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CONSTRUCTION CONSULTANTS

Kneller Hall, 65 Kneller Road, Twickenham TW2 7DN

Drainage Strategy and Maintenance Plan including Foul Water Drainage Strategy

Prepared for

Dukes Education Group Ltd

14/09/2022

Job №: L221004

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Revision	Amendments	Prepared By	Checked	Date
P01	First Issue	GK	KJ	29.07.2022
P02	Update following Emma Penson's comments	GK	KJ	09.09.2022
P02	Issue for planning	GK	KJ	14.09.2022

1.0 Introduction

AKS Ward have been commissioned by Dukes Education Group Ltd to undertake a Stage 3 Drainage Strategy and Maintenance Plan and Foul Water Drainage Strategy report to support the planning application for the redevelopment and conversion of the existing buildings, previously used as the Royal Military School of Music (residential education use), and associated hard and soft landscaping located in 65 Kneller Road, Twickenham of London Borough of Richmond upon Thames (LBR), National Grid Reference TQ 14684 74191.

The Drainage Strategy is designed to agree with National Standards for Sustainable Drainage and also in accordance with London Sustainable Drainage Action Plan, including its prescribed criteria for matters such as surface water run off rates and climate change allowances.

It includes drainage calculations and discussion on the most suitable SuDs selection to support the pre-planning application.

2.0 Development Site Details

2.1 Existing Site Description

The site was formerly a Royal Military School of Music which included residential accommodation (Use Class C2). Kneller Hall was vacated by the Ministry of Defence (MOD) in the summer of 2021. The site has now been acquired by Dukes Education and Radnor House School Limited.

The site is accessed by road via Kneller Road, a 'Local distributor road' (Kneller Road/Warren Road) which provides access to Chertsey Road (A316), which links Richmond to Central London via Hammersmith and the M3 to the west. The site's location is shown in Figure 1.

The overarching landscape typology of the site is a parkland setting, comprising trees across the site. Many of the trees are mature and protected by a Tree Preservation Order. The western part of the site contains a large amount of existing buildings, hardstanding and car parking. The eastern part of the site is within Metropolitan Open Land (MOL), largely comprising grassed fields, playing fields, with some sports pitches and supporting buildings and structures.

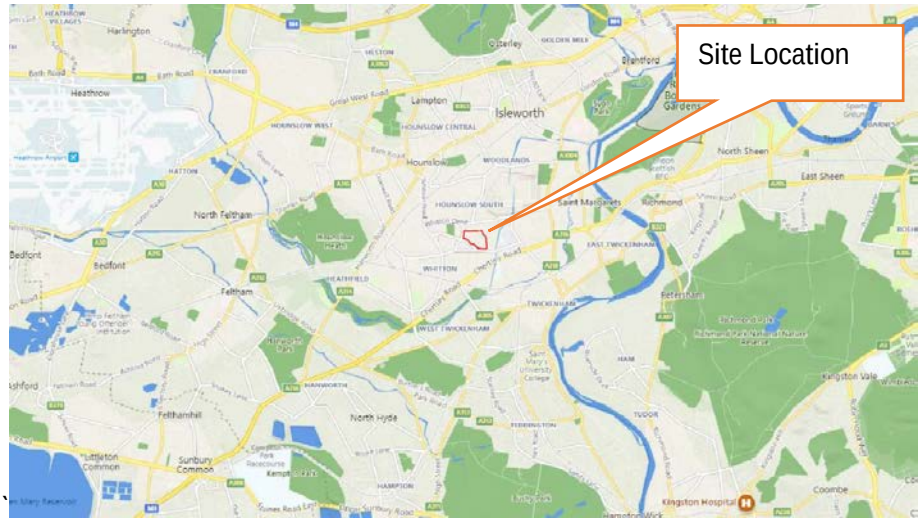

Figure 1 – Site Location – Source: Bing Maps

2.2 Site Characteristics

The site is uniform in shape and extends to approximately 9.7ha. A topographical survey has been undertaken by Warner Surveys Ltd in January 2021 and it is shown in Appendix A. The total existing impermeable area is estimated to be approximately 2.35ha and it is largely located in the western two thirds of the site. It is therefore classified as a brownfield site.

The site is within Flood Zone 1, and therefore at low risk of fluvial flooding. It is however understood to be locally susceptible to surface water flood risk..RPS Group plc has been appointed to prepare a Flood Risk Assessment, which accompanies the planning application.

The nearest watercourse to the site is the Duke of Northuberland's River approximately 150m east of the site. The land between the site and the river is a third party land.

2.3 Ground Conditions

Published British Geological Society BGS information (1:50,000 and 1:10,000 scale maps) indicates that the northwest corner of the site is underlain by Head Deposits which, are directly underlain by River

Terrace Deposits, which outcrop across the remainder of the site. The younger Taplow Gravel Member outcrops across the western part with the older Kempton Park Gravel Member to the east. These River Terrace Deposits are underlain by the London Clay Formation which attains an appreciable thickness in this area.

A ground investigation report has been undertaken by Soil Consultants Ltd in May 2022 and the results can be found in Appendix B.

The boreholes confirmed the presence of ground water in satisfactory depths between 2m to 4m at the locations with drainage interest. Additionally, the soil samples indicated the presence of different sandy gravel, sand and clay areas. The preferred location of the proposed SUDS will be based on the presence of gravel and sand which offer satisfactory infiltration rates.

Soil consultants Ltd undertook soakaway tests at two trial pit locations and the results are shown below:

SK01, Test 1: 2.48×10^{-5} m/s

SK01, Test 2: 7.71×10^{-6} m/s

SK02, Test 1: 2.97×10^{-6} m/s

Both tests gave satisfactory infiltration rates. A mean value will be used for the calculations for the hydraulic design:

Mean Infiltration Rate: 1.63×10^{-5} m/s

Further soakaway testing as per Digest BRE365 will be required post planning and during the detailed design phase to confirm the above infiltration rates.

3.0 Proposed Development

The site comprises of existing former education buildings, some of which will be demolished to allow the construction of new teaching blocks and some will be retained and undergo refurbishment and change of use. The proposal contain:

- Use of the main Grade II listed Kneller Hall for day school education use (Use Class F1);
- Use of two other buildings, the Guard Room and the Band Practice Hall for Education Use (Class F1) and conversion of existing buildings to provide an energy centre to support the school's energy demand;
- Demolition of some existing modern buildings;New build development to provide new purpose built buildings for school use including a Sports Centre (with indoor sports courts and swimming pool), a teaching block and a sports pavilion (Use Class F1);
- Ancillary works to facilitate the use of the site as a school to include, astro turf pitch, sports pitches, vehicle and cycle parking, play areas and a Forest School programme; andFacilitation of managed public access to the outdoor sports and forest school facilities.

All the above proposals are presented in Appendix B.

4.0 Surface Water Drainage Strategy

4.1 Design Criteria

The surface water drainage system has been designed in accordance with the National Planning Policy Framework (NPPF) and the accompanying Guidance and Technical Standards for SuDS. It also complies with the requirements under Building Regulations Part H.

London Borough of Richmond upon Thames' (LBRT) adopted Local Plan (2018) at Policy LP21 (Flood Risk and Sustainable Drainage) Part C states that:

> *"Sustainable drainage*
> *C. The Council will require the use of Sustainable Drainage Systems (SuDS) in all development proposals.*
> *Applicants will have to demonstrate that their proposal complies with the following:*
> *1. A reduction in surface water discharge to greenfield run-off rates wherever feasible.*
> *2. Where greenfield run-off rates are not feasible, this will need to be demonstrated by the applicant, and*
> *in such instances, the minimum requirement is to achieve at least a 50% attenuation of the site's surface water runoff at peak times based on the levels existing prior to the development."*

The explanatory text to Policy LP21 at paragraph 6.2.22 and 6.2.23 states that:

> *"to reduce the risk of surface water and sewer flooding, all development proposals in the borough that could lead to changes to, and have impacts on, surface water run-off are required to follow the London Plan drainage hierarchy:*
> *• store rainwater for later use*
> *• use infiltration techniques, such as porous surfaces in non-clay areas*
> *• attenuate rainwater in ponds or open water features for gradual release to a watercourse*
> *• attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse*
> *• discharge rainwater direct to a watercourse*
> *• discharge rainwater to a surface water drain*
> *• discharge rainwater to a combined sewer.*

If discharging surface water to a public sewer, developers are required to provide evidence that:

> *''capacity exists in the public sewerage network to serve their development in the form of written confirmation."*

LBRT's website advised that from April 2019, applicants are required to complete a London Sustainable Drainage Proforma for all planning applications and that applicants will have to demonstrate that their proposal complies with the following:

> "A reduction in surface water discharge to greenfield run-off rates wherever feasible. Where greenfield run-off rates are not feasible, this will need to be demonstrated by the applicant, and in such instances, the minimum requirement is to achieve at least a 50% attenuation of the site's surface water runoff at peak times based on the levels existing prior to the development. "

The LBRT has prepared the Planning Guidance Document Delivering SuDS in Richmond February 2015, which provides further guidance on drainage strategies.

4.2 Existing Surface Water

The surface water sewer provider of the area is Thames Water (TW). Thames Water's existing asset locations are showing in Appendix D.

A CCTV survey has been undertaken by Express Solutions Ltd in June/July 2022 and the results are shown in Appendix D. The survey revealed three combined sewer pipe networks that discharge foul and surface water into three different locations, two south in Kneller road and one north in Kneller Gardens road.

4.3 Greenfield Run-off Rate

The existing greenfield runoff rates for the site have been calculated as follows:

1 in 1 year return period (100% Annual Exceedance Probability (AEP)): 12.5 l/s

1 in 2 year (Q_{BAR}) return period: 14.8 l/s

1 in 30 years return period (3.3% AEP): 33.5 l/s

1 in 100 years return period (1% AEP): 47.1 l/s

Appendix E includes the greenfield run-off rate as calculated with Microdrainage using the ICP SUDS method.

