AMBIENTAL

ENVIRONMENTAL ASSESSMENT

Surface Water Drainage Strategy

Godwin and Crowndale Estate,
Crowndale Road,
London,
NW1 1NW

Ambiental Environmental Assessment
Sussex Innovation Centre,
Science Park Square,
Brighton, BN1 9SB

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Project: Surface Water Drainage Strategy

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Site Location: Godwin and Crowndale Estate, Crowndale Road, London, NW1 1NW

Proposed Development: The proposed development is understood to comprise the construction of ten new residential dwellings with private gardens and landscape improvements to the courtyard of the Godwin and Crowndale Estate.

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Contents

1. Introduction

1.1 Ambiental Environmental Assessment has been appointed by London Borough of Camden to undertake a Surface Water Drainage Strategy (SWDS) for the proposed development at Godwin and Crowndale Estate, Crowndale Road, London, NW1 1NW.

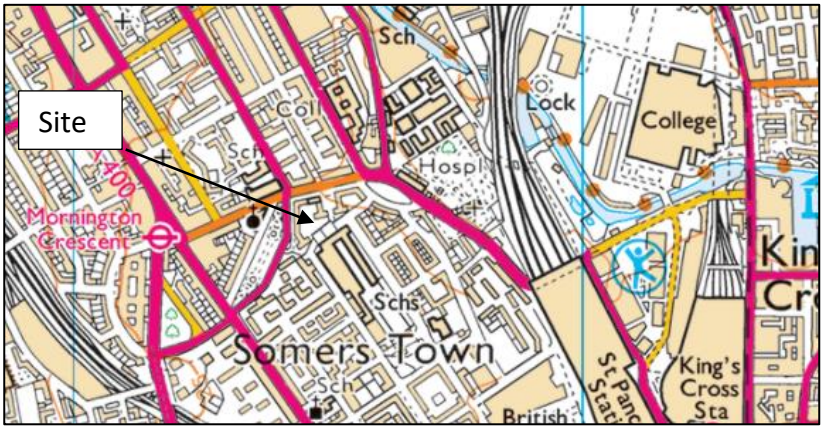


Figure 1: Site Location plan

1.2 The site area is approximately 3910sqm based on the green line boundary on the architects site plan. The area under investigation comprised a public area to the rear of the Godwin and Crowndale residential buildings. This area included a car park, Multi Use Games Area (MUGA), and communal landscaped gardens.

1.3 The proposed development is understood to comprise the construction of ten new residential dwellings with private gardens and landscape improvements to the courtyard of the Godwin and Crowndale Estate. The site extent and proposed layouts can be seen below in Figures 1 and 2. The site plans are attached in Appendix I – Supporting Information.

1.4 For the purpose of this assessment the children's play area and access pathways shown on the architects site layout plan are assumed to be laid in a permeable material and would drains as per the existing grassed areas. This report focussed mainly on the residential development located over the MUGA and Car Park as defined on the drainage strategy plan in Appendix III. This amounts to a drained area of 1220sqm. The existing hard surface area within the assessed area amounts to 965sqm.

Figure 2: Site Location – Redline boundary

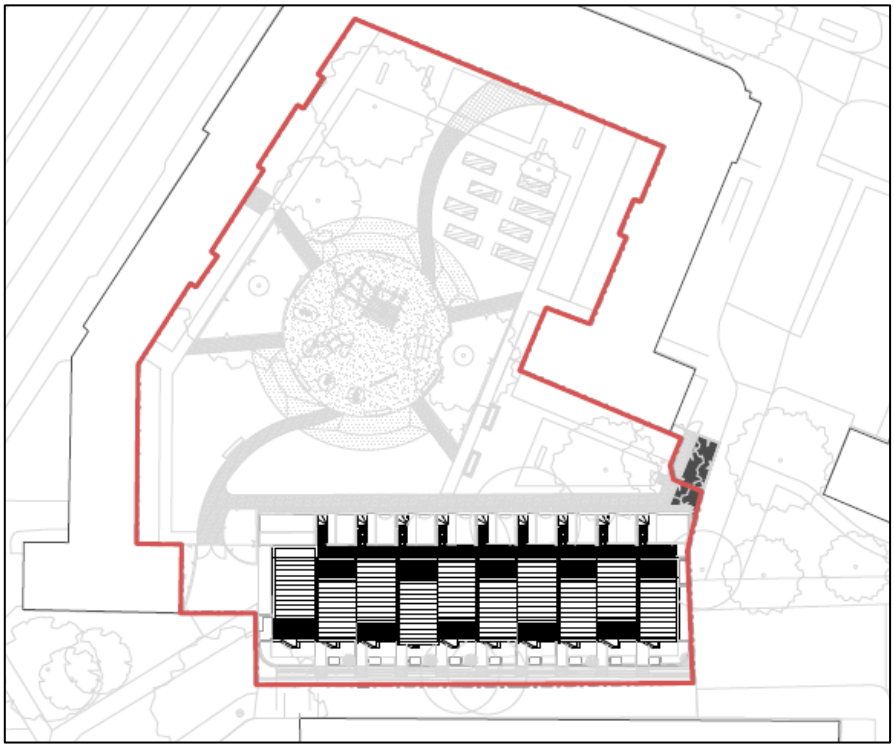


Figure 3: Proposed site layout

1.5 The developer has had a topographic survey undertaken on site. The surveyed levels have can be found on the existing site plan included with in Appendix I. A review of the surveyed levels shows that the topographic levels on site have been surveyed to a local datum and not metres Above Ordnance Datum. The values vary between 21.7m and 21.3m AOD.

1.6 The purpose of this assessment is to demonstrate that the development proposal outlined above can be satisfactorily accommodated without worsening flood risk for the area and without placing the development itself at increased risk of flooding, as per national guidance provided within the National Planning Policy Framework (NPPF) 2019, the National Planning Practice Guidance (NPPG), DEFRA's National Standards for Sustainable Drainage and Local guidance provided within the London Borough of Camden Strategic Flood Risk Assessment (SFRA) 2014 (section 7, Sustainable Drainage Systems)

Existing Drainage Infrastructure and Watercourses

1.7 The closest watercourse to the site is the Grand Union Canal. This is located approximately 400m east of the site at its closest proximity and is classified as an EA Main River.

1.8 The client has not provided Ambiental with a CCTV drain survey at the site. It is recommended a detailed CCTV drain survey is undertaken to determine the location and condition of existing drainage as detailed design progresses.

1.9 The client has provided the Thames Water sewer records for the general area. This shows a large diameter combined sewer crossing the site towards the South boundary. This sewer may be subject to specific drainage easements by Thames Water. Any works close to the sewer should be agreed with Thames Water prior to proceeding. Sewer record plans are included in Appendix IV an extract is shown in Figure 4 below.

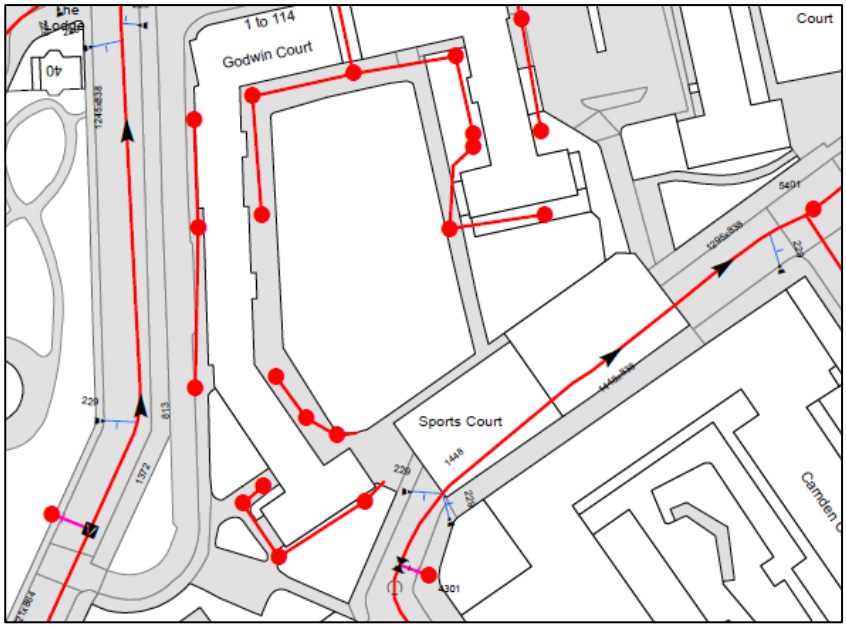


Figure 4: Thames Water sewer record extract

Geology and Infiltration Potential

1.10 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the bedrock underlying the site is part of the London clay formation. No superficial deposits have been identified as being located beneath the site.

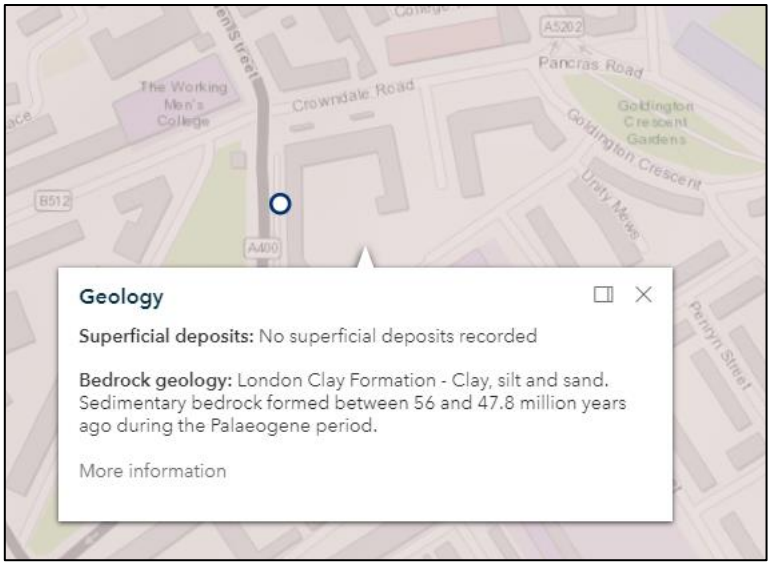


Figure 5:Underlying Bedrock Groups (Source: BGS)

1.11 Given the underling clay infiltration has been discounted as feasible at this time. A Phase II Geotechnical and Geo-environmental Investigation has been undertaken by land Science and this states '*A preliminary falling head soakage test was undertaken within WS1.2. However, the percolation was extremely poor and a soil infiltration rate could not be calculated.'* Therefore infiltration for large drained areas such as roofs is unlikely to be feasible. Small areas may still be able to infiltrate.

