



# Amethyst Lane Drainage Strategy Report

*For Reading Borough Council*

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*Date:* 1 December 2023

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# DOCUMENT CONTROL SHEET

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## 1. INTRODUCTION

Hydrock have been appointed by Reading Borough Council to provide a Drainage Strategy report in relation to the redevelopment of a brownfield site at Amethyst Lane, Reading for the approval of Reading Council Lead Local Flood Authority (LLFA).

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

The report is based upon sewer asset information provided by the sewerage undertakers Thames Water in relation to assets within the vicinity of the development site. A CCTV drainage survey has also been undertaken.

The report also highlights the key stakeholders in terms of ownership and maintenance to ensure the drainage system is kept well maintained and reduce the risk of failure.

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

### *Post Development Surface and Foul Water Management Summary*

The development is on a previously developed land with significant hardstanding. Following the development, surface water runoff will be attenuated with a combination of dry swales, permeable paving and cellular tank with a discharge restricted at 5 l/s. Thames Water in their preliminary response have advised that provided the development follows the surface water discharge hierarchy as per national and local guidance, a discharge of 5 l/s into Thames Water sewer would be acceptable.

CCTV and drainage surveys indicated that the existing surface water drain / sewer in Amethyst Lane is too shallow for the site to drain into it by gravity. As such, connection into foul sewer has been considered which is subject to further discussion with Thames Water. Owing to site constraints, land raising has been considered impractical and economically unviable. Alternatively, a pumped option can be considered to drain to the surface water system.

The sustainable drainage system (SuDS) components in this design will incorporate swales and permeable paving wherever feasible to improve water quality, with an attenuation tank to meet the requirements for permitted discharge rates.

Foul flow from the development will be discharged by gravity into the existing foul sewer located beneath Amethyst Lane to the south of the site subject to an agreement with Thames Water. A preliminary response from Thames Water has confirmed that foul sewerage capacity will not be a concern.

It is the intention to get the swales and attenuation tank adopted by a responsible body (such as NAVs (New Appointee and Variation) or Reading Borough Council LLFA may be willing to adopt once Schedule 3 Flood and Management Act 2010 is implemented in 2024). We understand Thames Water currently do not adopt such SuDS features. Alternatively, maintenance will be undertaken by the engagement of a private management company.

### *References / Design Codes*

- BS EN 752 - Drain and Sewer Systems Outside Buildings.
- Building Regulations Approved Document Part H - Drainage and waste disposals.

- Sewerage Sector Guidance
- Reading Borough Council Local Plan (November 2019)
- CIRIA C753 - SuDS Manual
- National Planning Policy Framework (NPPF)
- DEFRA Non-Statutory Technical Standards for Sustainable Drainage

## 2. SITE INFORMATION

### 2.1 Site Location

The site is located approximately 2km West of Reading centre in the Southcote ward, Berkshire. The Ordnance Survey National Grid Reference for the site is SU 69433 72582. The postcode to the site is RG30 2EZ.

Table 2.1: Site Referencing Information

|              |                                        |
|--------------|----------------------------------------|
| Site Address | Amethyst Lane                          |
|              | Amethyst Lane                          |
|              | Postcode: RG30 2EZ                     |
|              | National Grid Reference SU 69433 72582 |

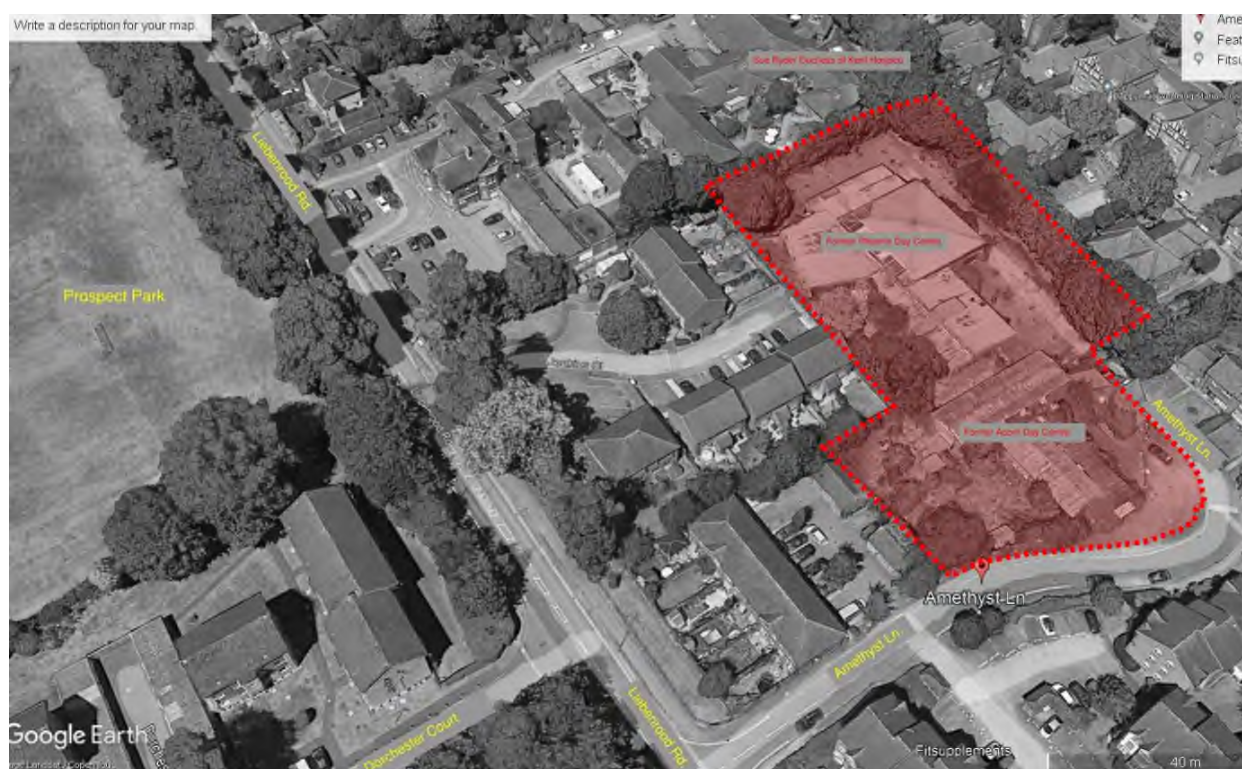


Figure 1: Site Location with Approximate Red Line Boundary

The site comprises an area of land of approximately 0.566 Ha in size. It is bound by low-rise residential properties to the South, East and West and the Sue Ryder Duchess of Kent Hospice to the North. The site is accessed from Amethyst Lane, connecting to Liebenrood Road to the West and Bath Road to the South.

### 2.2 Topography

The topographical survey indicates that the existing ground level within the development is generally flat and remains at between 58.00 – 58.70m. The site is roughly rectangular measuring approximately 110m x 67m.

See **Appendix A** for Topographical Survey.

### 2.3 Existing Sewers

Public Sewer asset maps have been obtained from Thames Water shows a 150mm foul sewer located beneath Amethyst Lane to the immediate south. This continues westerly to connect into a 225mm dia. foul sewer

running along Liebenrood Road to the west. A 225mm diameter surface water sewer is located at the end of Amethyst Lane, which ultimately connects into a 225mm diameter sewer running along Liebenrood Road.

The drainage and utility survey (in **Appendix A**) determined an existing 375mm surface water drain along Amethyst Lane which is not indicated on Thames water asset plans. The ownership of this sewer is assumed to belong to the highway authority however this should be confirmed by further investigations.

The drainage and utilities survey and CCTV survey undertaken show limited surface water drainage within the site boundary. A couple of soakaways are referenced and noted as heavily silted. Foul drainage from the site is shown to connect into the foul sewer located at Amethyst Lane. See.

See **Appendix C** for Sewer Asset Map and **Appendix E** for Existing Drainage Layout.

## 2.4 Geology

Based on British Geological Survey Mapping, the site is underlain by superficial geology of Lynch Hill Gravel Member. The underlying bedrock includes Lambeth Group over Seaford Chalk Formation.

Intrusive ground investigation works have been undertaken by Hydrock in March 2023. Works determined the underlying geology to include Made Ground between to 0.60m below ground level (bgl) over Lynch Hill Gravel Member (between 0.30m and 5.40m bgl), comprising slightly gravelly sandy clay, becoming sands and gravels, or gravelly sands at depth. This is underlain by Lambeth Group between 4.25m and 11.50m bgl, and comprises slightly silty fine to medium sand with localised sandy silty clay. Seaford Chalk Formation occurs beneath the Lambeth Group at between 11.50m and 20.00m bgl, and occurs as weak to moderately dense chalk.

Groundwater was not encountered during the investigation or during the post fieldwork monitoring.

Soakage tests undertaken within Lynch Gravel strata determined infiltration rates of between  $2.19 \times 10^{-5}$  –  $6.42 \times 10^{-5}$  m/s.

The study reports that there is the potential for chalk cavities (solution pipes and sink holes). Though not recorded on site, they have been recorded in the vicinity of the site. The underlying chalk is classed as of low density. Hydrock study concluded that there is a risk of features being present due to the number of cavities noted in the vicinity of site and underlying geology.

## 2.5 Hydrology & Hydrogeology

There are no surface water features within or in the vicinity of the site. The nearest watercourse relates to the Holly Brook, a tributary of the River Kennet, located 900m to the south. The River Kennet itself is located further to the south.

The Lynch Hill Gravel Member and the Lambeth Group are classified as Secondary A Aquifers. The Seaford Chalk Formation is classified as a Principal Aquifer.

The site is not located with any groundwater Source Protection Zone (SPZ).

## 2.6 Flood Risk

The EA floodplain map indicates that the level of flood risk to the site corresponds to a Flood Zone 1 – Low Probability in Table 1 of NPPF Planning Practice Guidance. This zone has less than a 1 in 1000-year annual probability of flooding.

The mapping shows some surface water flooding within the site between 'high' and 'high' risk events. The risk can be mitigated by managing surface water runoff with adequate onsite drainage / SuDS provision and making provision for overland flow routes.

## 2.7 Development Proposals

The current development consists of the demolition of the existing now vacated day centre that use to provide services for older people and a family centre for children in care to meet with the birth parents in a safe environment.

The subsequent redevelopment of the site provides 17 Dwellings and a Respite Centre, with access off Amethyst Lane, parking and landscaping works.

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

### 3. SURFACE WATER MANAGEMENT STRATEGY

#### 3.1 Pre-Development Surface Water Drainage

Based on surveys, surface water runoff from the existing buildings and hardstanding appears to drain into ground using soakaways. There are no public sewers in the immediate vicinity of the site.

See **Appendix C** for Sewer Asset Map and **Appendix E** for Existing Drainage Layout.

#### 3.2 Pre-Development Surface Water Runoff

##### 3.2.1 Brownfield Run-Off Rates

The site is a brownfield land, and comprised significant impermeable area in form of buildings and hardstanding (total 3624m<sup>2</sup>) as set out in table 3.1 below. See **Appendix G** for Pre-Development Catchment Plan.

Table 3.1: Pre-Development Catchment Areas

| Pre-Development Catchment | Area (m <sup>2</sup> ) |
|---------------------------|------------------------|
| Building / Roof           | 1803                   |
| Roads / Hardstanding      | 1821                   |
| Soft Landscaping          | 2033                   |
| <b>Total Area</b>         | <b>5657</b>            |

The estimated brownfield runoff rates from the existing site are shown in Table 3.2 below.

Table 3.2: Previous Brownfield Runoff Rates

| Storm Event   | Brownfield discharge rate (l/s) |
|---------------|---------------------------------|
| 1 in 1 Year   | 32.16                           |
| 1 in 30 Year  | 78.81                           |
| 1 in 100 Year | 102.02                          |

##### 3.2.2 Greenfield Run-Off Rates

The following table considers what the maximum surface water discharge from the site would be if the site was 'Greenfield' i.e., not developed. Refer to Table 33 below and Appendix I.

Table 3.3: Equivalent Greenfield Run-Off Rates

| Storm Event   | Greenfield Runoff Rate (l/s) |
|---------------|------------------------------|
| 1 in 1 Year   | 0.79                         |
| 1 in 30 Year  | 2.14                         |
| 1 in 100 Year | 2.97                         |
| <b>QBAR</b>   | <b>0.93</b>                  |

#### 3.3 Post Development Catchment

The table below indicates the proposed land use within the proposed development site:

Table 3.4: Post-Development Catchment Areas

| Post-Development Catchment | Area (m <sup>2</sup> ) |
|----------------------------|------------------------|
| Building / Roof            | 1730                   |

|                      |      |
|----------------------|------|
| Roads / Hardstanding | 1580 |
| Soft Landscaping     | 2347 |
| Total Area           | 5657 |

See **Appendix F** for Post-Development Catchment Plan.

### 3.4 Proposed Discharge Rates

In line with the Non-Statutory Technical Standard for Sustainable Drainage S2 (Peak Flow Control), it is a requirement that on new developments that consideration be given to limit discharge as close as reasonably practical to the equivalent 'Greenfield' rate for the corresponding storm event. However, as the greenfield discharge rates from the site is too low to restrict to (Table 3.3 above), it will not be practically feasible to limit the discharge from the development site to such a low rate.

As per NTSSD Policy S3, if greenfield rates are unachievable a higher rate may be allowed for previously developed site, which should never exceed the rate of discharge from the development prior to redevelopment for that event.

Accordingly, it is proposed that discharge from the redeveloped site is limited to a maximum of 5.0 l/s. SuDS measures will be put in place to limit the discharge rate to as low as possible and provide betterment over the existing brownfield rates to ensure the site does not increase flood risk once developed. (Refer to Table 3.4 below and calculations in **Appendix I**).

Thames Water in their preliminary response have advised that provided the development follows the surface water discharge hierarchy as per national and local guidance, a discharge of 5 l/s into Thames Water sewer would be acceptable. Refer to **Appendix C**.

Table 3.5: Proposed Discharge Rates

| Storm Event   | Brownfield discharge rate (l/s) | Proposed Discharge Rate (l/s) | % Improvement |
|---------------|---------------------------------|-------------------------------|---------------|
| 1 in 1 Year   | 32.16                           | 3.9                           | 88%           |
| 1 in 30 Year  | 78.81                           | 4.2                           | 95%           |
| 1 in 100 Year | 102.02                          | 4.3*                          | 96%           |

\*40% climate change allowance considered for post development scenario

### 3.5 Run-off Destinations

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

1. Infiltration to the ground using a sustainable drainage system.
2. If this is not feasible, discharge to a watercourse or river; generally, at a controlled rate unless it does not affect flood risk e.g., if to the sea or an estuary.
3. Discharge at a controlled rate to a surface water sewer or drain.
4. Discharge at a controlled rate to a combined sewer system, with the approval from the Water Authority.

5. Only if the above have all been investigated and it has been proved that none of these options are suitable will discharge at a controlled rate to a foul sewer system, with the approval from the Water Authority.

In terms of infiltration SuDS, despite favourable infiltration rates, the Hydrock report concluded that:

‘the site is an area with a moderate subsidence risk and use of Suds as a means of surface water drainage is not recommended. Alternative strategies should be sought prior to committing to discharging surface water to the ground. Concentrated flows of surface water could wash-out and/or disturb relict infill to buried solution features, which could lead to ground movements/collapse.’

The study further states that consideration may be given to deep borehole soakaways giving consideration to CIRIA C574 guidance. As per the guidance, *‘in areas where dissolution features are known to be prevalent, soakaways should be avoided if at all possible but, if unavoidable, should be sited at least 20 m away from any foundations.’* However, achieving 20m offset is not feasible within the site.

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

Table 3.6: SuDS Hierarchy

| Method                                                           | Reasoning                                                                                                                                                                                                                                                                                           |   |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| Infiltration                                                     | As there are no superficial soils, the chalk is likely to be poor quality and dissolution present in Reading, soakaways have not been considered                                                                                                                                                    | X |
| Surface water body                                               | There are no surface water bodies within the vicinity of the site.                                                                                                                                                                                                                                  | X |
| To dedicated surface water sewer (public, highways or otherwise) | Surface water discharge has been discounted due to levels constraints of the site and Invert level of the connecting surface water sewer. CCTV carried out has confirmed that connection into the public sewer at Amethyst Lane will require extensive land raising, which is practically unviable. | X |
| To a combined sewer                                              | No combined sewer in the vicinity.                                                                                                                                                                                                                                                                  | X |
| To a foul sewer                                                  | This has been selected as the means of discharge of this site. All other options have been exhausted.                                                                                                                                                                                               | ✓ |

### 3.6 Suitability of SuDS Components

The drainage design should adopt the principles of SuDS where appropriate taking into consideration the site context and location. The principals of SuDS are that they should be designed to maximise the opportunities and benefits that can be secured surface water run-off management in terms of quality, quantity, flood risk, and amenity.