4.4 Existing Brownfield Run-off Rate

The site is currently a brownfield site and therefore the existing brownfield peak run-off rates should be calculated. The most common of calculating this amount in the UK is the Modified Rational Method using the formula:

Q=2.78CIA where,

C: Coefficient of Runoff, 0.84

I: Average Rainfall Intensity

A: Existing Impermeable Area (2.35ha)

The detailed calculations are presented in Appendix F. The most intense rainfall duration of 15 minutes exports the following brownfield peak run-off rates, based on the impermeable areas of the existing development:

1 in 1 year return period (100% Annual Exceedance Probability (AEP)): 171.052 l/s

1 in 2 year (Q_{BAR}) return period: 221.089 l/s

1 in 30 years return period (3.3% AEP): 419.706 l/s

1 in 100 years return period (1% AEP): 544.826 l/s

4.5 Proposed Surface Water

The proposed surface system will be designed to agree with the National Standards for Sustainable Drainage. As stated in the National Planning Practice Guidance (NPPG), the aim should be to discharge surface water run-off as high up the drainage hierarchy, as reasonably practicable:

1. into the ground (infiltration);
2. to a surface water body*;

3. to a surface water sewer, highway drain, or another drainage system*;

4. to a combined sewer*.

The soakaway testing undertaken by Soil Consultants Ltd proved that infiltration is a viable discharge option at specific areas of the site. Thus, the first option of NPPG's hierarchy is selected

The existing buildings and the hardstanding areas that will not be amended are not covered by this drainage strategy and they will keep their existing drainage systems. The surface water runoff from the proposed buildings and hardstanding areas will be collected by gullies and ACO drains and transferred via pipe systems at SuDS infiltrating systems.

The total impermeable area for the proposed development is 1.067 ha. However, 0.124ha from those are existing buildings that will remain and their existing surface water drainage will not change. Thus the impermeable area that will be used at the calculations is 0.943ha.

A plan showing the distribution of the impermeable areas into the different discharge locations is shown in Appendix G and a plan showing the materials of the permeable areas will be issued by the appointed landscape architect.

The drainage strategy is shown in Appendix G and the relevant calculations in Appendix H.

4.6 Surface Water Discharge Betterment

The LBRT Local Plan policy LP21 requires a reduction in surface water discharge to greenfield run-off rates wherever feasible. Where greenfield run-off rates are not feasible, this will need to be demonstrated by the applicant, and in such instances, the minimum requirement is to achieve at least a 50% attenuation of the site's surface water runoff at peak times based on the levels existing prior to the development.

At the proposed development is proposed the solution of infiltration for the new buildings and the hard-landscaping areas and the uncontrolled runoff discharge for the existing buildings that will remain as it currently occurs. This approach offers a significant betterment of 84.6% for the 1 in 100 + 40% climate change. The betterment for different rainfall events is shown at the table below:

Rainfall Event	Existing Brownfield Run-off Rate	Proposed Unattenuated Brownfield Run-off Rate	Betterment
1 in 1	171.052l/s	18.779l/s	89%
1 in 2	221.089l/s	24.273l/s	89%
1 in 30	419.706l/s	46.078l/s	89%
1 in 100	544.826l/s	59.815l/s	89%
1 in 100 + 40% cc	-	83.741l/s	84.6%

Figure 2 – Surface Water Discharge Betterment

4.7 SUDS selection

Set out below are the SuDS features that are considered or proposed to be used for the surface water management strategy:

- Rainwater Harvesting

Rainwater harvesting is the collection of rainwater runoff for use. Runoff can be collected from roofs and other impermeable areas, stored, treated and then used as a supply of water for domestic, commercial, industrial and/or institutional properties.

It has been decided not to select rainwater harvesting at this stage due to its implications at the structural design and the extremely high cost of installation and maintenance which will make the development inviable.

- Soakaway

Soakaways is the preferred on-site SUDS discharge method. Soakaways are square or circular excavations either filled with rubble or lined with brickwork, precast concrete or polyethylene rings/perforated storage structures surrounded by granular backfill. They can be grouped and linked together to drain large areas including highways. Soakaways provide storm water attenuation, storm water treatment and groundwater recharge. The supporting structure and backfill can be substituted by modular geocellular units. This option is not offering storm water treatment though.

A soakaway will be installed in the centre of the site where the surface water from the roofs and roads of south and central new development will be discharged. The design of the soakaway is described in section 4.6. The relevant areas to be discharged are shown on drawing KNE-AKS-ZZ-XX-DR-C-9201 Drainage strategy_P06 in appendix G.

- Permeable Pavement

Permeable paving is proposed to be utilised on parts of the site where the existing surface is proposed to be removed and works are being undertaken as part of the landscaping strategy. Where the existing surface is proposed to be retained and no/ limited works are being undertaken, permeable paving is not proposed. Due to the good infiltration rates the permeable pavement will allow the surface water to pass through the surface to the ground below.
The final permeable paving design is subject to the detail drainage design, which will be dependent on the final depth of the permeable paving sub-base, final site gradients and the structural requirements (based on the surface loading and ground CBR value), as well as the depth required for surface water attenuation purposes.

- Infiltration Basin

Infiltration basins are landscaped depressions that are normally dry except during and immediately following storm events. Surface water can be stored or conveyed which can be designed to allow infiltration. They should promote low flow velocities to allow much of the suspended particulate load in the storm water runoff to settle out, thus providing effective pollutant removal. Infiltration basins should be incorporate into the landscape design in order to provide attenuation or infiltration if possible.

An infiltration basin is proposed to be installed at the north boundary of the site. The relevant areas to be discharged are shown on drawing KNE-AKS-ZZ-XX-DR-C-9202 Proposed Impermeable Areas in appendix G.

- Green Roofs

A green roof is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane. Green roofs serve several purposes for a building, such as absorbing rainwater, providing insulation, creating a habitat for wildlife, providing a more aesthetically pleasing landscape, and helping to lower urban air temperatures and mitigate the heat island effect.

Three buildings have been chosen to have green roofs installed, the teaching block, the sports hall and the sports pavilion. The final green roof design is subject to the detail drainage design and it will be undertaken by a third party.

4.8 Design of Soakaway and Infiltration Basin

As stated at section 4.7 a soakaway, an infiltration basin, green roofs and permeable paving has been considered for the proposed development. The green roofs have not been taken into account at the hydraulic calculations at this stage because their final design has not been selected. It is expected to provide a reduction of the peak flows up to 30% for the 1 in 100 plus 40% climate change rainfall events though. The permeable paving will not be in line with the rest of the surface water drainage system and the surface water at the specific locations will infiltrate directly into the ground. Details regarding the design of the soakaway and the infiltration basin are showing below:

- Soakaway

One Geo-cellular soakaway (24m x 11m x 1.2m deep) is proposed at the new yard at the centre of the site outside the new pool. The soakaway will have a capacity of 316.8m^3 and it will be based at 3m below the ground surface which is 1m higher than the ground water level at the specific location. Rainwater from impermeable areas equal to 0.477ha will be discharged inside the soakaway. The infiltration rate at the location is estimated at 1.63x10^{-5} m/s.

AquaCells Prime from Wavin (or similar) are proposed for the construction of the soakaway. The dimensions of the AquaCells are 1m length, 0.5m width and 0.4m height. Maintenance access will be provided with the use of AquaCell Plus-R or similar system to allow maintenance access through the tanks. The soakaway will be wrapped with a permeable membrane in order to let the water discharge into the ground using an infiltration process that can support the natural rate of the surrounding environment.

The location and the dimensions of the soakaway is shown in drawing KNE-AKS-ZZ-XX-DR-C-9201 Drainage strategy at Appendix G.

- Infiltration Basin

An infiltration basin is proposed to be installed at the north of the site. The basin will offer a capacity of 613m^3 and it will have a maximum depth of 0.9m which is 1.0m higher than the ground water level at this location. Rainwater from impermeable areas of 0.467ha will be discharged inside the swale. Its construction will not require the removal of any existing tree.

The location and the dimensions of the soakaway is shown on drawing KNE-AKS-ZZ-XX-DR-C-9201 Drainage strategy at Appendix G.

Both the proposed soakaways and the basin have been designed by Microdrainage in accordance with CIRIA SuDS manual to avoid flooding in the 100-year flooding events and no flood water leaving the site for the 100 year + 40% climate change critical storm event. The relevant Microdrainage calculations are shown in Appendix G.

4.9 Exceedance Events

In storm events exceeding the designed storm events above the 100 year plus 40% climate change the flow of water would run towards the east of the development to the sports fields.

5.0 Foul Water Management

5.1 Existing Foul Water

A CCTV survey has been undertaken by Express Solutions Ltd in June/July 2022 and the results are shown in Appendix D. The survey revealed three combined sewer pipe networks that discharge foul and surface water into three different locations, two south in Kneller road and one north in Kneller Gardens road.

5.2 Proposed Foul Water

The foul drainage system will be designed with regard to the Design and Construction Guidance for foul and surface water sewers Approved Version 2.0, 10 March 2020, and Building Regulations Part H

All foul water drainage from the school will be collected and, via gravity, will be transferred to the public sewer at the existing outflow locations. A S106 connection application is required to be submitted to the Thames Water. AKS Ward have submitted this application on behalf of the applicant and are awaiting a response.

The proposed development projects the use of the facilities from up to 1000 students and up to 170 members of staff. This together with the change of use of the development will require a capacity capability confirmation by Thames Water.

Using the British Water Flow and Loads guide the proposed foul flow rates for 12 hours occupation time for Non Residential School with Canteen are the following:

Peak flow: 14.63 l/s

Average flow: 2.44 l/s

The proposed foul calculations are showing in appendix I and the amendments at the existing foul pipe network in drawing KNE-AKS-ZZ-XX-DR-C-9201 Drainage strategy_P04 at Appendix G.

6.0 Water Quality Management

The surface system will be designed in order to not affect the water quality of the receiving public sewer.

CIRIA SuDS Manual 2015 Chapter 26 assigns pollution hazard indices for different land use types and SuDS mitigation index for every SuDS component depending on where the discharge is, surface or ground water.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

CIRIA SuDS Manual states that 'To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index that equals or exceeds the pollution hazard index'

Total SuDS mitigation index ≥ pollution hazard index
(for each contaminant type) (for each contaminant type)

Pollution hazard indices for land use are as follows:

Roof (Other):	TSS 0.3	Metals 0.2	Hydrocarbons 0.05
Non- Residential Car park:	TSS 0.7	Metals 0.6	Hydrocarbons 0.7

SuDS mitigation indices are determined by the type of SuDS utilised on site. The proposals for this site are permeable paving and a swale, therefore the following indices have been used:

Permeable Paving:	TSS 0.7	Metals 0.6	Hydrocarbons 0.7
Infiltration Basin:	TSS 0.5	Metals 0.5	Hydrocarbons 0.6

As a result, the proposed drainage solutions will significantly improve the water quality of the proposed development.

7.0 Schedule of Maintenance

7.1 Infiltration Basins Operation & Maintenance Requirements

Regular inspection and maintenance is important for the effective operation of infiltration basins as designed.