2. EA Flood Map for Planning

2.1 According to the national-scale flood mapping created on behalf of the Environment Agency (EA), the application site is shown to be located within Flood Zone 1 (Figure 6). Based on the EA Flood Map for Planning the proposed development has an annual probability of fluvial or tidal flooding of less than 0.1% (1 in 1,000) in any year.

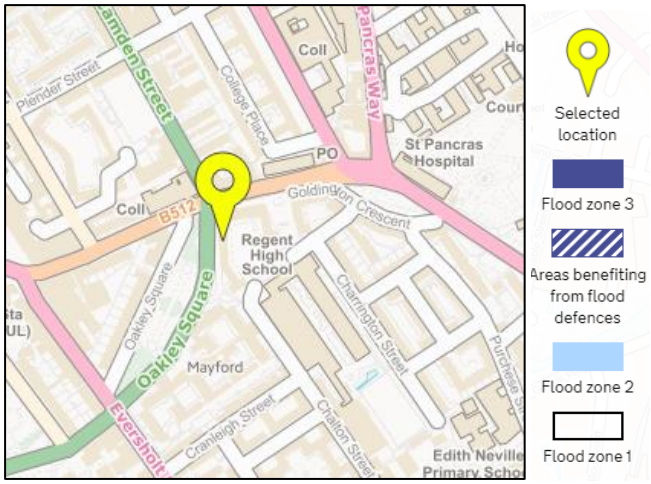


Figure 6:EA Flood Map for Planning (Source: EA)

2.2 Whilst the EA Flood Map for Planning does not account for the impacts of climate change, the site could subsequently be considered safe for its lifetime given the difference in topographic levels.

Vulnerability Classification

2.3 The site is used for residential amenity use as existing and would subsequently be considered as "Less Vulnerable", with regards to the National Planning Policy Framework vulnerability classification guidelines.

2.4 The proposed development is understood to comprise the construction of ten new residential dwellings with private gardens and landscape improvements to the courtyard of the Godwin and Crowndale Estate. As residential use this could be considered a 'More Vulnerable' classification. There would subsequently be an increase in vulnerability post-development.

2.5 Under the NPPF, all new planning applications should undergo a *Sequential Test*. This test should be implemented by local planning authorities with a view to locating particularly vulnerable new developments (e.g. residential, hospitals, mobile homes etc.) outside of the floodplain.

2.6 The NPPF *Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table* is reproduced below;

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	**Zone 1**	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	×	Exception Test Required	✓
	Zone 3b *Functional Floodplain*	Exception Test Required	✓	×	×	×

Table 1 The Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table as specified by NPPF. Please note: ✓means development is appropriate; ×means the development should not be permitted.

2.7 Using the principles of the Sequential Test outlined above, the proposed development is 'More Vulnerable'. The proposed development and redline site boundary is sequentially located wholly within Flood Zone 1 (as defined by the EA) and therefore, under the NPPF, does not require the application of either the Sequential Test or the Exception Test.

3. SUDS Assessment

3.1 Surface water run-off generated by developments that include an increase in impermeable surface areas, have the potential to increase flood risk to others by increasing the peak rate of surface water discharged from the site. Consequently, the NPPF requires that all developments requiring a Flood Risk Assessment, consider the sustainable management of surface water so as not to increase the peak rate of surface water run-off when compared to the baseline scenario.

3.2 In accordance with the SuDS management train approach, the use of various SuDS measures to reduce and control surface water flows have been considered in detail for the development.

3.3 Paragraph 80 of the Planning Practice Guidance of the National Planning Policy Framework (NPPF) states that: *Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable* (Table 3).

3.4 The management of surface water has been considered in respect to the SuDS hierarchy (see Table 2) (as detailed in Building Regulations Part H and within the *CIRIA 753 'The SUDS Manual', Section 3.2.3*):

Hierarchy (most preferred first)	Suitability	Comment
Discharge to the Ground (Infiltration)	X	Infiltration not viable for large drained areas.
Discharge to Surface Water (lake, watercourse, canal, etc.)	X	No surface water course available for connection.
Discharge to Surface Water Sewer, Highway Drain or another Drainage System	X	No surface water sewer available for connection
Discharge to Combined Sewer	✓	Existing combined sewer on site
Discharge to Foul Sewer	X	

Table 2 SuDS Hierarchy

3.5 The suitability of SuDS components has been assessed (Table 3) to determine which methods are appropriate to be used within the proposed development.

SuDS Component	Description	Constraints and Opportunities	Suitability
Infiltrating SuDS	Infiltration can contribute to reducing runoff rates and volumes while supporting baseflow and groundwater recharge processes. The suitability and infiltration rate depends on the permeability of the surrounding soils.	Infiltration potential shown to be poor via falling head testing by Land Sciance	X
Permeable Pavement	Pervious surfaces can be used in combination with aggregate sub-base and/or geocellular/modular storage to attenuate and/or infiltrate runoff from surrounding surfaces and roofs. Liners can be used where ground conditions are not suitable for infiltration.	Permeable paving could be provided within suitable hardstanding areas. Infiltrating paving should be located at least 1.5 m away from proposed and existing building.	✓

SuDS Component	Description	Constraints and Opportunities	Suitability
Green Roofs	Green Roofs provide areas of visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. They are generally more costly to install and maintain than conventional roofs but can provide many long-term benefits and reduce the on-site storage volumes.	The volume of surface water attenuation achieved by green roofs, is limited, and they are generally not suited to traditional pitched roofs. The development proposals aim to mimic the traditional pitch roof approach of traditional residential buildings.	X
Rainwater Harvesting	Rainwater Harvesting is the collection of rainwater runoff for use. It can be collected form roofs or other impermeable area, stored, treated (where required) and then used as a supply of water for domestic, commercial and industrial properties.	Considered a suitable method for providing additional storage on site and attenuating flows to as close to greenfield rates as practical.	✓
Swales	Swales are designed to convey, treat and attenuate surface water runoff and provide aesthetic and biodiversity benefits. They can replace conventional pipework as a means of conveying runoff, however space constraints of some sites can make it difficult incorporating them into the design.	Open landscaped features are generally situated within landscaped corridors as part of larger multi-dwelling developments, to facilitate conveyance to central attenuation facilities. It is considered unlikely that an open surface feature would provide a suitable method of conveyance within private residential properties. If open SuDS features were proposed these would need to be subject to specific legal agreements to ensure that the effectiveness of these devices within private property was maintained over the life-time of the development. Consideration of the long-term maintenance has to be factored into the decision-making process.	X
Rills and Channels	Rills and Channels keep runoff on the surface and convey runoff along the surface to downstream SuDS components. They can be incorporated into the design to provide a visually appealing method of conveyance, they also provide effectiveness in pre-treatment removal of silts.		X
Bioretention Systems	Bioretention systems can reduce runoff rates and volumes and treat pollution through the use of engineer soils and vegetation. They are particularly effective in delivering interception, but can also be an attractive landscape feature whilst providing habitat and biodiversity		X
Retention Ponds and Wetlands	Ponds and Wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They enhance treatment processes and have great amenity and biodiversity benefits. Often a flow control system at the outfall controls the rates of discharge for a range of water levels during storm events.		X
Detention Basins	Detention Basins are landscaped depressions that are usually dry except during and immediately following storm events and can be used as a recreational or other amenity facility. They generally appropriate to manage high volumes of surface water from larger sites such as a neighbourhoods.		X
Geocellular Systems	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The inherent flexibility in size and shape means they can be tailored to suit the specific characteristics and requirements of any site.	If necessary, these could be provided to complement the other SuDS solutions, such as the permeable paving.	✓

SuDS Component	Description	Constraints and Opportunities	Suitability
Proprietary Treatment Systems	Proprietary treatment systems are manufactured products that remove specific pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods and can be useful in reducing the maintenance requirements of downstream SuDS.	Proprietary treatment systems could be utilised on site in conjunction with other drainage methods to remove pollutants from surface water runoff.	✓
Filter Drains and Filter Strips	Filter drains are shallow trenches filled with stone, gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation, designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration.	Techniques such as Filter Drains and Strips typically offer a means of conveying runoff from the proposed development to downstream SuDS components. Given the large are of impermeable area post-development and the slope of the site, it is unlikely that the proposed site layout would suit the inclusion of this method.	X

Table 3: SuDS Selection Matrix (x = not suitable, - = limited potential, ✓= suitable)

3.6 It has been indicated in Table 3 above, that several SuDS components are deemed appropriate to be used in the following SuDS management train.

3.7 As such, it is suggested that **Geocellular Systems** and **Permeable Paving** are to be used as the main SuDS component to treat, attenuate and infiltrate the surface water runoff generated by the proposed development.

3.8 Permeable surfacing is proposed to all new paths and the play area (assumed to be a chipped bark finish) in the retained amenity area.

3.9 Geocellular storage is to be used to manage runoff from the main drained areas as defined on the drainage strategy plan included in Appendix III.

3.10 Rainwater harvesting should be incorporated where feasible. As a minimum rainwater butts should be installed around the building to provide water for use in maintaining municipal areas. A pumped RWH system could be used where appropriate to provide an outdoor tap for car washing etc. For the purposes of attenuation and storage calculations, it is considered the harvesting devices are full at the time of the design rainfall event therefore final design would be confirmed by the client and submitted as part of the detailed design proposals.

3.11 SuDS components should be designed to accommodate and dispose of surface water runoff from storms up to and including the 1:100 annual probability, with a +40% increase to allow for climate change, over the lifetime of the development.

Permeable Paving

3.12 Unlined permeable paving should be provided in all hardstanding areas, where possible, to aid interception, treatment, conveyance of runoff, whilst allowing for some infiltration. Surface water attenuation is proposed in the car parking pavement sub-base only. The Permeable Paving would be formed by the following layers:

- Permeable surfacing
- Laying course material
- Filter Geotextile
- Sub-base: 6-20mm Clean Crushed Stone (Provide min. 0.3m sub-base depth).
- Filter Geotextile

Geocellular

3.13 The Geocellular Systems are generally built by placing together (e.g. stacking) cuboid plastic structures with very high void ratios (min. 95%). The formed volume is then surrounded by either a geotextile or geomembrane to form the attenuation tank.

3.14 It is proposed to provide an unlined (wrapped in geotextiles) attenuation tank – geocellular system at the base of the permeable paved car park. See Appendix 2 - Proposed Surface Water Drainage Strategy Layout.

