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Flood Risk Assessment & Drainage Strategy

Proposed Dwellings – Windermere Road & Fell View Avenue, Woodhouse, Whitehaven

Thomas Armstrong Construction and Home Group

Ref: K39225.DS/001

Version	Date	Prepared By	Checked By	Approved By
Original	16 August 2022	C. Abram	T. Melhuish	T. Melhuish

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6. GLOSSARY OF TERMS

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Society
CC	Climate Change
CCC	Cumbria County Council
DSM	Digital Surface Model
DTM	Digital Terrain Model
EA	Environment Agency
FEH	Flood Estimation Handbook
FFL	Finished Floor Level
FRA	Flood Risk Assessment
GIS	Geographical Information System
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
OS	Ordnance Survey
RGP	RG Parkins & Partners Ltd
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage System
UU	United Utilities

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7. INTRODUCTION

7.1 BACKGROUND

This report has been prepared by R. G. Parkins & Partners Ltd (RGP) acting on behalf of Thomas Armstrong Construction and Home Group in support of their proposal to construct 40 no. new dwellings at Windermere Road & Fell View Avenue, Whitehaven.

RGP has been appointed to undertake a Flood Risk Assessment and Foul and Surface Water Drainage Strategy to support a planning application that fulfils the requirements of the Local Planning Authority, Lead Local Flood Authority, Environment Agency and the Sewerage Undertaker.

The following report demonstrates the proposed development will not adversely affect flood risk elsewhere.

7.2 PLANNING POLICY

The NPPF [1] and its Planning Practice Guidance [2] states "a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in the future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."

7.3 THE DEVELOPMENT IN THE CONTEXT OF PLANNING POLICY

Owing to the size of the development in terms of number of properties (40 no.), it is classed as major development (over 10 dwellings) in accordance with The Town and Country Planning Order 2015 [3].

The area covered by the application is 1.30 ha (hectares) and by reference to the Environment Agency Flood Map, the site lies entirely in Flood Zone 1.

Table 2 of the NPPF's Planning Practice Guidance [2] classifies each development into a vulnerability class, depending on the type of development, as outlined in Table 7.1. The site is to be developed for a housing development; and is classified as 'More vulnerable'. 'More Vulnerable' development classes are deemed acceptable in terms of flood risk within Flood Zones 1, 2 and 3a but are not generally considered acceptable within Flood Zone 3b.

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Table 7.1 Vulnerability Classification

Vulnerability Classification	Development
Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. Essential utility infrastructure, which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. Wind turbines.
Highly Vulnerable	Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operation during flooding. Emergency dispersal points. Basement dwellings. Caravans, mobile homes, and park homes intended for permanent residential use. Installations requiring hazardous substances consent.
More Vulnerable	Hospitals. Residential institutions such as residential care homes, children's homes, prisons and hostels. Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels. Non-residential uses for health services, nurseries, and education establishments. Landfill and sites used for waste management facilities for hazardous waste. Sites used for holiday or short let caravans and camping, subject to a specific warning and evacuation plan
Less Vulnerable	Police, ambulance, and fire stations which are NOT required to be operational during flooding. Buildings used for shops; financial, professional, and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distributions; non-residential institutions not included in the 'more vulnerable' class; and assemble and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill & hazardous waste facilities). Minerals working & processing (except for sand & gravel working). Water treatment works which do not need to remain operational during times of flood. Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water-Compatible Development	Flood control infrastructure. Water transmission infrastructure & pumping stations. Sewage transmission infrastructure & pumping stations. Sand & gravel working. Docks, marinas, and wharves. Navigation facilities. Ministry of Defence installations. Ship building, repairing & dismantling, dockside fish processing & refrigeration & compatible activities requiring a waterside location. Water based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation & biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. Essential ancillary sleeping or residential accommodation for staff required by uses in this category subject to a specific warning & evacuation plan.

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8. SITE CHARACTERISATION

8.1 SITE LOCATION

The sites are located on Windermere Road and Fell View Avenue, off Woodhouse Road in Whitehaven, at National Grid Co Ordinates 297203E 516030N and 297139E 516353N.