The implementation and selection of SuDS techniques is largely dependent on the site layout and context, and underlying ground conditions. Some SuDS techniques may be more appropriate than others.

The suitability of SuDS components has been assessed as follows:

Table 3.7: Suitability of SuDS Components

| Hierarchy   | Description                                                                                                  | Setting  | Required area        | Implemented                                                    |   |
|-------------|--------------------------------------------------------------------------------------------------------------|----------|----------------------|----------------------------------------------------------------|---|
| Green roofs | A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in | Building | Building integrated. | No. Not withing architects keeping with the building proposals | X |

|                                                                                                                  |                                                                                                                                                                                                                                                                                      |                     |                                                                      |                                                                                                                                                                           |   |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                 | the soil layer and absorbed by vegetation.                                                                                                                                                                                                                                           |                     |                                                                      |                                                                                                                                                                           |   |
| <b>Rainwater harvesting</b><br> | Rainwater is collected from the roof of a building or from other paved surfaces and stored in an over ground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.                                                            | Building            | Water storage (Underground or above ground).                         | No. Lack of space on site has meant that this was not feasible to be included within SUDS for this site.                                                                  | X |
| <b>Soakaway</b><br>             | A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.    | Open space          | Dependent on runoff volumes, water table and soils.                  | No. Risk of dissolution within the underlying chalk; hence soakaways have not been recommended. Achieving 20m offset as required for any soakaway device is unachievable. | X |
| <b>Filter strip</b><br>       | Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.                                                                                                                                                               | Open space          | Minimum length 5m.                                                   | No. Lack of space on site has meant that this was not feasible to be included within SUDS for this site.                                                                  | X |
| <b>Permeable paving</b><br>   | Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.                 | Street / open space | Can typically drain double its area.                                 | Yes. This has been implemented wherever possible to improve water quality and reduce requirement for below ground crated solutions.                                       | ✓ |
| <b>Bioretention area</b><br>  | A vegetated area with gravel and sand layers below designated to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens. | Street / open space | Typically, surface area is 5-10% of drained area with storage below. | No. Ground Investigation report has confirmed that infiltration rates are too poor to consider this as an option.                                                         | X |

|                                                                                                                   |                                                                                                                                                                                                                                                                                                           |                            |                                                                               |                                                                                                                                 |          |
|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Swale</b><br>                 | <p>Swales are shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.</p>                                                               | <p>Street / open space</p> | <p>Account for width to allow safe maintenance typically 2–3 metres wide.</p> | <p>Yes. This has been implanted alongside the onsite highway to provide high level source control for surface water runoff.</p> | <p>✓</p> |
| <b>Hardscape storage</b><br>     | <p>Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.</p>                                                                                                         | <p>Street / open space</p> | <p>Could be above or below ground and sized to storage need.</p>              | <p>No. Other more sustainable forms of SUDS have been identified.</p>                                                           | <p>X</p> |
| <b>Pond / Basin</b><br>          | <p>Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.</p> | <p>Open space</p>          | <p>Dependent on runoff volumes and soils.</p>                                 | <p>No. This has not been implemented on this site as there is insufficient space</p>                                            | <p>X</p> |
| <b>Wetland</b><br>             | <p>Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.</p>                  | <p>Open space</p>          | <p>Typically, 5–15% drainage area to provide good treatment.</p>              | <p>No. This has not been implemented on this site as there is insufficient space</p>                                            | <p>X</p> |
| <b>Underground storage</b><br> | <p>Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.</p>                                                                                                                                                                                                  | <p>Open space</p>          | <p>Dependent on runoff volumes and soils.</p>                                 | <p>Yes. Attenuation crates have been specified to satisfy excess requirement to meet permitted discharge rates.</p>             | <p>✓</p> |

### 3.7 Post-Development Surface Water Drainage

Based on the current layout, the development site comprises 3310m<sup>2</sup> (0.331ha) of hard area in form of roof, parking and access road, slightly less impermeability when compared to the previous site. Refer to tables 3.1 and 3.4 above and **Appendix F** for Pre and Post-Development Catchment Plan.

Further, runoff within the development will be managed using sustainable measures to ensure surface water runoff and resulting flood risk does not increase post development as discussed below. Where applicable, the surface water management strategy will incorporate the recommendations of the 'Non-Technical Standards for Sustainable Drainage' and general 'good practice' in terms of managing surface water runoff as per tables 3.6 and 3.7 above.

Accordingly, surface water runoff from roof and road areas will be collected by gullies and pipes and drained to online dry swales and a cellular tank and within oversized pipes and manholes. Permeable paving will also be used. The system will ultimately discharge into the Thames Water foul sewer to the south (at manhole 4601) via a Hydrobrake flow control. Discharge will be restricted to 5l/s, which provides a significant reduction in runoff over the existing brownfield discharge rates. Refer to **Appendix H** for the Drainage Strategy.

Based on site levels and invert of the existing storm sewer and highway drain (site level 58.00mm invert level 57.135m), a gravity connection into the surface water system is not feasible. The ability to raise levels within the site to facilitate more favourable levels for drainage is impeded by boundary conditions surrounding the site and economical viability. Accordingly, discharge into the foul sewer is being sought which is subject to further discussion with Thames Water. Response from Thames Water is awaited at this stage. Thames Water in their preliminary response have advised that provided the development follows the surface water discharge hierarchy as per national and local guidance, a discharge of 5 l/s into Thames Water sewer would be acceptable. Refer to **Appendix C**.

Alternatively, a pumped option can be considered to drain to the surface water system.

As discussed in paragraph 2.4, due to the risk of chalk dissolution, infiltration option is considered unfeasible.

The drainage and storage system in combination will be designed to accommodate the 1 in 100year storm event with 40% allowance for climate change. Refer to Microdrainage network/storage calculations in **Appendix I**.

### 3.8 Urban Creep

Urban Creep Factor (UCF) is defined as any increase in the impervious area that is drained to an existing drainage system without planning permission being required, such as the construction of patios, small extensions, etc. Owing to space constraints within the layout for future expansion, and as the design hard area already includes patios etc, this factor is not applied.

### 3.9 Interception Storage

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

Table 3.8: SuDS for Interception Storage

| Systems     | Reasoning                                 |   |
|-------------|-------------------------------------------|---|
| Green roofs | All surfaces that have green / blue roofs | X |

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

### 3.10 Post-Development Surface Water Volume

In line with the Non-Statutory Technical Standard for Sustainable Drainage S4 – S6 (Volume Control), where reasonably practicable, for brownfield developments the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6-hour rainfall event should be matched as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

Where there is an increase in the volume of run-off as a result of the development, infiltration or other SuDS techniques should be considered to mitigate volume run-off. However due to the underlying ground conditions (chalk dissolution risk), infiltration techniques have not been considered. As the site impermeability is reduced post development, with further reduction in discharge rate compared to the existing brownfield rate, this criteria is deemed to comply.

### 3.11 Design Exceedance

In line with the Non-Statutory Technical Standard for Sustainable Drainage S7 – S9 (Flood Risk), adequate drainage / SuDS provision will be made on site to manage runoff for up to the 1:100year + 40% event.

In the event that flows from rainfall exceeding the 1 in 100-year + climate change rainfall event or system failure occur through lack of maintenance, surface water run-off will be directed via exceedance routes away buildings into designated area, such as parking and swales.

Appropriate overland flow routes and raised property threshold will ensure that no internal flooding of properties will occur.

See **Appendix G** for Overland Flow Route Plan.

### 3.12 Water Quality

The simple index approach has been used as the approach to water quality risk management on this project.

The pollution hazard indices identified for land use classifications within this project (as identified in table 26.2 of Ciria C753 - The SuDS Manual) are as follows;

Table 3.9: Pollution hazard indices

| Pollution hazard indices for different land use classifications in accordance with CIRIA C753 - The SuDS Manual. Table 26.2                                                                                                                                                                                  |          |     |                                                                            |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----|----------------------------------------------------------------------------|--------------|
| Land Usage                                                                                                                                                                                                                                                                                                   | Level    | TSS | Metals                                                                     | Hydrocarbons |
| Residential roofs                                                                                                                                                                                                                                                                                            | Very Low | 0.2 | 0.2                                                                        | 0.05         |
| Other roofs (typically commercial / industrial roofs)                                                                                                                                                                                                                                                        | Low      | 0.3 | 0.2 (up to 0.8 where there is potential for metals to leach from the roof) | 0.05         |
| Individual property driveways, residential car parks, low traffic roads (e.g., cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g., schools, offices) i.e., <300 traffic movements/day                                                            | Low      | 0.5 | 0.4                                                                        | 0.4          |
| Commercial yard and delivery areas, non-residential car parking with frequent change (e.g., hospitals, retail), all roads except low traffic roads and trunk roads / motorways                                                                                                                               | Medium   | 0.7 | 0.6                                                                        | 0.7          |
| Sites with heavy pollution (e.g., haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways | High     | 0.8 | 0.8                                                                        | 0.9          |

The indicative SuDS mitigation indices for discharges to surface for this project (as identified in table 26.3 of The SuDS Manual), are as follows;

Table 3.10: SuDS pollution mitigation for discharge to surface waters

| Indicative SuDS mitigation indices for discharge of surface water |                                                                                                                                                                                                                                              |        |              |
|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------|
|                                                                   | Mitigation indices                                                                                                                                                                                                                           |        |              |
| Type of SuDS component                                            | TSS                                                                                                                                                                                                                                          | Metals | Hydrocarbons |
| Filter strip                                                      | 0.4                                                                                                                                                                                                                                          | 0.4    | 0.5          |
| Filter drain                                                      | 0.4                                                                                                                                                                                                                                          | 0.4    | 0.4          |
| Swale                                                             | 0.5                                                                                                                                                                                                                                          | 0.6    | 0.6          |
| Bioretention system                                               | 0.8                                                                                                                                                                                                                                          | 0.8    | 0.8          |
| Permeable pavement                                                | 0.7                                                                                                                                                                                                                                          | 0.6    | 0.7          |
| Detention basin                                                   | 0.5                                                                                                                                                                                                                                          | 0.5    | 0.6          |
| Pond                                                              | 0.7                                                                                                                                                                                                                                          | 0.7    | 0.5          |
| Wetland                                                           | 0.8                                                                                                                                                                                                                                          | 0.8    | 0.8          |
| Proprietary treatment systems                                     | These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately 1 in 1 year return period event, for inflow concentration relevant to the contributing drainage area |        |              |

Based on low pollution land use, a combination of dry swale and permeable paving with catch pits is deemed to comply with the water quality criteria in line with Ciria C753 - The SuDS Manual guidance.

Consideration will be given to both during construction and post-development water quality treatment to ensure that water quality is not impacted during the construction works:

### *3.12.1 Quality of Surface Water Run-off: Post-Development*

In accordance with Environment Agency Document PPG3 (now withdrawn but considered best practice guidance) the proposed as the car park is less than 50 spaces or 800m<sup>2</sup> it is considered to be 'low risk' in terms of pollution to the surface water network and as such an oil interceptor is deemed to be required.

Gullies and drainage channels will be specified with silt traps and catch pits will be incorporated in the drainage system to reduce the risk of silts / salts getting into the surface water network.

### *3.12.2 Quality of Surface Water Run-off: During Construction*

It is anticipated that the during construction adequate provisions will be put in place to ensure the existing drainage is protected to prevent material which could have a negative impact on water quality entering the system. The appointed contractor(s) would be required to implement a Construction Environmental Management Plan (CEMP) for the construction works which will detail the procedures and methods that must be followed to minimise the potential environmental effects of construction activities at the site.

## 4. FOUL WATER MANAGEMENT STRATEGY

### 4.1 Pre-Development Foul Water Drainage

As discussed in Para 2.3 above, there is a 150mm sewer in Amethyst Lane to the south, which ultimately connects into a 225mm dia. foul sewer running along Liebenrood Road to the west. The drainage and utilities survey undertaken showed a foul connection from the site running towards this sewer in Amethyst Lane.

See **Appendix C** for Sewer Asset Map and **Appendix E** for Existing Drainage Layout.

### 4.2 Post-Development Foul Water Drainage

The below-ground foul drainage system will connect all new soil, waste and ventilating pipes, sanitary appliances and gullies at ground level and discharge to a chamber outside each plot. The drainage will then run south beneath the site access road to eventually discharge into the public foul sewer located in Amethyst Lane. Refer to **Appendix H** for the Drainage Strategy.

Based on levels of the connecting foul sewer (site level 58.00m minimum, IL 56.27m), it will possible to achieve a gravity connection into this system.

The design of all foul sewers and lateral drains must conform to BS EN 752, BS EN 16933, Building Regulations 2010 Part H, planning policy and best practice guidelines (such as Sewers for Adoption 7th Edition) wherever applicable. Sanitary systems within building should be designed in accordance with BS EN 12056-2.

### 4.3 Post-Development Foul Water Flow Rates

The assessment of the proposed foul flow rates takes into account both daily average volumes and estimated peak flow rates.

The peak design flow rates should be calculated using Sewerage Sector Guidance Appendix C as below.

#### Residential Units

Flow per dwelling = 4000 litres/day (0.046 litres/sec)

Number of dwellings on site = 17 dwellings + 6 units (respite centre)

Design Flow rate = 1.06 litres/sec

A preliminary response from Thames Water has confirmed that foul sewerage capacity will not be a concern. Refer to **Appendix C**.

## 5. OWNERSHIP AND MAINTENANCE

Ownership and maintenance liabilities for the foul and surface water drainage system will be clearly defined so that in the event of failure the drainage system appropriate action can be taken to ensure that the drainage system continues to work efficiently.

### 5.1 Adoption & Ownership

It is the intention that the onsite drainage / SuDS system is adopted by a responsible body (NAV or Reading Borough Council LLFA following the implementation of Schedule 3 of the FMA).

The adopting body together with Thames Water and Local Highway Authority will need to agree on the final design and type of SuDS system to be implemented. Currently, Local Highway Authority do not adopt roads draining to a private system. Thames Water do not adopt SuDS features apart from piped networks and below ground tanks.

Alternatively, maintenance will be undertaken via the engagement of a private management company.

### 5.2 Maintenance Routine

Regular inspection and maintenance are important for the effective operation of SuDS systems as designed. The proposed SuDS features will require maintenance including litter and debris removal, sediment removal, vegetation maintenance and remediation to any damaged structures.

Regular maintenance of SuDS should be carried out in line with the C753 The SuDS Manual or as per manufacturer's specification, as outlined in tables below.