Rainwater Harvesting

3.15 Rainwater harvesting (RWH) Systems should be considered for rainwater re-use. Rainwater harvesting can take various forms including simple water butts to utilise runoff for watering and irrigation, to more complex pumped RWH systems to be used in grey water uses. It is strongly recommended that rainwater harvesting is considered. However, the viability and suitability of a RWH system should be reviewed by a specialist to determine the suitability in context to the rest of the site proposals. For the purposes of attenuation and storage calculations, it is considered the harvesting devices are full at the time of the design rainfall event.

Proprietary Treatment Systems

3.16 Sediment Traps should be installed between downpipes and SuDS devices to reduce the incidence of blockage or silting up. External hard landscaping should be laid such that the arising runoff from the hardstanding areas can be collected and managed by the proposed SuDS train.

4. Surface Water Drainage Strategy

4.1 In order to mitigate the potential flood risk posed by the proposed development, due to the increase in impermeable area, adequate surface water management is required. This will ensure that surface water runoff is dealt with at source and the flood risk on/off site is not increased over the lifetime of the development.

4.2 For the purpose of this assessment the children's play area and access pathways shown on the architects site layout plan are assumed to be laid in a permeable material and would drains as per the existing grassed areas. This report focussed mainly on the residential development located over the MUGA and Car Park as defined on the drainage strategy plan in Appendix III. This amounts to a drained area of 1220sqm. The existing hard surface area within the assessed area amounts to 965sqm.

4.3 The surface water run-off generated as a result of the development works will need to be managed in accordance with the National Planning Policy Framework (NPPF 2019) policy which requires the use of Sustainable Drainage Systems (SuDS).

4.4 The design lifetime of a residential site is 100 years, and an allowance for climate change should be considered in accordance with published guidance by the Environment Agency 2020. The climate change criteria are reproduced below, and it is likely that the 'upper end' allowance for 2070 to 2115 is deemed suitable for the proposed development. To provide a worst-case scenario, the 'upper end' 40% climate change allowance will be used (Table 5).

PEAK RAINFALL INTENSITY ALLOWANCE IN SMALL AND URBAN CATCHMENTS			
Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

Table 4: Peak rainfall intensity allowance in small and urban catchments

4.5 As such, it is suggested that **Geocellular Systems** and **Permeable Paving** be used as the main SuDS component to treat, attenuate and infiltrate the surface water runoff generated by the proposed development.

4.6 Permeable surfacing is proposed to all new paths and the play area (assumed to be a chipped bark finish) in the retained amenity area.

4.7 Geocellular storage is to be used to manage runoff from the main drained areas as defined on the drainage strategy plan included in Appendix III.

4.8 Rainwater harvesting should be incorporated where feasible. As a minimum rainwater butts should be installed around the building to provide water for use in maintaining municipal areas. A pumped RWH system could be used where appropriate to provide an outdoor tap for car washing etc. For the purposes of attenuation and storage calculations, it is considered the harvesting devices are full at the time of the design rainfall event therefore final design would be confirmed by the client and submitted as part of the detailed design proposals.

4.9 The rainfall model used in the calculations has been generated using the FEH2013 method.

The SuDS system proposed for the new development adheres to the Council's requirement of demonstrating surface water control and attenuation storage on site with the intention of mitigating the impact on the existing flooding regime.

Permissible Surface Water Discharge Rate

4.10 As outlined previously, a key component of the NPPF regarding flood risk is to ensure that new developments do not increase the risk of flooding to others. As a minimum, the existing rate of surface water discharge should be maintained.

4.11 The existing site is to be redeveloped. The proposed works are for the construction of a new larger building and for alterations to the access drive and construction of parking and turning facilities to the rear of the site. With reference to the Ciria SuDS Manual C753:

"For previously developed sites, the peak discharge rate must be as close as reasonably practicable to the equivalent greenfield runoff rate for the site. It should never exceed the rate off discharge from the site prior to redevelopment."

4.12 To adhere to the likely requirements of the Lead Local Flood Authority, the London Borough of Camden, it is recommended that Surface Water Runoff is discharged from the site as close to greenfield as reasonably practicable for the 1 in 100 year + 40%CC scenario.

4.13 The Greenfield Rate calculations for the main development area are reported below in Table 5. It can be seen from the calculation ibn Appendix II that the HR Wallingford map soil values have been altered to 4 to suit the poorly infiltrating ground conditions encountered on site. The Q_{BAR} rate for an area of 0.12 ha, has been calculated to be 0.51 l/s. This is a very low value and not practical to achieve without increasing maintenance liability. A

4.14 As such a practical minimum runoff rate, as close to Q_{BAR} as feasible has been utilised. This has been determined by using a 50mm aperture Hydrobrake. As defined in Sewers for Adoption 8 guidance flow control devices should have a minimum aperture of 50mm to reduce undue blockage risk. With the design proposed this results in a maximum offsite flow rate of 1.3l/s for the 1in100yr rainfall event plus 40% climate change. This is a significant reduction over the existing situation brownfield runoff as can be seen below. As the FEH13 rainfall model has been used the min rainfall event that can be calculated is the 1in 2 yr event. All Calculations can be seen within Appendix II.

Surface Water Discharge Rates Summary					
	Area (ha)	**Discharge Rates (l/s)**			
		1 year	**2 year/Q_{BAR}**	**30 year**	**100 year**
Greenfield Rates	0.12	0.43	0.51	1.18	1.63
Brownfield	0.091	-	14.4	44.8	59.4
Proposed Discharges	0.12	-	1.0	1.1	1.3

Table 5: Surface water discharge rates summary

4.15 Given the site is drained through an attenuation tank with runoff controlled by Hydrobrake runoff from the site would be 1.3l/s from the design catchment area for rainfall events up to and including the 1in100yr rainfall event plus 40% climate change. Thus complying with London borough of Camden SuDS Guidance.

Surface Water Attenuation

4.16 Surface water attenuation is needed to temporarily store water during periods when the runoff rates from the development site exceed the allowable discharge rates from the site.

4.17 Rainfall depths for the 1 in 100 years Return Period plus 40% of climate change were produced using the Causeway software using FEH2013 Rainfall in order to estimate the largest volume critical storm, for typical storm durations up to and including the 2160min rainfall duration. See summary calculations in Appendix II - Calculations.

4.18 It is recommended to attenuate runoff from the residential are within geocellular crates located in the amenity area above the proposed development.

4.19 According to the proposed site plan, the proposed additional hardstanding areas account for an area of approximately 1220m2. The crates (min. void ratio of 0.95) should have a plan area of 90m^2 and depth of at least 1.2m (IL at approx. 19.65mAOD) in order accommodate the required runoff and attenuation volume. The final crate layout should be confirmed by a specialist crate manufacturer one the level of the outfall sewer has been confirmed.

4.20 For the purpose of this assessment the children's play area and access pathways shown on the architects site layout plan are assumed to be laid in a permeable material and would drains as per the existing grassed areas

4.21 Guidance about proper use, installation and maintenance of any proprietary system must be provided by the supplier and incorporated into the site proposals at detailed design stage.

5. Design Exceedance

5.1 In the event of drainage system failure under extreme rainfall events or blockage, overland flow may occur within the site. In the event of the development's drainage system failure, the surface water flow will be dictated by topography on site. Design of external ground levels should be completed at detailed design stage to finalise these overland routes, but some indicative flow paths have been included on the drainage strategy drawing. External levels should be designed to direct overland flow away from buildings and threshold as depicted on the proposed surface water drainage layout in Appendix III.

5.2 It is advised that the finished floor level of the entrance to the proposed building (at the northern extent of the site) should be a minimum of 150mm above the external ground levels. In the event of drainage system failure, extreme rainfall events or blockage, as flooding would occur within the site. In the event it should be ensured water runoff should not impact on the building.

6. Water Quality

6.1 Adequate treatment must be delivered to the water runoff to remove pollutants through SuDS devices, which are able to provide pollution mitigation. Pollution Hazards and the SuDS Mitigation have been indexed in the CIRIA 753 'The SUDS Manual'.

6.2 The Pollution Hazard Indices are summarized in Table6 – Summary of Pollution Hazard Indices for different Land Use below (reference: Table 26.3.CIRIA SuDS Manual 2015).

Pollution Hazard Indices For Different Land Use Classifications				
Land use	Pollution Hazard Level	Total suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05

Table 6: Summary of Pollution hazard Indices for different Land Use.

6.3 The Mitigation Indices of the proposed SuDS techniques are summarized in the Table 7 - Indicative SuDS Mitigation Indices below. It can be seen the water treatment provided by the Permeable Pavement should be enough to remove the pollutants arising on the driveway.

6.4 Sediment Traps should be installed on the storm drainage pipework at incoming connections to the Geocellular System to reduce the incidence of blockage or silting up. External hard landscaping should be laid such that the arising runoff from the hardstanding areas can be collected and managed by the proposed SuDS train.

6.5 Given only roof or pedestrian area runoff is managed by the development this is considered low risk of contamination therefore treatment required is limited to the use of sediment traps or proprietor treatment systems.

Indicative SuDS Mitigation Indices For Discharges To Surface Water			
SuDS Component	Total suspended Solids (TSS)	Metals	Hydrocarbons
Proprietary Treatment Systems	Details should be provided at the detailed design phase to account for the final SuDS strategy layout and wider construction design details.		

Table 7: Indicative SuDS Mitigation Indices

7. Adoption and Maintenance

7.1 All onsite SuDS and drainage systems will be privately maintained. A long-term maintenance regime should be agreed with the site owners before adoption. In addition to a long-term maintenance regime, it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post-construction and monthly for the first quarter following construction.