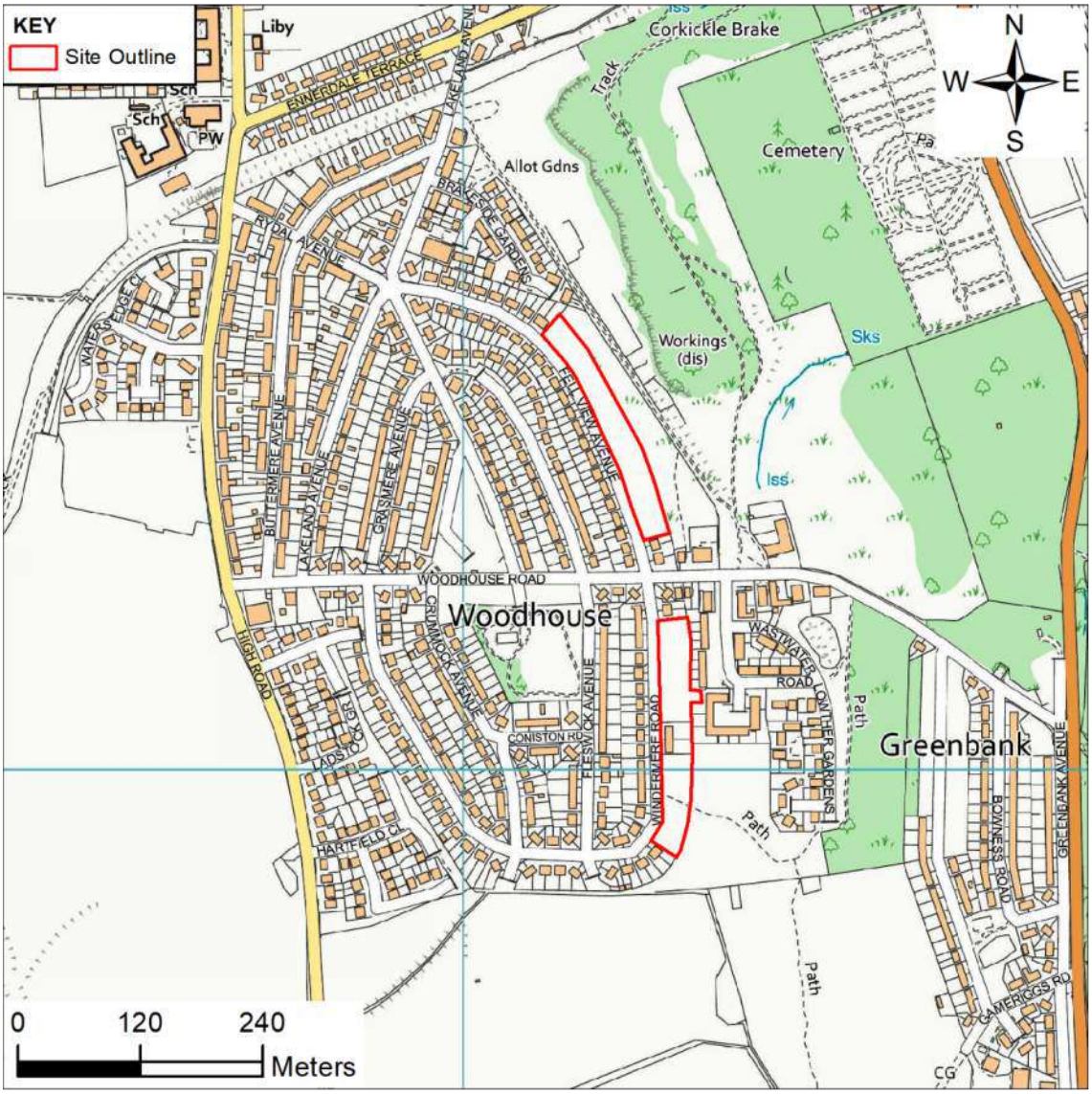

Figure 8.1 Site Location

8.2 SITE DESCRIPTION

The entire combined site area covers approximately 1.3 ha (13,000 m²), and at present is unused. The site is formerly an area of residential terraced housing which was demolished approximately 10 years ago.

The site area to the north of Woodhouse Road is bounded by properties on Fell View Avenue to the west, with allotments to the north and former quarry workings to the east. The site area to the south of Woodhouse Road is bounded by properties on Windermere Road to the west, with Wastwater Road and Lowther Gardens to the east.

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Topographically, both sites slope down away from the existing public highways and footways towards the east, with variable levels ranging from around approximately 98.00 mAOD down to 95.50 mAOD in the Windermere Road area and between approximately 93.00-94.00 mAOD down to 89.00 mAOD at the proposed Fell View Avenue site.

The sites are directly access from either Windermere Road or Fell View Avenue via Woodhouse Road.

8.3 GEOLOGY & HYDROGEOLOGY

British Geological Survey (BGS) [4] and Land Information Systems (LandIS) [5] mapping indicates the site is underlain by the geological sequences outlined in Table 8.1. The DEFRA Magic Map Application[6] indicates that the nearest Groundwater Source Protection Zone is located approximately 3.75 km south-east of the site.

Table 8.1 Site Geological Summary

Geological Unit	Classification	Description	Aquifer Classification
Soil	Soilscape 6	Freely draining slightly acid loamy soils	N/A
Drift	None Recorded	-	N/A
Solid	Whitehaven Sandstone Formation	Sandstone	Summary: Secondary A

8.4 HYDROLOGY

The site is located approximately 1.15 km east of Saltom Bay off the coast of Whitehaven. The nearest Main River located to the site is Pow beck which lies approximately 620m to the east.

The nearest hydrological feature to the site identified on local ordnance survey maps is a small unnamed watercourse which appears to issue approximately 100m to the east of Fell View Avenue and flows in the direction of Low Road Cemetery where it is culverted through the cemetery to the east of Low Road. RGP have previously undertaken CCTV investigations of this watercourse and culvert as part of another proposed housing development located off Low Road. This work was presented in RGP report no. K36110/01/FRA/CA dated 25th November 2020 in support of CBC Planning Ref: 4/20/2514/OF1. It was confirmed that the watercourse and culvert was in a poor condition with clear root ingress and prone to localised flooding in Low Road. The culvert through the cemetery had significant structural defects and was deemed unsuitable to take any additional run-off from the proposed development site.

8.5 EXISTING SEWERS

Reference to the United Utilities sewer records (Appendix B) indicate there are a number of combined and surface water public sewers within each of the sites.

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Windermere Road

A 225mm diameter public surface water sewer is located parallel to the road alignment within the front driveways of the proposed new dwellings. The surface water sewer then runs north towards Woodhouse Road.

150mm and 225mm diameter public combined sewers run through the development site towards the north.

Fell View Avenue

The 225mm dia. surface water sewer continues from Woodhouse Road and runs towards the north and is located within the front driveways of the proposed new dwellings.

The main 225mm diameter public combined sewer also continues to run north from Woodhouse Road through the development site towards the north. Additional sections of 100mm and 150mm dia. combined sewers associated with the previous housing are also present throughout the development site.

A pre-development wastewater enquiry has been submitted to United Utilities on 21st July 2022 and a response received on 4th August 2022 and is included in Appendix B for reference. RGP will continue to liaise with UU with regards to the detailed design of the proposed drainage.

8.6 DRAINAGE INVESTIGATION

RGP instructed Drain Doctor to carry out a drainage investigation and CCTV survey of all the existing sewers in the proposed development areas to verify the size, depth and condition of the existing drainage infrastructure. The survey was undertaken on 21st and 22nd April 2022. Full details of the drainage investigation are included in Drain Doctor's report (ref: 2022-03-17167, dated 22/04/22).

The investigations found most of the sewer locations and depths to be reasonably consistent with the UU sewer records. There was only one surface water sewer which was different to the south of Windermere Road, whereby the sewer appeared to flow to the north rather than the south.

Not all existing manholes were accessible at the time of the survey, and therefore further investigation is planned to be carried out. This will provide the required information to gain a complete survey record for the area and to assist in future detailed drainage design and for S185 sewer diversions and abandonments.

A detailed record of the existing drainage for the proposed development areas is included on RGP drawings nos. K39225/100-103 are included in Appendix A for reference.

8.7 GROUND INVESTIGATION

Ground investigation was undertaken at the site in June and July 2022 by GEO Environmental Engineering Ltd. Full details of the ground investigation are included in GEO's report (ref: 2022-5335, dated 29/07/22).

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Intrusive investigations were undertaken and comprised a number of mechanically excavated trial pits, mini-percussive boreholes, shallow hand dug pits, rotary open-holed boreholes, falling head permeability tests and gas/groundwater monitoring.

