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FLOOD RISK ASSESSMENT and SUDS STRATEGY

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1 EXECUTIVE SUMMARY

This Drainage Assessment reviews the existing drainage arrangement at the application site and proposes a surface water drainage strategy in line with Local Authority and Lead Local Flood Authority (LLFA) guidance.

The site is currently occupied by a single dwelling and located at 11 Sandy Way Lodge, Northwood.

The proposed development comprises the construction of a new 4 unit residential block and associated external works.

The proposed strategy presented in detail in this report aims to reduce the surface water discharge to greenfield rates. All post development run-off from the entire site will be limited to less than the greenfield rate for all storm events up and including the 100 year +40% storm in accordance with best practice.

Attenuation and reduced discharge will be provided for all storm events up to and including the 1 in 100-year storm plus 40% allowance for climate change. Sustainable Drainage Systems (SuDS) shall be used, including an area of tanked permeable paving for surface water attenuation and silt traps.

It is proposed to reuse the existing sewer connections. It is assumed that both foul and surface water sewer currently discharge uncontrolled into the existing chamber within the site frontage.

An additional 10% allowance for urban creep has been included in the sizing of attenuation. Maintenance/management of all onsite drainage infrastructure has been considered within a separate maintenance plan appended to this report. This will be updated through the development process.

The proposed drainage strategy is entirely based on-site with the exception of the new sewer connections if required.

Overall, the proposals provide a high level of water treatment, runoff reduction and flooding protection for the proposed development and are in accordance with all requirements of the Lead Local Flood Authority (LLFA).

Foul Drainage

It is proposed to discharge the foul drainage from the site into the existing Thames Water sewers.

2 INTRODUCTION

- 2.1.1 Jomas was commissioned to undertake a Drainage Assessment for the proposed development of the site located at 11 Sandy Way Lodge, Northwood.
- 2.1.2 The proposed development comprises the construction of a new 4 unit residential block and associated external works.
- 2.1.3 This Flooding and Drainage Assessment has been produced in support of a planning application and should be read in conjunction with the other planning documents.

3 SITE DESCRIPTION

- 3.1.1 The site is approximately 1170 square metres in size and is occupied by a single dwelling.
- 3.1.2 Pre-development, the site is approximately 31% impermeable. Post development, the impermeable area will increase to approximately 50%.
- 3.1.3 The site location information is as follows:
- Nearest Postcode: HA6 2AH.

3.2 Topography

Site Topography

- 3.2.1 The site location plan and existing plan is provided in appendix B. A topographic survey has not been carried out however the site is relatively flat with a gentle fall towards the street.

4 DESIGN PRINCIPLES AND POLICY REQUIREMENTS

4.1.1 Since April 2015, Lead Local Flood Authorities (LLFA's) have become a statutory consultee on surface water drainage for many planning applications. For this site, the following is considered to be the required level of detail required for planning approval:

4.1.2 Report to be prepared in accordance with the National Planning Policy Framework (NPPF), the accompanying Planning Practice Guidance (PPG), and the London Borough of Hillingdon Strategic Flood Risk Assessment (SFRA) and SUDS policies as the Lead Local Flood Authority (LLFA).

4.2 General Principles for Flooding

4.2.1 The National Planning Policy Framework (NPPF) states that when determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where informed by a site-specific FRA. This assessment is required for:

"Proposals of 1 hectare (ha) or greater in Flood Zone 1, all new development (including minor development and change of use) in Flood Zones 2 and 3 and an area within Flood Zone 1, which has critical drainage problems as notified to the local planning authority by the Environment Agency (EA)."

4.2.2 In accordance with the March 2014 Planning Practice Guidance (PPG), which supports the NPPF, the objectives of this FRA are to establish:

- *Whether a proposed development is likely to be affected by current or future flooding from any source;*
- *Whether it will increase flood risk elsewhere;*
- *Whether the measures proposed to deal with these effects and risks are appropriate.*

4.3 General Principles for Surface Water Drainage

4.3.1 The DEFRA Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March, 2015), the London Borough of Hillingdon Surface Water Management Plan, Local Flood Risk Management Strategy and the London Plan require sustainable drainage systems in all development to reduce surface water runoff and provide water treatment on site. This includes but is not limited to addressing the following issues in order of preference:

- store rainwater for later use
- use infiltration techniques, such as porous surfaces in non-clay areas
- attenuate rainwater in ponds or open water features for gradual release
- attenuate rainwater by storing in tanks or sealed water features for gradual release
- discharge rainwater direct to a watercourse
- discharge rainwater to a surface water sewer/drain

- discharge rainwater to the combined sewer.

Consideration must be given to the direction of water flow across the site and where this may be dispersed and incorporating any features that will help reduce surface water run-off. All developments should aim to achieve greenfield run off with at least a 50% reduction in surface water discharge and this needs to be demonstrated as part of the planning submission.

5 FLOODING INFORMATION

5.1 Flood Risk from Rivers (Fluvial)

5.1.1 As the site is within Flood Zone 1, there is a low risk of fluvial flooding to the site.

5.1.2 Based on the above, the risk of flooding from rivers is considered very low.

5.2 Coastal and Tidal Flood Risk

5.2.1 The site is located inland and is not near any tidally influenced watercourses; therefore, there is negligible risk of flooding from this source.

5.3 Geology and Hydrogeology (Groundwater)

5.3.1 The British Geological Survey (BGS) mapping available on line suggests that the area is underlain by London Clay Formation - Clay and Silt. Sedimentary Bedrock formed approximately 48 to 56 million years ago in the Palaeogene Period. Local environment previously dominated by deep seas.

5.3.2 The MAGIC Map indicates the area is not of any note regarding ground conditions.

5.3.3 The site is located within a Zone II Outer Source protection zone.

5.3.4 On site infiltration testing has confirmed that soakaways are not an option on this site.

5.3.5 Due to the presence of the impermeable clay, groundwater is unlikely to raise above ground level, hence the risk of flooding from ground water is considered very low.

5.4 Surface Water Flood Risk (Overland Flows)

5.4.1 Surface water flooding occurs when the rainwater does not drain away through the normal drainage system or infiltrate the ground, but instead lies on or flows over the ground.

5.4.2 The EA produced a Risk of Flooding from Surface Water Map in December 2013. The maps were produced using 'direct rainfall' modelling. Although they consider local drainage capacity, non-surface water influences such as rivers, seas or groundwater are not considered. The map is based on LIDAR topographic data which is not suitable for site specific assessment and therefore, where available, topographic survey data should be used to provide a more accurate understanding of potential flow paths.

5.4.3 The map shows the entire country within four different risk categories, defined below in Table 1.

Table 1: EA Surface Water Flood Risk Categories

Risk Category	Definition
High	Each year, there is a chance of flooding of greater than 1 in 30 (3.3%)

Medium	Each year, there is a chance of flooding of between 1 in 30 (3.3%) and 1 in 100 (1%)
Low	Each year, there is a chance of flooding of between 1 in 100 (1%) and 1 in 1000 (0.1%)
Very Low	Each year, there is a chance of flooding of less than 1 in 1000 (0.1%)

5.4.4 An extract of the map, provided below, shows no surface water flooding within the site.



Figure 1: EA Flood Risk from Surface Water Map

5.4.5 The local Flood Risk Management Strategy does not show any risk of surface water flooding within this area.

5.4.6 Based on the EA's mapping, the local SFRA, historical data and local topography, the risk of surface water flooding to the site is considered to be very low.

5.5 Sewer/Drainage Flood Risk

- 5.5.1 Sewer flooding is often caused by excess surface water entering the drainage system when there is insufficient sewer capacity to cope with this excess water, but also due to 'one off' events such as blockages.
- 5.5.2 Thames Water is the statutory undertaker for the local public sewer network. The nearest Thames Water sewers to the site are located within the street.
- 5.5.3 As the natural topography of the site falls away towards the street, this indicates that the site is at very low risk of sewer flooding.
- 5.5.4 There are no records within any local flooding and drainage documents of sewer flooding in the area.
- 5.5.5 On the basis there is considered to be a very low risk of sewer flooding to the site.

5.6 Reservoir Flood Risk

- 5.6.1 The EA has produced a Reservoir Flood Map that shows that the site is at risk from reservoir flooding. This map indicates very low risk of reservoir flooding at this site.
- 5.6.2 It should be emphasised that the risk of flooding from reservoir breach is very small since the EA is the enforcement authority for the Reservoirs Act (1975) and all large raised reservoirs are inspected and supervised by reservoir panel engineers.
- 5.6.3 On the basis there is considered to be a negligible risk of reservoir flooding to the site.

5.7 Summary of risk levels

- 5.7.1 Pre-development, the risk of flooding is summarised below.

Table 2: Flood Risk Categories

Source	Risk Category
Fluvial (Rivers and Sea)	Very low
Coastal and tidal	Negligible
Groundwater	Very low
Surface water	Very low
Sewers	Very low
Reservoirs	Negligible

6 SITE DRAINAGE INFORMATION

6.1.1 The DEFRA Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March, 2015) states that the following options must be considered for disposal of surface water runoff in order of preference:

- Discharge to ground
- Discharge to a surface water body
- Discharge to a surface water sewer
- Discharge to a combined sewer

Discharge to Ground

6.1.2 The potential for surface water to discharge to ground has been assessed through a review of the likely ground conditions and possible infiltration structures.

6.1.3 The surface geology of this site is within an area generally underlain by London Clays and so not suitable for infiltration. Soakaway tests have been completed (see Appendix C) confirming that infiltration is not possible.

Discharge to Surface Water Body

6.1.4 There are no suitable surface water bodies near to the site that can be used for surface water discharge.

Discharge to Surface Water Sewer/Combined Sewer

6.1.5 Discharge to the public sewer network should only be considered once all other options for draining surface water from the site have been exhausted.

6.1.6 It is proposed to connect to the sewer via existing manholes on site, or new connections if the existing manholes cannot be found.

6.1.7 Thames Water sewer maps are provided in Appendix C. There are both foul and surface water sewers within the street than can be used.

6.2 Sustainable Drainage Systems (SuDS)

6.2.1 To maximise the potential use of SuDS at the site, a review has been undertaken as shown in Table 3 in accordance with the SuDS Hierarchy. This review highlights the components referenced in the SuDS Hierarchy and provides recommendations on whether the components could be incorporated into the development.

Table 3: SuDS Selection Based on the SuDS Hierarchy

Component	Recommendation
Green/Blue roofs	Whilst the use of green and blue roofs provides additional environmental benefits such as enhanced aesthetics and ecology, its exposure to wind and orientation must be considered. Access to undertake the construction and maintenance easily and safely is also a high priority.

Component	Recommendation
	If feasible, depending on the roof design, a green/blue roof will provide water quality, biodiversity and aesthetic benefits to the site. Additionally, the green/blue roof/s will offer some attenuation for run-off, reducing volumes of run-off and in higher frequency events (i.e. 1in2 year storms) will result in no run-off for the building. The proposed roof is pitched and so not suitable for a green roof.
Basins and Ponds	Ponds and attenuation basins can provide overland storage of surface water whilst also providing additional biodiversity and aesthetic/amenity value. There are no open areas on the site which are suitable for basins or ponds.
Filter Strips and Swales	Swales are linear vegetated drainage features, which provide overland conveyance and storage of surface water whilst trapping sediments and hydrocarbons within run-off. They also create biodiverse areas for planting and habitat. Swales are not considered suitable for this site due to the urban setting restricting the availability of space.
Infiltration Devices	Infiltration devices are likely to be suitable for the main drainage system due to the permeable nature of the existing ground. Infiltration is not considered suitable for this site.
Permeable Paving	Whilst incorporating attenuation storage, permeable paving also provides treatment through filtration of silt (and attached pollutants), settlement and retention of solids, adsorption of pollutants and biodegradation of organic pollutants, including petrol and diesel. There is a large area of tanked permeable paving proposed for the site.
Tanked Systems	This is the least sustainable option in terms of the SuDS Hierarchy. However, the use of tanked systems would still be of benefit compared to traditional drainage systems as it does allow run-off to be slowed down to an acceptable discharge rate. There are no tanks proposed for the site.

7 SURFACE WATER DRAINAGE DESIGN

7.1 Site Areas

7.1.1 The development area currently comprises a single dwelling. The existing and proposed areas are summarised below.

Table 4: Site Areas

Parameter	Existing (m2)	Existing (%)	Proposed (m2)	Proposed (%)
Impermeable area	362	31	580	50
Permeable area	708	69	590	50
Total area	1170	100	1170	100

7.1.2 It is assumed that the surface water runoff from the site is currently picked up in the site drainage system and discharges into the sewers in Sandy Lodge Way.

7.2 Design Considerations

7.2.1 Consideration has been given to the following when calculating the proposed impermeable areas.

- The 2013 EA 'Rainfall Run-off Management for Developments' Report (SC030219) states that urban creep, the process of gradually increasing impermeable area within an urban area (through paving soft landscaped surfaces and constructed outbuildings etc), is an acknowledged issue. To include an allowance for urban creep, the impermeable area used in the drainage calculations has been increased by 10% in accordance with the recommendation made in SC030219.

7.2.2 The climate change allowance used in the Drainage Strategy is in line with updated EA guidance values published in February 2016 for increased rainfall intensities by 2115.

7.3 Greenfield Run-Off Rates

7.3.1 The greenfield run off rates have been calculated using the Wallingford method. Calculations are provided in Appendix C and summarised in the table below.