Table 5.1: Proposed Schedule for Maintenance of Cellular Tanks

| Underground Cellular Tanks - Operation and maintenance requirements in accordance with CIRIA C753 - The SuDS Manual |                                                                                                                                                                                                       |                                      |
|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| <u>Maintenance Schedule</u>                                                                                         | <u>Required Action</u>                                                                                                                                                                                | <u>Frequency</u>                     |
| <b>Regular maintenance</b>                                                                                          | Inspect and identify any areas that are not operating correctly. If required, take remedial action.                                                                                                   | Monthly for 3 months, then annually. |
|                                                                                                                     | Remove debris from the catchment surface (where it may cause risks to performance).                                                                                                                   | Monthly.                             |
|                                                                                                                     | For systems where rainfall infiltrates into the tank from above, check surface or filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary | Annually.                            |
|                                                                                                                     | Remove sediment from pre-treatment structures and / or internal forebays.                                                                                                                             | Annually, or as required.            |
| <b>Remedial actions</b>                                                                                             | Repair / rehabilitate inlets, outlet, overflows and vents.                                                                                                                                            | As required.                         |
| <b>Monitoring</b>                                                                                                   | Inspect / check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.                                                                         | Annually.                            |
|                                                                                                                     | Survey inside of tank for sediment build-up and remove if necessary.                                                                                                                                  | Every 5 years or as required.        |
| Reference should be made to the manufacturer recommendations where applicable                                       |                                                                                                                                                                                                       |                                      |

Table 5.2: Proposed Schedule for Maintenance of Swales

| Swale - Operation and maintenance requirements in accordance with CIRIA C753 - The SuDS Manual |                        |                  |
|------------------------------------------------------------------------------------------------|------------------------|------------------|
| <u>Maintenance Schedule</u>                                                                    | <u>Required Action</u> | <u>Frequency</u> |

|                        |                                                                                                                                         |                                                                                      |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Regular maintenance    | Remove litter and debris                                                                                                                | Monthly, (or as required).                                                           |
|                        | Cut grass - to retain height within specified design range                                                                              | Monthly (during growing season), or as required.                                     |
|                        | Manage other vegetation and remove nuisance plants.                                                                                     | Monthly (at start, then as required).                                                |
|                        | Inspect inlets, outlets and overflows for blockages, and clear if required.                                                             | Monthly.                                                                             |
|                        | Inspect infiltration surfaces for ponding, compaction, silt accumulation. Record areas where water is ponding for > 48 hours.           | Monthly, or when required.                                                           |
|                        | Inspect vegetation coverage                                                                                                             | Monthly for 6 months, quarterly for 2 years, then half early.                        |
|                        | Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.                              | Half yearly.                                                                         |
| Occasional maintenance | Re-seed areas of poor vegetation growth, alter plant types to better suit conditions, if required                                       | As required or if bare soil is exposed over 10% or more of the swale treatment area. |
| Remedial actions       | Repair erosion or other damage by re-turfing or reseeded.                                                                               | As required.                                                                         |
|                        | Relevel uneven surfaces and reinstate design levels                                                                                     | As required.                                                                         |
|                        | Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface. | As required.                                                                         |
|                        | Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip.                                         | As required.                                                                         |
|                        | Remove and dispose of oils or petrol residues using safe standard practices.                                                            | As required.                                                                         |

Table 5.3: Proposed Schedule for Maintenance of Permeable Paving

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

|                                                                                      |                                                                                                |                                                                                                           |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
|                                                                                      | Rehabilitation of surface and upper substructure by remedial sweeping.                         | Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging). |
| <b>Monitoring</b>                                                                    | 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.                                                                                                 |
| <b>Reference should be made to the manufacturer recommendations where applicable</b> |                                                                                                |                                                                                                           |

Table 5.4: Proposed Schedule for Maintenance of Other Drainage Components

| <b>Other Drainage Items - Ownership &amp; Maintenance Responsibility Matrix</b> |                                   |                                                                                       |
|---------------------------------------------------------------------------------|-----------------------------------|---------------------------------------------------------------------------------------|
| <u>Feature</u>                                                                  | <u>Maintenance</u>                | <u>Frequency</u>                                                                      |
| <b>Private Drains</b>                                                           | Inspection                        | CCTV survey every 5-10 years.                                                         |
|                                                                                 | Regular Maintenance               | Jet clean system fully every 5-10 years. (Recommend prior to CCTV drainage survey is) |
|                                                                                 | Remedial / Occasional Maintenance | Carry out remedial works as identified in CCTV survey.                                |
| <b>Discharge orifice manholes/flow control devices</b>                          | Inspection                        | Quarterly                                                                             |
|                                                                                 | Regular Maintenance               | Remove silt and debris as necessary to prevent build up.                              |
| <b>Gully / Drainage Channels</b>                                                | Inspection                        | Quarterly                                                                             |
|                                                                                 | Regular Maintenance               | Remove silt and debris as necessary to prevent build up.                              |

The following information should be passed to the development operator to ensure that future maintenance is carried out in a safe and proper manner.

A formal review of the risks should be undertaken on an annual basis. All inspection and maintenance works should take into consideration the implications of 'lone working'. An assessment should be carried out and the risks mitigated accordingly.

Table 5.5: Proposed Operational Schedule for Below Ground Drainage

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

|                                       |                                  |                                                                        |
|---------------------------------------|----------------------------------|------------------------------------------------------------------------|
|                                       | 2. Open Water                    | 2. To be carried out by appropriately trained personnel                |
| Removal of silt from drainage channel | 1. Risk to members of the public | 1. Access to hazardous areas by members of the public to be prohibited |

## 6. CONSENT / PLANNING

Summary of expected consents required:

- Ordinary Watercourse Consent – Not required.
- **Sewerage Undertaker Consent – Required.**
- **Section 104 / 106 Drainage Adoption - Required.**

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

## 7. CONCLUSION

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

- The development is on a previously developed land, which will reduce site impermeability and discharge rates with the use of SuDS when compared to the existing brownfield site.
- Attenuation will be provided within dry swales, cellular tank and permeable paving prior to discharging into the public sewerage system at of 5l/s maximum. Due to the space and level constraints, these are the only SuDS elements that can feasibly be considered.
- The proposed discharge location is into the foul manhole 4601 located within Amethyst Lane to the south (subject to agreement with Thames). Due to the shallow nature of the surface water system and constraints on land raising, connection into the foul sewer has been proposed. This is subject to further discussion with Thames Water. Alternatively, a pumped option can be investigated.
- All surface water run-off from storm events up to and including the 100-year plus 40% climate change will be retained within the overall site.
- In the event that flows from rainfall exceed the 1 in 100-year + climate change rainfall event or system failure occur through lack of maintenance, surface water run-off will be directed via exceedance routes away buildings and/or critical infrastructure towards low risk areas, parking, green spaces
- Foul flows will be discharged into the foul sewer located at Amethyst Lane in agreement with Thames Water.
- Regular maintenance of SuDS components be carried out in line with the C753 The SuDS Manual or as per manufacturer's specification. The onsite drainage system to be offered for adoption by a responsible body (potentially a NAV or Reading LLFA) subject to further discussion. Currently, Thames Water do not adopt SuDS features (apart from pipes, manholes and tanks); the Highway Authority do not adopt roads draining to a private drainage system.
- The use of permeable paving and swales for rainwater run-off mitigation, satisfies the water quality criteria of document Ciria C753 - The SuDS Manual.

## Appendix A

### *Topographical / Utilities & Drainage Survey*

# PAS 128: 2014 QUALITY LEVEL GUIDE

| Q-LEVEL | DESCRIPTION                                                                               | ACC.                | Q-LEVEL | DESCRIPTION                                                                                          |
|---------|-------------------------------------------------------------------------------------------|---------------------|---------|------------------------------------------------------------------------------------------------------|
| Q1-D    | Service positions taken from records.                                                     | Disallowed          | Q1-B2   | Horizontal & vertical location using only one geophysical technique.                                 |
| Q1-C    | Visual evidence of service existence but undetectable by geophysical technology.          | Disallowed          | Q1-B1   | Horizontal & vertical location using multiple geophysical techniques.                                |
| Q1-B4   | Undetectable service present shown as an assumed route. (20%)                             | At or above 75% N/A | Q1-A    | Horizontal & vertical position verification by open excavation, manholes and/or inspection chambers. |
| Q1-B3   | Horizontal location by one geophysical technique but with some or poor depth information. |                     |         |                                                                                                      |

## DETECTION METHOD IN ACCORDANCE WITH PAS 128: 2014 SURVEY TYPE B

### DRAINAGE SURVEY

All accessible Manholes and Inspection chambers have had their respective covers lifted with pipe sizes, inverts, chamber sizes/types and service data recorded from ground level. All connections from DPs, Gullies, Drains, VPs, RE's and manholes have been proven wherever possible using audible connections (AC) and/or sonde instrumentation where applicable. Where these methods have proved unsuccessful then assumed (AR) straight line connections will be shown.

### CCTV DRAINAGE SURVEY

All accessible Manholes and Inspection chambers have had their respective covers lifted with pipe sizes, inverts, chamber sizes/type and service data recorded from ground level. Pipework has been traced, accessed and collected for post processing. Drainage layout, including manhole covers not located by topographical survey, may be taken from CCTV chainage and will be shown as indicative only.

### Electricity

Elec cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required.

### British Telecoms

BT cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required. Due to current laws and legislation protecting all BT apparatus, cabling can only be located remotely. We therefore compare all our telecom findings against record information to produce the final service layout. In some instances, where high amount of cable ducts are present, we may only be able to identify a linear centre peak signal rather than identifying all the individual duct positions. For further information regarding Telecoms apparatus, please contact Openreach directly.

### Cable TV & Communications

CTV and/or Com cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required.

### Fibre Optic

FO cables will have been predominantly located using GPR methodology. This is due to the materials used within fibre optic cabling. In some rare instances, tracer cabling or conductible non fibre optic cabling will be present within some or all ducting. When this is the case, both EML and GPR methodology will be combined to identify service network and achieve greater quality levels.

### Lighting, Traffic Signal & Security Cables

LC, TS and/or Sec cables will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required.

### Gas & Water Inc. Fuel Pipes and Hot Water Pipes

GM/GS and/or WMWS pipe work will have been attempted and located using both EML & GPR methodology with electronically derived depths shown for the former and depths to crown levels shown for the latter. When the Gas/Water pipe work is constructed using conductive materials, then we are able to employ multiple geophysical techniques to identify service network and achieve greater quality levels. When a non conductive material is used, GPR methodology will be employed to locate and plot the final service layout.

### Ground Penetrating Radar

GPR methodology is used to identify and locate all non metallic, non conductible piping and cabling. We also employ GPR to obtain a greater accuracy levels on EML located services. The GPR has a greater success rate on pipe or service diameter upward of Ø63mm, Ø63mm, as size increments increase, so does the chance of detection. The GPR can produce varying results and as such, wouldn't be used as an independent utility surveying instrument.

### Unidentified Traces

All UTs will have been predominantly located using EML methodology with electronically derived depths shown. GPR techniques will be employed to achieve greater quality levels as required. Every effort has been made to identify the service but in this instance, is not achievable. We recommend excavation work to determine identity and depth where applicable.

### Scarring (Q1-C)

Scarring has been identified on site with a potential of an undetectable service present.

### Assumed Routes & Taken from Records (Q1-B4/D)

Assumed routes (AR) are shown if there is evidence that a service exists but we are unable to trace it whilst on site. The surveyor will attempt to locate various (service evidence) etc. around site area to successfully determine an assumed route between these points. If there is little evidence on site but they believe a service is still present, then a common sense approach to an assumed route shall be employed.

Taken from records (TFR) are service routes that are taken from STAT record plans or previous survey information overlaid onto our drawings.

## SURVEY RECOMMENDATIONS

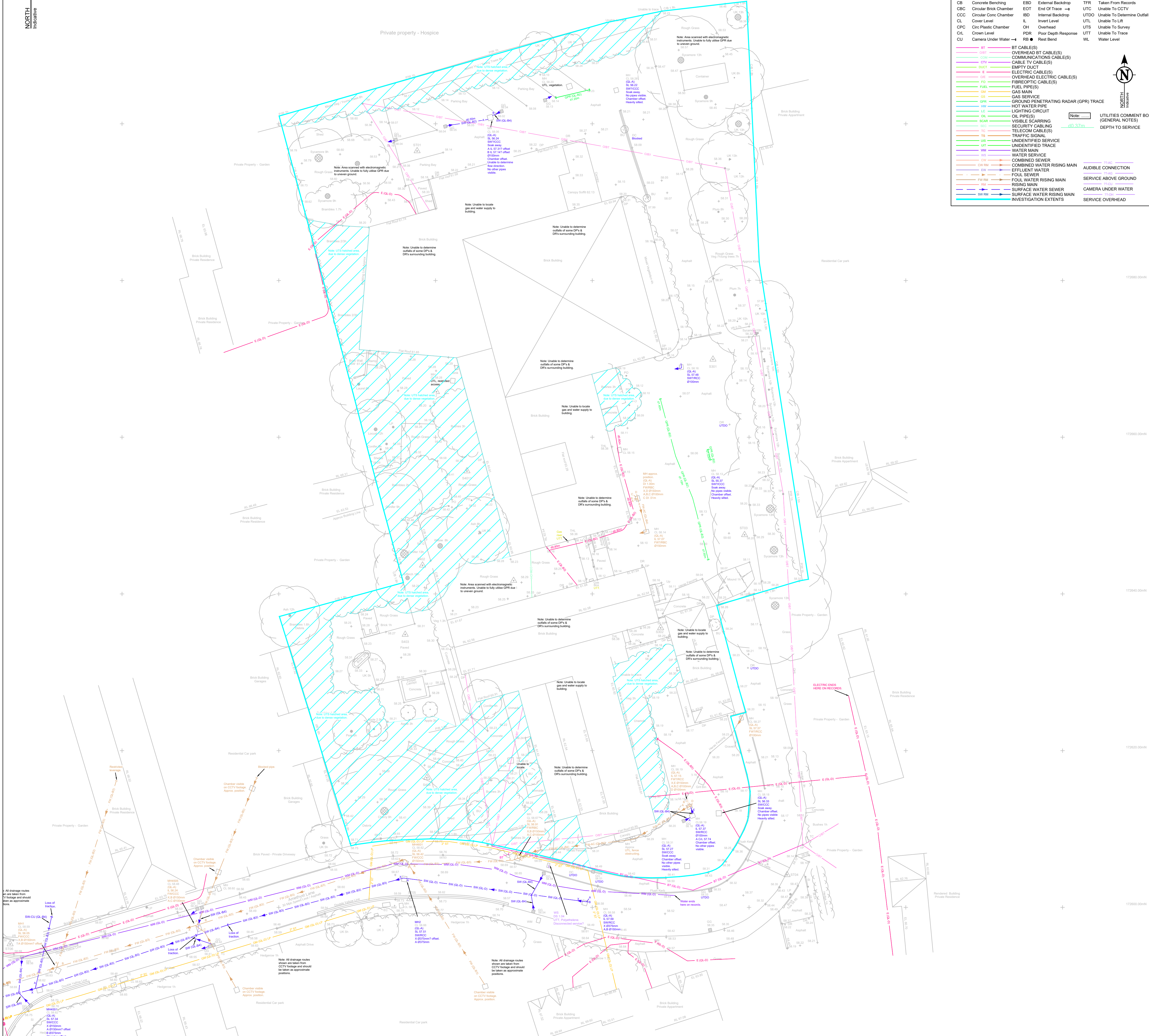
The areas of dense vegetation to be cleared to allow access if any of these areas are deemed critical or of high importance.

To undertake a CCTV drainage survey of the entire site area to establish a more comprehensive drainage network, and asset condition of the pipework.

The sewers with high levels of silt or blockages to be jetted to extend the CCTV drainage survey, if any of these areas are deemed critical or of high importance.

We recommend full statutory record information be obtained to confirm site findings and to position undetectable which may be present.

Due to the geophysical nature of subsurface technology, we always recommend excavation works to be carried out within critical areas for verification and to eliminate the possibility of undetectable services present.



## UTILITIES & UNDERGROUND INVESTIGATIONS

### DRAWING NOTES

All below ground details shown have been identified from above ground without excavation. Survey Solution use electro-magnetic and/or ground penetrating radar (GPR) methods to investigate for underground utilities, services and features. Results using these methods are not infallible and we recommend trial excavations are carried out to confirm any identifications, positions and depths.

Any areas on the drawing where services or features have not been shown are not necessarily clear of services or features but are an indication that no items have been identified during our investigations. All reasonable care and normal good practice should still be employed during design and construction processes.

Certain types of services such as plastic or concrete pipes, some conduit and ducting where direct access was not achieved for tracing may not be shown and alternative locating methods should be used.

Survey Solutions has used all reasonable care to research available service records but the completeness or use of the service records supplied to or by Survey Solutions cannot be guaranteed. Therefore Survey Solutions cannot be held responsible for any features annotated as 'taken from records' (TFR).

Depths obtained using electro-magnetic or GPR are effected by ground conditions and should be treated as indicative only. Electro-magnetic depths to utilities and services are generally taken to the centre of a feature. GPR depths to the top of a feature and drainage depth shown to inverts, unless otherwise indicated.

Drainage pipe sizes will be obtained without entering the chamber and therefore should be treated as approximate. Pipe dimensions which have not been obtained visually will be taken from records when available.

All services, drainage and utilities routes are assumed straight between access points, unless otherwise stated. The numbers of cables in runs will not be shown unless specifically requested. All services are below ground unless indicated.

Services, utilities and features may not have been surveyed if obstructed or not reasonably visible or accessible at the time of survey.

Survey Solutions accept no responsibility for the completeness or accuracy of either the topographical survey or base mapping on this project.

All critical dimensions and measurements should be checked and verified with any errors or discrepancies notified to Survey Solutions immediately. The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work.

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Do not scale from this drawing.