Typical ground conditions encountered across the site were found to be topsoil over reworked gravelly clay at depths of between 0.4m and 0.9m BGL (below ground level), with localised areas of Made Ground comprising of brick and concrete and other anthropogenic materials and occasional relict foundations encountered at similar depths.

This was underlain by firm to stiff becoming stiff sandy gravelly clays, with Sandstone gravel noted at the far northern parts of Fell View Avenue.

Testing in the existing boggy areas of land found the ground to be very soft saturated silt with organic matter and anthropogenic materials to depths of c.1.20m BGL, underlain by firm to stiff clays.

Falling Head permeability tests were undertaken in 4 of the Boreholes, where only one test returned a very slow infiltration result (3.38 x 10^{-9}m/s classified as very poor infiltration media) whilst the other tests were terminated as unsuitable due to the very slow fall in water levels over time. As such, it is concluded that the underlying strata is not suitable for infiltration-based SuDS.

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9. ASSESSMENT OF FLOOD RISK

9.1 BACKGROUND

The following risk assessment has been carried out in accordance with the National Planning Policy Framework [1] and its Planning Practice Guidance [2] on Flood Risk. The broad aim of the guidance is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages.

Responsibility for this assessment lies with the developers and they must demonstrate:

- Whether the proposed development is likely to be affected by flooding.
- Whether the proposed development will increase flood risk in other parts of the hydrological catchment.
- That the measures proposed to deal with any flood risk are sustainable.

The developer must prove to the Local Planning Authority and the Environment Agency that the existing flood risk or the flood risk associated with the proposed development can be satisfactorily managed.

9.2 FLOOD RISK TERMINOLOGY

Flood risk considers both the probability and consequence of flooding.

Flood events are often described in terms of their probability of recurrence or probability of occurring in any one year. The threshold between a medium flood and a large flood is often regarded as the 1 in 100-year event. This is an event which statistical analysis suggests will occur on average once every hundred years. However, this does not mean that such an event will not occur more than once every hundred years. Table 9.1 shows the event return periods expressed in years and annual exceedance probabilities as a fraction and a percentage. For example, a 1 in 100-year event has a 1% probability of occurring in any one year, i.e. a 1 in 100 probability. A 1000-year event has a 0.1% probability of occurring in any one year, i.e. a 1 in 1000 probability.

Table 9.1 Flood Return Periods & Exceedance Probabilities

Return Period (years)	Annual Exceedance Probability (AEP)	
	Fraction	Percentage
2	0.5	50%
10	0.1	10%
25	0.04	4%
50	0.02	2%
100	0.01	1%
200	0.005	0.5%
500	0.002	0.2%
1000	0.001	0.1%

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9.3 DATA COLLECTION

The following information was referred to for the Flood Risk Assessment:

- Environment Agency Flood Map for Planning covering the site and adjacent area.
- Environment Agency Surface Water Flood Risk Map
- Environment Agency Reservoir Flood Risk Map
- Environment Agency Historic Flood Map
- United Utilities sewer records
- British Geological Survey Groundwater Flooding Susceptibility Map
- Copeland Borough Council Strategic Flood Risk Assessment
- Development layout plan
- Topographic survey

9.4 STRATEGIC FLOOD RISK ASSESSMENT

Copeland Borough Council commissioned JBA Consulting to produce a Level 1 Strategic Flood Risk Assessment (SFRA) [7] finalised in 2021 which refers to the Environment Agency Flood Maps to determine flood risk.

It states there are several historic flooding incidents in Whitehaven, but these are generally attributed to tidal flooding due to the proximity of the town centre to the coastline. Some properties are at risk from the main watercourse, Pow Beck which bisects the town and during extreme events, flooding can be exacerbated in certain areas by insufficient sewer capacities. This site however is located away from the historically affected areas and is not shown to be at risk of flooding.

However, since the original SFRA's were undertaken, the understanding of flood mechanisms and risks has developed, and the EA has carried out new modelling to define flood risks. The SFRA maps are therefore regarded as superseded by the new EA Flood Maps for Planning in any case which have been used to determine the sites flood risk for the basis of this report.

9.5 ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING

Figure 9.2 is an extract from the EA's Flood Map for Planning[6].

This has been reviewed to assess the level of flood risk to the area. The flood map shows areas that may be at risk of fluvial flooding in a 1% (1 in 100 year, dark blue) or 0.1% (1 in 1000 year, light blue) Annual Exceedance Probability (AEP) event. Alternatively, if the flood risk is tidal the flood map will show areas predicted to be at risk of flooding from the sea in a 0.5% AEP event (1 in 200 year, dark blue) or a 0.1% AEP event (1 in 1000 year, light blue).

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The Flood Map shows the current best information on the extent of the extreme flooding from rivers or the sea that would occur without the presence of flood defences. The potential impact of climate change is not considered by the mapping.

