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Sustainable Drainage Strategy Report

Ducks Hill Road

Arens Management Ltd

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1. Introduction

1.1. Scope of Report

1.1.1. Engineeria have been commissioned by Arens Management Ltd to provide a Sustainable Drainage Strategy Report to discharge planning condition 12 of the approved application for Ducks Hill Road

1.1.2. The report is prepared to set out the design considerations made to prepare the proposed drainage strategy, shown in Appendix 3.

1.2. Preliminaries and Exclusions

1.2.1. This drainage strategy has been prepared in accordance with the NPPF, the associated PPG and Local Planning Policy. The proposed flood management (including ground floor level recommendations) and surface water management strategies are based on the relevant British Standards, the standing advice provided by the EA or based on common practice.

1.2.2. The insurance market applies its own tests to properties in terms of determining premiums and the insurability of properties for flood risk. Those undertaking development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurers (ABI) to seek further guidance prior to commencing development. Engineeria do not warrant that the advice in this report will guarantee the availability of flood insurance either now or in the future.

2. Site Description

2.1. Site Location

2.1.1. The site is located on Ducks Hill Road at the site of Arens Bar & Grill at the Six Bells.

2.1.2. The site is in the London Borough of Hillingdon.

2.2. Existing Site

2.2.1. The existing site is a pub with a substantial rear garden and car park.

2.3. Topography

2.3.1. The existing pub is set at a level of approximately 51.50 m AoD.

2.3.2. The surrounding site generally falls from north to south from approximately 53.0m at the northeast of the site, to 50.5m to the south-west.

2.4. Geology

2.4.1. A review of the 1:50,000 scale British Geological Survey (BGS) online digital viewer indicates the site is underlain by the 'Lambeth Group - Clay, Silt And Sand. Sedimentary Bedrock formed approximately 48 to 59 million years ago in the Palaeogene Period. Local environment previously dominated by swamps, estuaries and deltas' with no recorded superficial deposits.

2.4.2. The National Soil Resource Institute (NSRI) Soilscape viewer indicates the site is situated on Soilscape class 18 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils. This describes the drainage as "impeded".

2.5. Hydrology

2.5.1. The closest watercourse is Ruislip Lido 250m to the east.

2.5.2. The River Pinn is located 1.3 km to the south, whilst a tributary runs between the reservoir and the river which is located 230m to the south of the site.

2.6. Proposed Site

2.6.1. The works associated with the site comprise the extension of the existing pub into the rear garden. This will approximately replace the existing pergola which is in the garden.

2.6.2. The extension will contain dining area at ground floor and 6 new rooms for a guest house at ground floor.

2.6.3. New landscaping will be introduced around the site which will include an extension to the parking area, a new play area an paving around the new extension to facilitate access.

2.6.4. The proposed architectural layout is shown in **Appendix 1**.

3. Planning Context

3.1. Site Planning Conditions

3.1.1. The site has planning consent under application reference 14387/APP/2020/4128, dated 19.02.2020.

3.1.2. The consent includes condition 12 in relation to drainage, which is as follows:

Prior to the commencement of the superstructure (excluding demolition and site clearance), a scheme for the provision of sustainable water management shall be submitted to and approved in writing by the Local Planning Authority. The scheme shall clearly demonstrate that sustainable drainage systems (SUDS) have been incorporated into the designs of the development in accordance with the hierarchy set out in accordance with Policy 5.15 of the London Plan and will:

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

ii. include a timetable for its implementation; and

iii. provide a management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public authority or statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime. The scheme shall also demonstrate the use of methods to minimise the use of potable water through water collection, reuse and recycling and will:

iv. provide details of water collection facilities to capture excess rainwater;

v. provide details of how rain and grey water will be recycled and reused in the development.

3.2. Regional Planning Policy

3.2.1. The site is in Greater London and therefore design has been prepared in consideration of the London Plan (adopted 2021) which states:

Policy SI13 Sustainable Drainage

A. Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

B. Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

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

C. *Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways*

D. *Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.*

3.3. Local Planning Policy

3.3.1. Local policy contained within Hillingdon Local Plan Development Policies (adopted January 2020) sets out requirements for water management in policy DPEI 10 which is includes the following relevant provisions:

Policy DMEI 10: Water Management, Efficiency, and Quality

A) Applications for all new build developments (not conversions, change of use, or refurbishment) are required to include a drainage assessment demonstrating that appropriate sustainable drainage systems (SuDS) have been incorporated in accordance with the London Plan Hierarchy (Policy 5.13: Sustainable drainage).

C) Rain Gardens and non householder development should be designed to reduce surface water run-off rates to Greenfield run-off rates.

D) Schemes for the use of SuDS must be accompanied by adequate arrangements for the management and maintenance of the measures used, with appropriate contributions made to the Council where necessary

E) Proposals that would fail to make adequate provision for the control and reduction of surface water run-off rates will be refused.

F) Developments should be drained by a SuDs system and must include appropriate methods to avoid pollution of the water environment. Preference should be given to utilising the drainage options in the SuDS hierarchy which remove the key pollutants that hinder improving water quality in Hillingdon. Major

development should adopt a 'treatment train' approach where water flows through different SuDS to ensure resilience in the system.

G) All new development proposals (including refurbishments and conversions) will be required to include water efficiency measures, including the collection and reuse of rain water and grey water.

J) All new development proposals will be required to demonstrate that there is sufficient capacity in the water and wastewater infrastructure network to support the proposed development. Where there is a capacity constraint the local planning authority will require the developer to provide a detailed water and/or drainage strategy to inform what infrastructure is required, where, when and how it will be delivered.

4. Flood Risk

4.1.1. This section contains a brief review of Flood Risk, from review of the West London Flood Risk Assessment (WLFRA), in order to inform the drainage strategy.

4.2. Tidal and Fluvial Flooding

4.2.1. The Environment Agency's (EA) Flood Risk Map has identifies that the site is in Flood Zone 1.

4.2.2. The EA's definition of Flood Zone 1 is as follows:

Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)

4.2.3. This is the lowest level of risk assigned to any of the flood zones and as such there is considered to be a negligible risk of flooding from sea or river.

4.3. Pluvial Flooding

4.3.1. The WLFRA Flood Risk Map identifies the flooding risk from sources of Surface Water. This indicates that surface water flooding is modelled to occur to the west of the site during the 1 in 1000 year design rainfall event.

4.3.2. A screenshot from the WLFRA Flood Risk Map is shown below which indicates the extent of flooding for the 1 in 1000 year storm.

Figure 1 Screen-shot from the WLFRA's surface water flood map for the 1 in 1000 year event

4.3.3. During rainfall events more frequent than the 1 in 100 year storm, flooding is not modelled to occur on the site, though there appears to be flooding immediately to the west of the site boundary.

4.3.4. The site is considered to have a low risk of surface water flooding.

4.4. Groundwater Flooding

4.4.1. The WLFRA includes mapping containing data from the EA's "Areas Susceptible to Groundwater Flooding" (AStGWF).

4.4.2. AStGWF is a strategic scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km grid square where geological and hydrogeological conditions show that groundwater might emerge to interact with interlinked drainage systems (i.e. surface water). It does not show the likelihood of groundwater flooding occurring. The data should not be interpreted as identifying areas where groundwater is actually likely to flow or pond, thus causing flooding.

4.4.3. The mapping indicates that the susceptibility to Groundwater Flooding in the area is <25%.

4.4.4. The site is not positioned at a valley, and there are no major excavations proposed. As such long-term groundwater flooding risk is not expected to be increased from the pre-existing condition.

4.4.5. In consideration of the above evidence, the groundwater flooding risk is considered negligible.

5. Drainage Strategy

5.1. Overview

5.1.1. Rainwater will be collected from the sloped roof of the building extension and will discharge via piped drainage into the opengraded sub-base of plan area 228 m^2 beneath the car parking area in the garden.

5.1.2. Surface water will be attenuated below ground in the sub-base and will be positively drained by perforated pipework back into a private surface water drain.

5.1.3. The private surface water drain will discharge into both a rainwater recycling system, to be re-used as grey water within the site, and into opengraded sub-base beneath the car park which will attenuate surface water before discharging from the site via a flow control device.

5.1.4. The flow control device will be a hydrobrake that restricts the flow to 1l/s during the 1 in 100 year + 40% climate change allowance design storm.

5.1.5. The existing private surface water drain serving the existing building will be diverted to facilitate the delivery of the extension.

5.1.6. Foul water will be generated from the first floor of the extension by the guest rooms. This will discharge into a package pump and will be pumped into the existing on-plot private shallow foul water drain serving the site.

5.2. Existing Site Drainage Regime

Existing Catchments

5.2.1. An existing catchment plan has been prepared and is shown in **Appendix 3.** This plan identifies the extent of the proposed changes within the planning boundary.

5.2.2. This shows that the existing site is currently covered by the following surfaces:

- Impermeable Surfacing = 485 m^2
  - 210 m^2 car park and patio.
  - 275 m^2 roof area including the external pergola
- Permeable Surfacing = 360 m^2 (soft landscaping including the existing mulch playground)

5.2.3. Collectively this means that, of the site's 845 m^2 total area, 43 % is permeable.

Existing Drainage Connections

5.2.4. The following data sources, found in Appendix 2, have been assessed to establish the existing drainage arrangement for the site. The interpretation of this data is shown on the proposed drainage drawing in Appendix 3:

- Thames Water asset records
- Topographical survey
- CCTV Survey

5.2.5. The CCTV surveyor has confirmed that a private surface water drain runs across the site between catchpits beneath the existing car park and the appears to leave the site at the southern corner. This is understood to be the discharge position for the surface water drains serving the existing building.

5.2.6. The surface water drains serving the existing building have been identified in the CCTV survey report, and the alignment has been displayed in the report. This drain appears to start at the boundary to the highway, where the surveyor identified a 100mm surface water drain which is thought to connect into a gully or similar. This surface water drain then follows the northern façade of the existing building. It is then assumed that the surface water drainage connects into the aforementioned private surface water drain running across the site.

5.2.7. The existing surface water run-off rates have been calculated using the Modified Rational Method with the above impermeable areas, and the calculations are found in Appendix 3. These rates are as follows:

- 1 in 1 year: 2.38 l/s
- 1 in 30 year: 5.80 l/s
- 1 in 100 year: 7.59 l/s

5.2.8. The CCTV survey indicates that the site is served by a separate foul water drainage connection. This is shallow (<0.6m) and discharges to the east of the site.

5.2.9. There are foul and surface water Thames Water sewers located in Ducks Hill Road:

- The surface water network appears to be entirely independent of the on-site network.
- The foul water network may serve the site, though the connection is indirect.

5.3. Surface Water Drainage – Level of Service

Design Storm

5.3.1. The drainage system has been designed in accordance with the requirements for “Flood risk within the development” set out in “Sustainable Drainage Systems Non-statutory technical

standards for sustainable drainage systems", published by Department for the Environment and Rural Affairs, March 2015.

5.3.2. These requirements are as follows:

- 1 in 30 year rainfall event – no flooding of any of the site (unless designated to hold and convey water as part of the design)
- 1 in 100 year rainfall event (the peak design storm) – no flooding of any part of a building or utility plant susceptible to water within the development (unless designated to hold and convey water as part of the design)
- > 1 in 100 year rainfall event – where reasonably practicable, flows are managed in exceedance routes that minimise the risk to people and property.

Climate Change Allowance

5.3.3. The Environment Agency's guidance note on Flood Risk Assessments: climate change allowances, updated 22 July 2020 states that developers should make allowances for climate change when considering flood risk.

5.3.4. Table 2 of this guidance notes sets the changes to peak rainfall intensity for small (less than 5km^2) or urbanised drainage catchments for different time horizons, as follows.

Table 1 peak rainfall intensity allowance in small catchments (less than 5km2) or urban drainage catchments (based on a 1961 to 1990 baseline)

	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

5.3.5. The design life of the proposed development shall be 100 years. As such, the allowances for the '2080s' are appropriate.

5.3.6. To provide a resilient design, the peak design rainfall event therefore includes an allowance of 40% above the peak rate for climate change (CC).

5.4. Sustainable Drainage Hierarchy

Disposal Method

5.4.1. The Sustainable Drainage Hierarchy requires that surface water run-off is controlled and preferably re-used where possible. Where it cannot be re-used, Building Regulations Part H identifies that surface water should be disposed of in the following order of preference:

- via infiltration
- to a watercourse
- to sewers

Discharge via infiltration

5.4.2. The geotechnical information associated with the site indicates that the site is underlain by clay and is considered to have impeded drainage.

5.4.3. The site is located in EA Groundwater Protection Zone Zone I – Inner Protection Zone.

5.4.4. As a result infiltration is not proposed as the principal means of disposal and very low rates of hydraulic conductivity are anticipated.

5.4.5. However, permeable sub-bases will not be tanked so there will be potential for infiltration.

Discharge to Watercourse

5.4.6. As set out previously, there are no watercourses within close proximity of the development.

Discharge to Sewer

5.4.7. The proposed point of connection for drainage serving the site is proposed to be existing surface water drain running across the site.

Sustainable Drainage Hierarchy

5.4.8. The below table provides a summary of the sustainable drainage approach utilised to develop this drainage strategy.