Regular mowing in and around infiltration basins is required only along maintenance access routes, amenity areas (e.g. footpaths), across embankments and across the main storage area. The remaining areas can be managed as "meadow", unless additional management is required for landscaping purposes.

Adequate access should be provided to the infiltration basin for inspection and maintenance, including for appropriate equipment and vehicles, e.g. mowing equipment. Operation and maintenance requirements for infiltration basins are described below.

Infiltration basin operation and maintenance requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove litter, debris, and trash	Monthly
	Cut grass – for landscaped areas and access routes	Monthly (during growing season) or as required
	Cut grass – meadow grass in and around basin	Half yearly: spring (before nesting season) and autumn
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
Occasional maintenance	Reseed areas of poor vegetation growth	Annually or as required
	Prune and trim trees, and remove cuttings	As required
	Remove sediment from pretreatment system when 50% full	As required
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets, outlets, and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Re-level uneven surfaces and reinstate design levels	As required

Maintenance schedule	Required action	Frequency
Monitoring	Inspect inlets, outlets, and overflows for blockages, and clear if required	Monthly
	Inspect bank sides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and pretreatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Inspect infiltration surfaces for compaction and ponding	Monthly

Sediments excavated from infiltration basins that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can be safely disposed of by either land application or land filling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on site if there is an appropriate safe and acceptable location to do so.

Provided preventive maintenance measures are conscientiously undertaken, the need for corrective maintenance should rarely arise.

7.2 Soakaways Operation & Maintenance Requirements

The useful life and effective operation of a soakaway is related to the frequency of maintenance and the risk of sediment being introduced into the system. An easement should be considered where multiple properties discharge to a single soakaway, to ensure long-term access for maintenance purposes.

Operation and maintenance requirements for soakaways are described below.

Soakaway operation and maintenance requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Remove sediment and debris from pre-treatment devices and floor of inspection tube or chamber.	Annually.
	Cleaning of gutters and any filters on downpipes.	Annually.
	Trimming any roots that may be causing blockages.	Annually (or as required).
Occasional maintenance		
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs.	As required.

	Replacement of clogged geo-textile.	As required.
Monitoring	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.

Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal for large systems. If maintenance is not undertaken for long periods, deposits can become hard-packed and require considerable effort to remove.

Replacement of the void fill will be necessary if the device becomes blocked with silt. Monitoring will give information on changes in infiltration rate and provide a warning of potential failure in the long-term.

Roads and/or parking areas draining to soakaways should be regularly swept to prevent silt being washed off the surface. This will minimize the need for ongoing maintenance.

7.3 Permeable Paving Operation & Maintenance Requirements

Regular inspection and maintenance is important for the effective operation of pervious pavements. The facility should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. Manufacturers' recommendations should always be followed.

A brush cleaner, which can be a lorry-mounted device or a smaller precinct sweeper, should be used and the sweeping regime should be as follows:

End of winter (April) – to collect winter debris.

Mid-summer (July/August) – to collect dust, flower and grass-type deposits.

After autumn leaf fall (November).

Care should be taken in using vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced.

If reconstruction is necessary, the following procedure should be followed:

- Lift surface layer and laying course.
- Remove any geo-textile filter layer.
- Inspect sub-base and remove, and replace if required.
- Renew any geo-textile layers.
- Renew laying course, jointing material and concrete block paving.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

Pervious pavement operation and maintenance requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Brushing	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 surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilize and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosphate 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 50mm 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 ten to fifteen 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, 48hrs after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken.

8.0 Summary

- AKSWard have been commissioned by Dukes Education Group Ltd and Radnor House School Limited to prepare a Stage 3 Drainage Strategy and Maintenance Plan and Foul Water Drainage Strategy for the proposed development at Kneller Hall, Twickenham. The development consists of change of use of existing buildings and construction of new ones.

- Foul water will be discharged at the existing public sewer connections but a formal S106 connection application is required due to the change of use. This application is being progressed by AKW Ward.

- Ground conditions have been demonstrated acceptable infiltrate rates that make the site suitable for infiltration. Therefore, it is proposed that a soakaway, infiltration basin and permeable paving to be installed as a solution for the surface water discharge. Green roofs are also proposed.

- The design of the soakaway and the infiltration basin make them capable not to flood for rainfall events up to 1 in 100 plus 40% climate change.

- The surface water drainage strategy follows the drainage hierarchy and control run-off from impermeable areas at source and attenuate through SuDS features. The drainage strategy will reduce the surface water discharge run-off rates offering a betterment of 84.6%.

- The drainage strategy employed will also degrade pollutants, which thereby improve the quality of discharged surface water.

- The maintenance of SuDS features is vital ensuring that they work as efficiently as they set out to do.

- The proposals are considered to fully comply with National, Regional and local planning policy.

Appendix A

Topographical Survey

OS NORTH

Topographical Abbreviations

A/R	Assumed Route	MKR	Marker
BH	Borehole	MT	Mercury Telecom Cover
BOL	Bollard	OHC	Overhead Cable
BT	British Telecom Cover	OHP	Overhead Pipe
BW	Barbed Wire Fence	OSBM	Ordnance Survey Bench Mark
BWK	Brickwork	PB	Post Box
CATV	Cable TV Cover	PCH	Post and Chain Fence
CB	Close Boarded Fence	PR	Post & Rail Fence
CCTV	Closed Circuit TV	PW	Post & Wire Fence
CHLK	Chainlink Fence	PWM	Post & Wire Mesh Fence
CE	Cat's Eye	RE	Rodding Eye
CL	Cover Level	RG	Road Gully
CM	Cable Marker	RN	Road Name
CONC	Concrete	RS	Road Sign
CPS	Conc Paving Slabs	RW	Retaining Wall
DIA	Diameter	RWP	Rain Water Pipe
DK	Drop Kerb	SAP	Sapling
DP	Down Pipe	SC	Stop Cock
EJB	Electricity Junction Box	SPR	Spread
EC	Electricity Cover	STA	Traverse Station
EP	Electricity Pole	SV	Stop Valve
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F/B	Flower Bed	SW	Storm Water
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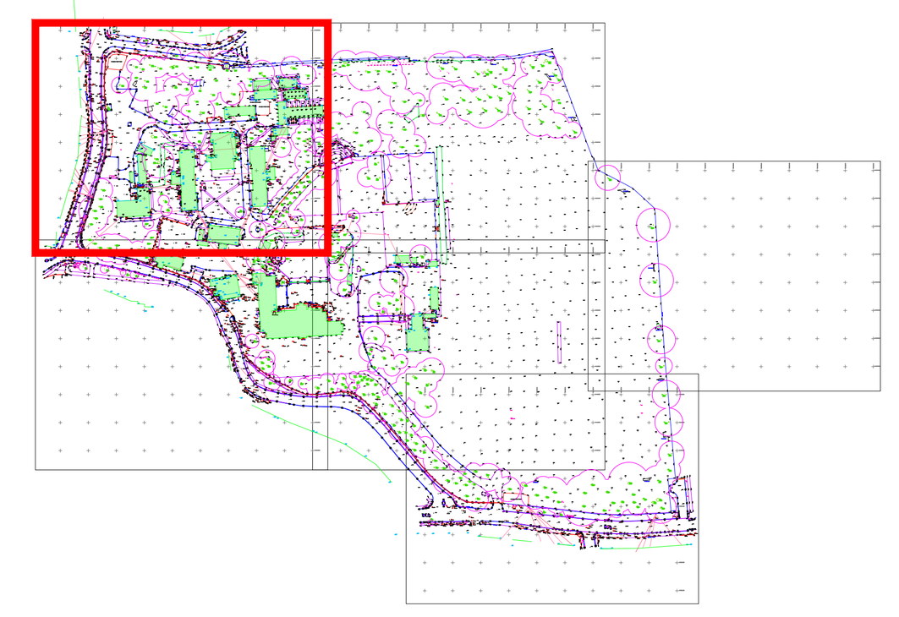

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Prelim		-	Preliminary - Not Complete	-

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DRAWN	EW	
SCALE	1:200	

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TOPOGRAPHICAL SURVEY

JOB No	DRAWING NUMBER
LT/220/0504	LT/220/0504/P/0001a

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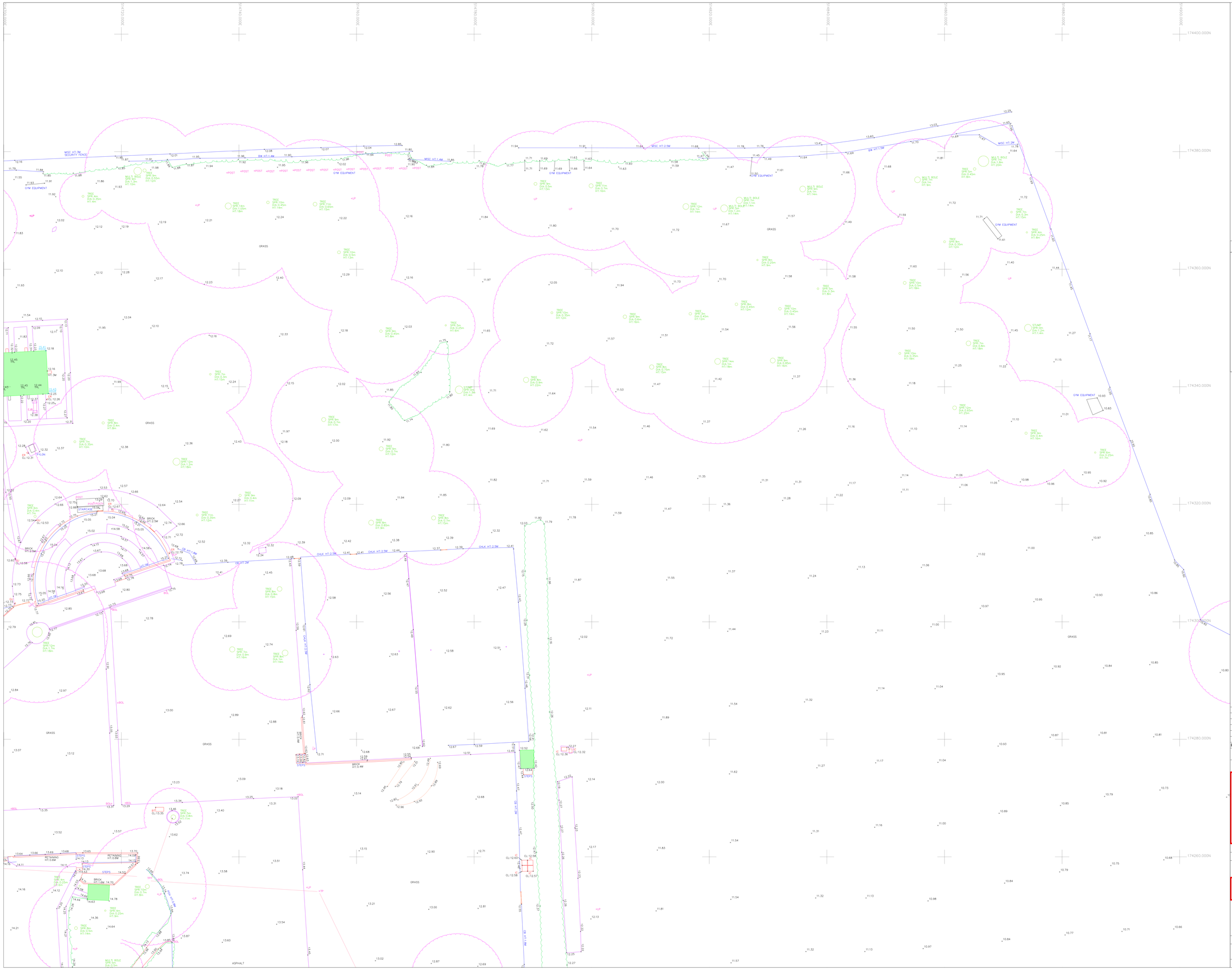