7.4 Existing Run-Off Rates

7.4.1 The existing run-off rates for a variety of return periods have been calculated using the Wallingford method.

7.4.2 The total site area is 1170 square metres and is 31% impermeable, resulting in an impermeable area of 362 square metres. Taking conservative peak 1 year, 30 year and 100 year rainfall rates of 50mm/hr, 125mm/hr and 185mm/hr respectively, the maximum existing peak discharge rates have been calculated as follows.

Contributing Area (ha) x 1 yr Rainfall (mm/hr) x 2.78

$362/1000 \times 50 \times 2.78 = 5.0 \text{ l/s}$

Contributing Area (ha) x 30 yr Rainfall (mm/hr) x 2.78

$362/1000 \times 125 \times 2.78 = 12.6 \text{ l/s}$

Contributing Area (ha) x 100yr Rainfall (mm/hr) x 2.78

$362/1000 \times 185 \times 2.78 = 18.6 \text{ l/s}$

7.4.3 The discharge rates for the existing and proposed site are summarised below.

Table 5: Existing Run-off Rates

Parameter	Existing Discharge (l/s)	Greenfield Discharge (l/s)	Proposed Discharge (l/s)
QBAR	NA	0.54	NA
1 year	5.0	0.46	0.4
30 year	12.6	1.24	0.5
100 year	18.6	1.72	0.5
100 year +40%	NA	NA	0.6

7.4.4 Site discharge should be as close to the greenfield rates as possible. As such, the discharge rate for this site will be set at a maximum of 0.6l/s with discharge rates for all storm events less than the greenfield rate.

7.5 Flood Risk Reduction

7.5.1 As infiltration is not possible on this site, reducing the post development run-off discharge rate to 0.6l/s is achieved through attenuation. Site discharge is via a hydrobrake into the sewers in Sandy Lodge Way.

7.5.2 By controlling run-off rates to less than greenfield rate and providing attenuation for all storm events up to and including a 1 in 100-year storm plus 40% climate change allowance, the risk of downstream flooding will be minimised.

7.5.3 Details of the drainage system and attenuation structures are presented in the design drawings and calculations in Appendix C.

7.5.4 Attenuation is provided in tanked permeable paving in the front yard. A total attenuation volume of approximately 30 cubic metres is proposed to cater for the 100 year +40% storm event.

7.5.5 The calculations include an assessment of the attenuation for all storm events up to the 100-year storm +40% climate change.

- 7.5.6 All external areas will be constructed using permeable material to mimic natural drainage as far as possible.

7.6 Exceedance Flooding and Overland Flow

- 7.6.1 The area is not subject to overland flow routes or surface water flooding as discussed in the Flooding section above.
- 7.6.2 The drainage system has been designed to cater for the 1 in 100 year + 40% climate change storm. ie in this storm event all surface water will be collected on site and slowly released. Thus, the overland flow route will only be in use in the event of drainage network failure, storms in excess of the 1 in 100 year + 40% climate change storm or flows from offsite flowing through the site.
- 7.6.3 Due to the site levels falling gently to the site frontage, all overland flow will overflow into the street. See overland flow plan in Appendix C.

7.7 Consents, Offsite Works and Diversions

- 7.7.1 The proposed surface water drainage strategy is accommodated mostly on site with consent required from Thames Water for the surface water sewer connection within the street should it be required.
- 7.7.2 Consent will also be required from Thames Water for the foul connection to the sewer within the street.

7.8 Maintenance

- 7.8.1 A SuDS maintenance plan has been prepared to outline the management of the potential SuDS features. The maintenance plan is provided in Appendix D.

8 WATER QUALITY

8.1 Post-Development Water Quality Treatment

8.1.1 In line with the 2015 SuDS Manual (CIRIA C753), certain criteria should be applied to manage the quality of run-off to support and protect the natural environment effectively. Treatment design, wherever practicable, should be based on good practice, comprising the following principles:

- Manage surface water run-off close to source
- Treat surface water run-off on the surface
- Treat surface water run-off to remove a range of contaminants
- Minimise risk of sediment remobilisation
- Minimise impacts from accidental spills

8.1.2 Managing pollution close to the source can help keep pollutant levels and accumulation rates low, essentially allowing natural treatment processes to be effective. This in turn can help maximise the amenity and biodiversity value of downstream surface SuDS components and keep maintenance activities straightforward and cost-effective.

8.1.3 The proposed development comprises a single type of land use; residential roofs. This land use is classified as having a very low hazard pollution level. The table detailing this is provided below in Table 6.

Table 6: Pollution Hazard Indices from 2015 SuDS Manual (C753)

TABLE 26.2 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
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

8.1.4 The proposed drainage strategy utilises the following SuDS features:

- Permeable Paving

8.1.5 The indicative SuDS mitigation indices, provided in Table 26.3 of the 2015 SuDS Manual (C753) have been reviewed for the roof and paving. This table is provided below in Table 7.

Table 7: Indicative SuDS Mitigation Indices from 2015 SuDS Manual (C753)

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters			
Type of SuDS component	Mitigation indices ¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

- 8.1.6 To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type), as follows:

Total SuDS mitigation index $\geq$ pollution hazard index

(for each contaminant type) (for each contaminant type)

- 8.1.7 For each type of land-use, the pollution hazard indices, mitigation indices and concluding hazard have been outlined in Table 8 below.

Table 8: Roof Space Water Quality Mitigation Summary

Residential Roofs				SuDS Manual Reference
	TSS	Metals	Hydrocarbons	
Pollution Hazard Index	0.2	0.2	0.05	Table 26.2
Mitigation Index (Permeable Paving)	0.7	0.6	0.7	Table 26.3
Total Mitigation index	0.7	0.6	0.7	Worst case only
Result	Total SuDS mitigation index $\geq$ pollution hazard index and therefore hazard is exceeded			

Table 9: External Areas Water Quality Mitigation Summary

Driveway/External Areas				SuDS Manual Reference
	TSS	Metals	Hydrocarbons	
Pollution Hazard Index	0.5	0.4	0.4	Table 26.2
Mitigation Index (Permeable Paving)	0.7	0.6	0.7	Table 26.3
Total Mitigation index	0.7	0.6	0.7	Worst case only
Result	Total SuDS mitigation index $\geq$ pollution hazard index and therefore hazard is exceeded			

- 8.1.8 Therefore, it can be concluded that the provision of permeable paving exceeds the required pollution mitigation indices and provides sufficient treatment as part of the surface water management train, in accordance with the 2015 SuDS Manual (CIRIA C753).
- 8.1.9 As the site is located in a Zone II Outer Source Protection Zone, care must be taken with surface water discharge to ensure the risk of pollution to groundwater is minimised.

9 FOUL DRAINAGE

9.1 Discharge to Public Sewer Network

9.1.1 Thames Water are the foul sewerage suppliers for the area.

9.1.2 The identified point of connection from the site is into the public foul sewer network in the street. A Sewer connection application will be submitted to Thames Water for approval.

10 DRAINAGE DURING CONSTRUCTION

10.1 Construction Run-off Management

- 10.1.1 Installing the surface water and foul drainage system, whilst managing temporary run-off, are key aspects of the construction works involved in any development. The information provided below is in accordance with the 'C698 Site handbook for the construction of SUDS' (CIRIA, 2007).
- 10.1.2 Please note that the measures recommended below are recommendations only and need to be confirmed at the construction stage by the client and the contractor.

10.2 Management of Construction (Including Drainage)

- 10.2.1 Drainage is typically an early activity in the construction stage of a development, taking form during the earthworks phase. However, final construction i.e. piped drainage system connections to the SuDS devices, should not take place until the end of site development work, unless a robust strategy for silt-removal is implemented prior to occupation of the site.
- 10.2.2 A plan for the management of construction (including phasing of works, details of any offsite works etc.) cannot be provided at this early stage, as construction work plans are not yet known. However, the following key points are general construction issues associated with SuDS which will be addressed when these plans are complete:
- Silt-laden waters from construction sites represent a common form of waterborne pollution;
 - These silt-laden waters cannot enter SUDS drainage systems unless specifically designed to accept this as it can clog the systems and pollute receiving waters. Therefore, piped drainage systems should not be connected to the attenuation SuDS devices until the late stages of construction.
 - Any gullies and piped systems should be capped off during construction and fully jetted and cleaned prior to connection to the attenuation SuDS devices.

10.3 Temporary Drainage During Construction

- 10.3.1 The three principal aspects of drainage control during construction are trapping sediment, conveying run-off, and controlling run-off.
- 10.3.2 Sediment traps and barriers can include basin traps and sediment fences (with any necessary boundary controls). The principal basins are to be installed after the construction site is accessed. Sediment fences and barriers will then be installed as needed during grading.
- 10.3.3 Conveyance of run-off can be achieved through small ditches/stream, storm drains, channels and sloped drains with sufficient inlet/outlet protection.
- 10.3.4 Slope stability needs to be considered when using any channels to convey run-off across the site into any basins etc.
- 10.3.5 Run-off control measures will need to be implemented in order not overwhelm the temporary system and cause flooding issues. Run-off rates from the site will be managed so they are no greater than pre-development or in keeping with the best practice guidance to minimise risk of blockage. Any additional conveyance measures are to be installed as needed during grading.

- 10.3.6 Run-off control to include provision of perimeter ditches or appropriate levels grading to direct any water from the construction site to remain on site.
- 10.3.7 Any necessary surface stabilisation measures are to be applied immediately on all disturbed areas where construction work is either delayed or incomplete.
- 10.3.8 Maintenance inspections are to be performed weekly, and maintenance repairs to be made immediately after periods of rainfall.

10.4 Protection of Drainage Infrastructure during Construction

- 10.4.1 All drainage infrastructure should be protected from damage by construction traffic and heavy machinery through the implementation of measures such as protective barriers, and storing construction materials away from the drainage infrastructure.



Appendix A: Proposed Development Details



Appendix B: Existing Site



Appendix C: Drainage Drawings and Calculations

Appendix D: SuDS Details and Maintenance Report

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Geotechnical Engineering and Environmental Services across the UK.



JOMAS ASSOCIATES LTD

6-9 The Square
Stockley Park
Uxbridge
UB11 1FW

CONTACT US

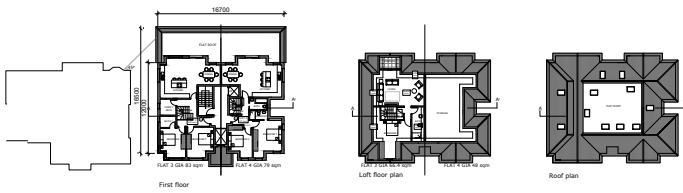
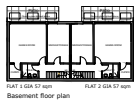
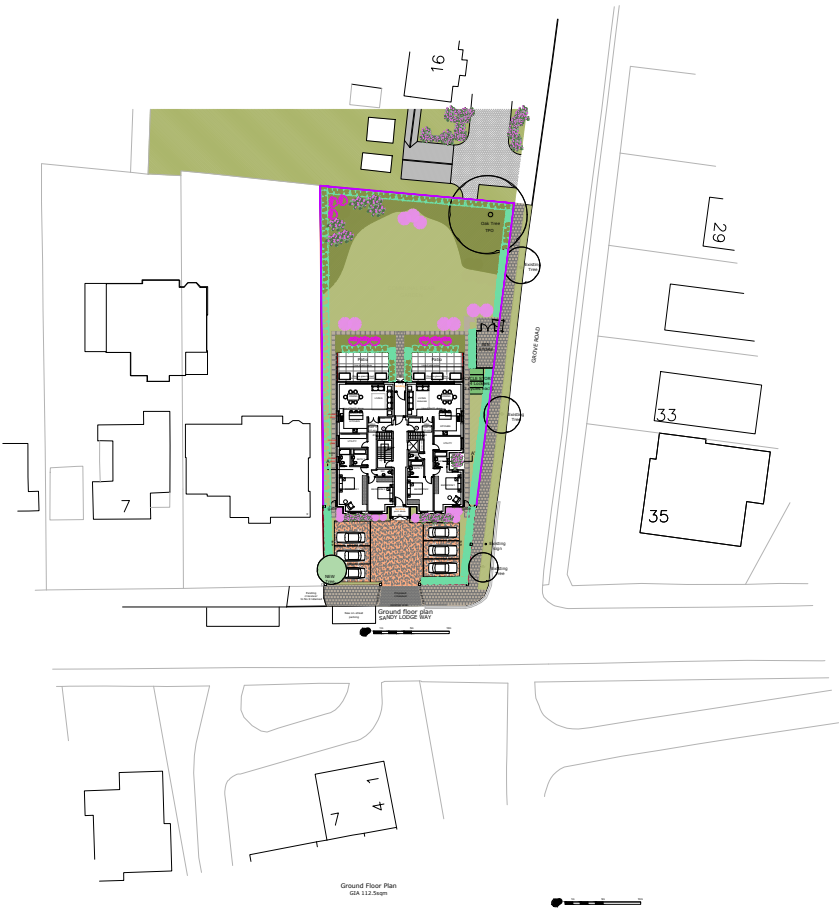
Website: www.jomasassociates.com