Table 2 Sustainable Drainage Hierarchy

	Criteria	Included	Justification
1	Rainwater use as a resource (for example rainwater harvesting, blue roof for irrigation)	Y	A rainwater harvesting unit is proposed in the garden which will be used to pump grey water into the building.
2	Rainwater infiltration at ground or close to source	Y	Infiltration is not proposed to be a principal means of disposal given the low infiltration potential of the soil. However, open-graded sub-bases will not be tanked and therefore infiltration is likely to occur, especially during

			frequent storms when there is low antecedent wetness. In addition, abundant green space will be provided within the scheme. Narrow footways will drain over the side onto the landscape areas and will slowly infiltrate during frequent storms with low antecedent wetness. Gullies and channel drains will also be provided at the low point of the paved areas to prevent waterlogging.
3	Rainwater attenuation in green infrastructure features for gradual release (for example, green roofs, rain gardens)	Y	See above.
4	Rainwater discharge direct to a watercourse (unless not appropriate)	Y/N	The closest watercourse is >200m away and it is considered impractical and unsustainable to connect directly into. It is anticipated that the on-site surface water drainage network connects into a tributary for the River Pinn.
5	Controlled rainwater discharge to a surface water sewer or drain	Y	All surface water will discharge to the on-site private drainage network.
6	Controlled rainwater discharge to a combined sewer	N	-

5.5. Proposed Site Surface Water Discharge Rate

Proposed Site Catchments

5.5.1. A proposed catchment plan has been prepared and is shown in **Appendix 3.**

5.5.2. This identifies the following catchment on the site:

- Impermeable – 380 m^2
  - Roof catchment – 220 m^2
  - Impermeable pavements – 160 m^2
- Permeable – 465 m^2 (including permeable paving and play area formed of bark mulch)

Greenfield Run-off Rate

5.5.3. Greenfield Run-off rates have been calculated for the site using the methodology set out within Institute of Hydrology Report 124. It is based on the total site area to estimate the rate of

surface water run-off from the site prior to development. These calculations identify the following greenfield rates for the site:

- Qbar: 0.38 l/s
- 1 in 1 year: 0.32 l/s
- 1 in 30 year: 0.88 l/s
- 1 in 100 year: 1.22 l/s

5.5.4. A printout of the calculations is found in Appendix 3.

Downstream Sewer Capacity

5.5.5. The existing surface water drain serving the building is 100mm diameter. The grade is unknown because the down-stream chamber could not be surveyed as it had been built over. It is assumed that the pipe would have been laid at a minimum grade of 1:100. Using the Colebrook White Equation, a surface water capacity of 6.2 l/s is estimated.

5.5.6. The drain which crosses is anticipated to take additional flows and it is therefore anticipated that the size of the pipe as it leaves the property boundary exceeds 100 mm, with a considerably greater capacity.

5.5.7. All pipe grades and sizes will be validated and checked by an engineer prior to scheme delivery.

Proposed Discharge Rate

5.5.8. As set out London Plan policy SL13.B, developments should aim to achieve greenfield run-off rates.

5.5.9. Meeting a greenfield run-off rate would mean achieving a peak discharge rate of 0.3 l/s and 1.2 l/s in the 1 in 1 year and 1 in 100 year + CC storms respectively.

5.5.10. To achieve this discharge rate an outfall orifice of <50mm would be required which would cause significant risk of blockage and therefore blockage.

5.5.11. The Design and Construction Guidance (Sewerage Sector Guidance, Appendix C), Water UK, 2019, states that a minimum flow control size of 50mm should be used for protected static controls and 100mm for unprotected static controls.

5.5.12. A vortex flow control device has been proposed with a 50mm aperture, as shown on the proposed drainage drawing. This can achieve a discharge rate of 1l/s during the storm event.

5.5.13. The Lead Local Flood Authority have confirmed that this is acceptable in the initial planning response dated 07/01/2022.

5.6. Water Quantity

5.6.1. The proposed scheme will reduce the amount of impermeable area covering the site from 485m^2 to 380m^2. As a result, the quantity of water running off the site and entering the drainage system shall be reduced.

5.6.2. Using the Modified Rational Method, the reduction in volume of surface water entering the drainage system can be crudely estimated. This indicates the following volume reductions entering the drainage network for the following design storms.

- 1 in 1 year: -2.0 m^3
- 1 in 30 year: -4.4 m^3
- 1 in 100 year: -5.7 m^3

5.7. Water Quality

5.7.1. In accordance with Table 26.2 of the Ciria SuDS Manual (2015), the proposed development will have the pollution hazard indices as shown below.

Table 3 Summary of Pollution Indices for Mixed Use Development

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Individual Driveway	Low	0.5	0.4	0.4

5.7.2. Rainfall will land on these surfaces, and potentially carry pollution into the downstream drainage network. As such, all rainfall will go through a treatment train in order to mitigate the risk of pollution.

5.7.3. The systems proposed in this scheme to mitigation pollution risk are:

- Catchpits proposed at inlets to storage structures
- Trapped gullies to drain paving areas
- Permeable paving

5.7.4. The following SuDS measures are proposed to provide mitigation against these pollution indices.

Land Use	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Pervious pavement (where the pavement is	0.7	0.6	0.7

not designed as an infiltration component)			

5.7.5. All drainage features are designed in accordance with the SuDS manual (Ciria report 753), to ensure that they reach their total mitigation potential.

5.7.6. The open-graded sub-base will be designed as a System C Permeable Paving to BS 7533-13, though will utilise of a permeable separation membrane at the invert.

5.8. Hydraulic Modelling

5.8.1. The proposed controlled surface water discharge rate will be less than the incoming peak surface water run-off rate during events which exceed the 1 in 1 year return period. As a result surface water will build up behind the flow control device, and storage will be required.

5.8.2. This scenario has been modelled using Microdrainage Source Control, with the following design parameters:

- Flood Studies Report Rainfall data (R=0.4, M5-60 =20)
- Catchment intake – as set out in section 5.5
- Peak discharge rate – as set out in section 5.5
- No flooding during the 1 in 100 year + CC storm event

5.8.3. The modelling is found in **Appendix 3**. A summary of core results from the modelling for each of the design return periods is identified in the table below.

Table 4 Indicative Storage Volumes for other design storms

Return Period	Critical Storm Duration by Depth	Storage Volume (m^3)	Discharge Rate (l/s)	Water Depth in Control Manhole (m)
1 in 1 year	60 min Winter	3.1	0.9	0.3
1 in 30 year	120 min Winter	11.3	0.8	0.334
1 in 100 year + CC	180 min Winter	24.0	0.9	0.528

5.9. Exceedance Routes

5.9.1. During storm events which exceed the peak design storm, flooding will occur from manholes and gully points.

5.9.2. The topography of the site has been designed to fall away from the building, so in the case of exceedance events, run-off will fall to the west of the site, following the route of the surface water drain which is understood to discharge into a tributary of the River Pinn.

5.10. Proposed Foul Water Drainage Strategy

5.10.1. The foul water drainage from the first-floor guest rooms will drain via foul water downpipes and into a pumping sump.

5.10.2. The pump will then discharge into the existing foul water drainage network serving the site.

5.10.3. Foul water drainage calculations are found in Appendix 3. These indicate:

- The pump shall be fitted with an alarm and it is assumed that the pump would be repaired/ flows could be stopped within a period of 24 hours. As such a storage volume of 1.5 m^3 is required to store foul water generated from the development over a period of 24 hours.
- The foul flows entering the system, to 6 DWF, shall amount to less than 1 l/s. As such the discharge rate will be governed by the minimum feasible discharge rate for a foul water pump. This is anticipated to be around 1 l/s. Design work will be undertaken by a mechanical engineer to validate this figure.

5.11. Diversions

5.11.1. As part of the works, a surface water drain which currently crosses the proposed extension site will be diverted and existing drains will be deepened to facilitate the delivery of surface water attenuation on the site.

5.11.2. The phasing of the diversion will need to be considered by the contractor who will need to temporarily pump the upstream manhole to the downstream manhole whilst delivering the diversion.

5.11.3. The diverted pipe is private and therefore no consents are required.

6. Maintenance Requirements

6.1.1. All drainage infrastructure on the site will be private and shall be maintained by the Building's management team.

6.1.2. Maintenance requirements for the components of drainage system are found in Appendix 4. This includes the maintenance requirements for:

- Permeable Paving
- Conveyance pipes
- Chambers
- Gullies and channel drains.

6.1.3. In addition, product data is provided for the proposed water recycling system, though this may change to an equivalent system.

7. Timetable for Implementation

7.1.1. The below is a list of the key delivery milestones:

- **Project enabling works** – Stage 1
- **Building construction** - Stage 2
- **Landscape work** – Stage 3
- **Ground Floor Fit out** – Stage 4
- **First Floor Fit out** – Stage 5

7.1.2. Furthermore, the below identifies the sequence of drainage delivery relative to the above stages.

Stage 1

- Diversion of existing on-site drainage.

Stage 2

- Part 1:
    - Delivery of flow control manhole and downstream pipe-work. Temporary bung to be fitted preventing surface water entering future permeable paving location, and orifice to not yet be fitted.
- Part 2:
    - Connection of building drainage pipes to downstream networks.
    - Delivery of water recycling system

Stage 3

- Delivery of car parking area including open-graded sub-base and connecting into flow control manhole.
- Install orifice plate to flow control manhole.

Stage 5

- Installation of foul water pump prior to commencement of this stage.

8. Conclusion

8.1.1. The site has been reviewed from a flood risk perspective which has indicated that the site is of low risk from flooding by river and tidal, surface water and groundwater flooding.

8.1.2. The SuDS hierarchy has been considered in determining the proposed surface water drainage strategy and sustainable drainage features have been included to the design including permeable paving and rainwater harvesting.

8.1.3. A proposed drainage strategy has been produced which controls surface water run-off rate to a maximum rate of 4.2 l/s and discharges into existing private surface water drain.

8.1.4. Hydraulic modelling for the proposed scheme has been undertaken to prove that, during the design storm of 1 in 100 year + climate change allowance, the opengraded sub-base of the car park fills up to prevent any above ground flooding on site.

8.1.5. Water quality has been considered and surface water will run through the permeable sub-base before discharging from the site to improve water quality.

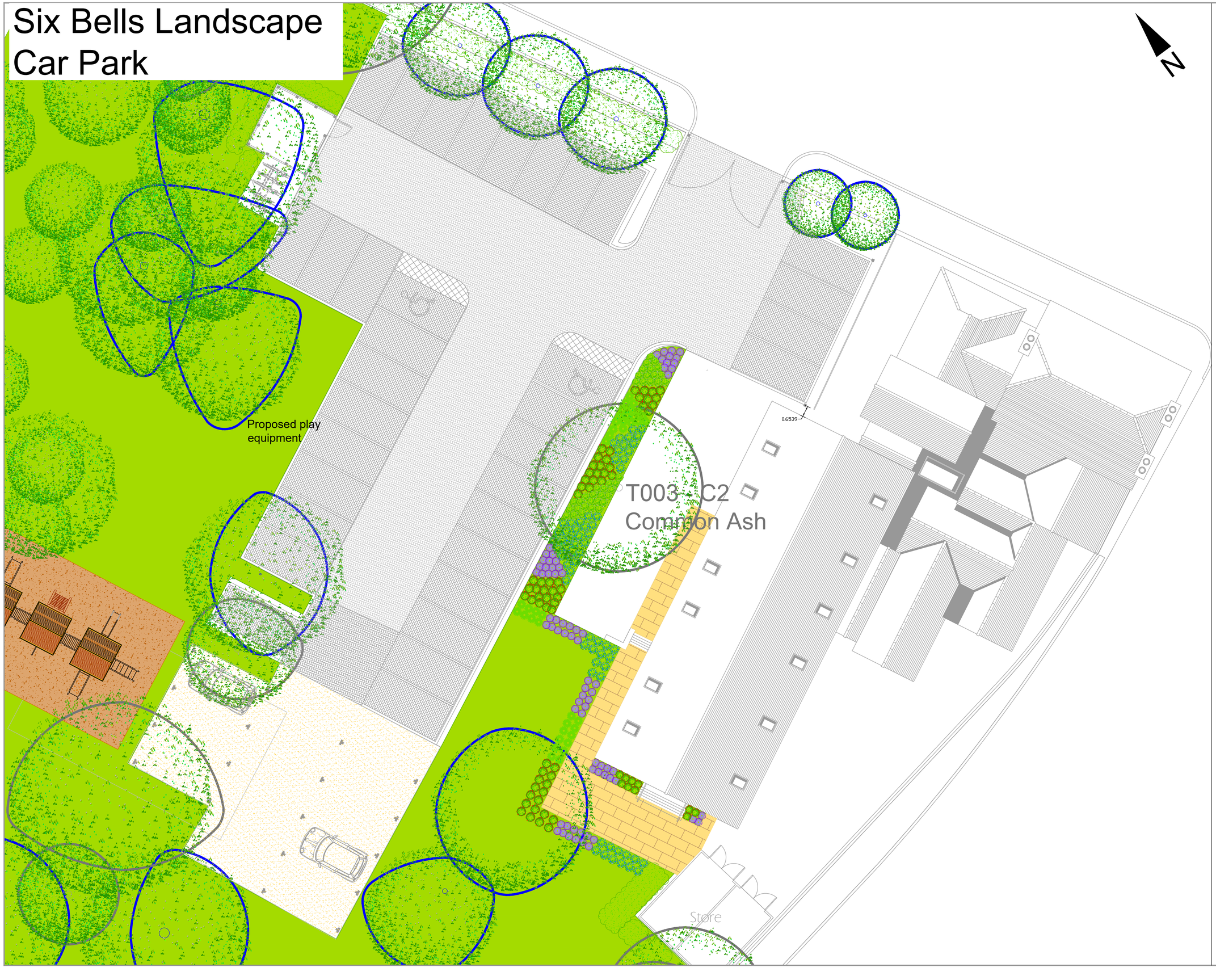
8.1.6. The maintenance requirements associated with various drainage components have been identified and included within this document.