## GENERAL SYNOPSIS

This survey has been carried out in accordance with PAS 128: 2014 & our version of the Royal Institution of Chartered Surveyors (RICS) specification for Measured Surveys of Land, Buildings and Utilities. Our survey extents have been agreed and confirmed with formal acceptance of 43954BWUG from Gleds Management Services Ltd. If you have any queries regarding the final services layout, please may we ask you to carefully read all the information within this title block in its entirety before continuing to do so.

| TOPOGRAPHICAL/DWG DRAWING INFORMATION |                  |                          |
|---------------------------------------|------------------|--------------------------|
| TOPOGRAPHICAL SURVEY DATE 19/08/2022  |                  |                          |
| SURVEY TYPE                           | DESCRIPTION      | EFFECT ON SURVEY RESULTS |
| TOPO                                  | Survey Solutions | None                     |
| OUTDATED                              |                  |                          |
| OS                                    |                  |                          |
| NTS                                   |                  |                          |

| GENERAL SITE CONDITIONS |                          |
|-------------------------|--------------------------|
| AVERAGE                 |                          |
| ADDITIONAL INFORMATION  | EFFECT ON SURVEY RESULTS |
|                         |                          |
|                         |                          |
|                         |                          |

| DESKTOP UTILITY RECORDS (PAS 128: 2014 SURVEY TYPE D) |              |                          |
|-------------------------------------------------------|--------------|--------------------------|
| PREREQUISITE FOR PAS 128: 2014 SURVEY TYPE B          |              |                          |
| COMMISSIONED: NO                                      |              |                          |
| UTILITY                                               | AVAILABILITY | UTILITY COMPANY PROVIDER |
| SEWER                                                 | NO           | N/A                      |
| WATER MAIN                                            | NO           | N/A                      |
| GAS MAIN                                              | NO           | PUBLIC                   |
| TELECOM                                               | NO           | N/A                      |
| CABLE TV                                              | NO           | N/A                      |
| ELECTRICITY                                           | NO           | N/A                      |
| OIL PIPES                                             | NO           | N/A                      |
| OTHER                                                 | NO           | N/A                      |

| B   | CCTV DRAINAGE INFORMATION ADDED | S/JH  | AJM     | G/SB | 14/03/2022  |
|-----|---------------------------------|-------|---------|------|-------------|
| A   | UTILITY RECORDS ADDED           | RJB   | JAB     | G/SB | 31/10/2022  |
| REV | DESCRIPTION                     | DRAWN | CHECKED | APPR | SURVEY DATE |

# SURVEY SOLUTIONS

**LAND SURVEYING**  
**BUILDING SURVEYING**  
**UNDERGROUND SURVEYING**  
**SITE ENGINEERING**  
**MONITORING**

**0845 040 5969**  
**survey-solutions.co.uk**

**IPSWICH BEDFORD COVENTRY GLASGOW LONDON MANCHESTER NORMICH NOTTINGHAM YEOUL**

| PROJECT TITLE                                |             |            |             |            |  |
|----------------------------------------------|-------------|------------|-------------|------------|--|
| AMETHYST LANE, READING, BERKSHIRE, RG30 2EZ. |             |            |             |            |  |
| DRAWING DETAIL                               |             |            |             |            |  |
| UTILITIES AND DRAINAGE SURVEY.               |             |            |             |            |  |
| SHEET 1 OF 2                                 |             |            |             |            |  |
| CLIENT                                       |             |            |             | SCALE      |  |
| GLEEDS MANAGEMENT SERVICES LTD               |             |            |             | 1:250      |  |
| SURVEYOR                                     | SURVEY DATE | CHECKED BY | APPROVED BY | DWG STATUS |  |
| RJB                                          | 23/09/2021  | AJM        | GSB         | FINAL      |  |
| DRAWING NUMBER                               | REVISION    |            |             | ISSUE DATE |  |
| 43954BWUG-01                                 | B           |            |             | 26/09/2022 |  |





## Appendix B

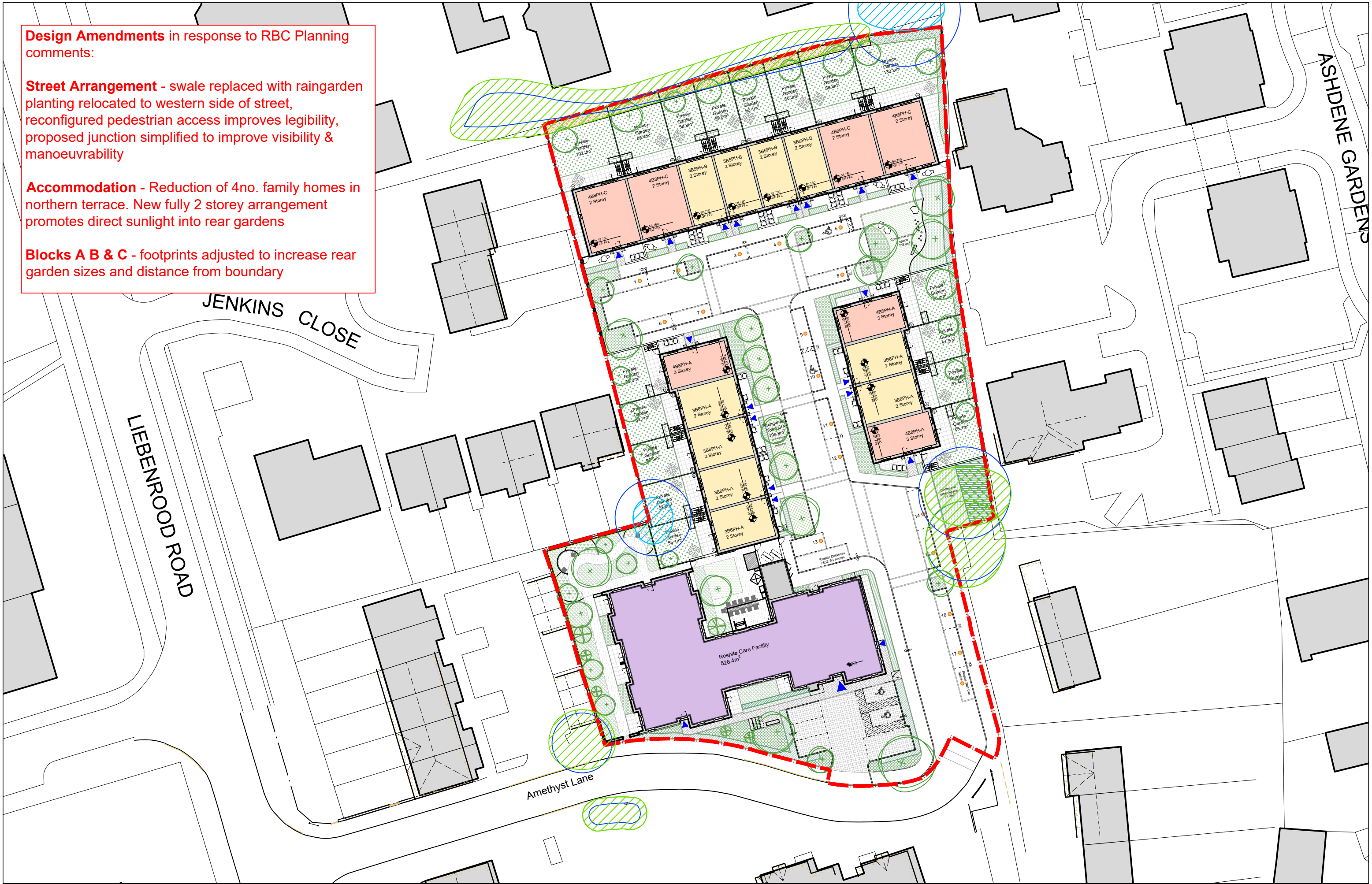
### *Architects Layout*

**Design Amendments** in response to RBC Planning comments:

**Street Arrangement** - swale replaced with raingarden planting relocated to western side of street, reconfigured pedestrian access improves legibility, proposed junction simplified to improve visibility & manoeuvrability

**Accommodation** - Reduction of 4no. family homes in northern terrace. New fully 2 storey arrangement promotes direct sunlight into rear gardens

**Blocks A B & C** - footprints adjusted to increase rear garden sizes and distance from boundary



| Rev | Date     | Drawn | Description                                                  |
|-----|----------|-------|--------------------------------------------------------------|
| A   | 01.12.22 | JCD   | Initial Issue                                                |
| B   | 07.12.22 | JCD   | Updated Respite footprint, Minor amends                      |
| C   | 03.01.23 | JCD   | Updated Respite footprint, Straightened Eastern terrace      |
| D   | 10.01.23 | JCD   | Updated Respite plan, Minor layout amends, Design Team Issue |
| E   | 03.02.23 | JCD   | Layout Amends, introduction of 3B5PH-A, Design Team Issue    |
| F   | 14.02.23 | JCD   | Minor Amends                                                 |
| G   | 21.02.23 | DEG   | FPL Amends                                                   |
| H   | 06.03.23 | TBD   | Updated Respite footprint, front gardens and footpath        |
| I   | 06.04.23 | ALA   | DRAFT Issue For Planning                                     |
| J   | 02.05.23 | KDU   | Transport Amends                                             |
| K   | 09.05.23 | KDU   | Issue for Planning - Transport Amends                        |
| L   | 03.11.23 | DEG   | Planning Amendments (see notes)                              |
| M   | 17.11.23 | DEG   | Drainage, Site Levels & FFL Coordination                     |
| N   | 20.11.23 | DEG   | Respite Cycle Parking Amend                                  |
| O   | 22.11.23 | DEG   | Landscape Design Coordination                                |
| P   | 24.11.23 | DEG   | Permeable Paving Extents & Parking Designation Amends        |

Notes:

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

This drawing is the copyright of HTA Design LLP and must not be copied or reproduced in part or in whole, without the express permission of HTA Design LLP. Drawing to be read in conjunction with specification.

Legend

- Site Boundary
- Existing Tree - Cat B
- Existing Tree - Cat C
- RPA
- Proposed Tree
- 3B5P House
- 3B6P House
- 4B8P House
- Respite Care Facility
- Hedge Planting
- Biodiverse Raingarden Planting
- Lawn Planting to Rear Gardens
- Biodiverse Shrub Planting
- Active Charging Spaces
- Building Entrances

Proposed Site Plan

drawing title

Reading Borough Council  
234 Southcote Lane  
client / project

HTA-A\_DR\_0101

drawing number

1:500  
scale @ A3

RBC-ALR

project number

JCD

originated by

FOR PLANNING

status

HTA Design LLP  
www.hta.co.uk  
London | Edinburgh | Manchester | Bristol

NORTH

hta

## Appendix C

*Sewer Asset Map*

*Thames Water Pre-Development Enquiry*

National One Call Plan To Dig  
Mill Place  
1 Mill Road Industrial Estate  
WEST LOTHIAN  
EH49 7TL

**Search address supplied** Amethyst Lane  
Reading  
RG30 2EZ

**Your reference** NOC/NKVQS361

**Our reference** ALS/ALS Standard/2022\_4735244

**Search date** 17 October 2022

### 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](mailto:searches@thameswater.co.uk)  
[www.thameswater-propertysearches.co.uk](http://www.thameswater-propertysearches.co.uk)



0800 009 4540

**Search address supplied:** Amethyst Lane, Reading, RG30 2EZ

Dear Sir / Madam

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

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

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

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

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

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

### Contact Us

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

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

Email: [searches@thameswater.co.uk](mailto:searches@thameswater.co.uk)

Web: [www.thameswater-propertysearches.co.uk](http://www.thameswater-propertysearches.co.uk)

### Waste Water Services

**Please provide a copy extract from the public sewer map.**

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

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

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

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

For your guidance:

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

### Clean Water Services

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

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

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



For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

## **Payment for this Search**

A charge will be added to your suppliers account.

### Further contacts:

#### Waste Water queries

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

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

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

Tel: 0800 009 3921  
Email: [developer.services@thameswater.co.uk](mailto: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](mailto:developer.services@thameswater.co.uk)



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 469471,172649  
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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

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

| Manhole Reference | Manhole Cover Level | Manhole Invert Level |
|-------------------|---------------------|----------------------|
| 6401              | 57.84               | 56.13                |
| 6502              | 58.99               | n/a                  |
| 6550              | 58.98               | n/a                  |
| 651C              | n/a                 | n/a                  |
| 651B              | n/a                 | n/a                  |
| 651A              | n/a                 | n/a                  |
| 6501              | 57.66               | 54.64                |
| 561A              | 57.65               | 56.2                 |
| 561C              | 57.45               | 56.173               |
| 561B              | 57.385              | 55.9                 |
| 661A              | 57.355              | 55.8                 |
| 6650              | 57.37               | 55.85                |
| 661C              | 57.2                | 55.902               |
| 661B              | 57.4                | 54.911               |
| 6602              | 57.48               | 54.98                |
| 5617              | 57.43               | 56.23                |
| 5606              | 57.46               | 55.7                 |
| 5616              | 57.46               | 56.13                |
| 5605              | 57.51               | 55.43                |
| 6659              | 57.39               | 56.03                |
| 6658              | n/a                 | 56.08                |
| 6657              | 57.44               | 55.31                |
| 6656              | n/a                 | 55.15                |
| 6601              | 57.72               | 55.3                 |
| 6751              | 57.85               | 56.43                |
| 6702              | 57.82               | 56.01                |
| 571A              | n/a                 | n/a                  |
| 571B              | n/a                 | n/a                  |
| 6703              | n/a                 | n/a                  |
| 6701              | 59.19               | 57.12                |
| 6750              | 59.15               | 57.79                |
| 581A              | n/a                 | n/a                  |
| 581B              | n/a                 | n/a                  |
| 3504              | 58.59               | 56.19                |
| 3552              | 58.6                | 57.1                 |
| 3554              | 58.71               | 57.42                |
| 4401              | 56.64               | 53.14                |
| 4451              | 59.55               | 54.66                |
| 4403              | n/a                 | n/a                  |
| 4402              | 59.29               | 53.33                |
| 541A              | n/a                 | n/a                  |
| 541B              | n/a                 | n/a                  |
| 541C              | n/a                 | n/a                  |
| 6402              | 59.26               | n/a                  |
| 3802              | 60.57               | 59.33                |
| 3851              | 60.11               | 58.07                |
| 38NC              | n/a                 | n/a                  |
| 38MN              | n/a                 | n/a                  |
| 3801              | 59.64               | 57.7                 |
| 3850              | 59.6                | 58.24                |
| 38MM              | n/a                 | n/a                  |
| 481D              | n/a                 | n/a                  |
| 481C              | n/a                 | n/a                  |
| 48NF              | n/a                 | n/a                  |
| 48ND              | n/a                 | n/a                  |
| 481B              | n/a                 | n/a                  |
| 48NC              | n/a                 | n/a                  |
| 48MN              | n/a                 | n/a                  |
| 48ML              | n/a                 | n/a                  |
| 48MK              | n/a                 | n/a                  |
| 48MM              | n/a                 | n/a                  |
| 4801              | 59.36               | 58.23                |
| 361H              | n/a                 | n/a                  |
| 361B              | n/a                 | n/a                  |
| 361C              | n/a                 | n/a                  |
| 3750              | 60.38               | 57.98                |
| 3702              | 60.27               | 57.15                |
| 3751              | 60.14               | 58.03                |
| 361G              | n/a                 | n/a                  |
| 37NE              | n/a                 | n/a                  |
| 3650              | 58.99               | 57.46                |
| 37NF              | n/a                 | n/a                  |
| 37NH              | n/a                 | n/a                  |
| 3604              | 58.98               | 56.09                |
| 3605              | 58.98               | 56.25                |
| 361A              | n/a                 | n/a                  |
| 471A              | n/a                 | n/a                  |
| 471B              | n/a                 | n/a                  |
| 5716              | 57.77               | 56.77                |
| 5705              | 57.73               | 56.71                |
| 5715              | 57.73               | 56.71                |
| 5704              | 57.75               | 56.57                |
| 5714              | 57.58               | 56.59                |
| 5703              | 57.67               | 56.45                |
| 5701              | 57.53               | 56.26                |
| 5712              | 57.5                | 56.46                |
| 5609              | 57.49               | 56.04                |
| 5608              | 57.52               | 55.95                |
| 5618              | 57.47               | 56.28                |
| 5607              | 57.49               | 55.79                |
| 261A              | n/a                 | n/a                  |