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DRAWN	EW	
SCALE	1:200	

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TOPOGRAPHICAL SURVEY

JOB No	DRAWING NUMBER
LT/220/0504	LT/220/0504/P/0001b

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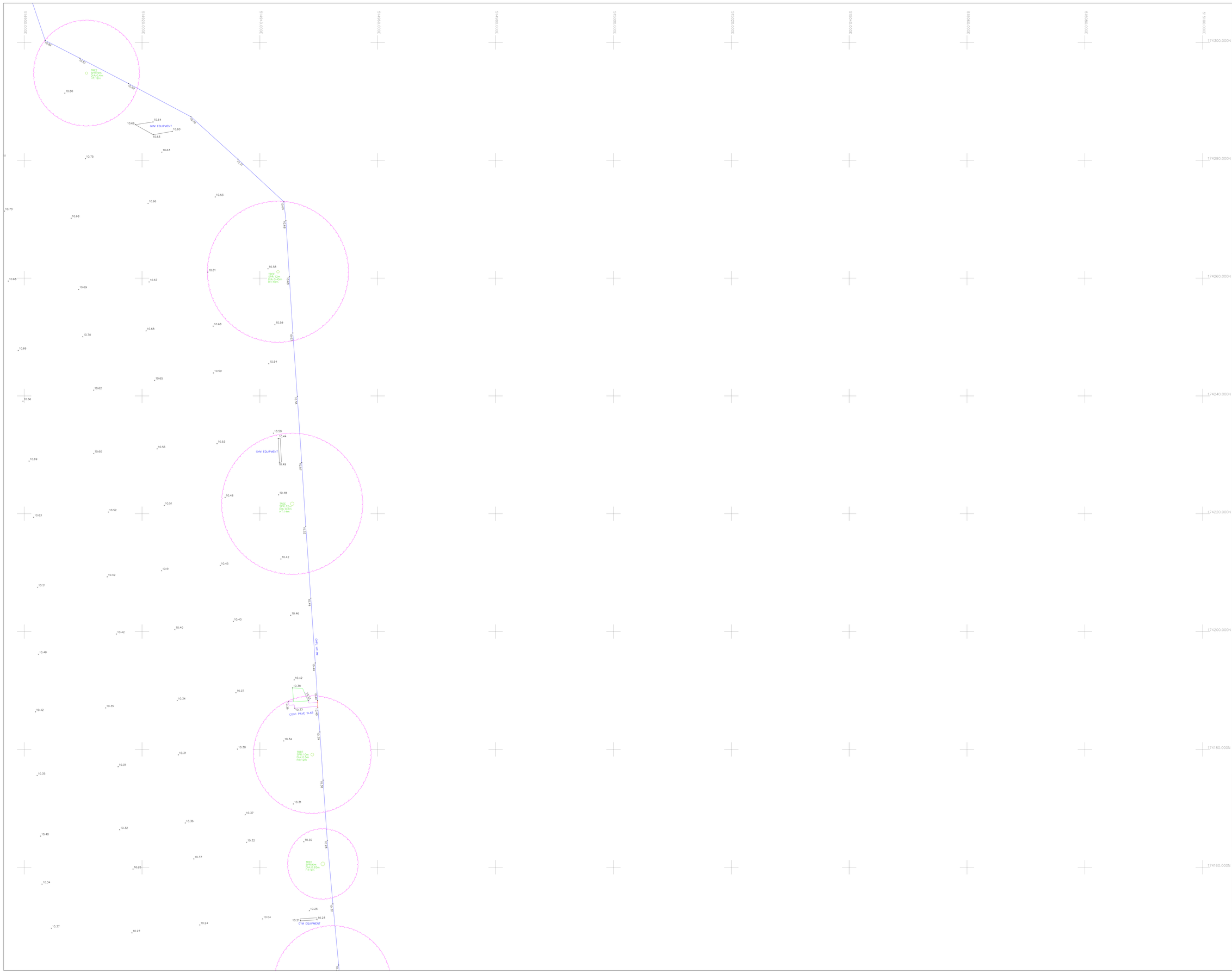

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SCALE	1:200	

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TOPOGRAPHICAL SURVEY

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A0 Sheet - 1,189mm X 841mm

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DRAWN	EW
SCALE	1:200

WOOD PLC

A24 – Kneller Hall

TOPOGRAPHICAL SURVEY

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LT/220/0504	LT/220/0504/P/0001d

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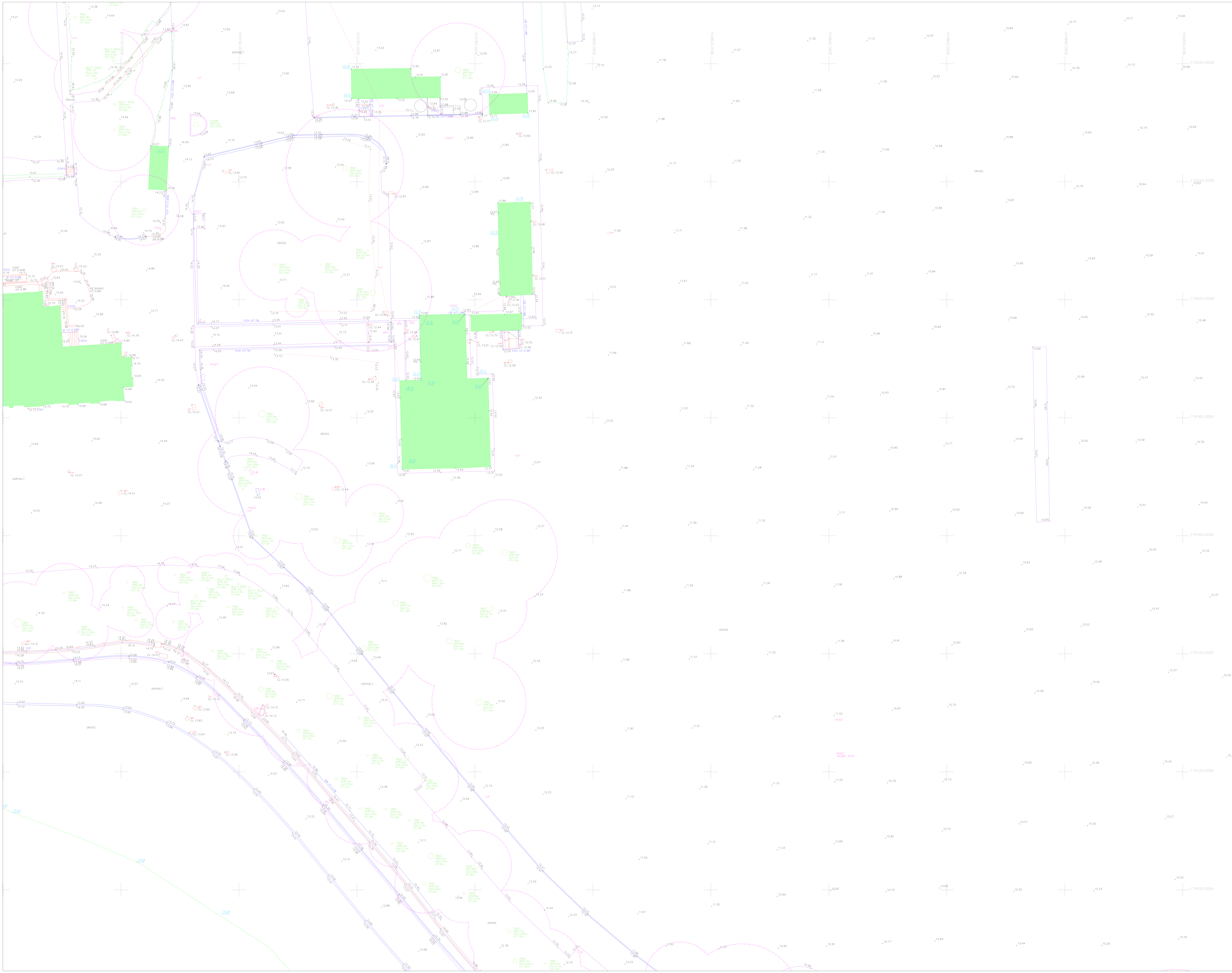