8.1.7. Lastly, a timetable for implementation has also been provided.

8.1.8. It is therefore considered that this report is sufficient to discharge condition 12 of the planning approval.

Appendix 1 Architectural Proposals

Six Bells Landscape Car Park



KEY

50mm gravel on 100mm MOT Type 3

Make up levels 1:50 existing car park

Existing car park to remain unchanged

NOTES
New car park extension for staff parking.
No dig construction over existing ground levels.
Gravel surface on MOT Type 3

This drawing must be printed and used in colour

USHERWOOD ARBORICULTURE
Lawrence Usherwood
Tel. 01883 340398
Mobile 07753 211306
Email. lawrence@usherwoodarboriculture.co.uk

FOR PLANNING

Client: Vernon Smith Associates

Project: Six Bells, Ruislip

Drawing Title: Car Park Detail

On base by: MVS Associates

Dwg No: UA/DD1 | Scale: 1:100@A1

Drawn By: MP | Checked By: LU

Date:21/07/21

NOT FOR CONSTRUCTION

Six Bells Landscape Playground

Timber play equipment to be installed in new location shown

To be enclosed by timber post and rail fence.
Surfacing to be chipped play bark

Timber play equipment to be installed in new location shown

New location for play equipment

Existing location

Acer campestre hedging

N

NOTES
Existing play structures are all to be taken down and moved to new location shown on plan.
With exception of swing attachment which will not form part of the new installation.
Play equipment manufacturer is NI Climbing Frames
Playground to be enclosed with timber post and rail fence as shown in pictures.
Play surfacing to be bark chip.

This drawing must be printed and used in colour

USHERWOOD ARBORICULTURE
Lawrence Usherwood
Tel. 01883 340398
Mobile 07753 211306
Email. lawrence@usherwoodarboriculture.co.uk

Client: Vernon Smith Associates
Project: Six Bells, Ruislip
Drawing Title: Playground
On base by: MVS Associates
Dwg No: UA/LD2 | Scale: 1:50@A1
Drawn By: MP | Checked By: LU
Date:09/07/21

NOT FOR CONSTRUCTION

Six Bells Landscape Terrace Paving

Sandstone paving, buff colour

Existing buff colur block paving to be retained.

New Indian Sandstone paved footpath terrace in buff colour, random coursed pattern

Steps to terrace and barn entrance, matching sandstone treads

New Indian Sandstone paved terrace in buff colour, random coursed pattern

Store

N

NOTES
Existing paving to rear of pub will be retained, making good where necessary after construction of barn.

New paving to provide an outdoor terrace adjacent to barn will be Indian sandstone, buff colour, laid in random coursed pattern.

This drawing must be printed and used in colour

USHERWOOD ARBORICULTURE
Lawrence Usherwood
Tel. 01883 340398
Mobile 07753 211306
Email. lawrence@usherwoodarboriculture.co.uk

FOR PLANNING

Client: Vernon Smith Associates

Project: Six Bells, Ruislip

Drawing Title: Terrace Paving

On base by: MVS Associates

Dwg No: UA/DD3 | Scale: 1:100@A1

Drawn By: MP | Checked By: LU

Date:20/08/21

NOT FOR CONSTRUCTION

Appendix 2 Existing Drainage Records and Correspondence

Asset location search

Property Searches

Engineeria Limited
7Ridgmount Street
LONDON
WC1E 7AE

Search address supplied

The Six Bells
The Six Bells
Ducks Hill Road
Ruislip
HA4 7TS

Your reference DUCKS HILL ROAD

Our reference ALS/ALS Standard/2021_4505040

Search date 15 September 2021

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

0800 009 4540

Asset location search

Property Searches

Search address supplied: The Six Bells, The Six Bells, Ducks Hill Road, Ruislip, HA4 7TS

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

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

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

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

Asset location search

Thames Water Property Searches

Waste Water Services

Please provide a copy extract from the public sewer map.

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.

With regard to the fresh water supply, this site falls within the boundary of another water company. For more information, please redirect your enquiry to the following address:

Affinity Water Ltd
Tamblin Way
Hatfield

Asset location search

Thames Water Property Searches

AL10 9EZ
Tel: 0345 3572401

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

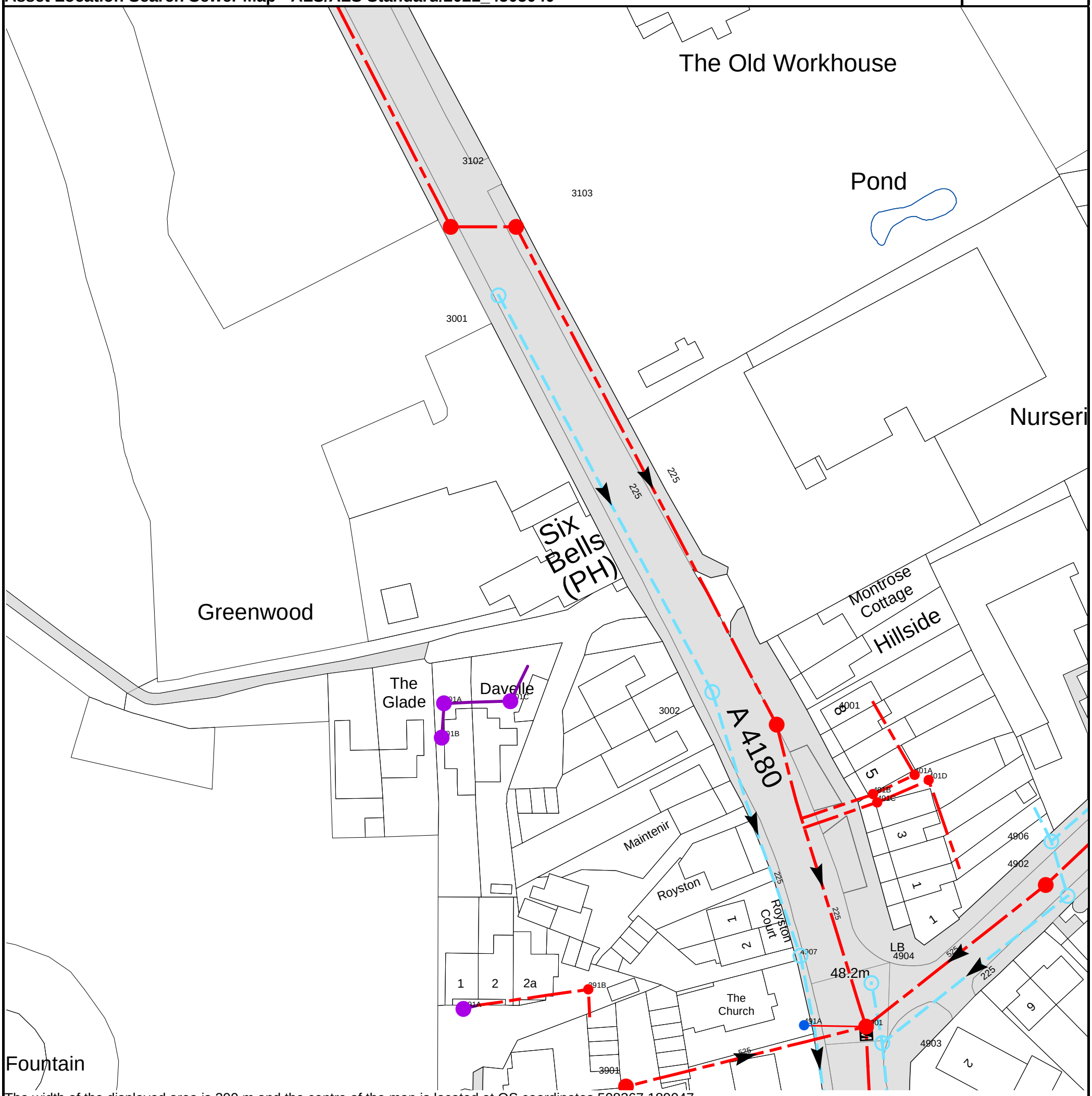
Clean Water queries

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/2021_4505040



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 508367,189047

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
391A	n/a	n/a
301C	n/a	n/a
391B	n/a	n/a
301B	n/a	n/a
301A	n/a	n/a
3002	n/a	n/a
3001	n/a	n/a
3103	n/a	n/a
3102	n/a	n/a
3901	n/a	n/a
4903	n/a	n/a
4901	47.83	45.13
491A	n/a	n/a
4904	n/a	n/a
4907	n/a	n/a
4905	48.58	47.61
4902	48.55	44.82
4906	48.14	47.21
401C	n/a	n/a
401B	n/a	n/a
401D	n/a	n/a
401A	n/a	n/a
4001	n/a	n/a

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.

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 Searches on 0800 009 4540.

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 14 days from due 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. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. 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'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. 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 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

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 0121 345 1000 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**	**Cheque**
Call **0800 009 4540** quoting your invoice number starting CBA or ADS / OSS	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	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

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

Happy Drains Ltd
Unit 12B Chalex Industrial Estate, Manor Hall Road, Southwick, BN42 4NH
Tel: 0800 849 8099 Email: service@happydrains.co.uk

Ref: C1002030

Date 2021-09-27

Arens Management Company
The Homestead
Fine Bush Lane
Harefield
UB9 6LY

Site Address: The Homestead , Fine Bush Lane , Harefield , UB9 6LY

1. DESCRIPTION OF PROPERTY

Commercial

2. DRAINAGE SYSTEM

The pipework surveyed is a Foul and Surface drainage system, access via Inspection chamber. The pipework is circular, in Dia 100mm in diameter and is of VC pipe material. Further specific variations will be in the report content as found.

3. SHARED

We have surveyed the Private drainpipes

The foul drains are connected to the main sewerage system.

4. CIRCUMSTANCES

Task type: Jetting

5. SUMMARY

No defects noted, and the system is in a sound structural condition

5. Observations

Happy Drains Ltd
Unit 12B Chalex Industrial Estate, Manor Hall Road, Southwick, BN42 4NH
Tel: 0800 849 8099 Email: service@happydrains.co.uk

No defects within the drains surveyed there is a buried manhole underneath some sheds this is not where the building works is happening also unable to lift foul manhole in walkthrough area again this is not where the building works are

If you require more information or wish to discuss this matter, please contact us

Yours sincerely

Happy Drains Ltd

Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
Tel. 0800 849 8099
service@happydrains.co.uk

Project

Project Name:	Arens Managment Co
Project Description:	CCTV
Project Number:	C1002030
Project Status:	Complete
Project Date:	27/09/2021
Inspection Standard:	MSCC5 Domestic GB (DRB Scoring)

Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
Tel. 0800 849 8099
service@happydrains.co.uk

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Arens Managment Co	C1002030	27/09/2021

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Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
Tel. 0800 849 8099
service@happydrains.co.uk

Project Information

Project Name	Project Number	Project Date
Arens Managment Co	C1002030	27/09/2021

Client

Contact: Arens Managment Co
Street: The Homstead Finebush Lane
Town or City: London
County: London
Post Code: UB9 6LY

Contractor

Company: Happy Drains Ltd
Contact: David Miele
Street: Unit 12B Chalex Industrial Estate Manor Hall Road
Town or City: Southwick
County: West Sussex
Post Code: BN42 4NH
Phone: 0800 849 8099
Mobile: 07842 757572
Email: service@happydrains.co.uk

Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
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Project Information

Project Name	Project Number	Project Date
Arens Managment Co	C1002030	27/09/2021

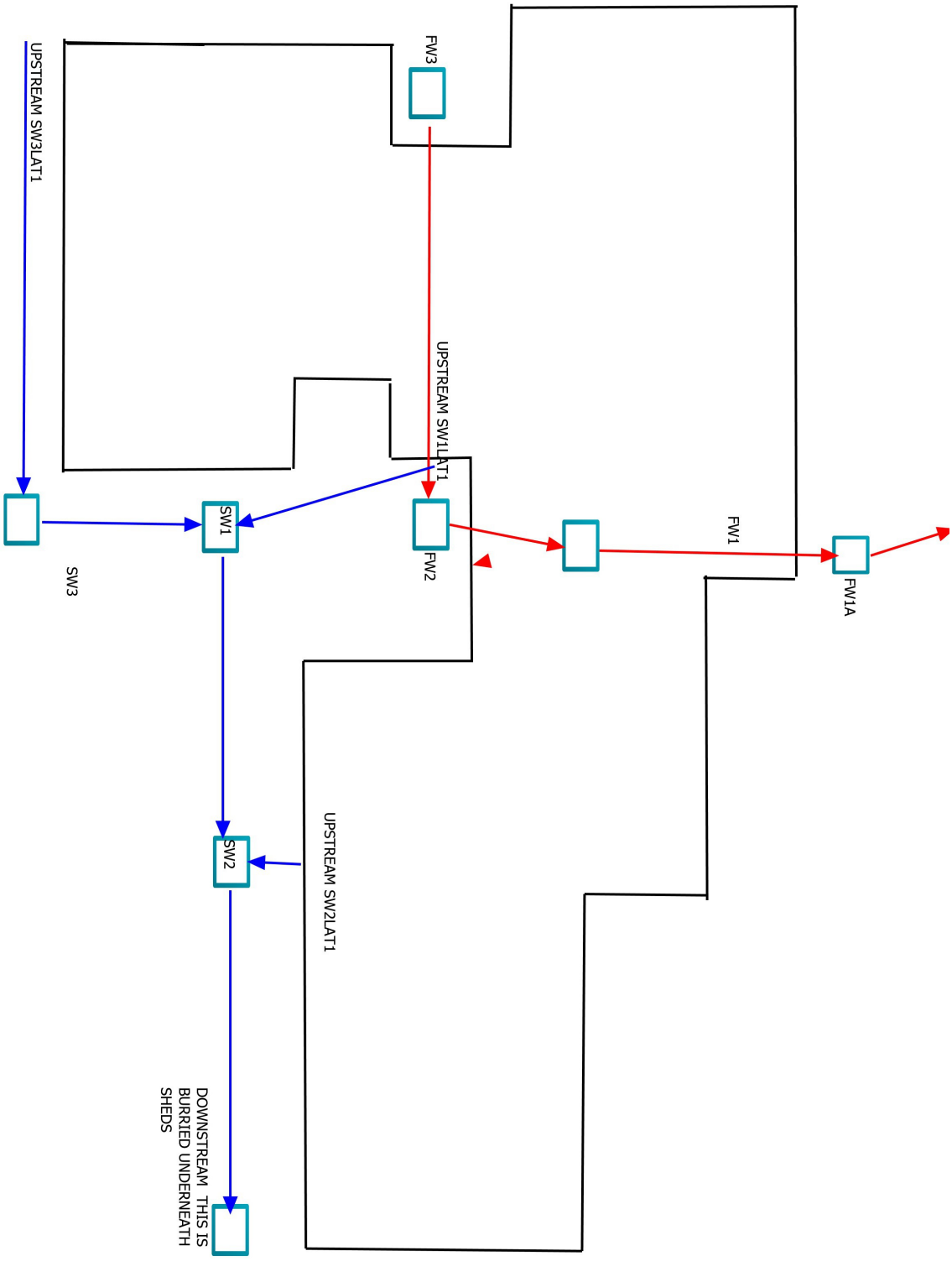
Drawing Legend

Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
Tel. 0800 849 8099
service@happydrains.co.uk