| Manhole Reference                                                                                                                                                                                                                                                                                                                                                                                                      | Manhole Cover Level | Manhole Invert Level |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------|
| 361K                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 3510                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.12               | 56.98                |
| 361J                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 361I                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 3502                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.63               | 57                   |
| 3550                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.34               | 57.35                |
| 3508                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 3509                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.19               | 56.7                 |
| 3501                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.35               | 56.73                |
| 361D                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 361E                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 361F                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 361L                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 361M                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 361N                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 3603                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.33               | 56.42                |
| 3553                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.85               | 57.62                |
| 361P                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 361O                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 3505                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.69               | 57.61                |
| 3506                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.68               | 55.96                |
| 3551                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.78               | 57.12                |
| 3503                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.74               | 55.7                 |
| 3507                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.78               | 55.8                 |
| 4550                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.9                | 57.04                |
| 4503                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.82               | n/a                  |
| 4551                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.45               | 57.17                |
| 4501                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.99               | 55.41                |
| 4505                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.45               | 55.9                 |
| 4601                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 3451                                                                                                                                                                                                                                                                                                                                                                                                                   | 59.12               | 54.27                |
| 3452                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 341B                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 3453                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.82               | 56.53                |
| 341C                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 3454                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.71               | 56.68                |
| 341A                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 3401                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.63               | 57.15                |
| 3402                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.56               | 56.49                |
| 3455                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.52               | 56.91                |
| 2501                                                                                                                                                                                                                                                                                                                                                                                                                   | 58.61               | 57.11                |
| 4850                                                                                                                                                                                                                                                                                                                                                                                                                   | 59.35               | 58.65                |
| 4802                                                                                                                                                                                                                                                                                                                                                                                                                   | 59.4                | 58.29                |
| 4803                                                                                                                                                                                                                                                                                                                                                                                                                   | 59.2                | 58.51                |
| 481A                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 5802                                                                                                                                                                                                                                                                                                                                                                                                                   | 60.01               | n/a                  |
| 5851                                                                                                                                                                                                                                                                                                                                                                                                                   | 60.27               | 58.99                |
| 5850                                                                                                                                                                                                                                                                                                                                                                                                                   | 60.51               | 58.86                |
| 5801                                                                                                                                                                                                                                                                                                                                                                                                                   | 60.13               | 57.84                |
| 68NK                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 68NJ                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 68NH                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 6801                                                                                                                                                                                                                                                                                                                                                                                                                   | n/a                 | n/a                  |
| 7801                                                                                                                                                                                                                                                                                                                                                                                                                   | 60.28               | 56.68                |
| 7850                                                                                                                                                                                                                                                                                                                                                                                                                   | 60.31               | 57.56                |
| The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken. |                     |                      |



# Asset Location Search - Sewer Key

## Public Sewer Types (Operated and maintained by Thames Water)

|                                                                                   |                                                                                                                                                   |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>Foul Sewer:</b> A sewer designed to convey waste water from domestic and industrial sources to a treatment works.                              |
|  | <b>Surface Water Sewer:</b> A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses. |
|  | <b>Combined Sewer:</b> A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.   |
|  | <b>Storm Sewer</b>                                                                                                                                |
|  | <b>Sludge Sewer</b>                                                                                                                               |
|  | <b>Foul Trunk Sewer</b>                                                                                                                           |
|  | <b>Surface Trunk Sewer</b>                                                                                                                        |
|  | <b>Combined Trunk Sewer</b>                                                                                                                       |
|  | <b>Foul Rising Main</b>                                                                                                                           |
|  | <b>Surface Water Rising Main</b>                                                                                                                  |
|  | <b>Combined Rising Main</b>                                                                                                                       |
|  | <b>Vacuum</b>                                                                                                                                     |
|  | <b>Thames Water Proposed</b>                                                                                                                      |
|  | <b>Vent Pipe</b>                                                                                                                                  |
|  | <b>Gallery</b>                                                                                                                                    |

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

|                                                                                     |                                                              |                                                                                     |                                                                |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------|
|  | <b>Sewer</b>                                                 |  | <b>Culverted Watercourse</b>                                   |
|  | <b>Proposed</b>                                              |  | <b>Decommissioned Sewer</b>                                    |
|  | <b>Content of this drainage network is currently unknown</b> |  | <b>Ownership of this drainage network is currently unknown</b> |

### Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plan are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

## Sewer Fittings

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

|                                                                                   |                  |                                                                                     |              |
|-----------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------------|--------------|
|  | <b>Air Valve</b> |  | <b>Meter</b> |
|  | <b>Dam Chase</b> |  | <b>Vent</b>  |
|  | <b>Fitting</b>   |                                                                                     |              |

## Operational Controls

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

|                                                                                   |                      |                                                                                     |                  |
|-----------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------|------------------|
|  | <b>Ancillary</b>     |  | <b>Drop Pipe</b> |
|  | <b>Control Valve</b> |  | <b>Weir</b>      |

## 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.

|                                                                                     |                      |                                                                                       |                |
|-------------------------------------------------------------------------------------|----------------------|---------------------------------------------------------------------------------------|----------------|
|  | <b>Inlet</b>         |  | <b>Outfall</b> |
|  | <b>Undefined End</b> |                                                                                       |                |

## Other Symbols

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

|                                                                                     |                                           |                                                                                     |                                         |
|-------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------|
|  | <b>Change of Characteristic Indicator</b> |  | <b>Public / Private Pumping Station</b> |
|  | <b>Invert Level</b>                       |  | <b>Summit</b>                           |

## Areas

Lines denoting areas of underground surveys, etc.

|                                                                                     |                         |
|-------------------------------------------------------------------------------------|-------------------------|
|  | <b>Agreement</b>        |
|  | <b>Chamber</b>          |
|  | <b>Operational Site</b> |

## Ducts or Crossings

|                                                                                       |                       |                                                                               |
|---------------------------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------|
|    | <b>Casement</b>       | <b>Ducts may contain high voltage cables. Please check with Thames Water.</b> |
|  | <b>Conduit Bridge</b> |                                                                               |
|  | <b>Subway</b>         |                                                                               |
|  | <b>Tunnel</b>         |                                                                               |

5) 'na' or '0' on a manhole indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 469471, 172649.

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

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



# Asset Location Search - Water Key

## Water Pipes (Operated & Maintained by Thames Water)

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

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

## Valves

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

## Hydrants

- Single Hydrant

## Meters

- Meter

## End Items

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

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

## Operational Sites

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

## Other Symbols

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

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

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

## 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 <b>0800 009 4540</b> quoting your invoice number starting CBA or ADS / OSS | Account number<br><b>90478703</b><br>Sort code <b>60-00-01</b><br>A remittance advice must be sent to:<br><b>Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.</b><br>or email<br><a href="mailto:ps.billing@thameswater.co.uk">ps.billing@thameswater.co.uk</a> | By calling your bank and quoting:<br>Account number<br><b>90478703</b><br>Sort code <b>60-00-01</b><br>and your invoice number | Made payable to ' <b>Thames Water Utilities Ltd</b> '<br>Write your Thames Water account number on the back.<br>Send to:<br><b>Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW</b><br>or by DX to <b>151280 Slough 13</b> |

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



Jason Magee

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Merchant House North, Wapping Road  
Bristol, Avon  
BS1 4RW



13 March 2023

## Pre-planning enquiry: Confirmation of sufficient capacity (Both Foul and Surface water)

Dear Jason,

Thank you for providing information on your development on Amethyst Lane, Reading, RG30 2DX for the proposed developments of 21 general housing units to be build. An existing Respite centre (640 sqm) is to be demolished.

Proposed FW to be discharged into FWMH SU69724601 via gravity.

Proposed SW to be discharged into SWMH SU69724551 via gravity at 5l/s

Proposed impermeable area per connection 3423 sqm.

Existing runoff 1 in 1 at 32.16 l/s, 1 in 30 at 78.81 l/s, 1 in 100 at 102.02 l/s, 1 in 100yr +40% at NA

Proposed runoff 1 in 1 at 5 l/s, 1 in 30 at 5 l/s, 1 in 100 at 5 l/s, 1 in 100yr +40% CC at 5 l/s

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

### Foul Water

If your proposals progress in line with the details you've provided, we're pleased to confirm that there will be sufficient sewerage capacity in the adjacent foul water sewer network to serve your development.

This confirmation is valid for 12 months or for the life of any planning approval that this information is used to support, to a maximum of three years.

**You'll need to keep us informed of any changes to your design – for example, an increase in the number or density of homes. Such changes could mean there is no longer sufficient capacity.**

### Surface Water

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal

methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.

The disposal hierarchy being:

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

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

If the above surface water hierarchy has been followed and if the flows are restricted to a total of 5 l/s then Thames Water would not have any objections to the proposal.

Please see the attached 'Planning your wastewater' leaflet for additional information.

#### **What happens next?**

Please make sure you submit your connection application, giving us at least 21 days' notice of the date you wish to make your new connection/s.

If you've any further questions, please contact me on 07747642636.

Yours sincerely

**Nathanael Bryant Sanjaya**

Adoption Engineer

Developer Services

## Appendix D

### *Ground Investigation Report Extract*

## 5. Ground investigation records and data

### 5.1 Physical ground conditions

#### 5.1.1 Summary of strata encountered

The following presents a summary of the properties of the ground and groundwater conditions encountered by Soils Limited, based on field observations, interpretation of the field data and laboratory test results, taking into account drilling, excavation and sampling methods, transport, handling and specimen preparation.

Details of the Soils Limited ground investigation works are provided in the factual report in Appendix B, a summary of the ground model is presented in Table 5.1 and the individual strata are described in the sections below.

Table 5.1: Strata encountered

| Stratum                                                                        | Depth to top<br>(m bgl) | Depth to base<br>(m bgl) | Thickness<br>(m) (range) | Thickness<br>(m) (average) |
|--------------------------------------------------------------------------------|-------------------------|--------------------------|--------------------------|----------------------------|
| Surface Cover –<br>bituminous bound<br>pavement hardstanding                   | 0.00                    | 0.07 - 0.20              | 0.07 - 0.20              | 0.13                       |
| 'General' Made Ground                                                          | 0.00 - 0.45             | 0.55 - 1.75              | 0.15 - 1.75              | 0.69                       |
| 'Sub Base' Made Ground                                                         | 0.07 - 0.20             | 0.30 - 0.60              | 0.20 - 0.40              | 0.29                       |
| Lynch Hill Gravel<br>Member                                                    | 0.30 - 1.75             | 4.25 - 5.40              | 3.45 - 5.10              | 4.38**                     |
| Lambeth Group                                                                  | 4.25 - 5.40             | 11.50*                   | 6.50*                    | 6.50*                      |
| Seaford Chalk Formation                                                        | 11.50                   | >20.00                   | >8.50                    | Not proven                 |
| *only proven at BH1.                                                           |                         |                          |                          |                            |
| **in those locations in which the base of the geological unit was encountered. |                         |                          |                          |                            |

The recorded geological units (as per the BGS nomenclature) have been inferred from the log descriptions.

#### 5.1.2 Bituminous bound pavement

Asphalt hardstanding was encountered ranging from 0.07m to 0.20m in thickness. This was found to rest directly on a generally granular sub-base.

#### 5.1.3 Made Ground

Made Ground was recorded across the entire site. In general (but not including hardstanding) there are two main types of Made Ground present at the site:

- » 'Sub Base' Made Ground: located underneath the asphalt hardstanding to a maximum recorded depth of 0.60m below ground level (bgl). This generally comprised a locally slightly clayey sandy gravel / sands and gravels; gravel is noted to comprise limestone and flint, with some localities also encountering anthropogenic material such as brick and clinker.
- » 'General' Made Ground: this type of Made Ground was highly variable across the site, and was found to either underlie the Sub Base Made Ground from between 0.40m to 0.45m bgl or, where asphalt was not present, from the surface to a maximum depth of 1.75m bgl. The Made Ground was encountered generally as a soft to firm sandy gravelly clay / gravelly clayey sand,

with the gravel comprising flint, clinker, brick and concrete. Made Ground is deepest between or adjacent to the structures present on site and so may be associated with the historic construction.

#### 5.1.4 *Lynch Hill Gravel Member*

Whilst the BGS maps indicate no superficial deposits to be present, the investigation has found sands and flint gravels near surface. Hydrock consider the rounded gravels and sands to be part of the Lynch Hill Gravel Member.

The Lynch Hill Gravel Member was encountered underlying the Made Ground across the entirety of the site, to depths of between 4.25m – 5.40m bgl.

In its uppermost section, the Lynch Hill Gravel member was generally encountered as a soft to firm / firm brown slightly gravelly sandy clay. This was noted to transition, with depth, into dense orangish brown sands and gravels, or a gravelly sand.

#### 5.1.5 *Lambeth Group*

The Lambeth Group, noted to be variable in nature, was encountered underlying the Lynch Hill Gravel Member in a number of locations, from between 4.25m to 5.4m bgl to a maximum recorded depth of 11.50m bgl.

For the most part, the Lambeth Group was encountered as a very dense yellowish brown slightly silty fine to medium sand; however, the unit was also noted to locally consist of sandy silty clay,

#### 5.1.6 *Seaford Chalk Formation*

The Seaford Chalk Formation was encountered only at BH1, underlying the Lambeth Group. This was encountered between 11.50m to 20.00m bgl (the base was not proven).

The formation was found to consist of structureless chalk (likely Grade Dm/ Dc), recovered as fine to coarse gravel sized clasts of weak to moderately dense chalk in a comminuted silty matrix.

### 5.2 *Evidence of potential dissolution features and dynamic probe data*

No evidence of solution hollows are visible on site and the dynamic probes do not indicate any significant zones of strength loss or loose materials. At these location only can the risk of dissolution feature be noted to be low.

It is determined that the superficial Lynch Hill Gravel member is present on site and the depth to the Lambeth Group and Seaford Chalk Formation has been established. Further risk assessment is considered in Section 6.

### 5.3 *Groundwater*

#### 5.3.1 *Groundwater observations and levels*

Groundwater was not encountered during the investigation or the post fieldwork monitoring.

#### 5.3.2 *Infiltration tests*

The results of the infiltration testing undertaken are summarised in Table 5.2. The results sheets are presented in Appendix C.

Testing was carried out in general accordance with BRE Digest 365 (BRE DG365) (2016).

Table 5.2: Infiltration test results

| Stratum                  | Location | Depth to base of pit (m bgl) | Infiltration rate (m/s) |                       |                       |                                             |
|--------------------------|----------|------------------------------|-------------------------|-----------------------|-----------------------|---------------------------------------------|
|                          |          |                              | Run 1                   | Run 2                 | Run 3                 | Range                                       |
| Lynch Hill Gravel Member | TPSA1    | 2.40                         | $3.99 \times 10^{-5}$   | $4.14 \times 10^{-5}$ | $6.42 \times 10^{-5}$ | $2.19 \times 10^{-5} - 6.42 \times 10^{-5}$ |
|                          | TPSA2    | 3.00                         | $2.19 \times 10^{-5}$   | $2.36 \times 10^{-5}$ | $3.10 \times 10^{-5}$ |                                             |

### 5.3.3 Groundwater summary

No groundwater was encountered during the ground investigation and post works groundwater monitoring reports the wells being dry with one exception being BH1 reporting a level of 13.10m bgl and this is not considered representative.

It is considered that the levels not being able to be established represents that the regional groundwater body within the Seaford Chalk Formation is at depth.

## 5.4 Ground gases (carbon dioxide and methane)

Records from the gas monitoring boreholes are presented in the Soils Limited factual report, presented in Appendix B, and summarised in Table 5.3.

Three monitoring visits have been undertaken and the monitoring programme is complete. The data are assessed in Section 7.6.

Table 5.3: Range of ground gas data

| Stratum                  | Methane (%) | Carbon dioxide (%) | Oxygen (%)  | Steady flow rate (L/hr) |
|--------------------------|-------------|--------------------|-------------|-------------------------|
| Lynch Hill Gravel Member | 0.0         | 0.0                | 17.5 – 21.0 | 0.0                     |
| Seaford Chalk Formation  | 0.0         | 0.0                | 16.7 – 20.9 | 0.0                     |

## 5.5 Geotechnical data

### 5.5.1 Introduction

Laboratory test results and *in situ* test results (shown on the relevant exploratory hole log or datasheet), are contained in Appendix B. The following sections summarise the main findings and provide interpretation where appropriate.

### 5.5.2 Plasticity

The volume change potentials in terms of NHBC Standard (Chapter 4.2) with respect to building near trees have been determined from the results of plasticity index tests on samples of soil. These are summarised in Table 5.4.