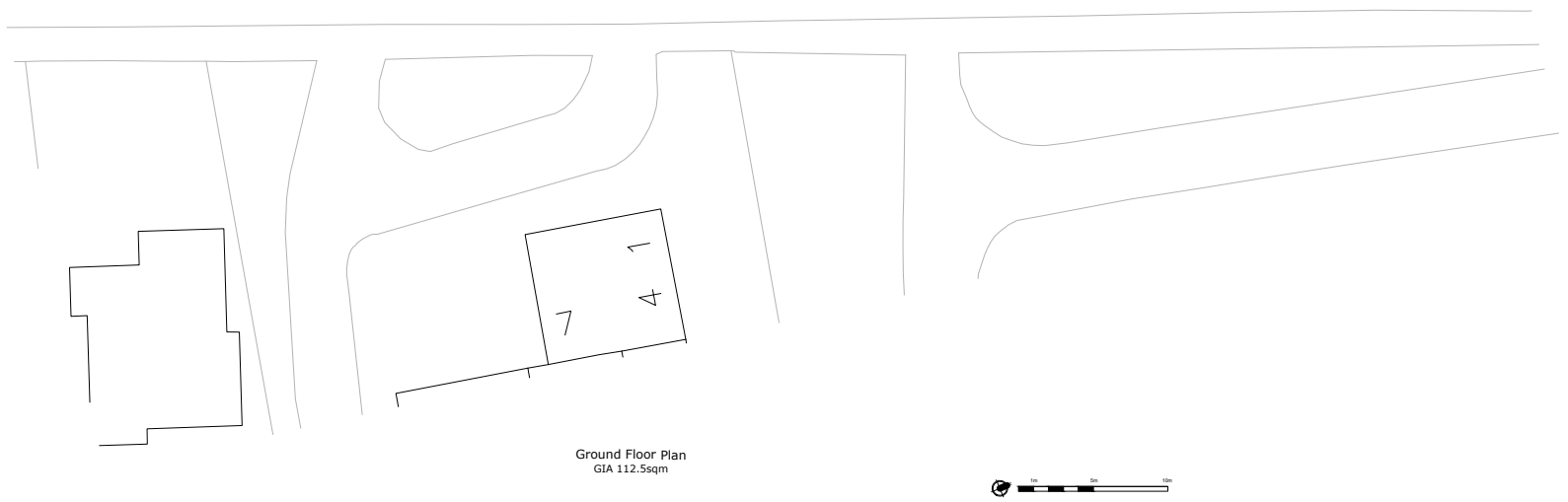
Tel: 0843-289-2187

Fax: 0872-115-4505

Email: info@jomasassociates.com

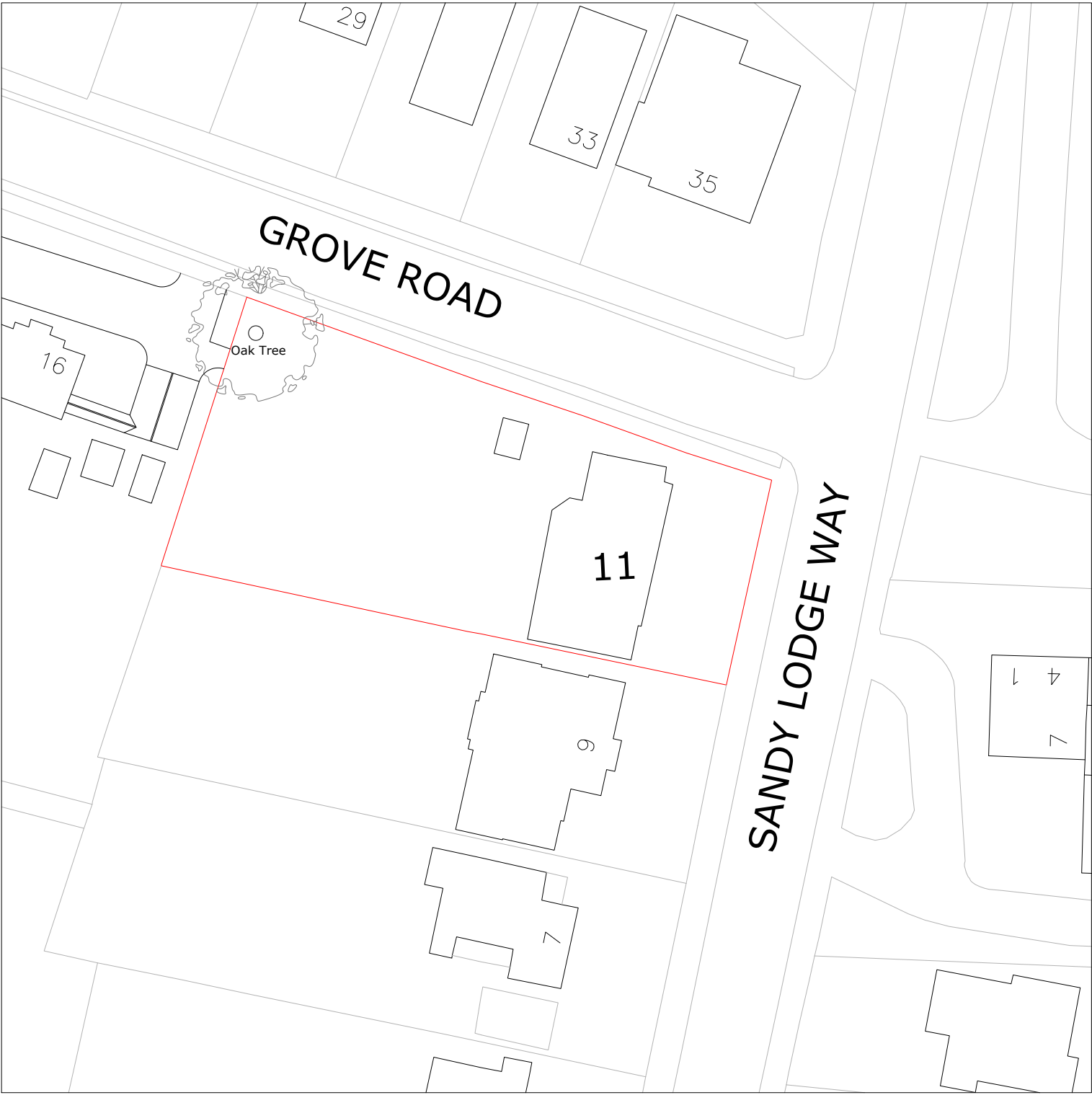
PROPOSED PLANS AND ELEVATIONS





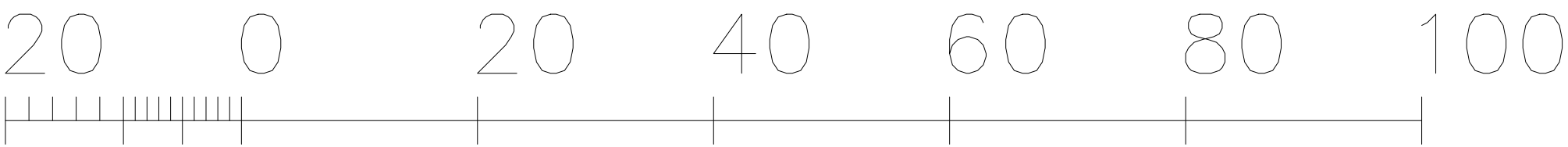


Appendix B: Existing Site



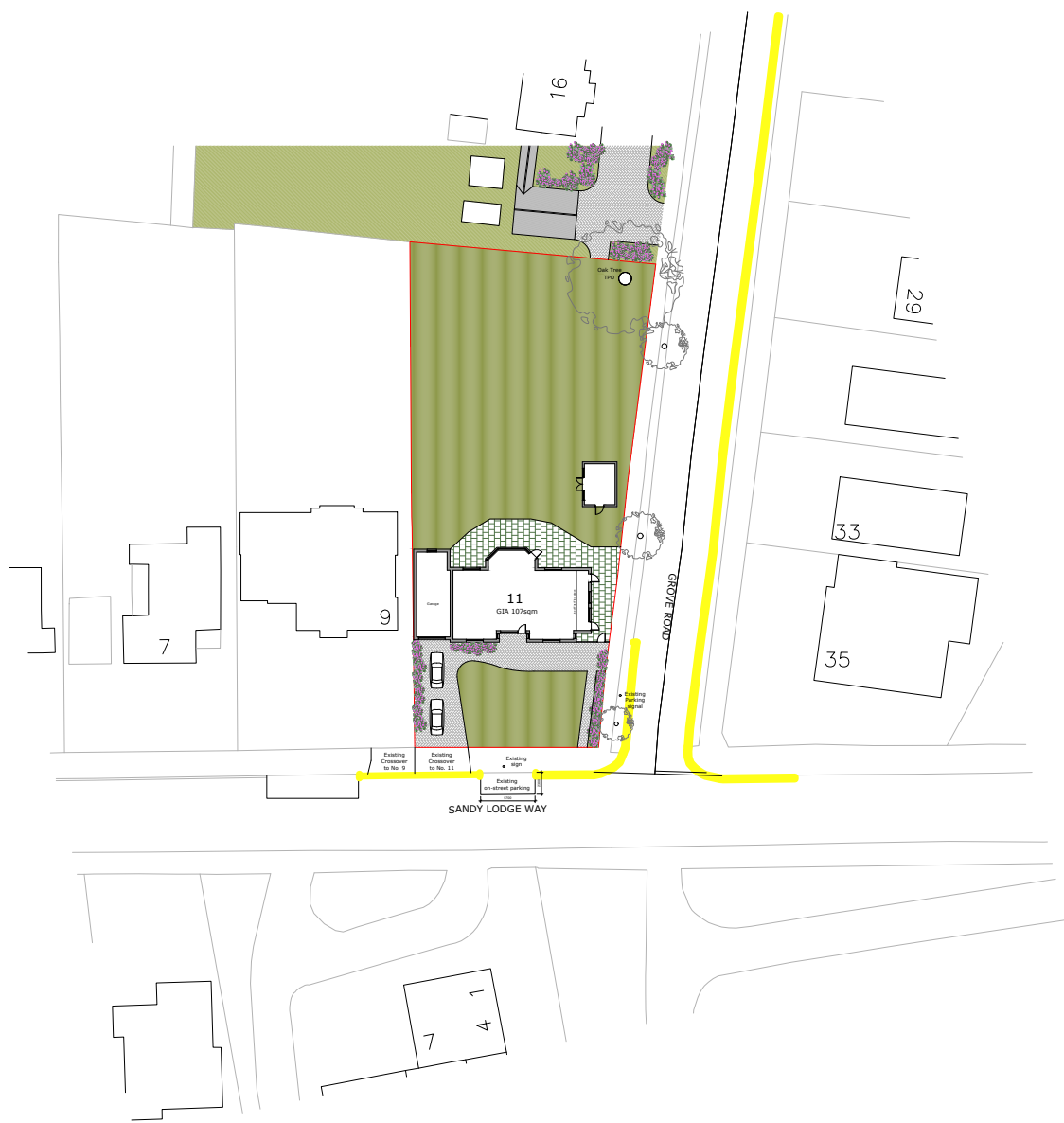
Scale: 1/1250

11 SANDY LODGE WAY, MIDDLESEX
HA6 2AH

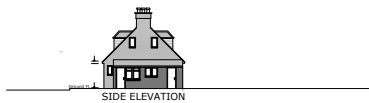
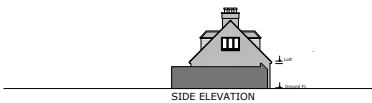
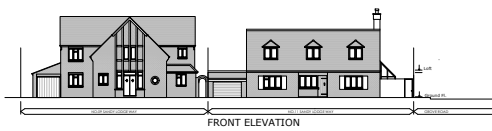
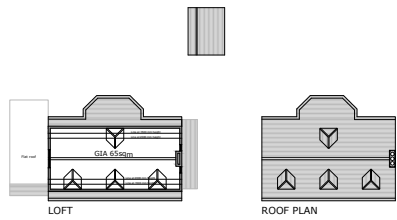


Metres

EXISTING PLANS AND ELEVATIONS



GROUND FLOOR PLAN





Appendix C: Drainage Drawings and Calculations

Asset location search



Property Searches

andrew wallace
22Park Rise
HARPENDEN
AL5 3AL

Search address supplied 5
Sandy Lodge Way
Northwood
HA6 2AH

Your reference sandy

Our reference ALS/ALS Standard/2020_4291564

Search date 2 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

Search address supplied: 5, Sandy Lodge Way, Northwood, HA6 2AH

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 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.