Project Information

Project Name	Project Number	Project Date
Arens Managment Co	C1002030	27/09/2021

Project Drawing, Page 'Arens Managment Co'



Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
Tel. 0800 849 8099
service@happydrains.co.uk

Section Profile

Project Name	Project Number	Project Date
Arens Managment Co	C1002030	27/09/2021

Circular, 100 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Pipe Material	Total Length	Inspected Length
2	FW3	FW2	20/09/2021	Fine Bush Lane	Vitrified clay	5.03 m	5.03 m
3	UPSTREAM	SW1LAT1	20/09/2021	Fine Bush Lane	Vitrified clay	3.29 m	3.29 m
4	SW3	SW1	20/09/2021	Fine Bush Lane	Vitrified clay	5.15 m	5.15 m
5	UPSTREAM	SW3LAT1	20/09/2021	Fine Bush Lane	Vitrified clay	7.83 m	7.83 m
6	SW1	SW2	20/09/2021	Fine Bush Lane	Vitrified clay	6.28 m	6.28 m
7	UPSTREAM	SW2LAT1	20/09/2021	Fine Bush Lane	Vitrified clay	1.37 m	1.37 m
8	SW2	DOWNSTREAM	20/09/2021	Fine Bush Lane	Vitrified clay	8.99 m	8.99 m
9	FW1	FW1A	05/10/2021	Fine Bush Lane	Vitrified clay	6.16 m	6.16 m
10	FW1A	DOWNSTREAM	05/10/2021	Fine Bush Lane	Vitrified clay	28.38 m	28.38 m

Total: 9 Inspections x Circular 100 mm = 72.48 m Total Length and 72.48 m Inspected Length

Circular, 100 mm, 100 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Pipe Material	Total Length	Inspected Length
1	FW2	FW1	20/09/2021	Fine Bush Lane	Vitrified clay	3.00 m	3.00 m

Total: 1 Inspection x Circular 100 mm, 100 mm = 3.00 m Total Length and 3.00 m Inspected Length

Total: 10 Inspections = 75.48 m Total Length and 75.48 m Inspected Length

Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
Tel. 0800 849 8099
service@happydrains.co.uk

Section Inspection - 20/09/2021 - FW2X

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
1	1	20. September 2021	CCTV	C1002030		FW2X

Operator	Vehicle	Camera	Temperature	Pre Cleaned	Weather
Andy	HY66 VGR	Solopro		Yes	No rain or snow

Town or Village:	London	**Inspection Direction:**	Downstream	**US MH:**	FW2
Road:	Fine Bush Lane	**Use:**	Foul	**US Depth:**	0.45 m
Location:	Property or buildings	**Total Length:**	3.00 m	**DS MH:**	FW1
Post Code:	UB9 6LY			**DS Depth:**	0.50 m

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 100mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:

Scale: 1:50	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: 0.45						
FW2						
	0.00	MH	Start manhole, FW2			
	0.00	WL	Water level, 0% of the height	00:00:00	FW2X_02 4f8048-cb 5d-4dfb-9c	A
	3.00	MHF	Finish manhole, FW1, the pipe is flowing fine	00:00:09	FW2X_efd 1b21f-f2fb- 4074-af9c-	
FW1						
Depth: 0.50						

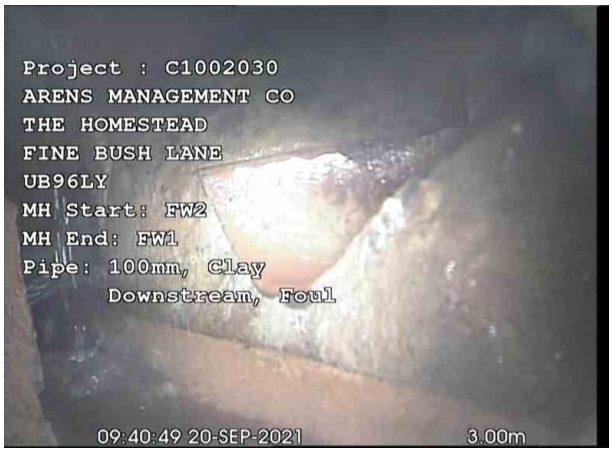
Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
Tel. 0800 849 8099
service@happydrains.co.uk

Section Pictures - 20/09/2021 - FW2X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Downstream	FW2X	CCTV	C1002030

FW2X_024f8048-cb5d-4dfb-9c9b-2587a28d5cf2_20210927_082854_182.jpg, 00:00:00, 0.00 m
Water level, 0% of the height



FW2X_efd1b21f-f2fb-4074-af9c-1dab4be8da9c_20210927_082913_698.jpg, 00:00:09, 3.00 m
Finish manhole, FW1, the pipe is flowing fine

Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
Tel. 0800 849 8099
service@happydrains.co.uk

Section Inspection - 20/09/2021 - FW3X

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
2	1	20. September 2021	CCTV	C1002030		FW3X

Operator	Vehicle	Camera	Temperature	Pre Cleaned	Weather
Andy	HY66 VGR	Solopro		Yes	No rain or snow

Town or Village:	London	**Inspection Direction:**	Upstream	**US MH:**	FW3
Road:	Fine Bush Lane	**Use:**	Foul	**US Depth:**	0.40 m
Location:	Property or buildings	**Total Length:**	5.03 m	**DS MH:**	FW2
Post Code:	UB9 6LY			**DS Depth:**	0.45 m

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 0mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:

Scale: 1:50

Depth: 0.45
FW2

FW3

Depth: 0.40

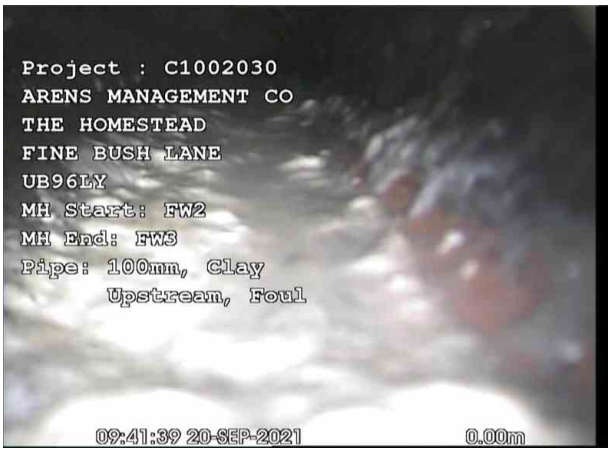
Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start manhole, FW2			
0.00	WL	Water level, 0% of the height	00:00:00	FW3X_2d2d019c-938f-4a20-88	A
5.03	MHF	Finish manhole, FW3, the pipe is flowing fine	00:00:18	FW3X_81cebaaa-2ead-4f30-8e	

Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

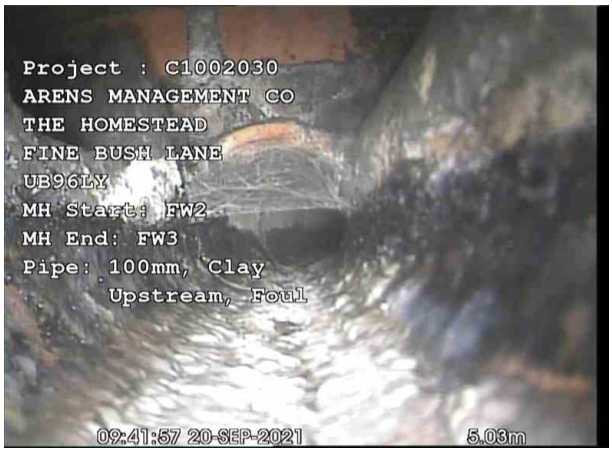
Happy Drains Ltd
Unit 12B Chalex Industrial Estate Manor Hall Road, Southwick
Tel. 0800 849 8099
service@happydrains.co.uk

Section Pictures - 20/09/2021 - FW3X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
2	Upstream	FW3X	CCTV	C1002030



FW3X_2d2d019c-938f-4a20-883e-9e8981242adb_20210927_083022_549.jpg, 00:00:00, 0.00 m
Water level, 0% of the height



FW3X_81cebaaa-2ead-4f30-8e9a-0c4d51c9ed1c_20210927_083037_889.jpg, 00:00:18, 5.03 m
Finish manhole, FW3, the pipe is flowing fine

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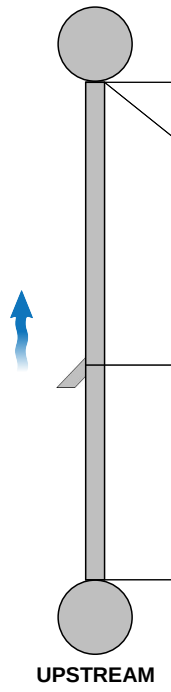
Section Inspection - 20/09/2021 - UPSTREAMX

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
3	1	20. September 2021	CCTV	C1002030		UPSTREAMX
Operator		**Vehicle**	**Camera**	**Temperature**	**Pre Cleaned**	**Weather**
Andy		HY66 VGR	Solopro		Yes	No rain or snow

Town or Village:	London	**Inspection Direction:**	Upstream	**US MH:**	UPSTREAM
Road:	Fine Bush Lane	**Use:**	Surface water	**US Depth:**	
Location:	Property or buildings	**Total Length:**	3.29 m	**DS MH:**	SW1LAT1
Post Code:	UB9 6LY			**DS Depth:**	0.40 m

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 0mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:



Scale: 1:50	Position [m]	Code	Observation	MPEG	Photo	Grade
	0.00	MH	Start manhole, SW1LAT1			
	0.00	WL	Water level, 0% of the height	00:00:00	UPSTREAMX_051b3a1c-aa24-	A
	1.87	JN	Junction at 3 o'clock, diameter: 100mm	00:00:06	UPSTREAMX_47231b34-8d51-	A
	3.29	BRF	Finish connection without manhole, UPSTREAM, the pipe is flowing fine	00:00:11	UPSTREAMX_ba519dc2-24c4-	

Depth:

Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

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Section Pictures - 20/09/2021 - UPSTREAMX

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
3	Upstream	UPSTREAMX	CCTV	C1002030

UPSTREAMX_051b3a1c-aa24-4790-99e6-04464e5eb72a_20210927_083447_343.jpg, 00:00:00, 0.00 m
Water level, 0% of the height

UPSTREAMX_47231b34-8d51-4185-992f-fbf23499fc12_20210927_083514_725.jpg, 00:00:06, 1.87 m
Junction at 3 o'clock, diameter: 100mm

UPSTREAMX_ba519dc2-24c4-4d92-8d66-d73c244be859_20210927_083535_929.jpg, 00:00:11, 3.29 m
Finish connection without manhole, UPSTREAM, the pipe is flowing fine

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Section Inspection - 20/09/2021 - SW3X

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
4	1	20. September 2021	CCTV	C1002030		SW3X

Operator	Vehicle	Camera	Temperature	Pre Cleaned	Weather
Andy	HY66 VGR	Solopro		Yes	No rain or snow

Town or Village:	London	**Inspection Direction:**	Upstream	**US MH:**	SW3
Road:	Fine Bush Lane	**Use:**	Surface water	**US Depth:**	0.35 m
Location:	Property or buildings	**Total Length:**	5.15 m	**DS MH:**	SW1
Post Code:	UB9 6LY			**DS Depth:**	0.45 m

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 0mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:

Scale: 1:50

Depth: 0.45
SW1

SW3

Depth: 0.35

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start manhole, SW1			
0.00	WL	Water level, 0% of the height	00:00:00	SW3X_4500b579-fc8e-47d2-b	A
5.15	MHF	Finish manhole, SW3, the pipe is flowing fine	00:00:19	SW3X_82612b79-91ec-4c77-8	

Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

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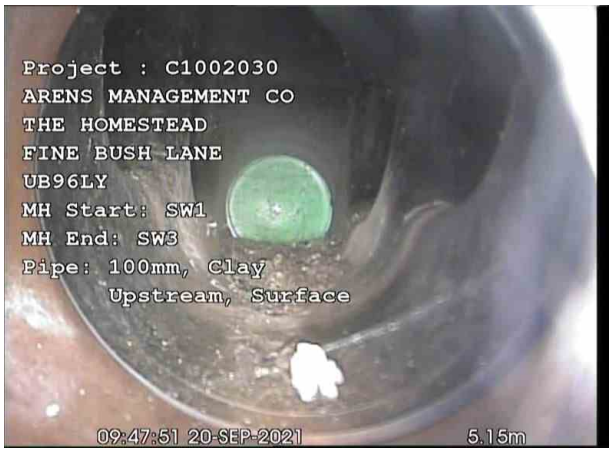
Section Pictures - 20/09/2021 - SW3X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
4	Upstream	SW3X	CCTV	C1002030