Table 5.4: Volume change potential

| Stratum                  | No. of tests | Plasticity Index |     |      | Modified Plasticity Index |      |      | Plasticity designation | Volume Change Potential |
|--------------------------|--------------|------------------|-----|------|---------------------------|------|------|------------------------|-------------------------|
|                          |              | Min.             | Max | Av.  | Min.                      | Max  | Av.  |                        |                         |
| Lynch Hill Gravel Member | 8*           | 16               | 31  | 21.1 | 14                        | 30.1 | 19.4 | Low to Medium          | Low to Medium           |

\*One sample is noted as being non-plastic and therefore excluded from this assessment.

### 5.5.3 Particle size distribution

Particle Size Distribution test (PSDs) results are summarised in Table 5.5 and summary descriptions and PSD plots of the material analysed are presented in Appendix C.

Table 5.5: PSD results summary

| Stratum                  | No. of tests | Silt/Clay % | Sand %  | Gravel % | General description                                                     |
|--------------------------|--------------|-------------|---------|----------|-------------------------------------------------------------------------|
| Lynch Hill Gravel Member | 2            | 12 - 18     | 36 - 42 | 24 - 52  | Silty / clayey gravelly sand with a low cobble content or sandy gravel. |

### 5.5.4 Soil strength

Table 5.6 summarises information pertaining to the shear strength of the soils according to geological stratum. Factual results are summarised for laboratory tests, field tests (e.g., hand shear vane) and uncorrected Standard Penetration Tests (SPT). Where the SPT is used to infer shear strength by published correlation, this is also tabulated.

Table 5.6: Soil strength results and derived values

| Stratum                  | No. of tests | SPT (N-value) (range)                                                                                      | c <sub>u</sub> (kPa) | Method                  |
|--------------------------|--------------|------------------------------------------------------------------------------------------------------------|----------------------|-------------------------|
| Lynch Hill Gravel Member | 1            | 24                                                                                                         | 108*                 | SPT – cable percussion. |
| Seaford Chalk Formation  | 6            | 9 - >50 (The Chalk initially refuses then softens with depth likely associated with the groundwater table) | -                    | SPT – cable percussion. |

\*Correlation with Stroud (1975) based on 'average' plasticity

### 5.5.5 Relative density

Table 5.7 summarises information pertaining to the relative density of the granular soils according to geological stratum.

As the site is underlain by Chalk, the designer should take into account the recommendations in CIRIA Report C574 with regard to the design of soakaways. To assist with design, the following is noted:

- » the geological setting of the site means solution features cannot be ruled out;
- » there are no known solution features at the site. However, there is a recorded solution pipe feature 156m north-east of the site, as well as a further six records of natural cavities within 500m of the site; and
- » the density of the Chalk can be classified as low.

## 6.8 Buried concrete

Based on guidelines provided in BRE Special Digest 1 (BRE 2005) and the information presented in Section 5.5.8 (Table 5.9):

- » The Lynch Hill Gravel Member be classified as Design Sulfate Class DS-1 and ACEC Class AC-1.
- » The Lambeth Group and Seaford Chalk formation can preliminarily be classified as Design Sulfate Class DS-1 and ACEC Class AC-1; however, only one sample has been tested per stratum and, as such, further testing would be recommended, if required, to fully assess each of the stratum.

This equates to a Design Chemical Class<sup>3</sup> of:

- » DC-1 for the shallow natural soils.

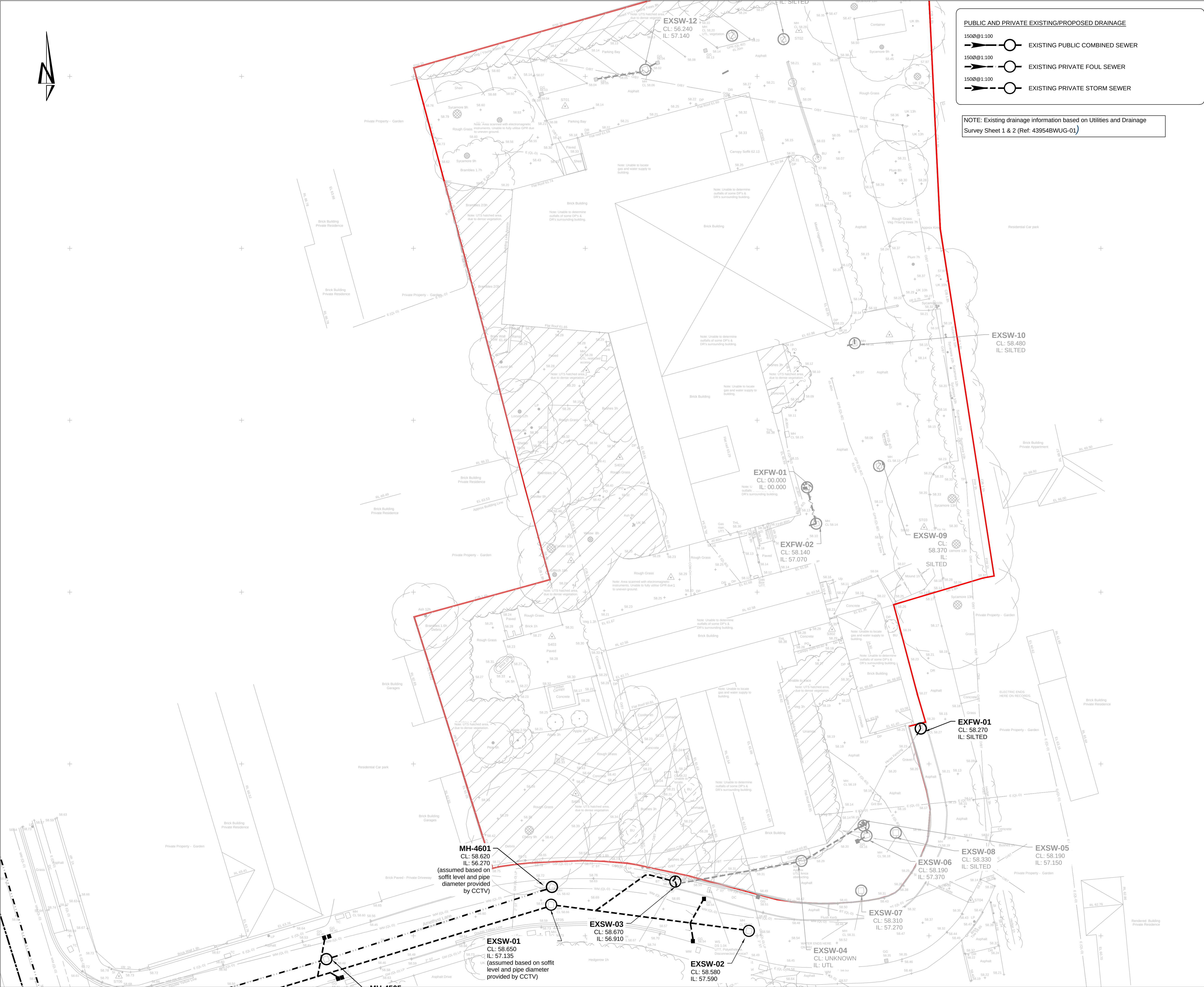
The designer should check and confirm the classification of concrete using the information presented in Appendix B and Appendix C during the design.

---

<sup>3</sup> The calculated ACEC class can be used in accordance with BS 8500-1+A2 (2019), Table A.9 to select the Designated Concrete (DC) class for an intended working life of 50 years. However, the designer is referred to BS 8500-1+A2 (2019), for full details and notes to Table A.9, including any Additional Protective Measures (APMs).

## Appendix E

### *Existing Drainage Layout*



KEY PLAN

NOTES

1.

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

2.

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

3.

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

4.

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

|                                            |             |          |             |          |             |
|--------------------------------------------|-------------|----------|-------------|----------|-------------|
| PROPOSED MASTERPLAN REMOVED, MINOR UPDATES |             |          |             |          |             |
| P03                                        | N. PARAJULI | 01/12/23 | G. HARDWICK | 01/12/23 | G. HARDWICK |
| UPDATED TO SUIT STAGE 3B MASTERPLAN        |             |          |             |          |             |
| P02                                        | D.WEBB      | 05/10/23 | J.MAGEE     | 05/10/23 | J.MAGEE     |
| PRELIMINARY ISSUE                          |             |          |             |          |             |
| P01                                        | J.NEAL-LONG | 22/02/23 | J.MAGEE     | 22/02/23 | J.MAGEE     |
| REVISION NOTES/COMMENTS                    |             |          |             |          |             |
| REV                                        | DRAWN BY    | DATE     | CHECKED BY  | DATE     | APPROVED BY |

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CLIENT

READING BOROUGH COUNCIL

PROJECT

AMETHYST LANE  
READING

TITLE

EXISTING DRAINAGE LAYOUT

HYDROCK PROJECT NO.

C-26887-C

SCALE @ A1

1:200

STATUS DESCRIPTION

PLANNING

STATUS

S2

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

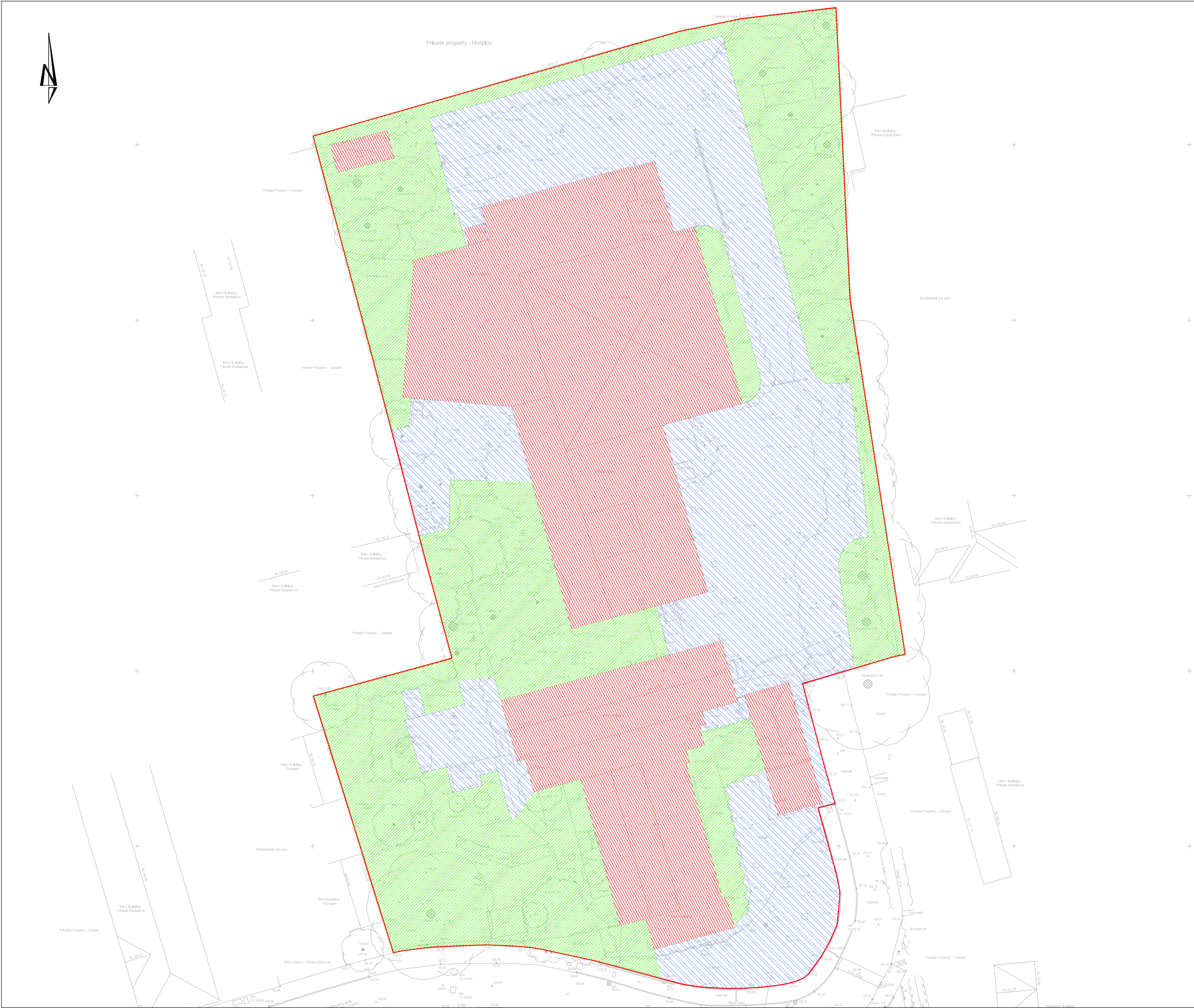
26887-HYD-00-ZZ-SK-C-7700

REVISION

P03

## Appendix F

### *Pre / Post Development Catchments*



KEY PLAN

NOTES

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

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

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

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

LEGEND

BUILDING / ROOF

= 1803m²

HARDSTANDING

= 1821m²

SOFT LANDSCAPING

= 2033m²

TOTAL

= 5657m²

|                                                                                                                                                                                                               |                         |          |            |            |             |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------|------------|------------|-------------|----------|
| P01                                                                                                                                                                                                           | PRELIMINARY ISSUE       |          |            |            |             |          |
|                                                                                                                                                                                                               | J.NEAL-LONG             | 22/02/23 | J.MAGEE    | 22/02/23   | J.MAGEE     | 22/02/23 |
| REV                                                                                                                                                                                                           | REVISION NOTES/COMMENTS |          |            |            |             |          |
|                                                                                                                                                                                                               | DRAWN BY                | DATE     | CHECKED BY | DATE       | APPROVED BY | DATE     |
| <div><div>Hydrock</div><div><div>Merchants' House North</div><div>Wapping Road</div><div>Bristol</div><div>BS1 4BW</div><div>t: +44 (0)117 945 9125</div><div>e: bristolcentral@hydrock.com</div></div></div> |                         |          |            |            |             |          |
| CLIENT                                                                                                                                                                                                        |                         |          |            |            |             |          |
| READING BOROUGH COUNCIL                                                                                                                                                                                       |                         |          |            |            |             |          |
| PROJECT                                                                                                                                                                                                       |                         |          |            |            |             |          |
| AMETHYST LANE                                                                                                                                                                                                 |                         |          |            |            |             |          |
| TITLE                                                                                                                                                                                                         |                         |          |            |            |             |          |
| PRE-DEVELOPMENT CATCHMENT PLAN                                                                                                                                                                                |                         |          |            |            |             |          |
| HYDROCK PROJECT NO.                                                                                                                                                                                           |                         |          |            | SCALE @ A1 |             |          |
| C-26887-C                                                                                                                                                                                                     |                         |          |            | 1:200      |             |          |
| STATUS DESCRIPTION                                                                                                                                                                                            |                         |          |            |            |             | STATUS   |
| PLANNING                                                                                                                                                                                                      |                         |          |            |            |             | S2       |
| DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)                                                                                                                                             |                         |          |            |            |             | REVISION |
| 26887-HYD-00-ZZ-SK-C-7710                                                                                                                                                                                     |                         |          |            |            |             | P01      |



KEY PLAN

NOTES

CATCHMENT

BUILDING / ROOF

= 1730m<sup>2</sup>

HARDSTANDING

= 1580m<sup>2</sup>

SOFT LANDSCAPING

= 2347m<sup>2</sup>

TOTAL

= 5657m<sup>2</sup>

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

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

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

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

|     |                                 |          |            |          |             |          |
|-----|---------------------------------|----------|------------|----------|-------------|----------|
| P07 | UPDATED TO SUIT NEW SITE LAYOUT |          |            |          |             |          |
|     | N PARAIJULI                     | 01/12/23 |            |          | JON CANDY   | 01/12/23 |
| P06 | UPDATED TO SUIT NEW SITE LAYOUT |          |            |          |             |          |
|     | J.SHIMMIN                       | 05/10/23 | D.WEBB     | 05/10/23 | J.MAGEE     | 05/10/23 |
| P05 | UPDATED TO SUIT NEW SITE LAYOUT |          |            |          |             |          |
|     | J.SHIMMIN                       | 01/09/23 | D.WEBB     | 02/05/23 | J.MAGEE     | 02/05/23 |
| P04 | UPDATED TO SUIT NEW SITE LAYOUT |          |            |          |             |          |
|     | D.WEBB                          | 02/05/23 | J.MAGEE    | 02/05/23 | J.MAGEE     | 02/05/23 |
| P03 | UPDATED TO SUIT NEW SITE LAYOUT |          |            |          |             |          |
|     | D.WEBB                          | 18/04/23 | J.MAGEE    | 18/04/23 | J.MAGEE     | 18/04/23 |
| P02 | UPDATED TO SUIT NEW SITE LAYOUT |          |            |          |             |          |
|     | J.SHIMMIN                       | 27/03/23 | J.MAGEE    | 27/03/23 | J.MAGEE     | 27/03/23 |
| P01 | PRELIMINARY ISSUE               |          |            |          |             |          |
|     | J.NEAL-LONG                     | 22/02/23 | J.MAGEE    | 22/02/23 | J.MAGEE     | 22/02/23 |
| REV | REVISION NOTES/COMMENTS         |          |            |          |             |          |
|     | DRAWN BY                        | DATE     | CHECKED BY | DATE     | APPROVED BY | DATE     |

Hydrock

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e: bristolcentral@hydrock.com

CLIENT

READING BOROUGH COUNCIL

PROJECT

AMETHYST LANE

TITLE

POST-DEVELOPMENT CATCHMENT PLAN

HYDROCK PROJECT NO.