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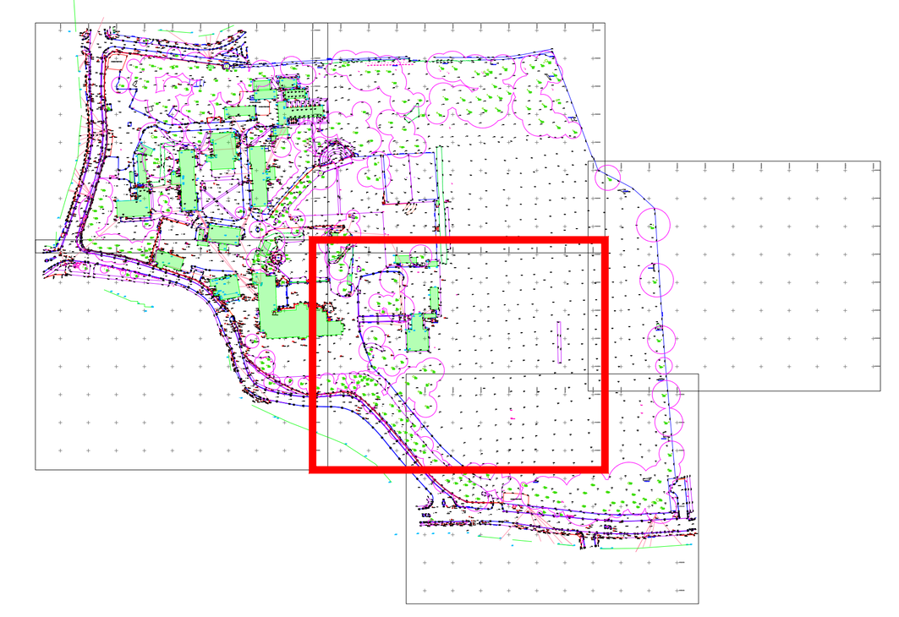

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SCALE	1:200	

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TOPOGRAPHICAL SURVEY

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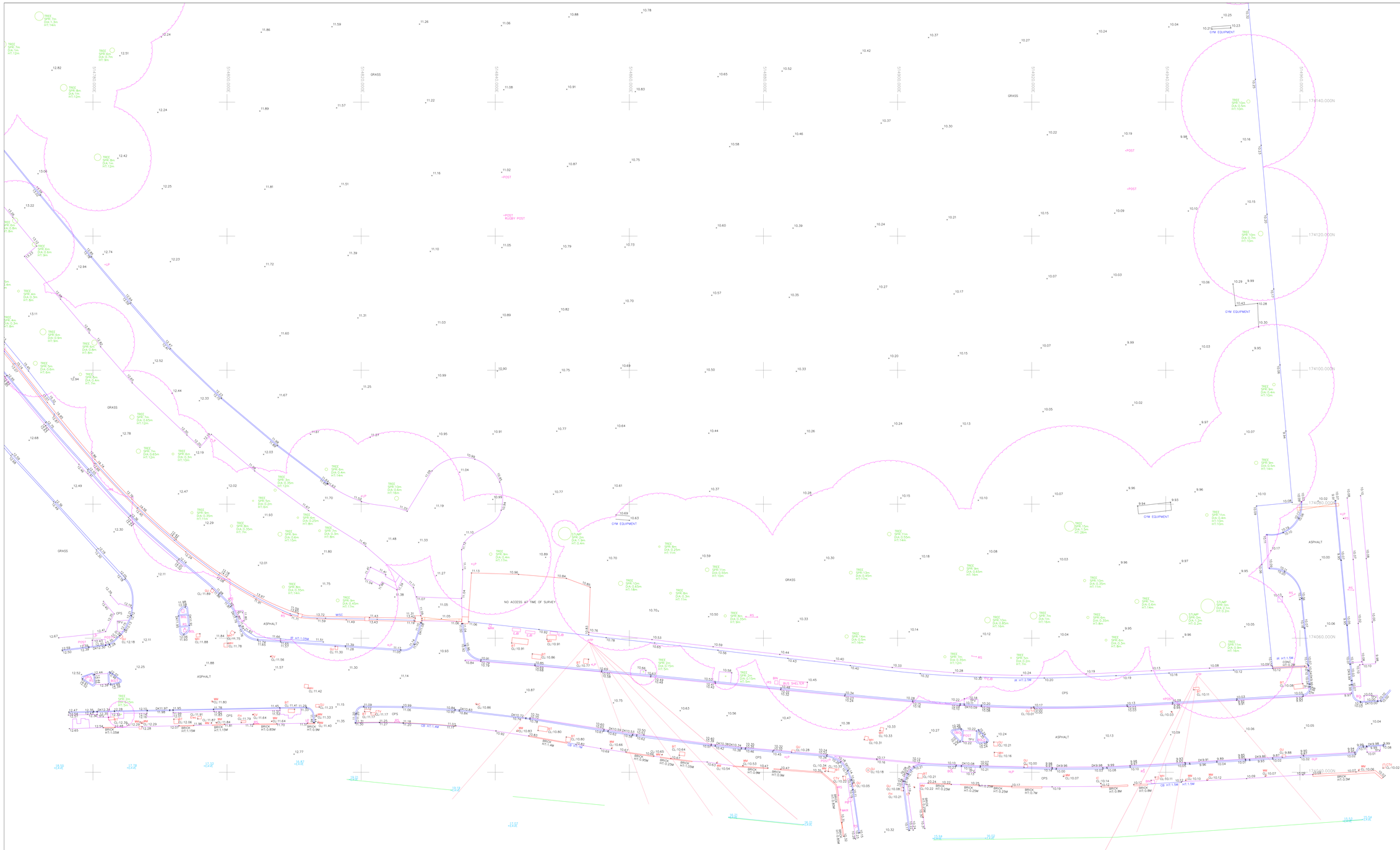

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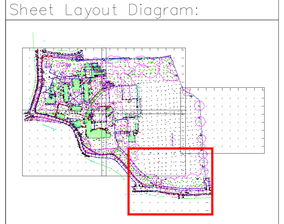

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SCALE	1:200	

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TOPOGRAPHICAL SURVEY

JOB No	DRAWING NUMBER
LT/220/0504	LT/220/0504/P/0001f

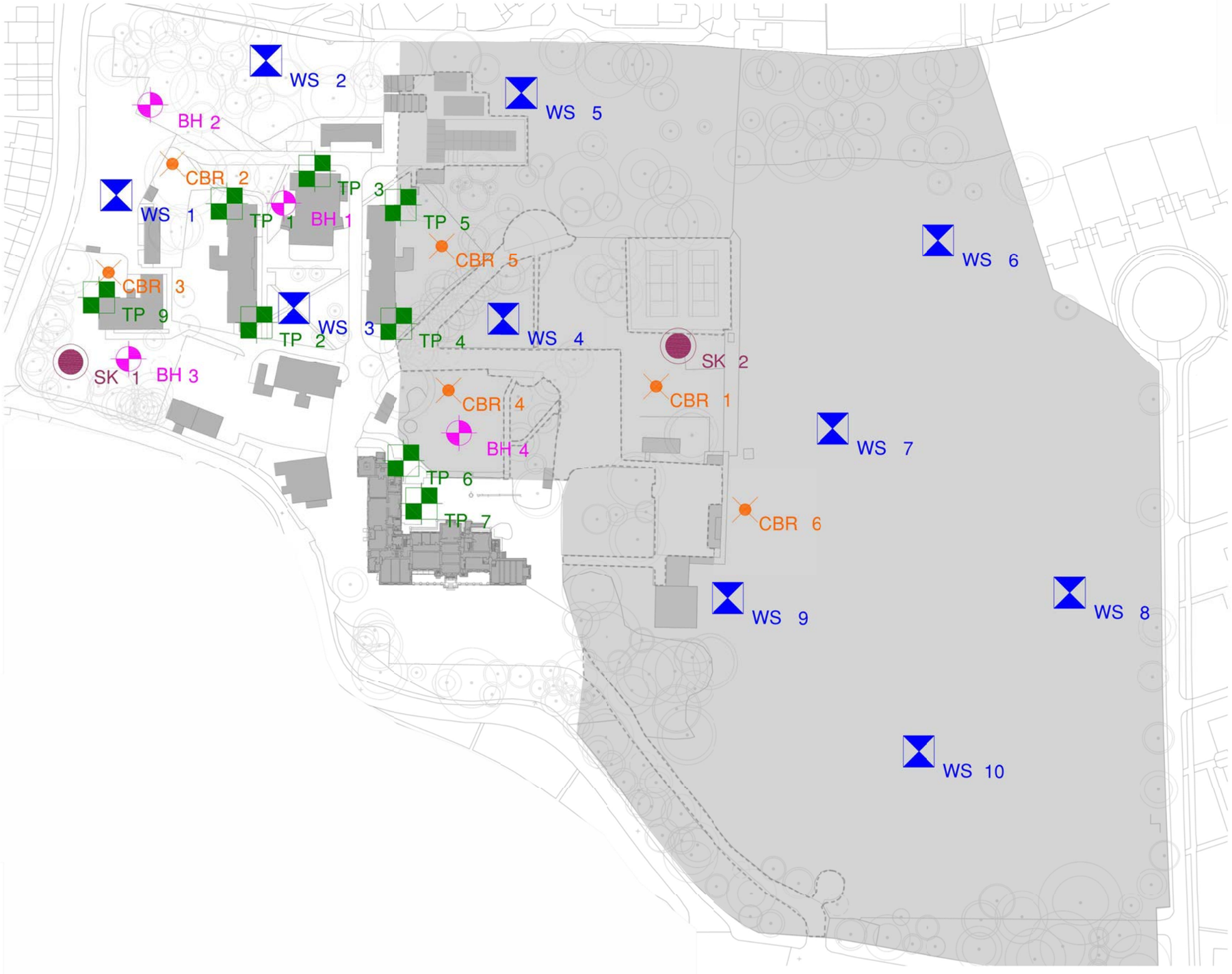
A0 Sheet - 1,189mm X 841mm

Appendix B

Soakaway Test Results

NOTES

1. All setting out to be in accordance with the Architect's drawings. Any discrepancies between the Engineer's and the Architect's drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.
2.