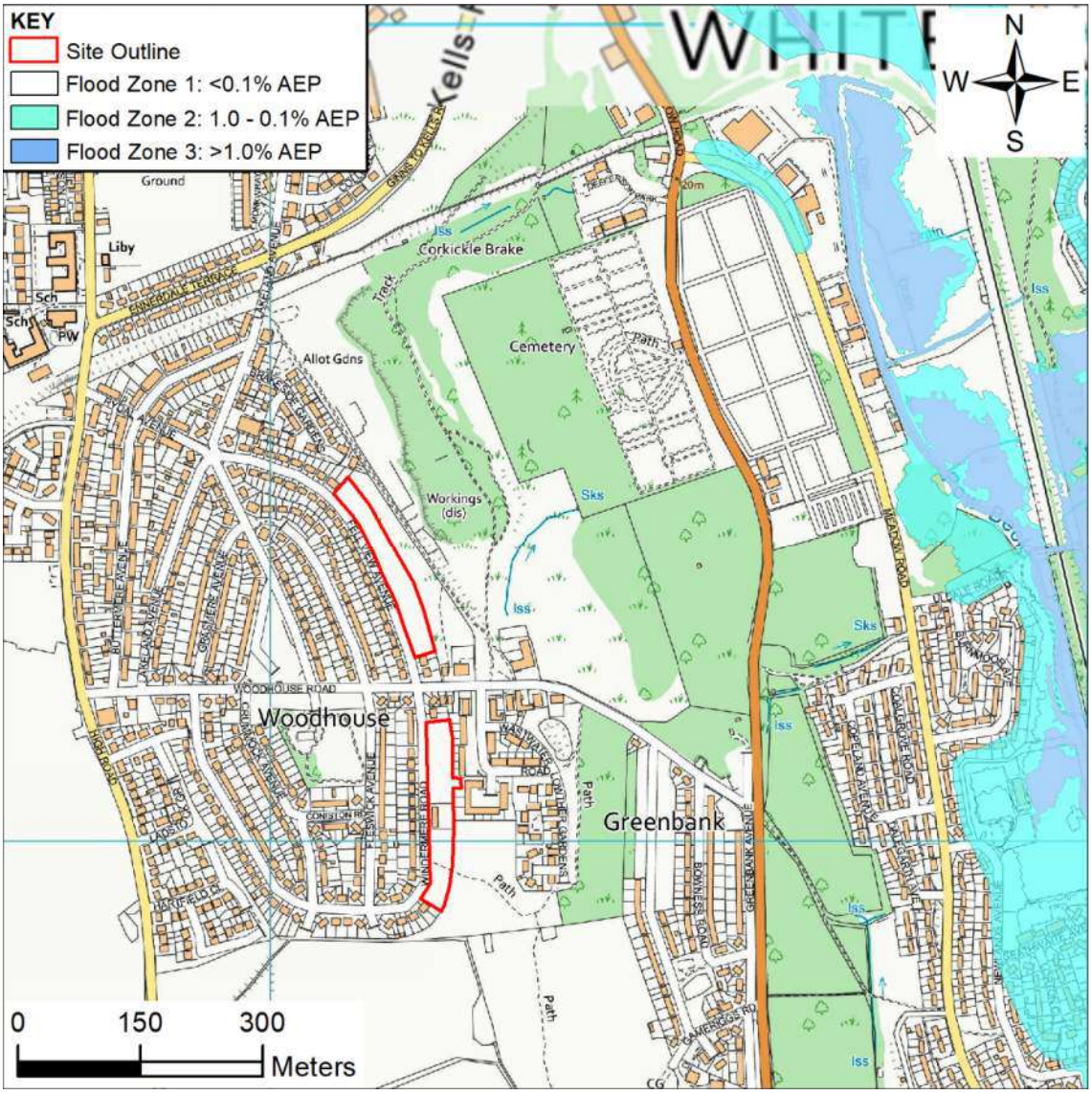

Figure 9.1 Environment Agency Flood Map for Planning

Reference to Figure 9.1 indicates the site lies within Flood Zone 1 "Low Probability", land assessed as having a less than 0.1% annual probability of flooding (i.e. rivers, lake or sea) in any year by reference to the NPPF and is therefore not considered to be at risk of fluvial flooding.

9.6 SURFACE WATER FLOOD RISK

Surface water flooding is that which results from extreme rainfall rather than overflowing rivers. This type of flooding typically occurs when extreme rainfall causes water to run down slopes and collect in depressions in the landscape or where runoff is focussed into an area where drainage is insufficient. It can also cause erosion resulting in the partial or complete blockage of drains or culverts.

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Figure 9.2 shows an extract from the EA Surface Water Flood Risk Map[6]. This has four risk classifications from very low probability (<0.1% AEP) to high probability (>3.3% AEP).

The EA surface water flood map indicates that the two areas proposed for development are predominantly at 'Very Low' risk of surface water flooding with the risk of flooding being less than 0.1% AEP (1 in 1000 year).

Outside the site boundary an area of 'High to Medium Probability' flooding is shown to the rear of Fell View Avenue down slope of the site along the line of the existing track. This is situated in an area located significantly lower levels than the proposed development site and is therefore not considered to pose any risk of flooding.

However, as surface water run-off from the greenfield site is currently directed towards this area due to the sloping topography, any development resulting in an increase in impermeable areas could cause additional run-off if not properly managed. It is therefore proposed to incorporate sufficient SuDS measures and attenuation storage to mitigate this as part of the overall Drainage Strategy. This is discussed in further detail in Section 10.0.

