/a	n/a
77LC	n/a	n/a
3751	65.69	n/a
2751	69.38	67.83
3757	61.6	59.84
3855	59.72	58.48
3851	63.58	n/a
2803	n/a	n/a
2851	n/a	n/a
3859	62.85	n/a
3801	62.69	60.22
77JJ	n/a	n/a
77JD	n/a	n/a
77HN	n/a	n/a
77JH	n/a	n/a
67JK	n/a	n/a
67JL	n/a	n/a
67JE	n/a	n/a
67KC	n/a	n/a
67JF	n/a	n/a
67KE	n/a	n/a
77HE	n/a	n/a
2752	67.14	n/a
3752	66.51	n/a
3756	n/a	n/a
3651	56.9	54.79
3755	n/a	n/a
3701	57.55	54.81
3754	57.28	56.04
3753	58.87	56.72
4653	53.06	50.41
4753	56.72	53.61
4603	n/a	n/a
471A	n/a	n/a
4601	52.67	49.56
4656	n/a	n/a
4654	50.99	48.75
4652	51.95	46.84
4602	51.53	48.28
n/a	n/a	n/a
471D	n/a	n/a
4751	52.35	48.42
n/a	n/a	n/a
4604	50.74	48.15
n/a	n/a	n/a
4605	50.45	47.9
461C	52.05	50.7
4655	50.67	46.27
4701	50.25	47.49
4752	50.35	46.14
461D	52.5	51.366
5752	50.05	46.07
5751	48.44	46.91
561B	n/a	n/a
561A	58.62	56.58
561C	n/a	n/a
5651	59.07	57.45
6751	56.84	55.57
6702	56.87	54.68
751C	n/a	n/a
751D	n/a	n/a
6651	59.37	57.03
6601	58.96	55.43
6652	58.9	57.34
6701	57.47	54.31
771D	n/a	n/a
77KK	n/a	n/a
77JK	n/a	n/a
77KJ	n/a	n/a
77JM	n/a	n/a
67KF	n/a	n/a
77KH	n/a	n/a
77JC	n/a	n/a
77JE	n/a	n/a
67JN	n/a	n/a
67KD	n/a	n/a
2556	58.57	57.37
2502	58.46	56.08
2553	n/a	n/a
4504	53.46	49.79
551E	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
5553	53.72	47.48
5502	54.12	51.36
551B	54.62	52.97
5552	55.17	51.24
551H	n/a	n/a
551D	n/a	n/a
5551	57.13	55.25
551C	57.14	55.41
551F	n/a	n/a
551A	n/a	n/a
5554	57.27	56.13
5556	n/a	n/a
5504	57.37	55.35
6551	57.95	56.37
6552	58.01	56.36
6501	58.46	56.36
451D	n/a	n/a
4503	55.37	50.99
4502	54.88	50.83
4553	54.97	49.75
451E	n/a	n/a
451G	n/a	n/a
451F	n/a	n/a
451H	n/a	n/a
4651	51.88	50.66
4551	53.39	50.96
451B	52.37	48.609
4501	53.23	50.22
451A	52.3	50.533
451C	n/a	n/a
4552	53.35	48.98
3453	61.41	55.7
3402	59.7	57.25
3452	n/a	n/a
3451	56.62	54.08
241E	n/a	n/a
3403	56.75	54.93
241J	n/a	n/a
241I	n/a	n/a
241F	n/a	n/a
241G	n/a	n/a
251A	n/a	n/a
2503	60.03	55.46
3551	56.69	51.78
2554	n/a	n/a
631A	n/a	n/a
531D	n/a	n/a
6352	55.24	52.86
6302	55.19	52.79
531E	n/a	n/a
6359	55.85	52.08
6303	55.82	52.36
6403	55.6	51.79
5401	55.69	51.77
641H	n/a	n/a
641G	n/a	n/a
6454	55.8	50.08
6402	56.37	51.56
641F	n/a	n/a
6401	57.13	55.56
641E	n/a	n/a
6453	57.85	55.29
7451	59.78	57.76
741A	n/a	n/a
541A	n/a	n/a
6451	58.64	56.2
6450	58.96	57.54
751A	n/a	n/a
5555	55.46	49.21
5503	55.68	50.63
341B	n/a	n/a
3454	60.41	54.73
341C	n/a	n/a
3352	62.09	59.61
431C	n/a	n/a
441C	n/a	n/a
4303	61.69	n/a
441D	n/a	n/a
441B	n/a	n/a
441A	n/a	n/a
441E	n/a	n/a
4452	55.67	53.9
4401	56.38	53.54
4454	58.02	55.87
4453	57.83	54.62
4451	57.32	54.41
5452	56.96	49.7
5402	55.81	50.47
5350	57.24	55.16
5301	57.12	52.77
551G	n/a	n/a
5454	57.05	54.94
5450	56.68	54.81

Manhole Reference	Manhole Cover Level	Manhole Invert Level
541B	n/a	n/a
5451	n/a	n/a
3301	63.58	60.78
2352	64.92	60.31
331C	n/a	n/a
2351	64.21	58.19
2355	64.02	62.31
331A	n/a	n/a
341A	n/a	n/a
3401	61.7	58.43
3858	62.56	60.66
3862	60.24	58.06
3802	n/a	n/a
3857	61.54	59.84
2852	64.46	63.15
2804	64.93	63.66
2855	64.82	63.98
281A	n/a	n/a
2856	n/a	n/a
2802	n/a	n/a
3854	55.17	53.85
3863	58.61	56.88
4860	58.47	56.57
4859	58.58	56.18
4801	58.69	55.96
4856	55.06	53.23
4802	55.54	53.15
4851	55.09	53.44
4854	54.3	52.69
4852	52.5	50.33
481F	n/a	n/a
4855	50.69	48.62
481A	n/a	n/a
481B	n/a	n/a
481C	n/a	n/a
481D	n/a	n/a
481E	n/a	n/a
5852	48.04	46.83
6851	55.78	54.06
68KM	n/a	n/a
68KK	n/a	n/a
6852	54.71	53.36
6803	n/a	n/a
5856	50.37	49.48
581A	n/a	n/a
5804	50.32	46.97
5855	n/a	n/a
5805	49.51	47.41
5858	49.6	45.76
581B	n/a	n/a
5854	48.03	46.35
5853	47.46	46.09
5857	47.48	46.09
5802	47.34	45.48
5803	47.81	46.31
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 and established on site before any works are undertaken.		



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

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.

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 diverts 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.

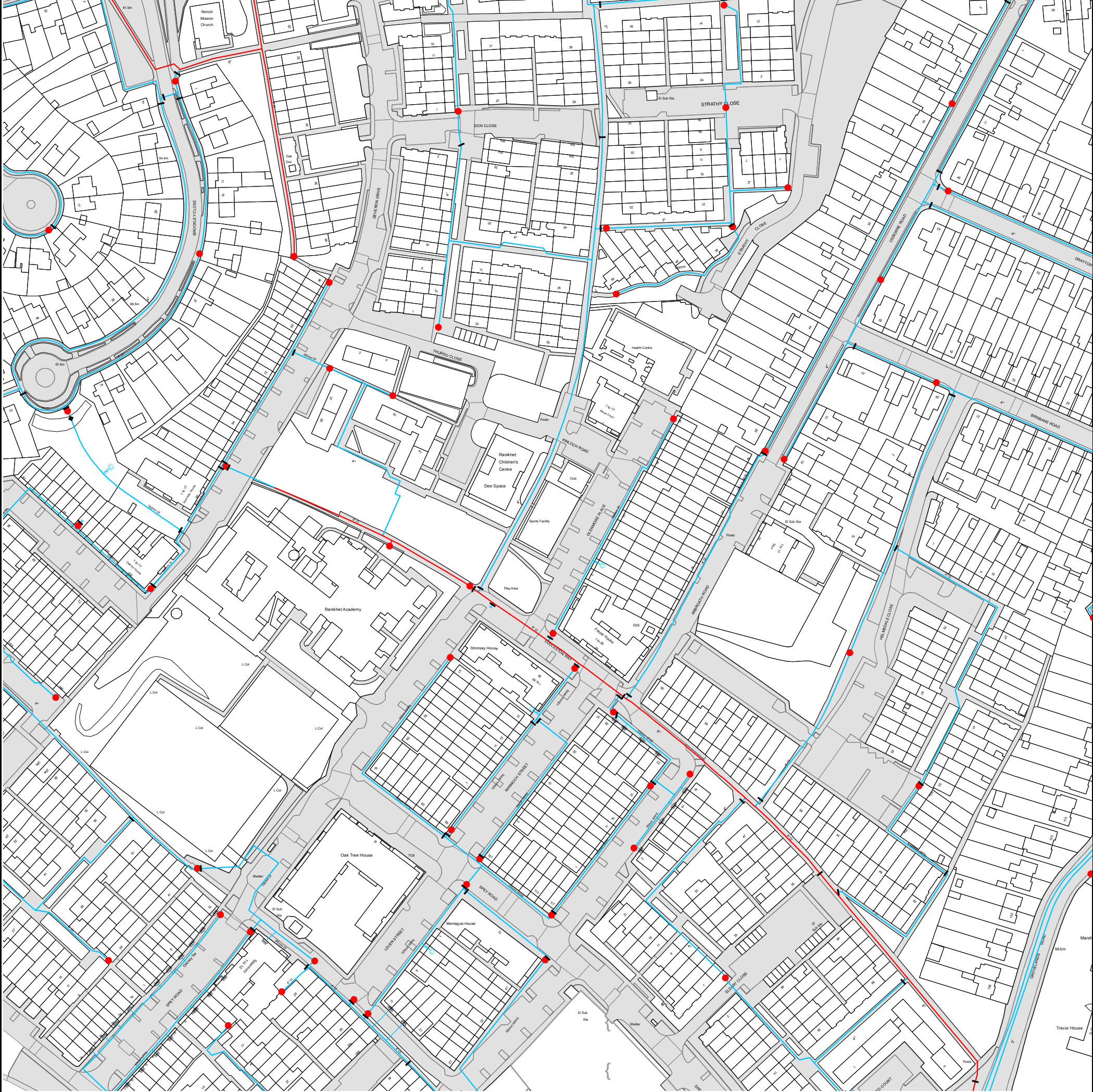
	Agreement
	Chamber
	Operational Site

Ducts or Crossings

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

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.



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 468483, 173629.
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 and established on site before any works are undertaken.

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.



Asset Location Search - Water Key

Water Pipes (Operated & Maintained by Thames Water)

- 4"** **Distribution Main:** The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.
- 16"** **Trunk Main:** A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.
- 3" SUPPLY** **Supply Main:** A supply main indicates that the water main is used as a supply for a single property or group of properties.
- 3" FIRE** **Fire Main:** Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.
- 3" METERED** **Metered Pipe:** A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.
- Transmission Tunnel:** A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.
- Proposed Main:** A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger
- Casement:** Ducts may contain high voltage cables. Please check with Thames Water.

Other Water Pipes (Not Operated or Maintained by Thames Water)

- Other Water Company Main:** Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.
- Private Main:** Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Payment Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
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'.
5. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
6. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 980 8800.

If you are unhappy with our service, you can speak to your original goods or customer service provider. If you are still not satisfied with the outcome provided, we will refer the matter to a Senior Manager for resolution who will provide you with a response.