GENERAL REQUIREMENTS		RESPONSIBILITY	
Generally	Frequency	Maintenance Company	Home Owner
Pipes and Litter: collect all litter or other debris and remove from site at each visit	Monthly	Yes, where draining more than one property or located in communal areas	Yes, where drains serve the one property only or within property boundary

INLETS, OUTLETS, CONTROLS, GULLIES, CHANNEL DRAINS, GEOCELLULAR ATTENUATION TANKS AND INSPECTION CHAMBERS			
Regular Maintenance	**Frequency**		
Inspect surface structures removing obstructions, sediment, oil/grease and floating debris and silt as necessary. Check there is no physical damage. Trim vegetation 1m min. surround to structures and keep hard aprons free from silt and debris.	Monthly	Yes, where draining more than one property or located in communal areas	Yes, where drains serve the one property only or within property boundary
Inspection chambers, Gullies, Channel Drains: Remove cover and inspect ensuring water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in autumn and major storm events	Annually	Yes, where draining more than one property or located in communal areas	
Geocellular Tanks: Remove sediment from pre-treatment structures; Inspect inside of tank for sediment build-up and remove as necessary.	Annually	Yes, where draining more than one property or located in communal areas	
Occasional Maintenance			
Cleaning of the system if necessary. CCTV Survey and Jetting	As necessary	Yes, where draining more than one property or located in communal areas	Yes, where drains serve the one property only or within property boundary
Remedial work			
Inspect and remove baskets or similar silt-traps, clean and replace. Repair physical damage if necessary.	As necessary	Yes, where draining more than one property or located in communal areas	Yes, where drains serve the one property only or within property boundary
PERMEABLE AND POROUS SURFACES			
Regular Maintenance			
Cleaning Brush regularly and remove sweepings from all hard surfaces	Monthly	Yes, shared access road	Yes, private areas
Occasional Maintenance			
Permeable Pavements. Brush and vacuum surface once a year to prevent silt blockage and enhance design life.	Annually	Yes, shared access road	Yes, private areas
Remedial work			
Monitor effectiveness of permeable pavement and when water does not infiltrate immediately advise Client of possible need for reinstatement of top layers or specialist cleaning. Recent experience suggests jet washing and suction cleaning will substantially reinstate pavement to 90% efficiency.	As required	Yes, shared access road	Yes, private areas

Table 8 Proposed Schedule of Maintenance for Below Ground Drainage.

8. Conclusion

8.1 Ambiental Environmental Assessment has been appointed by London Borough of Camden to undertake a Surface Water Drainage Strategy (SWDS) for the proposed development at Godwin and Crowndale Estate, Crowndale Road, London, NW1 1NW.

8.2 The site area is approximately 3910sqm based on the green line boundary on the architects site plan. The area under investigation comprised a public area to the rear of the Godwin and Crowndale residential buildings. This area included a car park, Multi Use Games Area (MUGA), and communal landscaped gardens.

8.3 The proposed development is understood to comprise the construction of ten new residential dwellings with private gardens and landscape improvements to the courtyard of the Godwin and Crowndale Estate. The site plans are attached in Appendix I – Supporting Information.

8.4 The client has not provided Ambiental with a CCTV drain survey at the site. It is recommended a detailed CCTV drain survey is undertaken to determine the location and condition of existing drainage as detailed design progresses as some existing sewers may require diversion as part of the works.

8.5 The client has provided the Thames Water sewer records for the general area. This shows a large diameter (1448x883mm) combined sewer crossing the site towards the South boundary. This sewer may be subject to specific drainage easements by Thames Water. Any works close to the sewer should be agreed with Thames Water prior to proceeding.

8.6 For the purpose of this assessment the children's play area and access pathways shown on the architects site layout plan are assumed to be laid in a permeable material and would drains as per the existing grassed areas. This report focussed mainly on the residential development located over the MUGA and Car Park as defined on the drainage strategy plan in Appendix III. This amounts to a drained area of 1220sqm. The existing hard surface area within the assessed area amounts to 965sqm.

8.7 With reference to the Environment Agency (EA) national-scale flood mapping created on behalf of the EA, the redline application boundary of the site is located within Flood Zone 1. The proposed development has an annual probability of fluvial or tidal flooding less than 0.1% (1 in 1000) in any given year. The development is classed as 'More Vulnerable' due to its residential use, and under the principles of the Sequential Test it is deemed appropriate.

8.8 Given the underling clay infiltration has been discounted as feasible at this time. A Phase II Geotechnical and Geo-environmental Investigation has been undertaken by land Science and this states '*A preliminary falling head soakage test was undertaken within WS1.2. However, the percolation was extremely poor and a soil infiltration rate could not be calculated.*' Therefore infiltration for large drained areas such as roofs is unlikely to be feasible. Small areas may still be able to infiltrate. As such, it is suggested that Geocellular Systems and permeable paving be used as the main SuDS component to treat, attenuate and infiltrate the surface water runoff generated by the proposed development.

8.9 The Q_{BAR} rate for an area of 0.12 ha, has been calculated to be 0.51 l/s. This is a very low value and not practical to achieve without increasing maintenance liability. As such a practical minimum runoff rate, as close to Qbar as feasible has been utilised. This has been determined by using a 50mm aperture Hydrobrake. As defined in Sewers for Adoption 8 guidance flow control devices should have a minimum aperture of 50mm to reduce undue blockage risk. With the design proposed this results in a maximum offsite flow rate of 1.3l/s for the 1in100yr rainfall event plus 40% climate change. This is a significant reduction over the existing situation brownfield runoff as can be seen within Section 4. of this report.

8.10 The proposed drainage strategy is to direct runoff from the residential area through an attenuation tank with runoff controlled by Hydrobrake runoff from the site would be 1.3l/s from the design catchment area for rainfall events up to and including the 1in100yr rainfall event plus 40% climate change. Thus complying with London borough of Camden SuDS Guidance.

8.11 Rainfall depths for the 1 in 100 years Return Period plus 40% of climate change were produced using the Causeway software using FEH2013 Rainfall in order to estimate the largest volume critical storm, for typical storm durations up to and including the 2160min rainfall duration. See summary calculations in Appendix II - Calculations.

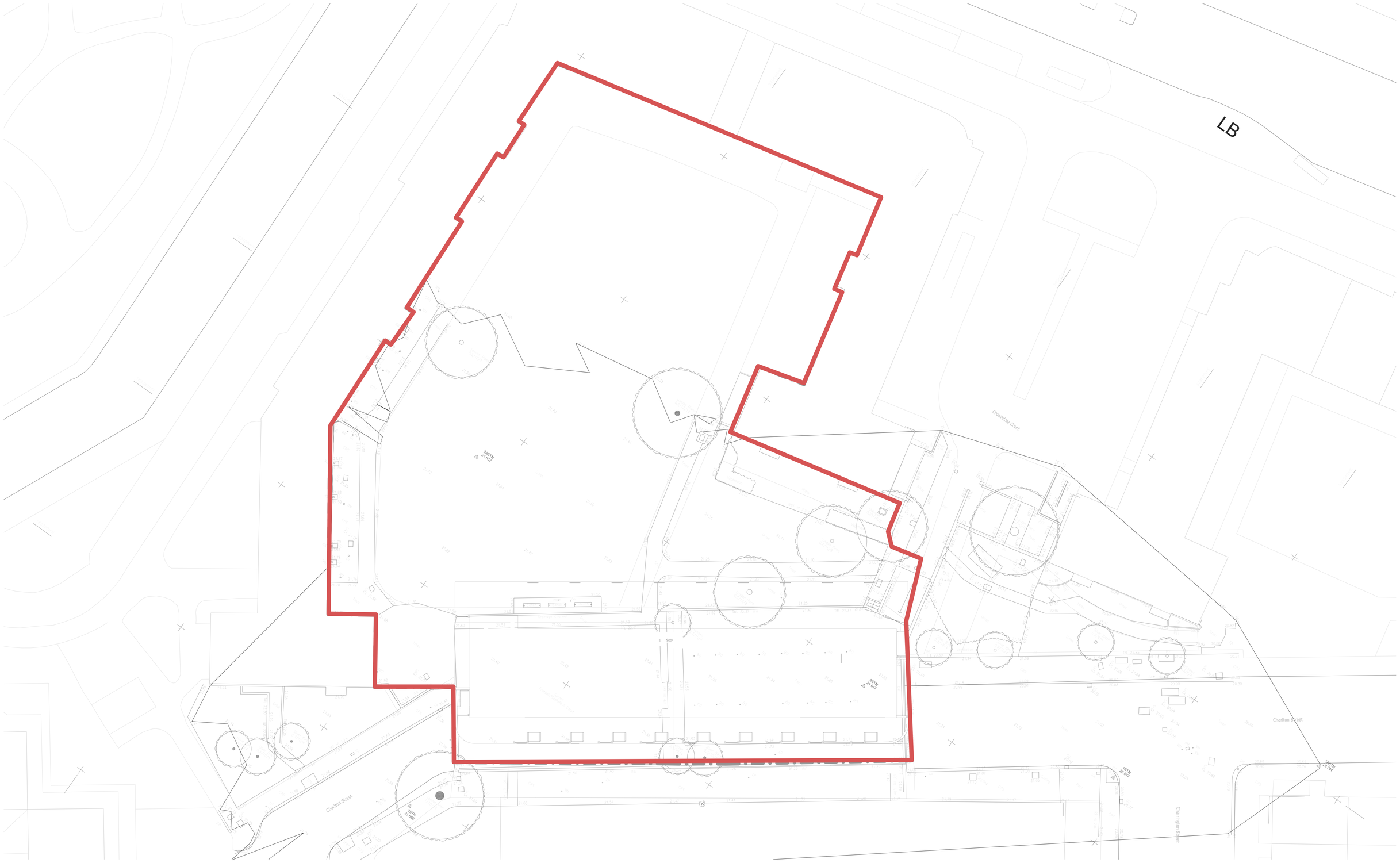
8.12 It is recommended to attenuate runoff from the residential are within geocellular crates located in the amenity area above the proposed development.

8.13 According to the proposed site plan, the proposed additional hardstanding areas account for an area of approximately 1220m2. The crates (min. void ratio of 0.95) should have a plan area of 90m^2 and depth of at least 1.2m (IL at approx. 19.65mAOD) in order accommodate the required runoff and attenuation volume required by the 1in100yr+40% rainfall event. The final crate layout should be confirmed by a specialist crate manufacturer one the level of the outfall sewer has been confirmed.

8.14 All of the proposed onsite SuDS and surface water drainage systems should be privately maintained. A long-term maintenance regime should be implemented by the residents as outlined in this report. In addition to a long-term maintenance regime, it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post-construction and monthly for the first quarter following construction.

8.15 The purpose of this assessment is to demonstrate that the development proposal outlined above can be satisfactorily accommodated without worsening flood risk for the area and without placing the development itself at increased risk of flooding, as per national guidance provided within the National Planning Policy Framework (NPPF) 2019, the National Planning Practice Guidance (NPPG), DEFRA's National Standards for Sustainable Drainage and Local guidance provided within the London Borough of Camden Strategic Flood Risk Assessment (SFRA) 2014 (section 7, Sustainable Drainage Systems)

Appendix I - Supporting Information



General Notes

1.Drawing indicates design intent only.
2.The contractor is responsible for taking and scheduling all dimensions on site.
3.Do not scale from drawings.
4.Report all discrepancies to the architect before proceeding.