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

Affinity Water Ltd
Tamblin Way
Hatfield
AL10 9EZ
Tel: 0345 3572401



For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

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

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

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

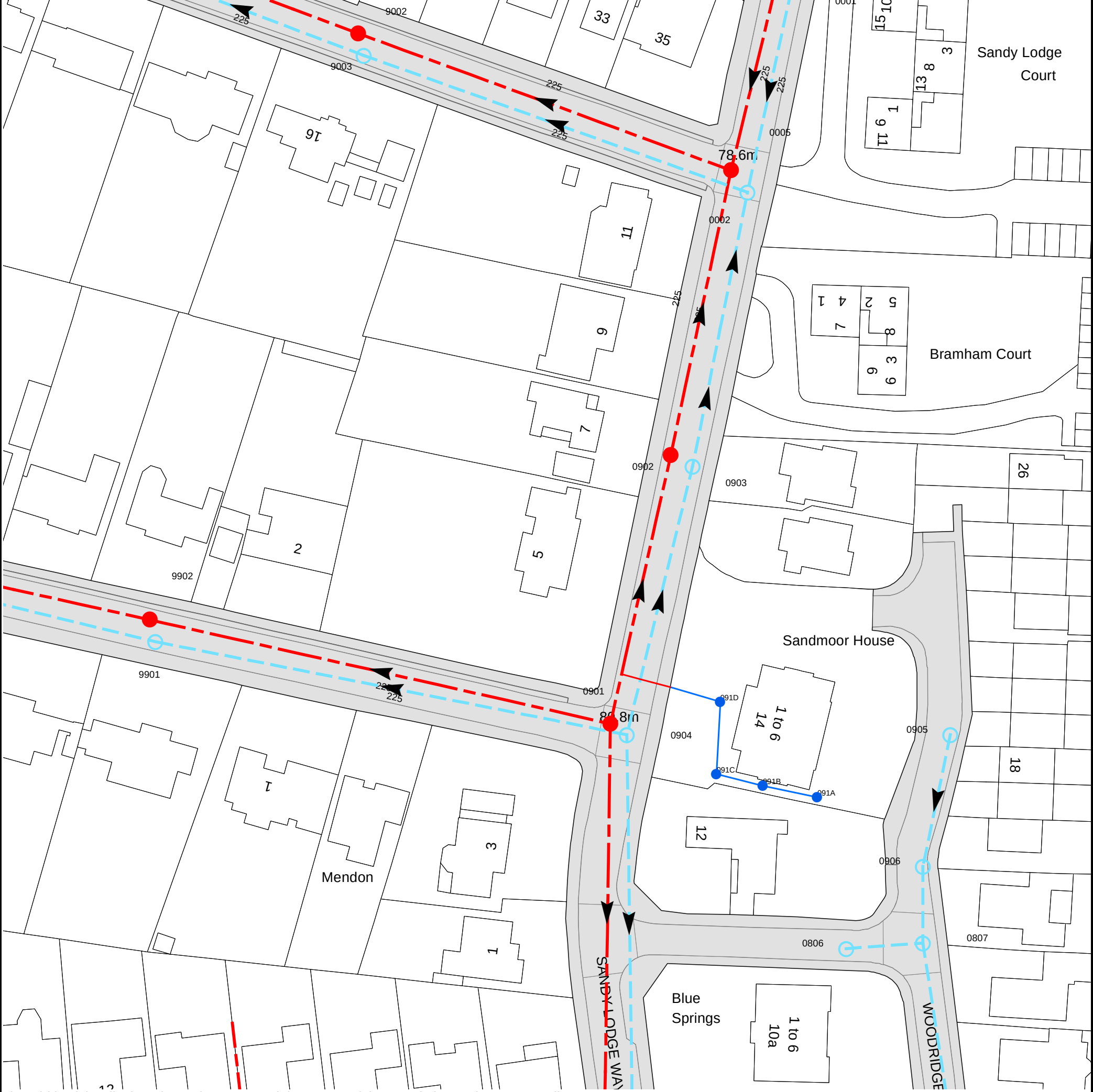
Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Clean Water queries

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

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

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



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 508999,191959
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
091D	n/a	n/a
0002	78.76	75.59
0005	78.87	76.01
091B	n/a	n/a
091A	n/a	n/a
0806	n/a	n/a
0807	n/a	n/a
0906	30.34	28.96
0905	30.53	29.45
9901	79.31	75.44
9902	78.84	76.21
9002	76.54	73.85
9003	76.67	74.21
0901	80.95	77.7
0904	82.01	79.73
0902	80	76.67
0903	80.09	77.49
091C	n/a	n/a
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.		



ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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.

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
	Gully
	Culverted Watercourse
	Proposed
	Abandoned Sewer

- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. 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.

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.

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

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:

Longitude:

Reference:

Date:

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	672	672
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.

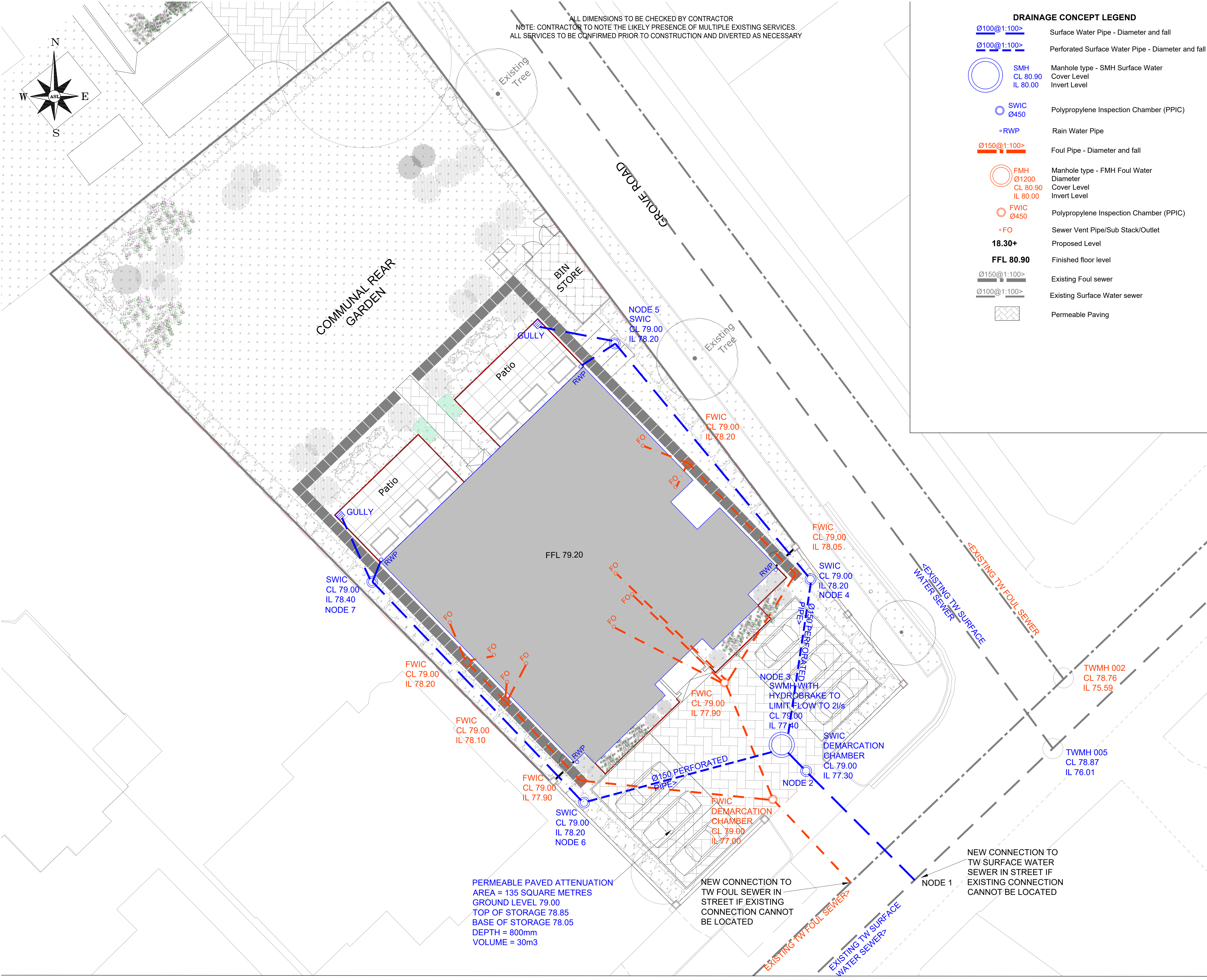
(3) Is SPR/SPRHOST ≤ 0.3?

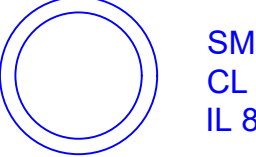
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	0.54	0.54
1 in 1 year (l/s):	0.46	0.46
1 in 30 years (l/s):	1.24	1.24
1 in 100 year (l/s):	1.72	1.72
1 in 200 years (l/s):	2.01	2.01

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at 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. 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.



DRAINAGE CONCEPT LEGEND	
$\varnothing 100@1:100>$	Surface Water Pipe - Diameter and fall
$\varnothing 100@1:100>$	Perforated Surface Water Pipe - Diameter and fall
	Manhole type - SMH Surface Water Cover Level Invert Level
	Polypropylene Inspection Chamber (PPIC)
$\bullet$ RWP	Rain Water Pipe
$\varnothing 150@1:100>$	Foul Pipe - Diameter and fall
	Manhole type - FMH Foul Water Diameter Cover Level Invert Level
	Polypropylene Inspection Chamber (PPIC)
$\bullet$ FO	Sewer Vent Pipe/Sub Stack/Outlet
18.30+	Proposed Level
FFL 80.90	Finished floor level
$\varnothing 150@1:100>$	Existing Foul sewer
$\varnothing 100@1:100>$	Existing Surface Water sewer
	Permeable Paving

Job. No.	P3042J2093
DRAINAGE NOTES	
1. THIS DRAWING IS FOR PLANNING ONLY AND IS TO BE RE CONJUNCTION WITH ALL RELEVANT SERIES DESIGN DRAW SPECIFICATIONS AND DOCUMENTATION.	
2. CONSTRUCTION TO BE IN ACCORDANCE WITH ALL BRITISH EUROPEAN STANDARDS AND BUILDING REGULATIONS.	
3. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN ME ABOVE LOCAL DATUM.	
4. ANY DISCREPANCIES IN THE DETAILS SHOWN ARE TO BE REPORTED TO THE EMPLOYER'S REPRESENTATIVE/ENGINE PRIOR TO CONSTRUCTION.	
5. ALL EXISTING SERVICES ARE TO BE LOCATED PRIOR TO COMMENCEMENT OF ANY WORKS. THE CONTRACTOR MUST NOTIFY THE ENGINEER IMMEDIATELY OF ANY CONFLICT WITH THE PROPOSED WORKS.	
6. THE GENERAL SPECIFICATION OF MATERIALS AND WORKMANSHIPS FOR THE CONSTRUCTION OF THE ACCESS ROAD, FOOTPATHS AND OTHER AREAS OF HARDSTANDING SHALL BE THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, VOLUME 1. SPECIFICATION OF HIGHWAY WORKS (SHW) PUBLISHED BY THE STATIONARY OFFICE.	
7. ALL RWP AND FO SHOWN ARE INDICATIVE ONLY AND SU TO APPROVAL AND SETTING OUT BY THE ARCHITECT.	
8. NODE NUMBERS REFER TO DRAINAGE MODEL OUTPUT IN REPORT	
9. UNLESS NOTED OTHERWISE, PIPES TO BE: FOUL PIPES UNDER BUILDING $\varnothing 100@1:40$, FOUL PIPES EXTERNAL $\varnothing 100@1:80$, SURFACE WATER PIPES $\varnothing 150@1:100$	

Notes.
Copyright of this plan is held by Jomas Associates No responsibility is taken for amendments by others Do not scale from copies or PDF's.
Key dimensions to be checked by engineer before structural works commence on site.
1. This survey has been computed and drawn about O S National Grid.
2. All levels are in metres and relate to O S National Datum by GPS instruments.
3. This survey was measured for a scale of 1:100, any subsequent enlargements should be verified on site.

Amendments		
Rev	Date	By
A	11.01.21 REVISED TO LLFA COMMENTS	AW

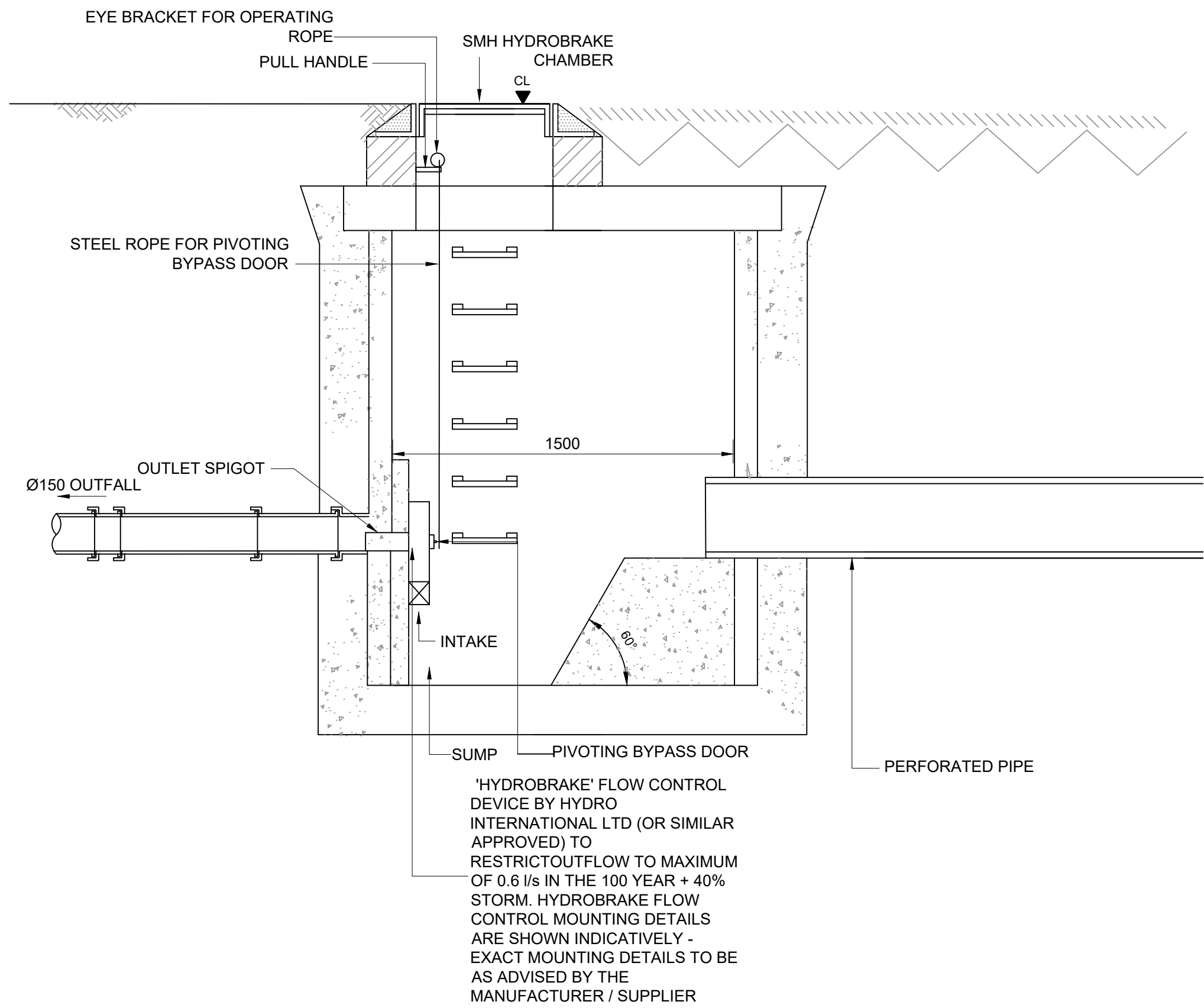


Jomas Associates Ltd.
1 Furzeground Way
Lakeside House
Stockley Park
UB11 1BD
Tel. 0843 2892187