If you are still dissatisfied with our final response, and in certain circumstances such as you are buying a residential property or commercial property within certain parameters, The Property Ombudsman will investigate your case and give an independent view. The Ombudsman can award compensation of up to £25,000 to you if he finds that you have suffered actual financial loss and/or aggravation, distress, or inconvenience because of your search not keeping to the Code. Further information can be obtained by visiting www.tpos.co.uk or by sending an email to admin@tpos.co.uk.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0300 034 2222 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

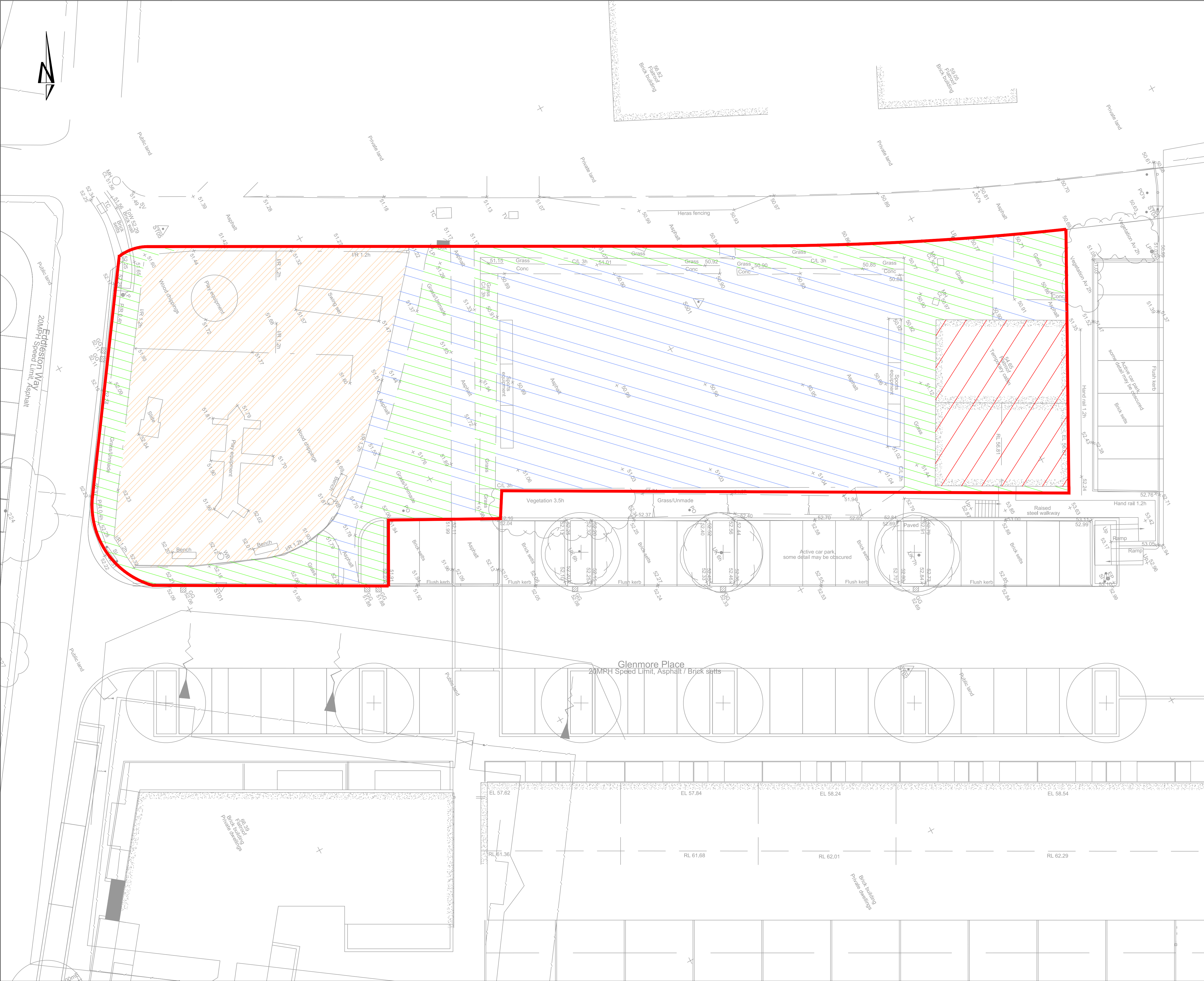
Ways to pay your bill

Credit Card	BACS Payment	Telephone Banking
Please Call 0800 009 4540 quoting your invoice number starting CBA or ADS	Account number 90478703 Sort code 60-00-01 A remittance advice must be sent to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW. or email ps.billing@thameswater.co.uk	By calling your bank and quoting: Account number 90478703 Sort code 60-00-01 and your invoice number

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Appendix D Existing Drainage / Utilities

Appendix E Pre/Post Development Catchments



KEY PLAN

NOTES

- All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
- The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and are not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.
- Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.
- All levels are shown in metres above Ordnance Datum (m AOD).

LEGEND

BUILDING / ROOF

= 118m²

HARDSTANDING

= 571m²

SOFT LANDSCAPING

= 267m²

PERMEABLE SURFACING

= 402m²

TOTAL

= 1358m²

PO2	SITE PLAN UPDATED					
	B.MURPHY	16/05/25	H.MILER	16/05/25	A.TODD	16/05/25
PO1	PRELIMINARY ISSUE					
	C.HOPKINSON	18/11/24	A.TODD	18/11/24	A.TODD	18/11/24
REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

Hydrock

Merchants' House North

Wapping Road

Bristol

BS1 4RW

t: +44 (0)117 945 9225

e: bristolcentral@hydrock.com

CLIENT

READING BOROUGH COUNCIL

PROJECT

DEE PARK OPEN SPACE

TITLE

PRE-DEVELOPMENT
CATCHMENT PLAN

HYDROCK PROJECT NO.

C-36064-C

SCALE @ A1

1:125

STATUS DESCRIPTION

PLANNING

STATUS

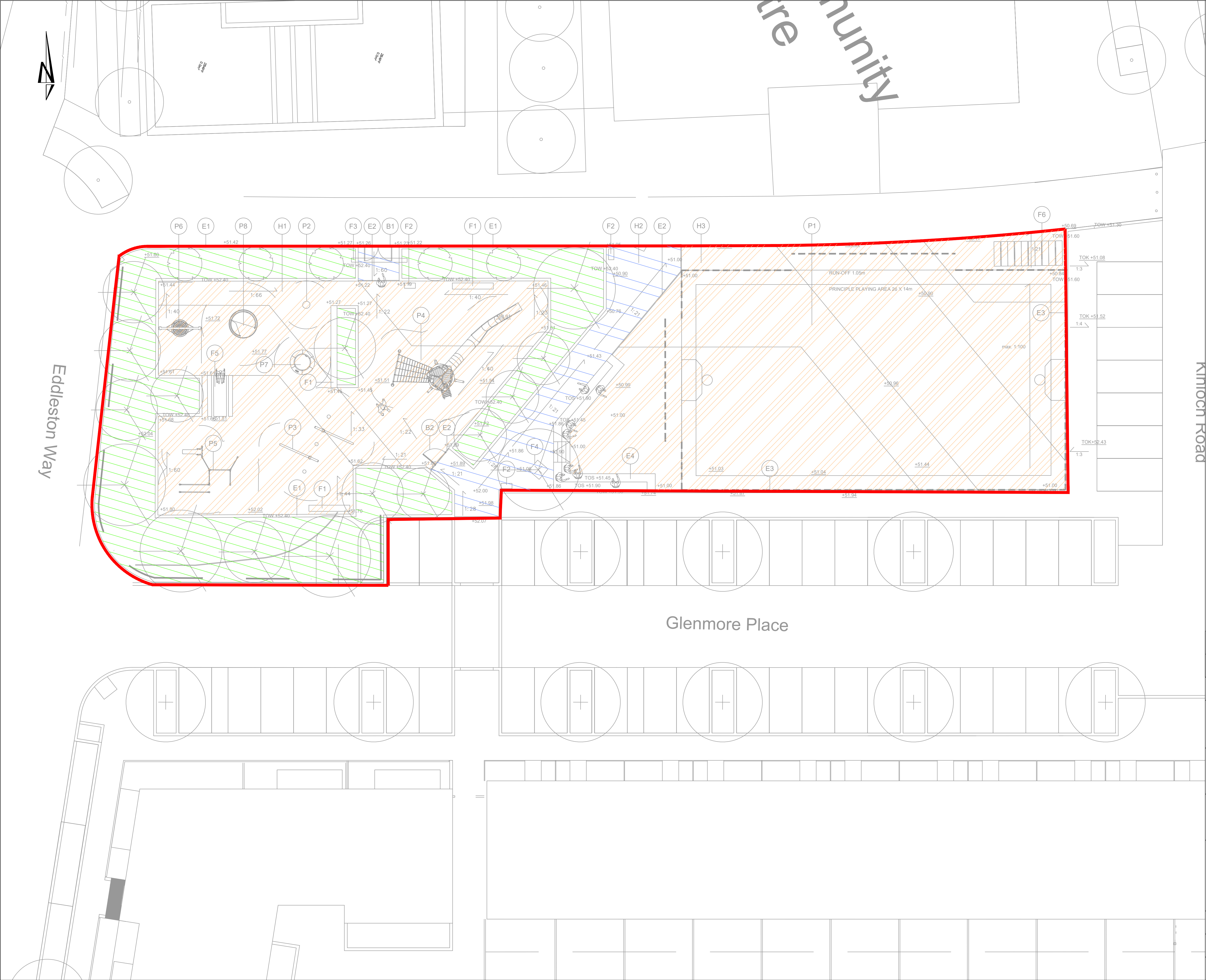
S2

DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)

36064-HYD-00-ZZ-SK-C-7710

REVISION

P02



KEY PLAN

NOTES

LEGEND

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.

2. The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and are not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.

3. Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.

4. All levels are shown in metres above Ordnance Datum (m AOD).

BUILDING / ROOF

HARDSTANDING

SOFT LANDSCAPING

PERMEABLE SURFACING

TOTAL

= 0m²

= 0m²

= 303m²

= 1055m²

= 1358m²

PO2	SITE PLAN UPDATED					
	B.MURPHY	16/05/25	H.MILER	16/05/25	A.TODD	16/05/25
PO1	PRELIMINARY ISSUE					
	H.MILLER	18/11/24	A.TODD	18/11/24	A.TODD	18/11/24
REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

Hydrock

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BS1 4RW
t: +44 (0)117 945 9225
e: bristolcentral@hydrock.com

CLIENT

READING BOROUGH COUNCIL

PROJECT

DEE PARK OPEN SPACE

TITLE

POST DEVELOPMENT
CATCHMENT PLAN

HYDROCK PROJECT NO.
C-36064-C

SCALE @ A1
1:125

STATUS DESCRIPTION
PLANNING

STATUS
S2

DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)
36064-HYD-00-ZZ-SK-C-7720

REVISION
P02

Appendix F Calculations

Project:	Date: 15/11/2024			
	Designed by:	Checked by:	Approved By:	
Report Details: Type: Inflows Storm Phase: Phase	hgmler			
	Company Address:			



Catchment Area AS-01

Type : Catchment Area

Area (ha)	0.04
-----------	------

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.950
Winter Volumetric Runoff	0.950
Time of Concentration (mins)	5
Percentage Impervious (%)	100



Catchment Area AS-01 Central Paving

Type : Catchment Area

Area (ha)	0.007
-----------	-------

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.950
Winter Volumetric Runoff	0.950
Time of Concentration (mins)	5
Percentage Impervious (%)	100