SW3X_4500b579-fc8e-47d2-b538-58dab6338272_20210927_083807_938.jpg, 00:00:00, 0.00 m
Water level, 0% of the height



SW3X_82612b79-91ec-4c77-8a3f-d2a1480fed2c_20210927_083917_214.jpg, 00:00:19, 5.15 m
Finish manhole, SW3, the pipe is flowing fine

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Section Inspection - 20/09/2021 - UPSTREAMX

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
5	1	20. September 2021	CCTV	C1002030		UPSTREAMX

Operator	Vehicle	Camera	Temperature	Pre Cleaned	Weather
Andy	HY66 VGR	Solopro		Yes	No rain or snow

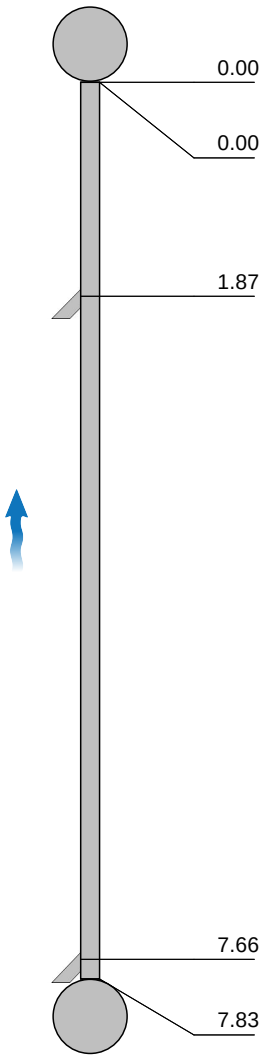
Town or Village:	London	**Inspection Direction:**	Upstream	**US MH:**	UPSTREAM
Road:	Fine Bush Lane	**Use:**	Surface water	**US Depth:**	
Location:	Property or buildings	**Total Length:**	7.83 m	**DS MH:**	SW3LAT1
Post Code:	UB9 6LY			**DS Depth:**	0.35 m

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 0mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:

Scale: 1:66

Depth: 0.35
SW3LAT1



UPSTREAM
Depth:

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start manhole, SW3LAT1			
0.00	WL	Water level, 0% of the height	00:00:00	UPSTREAMX_b736af34-ddac-4	A
1.87	JN	Junction at 3 o'clock, diameter: 100mm	00:00:04	UPSTREAMX_006d9dc1-aed4-	A
7.66	JN	Junction at 3 o'clock, diameter: 100mm	00:00:13	UPSTREAMX_b41d7a84-b3d3-	A
7.83	BRF	Finish connection without manhole, UPSTREAM, the pipe is flowing fine	00:00:16	UPSTREAMX_54f6bd31-f753-4	

Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

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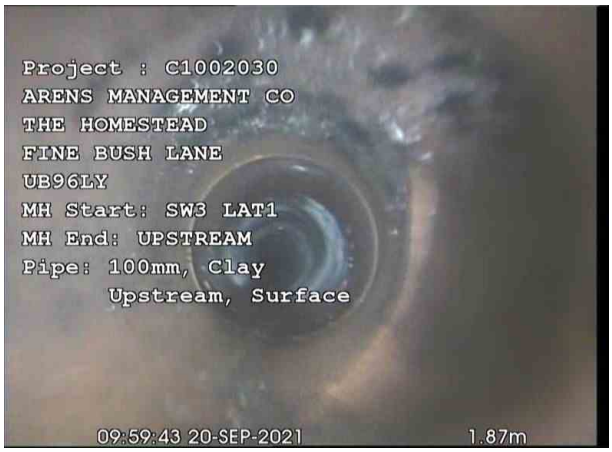
Section Pictures - 20/09/2021 - UPSTREAMX

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
5	Upstream	UPSTREAMX	CCTV	C1002030

UPSTREAMX_b736af34-ddac-449c-81e0-4e0b4effd826_20210927_084933_287.jpg, 00:00:00, 0.00 m
Water level, 0% of the height



UPSTREAMX_006d9dc1-aed4-4e4f-b141-69f3e407ae86_20210927_084947_673.jpg, 00:00:04, 1.87 m
Junction at 3 o'clock, diameter: 100mm

UPSTREAMX_b41d7a84-b3d3-48d2-8f29-3671441025e3_20210927_085013_339.jpg, 00:00:13, 7.66 m
Junction at 3 o'clock, diameter: 100mm

UPSTREAMX_54f6bd31-f753-4e34-9378-9c2c8bece954_20210927_085033_624.jpg, 00:00:16, 7.83 m
Finish connection without manhole, UPSTREAM, the pipe is flowing fine

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Section Inspection - 20/09/2021 - SW1X

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
6	1	20. September 2021	CCTV	C1002030		SW1X

Operator	Vehicle	Camera	Temperature	Pre Cleaned	Weather
Andy	HY66 VGR	Solopro		Yes	No rain or snow

Town or Village:	London	**Inspection Direction:**	Downstream	**US MH:**	SW1
Road:	Fine Bush Lane	**Use:**	Surface water	**US Depth:**	0.45 m
Location:	Property or buildings	**Total Length:**	6.28 m	**DS MH:**	SW2
Post Code:	UB9 6LY			**DS Depth:**	0.60 m

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 0mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:

Scale: 1:53

Depth: 0.45
SW1

SW2
Depth: 0.60

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start manhole, SW1			
0.00	WL	Water level, 0% of the height	00:00:00	SW1X_c95ab936-36db-444a-9	A
0.93	JN	Junction at 9 o'clock, diameter: 100mm	00:00:03	SW1X_a436c66e-90db-4588-b	A
6.28	MHF	Finish manhole, SW2, the pipe is flowing fine	00:00:12	SW1X_3f3c65e9-6ecb-4c1a-b2	

Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

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Section Pictures - 20/09/2021 - SW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
6	Downstream	SW1X	CCTV	C1002030

SW1X_c95ab936-36db-444a-9392-0683d654bc91_20210927_085126_357.jpg, 00:00:00, 0.00 m
Water level, 0% of the height

SW1X_a436c66e-90db-4588-be63-e4759c3dcd45_20210927_085154_178.jpg, 00:00:03, 0.93 m
Junction at 9 o'clock, diameter: 100mm

SW1X_3f3c65e9-6ecb-4c1a-b295-d14f6f591466_20210927_085215_336.jpg, 00:00:12, 6.28 m
Finish manhole, SW2, the pipe is flowing fine

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Section Inspection - 20/09/2021 - UPSTREAMX

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
7	1	20. September 2021	CCTV	C1002030		UPSTREAMX

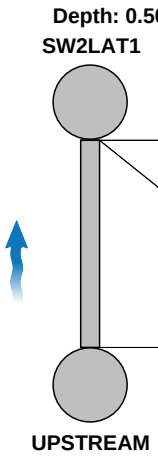
Operator	Vehicle	Camera	Temperature	Pre Cleaned	Weather
Andy	HY66 VGR	Solopro		Yes	No rain or snow

Town or Village:	London	**Inspection Direction:**	Upstream	**US MH:**	UPSTREAM
Road:	Fine Bush Lane	**Use:**	Surface water	**US Depth:**	
Location:	Property or buildings	**Total Length:**	1.37 m	**DS MH:**	SW2LAT1
Post Code:	UB9 6LY			**DS Depth:**	0.50 m

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 0mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:

Scale: 1:50



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start manhole, SW2LAT1			
0.00	WL	Water level, 0% of the height	00:00:00	UPSTREAMX_42ef75c2-72f3-4	A
1.37	BRF	Finish connection without manhole, UPSTREAM, the pipe is flowing fine	00:00:09	UPSTREAMX_ca45a53c-90f5-4	

Depth:

Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

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Section Pictures - 20/09/2021 - UPSTREAMX

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
7	Upstream	UPSTREAMX	CCTV	C1002030

UPSTREAMX_42ef75c2-72f3-4ec1-9816-5d6ea07d888b_20210927_085305_974.jpg, 00:00:00, 0.00 m
Water level, 0% of the height

UPSTREAMX_ca45a53c-90f5-460b-8fe8-f028685f26c1_20210927_085334_124.jpg, 00:00:09, 1.37 m
Finish connection without manhole, UPSTREAM, the pipe is flowing fine

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Section Inspection - 20/09/2021 - SW2X

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
8	1	20. September 2021	CCTV	C1002030		SW2X

Operator	Vehicle	Camera	Temperature	Pre Cleaned	Weather
Andy	HY66 VGR	Solopro		Yes	No rain or snow

Town or Village:	London	**Inspection Direction:**	Downstream	**US MH:**	SW2
Road:	Fine Bush Lane	**Use:**	Surface water	**US Depth:**	0.50 m
Location:	Property or buildings	**Total Length:**	8.99 m	**DS MH:**	DOWNSTREAM
Post Code:	UB9 6LY			**DS Depth:**	

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 0mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:

Scale: 1:75

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start manhole, SW2			
0.00	WL	Water level, 0% of the height	00:00:00	SW2X_5a384ff6-d1a1-413e-a5	A
8.99	MHF	Finish manhole, DOWNSTREAM, the pipe is flowing fine: THIS MANHOLE IS BURRIED UNDERNEATH THE SHEDS WHICH ARE THERE	00:00:19	SW2X_ec4d5b4b-9db5-47a4-9	

Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

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Section Pictures - 20/09/2021 - SW2X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
8	Downstream	SW2X	CCTV	C1002030

SW2X_5a384ff6-d1a1-413e-a55d-10b5e11f1ad2_20210927_085445_696.jpg, 00:00:00, 0.00 m
Water level, 0% of the height

SW2X_ec4d5b4b-9db5-47a4-9aa4-c56e4e7147cc_20210927_085538_752.jpg, 00:00:19, 8.99 m
Finish manhole, DOWNSTREAM, the pipe is flowing fine, THIS MANHOLE IS BURRIED UNDERNEATH THE SHEDS WHICH ARE THERE

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Section Inspection - 05/10/2021 - FW1X

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
9	1	5. October 2021	CCTV	C1002030		FW1X

Operator	Vehicle	Camera	Temperature	Pre Cleaned	Weather
Andy	HY66 VGR	Solopro		Yes	No rain or snow

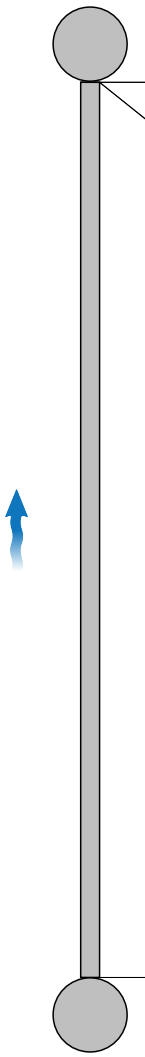
Town or Village:	London	**Inspection Direction:**	Upstream	**US MH:**	FW1
Road:	Fine Bush Lane	**Use:**	Foul	**US Depth:**	
Location:	Property or buildings	**Total Length:**	6.16 m	**DS MH:**	FW1A
Post Code:	UB9 6LY			**DS Depth:**	0.95 m

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 0mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:

Scale: 1:52

Depth: 0.95
FW1A



Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start manhole, FW1A			
0.00	WL	Water level, 0% of the height	00:00:00	FW1X_1bca6270-3cc8-4ebe-a	A
6.16	MHF	Finish manhole, FW1, the pipe is flowing fine	00:00:33	FW1X_ad8805ad-907f-4412-9a	

FW1

Depth:

Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

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Section Pictures - 05/10/2021 - FW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
9	Upstream	FW1X	CCTV	C1002030

FW1X_1bca6270-3cc8-4ebe-a429-c0b2bb7825e0_20211011_174758_242.jpg, 00:00:00, 0.00 m
Water level, 0% of the height

FW1X_ad8805ad-907f-4412-9a9a-ec66db2a4ff8_20211011_174835_299.jpg, 00:00:33, 6.16 m
Finish manhole, FW1, the pipe is flowing fine

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Section Inspection - 05/10/2021 - FW1AX

Section	Inspection	Date	Client's Ref	Contractor's Ref	Surface Type	PLR
10	1	5. October 2021	CCTV	C1002030		FW1AX

Operator	Vehicle	Camera	Temperature	Pre Cleaned	Weather
Andy	HY66 VGR	Solopro		Yes	No rain or snow

Town or Village:	London	**Inspection Direction:**	Downstream	**US MH:**	FW1A
Road:	Fine Bush Lane	**Use:**	Foul	**US Depth:**	0.95 m
Location:	Property or buildings	**Total Length:**	28.38 m	**DS MH:**	DOWNSTREAM
Post Code:	UB9 6LY			**DS Depth:**	

Inspection Purpos	Sample condition survey	**Pipe Shape:**	Circular
Surface Defects:		**Height / Width:**	100 / 0mm
Lining Type:	None	**Pipe Material:**	Vitrified Clay
Lining Material:	None	**Standard:**	WRC MSCC5 Light

Comments:
Recommendations:

Scale: 1:237

Position [m]	Code	Observation	MPEG	Photo	Grade
0.00	MH	Start manhole, FW1A			
0.00	WL	Water level, 0% of the height	00:00:00	FW1AX_0acfb292-ab2e-4a75-	A
28.38	BRF	Finish connection without manhole, DOWNSTREAM, the pipe is flowing fine	00:01:42	FW1AX_385f4008-d493-4c8f-a	