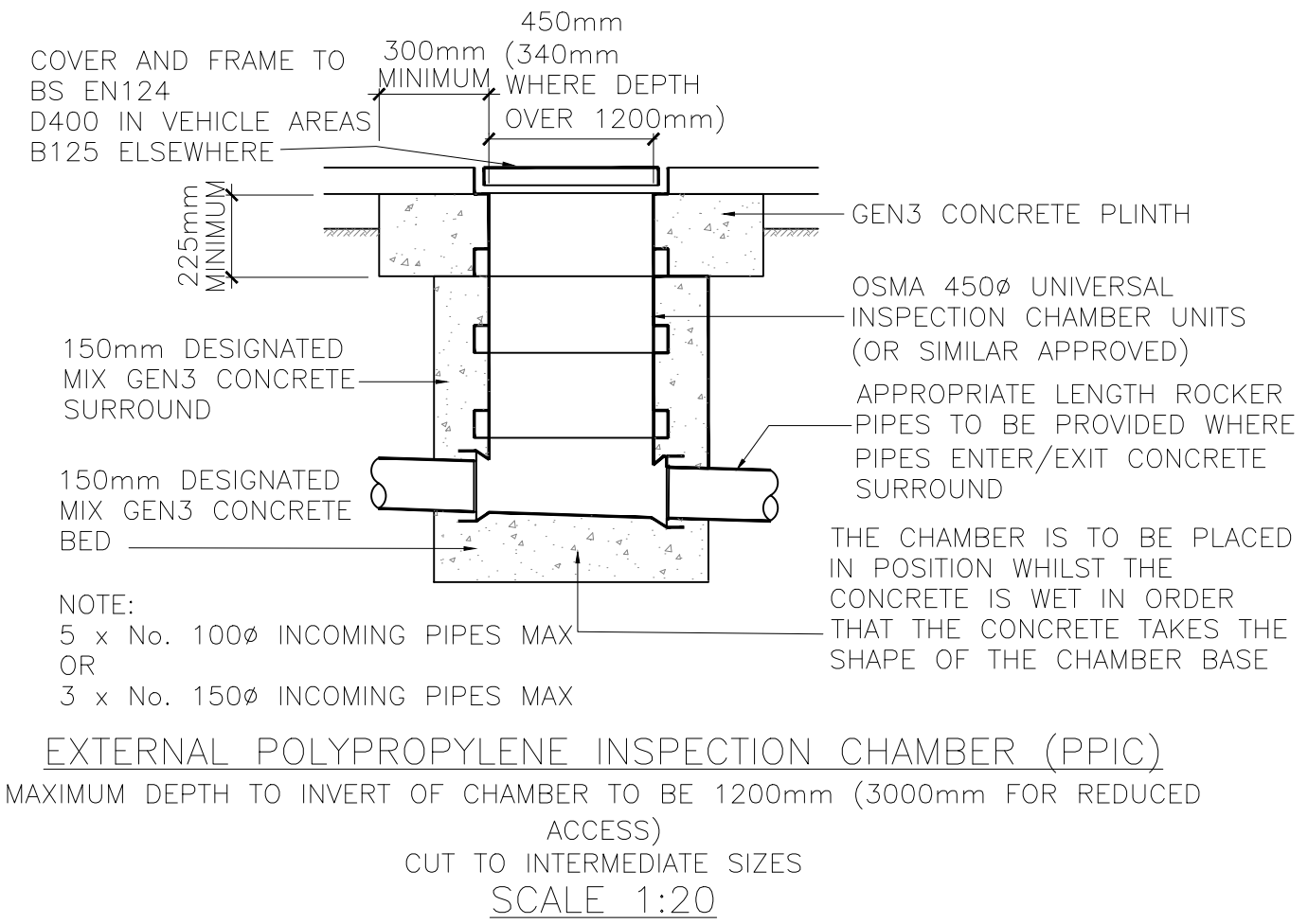
Client
Ravi Rao & Ramindar S Gu

Project
11 Sandy Lodge Way

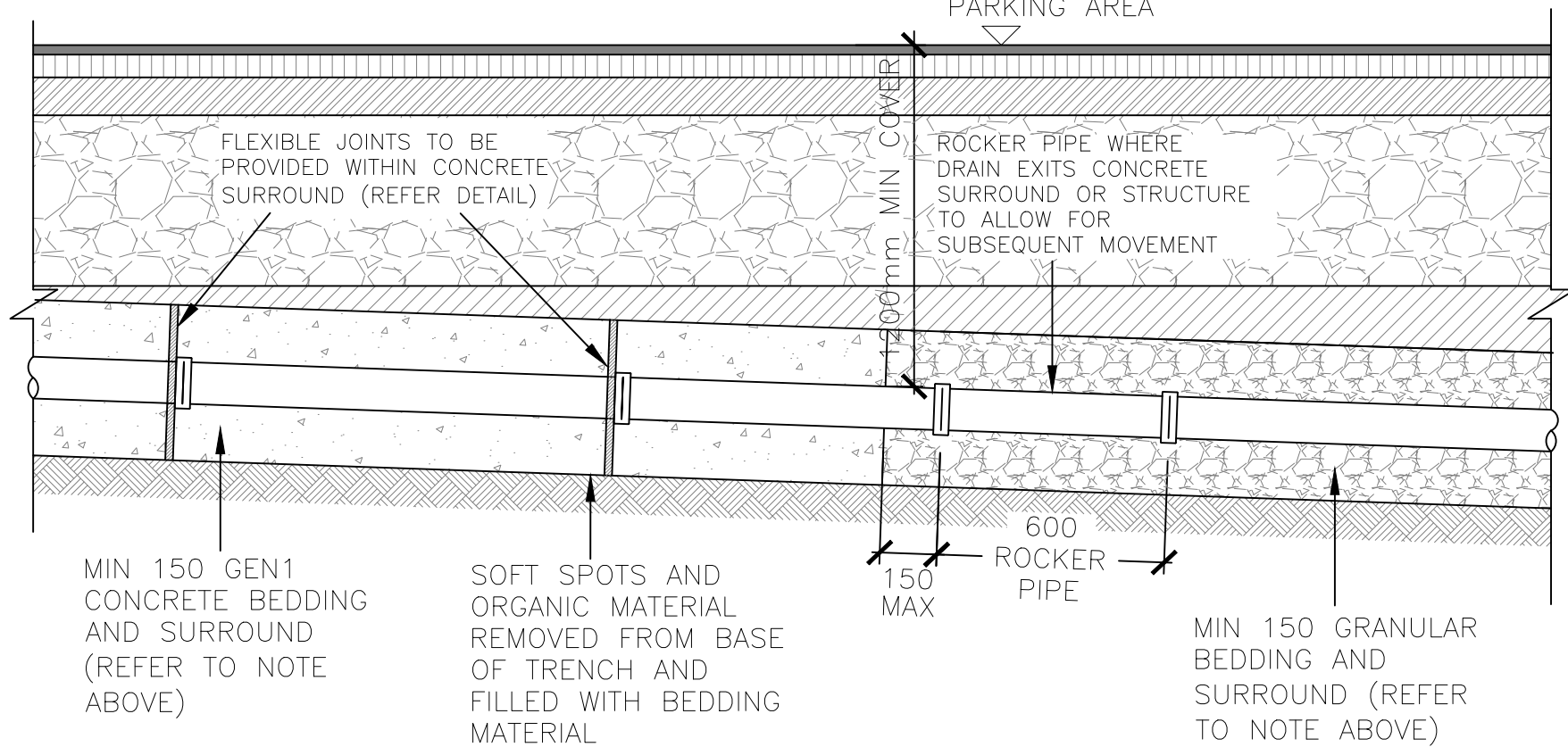
Drawing Proposed Drainage Plan		
Dwg no C01	Checked AW	Surveyor NA
Date 04.11.20	Scale 1:100 @ A1	Job No. P3042J2093



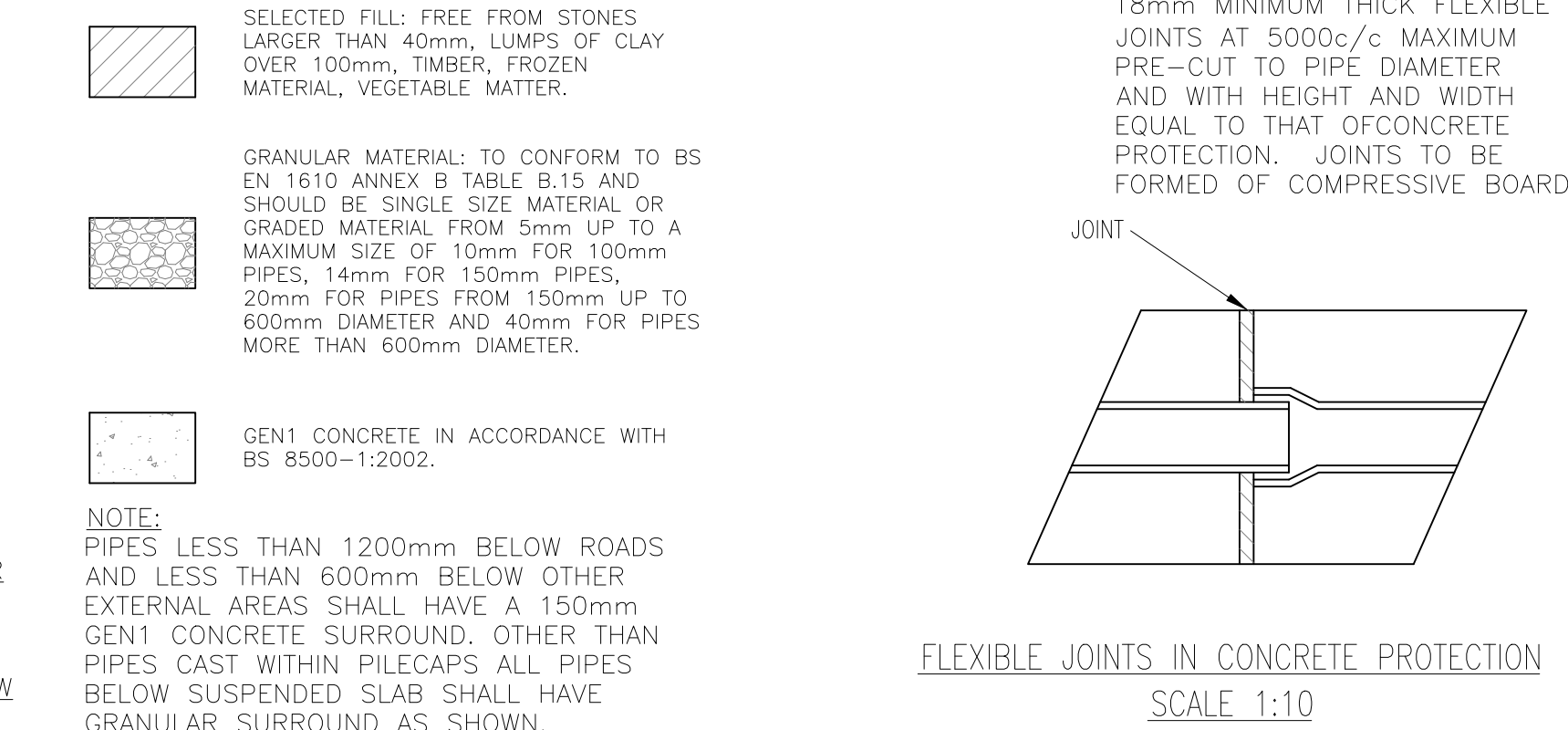
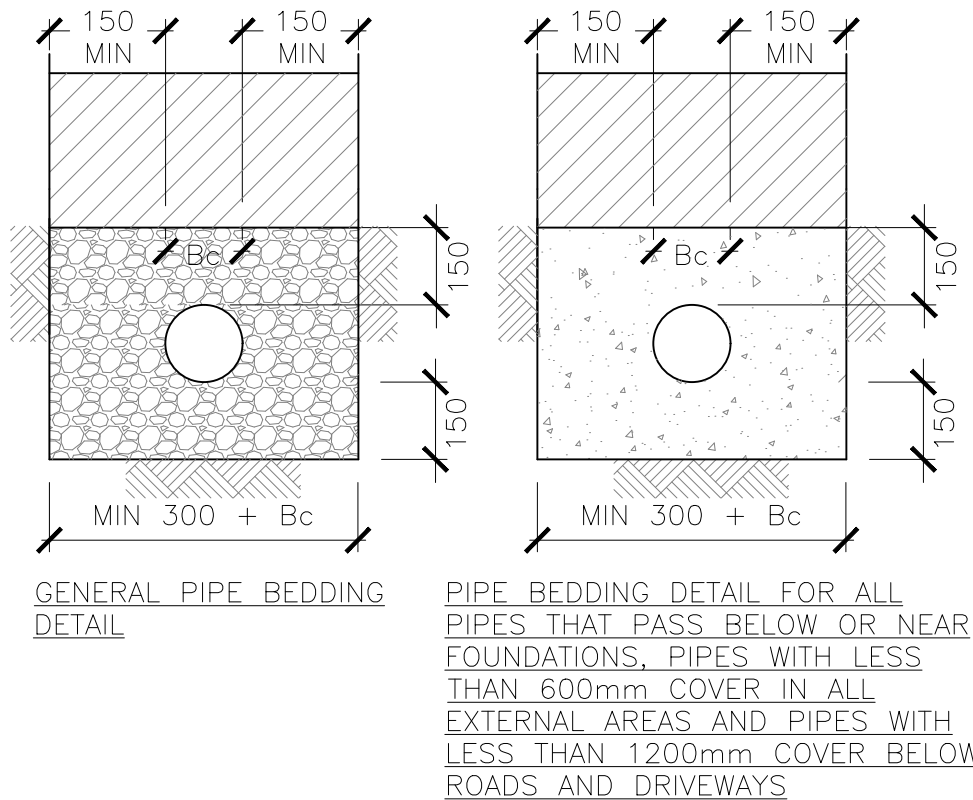
TYPICAL SECTION THROUGH STORM
HYDROBRAKE FLOW CONTROL
SCALE 1:20