AS-02 Catchment Area MUGA

Type : Catchment Area

Area (ha)	0.056
-----------	-------

Dynamic Sizing

Runoff Method	Time of Concentration
Summer Volumetric Runoff	0.950
Winter Volumetric Runoff	0.950
Time of Concentration (mins)	5
Percentage Impervious (%)	100

Project:	Date: 15/11/2024			
	Designed by: hgmler	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Storm Phase: Phase				



Soakaway

Type : Soakaway

Dimensions

Exceedance Level (m)	50.460
Depth (m)	0.500
Base Level (m)	49.960
Freeboard (mm)	0
Soakaway Shape	Rectangular
Diameter / Width (m)	5.000
Length (m)	4.000
Porosity (%)	30
Ineffective Storage Depth (m)	0.000
Number of Soakaways	1
Base Infiltration Rate (m/hr)	1.56
Safety Factor	2.0
Total Volume (m³)	3.000

Inlets

Inlet (1)

Incoming Item(s)	AS-02 SUBBASE
Bypass Destination	(None)
Capacity Type	No Restriction

Project:	Date: 15/11/2024		
	Designed by: hgmler	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		



AS-01

Type : Porous Paving

Dimensions

Exceedance Level (m)	51.190
Depth (m)	0.380
Base Level (m)	50.810
Paving Layer Depth (mm)	80
Membrane Percolation (m/hr)	50.0
Porosity (%)	30
Length (m)	33.198
Long. Slope (1:X)	200.00
Width (m)	11.996
Total Volume (m³)	36.025

Under Drain

Height Above Base (m)	0.050
Diameter (mm)	100
No. of Barrels	1
Release Height (m)	0.000
Friction Scheme	Manning's n
n	0.015

Inlets

Inlet

Inlet Type	Lateral Inflow
Incoming Item(s)	Catchment Area AS-01
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	PERFORATED PIPE
Outlet Type	Under Drain

Advanced

Conductivity (m/hr)	216.0
---------------------	-------

Project:	Date: 15/11/2024			
	Designed by: hgmler	Checked by:	Approved By:	
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:			



AS-02

Type : Porous Paving

Dimensions

Exceedance Level (m)	50.840
Depth (m)	0.430
Base Level (m)	50.410
Paving Layer Depth (mm)	80
Membrane Percolation (m/hr)	50.0
Porosity (%)	30
Length (m)	38.992
Long. Slope (1:X)	10000.00
Width (m)	14.385
Total Volume (m³)	58.894

Inlets

Inlet

Inlet Type	Lateral Inflow
Incoming Item(s)	AS-02 Catchment Area MUGA Pipe Pipe (1)
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	AS-02 SUBBASE
Outlet Type	Free Discharge

Advanced

Conductivity (m/hr)	216.0
---------------------	-------

Project:	Date: 15/11/2024		
	Designed by: hgmler	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		



AS01- Central paving

Type : Porous Paving

Dimensions

Exceedance Level (m)	51.000
Depth (m)	0.430
Base Level (m)	50.570
Paving Layer Depth (mm)	130
Membrane Percolation (m/hr)	50.0
Porosity (%)	30
Length (m)	22.988
Long. Slope (1:X)	200.00
Width (m)	3.166
Total Volume (m³)	6.549

Inlets

Inlet

Inlet Type	Lateral Inflow
Incoming Item(s)	Catchment Area AS-01 Central Paving
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	Pipe (1)
Outlet Type	Free Discharge

Advanced

Conductivity (m/hr)	216.0
---------------------	-------

Project:	Date: 15/11/2024			
	Designed by: hgmler	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Junctions Summary Storm Phase: Phase				



FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH1	FSR: 1 years: +0 %: 2160 mins: Summer	51.00 0	50.57 0	50.577	0.007	0.1	0.008	0.000	0.1	10.612	OK

Project:	Date: 15/11/2024			
	Designed by: hgmler	Checked by:	Approved By:	
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:			



FSR: 30 years: Increase Rainfall (%): +35: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH1	FSR: 30 years: +35 %: 2880 mins: Summer	51.00 0	50.57 0	50.713	0.143	0.4	0.162	0.000	0.4	34.653	Surcharged

Project:	Date: 15/11/2024			
	Designed by:	Checked by:	Approved By:	
Report Details: Type: Junctions Summary Storm Phase: Phase	hgmler			
	Company Address:			



FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH1	FSR: 100 years: +40 %: 1440 mins: Summer	51.00 0	50.57 0	50.765	0.195	0.7	0.220	0.000	0.7	37.252	Surcharged

Project:	Date: 15/11/2024			
	Designed by: hgmler	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Summary Storm Phase: Phase				



FSR: 1 years: Increase Rainfall (%): +0: Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residant Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
AS-01	FSR: 1 years: +0 %: 1440 mins: Summer	51.019	50.886	0.043	0.076	0.5	7.745	0.000	0.000	0.1	8.536	78.501	OK
AS-02	FSR: 1 years: +0 %: 7200 mins: Summer	50.557	50.413	0.143	0.003	0.3	16.673	0.000	0.000	0.2	38.585	71.689	OK
AS01-Central paving	FSR: 1 years: +0 %: 720 mins: Winter	50.727	50.574	0.042	0.004	0.1	0.877	0.000	0.000	0.0	1.400	86.611	OK
Soakaway	FSR: 1 years: +0 %: 15 mins: Summer	49.960	49.960	0.000	0.000	0.8	0.000	0.000	0.713	0.0	0.000	100.000	OK

Project:	Date: 15/11/2024			
	Designed by: hgmler	Checked by:	Approved By:	
Report Details:	Company Address:			
Type: Stormwater Controls Summary Storm Phase: Phase				



**FSR: 30 years: Increase Rainfall (%): +35: Critical Storm Per Item: Rank By: Max.
Avg. Depth**

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
AS-01	FSR: 30 years: +35 %: 720 mins: Summer	51.115	50.931	0.139	0.121	2.4	17.912	0.000	0.000	0.6	19.859	50.279	OK
AS-02	FSR: 30 years: +35 %: 2880 mins: Summer	50.713	50.418	0.299	0.008	1.6	34.870	0.000	0.000	0.7	81.165	40.792	OK
AS01-Central paving	FSR: 30 years: +35 %: 2160 mins: Summer	50.799	50.711	0.114	0.141	0.2	2.777	0.000	0.000	0.1	6.136	57.605	OK
Soakaway	FSR: 30 years: +35 %: 15 mins: Summer	49.960	49.960	0.000	0.000	4.6	0.001	0.000	2.601	0.0	0.000	99.953	OK

Project:	Date: 15/11/2024		
	Designed by: hgmler	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase		Company Address:	




FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item: Rank By:
Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
AS-01	FSR: 100 years: +40 %: 600 mins: Summer	51.168	50.952	0.192	0.142	3.8	22.972	0.000	0.000	0.9	25.201	36.233	OK
AS-02	FSR: 100 years: +40 %: 2160 mins: Summer	50.849	50.420	0.435	0.010	2.5	43.016	0.695	0.000	1.0	98.283	26.961	Flood
AS01-Central paving	FSR: 100 years: +40 %: 1440 mins: Summer	50.851	50.764	0.166	0.194	0.3	4.020	0.000	0.000	0.1	6.770	38.622	OK
Soakaway	FSR: 100 years: +40 %: 30 mins: Summer	50.030	50.030	0.070	0.070	5.5	0.421	0.000	5.302	0.0	0.000	85.974	OK

Appendix G Overland Flow Routes



KEY PLAN

NOTES

LEGEND

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.

2. The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and are not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.

3. Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.

4. All levels are shown in metres above Ordnance Datum (m AOD).

OVERLAND FLOW ROUTE

PO2	SITE PLAN UPDATED					
	B.MURPHY	16/05/25	H.MILLER	16/05/25	A.TODD	16/05/25
PO1	PRELIMINARY ISSUE					
	H.MILLER	18/11/24	A.TODD	18/11/24	A.TODD	18/11/24
REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

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CLIENT

READING BOROUGH COUNCIL

PROJECT

DEE PARK OPEN SPACE

TITLE

OVERLAND FLOW ROUTES

HYDROCK PROJECT NO.
C-36064-C

SCALE @ A1
1:125

STATUS DESCRIPTION
PLANNING

STATUS
S2

DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)
36064-HYD-00-ZZ-SK-C-7730

REVISION
PO2

Appendix H Drainage Strategy



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PROJECT

DEE PARK OPEN SPACE

DRAINAGE STRATEGY

HYDROCK PROJECT NO. C-36064-C		SCALE @ A1 1:125
STATUS DESCRIPTION PLANNING		STATUS S2
DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) 36064-HYD-00-ZZ-DR-C-7000		REVISION P02

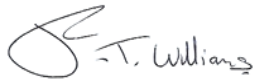
Appendix I

Phase 2 Site Investigation Report

Phase II Site Investigation Report

Dee Park Sports, Reading, RG30 4EP

On behalf of Reading Borough Council

Report Reference: GWPR6479/SIR/March 2025			Status: Final
Issue	Prepared By	Checked By	Verified By
v.1.01			
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EXECUTIVE SUMMARY	
PROPOSED DEVELOPMENT	At the time of reporting, March 2025, the proposed development was understood to comprise redevelopment of the site into an updated play area.
GEOLOGY AND HYDROGEOLOGY	The British Geological Survey Solid and Drift Geology Map for the Reading area (Reading Sheet No. 268) revealed that the northern section of the site was underlain by the Lambeth Group (clay,silt and sand) whilst the southern section was underlain by Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated). Areas of Worked Ground were recorded 1m northeast and 224m south of the site. An inferred bedrock fault was running through the middle of the site, separating the two areas. A study of the aquifer maps on the DEFRA website revealed the northern section of the site was underlain by a Secondary A Aquifer comprising bedrock deposits of the Lambeth Group whilst the southern section of the site was underlain by a Principal Aquifer comprising bedrock deposits of the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated).
FOUNDATION DESIGN	Please consult relevant sections
SUB-SURFACE CONCRETE	Lambeth Group One sample was tested at the boundary between the Made Ground and the Lambeth Group. The water-soluble sulphates were noted to be 28 mg/l, with a pH of 8.1, from chemical and geotechnical laboratory testing. The total potential sulphate (3x total sulphur) was 0.054%, from chemical laboratory testing. According to BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' a Sulphate Design Class of DS-1 should be used for sub-surface concrete in contact with the Lambeth Group. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1. Chalk The water-soluble sulphates were noted to be 8.17 – 34.2 mg/l, with a pH of 8.1, from chemical and geotechnical laboratory testing. According to BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' a Sulphate Design Class of DS-1 should be used for sub-surface concrete in contact with the Chalk. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1.

CONTAMINATION	The comparison between the laboratory analysis and the assessment criteria indicates that each of the determinands were identified at below the adopted screening value and are not considered to represent an unacceptable risk to future receptors.
REMEDIATION	A nominal capping of topsoil of at least 100mm is recommended for any soft-landscaped areas of the site. Full liaison must be made with the statutory authority, prior to the implementation of this remediation strategy and/or removal of soils from the site. All works must be undertaken to meet their approval.

1. INTRODUCTION

1.1. General

Ground and Water Limited were instructed by Reading Borough Council on the 10th February 2025 to conduct a Site Investigation on the site at Dee Park, Glenmore Place, Reading, RG30 4EP. The scope of the investigation was detailed within the fee proposal QU-1020, dated the 15th January 2025.

1.2. Aims of the Investigation

The aim of this report was to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

The investigation was to be undertaken to provide parameters for the design of foundations by means of in-situ and laboratory geotechnical testing undertaken on soil samples recovered from trial holes.