Structural Defects	Construction Features
Service & Operational Observations	Miscellaneous Features
Pipe Condition Grade: A	**Service Condition: Serviceable**

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Section Pictures - 05/10/2021 - FW1AX

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
10	Downstream	FW1AX	CCTV	C1002030

FW1AX_0acfb292-ab2e-4a75-89a4-0ecbc790a9b4_20211011_174920_341.jpg, 00:00:00, 0.00 m
Water level, 0% of the height

FW1AX_385f4008-d493-4c8f-afb6-0d3aedbf88c2_20211011_174937_770.jpg, 00:01:42, 28.38 m
Finish connection without manhole, DOWNSTREAM, the pipe is flowing fine

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Damage overview

Project Name	Project Number	Project Date
Arens Managment Co	C1002030	27/09/2021

Group	Count

Happy Drains Ltd
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Tel. 0800 849 8099

Inspection Summary

Project Name	Project Number	Project Date
Arens Managment Co	C1002030	27/09/2021

Node from:	
Node to:	
Section height:	
Section length:	
Inspected length:	
Abandoned:	

Appendix 3 Proposed Drainage Strategy Drawings and Hydraulic Calculations

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Inflows Storm Phase: Phase	Company Address:		

Porous Paving - TAD 1

Type : Catchment Area

Area (ha)	0.00

Dynamic Sizing

Runoff Method	Time Area Diagram
Summer Volumetric Runoff Coefficient	0.750
Winter Volumetric Runoff Coefficient	0.840
Percentage Impervious (%)	100

Time (mins)	Area (ha)
4	0.055

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Junctions Storm Phase: Phase	Company Address:		

Name	Junction Type	Easting (m)	Northing (m)	Cover Level (m)	Depth (m)
SW2	Manhole	508340.188	189045.914	51.500	1.340
SW3	Manhole	508328.296	189046.876	50.750	0.670

Name	Invert Level (m)	Chamber Shape	Diameter (m)	Manhole Locked
SW2	50.160	Circular	1.200	☐
SW3	50.080	Circular	1.200	☐

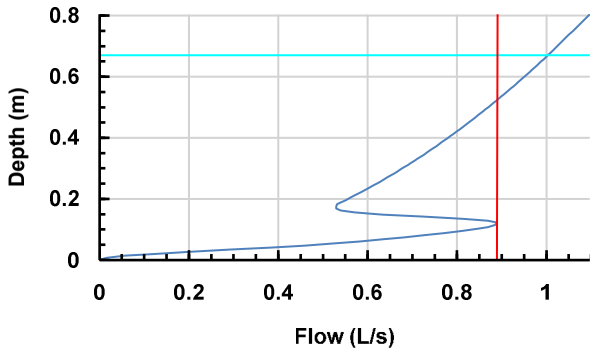
Inlets

Junction	Inlet Name	Incoming Item(s)	Bypass Destination	Capacity Type
SW2	Inlet	Porous Paving - TAD 1	(None)	No Restriction
SW3	Inlet	Pipe Pipe (1)	(None)	No Restriction

Outlets

Junction	Outlet Name	Outgoing Connection	Outlet Type
SW2	Outlet	Pipe	Free Discharge
SW3	Outlet (1)	(None)	Hydro-Brake®

Invert Level (m)	50.080
Design Depth (m)	0.670
Design Flow (L/s)	1.0
Objective	Minimise Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☐
Unit Reference	CHE-0050-1000-0670-1000



DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		

Porous Paving

Type : Tank

Dimensions

Exceedence Level (m)	50.750
Depth (m)	0.500
Base Level (m)	50.250
Freeboard (mm)	0
Initial Depth (m)	0.000
Porosity (%)	30
Average Slope (1:x)	0.00
Total Volume (m³)	26.112

Depth (m)	Area (m²)	Volume (m³)
0.000	228.00	0.000
0.370	228.00	25.308
0.380	228.00	25.992

Outlets

Outlet

Outgoing Connection	Pipe (1)
Outlet Type	Free Discharge

Advanced

Perimeter	Circular
Length (m)	14.800

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Inflow Summary Storm Phase: Phase	Company Address:		

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Porous Paving - TAD 1	SW2		Time Area Diagram	0.055	100	0	100	0.055
TOTAL		**0.0**		**0.055**				**0.055**

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Outfall Details Storm Phase: Phase	Company Address:		

Outfalls

Outfall	Outfall Type	Fixed Surcharged Level (m)	Level Curve
SW3	Free Discharge		

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Audit Report Storm Phase: Phase	Company Address:		

Inflow Summary

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Porous Paving - TAD 1	SW2		Time Area Diagram	0.055	100	0	100	0.055
TOTAL		**0.0**		**0.055**				**0.055**

Outfall Details

Outfalls

Outfall	Outfall Type	Fixed Surcharged Level (m)	Level Curve
SW3	Free Discharge		

Manhole Sizes

Audit Details

Manhole Size Library	Default

Diameter / Width

Connection (mm)	Diameter / Length (m)	Width (m)
0	1.200	0.000
375	1.350	0.000
500	1.500	0.000
750	1.800	0.000

Depth

Depth (m)	Diameter / Length (m)	Width (m)
0.000	1.050	0.000
1.500	1.200	0.000

Results

All items pass

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Audit Report Storm Phase: Phase	Company Address:		

Flood Warnings

Junctions

No flood warnings are reported

Stormwater Controls

No flood warnings are reported

Discharge Rate

Audit Details

Selected Rainfall
Rainfall Details FSR

Results

Outfall	Rainfall	Audit Discharge Rate (L/s)	Actual Discharge Rate (L/s)	Pass/Fail
SW3	100 (years) + 40 (%)	1.0	0.9	Pass

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Inflows Storm Phase: Phase	Company Address:		

Porous Paving - TAD 1

Type : Catchment Area

Area (ha)	0.00

Dynamic Sizing

Runoff Method	Time Area Diagram
Summer Volumetric Runoff Coefficient	0.750
Winter Volumetric Runoff Coefficient	0.840
Percentage Impervious (%)	100

Time (mins)	Area (ha)
4	0.055

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		

Porous Paving

Type : Tank

Dimensions

Exceedence Level (m)	50.750
Depth (m)	0.500
Base Level (m)	50.250
Freeboard (mm)	0
Initial Depth (m)	0.000
Porosity (%)	30
Average Slope (1:x)	0.00
Total Volume (m³)	26.112

Depth (m)	Area (m²)	Volume (m³)
0.000	228.00	0.000
0.370	228.00	25.308
0.380	228.00	25.992

Outlets

Outlet

Outgoing Connection	Pipe (1)
Outlet Type	Free Discharge

Advanced

Perimeter	Circular
Length (m)	14.800

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Inflow Summary Storm Phase: Phase	Company Address:		

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Porous Paving - TAD 1	SW2		Time Area Diagram	0.055	100	0	100	0.055
TOTAL		**0.0**		**0.055**				**0.055**

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Outfall Details Storm Phase: Phase	Company Address:		

Outfalls

Outfall	Outfall Type	Fixed Surcharged Level (m)	Level Curve
SW3	Free Discharge		

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:		

Critical Storm

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow (m^3)
Porous Paving - TAD 1	Rainfall Details FSR: 100 years: +40 %: 15 mins: Winter	0.00	34.5	15.934

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:		

Critical Storm

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
SW2	Rainfall Details FSR: 100 years: +40 %: 240 mins: Winter	51.500	50.160	50.614	0.454	7.1	0.514	0.000	8.9	41.847	Surcharged
SW3	Rainfall Details FSR: 100 years: +40 %: 120 mins: Winter	50.750	50.080	50.676	0.596	18.5	0.674	0.000	0.9	45.652	OK

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

Critical Storm

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. Resident Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Porous Paving	Rainfall Details FSR: 100 years: +40 %: 180 mins: Winter	50.598	50.598	0.348	0.348	16.9	23.791	0.000	0.000	26.9	21.884	9	OK

DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

Critical Storm

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
Pipe	Rainfall Details FSR: 100 years: +40 %: 15 mins: Winter	Pipe	SW2	SW3	51.5	50.508	0.225	15.376	0.9	0.8	34.0	Surcharged
Pipe (1)	Rainfall Details FSR: 100 years: +40 %: 180 mins: Winter	Pipe	Porous Paving	SW3	50.8	50.598	0.225	0.000	0.7	0.9	26.9	Surcharged

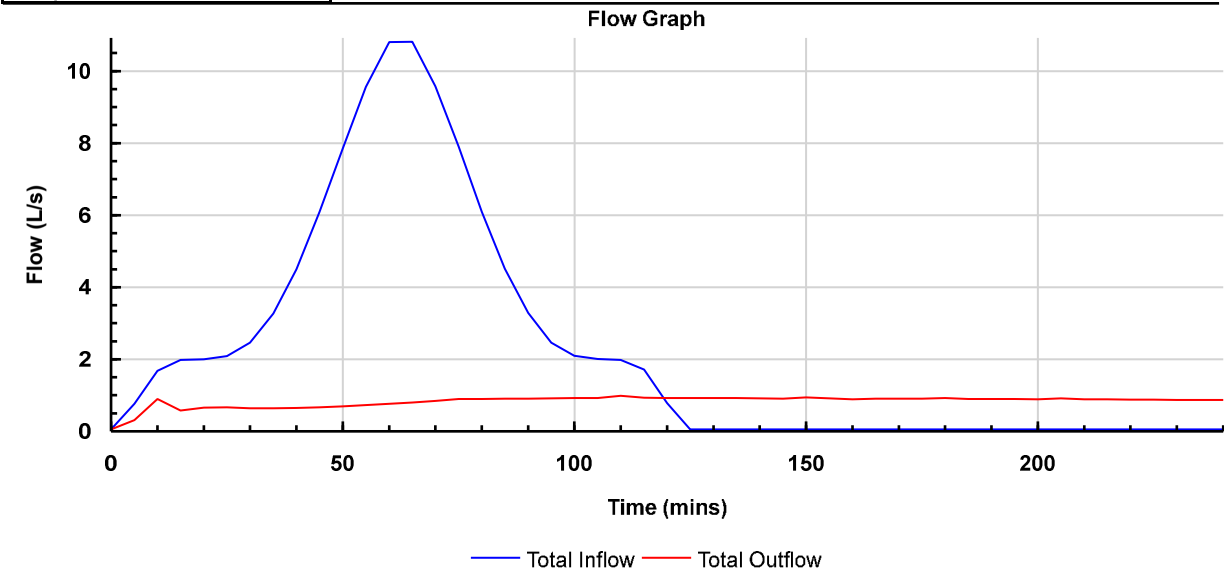
DUCKS HILL ROAD: SURFACE WATER DRAINAGE 1 IN 100 + 40%CC	Date: 01/08/2022		
	Designed by: KG	Checked by:	Approved By:
Report Details: Type: Phase Management Storm Phase: Phase	Company Address:		

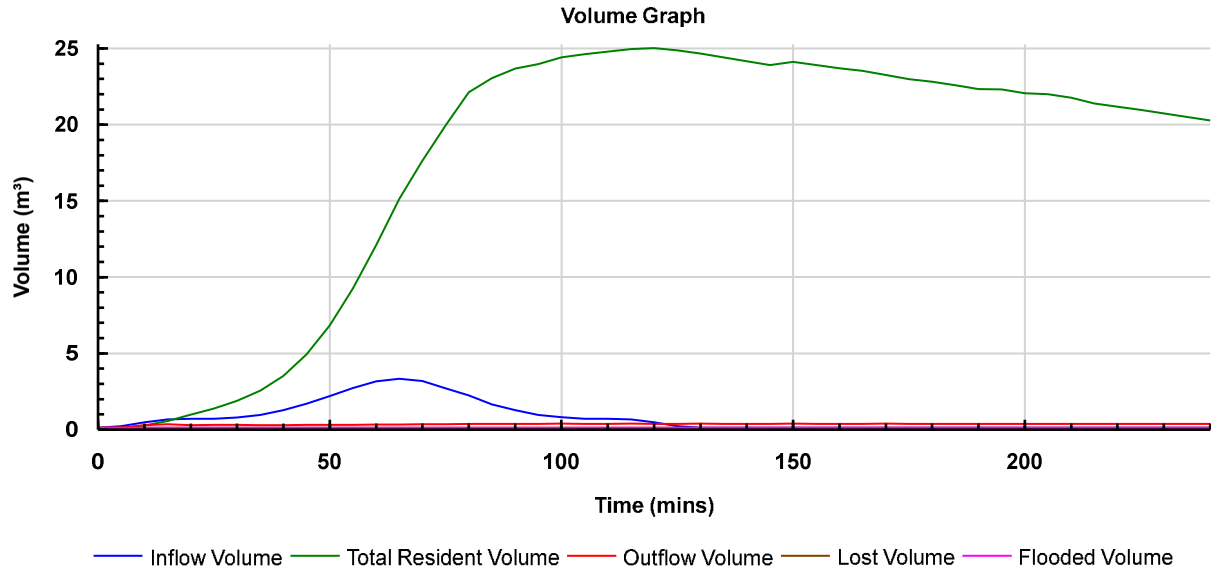
Phase
Rainfall Details FSR: 100 years: Increase Rainfall (%): +40: 120 mins: Winter

Tables

Name	Max. Inflow (L/s)	Total Inflow Volume (m³)	Max. Outflow (L/s)	Total Outflow Volume (m³)
SW3			0.9	11.252
TOTAL	10.8	31.671	0.9	11.252