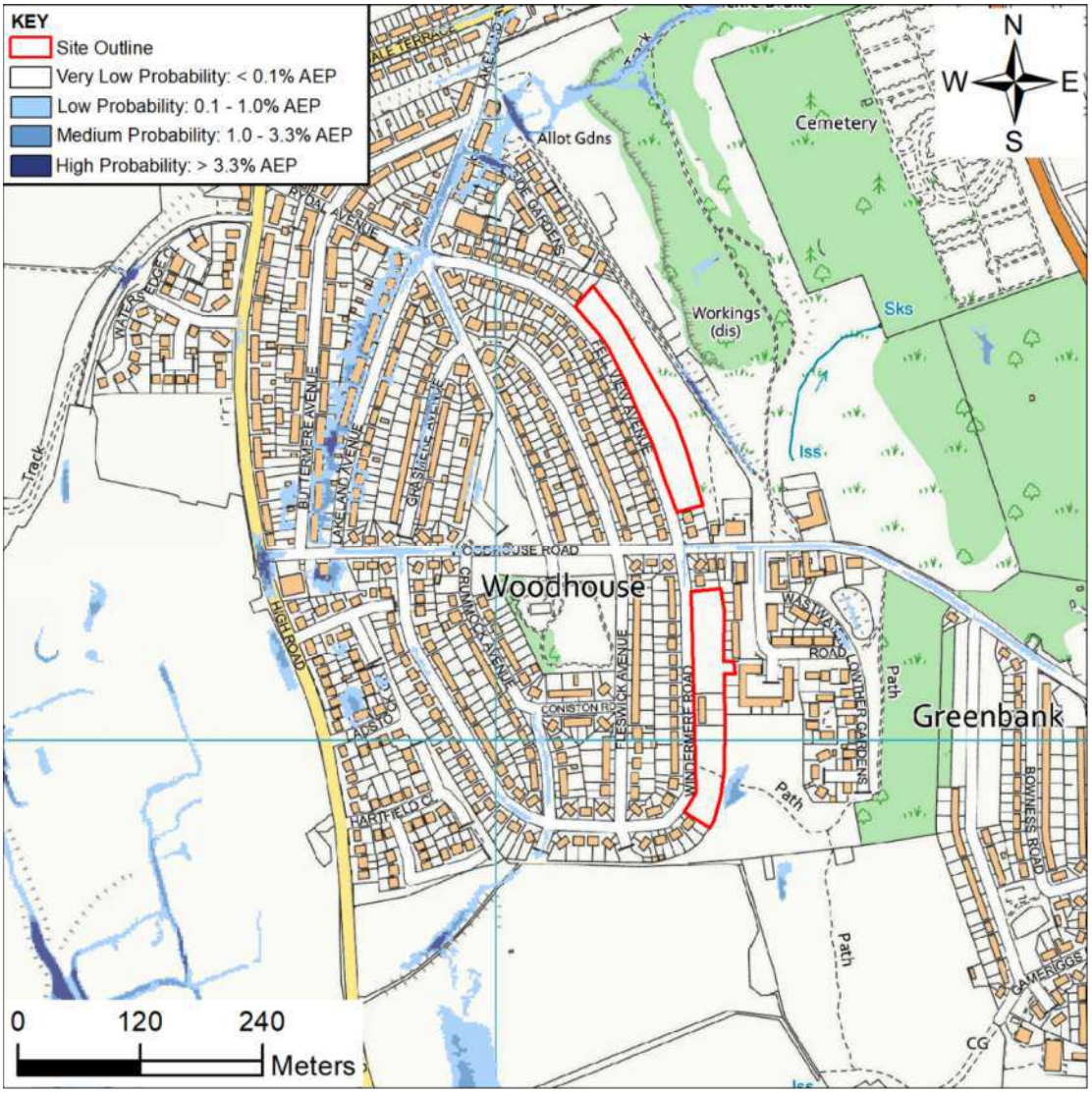

Figure 9.2 Environment Agency Surface Water Flood Map

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9.7 GROUNDWATER FLOOD RISK

Groundwater flooding occurs when water levels in the ground rise above the ground surface. It is most likely to occur in low lying areas underlain by permeable drift and rocks.

British Geological Survey (BGS) records (Figure 9.3) indicate the majority of the site has 'Limited Potential for Groundwater Flooding to Occur at the Surface' particularly at the Fell View Avenue end. The dataset shows areas susceptible to groundwater flooding, but it does not indicate the likelihood of it occurring.

As the existing ground levels fall off consistently and steeply to the rear of the proposed plots. The proposals involve raising levels to allow consistent floor levels by incorporating features such as retaining walls etc which will mean the proposed buildings will be well above existing ground levels in the majority of places, and no below ground development is proposed in any case therefore groundwater would not pose a risk of flooding to the site.

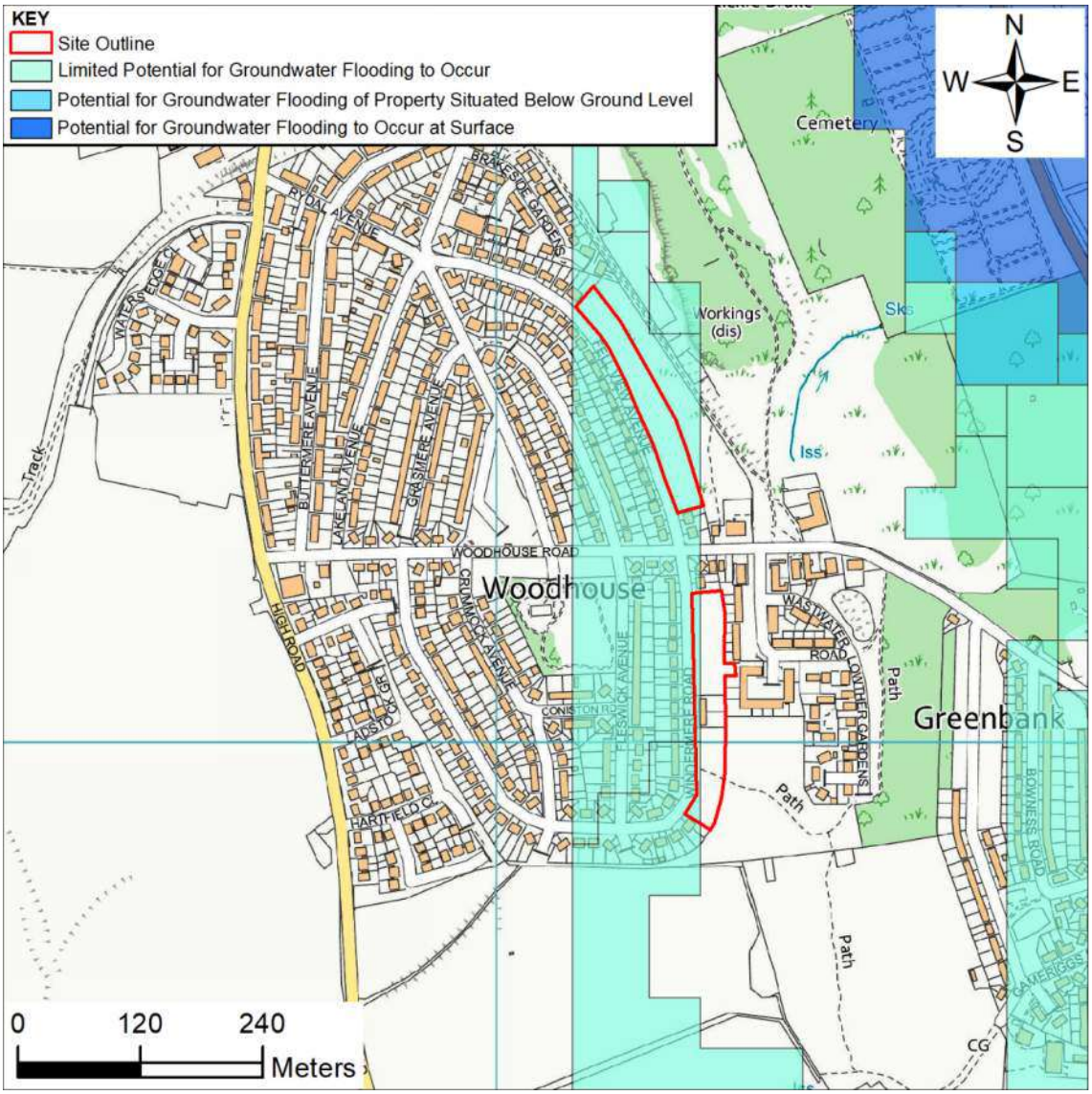

Figure 9.3 BGS Ground Water Flood Map

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9.8 FLOODING FROM RESERVOIRS, CANALS OR OTHER ARTIFICIAL SOURCES

The likelihood of reservoir flooding is considered to be much lower than other forms of flooding. Current reservoir regulation, which has been further enhanced by the Flood and Water Management Act, aims to make sure that all reservoirs are properly maintained and monitored to detect and repair any problem.