A contamination assessment was to be undertaken following chemical laboratory testing on soil samples recovered from the site to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any potential contamination identified. The assessment comprises a Tier 2 Generic Quantitative Risk Assessment, under Land Contamination Risk Management (LCRM), with the intention of discharging planning conditions.

This Site Investigation Report must be read in conjunction with the Desk Study Report referenced GWPR6235/DS/October 2024.

The techniques adopted for the investigation were chosen considering the requirements of the client, anticipated ground conditions, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

1.3. Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

1.4. Technical Glossary

Generic technical terms and their description can be viewed within the glossary provided within Appendix B.

2. SITE SETTING

2.1. Site Location

The site comprised a ~1,600m² rectangular-shaped plot of land, along the north-western side of Glenmore Place. The site was located in the north-western portion of Reading, Berkshire.

The national grid reference for the centre of the site was approximately 468479 173632. A site location plan is given within Figure 1.

2.2. Site Description

A Site Walkover was undertaken on the 3rd February 2025. A description of the site, as noted during the Site Walkover, is tabulated below.

Site Description Sheet	
Use of site	At the time of the site walkover, 3 rd February 2025, the site comprised a children's park and sports court.
Site topography	The site was noted to be generally flat.
Area topography	The surrounding area was noted to be generally flat.
Structures onsite	The site is occupied a fenced off sports court within the centre of the site and children's play area within the southern section.
Structures off-site	The site was surrounded by residential developments.
Use of surrounding ground	The surrounding ground comprised predominantly residential housing, gardens and parking.
Boundary features	Northern Boundary: An open boundary to residential development Eastern Boundary: An open boundary to residential development Southern Boundary: An open boundary to residential development Western Boundary: An open boundary to community centre
Site covering	The sports court was laid to tarmac hardstanding whilst the children's play area laid to wood chips. The remainder of the site generally comprised soft-landscaping with some tarmac pathways.
Contamination sources onsite	None noted.
Contamination sources off-site	None noted.
Vegetation onsite	Some 3 – 7m mature to semi-mature trees along the perimeters of the site.
Vegetation off-site	Some small shrubs/bushes and 3-5m trees.
Services	Drainage and lampposts along the eastern and western edges of the site.

2.3. Proposed Development

At the time of reporting, March 2025, the proposed development was understood to comprise redevelopment of the site into an updated play area.

The proposed development plan can be seen within Figure 4.

2.4. Geology

The British Geological Survey Solid and Drift Geology Map for the Reading area (Reading Sheet No. 268) revealed that the northern section of the site was underlain by the Lambeth Group (clay, silt and sand) whilst the southern section was underlain by Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated). Areas of Worked Ground were

recorded 1m northeast and 224m south of the site. An inferred bedrock fault was running through the middle of the site, separating the two areas.

A BGS borehole (SU67SE718) located ~290m northeast of the site revealed a 0.10m capping of Topsoil over chalk and clayey chalk fill to 1.20m bgl followed by a brown flinty clay to 1.60m bgl. From here up to 2.20m bgl a remoulded chalk with lumps of intact chalk, clay and flints was identified over remoulded chalk with some intact chalk up to 3.10m bgl. A rubbly chalk with some remoulded chalk and flints was then recorded to the base of the borehole at a depth of 6.0m bgl. No groundwater was recorded.

2.5. Hydrogeology and Hydrology

A study of the aquifer maps on the DEFRA website revealed the northern section of the site was underlain by a Secondary A Aquifer comprising bedrock deposits of the Lambeth Group whilst the southern section of the site was underlain by a Principal Aquifer comprising bedrock deposits of the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated).

Examination of the Environment Agency records showed that the site **did not** fall within a Groundwater Source Protection Zone (SPZ) as classified in the Policy and Practice for the Protection of Groundwater.

No surface water features were present within a 250m radius of the site. The nearest surface water feature was identified to be the River Thames ~940m north of the site flowing in an easterly direction.

From analysis of hydrogeological and topographical maps the actual groundwater table was anticipated to be encountered at depth within the Chalk Formation. Some amounts of groundwater however may be present at shallower depths within the Lambeth Group or within Made ground. It was considered that groundwater was flowing in a northern direction toward the River Thames and in line with local topography.

Examination of the Environment Agency records showed that the site was located within a Flood Zone 1, i.e. an area with a very low probability of flooding.

The Groundsure Datasheets revealed the site was at a low risk of flooding from rivers and the sea. The datasheets also revealed the site was at low risk of groundwater flooding. The risk of surface water flooding at the site ranged from low to high.

2.6. Radon

A review of the freely available UK Health Security Agency radon database, UK Radon, indicated that majority of the site was located within a 1km grid square, where the maximum radon potential of 1 – 3% was recorded for above ground structures. A small section of the site within the northeastern corner of the site and extending offsite to the east was within an area of where the maximum radon potential of less than 1% for above ground structures. Basic radon protection measures are required in areas where more than 3% of houses are at or above the Action Level.

The site was in an area where a risk assessment was not required.

2.7. Internet Search (Site Setting)

2.7.1. Available Unexploded Ordnance (UXO) Map Review

A review of the data available on www.zeticauxo.com/ revealed the site was located within a low -risk area associated with unexploded ordnance (UXO), as indicated by having <15 bombs dropped per 1000 acres.

2.7.2. Historical Landfill Tool Review

A review of the data available on www.groundsure.io/ revealed no records of historical landfilling within a 250m radius of the site. The nearest record was noted ~925m northwest of the site.

2.8. Preliminary Risk Assessment

The tabulated Conceptual Site Model developed as part of the Ground and Water Ltd Desk Study (GWPR6235/DS/October 2024) is outlined overleaf. For ease of reference and understanding, the risks have been classified within this risk assessment against four possible levels / categories, summarised in the table below. Any risk deemed to be negligible within the Preliminary Risk Assessment have been excluded from this report.

Risk Categories used in the Tabulated CSM	
Low Risk	Regarding this potential SPR linkage, the site is considered suitable for the proposed end-use and there is not considered to be an unacceptable risk to receptors. However, it is considered that further investigation to confirm this is recommended.
Moderate Risk	Regarding this potential SPR linkage, the site may not be suitable for the proposed end-use in its current condition and there may be an unacceptable risk to receptors. Further investigation is required to confirm this.
High Risk	Regarding this potential SPR linkage, the site is probably or certainly not suitable for proposed end-use and there is likely to be an unacceptable risk to receptors. Contaminants probably or certainly present and urgent action required in the short term.

Tabulated Conceptual Site Model – Pollutant Linkage Summary			(On-Site Sources)
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Made Ground from construction/ demolition activities and infill of pit: - Asbestos, - PAHs, - TPHs, - VOCs,-negligible - Sulphates, and - Metals.	- Direct ingestion of soil and soil derived dust - Dermal contact of soil and soil derived dust - Inhalation of dust (indoors and outdoors) with elevated concentration of determinands - Ingestion of home-grown produce, and soils attached - Direct ingestion of groundwater - Inhalation of volatile vapour (indoors and outdoors)	Human Health - End Users (Site workers/Future site visitors) - Construction workers during development - Site operatives during maintenance works - Neighbours and public	Moderate
	- Direct uptake of groundwater - Direct uptake of determinands in the soil	Flora and Fauna Vegetation within soft landscaped areas	Moderate
	- Anthropogenic (man-made) pathways - Vertical and lateral migration in permeable strata - Surface water runoff	Controlled Waters - Principal Aquifer (Lewes Nodular, Seaford and Newhaven Chalk Formation (undifferentiated)) - Secondary A Aquifer (Lambeth Group).	Low
Aggressive ground conditions with Made Ground and natural ground, including groundwater: - Sulphates, - PAH/TPH.	Direct contact with aggressive ground conditions	Building Materials and Services - Buried Concrete - Underground services (water pipes)	Low

Tabulated Conceptual Site Model – Pollutant Linkage Summary				(Off-Site Sources)
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification	
Made Ground from nearby works/development: - Asbestos, - PAHs, - TPHs, - VOCs,-negligible - Sulphates, and - Metals.	- Direct ingestion of soil and soil derived dust - Dermal contact of soil and soil derived dust - Inhalation of dust (indoors and outdoors) with elevated concentration of determinands - Direct ingestion of groundwater - Inhalation of volatile vapour (indoors and outdoors)	Human Health - End Users (Residents/Future site visitors) - Construction workers during development - Site operatives during maintenance works	Low	
	Direct uptake of groundwater	Flora and Fauna Vegetation within soft landscaped areas	Low	
Aggressive ground conditions associated with impacted groundwater; - Sulphates, - PAH/TPH.	Direct contact with aggressive ground conditions	Building Materials and Services - Buried Concrete - Underground services (water pipes)	Low	

3. SITE WORKS

3.1. Scope of Works

Site works were undertaken in February 2025 and comprised the drilling of 4No. Windowless Sampler Boreholes (WS01) to a depth of 5.45m bgl. Standard Penetration Tests were carried out at 1.00m intervals.

Additionally, 4No. Trial Pits (SA1 –SA2) were machine excavated up to 2.00m bgl to allow for the conduct of BRE365 soakage testing.

The location of the trial hole locations can be seen within Figure 5.

Prior to commencing the ground investigation, a walkover survey was carried out to identify the presence of underground services and drainage. Where underground services/drainage were suspected and/or positively identified, the exploratory position was relocated away from these areas.

As a further precautionary measure, the borehole was hand excavated to 1.20m below the local ground level (bgl) and scanned with a Cable Avoidance Tool (CAT scanner) to minimise the risk to services.

Upon completion of the drilling works, the trial holes were backfilled and made good, in relation to the surrounding area.

3.2. Sampling Procedures

Small disturbed samples and environmental samples were recovered from the trial holes at the depths shown on the trial hole records. Soil samples were generally retrieved from each change of strata and/or at specific areas of concern. Samples were also taken at approximately 0.5m intervals during broad homogenous soil horizons.

A selection of samples were despatched to a laboratory for both geotechnical and chemical testing purposes.

4. ENCOUNTERED GROUND CONDITIONS

4.1. Soil Conditions

The trial holes were logged by a Ground and Water Limited representative, generally in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'.

The ground conditions encountered within the trial holes constructed on the site did generally conform to that anticipated from examination of the geology map. A capping of Made Ground was noted to overlie the superficial Lambeth Group and the bedrock Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated).

The succession of conditions and description of soils encountered in the trial holes in descending order is tabulated below.

Summary of Strata Encountered		
Strata	Top Depth (m bgl)	Base Depth (m bgl)
MADE GROUND: Generally, a brown sandy gravelly clay or light brown slightly clayey, gravelly SAND in places. To see the percentage of various fragments within the Made Ground, please refer to logs found within Appendix D.	GL	1.00 – 2.10
TOPSOIL: Orange brown sandy gravelly CLAY. Gravel is fine to medium, angular to sub angular of flint and chalk.	GL	0.30 – 0.50
LAMBETH GROUP (WS1, WS2, WS4) Generally a dark brown to orange brown soft to firm gravelly CLAY. Gravel is fine to medium, angular to sub angular, of flint.	1.00 – 2.10	2.00 – 4.00
UNDIFFERENTIATED SEAFORD AND NEWHAVEN CHALK FORMATION: Recovered as structureless CHALK composed of cream slightly gravelly SILT. Gravel is very weak, low density white and rounded. Grade (Dm)	0.50 – 4.00	>5.00

For details of the composition of the soils encountered at particular points, reference must be made to the individual trial hole logs within Appendix D of this report. A trial hole location plan can also be viewed within Figure 5.