Graphs





E0721 - Ducks Hill Road

By: KG

Dated: 19.10.2021

Site Run Off Rate Comparison

Calc-C-001

Data

Site Areas (m^2)

Total Site Area	845
Existing Impermeable Area	485
Proposed Impermeable Area	380

Flood Studies Report Rainfall Data

M5-60 (mm)	20
R	0.4
Areal Reduction Factor	0.9

Modified Rational Method Data

Cv	0.75
Cr	1.3

Rainfall Intensity

Return Period (T)	Duration (D)	Z1	M5-D (mm)	Z2	MT-D (mm)	i (mm/hr)	i, catchment (mm/hr)
1	30	0.8	16	0.628	10.05	20.10	18.09
30	30	0.8	16	1.532	24.51	49.02	44.12
100	30	0.8	16	2.006	32.10	64.19	57.77
1	360	1.6	32	0.686	21.95	3.66	3.29
30	360	1.6	32	1.499233333	47.98	8.00	7.20
100	360	1.6	32	1.946	62.27	10.38	9.34

Modified Rational Method

Q=2.78 x Cv x Cr x i x A/10,000

Existing - Peak

Return Period (T)	Duration (D)	Q (l/s)
1	30	**2.38**
30	30	**5.80**
100	30	**7.59**

Proposed - Peak

Return Period (T)	Duration (D)	Q (l/s)
1	30	**1.86**
30	30	**4.54**
100	30	**5.95**

Existing - 6 Hour

Return Period (T)	Duration (D)	Q (l/s)
1	360	**0.43**
30	360	**0.95**
100	360	**1.23**

Proposed - 6 Hour

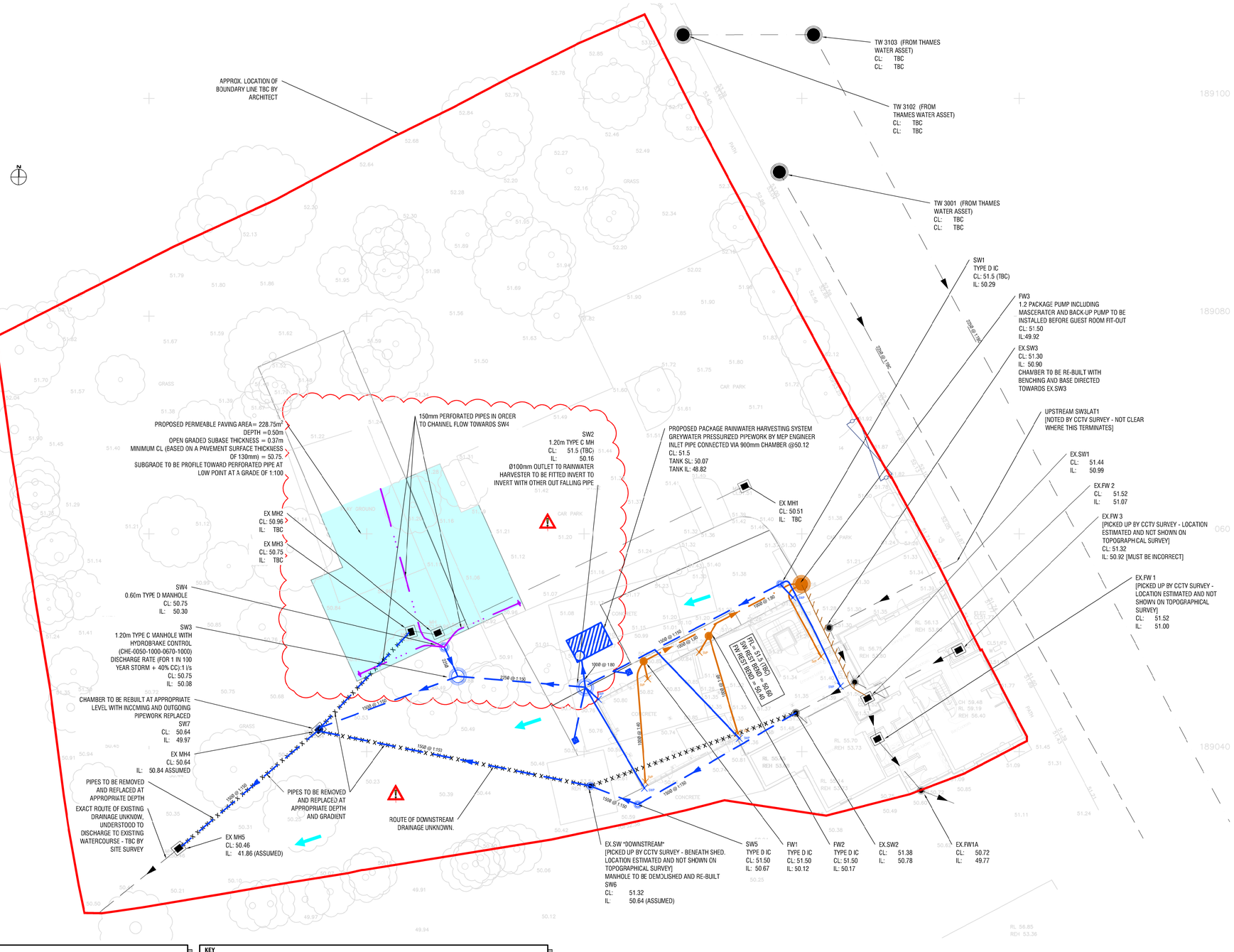
Return Period (T)	Duration (D)	Q (l/s)
1	360	**0.34**
30	360	**0.74**
100	360	**0.96**

Greenfield Rate (scale down for sites<0.01ha)

Return Period (T)	Greenfield Rate for 0.1ha	Greenfield Rate for Site
Qbar	0.45	**0.38**
1	0.38	**0.32**
30	1.04	**0.88**
100	1.44	**1.22**

Summary

Return Period	Existing Run-off		Greenfield (l/s)	Proposed (l/s)	Improvement to Existing Peak	Improvement to Greenfield	Discharge Volume Change (m^3)
	Duration	Q (l/s)					
Qbar			0.38				
1	360	2.38	0.32	1.9	**22%**	**-480%**	**-2.02**
30	360	5.80	0.88	4.5	**22%**	**-417%**	**-4.42**
100	360	7.59	1.22	6.0	**22%**	**-389%**	**-5.74**



GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S AND ARCHITECT'S DRAWINGS, SPECIFICATIONS AND RISK REGISTERS.
2. DO NOT SCALE FROM THIS DRAWING. USE ONLY DIMENSIONS AS INDICATED. CHECK ALL SITE DIMENSIONS PRIOR TO PLACING ANY ORDER OR FABRICATION. WHERE A CONFLICT OF INFORMATION EXISTS SEEK CONFIRMATION FROM CONSULTANTS PRIOR TO PROCEEDING FURTHER WITH THE WORKS.
3. THIS DRAWING IS TO BE PRINTED IN COLOUR.
4. TEMPORARY STABILITY OF THE EXISTING STRUCTURE AND ANY NEWLY CONSTRUCTED ELEMENTS OF PERMANENT WORKS DURING CONSTRUCTION IS SOLELY CONTRACTOR'S RESPONSIBILITY.
5. ONLY DRAWINGS AND SPECIFICATIONS ISSUED FOR **CONSTRUCTION** CAN BE USED FOR THE WORKS. IT IS CONTRACTOR'S RESPONSIBILITY TO SEEK THE INFORMATION FROM CONSULTANTS.
6. ALL PROPRIETARY ITEMS TO BE INSTALLED STRICTLY IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS AND SPECIFICATIONS. ALL WATERPROOFING SUCH AS TANKING DETAILS, DAMP PROOF MEMBRANES, DAMP PROOF COURSES, CAVITY TRAYS ETC. ARE TO BE INSTALLED AS PER ARCHITECT'S DETAILS.
7. THE ACTUAL FORM, EXTENT AND CONDITION OF ANY ELEMENTS MARKED AS "TBC", IS TO BE CONFIRMED BY THE CONTRACTOR VIA LOCAL OPENING/TRIAL PIT PRIOR TO COMMENCEMENT OF ANY WORKS. EXACT DETAILS OF FINDINGS ARE TO BE IMMEDIATELY REPORTED TO ENGINEER.

DRAINAGE NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DETAILS.
2. ALL PRIVATE ON-PLOT DRAINAGE WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH BUILDING REGULATIONS PART H. ALL ADOPTABLE DRAINAGE TO BE CARRIED OUT IN ACCRDANCE WITH SEWERAGE SECTOR GUIDANCE, APPENDIX C - DESIGN AND CONSTRUCTION GUIDANCE (SSG).
3. THE CONTRACTOR IS RESPONSIBLE FOR VALIDATING ALL ASSUMPTIONS PRIOR TO THE COMMENCEMENT OF WORKS. INCLUING THE POSITION, DEPTH AND SIZE OF ANY EXISTING EXISING DRAINAGE INFRASTRUCTURE. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE WORKS ARE ADVANCED.
4. ALL WORKS ARE DESIGNED FOR THE FINAL CONSTRUCTED USE. TEMPORARY WORKS ARE THE RESPONSIBILITY OF THE PRINCIPAL CONTRACTOR.
5. ALL DRAINAGE WORKS ABOVE THE UNDERSIDE OF THE LOWEST STRUCTURAL SLAB BY OTHERS. DRAINAGE POINTS ARE SHOWN APPROXIMATELY ONLY. EXACT PCSITION OF THESE ARE SET OUT AS FOLLOWS:
6. RAINWATER BY ARCHITECT
7. FOUL WATER AND ALL ASSOCIATED FITTINGS AND INTERNAL GULLIES - MEP
8. ANY STATED COVER LEVELS ARE FOR GUIDANCE ONLY AND SHALL BE SET TO THE FINISHED LEVELS SPECIFIED BY THE ARCHITECT.
9. THE CONTRACTOR SHALL ADJUST THE EXACT POSITION OF GULLIES AND DRAINS TO SUIT THE AS-BUILT SURFACE LEVELS. GULLIES SHALL BE PLACED AT LOWS SPOTS.
10. ALL PIPES TO CONNECT SOFFIT TO SOFFIT UNLESS OTHERWISE STATED.
11. ALL INTERNAL MANHOLES TO BE RECESSED, DOUBLE SEALED, AIRTIGHT TYPE IN ALUMINIUM OR STEEL. RECESS DEPTH TO THE SPECIFICATION OF THE ARCHITECT.
12. ALL INTERNAL MANHOLES SHALL BE SET OUT BY THE ARCHITECT. THE CONTRACTOR MUST ENSURE THE GRADIENT AND SIZE OF CONNECTING PIPE-WORK IS AS SHOWN ON THIS DRAWING.
13. ALL GROUND-FLOOR AND BASEMENT RWP'S AND SVP'S TO BE FITTED WITH ABOVE GROUND RODDABLE ACCESS PLATES TO ALLOW FOR JETTING/ CLEARANCE FROM THE INSIDE.
14. ALL BELOW SLAB RAINWATER PIPES TO BE 150MM Ø @ 1:80 AND FOUL WATER TO BE 100MM Ø @ 1:40 (DIA) UNLESS OTHERWISE STATED
15. THE CONTRACTOR SHALL CLEAN OUT AND REPAIR ALL RETAINED EXISTING DRAINAGE ON-SITE
16. SEALANT DETAIL THROUGH ALL WATERPROOFED STRUCTURAL ELEMENTS TO BE AGREED WITH TANKING SPECIALIST AND INSTALLED IN STRICT COMPLIANCE WITH THEIR INSTRUCTIONS.

THIS DESIGN IS BASED ON THE FOLLOWING CONTEXTUAL INFORMATION:

CONTENT	AUTHOR	DOC REF	DATE
TOPOGRAPHICAL SURVEY	TOP SURVEY LTD		22/03/2021
THAMES WATER ASSET RECORDS	THAMES WATER	ASL/ALS STANDARS/2021_4505040	15/09/2021
CCTV SURVEY	HAPPY DRAINS LTD	C1002030	27/09/2021
ARCHITECTURAL DRAWING	TR HARRIS (DESIGN & SURVEYING SERVICES) LTD	21/SB/200	SEPT 2021

DESIGN RISK - 1
EXISTING DRAINS NOT YET SURVEYED. LEVEL AND ALIGNMENT TO BE VALIDATED BY CCTV SURVEY OR TRIAL PIT. CLASH DETECTION TO BE UNDERTAKEN AND DESIGN REVISION MAY BE REQUIRED DEPENDING ON WHETHER CLASHES OCCUR

DESIGN RISK - 2
DESIGN TO BE CHECKED AND APPROVED BY RAINWATER HARVESTING SYSTEM MANUFACTURER AND MEP ENGINEER.