Key Plan / Section

0 4m 8m 12m 16m 20m

N

Revision Date Description

Client

London Borough of Camden

SURFACE TO AIR

Unit 210, Metropolitan Wharf Building, 70 Wapping Wall, London, E1W 3SS
T +44 (0)203 727 3300 E info@surface4o-air.com
Registered office in England and Wales No: 05302392

Project

Godwin & Crowndale

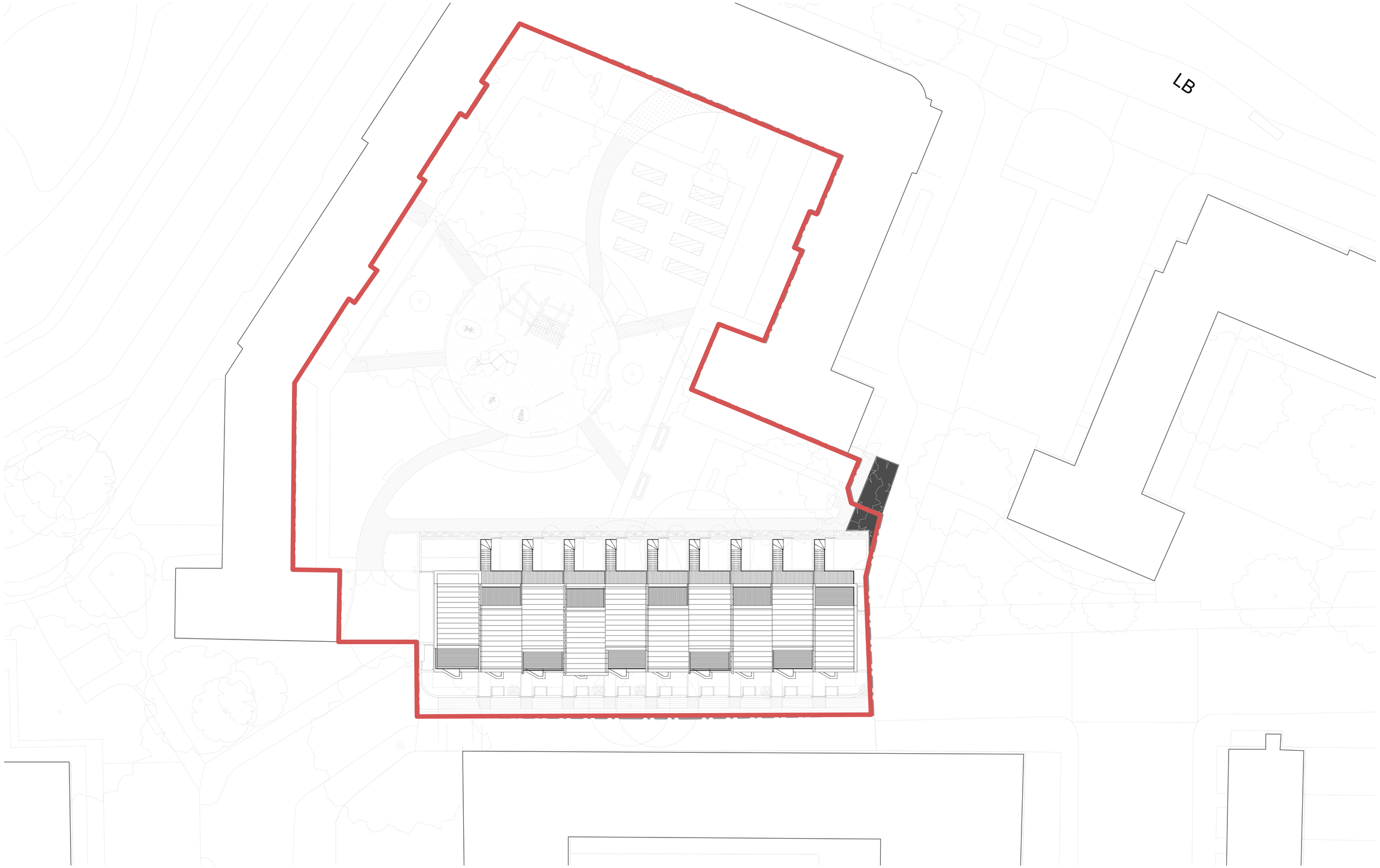
Drawing Title

Existing Site Plan

Scale: 1 : 200 @ A1
Status: For Information
Checked By: Checker

Project	Origin	Role	Zones	Level	Type	Class	Number	Suitability	Revision
1674	S2A	A	XX	XX	DR	00	001	S0	

01/04/2020 13:14:19



General Notes

1. Drawing indicates design intent only.
2. The contractor is responsible for taking and scheduling all dimensions on site.
3. Do not scale from drawings.
4. Report all discrepancies to the architect before proceeding.

Key Plan / Section

4m 8m 12m 16m 20m

N

INDICATIVE

Revision	Date	Description

Client

London Borough of Camden

SURFACE TO AIR

Unit 210, Metropolitan Wharf Building, 70 Wapping Wall, London, E1W 3SS
T +44 (0)203 727 3300 E info@surface-to-air.com
Registered office in England and Wales No: 05302392

Project

Godwin & Crowndale

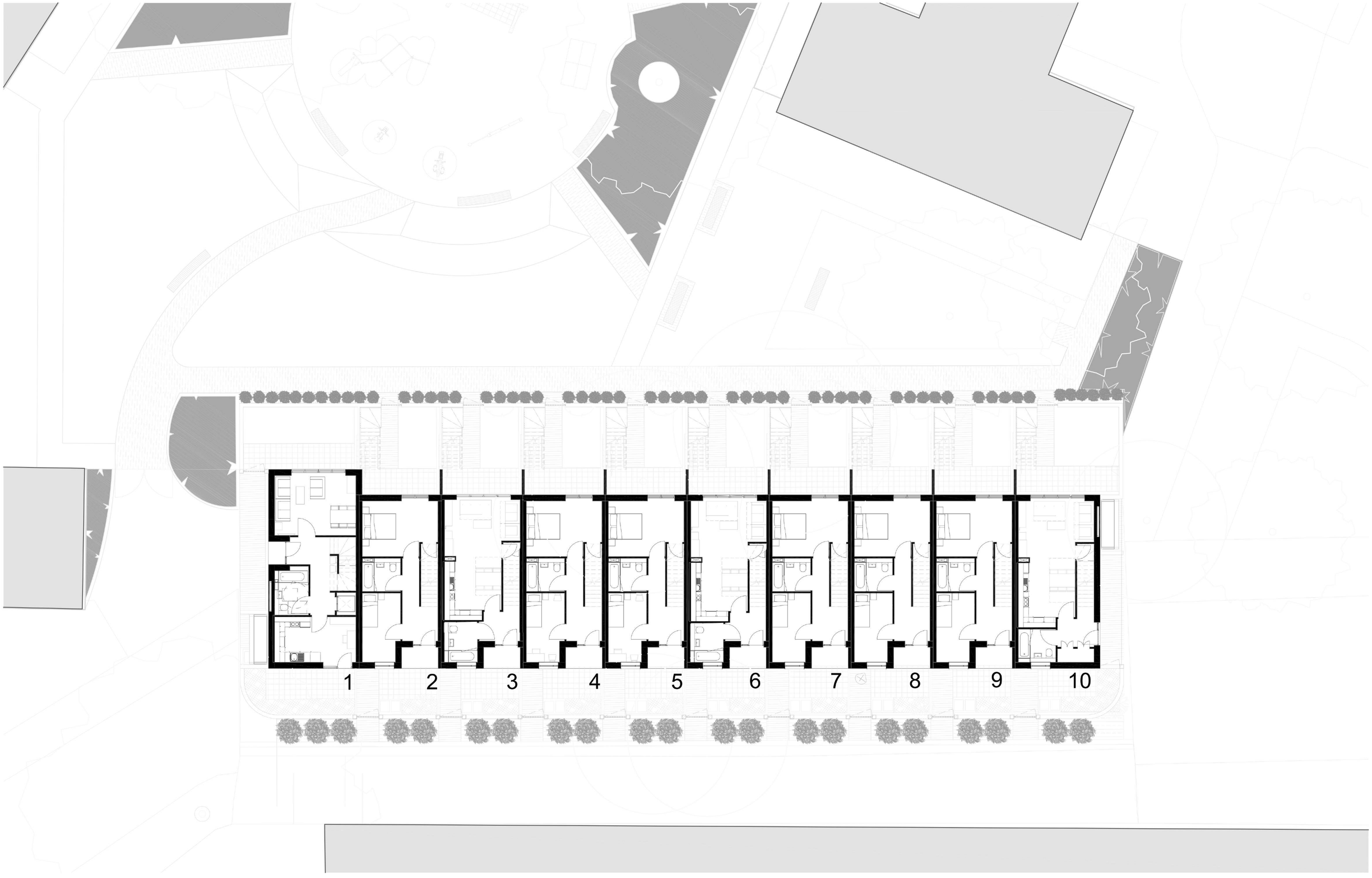
Drawing Title

Proposed Site Plan

Scale: 1 : 200 @ A1 | Status: For Information | Checked By: Checker

Project	Origin	Role	Zones	Level	Type	Class	Number	Suitability	Revision
1674	S2A	A	01	XX	DR	00	100	S3	

01/04/2020 13:01:48



General Notes

1. Drawing indicates design intent only.
2. The contractor is responsible for taking and scheduling all dimensions on site.
3. Do not scale from drawings.
4. Report all discrepancies to the architect before proceeding.

Key Plan / Section

0 2m 4m 6m 8m 10m

N

Revision	Date	Description
A	10.06.19	Bin Storage amended

Client

London Borough of Camden

SURFACE TO AIR

Unit 210, Metropolitan Wharf Building, 70 Wapping Wall, London, E1W 3SS
T +44 (0)203 727 3300 E info@surface-to-air.com
Registered office in England and Wales No: 05202292

Project

Godwin & Crowndale

Drawing Title

Ground Floor Plan

Scale	Status	Checked By
1 : 100 @ A1	For Information	Checker

Project	Origin	Role	Zones	Level	Type	Class	Number	Suitability	Revision
1674	S2A	A	XX	XX	DR	01	100	S3	A

01/04/2020 14:49:15

Appendix II - Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	mark naumann
Site name:	5835_Camden_
Site location:	Somers Town, London

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.