4.2. Roots Encountered

Roots were noted to a proved depth of 0.30 – 0.80m bgl within the exploratory holes.

It must be noted that the chance of determining actual depth of root penetration through a narrow diameter borehole is low. Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

4.3. Groundwater Conditions

Groundwater was not encountered within the exploratory holes.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was undertaken in February 2025 when groundwater levels are likely to be approaching their annual maximum (highest elevation). Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site.

4.4. Obstructions

No other artificial or natural sub-surface obstructions were noted during construction of the trial holes.

5. IN-SITU AND LABORATORY TESTING

5.1. In-situ Strength Testing

Standard Penetration Tests (SPTs) and Super Heavy Dynamic Probes (SHDPs) were undertaken as part of the site investigation. The results of the SPT's have not been amended to consider hammer efficiency, rod lengths and overburden pressure in accordance with Eurocode 7. The test results are presented on the borehole logs within Appendix D. An interpretation of the in-situ geotechnical testing results is given in the table below.

Interpretation of In-situ Geotechnical Testing Results					
Strata	SPT "N" Blow Counts/Equivalent SPT "N" Value from DP	Equivalent Undrained Shear Strength (Cu) (kPa)	Soil Type		Trial Hole/s
			Granular (Density)	Cohesive (Cu)	
Soft spots within Lambeth Group (Cohesive)	5	25	-	Low	WS1/2.00-2.45m bgl
Lambeth Group (Cohesive)	12 – 14	60 – 70	-	Medium	WS1/1.00 – 2.00m bgl WS2/2.10 – 4.00m bgl
Chalk	5 – 13				WS1/4.00-5.45m bgl WS2/4.00-5.45m bgl WS3/0.50-5.45m bgl WS4/2.00-5.45m bgl

It must be noted that field measurements of undrained shear strength (Cu) are dependent on a number of variables including disturbance of sample, method of investigation and also the size of specimen or test zone.

5.2. Geotechnical Laboratory Testing

A programme of geotechnical laboratory testing, scheduled by Ground and Water Limited and carried out by an accredited geotechnical testing laboratory was undertaken on samples recovered. Details of the specific tests used in each case are given below.

Standard Methodology for Laboratory Geotechnical Testing		
Test	Standard	Number of Tests
Atterberg Limit Tests	BS1377:2016:Part 2:Clauses 3.2, 4.3 & 5	3
Water Soluble Sulphate and pH Test	BS1377:2018:Part 3:Clause 5	1
BRE Special Digest 1 Tests	BRE Special Digest 1 "Concrete in Aggressive Ground (BRE, 2005).	2

5.2.1. Atterberg Limit Testing

A précis of Atterberg limit testing undertaken can be seen tabulated below. The test results are presented within Appendix E.

Atterberg Limit Tests Results Summary							
Stratum	Moisture Content (%)	Passing 425 µm sieve (%)	Modified PI (%)	Soil Class	Consistency Index (Ic)	Volume Change Potential	
						BRE	NHBC
Lambeth Group	16.7 – 30.4	87 – 92	12.8 – 36.54	CL – CH	Stiff - Very Stiff	Low to Medium	Low to Medium
- NP – Non-plastic - BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results) - Soil Classification based on British Soil Classification System. - Consistency Index (Ic) based on BS EN ISO 14688-2:2018.							

5.2.2. Moisture Deficit Assessment

The results of the Atterberg Limit tests were analysed to determine the Liquidity Index of the samples, to give an indication as to whether the samples recovered showed a moisture deficit as well assessing their degree of consolidation. Liquid Limit analyses was undertaken to assess whether there were any potentially significant moisture deficits within the samples tested.

No significant potential moisture deficit was identified within the samples analysed.

5.2.3. Saturation Moisture Content

The results of the saturation moisture content testing undertaken can be seen in the following table. The test results are presented within Appendix F.

Summary of Saturation Moisture Content Test Results							
Stratum			Moisture Content (%)	Saturation Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	CIRIA Dry Density Classification
Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (WS2/5.00m bgl)			32	34	1.86	1.41	Low density
Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (WS3/3.00m bgl)			26	30	1.88	1.49	Low density
● Density in accordance with CIRIA 574 Chapter 3.0, Table 3.7							

6. ENGINEERING CONSIDERATIONS

6.1. Chalk Dissolution and Mining Risk Assessment

The presence of dissolution features on-site can prove problematic, as they often provide inconsistency within the underlying geology. Often formed during glacial and periglacial conditions, the depth and width of these features can vary substantially, often providing inconsistency in geological strength data.

If a dissolution feature is suspected, a geotechnical engineer and structural engineer should be contacted for suitable engineering designs, based on further works identifying and classifying the area the feature occupies.

The Groundsure Geosight datasheets, presented Appendix C of this report, revealed the following information which may be pertinent to this risk assessment.

- Ground Dissolution of Soluble Rocks – The northern section of the site was classified as a Low risk of ground dissolution of soluble rocks whilst the southern section of the site was classified as Moderate risk.
 - *Low Risk was described as “Soluble rocks are present within the ground. Some dissolution features may be present. Potential for difficult ground conditions are at a level where they may be considered, localised subsidence need not to be considered except in exceptional circumstances”.*
 - *Moderate risk was described as “Soluble rocks are present within the ground. Many dissolution features may be present. Potential for difficult ground conditions are at a level where they should be considered. Potential for subsidence is at a level where it may need to be considered”.*
- An on-site Class B Non-coal Mining area was identified on-site. A Class B area was described as *“Underground mine workings may have occurred in the past or current mines may be working at significant depth to modern engineering standards. Potential for difficult ground conditions are unlikely and are at a level where they need not be considered.”*. However, this is generally a precautionary statement attributed to all areas associated with chalk within the ground profile.
- 1no. record of researched mining on site relating to stone.
- 1No. Natural cavity, solution pipe and sinkhole, was identified 355m southeast of the site.
- 4No. Britpits were noted within 250m radius of the site, 21m south-east, 27m northeast, 164m northeast relating to gravel pits and 241m south relating to a brick, tile and pottery works.
- 7No. on-site and 13No. records of surface ground workings were noted. The on-site records correspond to old gravel and unspecified pits (1900-1961), with the off-site features comprising pits and ground workings.
- 1no. record of underground workings was noted within a 500m radius of the site located 396m south and relating to unspecified workings.
- 2no. records of Mining Cavities within 500m of the site relating to chalk located 305m south and 403m northwest.
- No records of JPB Mining Areas were noted within a 500m radius of the site.

- The Edmonds Procedure (Edmonds, C.N., 2001. Predicting natural cavities in chalk. Geological Society, London, Engineering Geology Special Publications, 18(1), pp.29-38.); highlighted a moderate subsidence hazard classification.

The historical mapping review confirmed the findings of the Groundsure datasheets discussed above. **Pits were identified adjacent to the east of the site (also noted to overlap into eastern section of the site) and ~175m north of the site.**

From a review of LiDAR data for the site and surrounding area a feature assumed to be a pit is noted ~440m northwest of the site.

This risk assessment indicates that there is a moderate risk from the dissolution of soluble rocks at the site. Furthermore, along the eastern boundary and extending off-site to the east a pit has been identified from historical mapping. The presence of potential dissolution features and former infilled pits should not be discounted, and it is recommended a site investigation is undertaken to investigate further.

The ground investigation consisted of a series of windowless sampling boreholes, and trial pits. Some of them were located near the indicated pit area. Made Ground was recorded to depths of 0.40 – 2.10m bgl, indicating variations in thickness. Below, most of the trial holes recorded soils considered being representative of the Lambeth Group, with the chalk bedrock beneath. Trial holes WS3 and SA4 (both located in the north-eastern part of the site), recorded chalk directly below the Made Ground.

The chalk was generally recorded at depths between 2.00 – 4.00m bgl where soils of the Lambeth Group were present, and from 0.50m bgl, where they were absent.

Some soft spots were noted within the Lambeth Group, namely at WS1 between 2.00 and 3.00m bgl. The chalk, where recorded, was generally towards the softer side, with N SPTs between 5 – 13 and typically around ~9 - 11.

It is understood that foundations will be minimal with no heavy buildings proposed. Any foundations should be kept as shallow as possible / permitted in order to avoid stressing any soft horizons at depth. If larger/heavier buildings / construction is proposed, then the foundation design will require probing at specific foundation locations and further assessment.

6.2. Soil Characteristics and Foundation Considerations

A summary of the soil characteristics following the intrusive site investigation and laboratory testing and the relevant foundation considerations has been provided below. The following information from the ground investigation was considered pertinent to the design of foundations.

It is understood that foundations will be minimal with no heavy buildings proposed. The below sections are more generalised and refer to the approach in foundation design.

- Foundations should be taken through any Made Ground/Topsoil and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.
- Foundations should be designed in accordance with soils of medium VCP, with regards to the Lambeth Group. The chalk is not anticipated to have VCP.

- Given the presence of cohesive soils at shallow depth, special foundation precautions may be required to prevent possible future shrinkage/swelling of the soils affecting the integrity of the faces of foundations (underfloor void diameter/compressible material/void formers etc.). A compressible layer must be provided to accommodate potential seasonal movement, based on NHBC guidance.
- The loads of proposed foundations should not exceed the allowable bearing capacity of the soils they are founding upon.
- If soft spots are encountered, they should be bypassed or designed against.
- Care should be taken not to overdig foundations as this may stress underlying soft spots, should they be present.
- Foundations must not be placed within fresh root penetrated and/or desiccated soils with volume change potential. It is recommended that foundations are taken at least 300mm into non-fresh root penetrated strata if the soils have volume change potential, or into soils of no volume change potential.
- The influence of trees on or surrounding the site will need to be taken into account in final design.
- Any water ingress must be prevented from entering foundation trenches and excavations must be kept dry and either concreted or blinded as soon after excavation as possible. If water were allowed to accumulate within the excavation for even a short period of time, an increase in heave may occur. The shear strength will also be reduced, resulting in lower bearing capacities, resulting in increased settlements. Instability issues may arise within the foundation trenches, in case of perched water being present.

6.3. Shallow Foundations

Based on the previous section, foundations should bypass any Made Ground/Topsoil and soft spots/loose granular soils, before extending 300mm below the proved depth of root penetration. Foundations should be constructed on competent, moisture stable soils of the Lambeth Group. Foundations should be constructed based on a bearing capacity of 60kPa, locally 90kpa.

Additional Comments

A number of comments and recommendations has been provided below.

- It is prudent to avoid having a foundation spanning across materials of different consistency, like clay and gravel, in order to avoid potential differential settlements. If unavoidable, foundations must be reinforced to allow for such potential differential movement. It should be noted that differential settlement may also occur between strip and isolated pad foundations.
- Foundation excavations must be carefully bottomed out and any loose soil or soft spots removed prior to the foundation concrete or blinding being placed. Failure to ensure that foundation excavations are suitably bottomed out could result in additional settlements.
- Inspection of foundation excavations, prior to concreting, must be made by a competent and suitably qualified person to check for soft spots and to check for the presence of roots.
- Foundations must not be cast over foundations of former structures and/or other hard spots.

- Isolated Pad Foundations must be at least 1.5 times the width of the widest pad apart to keep to the anticipated settlements.
- Final designs for the foundations should be carried out by a suitably qualified Engineer based on the findings of this investigation and with reference to the anticipated loadings, serviceability requirements for the structure and the developments proximity to former, present, and proposed trees. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

6.4. Piled Foundation

Based on the scheme, it is not anticipated that piles would be applicable/required.