NOTE: A 150mm GEN1 CONCRETE SURROUND SHALL BE USED ON ALL PIPE WORK PASSING BELOW GROUND BEARING FOUNDATIONS (I.E. STRIP FOOTINGS FOR LANDSCAPING WALLS / PLANTERS). 150mm GEN1 CONCRETE SURROUND SHALL BE USED ON ALL PIPE WORK (EXCEPT LAND DRAINS) WHICH ARE LESS THAN 1200mm BELOW TRAFFICABLE PAVED AREAS AND LESS THAN 600mm IN ALL OTHER EXTERNAL AREAS. ALL PIPEWORK WITHIN BUILDING FOOTPRINT TO BE BEDDED ON GEN1 CONCRETE TO A DEPTH OF AT LEAST HALF THE PIPE DIAMETER



PIPE BEDDING
SCALE 1:20



PIPE BEDDING DETAIL
SCALE 1:10

- Job. No. **P3042J2093** Rev.
- NOTES
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT SERIES DESIGN DRAWINGS, SPECIFICATIONS AND DOCUMENTATION.
 - CONSTRUCTION TO BE IN ACCORDANCE WITH ALL BRITISH AND EUROPEAN STANDARDS AND BUILDING REGULATIONS.
 - ANY DISCREPANCIES IN THE DETAILS SHOWN ARE TO BE REPORTED TO THE EMPLOYER'S REPRESENTATIVE/ENGINEER PRIOR TO CONSTRUCTION
 - ALL EXISTING SERVICES ARE TO BE LOCATED PRIOR TO THE COMMENCEMENT OF ANY WORKS. THE CONTRACTOR MUST NOTIFY THE ENGINEER IMMEDIATELY OF ANY CONFLICT WITH THE PROPOSED WORKS.
 - FOR GRAVITY SEWERS, ALL DRAINAGE AND FITTINGS ARE TO BE FLEXIBLY JOINTED UPVC TO BS EN 1401-1 OR CLAYWARE TO BS EN295 OR CONCRETE TO BS5911 PART 100
 - CHAMBER WALLS 225 THICK TO BE CONSTRUCTED IN CLASS B ENGINEERING BRICKS TO SHW SERIES 2400 IN DESIGNATION (I) MORTAR OR IN-SITU STRENGTH CLASS C16/20 CONCRETE TO CLAUSE 2602
 - CHAMBER WALLS AND COVER SLAB TO BE CONSTRUCTED IN PRECAST CONCRETE TO BS EN 1917 AND BS 5911-3.
 - CONCRETE MIXES INDICATED ON THIS DRAWING ARE DESIGNATED MIXES IN ACCORDANCE WITH BS8500-1:2006. ALL CONCRETE TO BE SULPHATE RESISTANT
 - BACKFILL TO ALL TRENCHES UNDER CARRIAGEWAYS TO BE TYPE 1 SUB-BASE MATERIAL, ELSEWHERE BACKFILL TO BE IN ACCORDANCE WITH THE SPECIFICATION, FREE DRAINING READILY COMPACTIBLE MATERIAL, FREE FROM RUBBISH AND ORGANIC MATTER, FROZEN SOIL, CLAY LUMPS AND LARGE STONES. TO BE COMPACTED IN LAYERS NOT EXCEEDING 150mm THICK.
 - A FLEXIBLE JOINT SHALL BE PROVIDED AS CLOSE AS IS FEASIBLE TO OUTSIDE FACE OF ANY STRUCTURE INTO WHICH A PIPE IS BUILT, IN ACCORDANCE WITH THE DETAIL.
 - THE GENERAL SPECIFICATION OF MATERIALS AND WORKMANSHIPS FOR THE CONSTRUCTION OF THE ACCESS ROAD FOOTPATHS AND OTHER AREAS OF HARDSTANDING SHALL BE THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, VOLUME 1, SPECIFICATION OF HIGHWAY WORKS (SHW) PUBLISHED BY THE STATIONARY OFFICE.
 - ALL PIPES TO BE LAID SOFFIT TO SOFFIT UNLESS NOTED OTHERWISE.
 - MANHOLE COVERS AND FRAMES SHALL COMPLY WITH BS EN124 AND SHALL BE OF A NON-ROCKING DESIGN WHICH DOES NOT RELY ON THE USE OF CUSHION INSERTS. CLASS D COVERS SHALL BE USED IN CARRIAGEWAYS, HARD SHOULDERS AND PARKING AREAS USED BY ALL TYPE OF ROAD VEHICLES. CLASS C SHALL BE USED IN FOOTWAYS, PEDESTRIAN AREAS AND ALL COMPARABLE LOCATIONS.

Notes.

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- This survey was measured for a scale of 1:100, any subsequent enlargements should be verified on site.

Amendments

Rev	Date		By	Chkd
A	11.01.21	REVISED TO LLFA COMMENTS	AW	AW

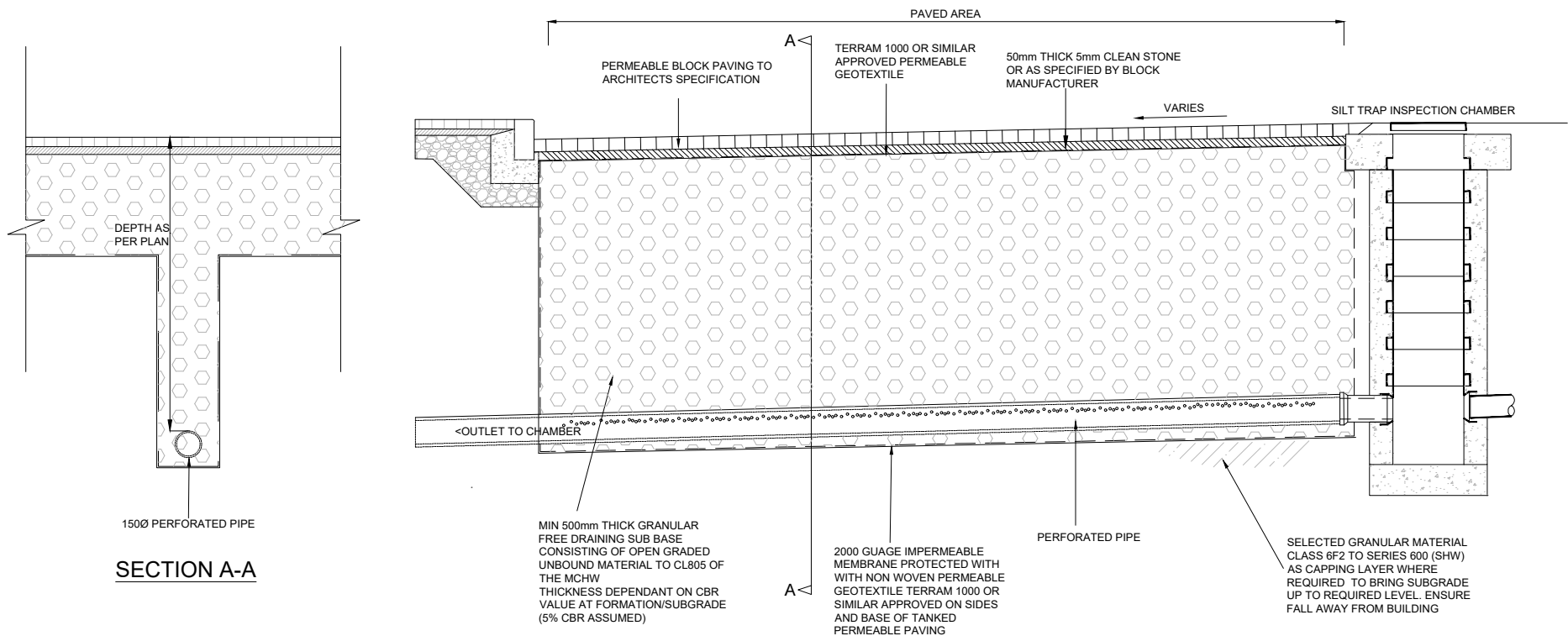
JOMAS
Jomas Associates Ltd.
1 Furzeground Way
Lakeside House
Stockley Park
UB11 1BD
Tel. 0843 2892187

Client
Ravi Rao & Ramindar S Gurm

Project
11 Sandy Lodge Way

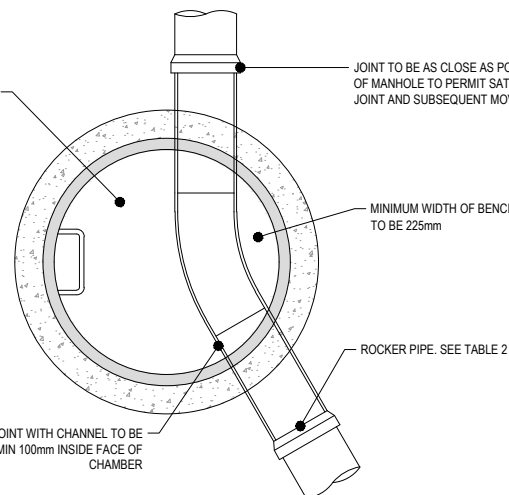
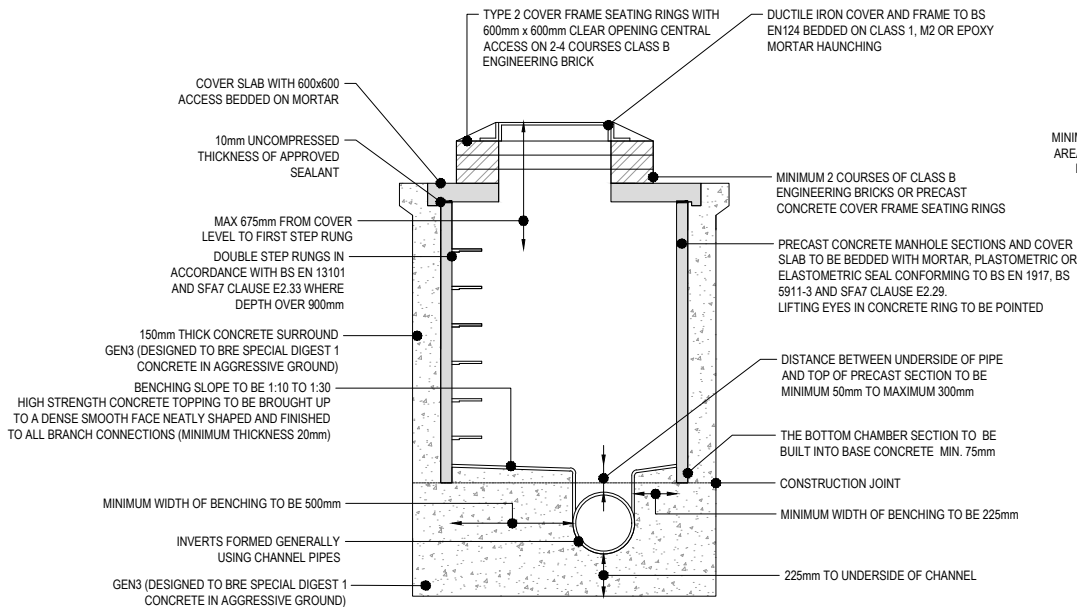
Drawing
**Proposed Drainage Details
Sheet 1 of 2**

Dwg no	Checked	Surveyor
C02	AW	NA
Date	04.11.20	Scale As shown
Job No.	P3042J2093	Rev. A
Grid	Contours	Level Datum



TANKED PERMEABLE PAVING DETAIL WITH SILT TRAP MANHOLE

SCALE 1:20



TYPICAL PCC MANHOLE DETAIL
DEPTH TO PIPE SOFFIT LESS THAN 1.5m
SCALE 1:20

NOTES:
CHAMBERS WITH OUTGOING PIPES GREATER THAN 500mm DIAMETER SHALL BE FITTED WITH GUARD BARS, SAFETY CHAINS OR OTHER SAFETY DEVICES. TOE HOLES TO BE PROVIDED IN BENCHING OF SEWERS GREATER THAN 450mm DIAMETER FOR ACCESS TO INVERT. WHERE INTERNAL HEIGHT EXCEEDS 1800mm MANHOLE MAY BE PROVIDED WITH REDUCING COVER AND SHAFT. SHAFT DIAMETER TO BE 600mm DIAMETER OR 900mm DIAMETER IF LONGER THAN 900mm.