C-26887-C

SCALE @ A1

1:200

STATUS DESCRIPTION

PLANNING

STATUS

S2

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

26887-HYD-00-ZZ-SK-C-7720

REVISION

P07

## Appendix G

### *Overland Flow Routes*



- NOTES
- All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
  - The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.
  - Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.
  - Levels shown in metres above Ordnance Datum (mAOD).
  - All private drainage to comply with current Building Regulations, BS EN-752 Drain and Sewer systems outside Buildings and other relevant British Standards and Codes of Practices.
  - All external drainage within trafficked areas with less than 1.2m cover to have type Z concrete bed and surround. All external drainage within landscaped areas with cover less than 0.6m to have type Z concrete bed and surround. All drainage with greater cover than the minimum required to have type S bed and surround.
  - All drainage to be laid soffit to soffit unless otherwise shown.
  - The Contractor is to verify the line, level and diameter of existing sewers before commencing drainage works.
  - All foul drainage to be minimum 100mm diameter, all surface water drainage to be minimum 150mm diameter unless otherwise shown.
  - Cover levels shown on this drawing refer to approximate surface levels. It is the contractors responsibility to ensure that access covers and frames are set at the final surface levels.
  - Where possible the contractor is to orientate manhole biscuits and covers to locate them parallel to kerbs and paving.
  - The Contractor should comply with hsg(g) 47 "Avoiding Danger from Underground Services" when excavating around existing services.
  - It is the contractors responsibility to determine the location and depth of all existing services, mains and cables prior to construction.
  - Contractor to provide temporary screens in each of the down stream manholes during the construction period of the development in accordance with SFA 2.9.10 and the local sewerage undertakers requirements.
  - All in-situ concrete and precast concrete components to be manufactured using Sulphate Resisting Portland Cement, (SRPC) to BS 4027, if required, subject to soil conditions. Manhole components to be to BS EN 1917:2002.
  - All ironwork to be kite marked by BSI or certified by equal inspection authority.
  - All redundant connections to be capped off and grouted with the down stream manhole.
  - All new drainage pipes to be jetted, CCTV surveyed with DVD recording and any defects highlighted to the supervising officer. Following the rectification of any defects, the drain is to be re-surveyed with CCTV and the recordings made available to the project manager/engineer.
  - Prior to commencing the works the contractor is to confirm details of the existing drainage system as noted on the drawing.
  - Prior to commencing the works the contractor is to undertake the drainage investigation work as noted on the drawing.

**NOTE A**  
Prior to commencement of remediation/overlay works the contractor is to undertake a full service/utilities scan to establish details of existing utilities in the vicinity of the works. The contractor is responsible for the co-ordination/alterations of such utilities with the proposed works.

|                                                                                                                                                                      |              |          |            |          |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------|------------|----------|-------------|
| FIRST ISSUE                                                                                                                                                          |              |          |            |          |             |
| P01                                                                                                                                                                  | H.RICHARDSON | 27.11.23 | G.HARDWICK | 27.11.23 | G.HARDWICK  |
| REVISION NOTES/COMMENTS                                                                                                                                              |              |          |            |          |             |
| REV                                                                                                                                                                  | DRAWN BY     | DATE     | CHECKED BY | DATE     | APPROVED BY |
| <div><div>Hydrock</div><div>Merchants' House North<br/>Wapping Road<br/>Bristol<br/>BS1 4RW<br/>t: +44 (0)117 945 9225<br/>e: bristolcentral@hydrock.com</div></div> |              |          |            |          |             |
| CLIENT                                                                                                                                                               |              |          |            |          |             |
| READING BOROUGH COUNCIL                                                                                                                                              |              |          |            |          |             |
| PROJECT                                                                                                                                                              |              |          |            |          |             |
| AMETHYST LANE                                                                                                                                                        |              |          |            |          |             |
| TITLE                                                                                                                                                                |              |          |            |          |             |
| FLOOD EXCEEDANCE ROUTE                                                                                                                                               |              |          |            |          |             |
| HYDROCK PROJECT NO.                                                                                                                                                  |              |          | SCALE @ A1 |          |             |
| C-26887-C                                                                                                                                                            |              |          | 1:250      |          |             |
| STATUS DESCRIPTION                                                                                                                                                   |              |          |            |          | STATUS      |
| SUITABLE FOR STAGE 3                                                                                                                                                 |              |          |            |          | S3          |
| DRAWING NO. (PROJECT CODE ORIGINATOR:ZONE-LEVEL-TYPE-ROLE-NUMBER)                                                                                                    |              |          |            |          | REVISION    |
| 26887-HYD-00-ZZ-DR-C-7010                                                                                                                                            |              |          |            |          | P01         |

## Appendix H

### *Drainage Strategy Layout*



**DRAINAGE LEGEND**

- PROPOSED FOUL SEWER
- PROPOSED SURFACE WATER SEWER
- FOUL WATER INSPECTION CHAMBER (PVCu 450mm DIA. Max 1.2m depth - reduced access to 3.0m)
- SURFACE WATER INSPECTION CHAMBER (PVCu 450mm DIA. Max 1.2m depth - reduced access to 3.0m) (300mm min catchpit directly upstream of soakaway) (Orifice plate downstream of permeable paving)
- PERMEABLE PAVING
- CELLULAR CRATE STORAGE STRUCTURE
- PERFORATED PIPE UNDERDRAINED DRY SWALE
- EXISTING THAMES WATER FOUL SEWER
- EXISTING THAMES WATER STORM SEWER



- NOTES**
- All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
  - The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.
  - Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.
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  - All private drainage to comply with current Building Regulations, BS EN-752 Drain and Sewer systems outside Buildings and other relevant British Standards and Codes of Practices.
  - All external drainage within trafficked areas with less than 1.2m cover to have type Z concrete bed and surround. All external drainage within landscaped areas with cover less than 0.6m to have type Z concrete bed and surround. All drainage with greater cover than the minimum required to have type S bed and surround.
  - All drainage to be laid soffit to soffit unless otherwise shown.
  - The Contractor is to verify the line, level and diameter of existing sewers before commencing drainage works.
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  - Cover levels shown on this drawing refer to approximate surface levels. It is the contractors responsibility to ensure that access covers and frames are set at the final surface levels.
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  - The Contractor should comply with hsg(g) 47 "Avoiding Danger from Underground Services" when excavating around existing services.
  - It is the contractors responsibility to determine the location and depth of all existing services, mains and cables prior to construction.
  - Contractor to provide temporary screens in each of the down stream manholes during the construction period of the development in accordance with SFA 2.9.10 and the local sewerage undertakers requirements.
  - All in-situ concrete and precast concrete components to be manufactured using Sulphate Resisting Portland Cement, (SRPC) to BS 4027, if required, subject to soil conditions. Manhole components to be to BS EN 1917:2002.
  - All ironwork to be kite marked by BSI or certified by equal inspection authority.
  - All redundant connections to be capped off and grouted from the down stream manhole.
  - All new drainage pipes to be jetted. CCTV surveyed with DVD recording and any defects highlighted to the supervising officer. Following the rectification of any defects, the drain is to be re-surveyed with CCTV and the recordings made available to the project manager/engineer.
  - Prior to commencing the works the contractor is to confirm details of the existing drainage system as noted on the drawing.
  - Prior to commencing the works the contractor is to undertake the drainage investigation work as noted on the drawing.

**NOTE A**  
Prior to commencement of remediation/overlay works the contractor is to undertake a full service/utilities scan to establish details of existing utilities in the vicinity of the works. The contractor is responsible for the co-ordination/alterations of such utilities with the proposed works.

| PERMEABLE PAVING EXTENTS AMENDED. PLOT DRAINAGE LINETYPES AMENDED. |              |          |            |          |             |
|--------------------------------------------------------------------|--------------|----------|------------|----------|-------------|
| P08                                                                | H.RICHARDSON | 27.11.23 | G.HARDWICK | 27.11.23 | G.HARDWICK  |
| UPDATED TO SUIT LATEST LANDSCAPE ARCHITECTS LAYOUT                 |              |          |            |          |             |
| P07                                                                | H.RICHARDSON | 17.11.23 | G.HARDWICK | 17.11.23 | G.HARDWICK  |
| UPDATED TO SUIT LATEST LANDSCAPE ARCHITECTS LAYOUT                 |              |          |            |          |             |
| P06                                                                | J.SHIMMIN    | 06.09.23 | D.WEBB     | 06.09.23 | J.MAGEE     |
| STAGE 3 ISSUE                                                      |              |          |            |          |             |
| P05                                                                | J.SHIMMIN    | 04.08.23 | D.WEBB     | 04.08.23 | B.MURPHY    |
| STAGE 3 ISSUE                                                      |              |          |            |          |             |
| P04                                                                | J.SHIMMIN    | 04.07.23 | D.WEBB     | 04.07.23 | J.MAGEE     |
| DRAWING AMENDED TO SUIT LANDSCAPE ARCHITECT COMMENTS               |              |          |            |          |             |
| P03                                                                | D.WEBB       | 02.05.23 | J.MAGEE    | 02.05.23 | J.MAGEE     |
| PRELIMINARY ISSUE                                                  |              |          |            |          |             |
| P02                                                                | D.WEBB       | 18.04.23 | J.MAGEE    | 18.04.23 | J.MAGEE     |
| REVISION NOTES/COMMENTS                                            |              |          |            |          |             |
| REV                                                                | DRAWN BY     | DATE     | CHECKED BY | DATE     | APPROVED BY |

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|                                                                   |                     |
|-------------------------------------------------------------------|---------------------|
| CLIENT                                                            |                     |
| READING BOROUGH COUNCIL                                           |                     |
| PROJECT                                                           |                     |
| AMETHYST LANE                                                     |                     |
| TITLE                                                             |                     |
| DRAINAGE LAYOUT                                                   |                     |
| HYDROCK PROJECT NO.                                               |                     |
| C-26887-C                                                         | SCALE @ A1<br>1:250 |
| STATUS DESCRIPTION                                                |                     |
| SUITABLE FOR STAGE 3                                              | STATUS<br>S3        |
| DRAWING NO. (PROJECT CODE ORIGINATOR:ZONE-LEVEL-TYPE-ROLE-NUMBER) |                     |
| 26887-HYD-00-ZZ-DR-C-7010                                         | REVISION<br>P08     |

## Appendix I

### *Drainage Calculations*

[Print](#)[Close Report](#)

# Greenfield runoff rate estimation for sites

[www.ukstds.com](http://www.ukstds.com) | Greenfield runoff tool

Calculated by:

Site name:

Site location:

## Site Details

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

## Site characteristics

Total site area (ha):

## Methodology

Q<sub>BAR</sub> estimation method:

SPR estimation method:

## Soil characteristics

Default

Edited

SOIL type:

HOST class:

SPR/SPRHOST:

## Hydrological characteristics

Default

Edited

SAAR (mm):

Hydrological region:

Growth curve factor 1 year:

Growth curve factor 30 years:

Growth curve factor 100 years:

Growth curve factor 200 years:

## Notes

### (1) Is Q<sub>BAR</sub> < 2.0 l/s/ha?

When Q<sub>BAR</sub> is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

### (2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

### (3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

## Greenfield runoff rates

Default

Edited

Q<sub>BAR</sub> (l/s):

1 in 1 year (l/s):

1 in 30 years (l/s):

1 in 100 year (l/s):

1 in 200 years (l/s):

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at [www.uksuds.com](http://www.uksuds.com). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at [www.uksuds.com/terms-and-conditions.htm](http://www.uksuds.com/terms-and-conditions.htm). The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.



Date 01/12/2023 09:14

File 26887-HYD-XX-XX-CA-C-00...

Designed by harryrichardson

Checked by

Innovyze

---

Network 2020.1.3

Network Design Table for Storm

| PN    | Length<br>(m) | Fall<br>(m) | Slope<br>(1:X) | I.Area<br>(ha) | T.E.<br>(mins) | Base<br>Flow (l/s) | k<br>(mm) | n | HYD<br>SECT | DIA<br>(mm) | Section Type | Auto<br>Design                                                                      |
|-------|---------------|-------------|----------------|----------------|----------------|--------------------|-----------|---|-------------|-------------|--------------|-------------------------------------------------------------------------------------|
| 1.008 | 12.090        | 0.054       | 223.9          | 0.097          | 0.00           | 0.0                | 0.600     |   | o           | 300         | Pipe/Conduit |  |
| 1.009 | 23.815        | 0.106       | 224.7          | 0.044          | 0.00           | 0.0                | 0.600     |   | o           | 300         | Pipe/Conduit |  |
| 1.010 | 20.024        | 0.089       | 225.0          | 0.036          | 0.00           | 0.0                | 0.600     |   | o           | 300         | Pipe/Conduit |  |
| 1.011 | 23.708        | 0.237       | 100.0          | 0.018          | 0.00           | 0.0                | 0.600     |   | o           | 150         | Pipe/Conduit |  |

## Network Results Table

| PN    | Rain<br>(mm/hr) | T.C.<br>(mins) | US/IL<br>(m) | Σ I.Area<br>(ha) | Σ Base<br>Flow (l/s) | Foul<br>(l/s) | Add Flow<br>(l/s) | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) |
|-------|-----------------|----------------|--------------|------------------|----------------------|---------------|-------------------|--------------|--------------|---------------|
| 1.008 | 37.00           | 15.26          | 56.756       | 0.233            | 0.0                  | 0.0           | 0.0               | 1.05         | 74.0         | 23.4          |
| 1.009 | 36.47           | 15.64          | 56.702       | 0.277            | 0.0                  | 0.0           | 0.0               | 1.04         | 73.9         | 27.4          |
| 1.010 | 36.03           | 15.96          | 56.596       | 0.313            | 0.0                  | 0.0           | 0.0               | 1.04         | 73.8         | 30.5          |
| 1.011 | 35.51           | 16.35          | 56.507       | 0.331            | 0.0                  | 0.0           | 0.0               | 1.00         | 17.8         | 31.8          |

### Free Flowing Outfall Details for Storm

| Outfall<br>Pipe Number | Outfall<br>Name | C. Level<br>(m) | I. Level<br>(m) | Min<br>I. Level<br>(m) | D, L<br>(mm) | W<br>(mm) |
|------------------------|-----------------|-----------------|-----------------|------------------------|--------------|-----------|
|------------------------|-----------------|-----------------|-----------------|------------------------|--------------|-----------|

|       |        |        |        |   |   |
|-------|--------|--------|--------|---|---|
| 1.011 | 58.620 | 56.270 | 56.270 | 0 | 0 |
|-------|--------|--------|--------|---|---|

## Simulation Criteria for Storm

|                                 |       |                                     |       |
|---------------------------------|-------|-------------------------------------|-------|
| Volumetric Runoff Coeff         | 0.750 | Additional Flow - % of Total Flow   | 0.000 |
| Areal Reduction Factor          | 1.000 | MADD Factor * 10m³/ha Storage       | 0.000 |
| Hot Start (mins)                | 0     | Inlet Coefficient                   | 0.800 |
| Hot Start Level (mm)            | 0     | Flow per Person per Day (l/per/day) | 0.000 |
| Manhole Headloss Coeff (Global) | 0.500 | Run Time (mins)                     | 60    |
| Foul Sewage per hectare (l/s)   | 0.000 | Output Interval (mins)              | 1     |

|                             |   |                              |   |
|-----------------------------|---|------------------------------|---|
| Number of Input Hydrographs | 0 | Number of Storage Structures | 4 |
| Number of Online Controls   | 1 | Number of Time/Area Diagrams | 0 |
| Number of Offline Controls  | 0 | Number of Real Time Controls | 0 |