6.5. Excavations and Stability

Shallow excavations in the Made Ground are likely to be marginally stable at best. Long, deep excavations, through these strata and into the underlying natural soils are likely to become unstable.

Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported before excavations are entered by personnel.

6.6. Sub-Surface Concrete Design

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1, 2005, '*Concrete in Aggressive Ground*' considering the pH of the soils. For the classification given below, the "mobile" and "natural" case was adopted given the geology encountered and the use of the site.

Made Ground

The water-soluble sulphates in the Made Ground was noted to be 6.4 – 102mg/l, with a pH of 8.2 – 8.7. A class of DS, AC1 should be used for concrete in contact with the Made Ground.

Lambeth Group

One sample was tested at the boundary between the Made Ground and the Lambeth Group. The water-soluble sulphates were noted to be 28 mg/l, with a pH of 8.1, from chemical and geotechnical laboratory testing. The total potential sulphate (3x total sulphur) was 0.054%, from chemical laboratory testing.

According to BRE Special Digest 1, 2005, '*Concrete in Aggressive Ground*' a Sulphate Design Class of DS-1 should be used for sub-surface concrete in contact with the Lambeth Group. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1.

Chalk

The water-soluble sulphates were noted to be 8.17 – 34.2 mg/l, with a pH of 8.1, from chemical and geotechnical laboratory testing.

According to BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground' a Sulphate Design Class of DS-1 should be used for sub-surface concrete in contact with the Chalk. Table C1 of the Digest indicated an ACEC (Aggressive Chemical Environment for Concrete) classification of AC-1.

6.7. Roads and Hardstanding Design

This section provides information relating to the construction of roads and hardstanding, for each strata encountered.

6.7.1. Anticipated CBR Values and Frost Susceptibility

Topsoil

Roads and hardstanding should bypass Topsoil given the likely low strength, high compressibility and general variability.

Made Ground

Where roads and hardstanding are to be founded on Made Ground, a CBR value of 1% should be adopted, as a result of the variable nature of Made Ground in terms of consistency, strength and compressibility.

Lambeth Group (cohesive)

Roads and hardstanding constructed on the cohesive Aeolian Deposits should be designed based on a CBR value of 4.0%. This is based on reference to Table C1 of TRL1132 and average construction conditions. Based on wet conditions a CBR of 2.5% should be adopted, with dry conditions a CBR of 4.5% being applicable.

Due to their granular content, the soils should be treated as frost susceptible in design.

Chalk

In accordance with CIRIA 574, Part 4.7 *The Action of Frost on Chalk*, all chalk deposits can be seen to be frost susceptible. The magnitude of frost heave increases linearly with the saturation moisture content of the chalk aggregate. The weak chalk of south-east England is particularly prone to frost heave in the climatic conditions of the area. Therefore a minimum construction thickness of 450mm should be maintained.

All formation levels for roads and hardstanding should be proof rolled to highlight any soft areas which should then be dug out and replaced with selected granular material compacted in thin layers to a suitable specification.

6.8. Surface Water Disposal

Soakaway testing in accordance with BRE365 was undertaken within SA1-SA4, with the results tabulated below.

Soakage Testing Results						
Trial Hole	Test Number	Depth (m bgl)	Start Depth (m bgl)	Finish Depth (m bgl)	Time Taken (mins)	Infiltration Rate (m/sec)
SA1*	1	1.50	0.60	0.65	240	6.86×10^{-7}

SA2*	1	1.50	0.60	0.61	240	1.34×10^{-7}
SA3*	1	1.50	0.68	0.71	240	4.40×10^{-7}
SA4	1	1.50	0.79	1.38	6	5.06×10^{-4}
	2	1.38	0.68	1.21	6	4.43×10^{-4}
	3	1.21	0.74	1.19	4	7.24×10^{-4}
*Given the relatively slow infiltration rate encountered, only one test could be undertaken and it did not reach 75% mark.						

Any soakaways should be located sufficiently away from buildings and infrastructure, in order to prevent undermining of foundations.

The submission of a Sustainable Urban Drainage Scheme (SUDS) is likely to be required for this site due to the proposed development increasing the amounts of hardstanding.

Consultation with the Environment Agency must be sought regarding any use that may have an impact on groundwater resources, abstractions and surface water features/watercourses.

It should be noted that water discharge into the chalk may worsen / create dissolution features. Therefore, soakaways should be remote from structures and undertaken in accordance with available guidance.

A number of published information sources make reference to an appropriate distance at which a soakaway should be sited in relation to any building foundations in the vicinity:

- The British Standard BS8301 :1985 “Code of practice for building drainage” (1985), suggests that: “A soakaway is not desirable nearer to a building than about 5 metres nor in such a position that the ground below foundations is likely to be adversely affected.”
- The Building Research Establishment Digest 365 “Soakaway design” (1991), suggests that “Soakaways should not normally be constructed closer than 5m to building foundations. In chalk or other soil and fill material subject to modification or instability, the advice of a specialist geotechnologist should be sought as to the advisability and siting of a soakaway”.

In addition, the distance a soakaway is located from any foundations can be informed by both the soakaway type and chalk density present at the site.

- The Kent County Council Soakaway Design Guide (July 2000) states that “Highway soakaways shall be situated the following minimum distances from dwellings (measured from the outside edge of the soakaway): (1) 5 metres for conventional perforated soakaway; (2) 10 metres for deep bored soakaway. In addition, adjacent soakaways of a similar type shall also be spaced a minimum of 10 metres apart.
- CIRIA 574 states that soakaways should be sited at least 5-10m away from any structure, depending on the chalk density. Where the chalk present is of low or unknown density, soakaways should be sited at least 10m from any foundations, and where the chalk is of medium density or higher, any foundations should be sited at least 5m from any foundations.

7. CONTAMINATION RISK ASSESSMENT

7.1. Results of the Preliminary Risk Assessment

The tabulated Conceptual Site Model (CSM) developed by the Ground and Water Desk Study (ref. GWPR6235/DS/October 2024) is reproduced in section 2.8. For the complete information please see the Desk Study report.

No additional source of contamination, pathway or receptor was identified between the desk study and the ground investigation and as such, it was not necessary to modify the CSM.

In the UK, the assessment of risk from contamination follows the source-pathway-receptor (SPR) approach. For a risk to be present there must be a source of contamination, a receptor or receptors, and a pathway for contaminants to migrate or be absorbed. If there is a linkage between any given source and receptor, then a quantitative risk assessment is used to assess the significance or impact of the pollutant linkage.

7.2. Sampling Locations

The synopsis for the trial hole locations and their final depth can be seen tabulated below. A trial hole location plan is provided within Figure 5. The table also indicates whether any locations targeted a source of contamination as well as the proposed end-use. The proposed development can be seen in Figure 4.

Trial Hole Location Synopsis		
Trial Hole/Final Depth	Sampling Strategy	Proposed End-Use
WS1/5.00m	Close to infilled pit / Coverage	Ball sports area
WS2/5.00m	Targeted – Infilled Pit	Proposed planting
WS3/5.00m	Random	Soft Landscaping
WS4/5.00m	Random	Proposed planting
SA1	Random	Ball sports area
SA2	Random	Ball sports area
SA3	Random	Proposed planting
SA4	Random	Proposed planting

The investigation area totals approximately 1,600m² and with eight sampling locations, given an unknown hotspot shape, the sampling density means that a hotspot with an area of approximately 300m² and a radius of approximately 9.70m would be encountered (CLR 4).

7.3. Soil Risk Assessment

Sampling depths were chosen to reflect the receptor of concern (e.g. human health, controlled waters and vegetation). Samples where olfactory or visual evidence of contamination was present underwent targeted scheduling. The remaining samples were scheduled under a random strategy. The receptors relevant to the sampling depths are tabulated below.

Summary of Receptors per Sample Depth	
Depth	Receptors
Shallow Samples (< 0.75m bgl)	- End Users (Future site visitors) - Construction workers during development - Site operatives during maintenance works - Neighbours and public

	• Vegetation within soft landscaped areas (shallow rooted) • Secondary & Principal Aquifers (Lambeth Group / Chalk) • Buried Concrete • Receiving landfill
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Chemical laboratory testing, scheduled by Ground and Water Limited, and carried out by I2 Analytical Limited, was undertaken on four samples of Made Ground. The samples were subjected to a combination of analysis that comprised:

- Asbestos screen;
- Semi-metals and heavy metals incl. Arsenic, Cadmium, Chromium (incl. Hexavalent Chromium), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc;
- Polycyclic Aromatic Hydrocarbons (PAH's) incl. Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, Benzo(ghi)perylene;
- Speciated TPH including full aliphatic/aromatic split;
- BTEX compounds (Benzene, Toluene, Ethylbenzene, Xylene) and MTBE – used as marker compounds for Volatile Organic Compounds (VOCs);

A breakdown of the number of tests undertaken for each determinand is discussed in further sections. The chemical laboratory results are presented in Appendix C.

7.3.1. Soil Assessment Criteria and Results

At the time of reporting, March 2025, the proposed development was understood to comprise redevelopment of the site into an updated play area. Proposed site plans are provided as Figure 4.

Based on the proposed development, the results of the chemical laboratory testing were compared to the Generic Assessment Criteria (GAC) for a **'Public Open Space – Park'** land-use scenario, as this was considered the most appropriate land-use scenario.

Where a contaminant of concern's GAC varies according to the Soil's Organic Matter (SOM), the SOM recorded for each uncontaminated soil type was used to derive the appropriate GAC for each soil type. A SOM value of 1%, the most conservative value, was utilised.

A summary of the analytical results and the comparison to the determinands adopted screening value are presented in the table below and overleaf.

Soil Contamination Test Results and Screening Values					
Determinand	Number of Samples	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Adopted Screening Value (mg/kg)	Was the adopted screening value exceeded for relevant land-use scenario?
INORGANICS					
Asbestos	4	ND	ND	ND	No
Cyanide (total)	4	< 1	< 1	24	No
Phenols	4	< 1	< 1	760	No
METALS					