The Ordnance Survey map indicates that there are no reservoirs, canals or artificial structures in the close proximity of the proposed development site.

9.9 FLOODING FROM SEWERS

United Utilities (UU) do not provide information on flood risk from their assets and there have been no reports within the SFRA. It is therefore concluded the site is not at risk of flooding from these sources.

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10. SURFACE WATER DRAINAGE STRATEGY

10.1 INTRODUCTION

The principal aim of the following drainage strategy is to design the development to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses in order to protect watercourses and reduce the risk of localised flooding, pollution and other environmental damage.

In order to satisfy these criteria this surface water runoff assessment and drainage design has been undertaken in accordance with the following reports and guidance documents:

- SuDS Manual, CIRIA Report C753, 2015 [7]
- Code of Practice for Surface Water Management, BS8582:2013, November 2013 [9]
- Rainfall Runoff Management for Developments, Defra/EA, SC030219, October 2013 [10]
- Designing for Exceedance in Urban Drainage – Good Practice, CIRIA Report C635, 2006 [11]
- Flood Estimation Handbook (FEH) [12]
- Flood Studies Report (FSR), Volume 1, Hydrological Studies, 1993 [13]
- Flood Studies Supplementary Report No 14 (FSSR14), Review of Regional Growth Curves, 1983 [14]
- Flood Estimation for Small Catchments, Marshall & Bayliss, Institute of Hydrology, Report No. 124 (IoH 124), 1994 [15]

The following assessment and drainage strategy are based on the latest site layout plan. Any alterations to the site plan resulting in changes to impermeable areas will require the drainage strategy to be revisited.

10.2 SITE AREAS

To support the exploration of options for site drainage, the spatial extent of different types of proposed land cover on the site have been measured.

As the site can be subdivided into the two distinct areas of Fell View Avenue and Windermere Road. The impermeable areas have therefore been calculated for each respective area.

Table 10.1 & 10.2 show the measured proposed land cover areas subdivided for the Fell View Avenue and Windermere Road sites.

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Table 10.1 Land Cover Areas - Windermere Road

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total Roof Area	1432.0	0.143	24%
Total Parking Area	944.1	0.094	16%
Total Road Area	0.0	0.000	0%
Total Hardstanding Area	904.6	0.090	15%
Green & Landscaped Areas	2568.2	0.257	44%

Table 10.2 Land Cover Areas – Fell View Avenue

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total Roof Area	1248.2	0.125	21%
Total Parking Area	1083.4	0.108	19%
Total Road Area	0.0	0.000	0%
Total Hardstanding Area	913.2	0.091	16%
Green & Landscaped Areas	2604.1	0.260	45%

The site can be subdivided into land cover that could be permeable and that which could be impermeable. Potential impermeable areas are regarded as buildings, parking, roads, and hardstanding. All other areas (principally gardens) are regarded as having a permeable surface.

Table 10.3 & 10.4 give the areas of potentially permeable and impermeable land cover for each respective site area.

Table 10.3 Area of Potentially Impermeable & Permeable Land Cover – Windermere Road

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total Impermeable Area	3520.6	0.352	49%
Remaining Permeable Area	3628.8	0.363	51%

Table 10.4 Area of Potentially Impermeable & Permeable Land Cover – Fell View Avenue

Land Cover	Area		Percentage of total site area
	m²	Ha	
Total Impermeable Area	3509.5	0.351	60%
Remaining Permeable Area	2339.4	0.234	40%

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10.3 SURFACE WATER DRAINAGE DESIGN PARAMETERS

The surface water drainage system has been designed on the following basis using the modified rational method and a generated rainfall profile:

10.3.1 CLIMATE CHANGE

Projections of future climate change indicate that more frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall are likely to occur over the next few decades in the UK. These future changes will have implications for river flooding and for local flash flooding. These factors will lead to increased and new risks of flooding within the lifetime of planned developments.

Climate change guidance is issued by the Environment Agency and outlines the anticipated changes to extreme rainfall intensity. Table 10.5 shows anticipated changes in extreme rainfall intensity in small and urban catchments. Guidance states that for site-specific flood risk assessments and strategic flood risk assessments, the upper end allowance should be assessed. A climate change allowance of 40% has been selected for the purpose of drainage design based on the 100-year anticipated design life of the proposed development. No properties are located immediately downstream of the site and therefore the site poses low risk to neighbouring property.

Table 10.5 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%

10.3.2 PERCENTAGE IMPERMEABILITY (PIMP)

The percentage impermeability (PIMP) for all impermeable areas is modelled as 100%. The entirety of the impermeable areas is to be positively drained.

10.3.3 VOLUMETRIC RUNOFF COEFFICIENT (CV)

The volumetric runoff coefficient describes the volume of rainfall which runs off an impermeable surface following losses due to infiltration, depression storage, initial wetting and evaporation. The coefficient is dimensionless. Default industry standard volumetric runoff coefficients are 0.75 for summer and 0.84 for winter and are used for design.

10.3.4 RAINFALL MODEL

The calculations use the REFH2 unit hydrograph methodology in line with best practice as outlined in the SuDS Manual [10]. The calculations use the most up to date available catchment descriptors (2013) provided by the Centre for Ecology and Hydrology Flood Estimation Handbook web service.

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10.4 PRE-DEVELOPMENT RUNOFF ASSESSMENT

For the basis of this assessment the site is classified as Greenfield, despite the site having contained previous terraced housing. The ground investigations have also confirmed that the site is underlain by relatively impermeable natural clay.

For completeness greenfield runoff calculations have been undertaken. As the site covers an area of less than 200 ha, the Greenfield calculations have been undertaken in accordance with methodology described in IoH 124 [15]. For catchments of less than 50 ha the Greenfield runoff rate is scaled according to the size of the catchment in relation to a 50-hectare site.

Full details of the calculations and the methodology for deriving the Peak Rate of Runoff are in included in Appendix C. As the site can be subdivided into the two distinct areas of Fell View Avenue and Windermere Road. The equivalent greenfield runoff values have therefore been calculated for each respective area. A summary of the results is included in Table 10.6 & 10.7.