## Synthetic Rainfall Details

|                       |                   |                       |        |
|-----------------------|-------------------|-----------------------|--------|
| Rainfall Model        | FSR               | Profile Type          | Summer |
| Return Period (years) | 2                 | Cv (Summer)           | 0.750  |
| Region                | England and Wales | Cv (Winter)           | 0.840  |
| M5-60 (mm)            | 18.800            | Storm Duration (mins) | 30     |
| Ratio R               | 0.400             |                       |        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------|
| Hydrock Consultants Ltd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             | Page 3                                          |
| <div><div></div><div></div><div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             | <div><div></div><div>Micro Drainage</div></div> |
| Date 01/12/2023 09:14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Designed by harryrichardson |                                                 |
| File 26887-HYD-XX-XX-CA-C-00...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Checked by                  |                                                 |
| Innovyze                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Network 2020.1.3            |                                                 |
| <div>Online Controls for Storm</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |                                                 |
| <div>Hydro-Brake® Optimum Manhole: 7, DS/PN: 1.011, Volume (m³): 15.0</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |                                                 |
| <div><div>Unit Reference MD-SHE-0092-5000-1961-5000</div><div><div>Design Head (m)</div><div>1.961</div></div><div><div>Design Flow (l/s)</div><div>5.0</div></div><div><div>Flush-Flo™</div><div>Calculated</div></div><div><div>Objective</div><div>Minimise upstream storage</div></div><div><div>Application</div><div>Surface</div></div><div><div>Sump Available</div><div>Yes</div></div><div><div>Diameter (mm)</div><div>92</div></div><div><div>Invert Level (m)</div><div>56.507</div></div><div><div>Minimum Outlet Pipe Diameter (mm)</div><div>150</div></div><div><div>Suggested Manhole Diameter (mm)</div><div>1200</div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             |                                                 |
| <div><div>Control Points</div><div><div>Head (m)</div><div>Flow (l/s)</div></div><div><div>Design Point (Calculated)</div><div>1.961</div><div>5.0</div></div><div><div>Flush-Flo™</div><div>0.403</div><div>4.2</div></div><div><div>Kick-Flo®</div><div>0.823</div><div>3.3</div></div><div><div>Mean Flow over Head Range</div><div>-</div><div>4.0</div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                                                 |
| <div><div>The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated</div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                                                 |
| <div><div><div><div>Depth (m)</div><div>Flow (l/s)</div></div><div><div>Depth (m)</div><div>Flow (l/s)</div></div><div><div>Depth (m)</div><div>Flow (l/s)</div></div><div><div>Depth (m)</div><div>Flow (l/s)</div></div></div><div><div><div>0.100</div><div>2.9</div></div><div><div>1.200</div><div>4.0</div></div><div><div>3.000</div><div>6.1</div></div><div><div>7.000</div><div>9.1</div></div></div><div><div><div>0.200</div><div>3.9</div></div><div><div>1.400</div><div>4.3</div></div><div><div>3.500</div><div>6.5</div></div><div><div>7.500</div><div>9.4</div></div></div><div><div><div>0.300</div><div>4.1</div></div><div><div>1.600</div><div>4.5</div></div><div><div>4.000</div><div>7.0</div></div><div><div>8.000</div><div>9.7</div></div></div><div><div><div>0.400</div><div>4.2</div></div><div><div>1.800</div><div>4.8</div></div><div><div>4.500</div><div>7.4</div></div><div><div>8.500</div><div>10.0</div></div></div><div><div><div>0.500</div><div>4.1</div></div><div><div>2.000</div><div>5.0</div></div><div><div>5.000</div><div>7.7</div></div><div><div>9.000</div><div>10.2</div></div></div><div><div><div>0.600</div><div>4.0</div></div><div><div>2.200</div><div>5.3</div></div><div><div>5.500</div><div>8.1</div></div><div><div>9.500</div><div>10.5</div></div></div><div><div><div>0.800</div><div>3.5</div></div><div><div>2.400</div><div>5.5</div></div><div><div>6.000</div><div>8.4</div></div><div></div></div><div><div><div>1.000</div><div>3.7</div></div><div><div>2.600</div><div>5.7</div></div><div><div>6.500</div><div>8.8</div></div><div></div></div></div> |                             |                                                 |
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| <p align="center"><u>Storage Structures for Storm</u></p>              |                             |                                                                                     |
| <p align="center"><u>Dry Swale Pipe: 1.002</u></p>                     |                             |                                                                                     |
| Manning's N                                                            | 0.450                       | Trench Length (m)                                                                   |
| Infiltration Coefficient Base (m/hr)                                   | 0.00000                     | Trench Infiltration Side (m/hr)                                                     |
| Infiltration Coefficient Side (m/hr)                                   | 0.00000                     | Trench Porosity                                                                     |
| Safety Factor                                                          | 2.0                         | Side Slope (1:X)                                                                    |
| Swale Porosity                                                         | 1.00                        | Slope (1:X)                                                                         |
| Invert Level (m)                                                       | 56.947                      | Cap Volume Depth (m)                                                                |
| Trench Height (m)                                                      | 1.091                       | Cap Infiltration Depth (m)                                                          |
| Trench Width (m)                                                       | 1.0                         |                                                                                     |
| <p align="center">Under Drain Details</p>                              |                             |                                                                                     |
| Depth above Invert Level (m)                                           | 0.000                       | Number of Pipes                                                                     |
| Diameter (m)                                                           | 0.300                       | Manning's N                                                                         |
| <p align="center"><u>Dry Swale Pipe: 1.004</u></p>                     |                             |                                                                                     |
| Manning's N                                                            | 0.450                       | Trench Length (m)                                                                   |
| Infiltration Coefficient Base (m/hr)                                   | 0.00000                     | Trench Infiltration Side (m/hr)                                                     |
| Infiltration Coefficient Side (m/hr)                                   | 0.00000                     | Trench Porosity                                                                     |
| Safety Factor                                                          | 2.0                         | Side Slope (1:X)                                                                    |
| Swale Porosity                                                         | 1.00                        | Slope (1:X)                                                                         |
| Invert Level (m)                                                       | 56.871                      | Cap Volume Depth (m)                                                                |
| Trench Height (m)                                                      | 1.135                       | Cap Infiltration Depth (m)                                                          |
| Trench Width (m)                                                       | 1.0                         |                                                                                     |
| <p align="center">Under Drain Details</p>                              |                             |                                                                                     |
| Depth above Invert Level (m)                                           | 0.000                       | Number of Pipes                                                                     |
| Diameter (m)                                                           | 0.300                       | Manning's N                                                                         |
| <p align="center"><u>Dry Swale Pipe: 1.006</u></p>                     |                             |                                                                                     |
| Manning's N                                                            | 0.450                       | Trench Length (m)                                                                   |
| Infiltration Coefficient Base (m/hr)                                   | 0.00000                     | Trench Infiltration Side (m/hr)                                                     |
| Infiltration Coefficient Side (m/hr)                                   | 0.00000                     | Trench Porosity                                                                     |
| Safety Factor                                                          | 2.0                         | Side Slope (1:X)                                                                    |
| Swale Porosity                                                         | 1.00                        | Slope (1:X)                                                                         |
| Invert Level (m)                                                       | 56.808                      | Cap Volume Depth (m)                                                                |
| Trench Height (m)                                                      | 1.257                       | Cap Infiltration Depth (m)                                                          |
| Trench Width (m)                                                       | 1.0                         |                                                                                     |
| <p align="center">Under Drain Details</p>                              |                             |                                                                                     |
| Depth above Invert Level (m)                                           | 0.000                       | Number of Pipes                                                                     |
| Diameter (m)                                                           | 0.300                       | Manning's N                                                                         |
| <p align="center"><u>Cellular Storage Manhole: 7, DS/PN: 1.011</u></p> |                             |                                                                                     |
| Invert Level (m)                                                       | 56.507                      | Safety Factor                                                                       |
| Infiltration Coefficient Base (m/hr)                                   | 0.00000                     | Porosity                                                                            |
| Infiltration Coefficient Side (m/hr)                                   | 0.00000                     |                                                                                     |
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Cellular Storage Manhole: 7, DS/PN: 1.011

| Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------------------------|-----------|------------------------|-----------------------------|
| 0.000     | 99.0                   | 0.0                         | 1.201     | 0.0                    | 0.0                         |
| 1.200     | 99.0                   | 0.0                         |           |                        |                             |



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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

| PN    | US/MH<br>Name | Surcharged   |                | Flooded        | Flow /<br>Cap. | Overflow<br>(l/s) | Half Drain    | Pipe | Status      | Level<br>Exceeded |
|-------|---------------|--------------|----------------|----------------|----------------|-------------------|---------------|------|-------------|-------------------|
|       |               | Depth<br>(m) | Volume<br>(m³) | Time<br>(mins) |                |                   | Flow<br>(l/s) |      |             |                   |
| 1.000 | 1             | -0.029       | 0.000          | 0.06           |                |                   |               | 3.8  |             | OK                |
| 2.000 | 2             | -0.021       | 0.000          | 0.06           |                |                   |               | 3.6  |             | OK                |
| 1.001 | 3             | 0.026        | 0.000          | 0.08           |                |                   |               | 4.3  | SURCHARGED  |                   |
| 1.002 | Swale1        | -1.072       | 0.000          | 0.07           |                |                   | 24            | 4.8  |             | OK                |
| 1.003 | Swale2        | 0.002        | 0.000          | 0.07           |                |                   |               | 4.2  | SURCHARGED* |                   |
| 1.004 | Swale3        | -1.159       | 0.000          | 0.05           |                |                   | 33            | 4.4  |             | OK                |
| 1.005 | Swale4        | -0.011       | 0.000          | 0.07           |                |                   |               | 4.0  |             | OK*               |
| 1.006 | Swale5        | -1.293       | 0.000          | 0.06           |                |                   | 38            | 4.1  |             | OK                |
| 1.007 | Swale6        | -0.231       | 0.000          | 0.05           |                |                   |               | 2.8  |             | OK*               |
| 1.008 | 4             | -0.212       | 0.000          | 0.19           |                |                   |               | 11.2 |             | OK                |
| 1.009 | 5             | -0.199       | 0.000          | 0.24           |                |                   |               | 16.0 |             | OK                |
| 1.010 | 6             | -0.185       | 0.000          | 0.12           |                |                   |               | 7.7  |             | OK                |
| 1.011 | 7             | 0.050        | 0.000          | 0.23           |                |                   | 89            | 3.9  | SURCHARGED  |                   |



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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

| PN    | US/MH<br>Name | Surcharged   | Flooded        | Flow /<br>Cap. | Overflow<br>(l/s) | Half Drain     | Pipe          | Status      | Level<br>Exceeded |
|-------|---------------|--------------|----------------|----------------|-------------------|----------------|---------------|-------------|-------------------|
|       |               | Depth<br>(m) | Volume<br>(m³) |                |                   | Time<br>(mins) | Flow<br>(l/s) |             |                   |
| 1.000 | 1             | 0.571        | 0.000          | 0.14           |                   |                | 8.7           | SURCHARGED  |                   |
| 2.000 | 2             | 0.580        | 0.000          | 0.13           |                   |                | 7.6           | SURCHARGED  |                   |
| 1.001 | 3             | 0.624        | 0.000          | 0.21           |                   |                | 11.3          | SURCHARGED  |                   |
| 1.002 | Swale1        | -0.477       | 0.000          | 0.17           |                   | 32             | 12.0          | OK          |                   |
| 1.003 | Swale2        | 0.496        | 0.000          | 0.17           |                   |                | 10.2          | SURCHARGED* |                   |
| 1.004 | Swale3        | -0.665       | 0.000          | 0.11           |                   | 33             | 10.4          | OK          |                   |
| 1.005 | Swale4        | 0.432        | 0.000          | 0.16           |                   |                | 9.5           | SURCHARGED* |                   |
| 1.006 | Swale5        | -0.851       | 0.000          | 0.13           |                   | 34             | 9.8           | OK          |                   |
| 1.007 | Swale6        | 0.067        | 0.000          | 0.12           |                   |                | 7.4           | SURCHARGED* |                   |
| 1.008 | 4             | 0.086        | 0.000          | 0.21           |                   |                | 12.5          | SURCHARGED  |                   |
| 1.009 | 5             | 0.137        | 0.000          | 0.23           |                   |                | 15.4          | SURCHARGED  |                   |
| 1.010 | 6             | 0.240        | 0.000          | 0.26           |                   |                | 17.0          | SURCHARGED  |                   |
| 1.011 | 7             | 0.475        | 0.000          | 0.25           |                   |                | 4.2           | SURCHARGED  |                   |



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100 year Return Period Summary of Critical Results by Maximum Level (Rank  
1) for Storm

| PN    | US/MH<br>Name | Surcharged   |                | Flooded        | Flow /<br>Cap. | Overflow<br>(l/s) | Half Drain    | Pipe | Status      | Level<br>Exceeded |
|-------|---------------|--------------|----------------|----------------|----------------|-------------------|---------------|------|-------------|-------------------|
|       |               | Depth<br>(m) | Volume<br>(m³) | Time<br>(mins) |                |                   | Flow<br>(l/s) |      |             |                   |
| 1.000 | 1             | 0.995        | 0.000          | 0.33           |                |                   |               | 20.3 | FLOOD RISK  |                   |
| 2.000 | 2             | 1.005        | 0.000          | 0.34           |                |                   |               | 19.9 | FLOOD RISK  |                   |
| 1.001 | 3             | 1.038        | 0.000          | 0.74           |                |                   |               | 39.8 | FLOOD RISK  |                   |
| 1.002 | Swale1        | -0.077       | 0.000          | 0.48           |                |                   | 32            | 33.5 | FLOOD RISK* |                   |
| 1.003 | Swale2        | 0.976        | 0.000          | 0.41           |                |                   |               | 25.0 | FLOOD RISK* |                   |
| 1.004 | Swale3        | -0.181       | 0.000          | 0.25           |                |                   |               | 24.0 | FLOOD RISK* |                   |
| 1.005 | Swale4        | 0.991        | 0.000          | 0.32           |                |                   |               | 19.4 | FLOOD RISK* |                   |
| 1.006 | Swale5        | -0.271       | 0.000          | 0.26           |                |                   |               | 18.6 | FLOOD RISK* |                   |
| 1.007 | Swale6        | 0.902        | 0.000          | 0.19           |                |                   |               | 11.8 | SURCHARGED* |                   |
| 1.008 | 4             | 0.921        | 0.000          | 0.33           |                |                   |               | 19.9 | SURCHARGED  |                   |
| 1.009 | 5             | 0.972        | 0.000          | 0.37           |                |                   |               | 24.0 | SURCHARGED  |                   |
| 1.010 | 6             | 1.074        | 0.000          | 0.43           |                |                   |               | 27.4 | FLOOD RISK  |                   |
| 1.011 | 7             | 1.309        | 0.000          | 0.26           |                |                   |               | 4.3  | SURCHARGED  |                   |



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| <p style="text-align: center;"><u>Simulation Criteria for Foul - Main</u></p> <p> Volumetric Runoff Coeff 0.750    Additional Flow - % of Total Flow 0.000<br/> Areal Reduction Factor 1.000    MADD Factor * 10m<sup>3</sup>/ha Storage 0.000<br/> Hot Start (mins) 0    Inlet Coefficient 0.800<br/> Hot Start Level (mm) 0    Flow per Person per Day (l/per/day) 0.000<br/> Manhole Headloss Coeff (Global) 0.500    Run Time (mins) 60<br/> Foul Sewage per hectare (l/s) 0.000    Output Interval (mins) 1 </p> <p> Number of Input Hydrographs 0    Number of Storage Structures 0<br/> Number of Online Controls 0    Number of Time/Area Diagrams 0<br/> Number of Offline Controls 0    Number of Real Time Controls 0 </p> <p style="text-align: center;"><u>Synthetic Rainfall Details</u></p> <p> Rainfall Model    FSR    Profile Type Summer<br/> Return Period (years) 2    Cv (Summer) 0.750<br/> Region England and Wales    Cv (Winter) 0.840<br/> M5-60 (mm) 18.800    Storm Duration (mins) 30<br/> Ratio R 0.400 </p> |                             |                                                                                     |
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