Arsenic	4	3.80	19	170	No
Boron	4	0.50	1.30	46000	No
Cadmium	4	< 0.2	0.80	532	No
Chromium (III)	4	6.80	33	33000	No
Chromium (Hexavalent)	4	< 1.80	< 1.80	220	No
Copper	4	17	43	44000	No
Lead	4	12	110	1300	No
Mercury	4	< 0.30	0.40	30	No
Nickel	4	9.60	39	800	No
Selenium	4	< 1	1.80	1800	No
Vanadium	4	15	63	5000	No
Zinc	4	51	120	170000	No
TOTAL PETROLEUM HYDROCARBONS (TPHs)					
Aliphatic >C5 - C6	3	< 0.01	< 0.01	95000	No
Aliphatic >C6 - C8	3	< 0.01	< 0.01	150,000	No
Aliphatic >C8 - C10	3	< 0.01	< 0.01	14,000	No
Aliphatic >C10 - C12	3	< 1.0	< 1.0	21,000	No
Aliphatic >C12 - C16	3	< 2.0	< 2.0	25,000	No
Aliphatic >C16 - C21	3	< 8.0	< 8.0	450000	No
Aliphatic >C21 - C35	3	< 8.0	< 8.0		
Aliphatic >C35 – C40	3			450000	No
Aromatic >C5 - C7	3	< 0.01	< 0.01	76,000	No
Aromatic >C7 - C8	3	< 0.01	< 0.01	87,000	No
Aromatic >C8 - C10	3	< 0.02	< 0.02	7,200	No
Aromatic >C10 - C12	3	< 1.0	< 1.0	9,200	No
Aromatic >C12 - C16	3	< 2.0	2.50	10000	No
Aromatic >C16 - C21	3	< 10	< 10	7600	No
Aromatic >C21 - C35	3	< 10	25	7800	No
Aromatic >C35 – C40	3			7800	
Benzene	3	< 0.005	< 0.005	90	No
Toluene	3	< 0.005	< 0.005	87000	No
Ethylbenzene	3	< 0.005	< 0.005	17000	No
m,p-Xylene	3	< 0.008	< 0.008	17000	No
o-Xylene	3	< 0.005	< 0.005	17000	No
POLYCYCLIC-AROMATIC HYDROCARBONS					
Acenaphthene	4	< 0.05	0.06	29000	No
Acenaphthylene	4	< 0.05	0.22	29000	No
Anthracene	4	< 0.05	0.31	150000	No
Benzo(a)anthracene	4	< 0.05	1.20	49	No
Benzo(a)pyrene	4	< 0.05	1.40	11	No
Benzo(b)fluoranthene	4	< 0.05	1.50	13	No
Benzo(ghi)perylene	4	< 0.05	0.90	1400	No
Benzo(k)fluoranthene	4	< 0.05	0.67	370	No
Chrysene	4	< 0.05	1.20	93	No
Dibenzo(a,h)anthracene	4	< 0.05	0.19	1.1	No
Fluoranthene	4	< 0.05	2.30	6300	No
Fluorene	4	< 0.05	0.13	20000	No
Indeno(1,2,3-cd)pyrene	4	< 0.05	0.82	150	No

Naphthalene	4	< 0.05	< 0.05	1200	No
Phenanthrene	4	< 0.05	0.94	6200	No
Pyrene	4	< 0.05	2.0	15000	No
MARKER FOR VOLATILE ORGANIC COMPOUND					
Methyl tert-butyl ether (MTBE)	3	< 0.005	< 0.005	73	No
The derivation of the Soil Assessment Criteria used within this report can be seen within Appendix D. The soil concentrations were typically compared to the LQM/CIEH Suitable for Use Levels (S4UL) (2014), based upon the assumption of 1% soil organic matter. A screening value for Lead is based on the Category 4 Screening Levels (C4SLs). Where no S4UL or C4SL is available for Cyanide, a SoBRA acute GAC is assigned. Where no S4UL or C4SL is available for MTBE, a CL:AIRE 2010 GAC is assigned. Where exceedances are noted, the trial hole and depth of sample is recorded.					

The proposed development includes areas of soft-landscaping, where shallow rooted vegetation may be exposed to aggressive ground conditions. The previous table compares the results of the laboratory analysis to GAC that is protective of Human Health and therefore different GAC is required for vegetation.

Soil Contamination Test Results and Screening Value					
Determinand	Number of Samples	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Adopted Screening Value (mg/kg)	Was the adopted screening value exceeded for relevant land-use scenario?
Copper	4	17	43	100	No
Nickel	4	9.60	39	60	No
Zinc	4	51	120	200	No
The derivation of the Soil Assessment Criteria used within this report can be seen within Appendix D. The soil concentrations were compared to BS3882:2015 <i>Specification for Topsoil</i> and based on differing pH. For the purpose of conservatism, the pH of the soils have been assumed to be below 6 within this table. Where exceedances are noted, the trial hole and depth of sample is recorded.					

7.3.2. Soil Assessment

The comparison between the laboratory analysis and the assessment criteria indicates that each of the determinands were identified at below the adopted screening value and are not considered to represent an unacceptable risk to future receptors.

Asbestos

No asbestos has been identified during the testing, however, an **Asbestos Management Strategy** should be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination.

7.3.3. Water Supply Pipe Risk Assessment

As part of the proposed development it is expected that new water supply pipes will be installed at the site. Water supply pipes have the potential to be exposed to contaminants in the ground that can lead to unacceptable concentrations within the drinking water. If a risk is identified, specialist pipes that are protective of the drinking water are required.

A pipe selection risk assessment should be submitted to the water supply company as part of the development based on the supplier's assessment criteria. An indication of whether there is likely to

be a risk can be seen tabulated below, where the PE pipe thresholds are based on *UKWIR Contaminated Land Assessment Guidance, 2014*.

Pipe Selection Risk Assessment			
Determinand	PE Pipe Threshold (mg/kg)	Laboratory Analysis Range (mg/kg)	Was the Threshold Exceeded?
Total BTEX and MTBE	0.1	LOD	No
Total VOCs	0.5	N/A	No
Total SVOCs	2	N/A	No
Phenols	2	LOD	No
TPH EC5 – EC10 (aliphatics and aromatics)	2	LOD	No
TPH EC10 – EC16 (aliphatics and aromatics)	10	2.50	No
TPH EC16 – EC40 (aliphatics and aromatics)	500	38	No
Naphthalene	5	LOD	No

The results indicate that no determinands were above the threshold for the use of a PE pipe at the site.

7.4. Groundwater Risk Assessment

In the UK, the water environment is protected under a number of regulatory regimes, mainly governed by the Environment Agency. The Environment Agency is consulted when there may be a risk to Controlled Waters, or where a pollution incident has occurred historically. The Water Framework Directive is implemented in various guises covering groundwater, surface water and drinking water supply.

No surface water features were present within a 250m radius of the site. The nearest surface water feature was identified to be the River Thames ~940m north of the site flowing in an easterly direction.

From analysis of hydrogeological and topographical maps the actual groundwater table was anticipated to be encountered at depth within the Chalk Formation. Some amounts of groundwater however may be present at shallower depths within the Lambeth Group or within Made ground. It was considered that groundwater was flowing in a northern direction toward the River Thames and in line with local topography.

During the site investigation, Made Ground was encountered to 1.00 – 2.10m bgl. No groundwater was recorded.

Given the use of the site, the mainly cohesive Lambeth Group above the chalk and the low levels of contaminants found, it is not expected that the soils on-site represent an unacceptable risk to controlled water receptors. No further action is considered necessary.

7.5. Ground Gas & Vapours Risk Assessment

The CSM has identified a negligible risk from ground gases / vapours at the site as a result of the proposed development not anticipated to include buildings or confined spaces. If this changes, then more assessment will be required.

7.6. Updated Conceptual Site Model

Following completion of the Phase 2 Site Investigation, the CSM, inclusive of associated risk, within Section 2.8 of this report was re-evaluated.

For ease of reference and understanding, the risks have been re-assigned within this risk assessment against three possible levels / categories, summarised in the table below.

Risk Categories used in the Tabulated CSM	
Low Risk	Regarding this potential SPR linkage, the site is considered suitable for the proposed end-use and there is not considered to be an unacceptable risk to receptors.
Moderate Risk	Regarding this potential SPR linkage, the site is suitable for the proposed end-use however remediation and/or further investigation is required.
High Risk	Regarding this potential SPR linkage, the site is not suitable for proposed end-use and there is an unacceptable risk to receptors. Urgent action required in the short term.

Tabulated Conceptual Site Model – Pollutant Linkage Summary			(On-Site Sources)
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Made Ground from construction/demolition activities and infill of pit: - Asbestos, - PAHs, - TPHs, - VOCs,-negligible - Sulphates, and - Metals.	- Direct ingestion of soil and soil derived dust - Dermal contact of soil and soil derived dust - Inhalation of dust (indoors and outdoors) with elevated concentration of determinands - Ingestion of home-grown produce, and soils attached - Direct ingestion of groundwater - Inhalation of volatile vapour (indoors and outdoors)	Human Health - End Users (Site workers/Future site visitors) - Construction workers during development - Site operatives during maintenance works - Neighbours and public	Low
	- Direct uptake of groundwater - Direct uptake of determinands in the soil	Flora and Fauna Vegetation within soft landscaped areas	Low
	- Anthropogenic (man-made) pathways - Vertical and lateral migration in permeable strata - Surface water runoff	Controlled Waters - Principal Aquifer (Lewes Nodular, Seaford and Newhaven Chalk Formation (undifferentiated)) - Secondary A Aquifer (Lambeth Group).	Low
Aggressive ground conditions with Made Ground and natural ground, including groundwater: - Sulphates, - PAH/TPH.	Direct contact with aggressive ground conditions	Building Materials and Services - Buried Concrete - Underground services (water pipes)	Low

Tabulated Conceptual Site Model – Pollutant Linkage Summary			(Off-Site Sources)
Potential Sources	Potential Absorption Pathways	Potential Receptors	Risk Classification
Made Ground from nearby works/development: - Asbestos, - PAHs, - TPHs, - VOCs,-negligible - Sulphates, and - Metals.	- Direct ingestion of soil and soil derived dust - Dermal contact of soil and soil derived dust - Inhalation of dust (indoors and outdoors) with elevated concentration of determinands - Direct ingestion of groundwater - Inhalation of volatile vapour (indoors and outdoors)	Human Health - End Users (Residents/Future site visitors) - Construction workers during development - Site operatives during maintenance works	Low
	Direct uptake of groundwater	Flora and Fauna Vegetation within soft landscaped areas	Low
Aggressive ground conditions associated with impacted groundwater; - Sulphates, - PAH/TPH.	Direct contact with aggressive ground conditions	Building Materials and Services - Buried Concrete - Underground services (water pipes)	Low

8. CONTAMINATION RECOMMENDATIONS AND REMEDIATION STRATEGY

Based on the results of the intrusive works, chemical analyses and risk assessments undertaken, the following has been identified:

- No contaminants were found elevated from laboratory testing.
- The gas risk assessment should be revised if buildings / confined spaces are proposed. The risk in general however is low.

An Asbestos Management Strategy should be put in place so that any potentially asbestos containing materials are identified and removed from site in a suitable manner to prevent cross-contamination.

8.1. Soils

A nominal capping of topsoil of at least 100mm is recommended for any soft-landscaped areas of the site.

Full liaison must be made with the statutory authority, prior to the implementation of this remediation strategy and/or removal of soils from the site. All works must be undertaken to meet their approval.

8.1.1. Clean Capping of Soil

It is recommended that at least the top 100mm of the clean capping should comprise suitable topsoil for use as a growing medium.

All subsoil and topsoil must be fit for purpose to ensure that the receptors cannot come into contact with determinands that could be detrimental to their health, see 'Imported Material' Section 8.5.

8.1.2. Water Supply Pipes

The Water Supply pipe risk assessment indicated that the use of PE pipes is appropriate at the site and no further measures are required.

8.2. Groundwater

Based on the risk assessment, there is no risk to controlled water receptors.

8.3. Ground Gas and Vapours

The gas risk assessment should be revised if buildings / confined spaces are proposed. The risk in general however is low.

8.4. Discovery Strategy

There may be areas of contamination that have not been identified during the course of the intrusive investigation (e.g. underground storage tanks). Such occurrences may be discovered during the construction phases for the redevelopment of the site.

Groundworkers should be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil, discolouration, or odours and emission. Upon discovery advice must be taken from a suitably qualified person and then the Local Authority will need to be informed.

8.5. Imported Material

Any soil which is to be imported onto the site must undergo chemical analysis to prove that it is suitable for the purpose for which it is intended.