Without SuDS, the proposed development would increase the Rate of Runoff from the developed areas of the site.

Table 10.6 Pre-Development Peak Runoff Rates - Windermere Road

Event	Greenfield (l/s)
Q1	2.51
QBAR	2.89
Q10	3.99
Q30	4.91
Q100	6.01
Q100+ 40% CC	8.42

Table 10.7 Pre-Development Peak Runoff Rates – Fell View Avenue

Event	Greenfield (l/s)
Q1	2.51
QBAR	2.88
Q10	3.98
Q30	4.90
Q100	5.99
Q100+ 40% CC	8.39

The Greenfield QBAR runoff rates for each distinct area equal 2.89 l/s and 2.88 l/s respectively, thus totalling 5.8 l/s for the total development site area.

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10.5 SURFACE WATER DISPOSAL

Surface water disposal has been considered in line with the hierarchy outlined in the SuDS Manual[8]. The approach considers infiltration drainage in preference to disposal to watercourse, in preference to discharge to sewer.

Cumbria County Council as Lead Local Flood Authority prefer design in accordance with the Cumbria Design Guide which identifies the following hierarchy of techniques to be used:

- **Prevention**: Prevention of runoff by good site design and the reduction of impermeable areas.
- **Source Control**: Dealing with water where and when it falls (e.g. permeable paving).
- **Site Control**: Management of water in the local area (e.g. swales, detention basins).
- **Regional Control**: Management of runoff from sites (e.g. balancing ponds, wetlands).

10.5.1 INFILTRATION

Permeability testing at the site confirmed that disposal via soakaways or other infiltration-based SuDS is not a viable option for this site due to the underlying firm to stiff clay strata (Section 8.7).

10.5.2 WATERCOURSES AND/OR CULVERTS

As discussed on Section 8.4 there is an existing watercourse and culvert located c. 100m to the east of Fell View Avenue. Based on the Ordnance Survey maps, the head of this watercourse appears to be c. 10-15m downslope of Fell View Avenue. The watercourse is culverted near to the southern boundary of the cemetery and was CCTV surveyed by RGP as part of another proposed housing development in Low Road. This work was presented in RGP report no. K36110/01/FRA/CA dated 25th November 2020 in support of CBC Planning Ref: 4/20/2514/OF1. It was confirmed that the watercourse and culvert was in a poor condition with clear root ingress and prone to localised flooding in Low Road. The culvert through the cemetery had significant structural defects and was deemed unsuitable to take any additional run-off from that development. It can therefore be concluded that any additional inflow from the current proposals from Fell View Avenue or Windermere Road would increase flood risk downstream, and for this reason is discounted as a viable off-site solution.

10.5.3 POSITIVE DRAINAGE – SURFACE WATER SEWER

The proposed impermeable area of the development will require a positive drainage solution. Runoff will be attenuated to pre-development Greenfield QBAR rates as far as practical, with discharge proposed to the existing and diverted public surface water sewer located within the development area.

10.6 SURFACE WATER DRAINAGE DESIGN

The proposed surface water network serving the entire developable area of the site has been modelled using MicroDrainage Source Control (results included in Appendix C).

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The drainage design has been sized to store a future 1% AEP event of critical duration without any flooding. Future climate change (40%) and urban creep (10% to housing roof areas only) is accounted for within the calculations.

It is proposed that all plot roof and associated hardstanding areas will drain into shared private geocellular attenuation tanks, located predominantly within private drive areas.

Roof water, driveway and path runoff will connect directly into the surface water pipe network upstream of the attenuation systems, with inspection chambers utilised to route the new pipework and allow for future inspection and maintenance. Proposed ground and floor levels will be fall consistently to enable gravity connections to the drainage system.

Silt traps will be located upstream of each attenuation tank, which will provide surface water treatment and access for maintenance. Silt traps isolate silt and other particles by encouraging settlement into sumps, preventing ingress into the tank.

The attenuation tanks will be founded at a suitable level providing a minimum depth of suitable cover whilst allowing for connection to the existing or diverted surface water public sewers. These tanks will be wrapped and sealed with an impermeable membrane to provide a water-tight structure.

Orifice flow control chambers will restrict discharge from each geocellular attenuation system. With a total off-site discharge rate of 5.8 l/s equalling the pre-development greenfield QBAR rate.

Where practical the attenuation systems will be designed to be located outside of any easement areas associated with any existing or diverted public sewers.

Type C (no infiltration) permeable block paving with positive drainage connections to the proposed surface water drainage system will be used to construct the private driveways, providing enhanced treatment (i.e., removal of silt and pollutants), prior to discharge to the drainage network and additional surface water storage benefits.

Roof water will connect directly into the surface water pipe network. This will require ground levels to fall consistently around the site in order to enable gravity connections to the drainage system.

For further detail refer to the Drainage Layout Plans Nos K39225/105-108 included in Appendix A.

10.7 STORAGE VOLUME

The proposed surface water network serving the new plots has been modelled using MicroDrainage Source Control[19]. A storage assessment has been undertaken for the Q100+40% CC storm event and has been designed with sufficient capacity to convey flows without causing flooding, the results are provided in Table 10.8.

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Table 10.8 Attenuation Storage Volumes

Site Area	Tank Plan Area (m^2)	Tank Dimensions l x w x d (m)	Volume to TWL (m^3)	Discharge Rate (l/s)
Plots 1 - 22	348	29 x 12 x 0.8	261.1	2.9
Plots 23 - 28	130	52 x 2.5 x 0.8	96.7	1.1
Plots 29 - 40	217.5	87 x 2.5 x 0.8	164.3	1.8
			TOTAL	**5.8**

10.8 SEWER ABANDONMENT & DIVERSION

As discussed in Sections 8.5 & 8.6 there are several existing public surface water and combined sewers present in the areas proposed for development.

Drainage investigations have confirmed that some of these sewers are now redundant and can be abandoned. However, some of the existing sewers convey flows from the wider Woodhouse residential estate and will need to be retained. As such, a series of sewer diversions are required to ensure these sewers do not clash with the proposed development site layout.

Pre-application discussions with United Utilities have indicated that this would be acceptable in principle providing a 6m easement is included on the diversion of any assets to allow future access to maintenance if required.

Indicative sewer abandonment and diversion plans have therefore been produced to inform the works at planning stage and Drawing Nos K39225/109-112 are included in Appendix A for reference.