Site Details

Latitude:	51.53460° N
Longitude:	0.13466° W
Reference:	42081578
Date:	Nov 24 2020 13:25

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): .122

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	620	620
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} 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_{BAR} (l/s):	0.19	0.51
1 in 1 year (l/s):	0.16	0.43
1 in 30 years (l/s):	0.44	1.18
1 in 100 year (l/s):	0.62	1.63
1 in 200 years (l/s):	0.72	1.91

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
3	0.096	4.00	21.600	1200	8.415	42.294	1.950
2			21.600	1200	5.608	42.256	1.967
1			21.670	1200	2.352	42.256	2.057

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.003	2	1	3.256	0.600	19.633	19.613	0.020	162.8	225	4.10	50.0
1.002	3	2	2.807	0.600	19.650	19.633	0.017	165.1	225	4.05	50.0

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440	2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	0	0	0
30	0	0	0				

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	3	10	19.762	0.112	14.4	0.1268	0.0000	OK
15 minute winter	2	10	19.737	0.104	14.4	0.1172	0.0000	OK
15 minute winter	1	10	19.705	0.092	14.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	3	1.002	2	14.4	0.767	0.357	0.0528	
15 minute winter	2	1.003	1	14.4	0.872	0.354	0.0538	6.3

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

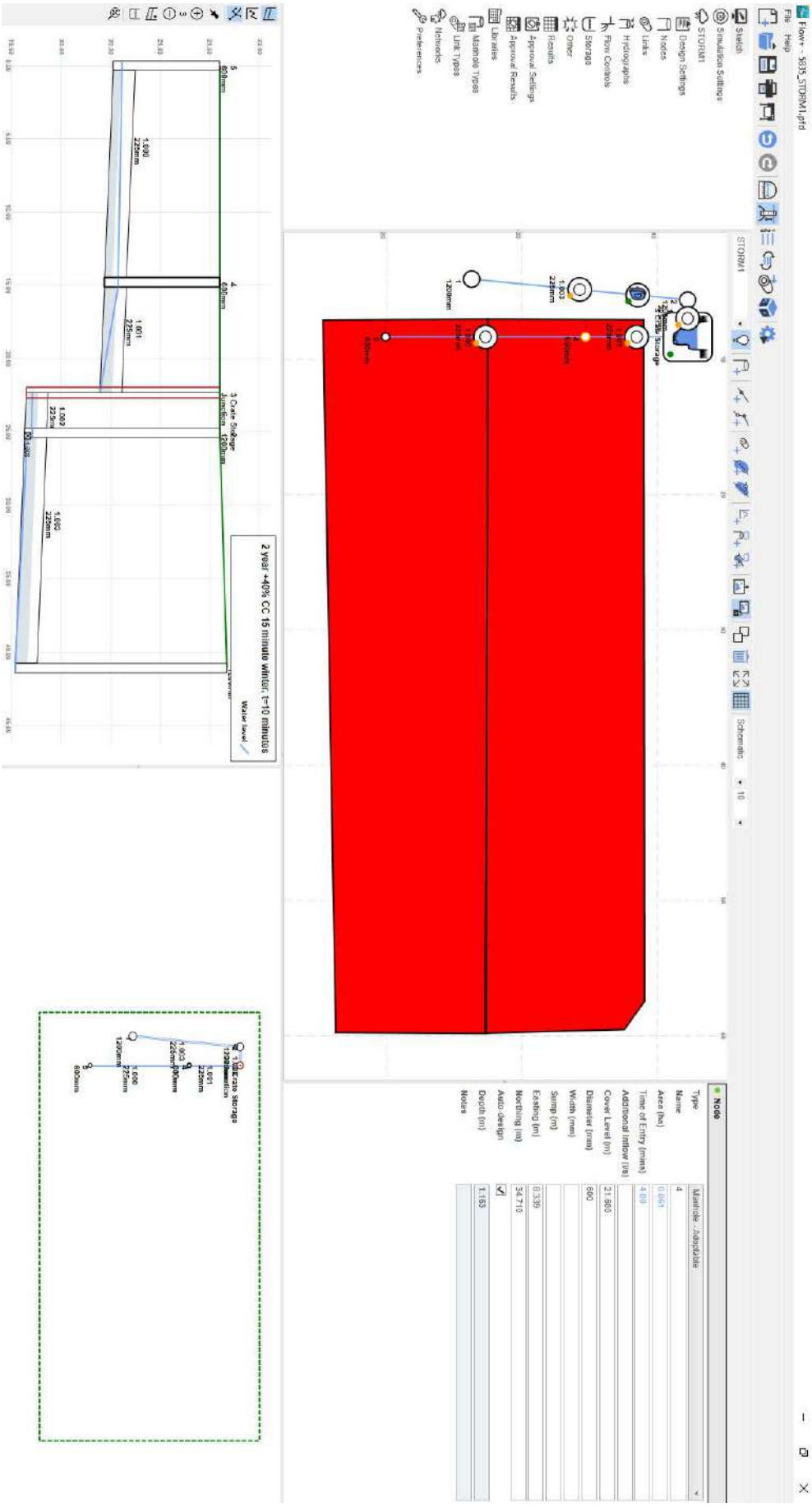
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	3	10	19.915	0.265	44.8	0.3000	0.0000	SURCHARGED
15 minute winter	2	10	19.862	0.229	44.8	0.2588	0.0000	SURCHARGED
15 minute winter	1	10	19.790	0.177	44.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	3	1.002	2	44.8	1.127	1.111	0.1116	
15 minute winter	2	1.003	1	44.8	1.188	1.103	0.1193	19.5

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	3	10	20.019	0.369	59.4	0.4177	0.0000	SURCHARGED
15 minute winter	2	10	19.924	0.291	59.4	0.3292	0.0000	SURCHARGED
15 minute winter	1	10	19.812	0.199	59.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	3	1.002	2	59.4	1.494	1.473	0.1116	
15 minute winter	2	1.003	1	59.4	1.495	1.462	0.1254	25.9



Site Network Schematic

Design Settings

Rainfall Methodology	FEH-13	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	0.850
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	4.00	Minimum Backdrop Height (m)	0.500		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
5	0.061	4.00	21.600	600	8.339	19.928	1.075
4	0.061	4.00	21.600	600	8.339	34.710	1.163
3 Crate Storage			21.600		8.339	42.256	1.950
2			21.600	1200	5.608	42.256	1.967
1			21.670	1200	4.065	26.292	2.132

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.003	2	1	16.038	0.600	19.633	19.538	0.095	168.8	225	4.68	50.0
1.002	3 Crate Storage	2	2.731	0.600	19.650	19.633	0.017	160.6	225	4.41	50.0
1.001	4	3 Crate Storage	7.546	0.600	20.437	20.392	0.045	167.7	225	4.37	50.0
1.000	5	4	14.782	0.600	20.525	20.437	0.088	168.0	225	4.24	50.0

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
5	8.339	19.928	21.600	1.075	600	0	1.000	20.525	225
4	8.339	34.710	21.600	1.163	600	1	1.000	20.437	225
						0	1.001	20.437	225
3 Crate Storage	8.339	42.256	21.600	1.950		1	1.001	20.392	225
						0	1.002	19.650	225
2	5.608	42.256	21.600	1.967	1200	1	1.002	19.633	225
						0	1.003	19.633	225
1	4.065	26.292	21.670	2.132	1200	1	1.003	19.538	225

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440	2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	40	0	0	100	40	0	0
30	40	0	0				

Node 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.003	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0051-1400-1400-1400
Invert Level (m)	19.633	Min Outlet Diameter (m)	0.075
Design Depth (m)	1.400	Min Node Diameter (mm)	1200
Design Flow (l/s)	1.4		

Node 3 Crate Storage Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	19.650
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	776

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	90.0	0.0	1.200	90.0	0.0	1.201	0.0	0.0

Results for 2 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	5	10	20.614	0.089	12.9	0.0251	0.0000	OK
15 minute summer	4	10	20.574	0.137	25.7	0.0388	0.0000	OK
240 minute winter	3 Crate Storage	196	19.912	0.262	5.9	22.4001	0.0000	SURCHARGED
240 minute winter	2	196	19.912	0.279	2.1	0.3155	0.0000	SURCHARGED
15 minute summer	1	1	19.538	0.000	1.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	5	1.000	4	12.9	0.648	0.323	0.2943	
15 minute summer	4	1.001	3 Crate Storage	25.7	1.050	0.643	0.1848	
240 minute winter	3 Crate Storage	1.002	2	2.1	0.257	0.052	0.1086	
240 minute winter	2	Hydro-Brake®	1	1.0				33.5

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	5	10	20.959	0.434	40.1	0.1227	0.0000	SURCHARGED
15 minute winter	4	10	20.841	0.404	79.9	0.1142	0.0000	SURCHARGED
360 minute winter	3 Crate Storage	352	20.470	0.820	10.6	70.1244	0.0000	SURCHARGED
360 minute winter	2	352	20.470	0.837	2.0	0.9468	0.0000	SURCHARGED
15 minute summer	1	1	19.538	0.000	1.0	0.0000	0.0000	OK