PIPE DIAMETER	ROCKER PIPE * LENGTH
150mm-450mm	500mm-750mm
475mm-750mm	750mm-1000mm
OVER 750mm	1200mm

* OR LINTEL AND COMPRESSIBLE SEALANT IN ACCORDANCE WITH CLAUSE 689 OF THE SPECIFICATION.

Job. No.	P3042J2093	Rev.
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- NOTES
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT SERIES DESIGN DRAWINGS, SPECIFICATIONS AND DOCUMENTATION.
 - CONSTRUCTION TO BE IN ACCORDANCE WITH ALL BRITISH AND EUROPEAN STANDARDS AND BUILDING REGULATIONS.
 - ANY DISCREPANCIES IN THE DETAILS SHOWN ARE TO BE REPORTED TO THE EMPLOYER'S REPRESENTATIVE/ENGINEER PRIOR TO CONSTRUCTION
 - ALL EXISTING SERVICES ARE TO BE LOCATED PRIOR TO THE COMMENCEMENT OF ANY WORKS. THE CONTRACTOR MUST NOTIFY THE ENGINEER IMMEDIATELY OF ANY CONFLICT WITH THE PROPOSED WORKS.
 - FOR GRAVITY SEWERS, ALL DRAINAGE AND FITTINGS ARE TO BE FLEXIBLY JOINTED UPVC TO BS EN 1401-1 OR CLAYWARE TO BS EN295 OR CONCRETE TO BS5911 PART 100
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- This survey was measured for a scale of 1:100, any subsequent enlargements should be verified on site.

Amendments

Rev	Date	By	Chkd

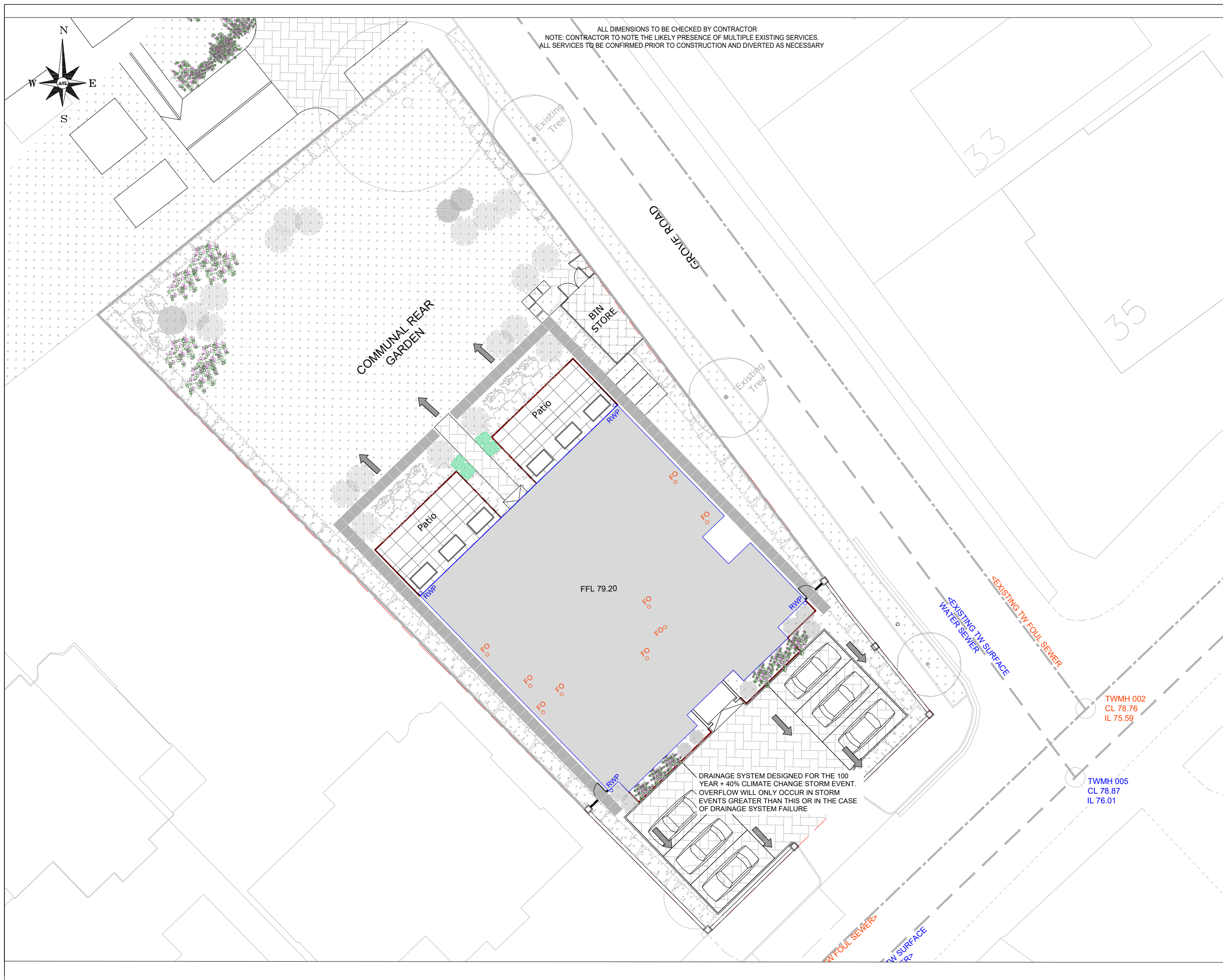
JOMAS
Jomas Associates Ltd.
1 Furzeground Way
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Stockley Park
UB11 1BD
Tel. 0843 2892187

Client
Ravi Rao & Ramindar S Gurm

Project
11 Sandy Lodge Way

Drawing
**Proposed Drainage Details
Sheet 2 of 2**

Dwg no	Checked	Surveyor
C03	AW	NA
Date	04.11.20	Scale As shown
Job No.	P3042J2093	Rev.
Grid	Contours	Level Datum



Job. No.

P3042J2093

Rev.

DRAINAGE NOTES

1. THIS DRAWING IS FOR PLANNING ONLY AND IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT SERIES DESIGN DRAWINGS, SPECIFICATIONS AND DOCUMENTATION.

2. CONSTRUCTION TO BE IN ACCORDANCE WITH ALL BRITISH AND EUROPEAN STANDARDS AND BUILDING REGULATIONS.

3. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES ABOVE LOCAL DATUM.

4. ANY DISCREPANCIES IN THE DETAILS SHOWN ARE TO BE REPORTED TO THE EMPLOYER'S REPRESENTATIVE/ENGINEER PRIOR TO CONSTRUCTION.

5. ALL EXISTING SERVICES ARE TO BE LOCATED PRIOR TO THE COMMENCEMENT OF ANY WORKS. THE CONTRACTOR MUST NOTIFY THE ENGINEER IMMEDIATELY OF ANY CONFLICT WITH THE PROPOSED WORKS.

6. THE GENERAL SPECIFICATION OF MATERIALS AND WORKMANSHIPS FOR THE CONSTRUCTION OF THE ACCESS ROAD, FOOTPATHS AND OTHER AREAS OF HARDSTANDING SHALL BE THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, VOLUME 1, SPECIFICATION OF HIGHWAY WORKS (SHW) PUBLISHED BY THE STATIONARY OFFICE.

7. ALL RWP AND FO SHOWN ARE INDICATIVE ONLY AND SUBJECT TO APPROVAL AND SETTING OUT BY THE ARCHITECT.

8. UNLESS NOTED OTHERWISE, PIPES TO BE:
FOUL PIPES UNDER BUILDING Ø100@1:40,
FOUL PIPES EXTERNAL Ø100@1:80,
SURFACE WATER PIPES Ø150@1:100

STORMWATER CONCEPT LEGEND

18.30x

Proposed Level

FFL 80.90

Finished floor level

←

Overland flow

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3. This survey was measured for a scale of 1:100, any subsequent enlargements should be verified on site.

Amendments

Rev	Date	By	Chkd

JOMAS

Jomas Associates Ltd.
1 Furzeground Way
Lakeside House
Stockley Park
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Tel. 0843 2892187

Client

Ravi Rao & Ramindar S Gurm

Project

11 Sandy Lodge Way

Drawing

Proposed Overland Flow

Dwg no	Checked	Surveyor
C04	AW	NA
Date	04.11.20	Scale 1:100 @ A1
Job No.	P3042J2093	Rev. -
Grid	Contours	Level Datum

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	10	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	0.600
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1			78.900	1200	50.000	50.000	2.700
2			79.000	450	40.000	60.000	1.700
3	0.025	5.00	79.050	1200	37.000	63.000	1.650
4	0.010	5.00	79.000	450	50.000	80.000	0.800
5	0.010	5.00	79.000	450	35.000	95.000	0.600
6	0.010	5.00	79.000	450	20.000	60.000	0.800
7	0.010	5.00	79.000	450	5.000	75.000	0.600

Links

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	14.142	0.600	77.300	76.200	1.100	12.9	150	5.74	50.0
1.002	3	2	4.243	0.600	77.400	77.300	0.100	42.4	150	5.65	50.0
1.001	4	3	21.401	0.600	78.200	77.400	0.800	26.8	150	5.55	50.0
1.000	5	4	21.213	0.600	78.400	78.200	0.200	106.1	150	5.36	50.0
2.001	6	3	17.263	0.600	78.200	77.400	0.800	21.6	150	5.61	50.0
2.000	7	6	21.213	0.600	78.400	78.200	0.200	106.1	100	5.47	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.003	2.825	49.9	8.8	1.550	2.550	0.065	0.0	42	2.134
1.002	1.549	27.4	8.8	1.500	1.550	0.065	0.0	58	1.381
1.001	1.954	34.5	2.7	0.650	1.500	0.020	0.0	28	1.169
1.000	0.975	17.2	1.4	0.450	0.650	0.010	0.0	28	0.581
2.001	2.177	38.5	2.7	0.650	1.500	0.020	0.0	27	1.253
2.000	0.746	5.9	1.4	0.500	0.700	0.010	0.0	32	0.603

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
10	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node 3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	77.400	Product Number	CTL-SHE-0032-5000-1000-5000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	0.5	Min Node Diameter (mm)	1200

Node 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	78.050
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	135.0	0.0	0.800	135.0	0.0	0.801	1.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 92.15%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	220	76.210	0.010	0.4	0.0000	0.0000	OK
240 minute winter	2	220	77.310	0.010	0.4	0.0016	0.0000	OK
240 minute winter	3	220	78.150	0.750	1.9	5.1601	0.0000	SURCHARGED
15 minute winter	4	10	78.228	0.028	2.8	0.0116	0.0000	OK
15 minute winter	5	10	78.429	0.029	1.4	0.0142	0.0000	OK
15 minute winter	6	10	78.227	0.027	2.8	0.0111	0.0000	OK
15 minute winter	7	10	78.434	0.034	1.4	0.0168	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)
240 minute winter	2	1.003	1	0.4	0.869	0.009	0.0072	10.9
240 minute winter	3	Hydro-Brake®	2	0.4				
15 minute winter	4	1.001	3	2.7	0.224	0.078	0.2132	
15 minute winter	5	1.000	4	1.4	0.580	0.079	0.0497	
15 minute winter	6	2.001	3	2.7	0.241	0.070	0.1705	
15 minute winter	7	2.000	6	1.4	0.668	0.231	0.0432	

Results for 10 year Critical Storm Duration. Lowest mass balance: 92.15%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	1	344	76.211	0.011	0.5	0.0000	0.0000	OK
360 minute winter	2	344	77.311	0.011	0.5	0.0017	0.0000	OK
360 minute winter	3	344	78.302	0.902	2.5	11.5278	0.0000	SURCHARGED
360 minute winter	4	344	78.302	0.102	0.8	0.0418	0.0000	OK
15 minute winter	5	10	78.441	0.041	2.7	0.0200	0.0000	OK
360 minute winter	6	344	78.302	0.102	0.8	0.0418	0.0000	OK
15 minute winter	7	10	78.450	0.050	2.7	0.0245	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)
360 minute winter	2	1.003	1	0.5	0.889	0.010	0.0076	15.3
360 minute winter	3	Hydro-Brake®	2	0.5				
360 minute winter	4	1.001	3	0.8	0.135	0.023	0.3252	
15 minute winter	5	1.000	4	2.7	0.703	0.155	0.0806	
360 minute winter	6	2.001	3	0.8	0.139	0.021	0.2623	
15 minute winter	7	2.000	6	2.7	0.808	0.454	0.0700	

Results for 30 year Critical Storm Duration. Lowest mass balance: 92.15%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	1	456	76.211	0.011	0.5	0.0000	0.0000	OK
480 minute winter	2	456	77.311	0.011	0.5	0.0017	0.0000	OK
480 minute winter	3	456	78.397	0.997	2.5	15.4928	0.0000	SURCHARGED
480 minute winter	4	456	78.397	0.197	0.8	0.0805	0.0000	SURCHARGED
15 minute winter	5	10	78.447	0.046	3.5	0.0229	0.0000	OK
480 minute winter	6	456	78.397	0.197	0.8	0.0805	0.0000	SURCHARGED
15 minute winter	7	10	78.458	0.058	3.5	0.0286	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)
480 minute winter	2	1.003	1	0.5	0.901	0.010	0.0079	18.9
480 minute winter	3	Hydro-Brake®	2	0.5				
480 minute winter	4	1.001	3	0.8	0.125	0.023	0.3768	
15 minute winter	5	1.000	4	3.4	0.754	0.200	0.0969	
480 minute winter	6	2.001	3	0.8	0.129	0.021	0.3039	
15 minute winter	7	2.000	6	3.4	0.864	0.584	0.0842	