ABBREVIATIONS:

SW	SURFACE WATER
FW	FOUL WATER
CW	COMBINED WATER
IC	INSPECTION CHAMBER
MH	MANHOLE
CL	COVER LEVEL
IL	INVERT LEVEL
SL	SOFFIT LEVEL
NRV	NON RETURN VALVE
RE	RODDING EYE
RWP	RAIN WATER PIPE FROM ABOVE
SVP	SOIL AND VENT PIPE FROM ABOVE
SS	SUB-STACK
UNO	UNLESS NOTED OTHERWISE
FG	FLOOR GULLY
YG	YARD GULLY
RG	ROAD GULLY

KEY

- PROPOSED SITE BOUNDARY
- EXISTING PUBLIC SURFACE WATER SEWER AND CHAMBER
- EXISTING PUBLIC FOUL WATER SEWER AND CHAMBER
- EXISTING PUBLIC COMBINED WATER SEWER AND CHAMBER
- PROPOSED PRIVATE SURFACE WATER DRAIN AND CHAMBER
- PROPOSED PRIVATE FOUL WATER DRAIN AND CHAMBER
- PROPOSED FOUL WATER DRAINAGE PENETRATION POINT AND DRAINAGE SPUR (100Ø @ 1:80 UNO). REFER TO ABBREVIATIONS
- PROPOSED SURFACE WATER DRAINAGE PENETRATION POINT AND PIPE SPUR (150Ø @ 1:80 UNO). REFER TO ABBREVIATIONS
- GRAVELY ON TYPE 3 SUB-BASE

KEY

- PROPOSED PERFORATED PIPE (100mmØ UNO) AND RODDING EYE
- PROPOSED TRAPPED GULLY AND BELOW GROUND DRAINAGE PIPE (100mm UNO). YG=YARD GULLY. RG= ROAD GULLY. COLOUR DENOTES DISCHARGE SYSTEM (BLUE=SW, BROWN=FW)
- EXCEEDANCE FLOW ROUTE
- EXISTING SEWER TO BE ABANDONED
- FOUL RISING MAIN

rev	date	description	by	checked
T01	21.10.2021	ISSUED FOR TENDER	MA	KG

PROJECT TITLE:
THE SIX BELLS, DUCKS HILL ROAD

CLIENT:
ARENS MANAGEMENT LIMITED

PROJECT No: E0721 | DRAWN: SC | CHECKED: KG

DRAWING TITLE:
PROPOSED BELOW GROUND DRAINAGE LAYOUT

DRAWING No:
E0721-EEE-00-XX-DR-C-7501

SUITABILITY STATUS:
ISSUED FOR APPROVAL

REV: T02 | SCALE: 1:200

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t: (+44)207 580 4588
w: www.engineeria.com

Appendix 4 Maintenance Requirements

Access Chamber (Inspection Chamber and Manholes) Maintenance Requirements

Activity Type	Required Action	Typical Frequency
Regular Inspection	Inspect inlet and outlet drains. Ensure working as required with no blockages or build-ups of silt.	6-monthly and after severe storms.
	Check cover is not damaged fits securely and that there is no damage to ironmongery which inhibits opening.	6-monthly and after severe storms.
	Check benching for scour or build-up of debris.	6-monthly and after severe storms.
	Check joints on pipes for damage or inflow from other sources	Annually and after severe storms
Regular Maintenance	Remove debris and silt	6-monthly and as required (after regular inspection)
Remedial Actions	If cover is damaged, arrange repair or replacement.	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate.	As required
Recording	Record observations, alterations and repairs in inspection log-book.	After each inspection, and remedial action.

Conveyance Pipes Maintenance Requirements

Activity Type	Required Action	Typical Frequency
Regular Inspection	Carry out flow tests between manholes to ensure free flow of system.	Annually and after severe storms
Remedial Actions	If flow is impeded, inspection by CCTV required in accordance with Manual for Sewer Condition Classification, MSCC.	As required
	If flow is impeded due to build-up of granular material within pipes, jet and clear all debris or silt.	As required
	If structural issue/ failure/ growth, review and remediate using pipe repair/ replacement methods.	As required
Recording	Record observations, alterations and repairs in inspection log-book.	After each inspection, and remedial action.

Flow Control Chambers Maintenance Requirements

Activity Type	Required Action	Typical Frequency
Regular Inspection	Inspect all flow control components including flow control device, bypass door and lifting facilities. Ensure working as required with no blockages or build-ups of silt.	6-monthly and after severe storms
	Inspect inlet and outlet drains. Ensure working as required with no blockages or build-ups of silt.	6-monthly and after severe storms.
	Check cover is not damaged fits securely and that there is no damage to ironmongery which inhibits opening.	6-monthly and after severe storms.
	Check benching for scour or build-up of debris.	6-monthly and after severe storms.
	Check joints on pipes for damage or inflow from other sources	Annually and after severe storms
Regular Maintenance	Remove debris sand silt.	Six monthly and as required (after regular inspection)
Remedial Actions	If cover is damaged, arrange repair or replacement.	As required
	If blocked, lift bypass door and remove any blockage from flow control device.	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required
Recording	Record observations, alterations and repairs in inspection log-book.	After each inspection, and remedial action.

Channel Drain and Gully Maintenance Requirements

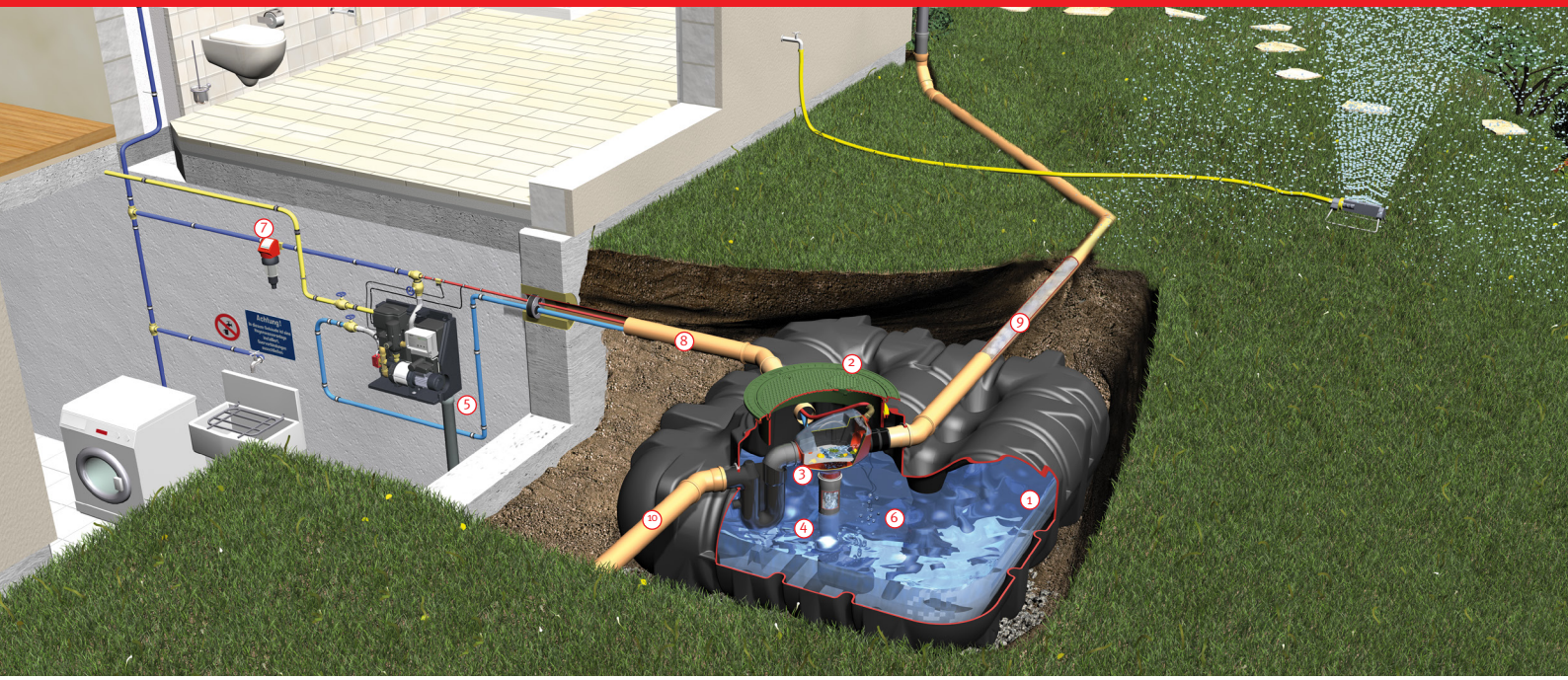
Activity Type	Required Action	Typical Frequency
Regular Inspection	Inspect sump. Ensure working as required with no blockages or build-ups of silt.	6-monthly and after severe storms
	Check access cover/ grating is not damaged fits securely and that there is no damage to ironmongery which inhibits opening.	6 -monthly and after severe storms.
	Check drainage channel for damage, settlement or silt build-up	6-monthly and after severe storms
Regular Maintenance	Remove debris and silt.	6- monthly and as required (after regular inspection)
Remedial Actions	If cover is damaged, arrange repair or replacement.	As required
	If channel or gully has settled, cracked or moved, investigate and repair as appropriate	As required
Recording	Record observations, alterations and repairs in inspection log-book.	After each inspection, and remedial action.

Permeable Paving Maintenance Requirements

Activity Type	Required Action	Typical Frequency
Regular Inspection	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
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 surface 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 glyphospate 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)
Recording	Record observations, alterations and repairs in inspection log-book.	After each inspection, and remedial action.

Platin Silentio Package



Platin Silentio package

- Simple & quick to install
- The Silentio is a wall mounted pump which supplies harvested rainwater on demand to WCs, washing machine & any external taps
- The black cistern at the top of the Silentio is filled with mains water. The water is drawn from this cistern when the rainwater in the Platin tank is low. This gives the system a main water backup.
- Innovative float sensor detection on the Silentio unit ensures that the household is constantly supplying water to the property but only the amount necessary.
- Maintenance and servicing of the Silentio is straight forward as the pump is located above ground where it can be easily accessed.
- Reversible flow filter included in the Silentio package, this filter gives the system another level of filtration.
- Water level reader inside the underground tank relays an accurate reading of the amount of rainwater left in the tank.
- Silentio package comes with a jet wash feature for the filter inside the tank which periodically removes any debris on the filter.

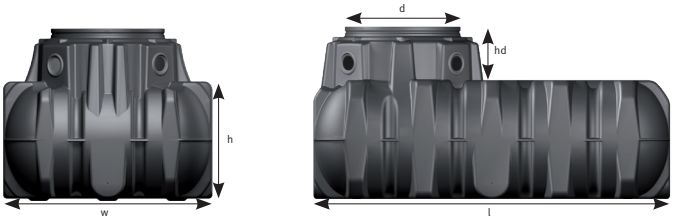
Scope of supply

1. Underground tank (choice of tanks available, sizes vary according to property type)
2. Telescopic lid (choice of telescopic lid available, depending on tank location)
3. Filter (Minimax filter supplied in accordnace with type of tank)
4. Floating water intake
5. Silentio unit
6. Float sensor (connected from Silentio unit to the underground tank)
7. Reversible flow filter

Supplied by others

8. 100mm diameter duct pipe to contain; float sensor cable and rainwater feed
9. 100mm diameter drainage pipe connected from downpipes to the inlet at the top of the tank (all downpipes brought into one pipe for connection to the filter)
10. 100mm diameter pipe for overflow from the tank to mains drainage network or soakaway

Dimensions/weight	1,500 litres (400 US gallons)	3,000 litres (800 US gallons)	5,000 litres (1,350 US gallons)	7,500 litres (1,980 US gallons)
Length (l)	2,100mm (82.6")	2,450mm (96.5")	2,890 (113.8")	3,600 (141.7")
Width (w)	1,250mm (49.2")	2,100mm (82.7")	2,300mm (90.6")	2,250mm (88.6")
Height of tank shoulder (h)	700mm (27.5")	735mm (28.9")	950mm (37.4")	1250mm (49.2")
Height of dome collar (hd)	315mm (12.4")	315mm (12.4")	315mm (12.4")	315mm (12.4")
Ø tank dome (d)	800mm (31.5")	800mm (31.5")	800mm (31.5")	800mm (31.5")
Weight	80kg	170kg	240kg	360kg



For more information please call us on 01608 661500 or visit our website www.grafuk.co.uk

Rainwater harvesting tank size calculator to BS 8515:2009

Created by and for Graf UK Ltd

Customer: Tim Harris
Project: Six Bells Public House, Ruislip - HA4 7TS
Plot/type:
Quantity:

The intermediate approach (extract from BS 8515:2009)
To apply the intermediate approach to sizing the rainwater harvesting system for non-potable domestic use, storage capacity should be calculated from the following equations and should be the lesser of 5% of the annual rainwater yield or 5% of the annual non-potable water demand.

5% of the annual rainwater yield should be calculated using the equation:

$Y_R = A \times e \times h \times \eta \times 0.05$

where:

Y_R is the annual rainwater yield (L);
A is the collecting area (m²);
e is the yield coefficient (%);
h is the depth of rainfall (mm);
η is the hydraulic filter efficiency.

A	=	200	m²
e	=	0.8	%
h	=	775	mm
η	=	0.95	

Y_R	=	A	x	e	x	h	x	η	x	0.05
5890		200.00	x	0.8	x	775	x	0.95	x	0.05

↓
5890 Litres

5% of the annual non-potable water demand should be calculated using the equation:

$D_N = P_d \times n \times 365 \times 0.05$

where:

D_N is the annual non-potable water demand (L);
P_d is the daily requirement per person (L);
n is the number of persons.

P_d	=	50	L
n	=	6	

D_N	=	P_d	x	n	x	365	x	0.05
5475		50.00	x	6	x	365	x	0.05

↓
5475 Litres

Final recommended tank size in accordance with BS 8515: 2009

5% of annual rainwater yield	=	5890	L
5% of annual non-potable water demand	=	5475	L
Lesser of the two above figures	=	5475	Litres
Closest/Most suitable tank size	=	7,500	Litres

Notes & Rainfall statistics;
Rainwater statistics taken from Figure 2 (page 9) BS 8515:2009
Above equations taken from 4.1.2.3 (page 12) BS 8515:2009
Enter site specific figures in to YELLOW boxes
Filter efficiency based on GRAF Optimax Pro filter (self-cleaning)
Tank sizes based on GRAF GmbH tanks by Graf UK Ltd

FEH Annual average rainfall (mm)			
From	To		Max.
520	to 650	=	650
650	to 775	=	775
775	to 890	=	890
890	to 1000	=	1000
1000	to 1250	=	1250
	> 1250	=	1250