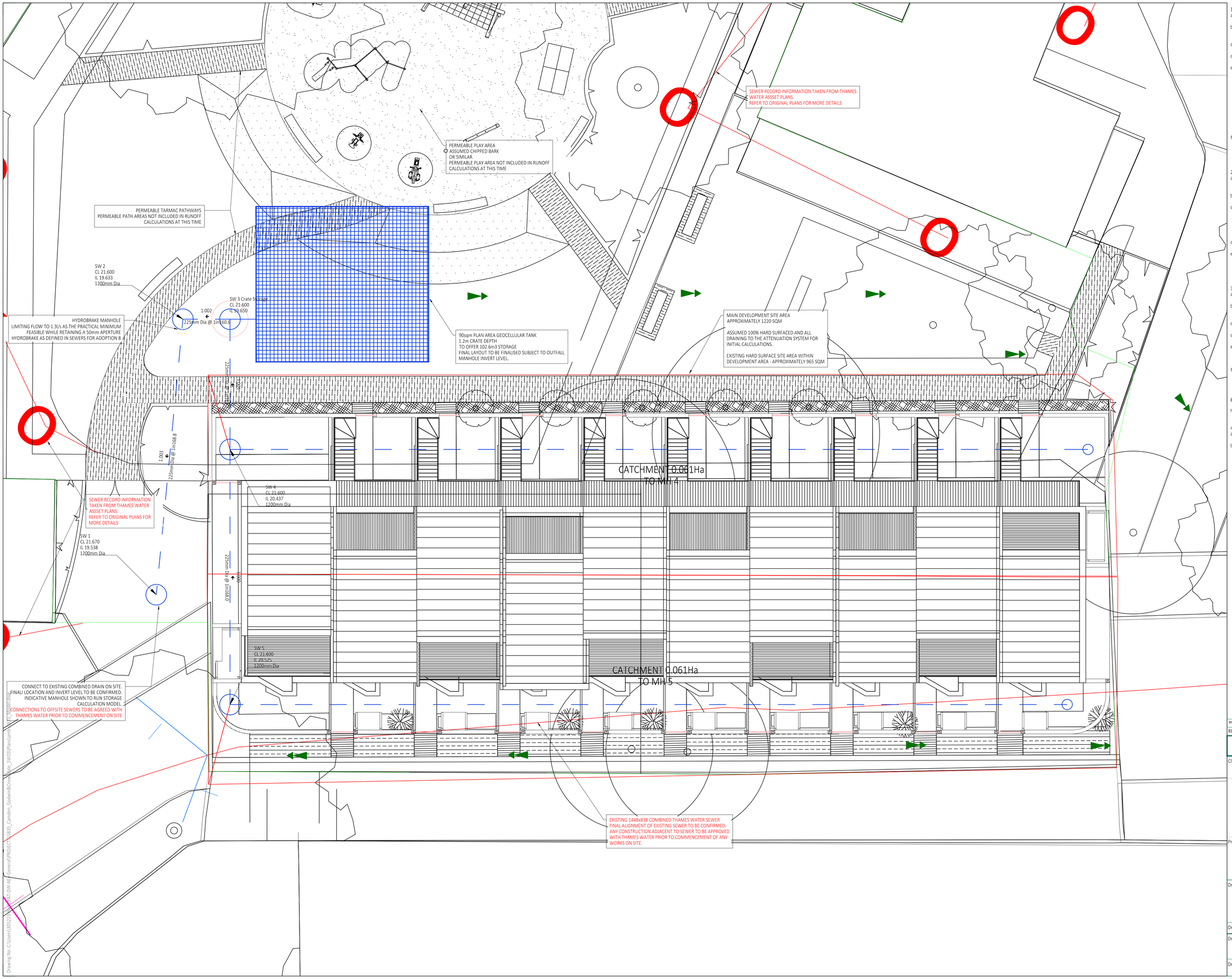
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	5	1.000	4	40.1	1.008	1.003	0.5879	
15 minute winter	4	1.001	3 Crate Storage	79.9	2.009	1.996	0.2971	
360 minute winter	3 Crate Storage	1.002	2	2.0	0.216	0.049	0.1086	
360 minute winter	2	Hydro-Brake®	1	1.1				90.1

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	5	10	21.226	0.701	53.2	0.1985	0.0000	SURCHARGED
15 minute winter	4	10	21.019	0.582	105.9	0.1646	0.0000	SURCHARGED
360 minute winter	3 Crate Storage	352	20.840	1.190	14.8	101.7355	0.0000	SURCHARGED
360 minute winter	2	352	20.840	1.207	2.4	1.3650	0.0000	SURCHARGED
15 minute summer	1	1	19.538	0.000	1.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	5	1.000	4	53.1	1.336	1.329	0.5879	
15 minute winter	4	1.001	3 Crate Storage	105.9	2.663	2.646	0.2971	
360 minute winter	3 Crate Storage	1.002	2	2.4	0.219	0.058	0.1086	
360 minute winter	2	Hydro-Brake®	1	1.3				113.4

Appendix III - Surface Water Drainage Layout



1. GENERAL
a. THIS DRAWING IS NOT TO BE SCALED, WORK TO FIGURED DIMENSIONS ONLY, CONFIRMED ON SITE.
b. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
c. ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.
d. THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.
e. CDM REGULATIONS 2015. ALL CURRENT DRAWINGS AND SPECIFICATIONS MUST BE READ IN CONJUNCTION WITH THE DESIGNER'S HAZARD RISK AND ENVIRONMENT ASSESSMENT RECORD. DESIGN HAS BEEN PRODUCED BASED ON INFORMATION PROVIDED BY THE CLIENT/PRINCIPLE DESIGNER AVAILABLE AT TIME OF ISSUE. CONTRACTOR TO REVIEW DRAWING AND SPECIFICATION IN CONTEXT WITH THE WIDER SITE AND SPECIFIC SITE INVESTIGATION, CONTAMINATION ASSESSMENT, ASBESTOS SURVEY, ENVIRONMENTAL SURVEY, UXO SURVEY AND ANY OTHER RELEVANT INFORMATION AND MANAGE RISKS RELATING TO THE WORKS OUTLINED IN THE DRAWINGS AND SPECIFICATION. PRINCIPLE CONTRACTOR TO MAKE DESIGNER AND CLIENT AWARE OF SITE SPECIFIC RISKS THAT MAY AFFECT THE DRAWING AND SPECIFICATION.
f. CDM REGULATIONS 2015. FOR GENERIC MAINTENANCE AND MANAGEMENT RISKS REFER TO CHAPTER 36 OF CIRIA 752 SUDS MANUAL. FOR PROPRIETARY SYSTEMS SEE MANUFACTURER'S MANAGEMENT AND MAINTENANCE DETAILS AND RISK ASSESSMENT WITH REGARDS TO MAINTENANCE OF PROPRIETARY SYSTEMS.

2. CONSTRUCTION NOTE
a. THE MAIN CONTRACTOR IS RESPONSIBLE FOR THE DESIGN OF ALL TEMPORARY WORKS, AND IS ALSO RESPONSIBLE FOR THE SAFE MAINTENANCE AND STABILITY OF EXISTING BUILDINGS AT ALL TIMES.
b. THE MAIN CONTRACTOR IS RESPONSIBLE FOR ALL OCCURRENCES OF GROUND WATER DURING THE CONSTRUCTION PERIOD.
c. ANY INFORMATION GIVEN REGARDING EXISTING UNDERGROUND SERVICES IS GIVEN IN GOOD FAITH AFTER CONSULTATION WITH THE RELEVANT AUTHORITY, HOWEVER ACCURACY IS NOT CERTAIN. THE MAIN CONTRACTOR IS RESPONSIBLE FOR CHECKING ALL INFORMATION ON SITE PRIOR TO WORK COMMENCING AND TAKING DUE CARE AND ATTENTION WHILST UNDERTAKING THE WORKS.
d. THE CONTRACTOR MUST COMPLY WITH ALL CURRENT LEGISLATION RELATING TO HEALTH & SAFETY.
e. ALL PRODUCTS SPECIFIED SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND INSTRUCTIONS. IF THERE ARE DISCREPANCIES BETWEEN THAT INFORMATION AND THE DETAILS ON ANY AMBIENTAL DRAWINGS, THE MANUFACTURERS INSTRUCTIONS MUST BE USED

3. BELOW GROUND DRAINAGE
a. PIPEWORK TO BE UPVC-U PIPES TO BS 4660 : 2000 AND INSPECTION CHAMBERS TO BS 7158 : 2001.
b. ALL ADOPTABLE DRAINAGE TO BE CONSTRUCTED IN ACCORDANCE WITH 'SEWERS FOR ADOPTION' 7TH EDITION AND THE RELEVANT COUNCIL DESIGN GUIDE.
c. ALL PRIVATE SURFACE WATER SEWERS TO BE LAID AT 1 IN 100 UNLESS OTHERWISE STATED ON THE DRAWING.
d. ALL PRIVATE FOUL WATER SEWERS TO BE LAID AT 1 IN 40 AT THE HEAD OF PIPE RUNS AND 1 IN 80 ELSEWHERE UNLESS OTHERWISE STATED.
e. ALL PRIVATE FOUL SEWER PIPES TO BE 100MM DIAMETER UNLESS OTHERWISE STATED ON THE DRAWING. ALL PRIVATE SURFACE WATER SEWER PIPES TO BE 100MM DIAMETER FROM DOWNPIPES AND 150MM DIAMETER ELSEWHERE UNLESS OTHERWISE STATED ON THE DRAWING.
f. ALLOW FOR RODDING ACCESS ABOVE GROUND WHERE RAINWATER DOWNPIPES DO NOT HAVE A DIRECT CONNECTION TO AN INSPECTION CHAMBER. EXISTING SEWER PIPE TO BE RE-USED TO BE SURVEYED AND LEVELLED PRIOR TO COMMENCEMENT OF THE DRAINAGE WORKS AND REFURBISHED IF NECESSARY.
g. CONNECTIONS TO AN ADOPTED SEWER ONLY TO BE MADE FOLLOWING APPROVAL FROM THE RELEVANT ADOPTING AUTHORITY.
h. ALL DRAINS, SEWER PIPES AND MANHOLES TO BE CLEANED AND TESTED FOR WATER TIGHTNESS ON COMPLETION OF CONSTRUCTION.

4. MANHOLE COVERS AND FRAMES
a. MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.
b. MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.

LEGEND

- PRIVATE SURFACE WATER DRAIN
- EXISTING COMBINED THAMES WATER SEWER
- TYPE 2 MANHOLE
- TYPE 3 INSPECTION CHAMBER
- TYPE 4 INSPECTION CHAMBER
- RE — RODDING EYE
- RWP — RAIN WATER PIPE
- ROAD GULLY
- BOTTLE GULLY
- ATTENUATION SYSTEM
- OVERLAND FLOW

REV	DATE	BY	CKD	APP	DESCRIPTION
##	XX.XX.XX	--	--	--	--

PRELIMINARY DRAWING
FOR INFORMATION ONLY. NOT FOR CONSTRUCTION.

Client
LONDON BOROUGH OF CAMDEN

AMBIENTAL
ENVIRONMENTAL ASSESSMENT
a company of Royal HaskoningDHV

Project
GODWIN AND CROWNDALE ESTATE
Crowndale Road, London, NW1 1NW

Drawing
SITE LAYOUT
DRAINAGE STRATEGY

Drawn by: MN
Date: NOV 20

Drawing No.: 5835 - DR01
Revision: -

Drawing Scale: 1:100 @ A1
0 1m 2m 3m 4m 5m

Drawing No: C:\Users\30522\Royal HaskoningDHV AEC\General\PROJECTS\5835_Camden_Godwin&Crowndale_SWDS\Plans\sam\5835-DR01.dwg

Appendix IV - Thames Water Sewer records

Asset location search

Property Searches

Ambiental
Sussex Innovation Centre
Science Park Square
BRIGHTON
BN1 9SB

Search address supplied Godwin and Crowndale Housing Estate
Camden
London
NW1 1NW

Your reference 5835 WO: AE1001-194-109

Our reference ALS/ALS Standard/2020_4300816

Search date 13 November 2020

Knowledge of features below the surface is essential for every development

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

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

Contact us to find out more.