Key

BH	Proposed cable percussion borehole
WS	Proposed window sample borehole
TP	Proposed trial pit
CBR	Proposed CBR test
SK	Proposed infiltration test

Note: Location of investigation indicative; final locations to be agreed following site walk-over

Rev.	Amendment	Drn	Chkd	Date
P01	Preliminary		SJG	07.03.22

Drg Status: Preliminary

AKS Ward
CONSTRUCTION CONSULTANTS
One West Smithfield
London
EC1A 9JU
Tel: 020 7236 0161
Fax: 020 7236 3239
e-mail: london@aksward.com
web: www.aksward.com
■ London
□ Hitchin
□ Oxford
□ Southampton

Client: Dukes Education

Project: Kneller Hall School, Twickenham

Title: Site Layout
Proposed Site Investigation Layout

Scales: NTS

Reviewed Scheme: SJG Date: 07.03.22

Reviewed Final: Date:

Project No.	Drg No.	Rev.
L22104	SK-GEO-001	P02

Site & Location	Kneller Hall, 65 Kneller Road, Twickenham, London TW2 7DN	Report No:	10728/SG

Trial pit soakage test results

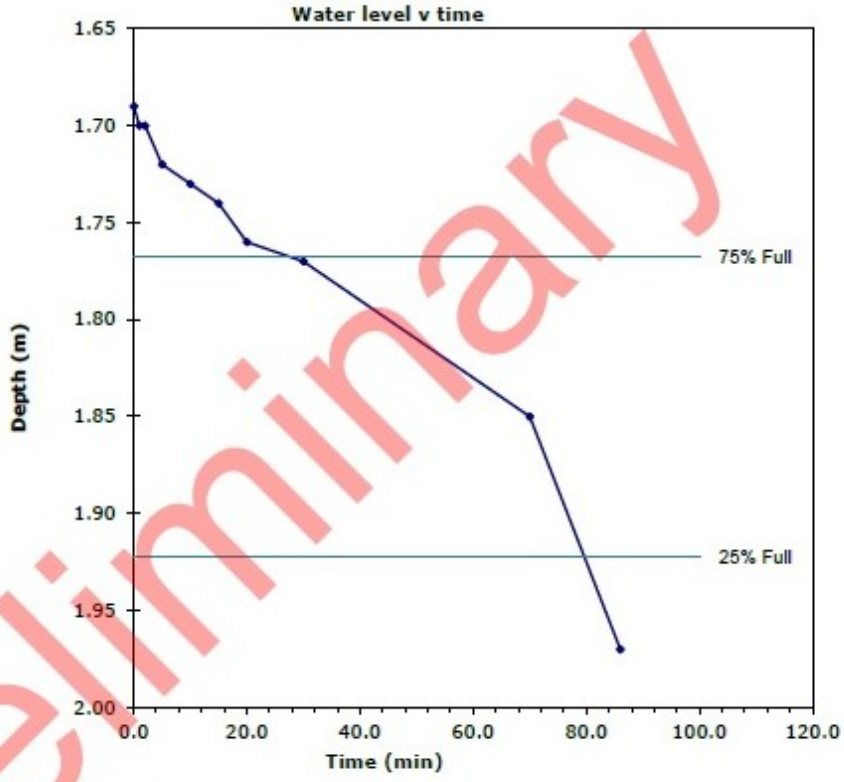
TP No: SK01 **Depth:** 2.00 m **Test No:** 1

Dimensions: Width = 0.45 m
Length = 1.00 m
Pit filled with gravel (Y/N) No
Voids Ratio

Ground sequence: See trial pit logs.

GW Standing at: **2.00 m**

Time (mins)	Depth (mBGL)
0.0	1.69
1.0	1.70
2.0	1.70
5.0	1.72
10.0	1.73
15.0	1.74
20.0	1.76
30.0	1.77
70.0	1.85
86.0	1.97



Depth of water at start of test	1.69 m
Depth of water at end of test	1.97 m
Depth at 75% full	1.77 m
Depth at 25% full	1.92 m
Base area of pit	0.45 m²
Effective soakage area a_{s50}	0.90 m²
Volume Change V_{75}-V_{25}	0.07 m³
Time used in calculation t_{p75}	1650 sec
Time used in calculation t_{p25}	4780 sec

Soil infiltration rate **2.48E-05 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Soil Consultants

Site & Location	Kneller Hall, 65 Kneller Road, Twickenham, London TW2 7DN	Report No:	10728/SG

Trial pit soakage test results

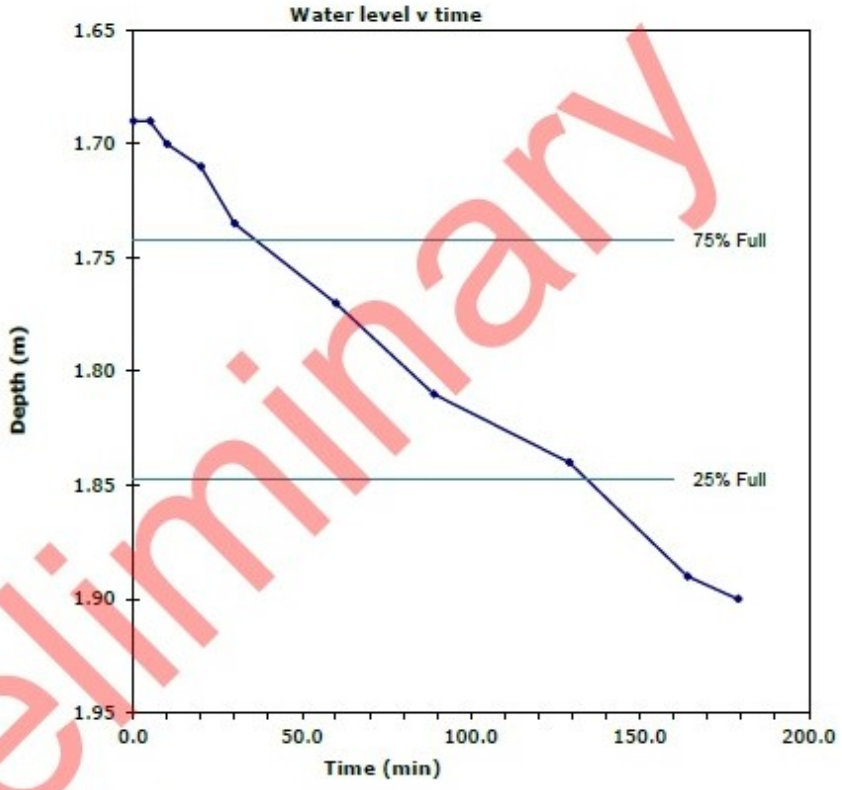
TP No: SK01 **Depth:** 2.00 m **Test No:** 2

Dimensions: Width = 0.45 m
Length = 1.00 m
Pit filled with gravel (Y/N) = No
Voids Ratio =

Ground sequence: See trial pit logs.

GW Standing at: **2.00 m**

Time (mins)	Depth (mBGL)
0.0	1.69
5.0	1.69
10.0	1.70
20.0	1.71
30.0	1.74
60.0	1.77
89.0	1.81
129.0	1.84
164.0	1.89
179.0	1.90



Depth of water at start of test	1.69 m
Depth of water at end of test	1.90 m
Depth at 75% full	1.74 m
Depth at 25% full	1.85 m
Base area of pit	0.45 m²
Effective soakage area a_{s50}	1.04 m²
Volume Change V_{75}-V_{25}	0.05 m³
Time used in calculation t_{p75}	2186 sec
Time used in calculation t_{p25}	8055 sec

Soil infiltration rate **7.71E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Soil Consultants

Site & Location	Kneller Hall, 65 Kneller Road, Twickenham, London TW2 7DN	Report No:	10728/SG

Trial pit soakage test results

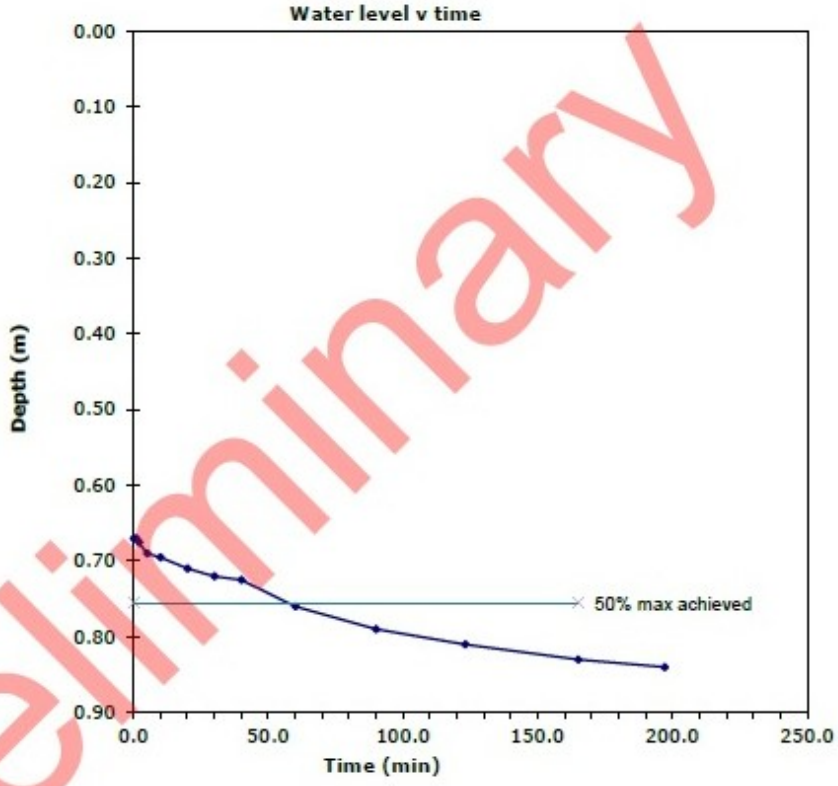
TP No: SK02 **Depth:** 1.50 m **Test No:** 1

Dimensions: Width = 0.45 m
Length = 0.90 m
Pit filled with gravel (Y/N) = No
Voids Ratio =

Ground sequence: See trial pit logs.

GW Standing at: **1.50 m**

Time (mins)	Depth (mBGL)
0.0	0.67
1.0	0.67
2.0	0.68
5.0	0.69
10.0	0.70
20.0	0.71
30.0	0.72
40.0	0.73
60.0	0.76
90.0	0.79
123.0	0.81
165.0	0.83
197.0	0.84



Depth of water at start of test	0.67 m
Depth of water at end of test	0.84 m
Depth at 75% full	0.71 m
Depth at 25% full	0.80 m
Base area of pit	0.41 m²
Effective soakage area a_{s50}	2.42 m²
Volume Change V_{75}-V_{25}	0.03 m³
Time used in calculation t_{p75}	1350 sec
Time used in calculation t_{p25}	6142 sec

Remark: GW seapage at 1.5

Soil infiltration rate **2.97E-06 m/sec**

The 'soil infiltration rate' is calculated using two selected water levels (BRE DG 365: 2016 "Soakaway design")

Soil Consultants

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Appendix C

Proposed Development

LEGEND

PLANNING APPLICATION RED LINE

METROPOLITAN OPEN LAND (MOL) DEMARKATION LINE

FENCE TYPES

EXISTING BOUNDARY TREATMENT TO BE RETAINED AND MADE GOOD.

3M HIGH TIMBER ACOUSTIC FENCE

3M HIGH WELD MESH FENCE TO ALL WEATHER HOCKEY PITCH

1.8M HIGH SECURE TIMBER ENCLOSURE TO CYCLE AND REFUSE STORES.