The soil must be fit for purpose and must either be supplied with traceable chemical laboratory test certificates or be tested, prior to placing (ideally) and after placing, to ensure that the future receptors (human health and vegetation) cannot come into contact with compounds that could be detrimental to their health. The compounds that are to be tested for are those given in the Generic Assessment Criteria, which can be viewed in Appendix E of this report.

8.6. Waste Disposal

The excavation of foundations and other soils is likely to produce waste which will require classification and then recycling or removal from site.

Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal, all waste must be classified as either: Inert; Non-hazardous; or Hazardous.

The Environment Agency's Hazardous Waste Technical Guidance (WM3) document outlines the methodology for classifying wastes. Once classified the waste can be removed to the appropriately licensed facilities, with some waste requiring pre-treatments prior to disposal.

Following the investigation, 3No. samples were submitted to the analytical laboratory to undergo a suite of testing for contamination testing, as discussed in the previous sections. Sampling depths were chosen to reflect the receptor of concern, human health, and typically comprised a surface or near surface sample and periodically to 1.00m bgl. Any horizon where olfactory or visual evidence of contamination was present was also sampled.

Based on a risk phase analysis of the chemical laboratory test results, in accordance with EC Hazardous Waste Directive and undertaken by Ground and Water Limited, all soil samples of Made Ground encountered on-site were NON-HAZARDOUS. The results of the assessment are given within Appendix H.

It is important to note that whilst we consider our in-house assessment tool to be an accurate interpretation of the requirements of WM3, therefore producing an initial classification in accordance with the guidance, this method classifies soils as either non-hazardous or hazardous and landfill operators have their own assessment tools and can often come to different conclusions. As a result, some landfill operators could refuse to take apparently suitable waste. It is recommended that the receiving landfill views the results of this assessment and the chemical laboratory results to determine their own classification.

In addition to the samples described above, 1No. sample of Made Ground was scheduled to undergo Waste Acceptance Criteria (WAC) testing with single batch leachate from samples with a range of depths. The results indicate that the sample was classified as non-inert as a result of high concentrations of Total Organic Carbon (TOC).

Where contaminated soils are to be removed, they should be placed on an impermeable membrane (visqueen or similar) to ensure that no cross-contamination of soils occurs.

8.7. Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust would be generated as a result of construction activities.

The site should be securely fenced at all times to prevent unauthorised access. Washing facilities should be provided and eating restricted to mess huts.

FIGURES



Site boundary

Not to Scale

Dee Park Sports, Reading, RG30 4EP

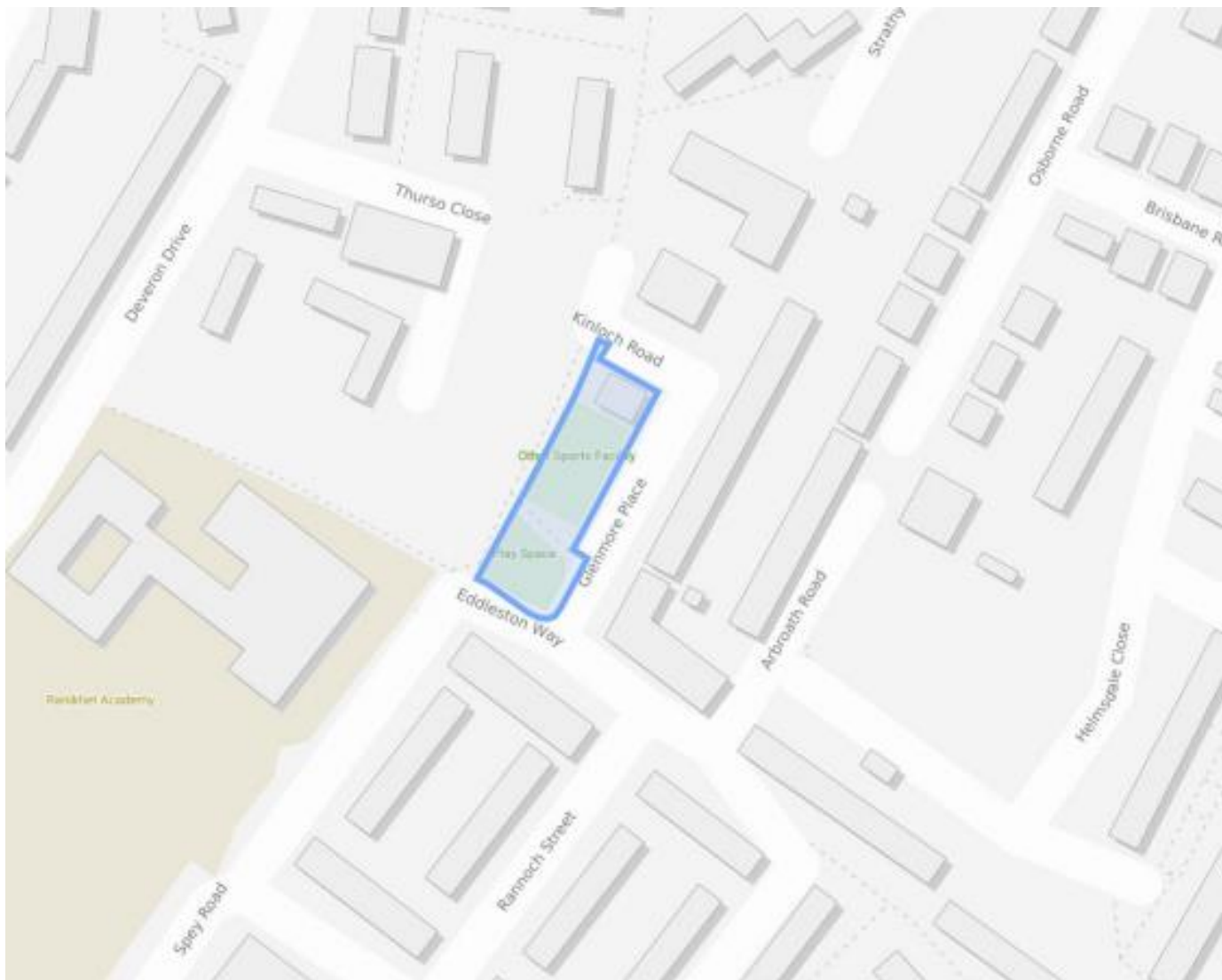
Reading Borough Council c/o Gleeds

March 2025

Figure 1: Site Location Plan

GWPR6479





Site boundary

Not to Scale

Dee Park Sports, Reading, RG30 4EP

Reading Borough Council c/o Gleeds

March 2025

Figure 2: Site Development Area

GWPR6479





◇ Site boundary

Not to Scale

Dee Park Sports, Reading, RG30 4EP

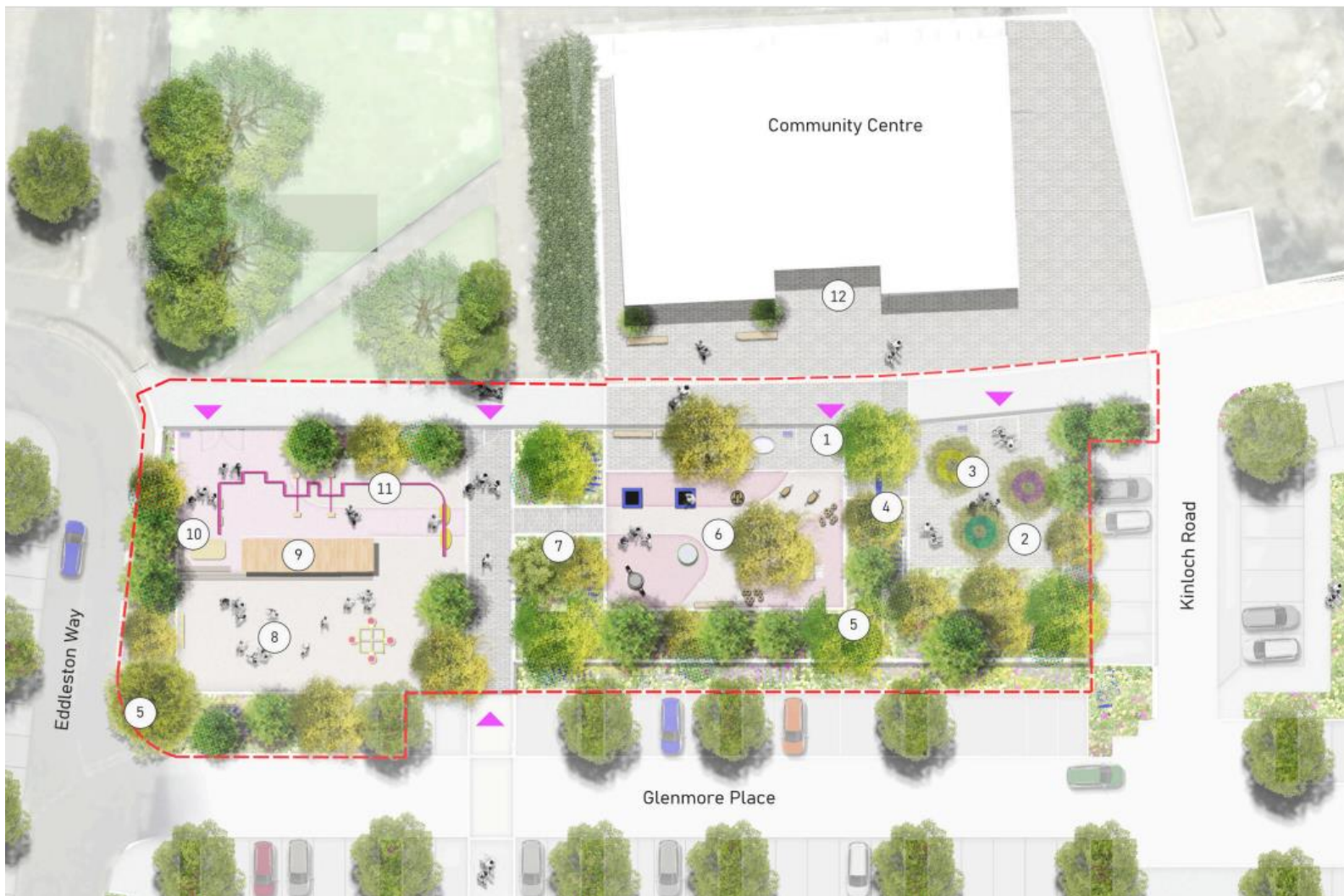
Reading Borough Council c/o Gleeds

March 2025

Figure 3: Aerial View of the Site

GWPR6479





◇ Site boundary

Key

- ① Paved space to link to community centre
- ② Flexible space for events
- ③ Circular tree seats
- ④ Arch from Lyons square
- ⑤ Proposed tree planting
- ⑥ Proposed play area for under 5's with in-ground trampolines, basket swing, roundabout and play frame
- ⑦ Proposed planting between play areas with link path
- ⑧ Proposed ball sports area with target wall and 4-way basketball hoops
- ⑨ Proposed stage with shelter
- ⑩ Proposed seating area
- ⑪ Proposed multi-element play structure with swings, see-saws, balance beam, up-and-over bars and monkey bars
- ⑫ Community Centre entrance
- ▲ Entrance to park

Not to Scale

Dee Park Sports, Reading, RG30 4EP

Reading Borough Council c/o Gleeds

March 2025

Figure 4: Proposed Development

GWPR6479





-  Site boundary
-  Machine Excavated Trial Pit (BRE365)
-  Windowless Sampler Borehole
-  CBR by DCP

Not to Scale

Dee Park Sports, Reading, RG30 4EP

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March 2025

Figure 5: Trial Hole Location Plan

GWPR6479