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

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

0845 070 9148

Asset location search

Property Searches

Search address supplied: Godwin and Crowndale Housing Estate, Camden, London, NW1 1NW

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

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

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

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

Waste Water Services

Please provide a copy extract from the public sewer map.

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

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

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

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

For your guidance:

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

Clean Water Services

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

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

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

pressure test to be carried out for a fee.

For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

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

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

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

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

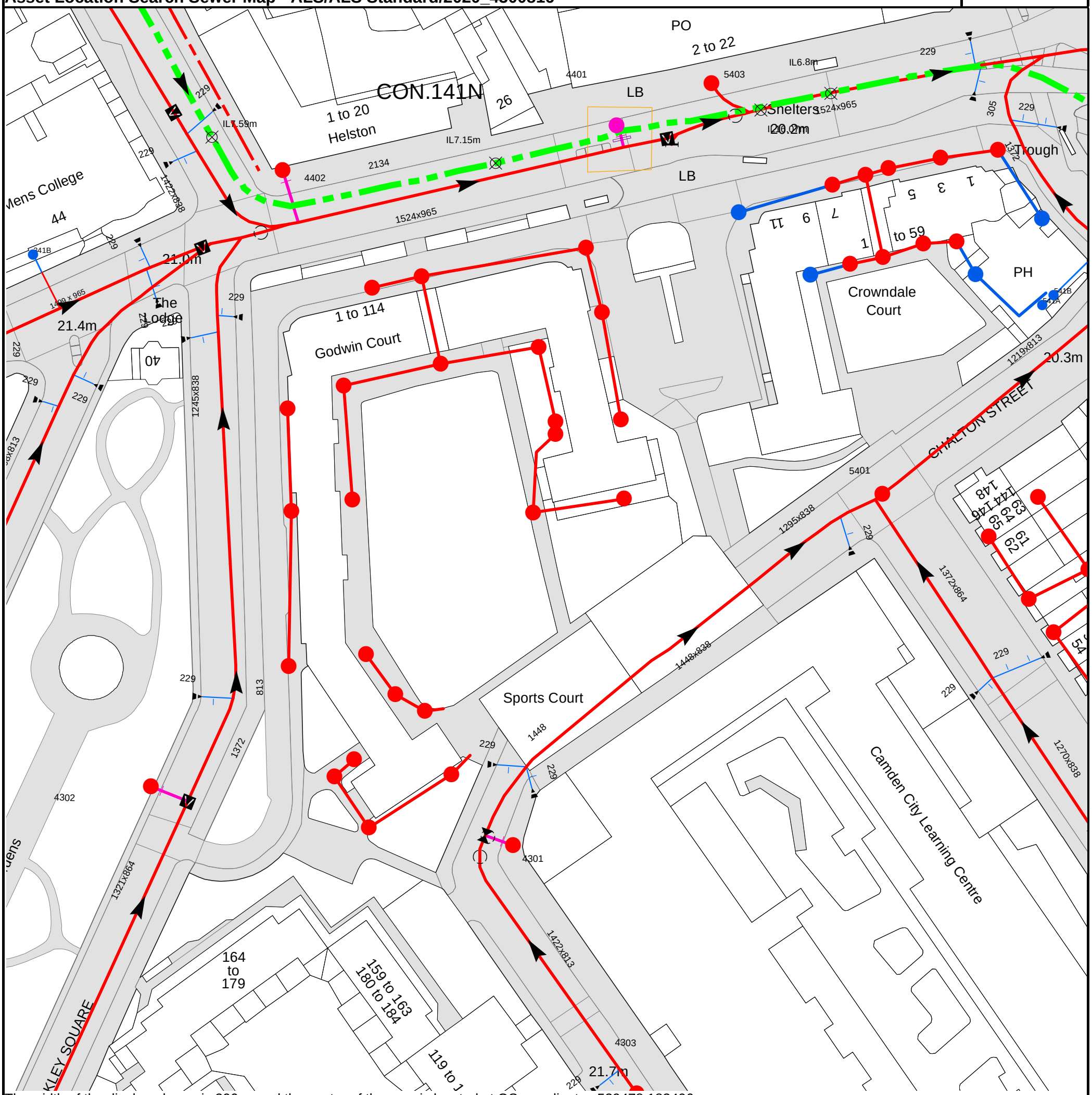
Clean Water queries

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

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

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

Asset Location Search Sewer Map - ALS/ALS Standard/2020_4300816



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 529478,183406

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.

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
341B	n/a	n/a
44DI	n/a	n/a
44ED	n/a	n/a
541A	n/a	n/a
541B	n/a	n/a
44EH	n/a	n/a
44EA	n/a	n/a
54FI	n/a	n/a
54EH	n/a	n/a
54FE	n/a	n/a
54FA	n/a	n/a
44EE	n/a	n/a
54EJ	n/a	n/a
54EI	n/a	n/a
54EA	n/a	n/a
54FJ	n/a	n/a
54FF	n/a	n/a
54FB	n/a	n/a
4402	n/a	n/a
54FC	n/a	n/a
54FD	n/a	n/a
54EB	n/a	n/a
4401	20.02	16.36
5403	n/a	n/a
4301	n/a	n/a
43CI	n/a	n/a
43CH	n/a	n/a
43CJ	n/a	n/a
43CG	n/a	n/a
43CE	n/a	n/a
43CD	n/a	n/a
43BD	n/a	n/a
43CC	n/a	n/a
53CI	n/a	n/a
53DA	n/a	n/a
54DH	n/a	n/a
54DI	n/a	n/a
44AJ	n/a	n/a
44EJ	n/a	n/a
44EF	n/a	n/a
44AE	n/a	n/a
54DG	n/a	n/a
5401	21.02	16.47
44DG	n/a	n/a
44DH	n/a	n/a
44EC	n/a	n/a
44EI	n/a	n/a
44EG	n/a	n/a
44DJ	n/a	n/a
4302	n/a	n/a

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

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

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

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

Control Valve

Drop Pipe

Ancillary

Weir

End Items

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

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

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

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

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

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

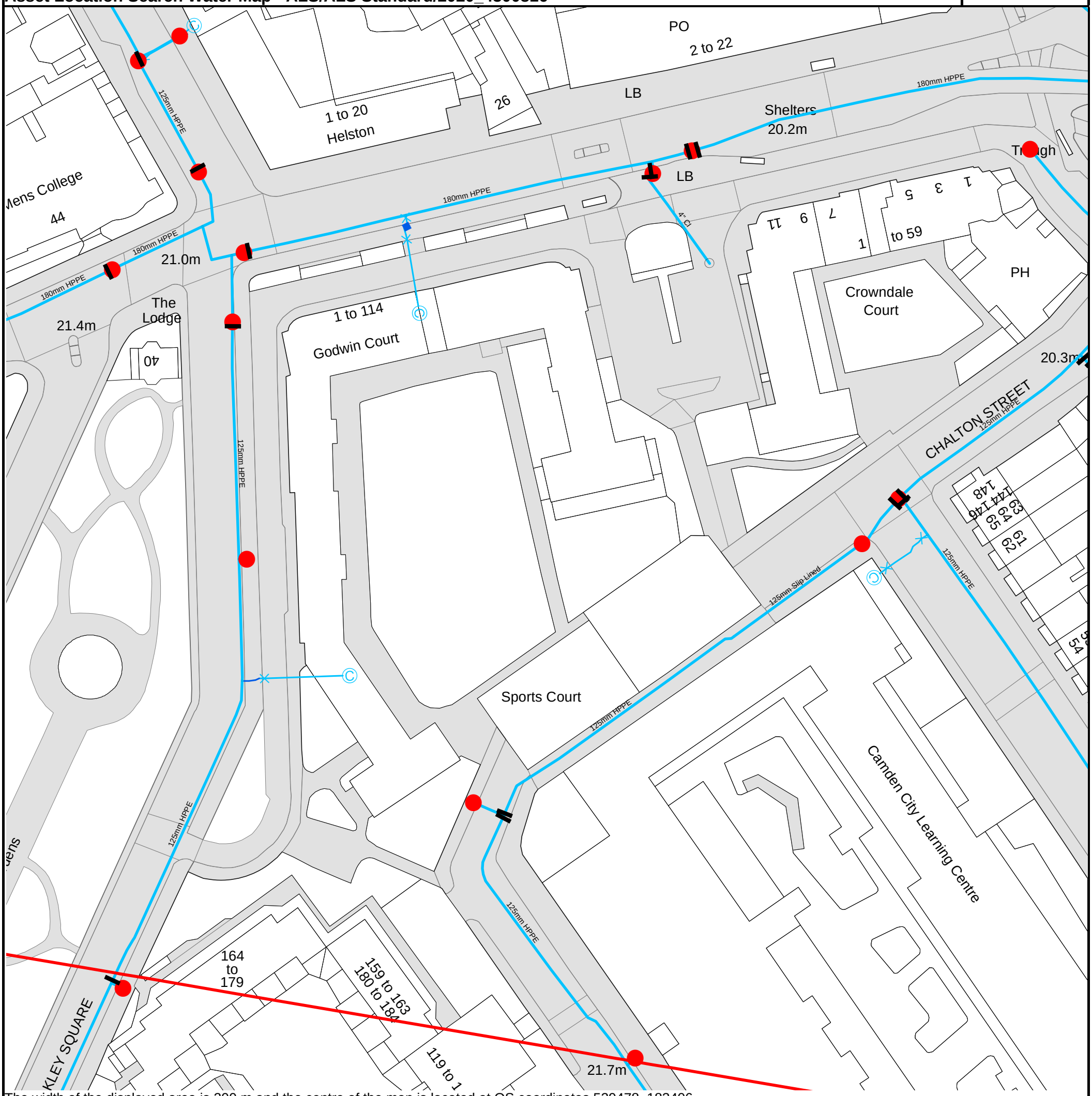
Proposed

Abandoned Sewer

Notes:

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

Asset Location Search Water Map - ALS/ALS Standard/2020_4300816



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 529478, 183406.

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

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

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

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')

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: Indiates 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 **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

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