HARD LANDSCAPE

TARMAC

PERMEABLE PAVING

RESIN BOUND GRAVEL

ROUGH GRANITE SETT

ALL WEATHER PITCH

SOFT LANDSCAPE

EXISTING TREE (CATEGORY A)

EXISTING TREE (CATEGORY B)

EXISTING TREE (CATEGORY C)

PROPOSED PARKLAND TREE (64NO. ADDED)

PROPOSED ORNAMENTAL TREE

EXISTING TREE (32NO. REMOVED)

FLOWERING LAWN

AMENITY GRASS

WILDFLOWER MEADOW

EXISTING ACID GRASSLAND TO BE ENHANCED

SWALE

PROJECT STATUS

0 1:1000 50m

REVISION	DATE	DESCRIPTION	ARCHITECT	PARTNER
S0 P1	00/00/00	DESCRIPTION	XX	XX

CHECK ALL DIMENSIONS AND VERIFY ON SITE. REPORT ANY ERRORS OR OMISSIONS

33a Vittoria Street
Birmingham
B1 3ND

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E birmingham@adp-architecture.com

www.adp-architecture.com

JOB TITLE:
KNELLER HALL
-
-

DRAWING TITLE:
LANDSCAPE MASTERPLAN
-
-

SCALE:	DRAWING SHEET SIZE:
1:1000	A1

JOB CODE:	DRAWING NUMBER:	REVISION:
000000	ADP-XX-XX-DR-L-1900	S0 P1

This line should measure 100mm along x and y axis when printed

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Appendix D

CCTV & Thames Water**'s** Assets

Asset location search

Property Searches

Cornerstone Projects LTD
91 Hoylake,

WIRRAL
CH47 5AA

Search address supplied Kneller Road, Twickenham
TW2 7DN

Your reference 42394

Our reference ALS/ALS Standard/2020_4170260

Search date 11 March 2020

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

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

0845 070 9148

Asset location search

Property Searches

Search address supplied: Kneller Road, Twickenham, TW2 7DN

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, 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.

The following quartiles have been printed as they fall within Thames' sewerage area:

TQ1474SE

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.

The following quartiles have been printed as they fall within Thames' water area:

TQ1474SE

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

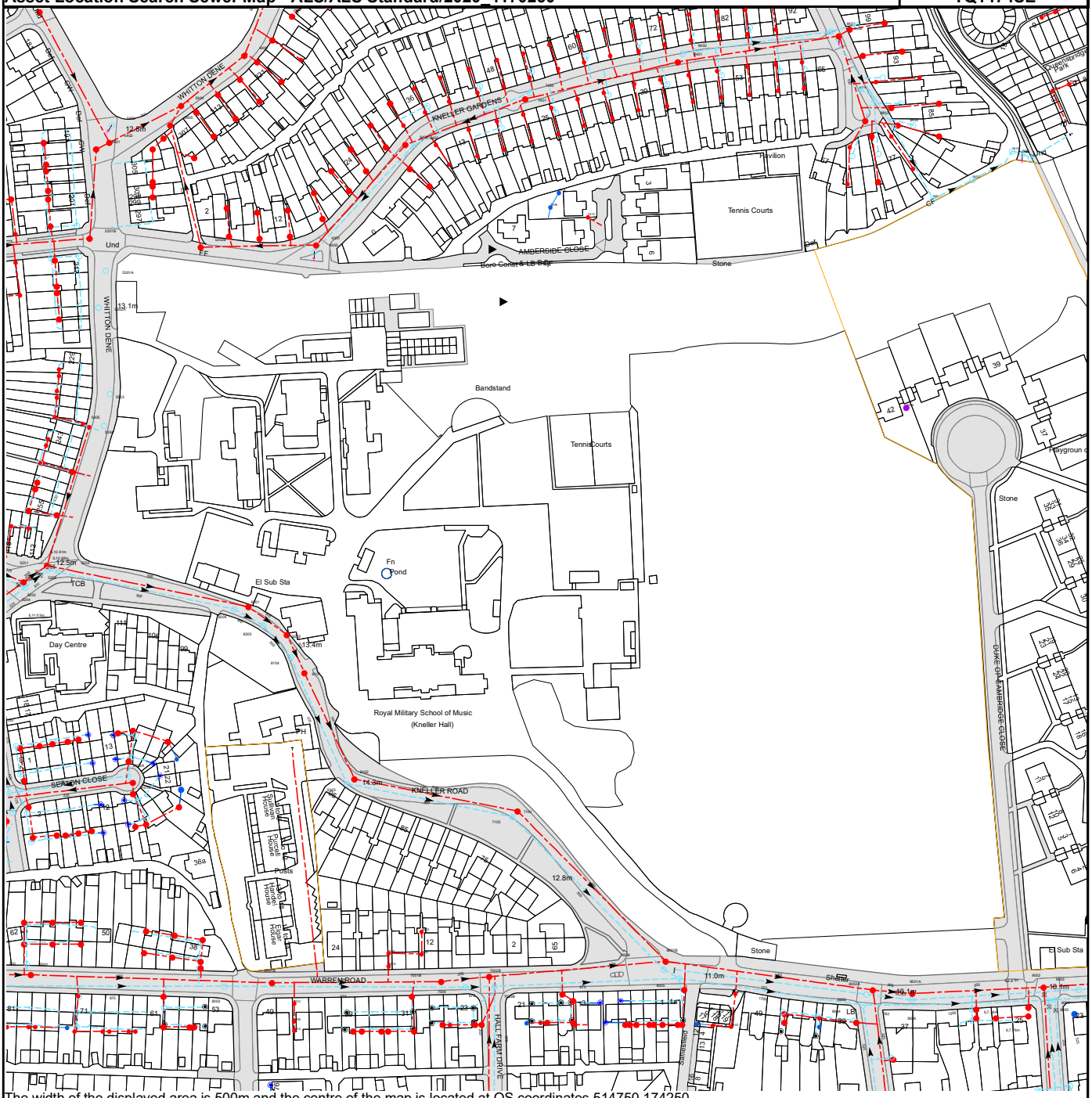
Clean Water queries

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/2020_4170260	TQ1474SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 514750,174250

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 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
90YS	n/a	n/a
90YR	n/a	n/a
90ZW	n/a	n/a
9002	9.93	8.85
9005	9.83	n/a
9004	9.83	7.18
90ZY	n/a	n/a
90ZR	n/a	n/a
9003	9.9	8.15
941C	n/a	n/a
941D	n/a	n/a
8451	12	n/a
84NO	n/a	n/a
84NS	n/a	n/a
74OQ	n/a	n/a
84LM	n/a	n/a
84LP	n/a	n/a
84LS	n/a	n/a
84ML	n/a	n/a
84NN	n/a	n/a
8402	11.91	9.75
84PR	n/a	n/a
84QO	n/a	n/a
84PP	n/a	n/a
94LM	n/a	n/a
94LL	n/a	n/a
94KT	n/a	n/a
74NT	n/a	n/a
84KO	n/a	n/a
84KQ	n/a	n/a
84KT	n/a	n/a
84MO	n/a	n/a
84MR	n/a	n/a
84NK	n/a	n/a
84OO	n/a	n/a
74OK	n/a	n/a
84KP	n/a	n/a
84OM	n/a	n/a
84KR	n/a	n/a
84OK	n/a	n/a
84LK	n/a	n/a
84QQ	n/a	n/a
84MP	n/a	n/a
84MS	n/a	n/a
84NL	n/a	n/a
8401	12.57	n/a
8450	12.68	n/a
74OR	n/a	n/a
84LN	n/a	n/a
74PQ	n/a	n/a
84LQ	n/a	n/a
84LT	n/a	n/a
84MM	n/a	n/a
84NQ	n/a	n/a
74LT	n/a	n/a
74KQ	n/a	n/a
74ML	n/a	n/a
74LK	n/a	n/a
7401	13.16	11.29
7450	13.18	n/a
74MM	n/a	n/a
74PM	n/a	n/a
74KT	n/a	n/a
74NK	n/a	n/a
741B	n/a	n/a
74MP	n/a	n/a
74QK	n/a	n/a
74NL	n/a	n/a
74MO	n/a	n/a
741A	n/a	n/a
74MS	n/a	n/a
74NN	n/a	n/a
74MR	n/a	n/a
74NO	n/a	n/a
74PO	n/a	n/a
741C	n/a	n/a
74ON	n/a	n/a
74NR	n/a	n/a
74PS	n/a	n/a
74OO	n/a	n/a
74NQ	n/a	n/a
931A	n/a	n/a
9451	10.92	10.09
84OQ	n/a	n/a
94KL	n/a	n/a
941G	n/a	n/a
94KM	n/a	n/a
941I	n/a	n/a
84QK	n/a	n/a
94LN	n/a	n/a
9452	n/a	n/a