Results for 100 year Critical Storm Duration. Lowest mass balance: 92.15%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	1	352	76.211	0.011	0.5	0.0000	0.0000	OK
360 minute winter	2	352	77.311	0.011	0.5	0.0018	0.0000	OK
360 minute winter	3	352	78.543	1.143	3.6	21.6417	0.0000	SURCHARGED
360 minute winter	4	352	78.543	0.343	1.2	0.1405	0.0000	SURCHARGED
360 minute winter	5	352	78.543	0.143	0.6	0.0706	0.0000	OK
360 minute winter	6	352	78.543	0.343	1.2	0.1405	0.0000	SURCHARGED
360 minute winter	7	352	78.543	0.143	0.6	0.0706	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	2	1.003	1	0.5	0.918	0.011	0.0082	16.9
360 minute winter	3	Hydro-Brake®	2	0.5				
360 minute winter	4	1.001	3	1.1	0.120	0.031	0.3768	
360 minute winter	5	1.000	4	0.6	0.432	0.035	0.3706	
360 minute winter	6	2.001	3	1.1	0.123	0.028	0.3039	
360 minute winter	7	2.000	6	0.6	0.499	0.102	0.1660	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 92.15%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	1	352	76.212	0.012	0.6	0.0000	0.0000	OK
360 minute winter	2	352	77.312	0.012	0.6	0.0018	0.0000	OK
360 minute winter	3	352	78.831	1.431	5.0	33.6869	0.0000	FLOOD RISK
360 minute winter	4	352	78.831	0.631	1.6	0.2579	0.0000	FLOOD RISK
360 minute winter	5	352	78.831	0.431	0.9	0.2119	0.0000	FLOOD RISK
360 minute winter	6	352	78.831	0.631	1.6	0.2579	0.0000	FLOOD RISK
360 minute winter	7	352	78.831	0.431	0.9	0.2119	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	2	1.003	1	0.6	0.946	0.012	0.0088	18.4
360 minute winter	3	Hydro-Brake®	2	0.6				
360 minute winter	4	1.001	3	1.5	0.120	0.042	0.3768	
360 minute winter	5	1.000	4	0.8	0.455	0.046	0.3735	
360 minute winter	6	2.001	3	1.5	0.123	0.038	0.3039	
360 minute winter	7	2.000	6	0.8	0.525	0.137	0.1660	

BRE 365 INFILTRATION TESTS

JOMAS JOB NAME: 11 Sandy Way Lodge, Northwood, HA6 2AH

CALCULATING ENGINEER: JLW

DATE: 29 October 2020

Notes:

APPROVED BY: JF

DATE: 29 October 2020

JOMAS JOB NO.: P3042J2093

TEST LOCATION: TP1

DATE OF TEST: 19 October 2020

Pit Details

Length 1.5 m

Breadth 0.45 m

Depth 1.9 m

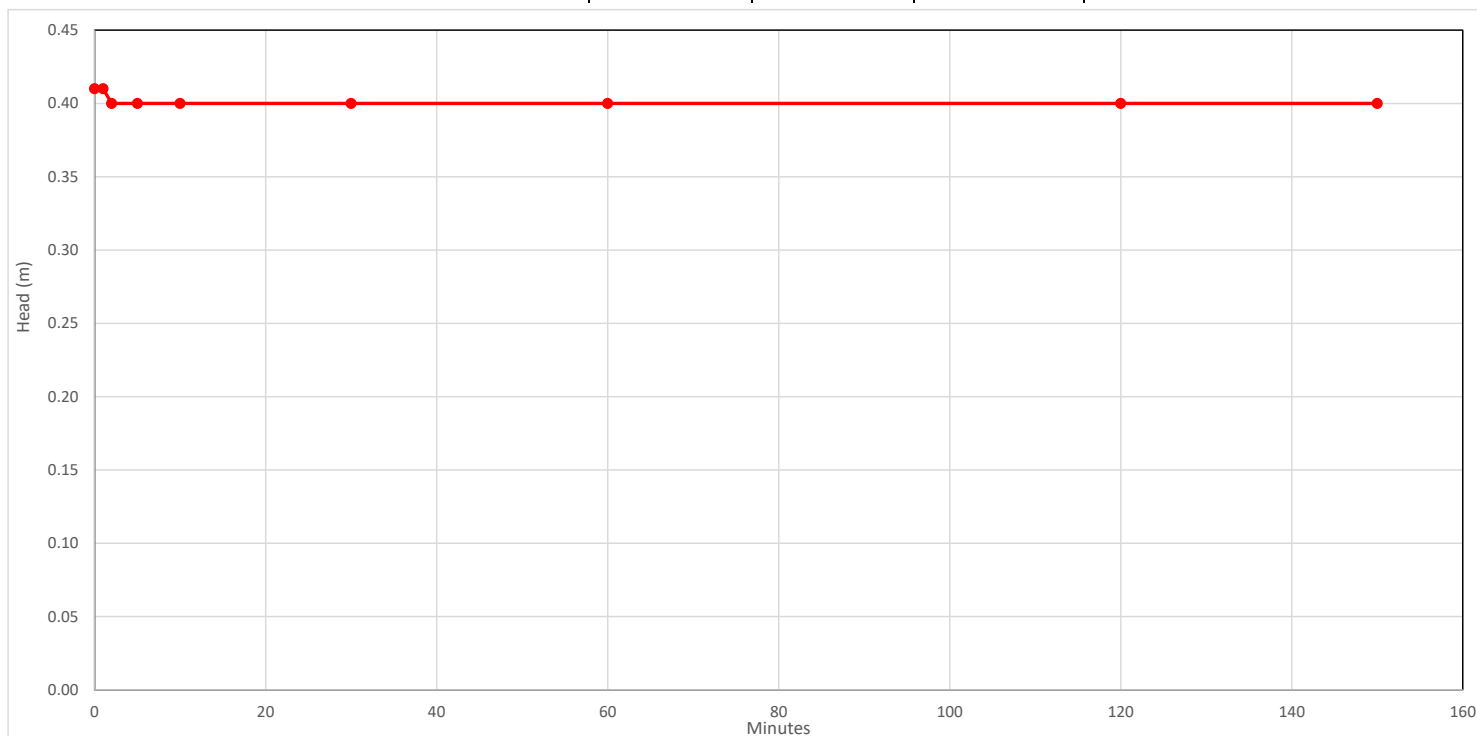
Groundwater? N

Filled With Gravel? N

	TP1 - Test 1	TP1 - Test 2	TP1 - Test 3
Dg 75% (m)	0.31		
Tp 75%			
Dg 25%	0.10		
Tp 25%			
Vp75% - Vp25% (m ³)	0.14		
ap50% (m ²)	1.47		
Tp75-Tp25 (min)			
Soil infiltration rate (m/sec)	Insuff. Drain		
Permeability Description			
Drainage Conditions			

Dw = depth to water

D_g = head of water in the pit

[illegible]



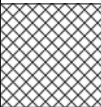
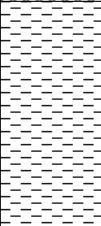
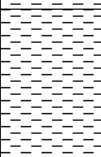
TRIAL PIT RECORD

Exploratory Hole No:

TP1

Site Address:	11 Sandy Way Lodge, Northwood, HA6 2AH				Project No:	P3042J2093	
Client:	Ravi Rao & Ramindar S Gurm				Ground Level:		
Logged By:	JE				Date Commenced:	19/10/2020	
Checked By:	JF				Date Completed:	19/10/2020	
Type and diameter of equipment:	JCB 3CX				Sheet No:	1 Of 1	
Pit Dimension:	Length:	1.50	Width:	0.45	Depth:	1.90	

Remarks
1: *Field description.
2: No water reported.
3: Soil infiltration test conducted at 1.90mbgl.
4:

Sample or Tests				Strata			Strata Description
Type	Depth (mbgl)	Result		Legend	Depth (mbgl)	Water Strikes (mbgl)	
			0.00		0.40		Grass over dark grey brown silty gravelly clay with frequent roots and rootlets. Gravel consists of ash and brick. (MADE GROUND)
			0.50		1.30		Firm consistency* light brown slightly gravelly CLAY with orange silty pockets. Gravel consists of fine to medium chalk. (LONDON CLAY FORMATION)
			1.00				
			1.50		1.90		Stiff consistency* grey brown to blue grey CLAY. (LONDON CLAY FORMATION)
			2.00				
			2.50				
			3.00				
			3.50				
			4.00				
			4.50				
			5.00				

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample
Jomas Associates Ltd - Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD
T: 0843 289 2187 E: info@jomasassociates.com W: www.jomasassociates.com

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Geotechnical Consultant

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Amersham Road
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The Planning Applications Team
London Borough of Hillingdon
Civic Centre, Uxbridge

7th December 2017

Dear Sirs

residential scheme at **11, Sandy Lodge Way, Northwood, HA6 2AH**

I carried out a hydro-geological assessment - 29th March 2016 - to consider the impact of a proposed basement on the ground water regime.

The Planning Consultant has recently advised me that the development proposals are being revised resulting in the two basements covering a smaller area than initially planned. My original findings and conclusions are still valid. Since the ground is impermeable London Clay and there is no ground water, the construction of the two basements will not alter the status quo. There will not be any influence on a surface water flood incident.

My Report and conclusions are applicable to this revised scheme.

Yours faithfully



S E Quarrell

cc Robin Bretherick Associates
PR Architecture Ltd

Appendix D: SuDS Details and Maintenance Report

WE LISTEN, WE PLAN, WE DELIVER

Geotechnical Engineering and Environmental Services across the UK.

DRAINAGE MAINTENANCE PLAN

11 Sandy Way Lodge, Northwood HA6 2AH

JOMAS ASSOCIATES LTD

6-9 The Square, Stockley Park, Uxbridge, UB11 1FW

www.jomasassociates.com 0843-289-2187 info@jomasassociates.com

Report Title: DRAINAGE AND SUDS MAINTENANCE PLAN

Report Status: Final v1.0

Job No: P3042J2093

Date: 04/11/20

Control: Previous Release

Version	Date	Issued By
V1.0	04/11/20	A Wallace

Prepared by: JOMAS ASSOCIATES LTD **For** Ravi Rao & Ramindar S Gurm

Should you have any queries relating to this report, please contact

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1.0 GENERAL

- 1.1** Sustainable Drainage Systems (SuDS) are an environmentally friendly approach to managing rainfall. SuDS techniques use landscape features to deal with surface water with the aim to:
- 1.1.1 Control the flow, volume and frequency of water leaving a development.
 - 1.1.2 Prevent pollution by intercepting silt and cleaning runoff from hard surfaces.
 - 1.1.3 Provide attractive surroundings for the community.
- 1.2** The surface water drainage strategy for this development utilises permeable paving as the main SUDS feature along with minor features including permeable paving, grassed areas, silt traps and sumps. The following sections provides a brief description of these features and outlines the maintenance programme that should be adopted.

2.0 CLEANING OF THE DRAINAGE SYSTEM

- 2.1** Drainage systems should be inspected at regular intervals and where necessary, thoroughly cleaned out at the same time. Any defects discovered should be made good.
- 2.2** The following operations should be carried out during the periodic cleaning of a drainage system:-

Product Type	Period	Responsibility	Maintenance Methods
<i>Silt Trap</i>	As necessary and before wet season	Owner or Maintenance Company for communal areas	- Sediment and debris that accumulated during summer needs to be removed before the wet season. - Inspect and clean out routinely prior to inlet pipework to minimise debris reaching the tank. - Conduct inspections more frequently during the wet season for the area where sediment or trash accumulates more often. Clean and repair as needed.
<i>Standard Manholes/ Inspection Chambers</i>	As necessary	Owner or Maintenance Company for communal areas	Remove and clean any soil and vegetation that covers the manhole cover to prevent blockage of the drainage system at the manhole.

Product Type	Period	Responsibility	Maintenance Methods
			Renew/replace any damaged/missing bolts and damaged/missing manhole covers.
Drainage Pipes	Six monthly interval	Owner or Maintenance Company for communal areas	Inspect underground drainage pipes to ensure that the distribution pipework arrangement is operational and free from blockages. If required, take remedial action.
Hydrobrake	Monthly for 3 months	Owner/ Maintenance Company	Inspect and identify any areas that are not operating correctly. If required, take remedial action.
	Monthly	Owner/ Maintenance Company	Debris removal from catchment surface (where may cause risks to performance).
	Annually	Owner/ Maintenance Company	Remove sediment from pre-treatment structures.
	Annually and after large storms	Owner/ Maintenance Company	Inspection/check all inlets and outlets to ensure that they are in good condition and operating as designed.
Permeable Paving	As required	Site Owner for private areas. Maintenance Company for communal areas	Inspect the paving after any precipitation to ensure no displacement of any organic matter onto the surface of the pavement.
	Six monthly (Ideally, this activity to be carried out in spring and autumn seasons)	Site Owner for private areas. Maintenance Company for communal areas	Agitate (e.g. brush, vacuum, etc.) the block paving to ensure no vegetation of any sort is allowed to grow and develop in the joints (where may affect performance).
	Winter season	Site Owner for private areas. Maintenance Company for communal areas	De-icing may be used without causing significant detrimental effects towards the permeable pavement's performance. When used carefully, the use of these chlorides will not

Product Type	Period	Responsibility	Maintenance Methods
			result in an increase in the chloride levels in the local ground.

3.0 SKETCHES AND PLANS

- 3.1 The locations of the above features can be found by examining Drawing P3042J2093-C01

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