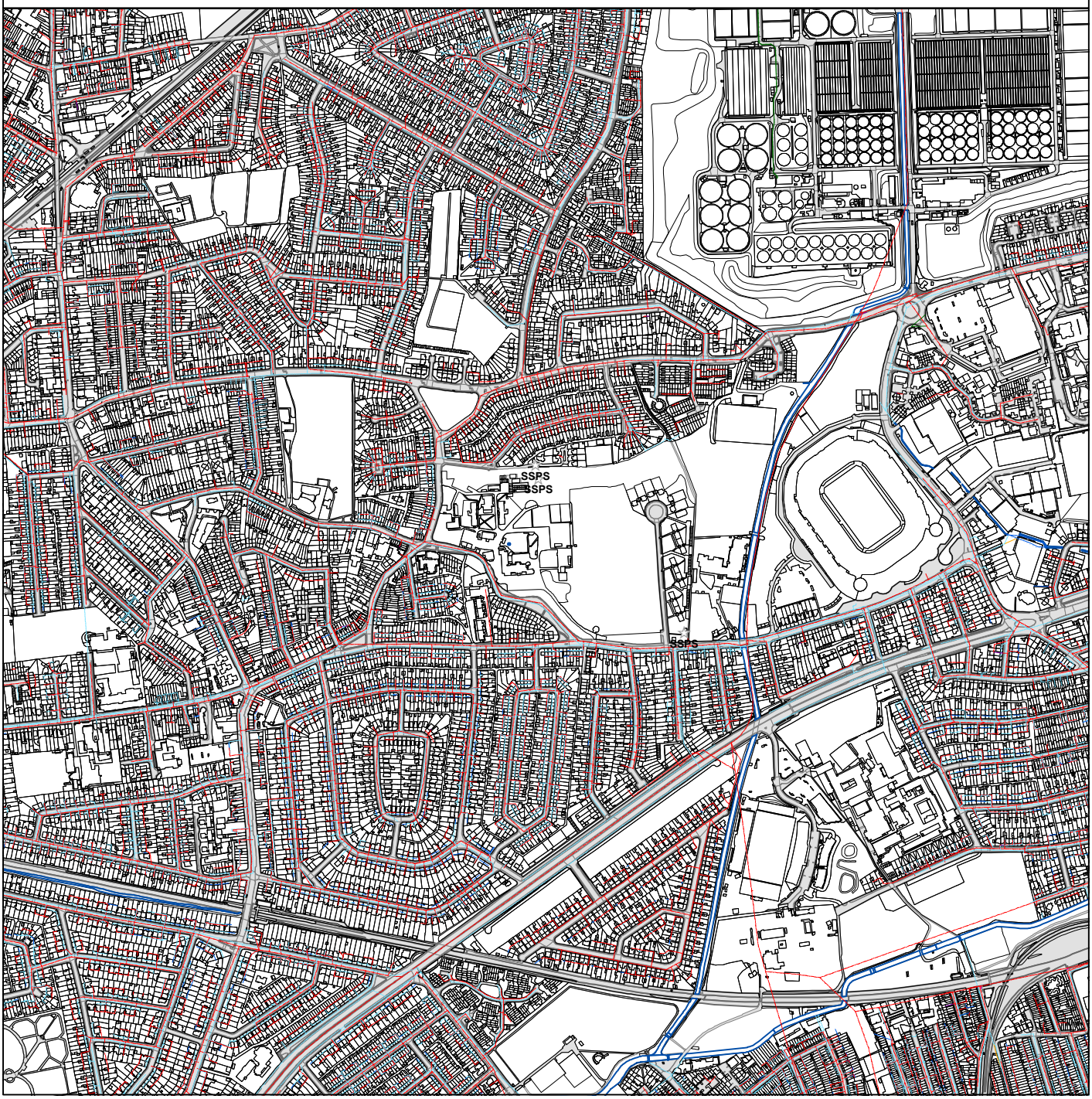
Manhole Reference	Manhole Cover Level	Manhole Invert Level
941F	n/a	n/a
84OR	n/a	n/a
94KN	n/a	n/a
84OT	n/a	n/a
94KP	n/a	n/a
9450	11.27	10.31
94KQ	n/a	n/a
94LO	n/a	n/a
8403	11.13	10.03
94KS	n/a	n/a
94LQ	n/a	n/a
94KR	n/a	n/a
941A	n/a	n/a
841A	n/a	n/a
941B	n/a	n/a
94LK	n/a	n/a
94LS	n/a	n/a
801D	n/a	n/a
801B	n/a	n/a
80ZQ	n/a	n/a
80ZR	n/a	n/a
70YW	n/a	n/a
70YZ	n/a	n/a
70YX	n/a	n/a
70YY	n/a	n/a
70ZP	n/a	n/a
80ZP	n/a	n/a
70XQ	n/a	n/a
801A	n/a	n/a
70WW	n/a	n/a
70XP	n/a	n/a
70WV	n/a	n/a
80YW	n/a	n/a
80YT	n/a	n/a
80XX	n/a	n/a
80YV	n/a	n/a
80XZ	n/a	n/a
70WZ	n/a	n/a
70WY	n/a	n/a
801C	n/a	n/a
80YZ	n/a	n/a
8005	11.32	7.84
8006	11.69	8.59
8001B	11.66	9.22
80YQ	n/a	n/a
80XW	n/a	n/a
80YS	n/a	n/a
8004	10.13	7.35
8003	10.23	8.53
8002A	10.23	8.8
90XX	n/a	n/a
90XV	n/a	n/a
9006	10.05	8.47
9001A	10.1	8.74
90YY	n/a	n/a
90YZ	n/a	n/a
90YP	n/a	n/a
90XZ	n/a	n/a
90YT	n/a	n/a
64KT	n/a	n/a
64LL	n/a	n/a
64LM	n/a	n/a
64LO	n/a	n/a
64LP	n/a	n/a
64LR	n/a	n/a
64LS	n/a	n/a
6402	12.94	n/a
64MO	n/a	n/a
64MK	n/a	n/a
6450	12.92	11.65
64ML	n/a	n/a
64MT	n/a	n/a
64MN	n/a	n/a
64MQ	n/a	n/a
74LM	n/a	n/a
74LN	n/a	n/a
74KM	n/a	n/a
74LP	n/a	n/a
74KO	n/a	n/a
74LQ	n/a	n/a
74KN	n/a	n/a
74OT	n/a	n/a
74KR	n/a	n/a
74LS	n/a	n/a
74QM	n/a	n/a
601B	n/a	n/a
601A	n/a	n/a
601C	n/a	n/a
6103	14.3	9.82
60YR	n/a	n/a
6102	14.24	10.1
60YQ	n/a	n/a
60YP	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
60XZ	n/a	n/a
601G	n/a	n/a
601F	n/a	n/a
60XX	n/a	n/a
60XY	n/a	n/a
601E	n/a	n/a
601D	n/a	n/a
7001B	14.29	9.72
70VW	n/a	n/a
70VV	n/a	n/a
7004	14.29	8.43
70VT	n/a	n/a
70VS	n/a	n/a
7002B	13.9	9.69
7003B	13.92	8.36
7102	13.7	9.54
7101	13.79	9.83
701A	n/a	n/a
5405	12.66	9.72
5450	12.92	n/a
64OK	n/a	n/a
54MK	n/a	n/a
5404	12.81	9.41
64NR	n/a	n/a
54MM	n/a	n/a
64NO	n/a	n/a
64NS	n/a	n/a
64NP	n/a	n/a
64NL	n/a	n/a
6401	13.41	9.21
64NM	n/a	n/a
64OL	n/a	n/a
64KL	n/a	n/a
53WT	n/a	n/a
5301A	n/a	n/a
53WS	n/a	n/a
53VQ	n/a	n/a
6350	12.26	n/a
5302B	12.21	9.92
6301	12.32	n/a
5301B	12.82	n/a
63KO	n/a	n/a
63KM	n/a	n/a
63KQ	n/a	n/a
53TR	n/a	n/a
64KR	n/a	n/a
64KO	n/a	n/a
64KP	n/a	n/a
64KN	n/a	n/a
54KQ	n/a	n/a
64KQ	n/a	n/a
54KR	n/a	n/a
54KS	n/a	n/a
64KS	n/a	n/a
54LR	n/a	n/a
54KT	n/a	n/a
5401	12.8	9.98
5402	12.89	9.29
54LK	n/a	n/a
54LT	n/a	n/a
51SR	n/a	n/a
51SQ	n/a	n/a
6101	13.82	10.24
6104	12.63	9.97
6202	13.63	10.3
6203	13.42	10.04
6204	n/a	n/a
6201	13.44	10.36
5203	n/a	n/a
52ZT	n/a	n/a
52ZY	n/a	n/a
52XT	n/a	n/a
52XZ	n/a	n/a
5305	12.76	11.17
53XW	n/a	n/a
5304	n/a	n/a
53YT	n/a	n/a
53XY	n/a	n/a
53YV	n/a	n/a
53YW	n/a	n/a
5303	n/a	n/a
53YX	n/a	n/a
53YY	n/a	n/a
53YZ	n/a	n/a
53WW	n/a	n/a
5302A	n/a	n/a
53WV	n/a	n/a
50WR	n/a	n/a
50WV	n/a	n/a
50WW	n/a	n/a
50WS	n/a	n/a
50WT	n/a	n/a
501A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
50YW	n/a	n/a
50YX	n/a	n/a
50XY	n/a	n/a
50YV	n/a	n/a
50XX	n/a	n/a
50ZT	n/a	n/a
50XW	n/a	n/a
50YT	n/a	n/a
50WQ	n/a	n/a
6002	15.94	9.08
6001B	15.62	10.11
50SR	n/a	n/a
50SP	n/a	n/a
50SS	n/a	n/a
50TR	n/a	n/a
50RY	n/a	n/a
50RZ	n/a	n/a
50QQ	n/a	n/a
50QR	n/a	n/a
50TS	n/a	n/a
50ST	n/a	n/a
50SV	n/a	n/a
50SW	n/a	n/a
50QY	n/a	n/a
50QX	n/a	n/a
51WX	n/a	n/a
51WW	n/a	n/a
51WY	n/a	n/a
51WZ	n/a	n/a
51PX	n/a	n/a
51QP	n/a	n/a
51QT	n/a	n/a
51QQ	n/a	n/a
51RS	n/a	n/a
51PZ	n/a	n/a
51QR	n/a	n/a
5101B	14.43	12.52
5103A	14.41	12.76
51RY	n/a	n/a
51RZ	n/a	n/a
51TR	n/a	n/a
51ZQ	n/a	n/a
51ZR	n/a	n/a
51SP	n/a	n/a
51ZS	n/a	n/a
51TS	n/a	n/a
5102B	14.12	11.99
5105A	13.87	11.99
5104B	14.08	12.23
50QV	n/a	n/a
50QW	n/a	n/a
51VX	n/a	n/a
50RS	n/a	n/a
50RR	n/a	n/a
50RT	n/a	n/a
51WT	n/a	n/a
5001	15.53	10.81
51VY	n/a	n/a
51WV	n/a	n/a
53ZX	n/a	n/a
53ZY	n/a	n/a
52ZW	n/a	n/a
52ZX	n/a	n/a
52XW	n/a	n/a
52YP	n/a	n/a
52YQ	n/a	n/a
53ZT	n/a	n/a
53VX	n/a	n/a
5403	12.82	n/a
51YY	n/a	n/a
51YQ	n/a	n/a
51YZ	n/a	n/a
51ZP	n/a	n/a
51YR	n/a	n/a
5204	12.67	10.61
5202	12.72	10.99
50VQ	n/a	n/a
50VS	n/a	n/a
50VR	n/a	n/a
53TQ	n/a	n/a
53TV	n/a	n/a
53TW	n/a	n/a
54YQ	n/a	n/a

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

ALS/ALS Standard/2020_4170260



0 45 90 180 270 360
Meters

Scale:	1:7158
Width:	2000m
Printed By:	G1KANAGA
Print Date:	12/03/2020
Map Centre:	514743,174224
Grid Reference:	TQ1474SE

Comments:

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

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

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

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.

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. 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 present on the plan, please contact a member of Property Insight on 0845 070 9148.