At detailed design stage, applications will need to be submitted to UU in order obtain binding S185 Sewer Diversion Agreements which will be required for any proposed diversions prior to commencement of any site works.

10.9 DESIGNING FOR LOCAL DRAINAGE SYSTEM FAILURE

In accordance with the general principles discussed in CIRIA Report C635 – Designing for Exceedance in Urban Drainage [13] the proposed surface water drainage, where practical, should be designed to ensure there is no increased risk of flooding on the site or elsewhere as a result of extreme rainfall, lack of maintenance, blockages or other causes. These measures are discussed below.

The following general measures will be implemented as part of the detailed drainage design:

Blockage & Exceedance - In the unlikely case of exceedance or blockage of the geocellular systems, associated silt traps and/or flow control chambers, spills would occur from the lowest access cover around the properties. Exceedance flows shall be retained on site within the drainage system as far as practical and in the case of extreme events site levels will be set to divert any exceedance flows to fall towards and disperse in more permeable green space areas towards the east and away from the development replicating the existing site runoff characteristics.

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Surface Storage & External Levels – where possible car parking areas should be designed to offer additional surface water storage volume and conveyance of flood water should the SuDS and drainage system fail, flood or exceed capacity. Where appropriate, the kerb lines should be raised to channel surface water runoff back into the drainage system.

Drainage Contingency – the proposed surface water system will be designed to provide adequate storage volume against flooding for the Q100 event, including a 40% allowance to account for climate change. The drainage system will also provide capacity for lower probability (greater design storm events) which are not critical duration.

Building Layout & Detail – the buildings will be designed and situated to ensure that they are not at risk of flooding from overland flow. The finished floor and threshold levels of the proposed new buildings will be set above the external levels where possible and external footpaths will fall away from the dwellings, ensuring that any flood water runs away from, rather than towards the properties. Threshold drains will be installed where required for additional redundancy.

10.10 SURFACE WATER QUALITY

The treatment of surface water is not a statutory requirement. Water quality remains a material consideration but there are no prescriptive standards to be imposed in terms of treatment train management. In the absence of a design standard, the SuDS manual has been used which outlines best practice.

Pollutants such as suspended solids, heavy metals and organic pollutants may be present in surface water runoff, the quantity and composition of the runoff is highly dependent upon site use.

The SuDS Manual[8] outlines best practice with regards to treatment of surface water by SuDS components prior to discharge to the environment. SuDS components can be effective in reducing the amount of pollutants within the surface water discharged and therefore environmental impact of the development. SuDS components may be installed in series to form a treatment train to treat the runoff.

The simple index approach as outlined in the SuDS Manual [8]. has been used to assess the pollution hazard indices and proposed treatment components. For the categories of runoff covering hardstanding including, parking, pavements and path areas, treatment is proposed by Type C permeable block paving.

Table 10.9 summarises the pollution hazard and mitigation indices for each type of runoff.

Table 10.9 Pollution Hazard & Mitigation Indices

Permeable Paving for Highway Areas			
Indices	**Suspended Solids**	**Metals**	**Hydrocarbons**
Pollution Hazard	0.5	0.4	0.4
Pollution Mitigation	0.7	0.6	0.7
Treatment Suitability	**Adequate**	**Adequate**	**Adequate**

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10.11 OPERATIONS & MAINTENANCE RESPONSIBILITY

The drainage systems will be privately maintained by Home Group. A SuDS *'Operations & Maintenance Plan'* has been prepared by RGP detailing the requirements for future maintenance of the SuDS components.

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11. FOUL WATER DRAINAGE STRATEGY

It is proposed that foul water from the new dwellings shall be drained via gravity with discharge to the existing or diverted 225mm diameter combined sewer located to the rear of the proposed properties in both Windermere Road and Fell View Avenue.

A pre-development enquiry has been submitted to United Utilities to confirm acceptability of the foul water drainage proposals and a detailed response received on 4th August 2022 (see Appendix B). In principle, they are accepting of the outline proposals and have requested detailed design information, which will be provided once Planning Approval has been received and detailed design commenced.

Under Section 106 of The Water Industry Act 1991, '*the owner / occupier of any premises shall be entitled to have his drain or sewer communicate with the public sewer of any sewerage undertaker and thereby to discharge foul water and surface water from those premises or that private sewer*.' Unless '*the making of the communication would be prejudicial to the undertaker's sewerage system'*.

Preliminary foul water discharge calculations have been undertaken for the new dwellings in accordance with the Design and Construction Guidance for Foul and Surface Water Sewers [17], as shown in Table 11.1 below.

Table 11.1 Peak Foul Flow Rates

Sewerage Sector Design and Construction Guidance Clause B3.1	
Peak Load Based on Number of Dwellings – 40 No. @ 4000 L/day	160,000
Peak Foul Flow Rate from Site (l/s)	1.85

The estimated predicted peak foul flow rate from the new development is 1.85 l/s.

The outline foul water drainage pipe routes are shown on drawing Nos K39225/105-108, included in Appendix A.

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12. CONCLUSIONS AND RECOMMENDATIONS

In consideration of the proposed drainage strategy for the site the following conclusions and recommendations are made:

- The site is located in Flood Zone 1 with a predicted annual probability of flooding from rivers or the sea of less than 0.1% AEP (1 in 1000).
- By reference to the National Planning Policy Framework [1] on Flood Risk, More Vulnerable development is acceptable within this flood zone.
- The site is not considered to be at significant risk of flooding from surface water, groundwater, reservoirs, canals, or any artificial structures.
- Ground investigations have confirmed that the underlying cohesive natural strata is not suitable for infiltration-based SuDS components. The watercourse and culvert located to the east of Fell View Avenue are also not suitable points of discharge due to known issues with localised flooding, root ingress and damaged sections of pipework.
- It is proposed that surface water drainage shall be positively drainage and attenuated, using geocellular tanks systems, with individual flow control devices restricting discharge to the pre-development Greenfield QBAR rate of 5.8 l/s. Discharge will be into the existing or diverted public surface water sewers
- Treatment of surface water runoff will be provided by incorporating Type C (No infiltration) permeable block paving into the construction of all driveway areas with a positive connection to the drainage network.
- A SuDS Operations and Maintenance Plan has been prepared detailing future maintenance requirements of all sustainable drainage systems.
- Foul flows from the site shall discharge via gravity to the existing public combined sewers via several new connections. A pre-development wastewater enquiry has been submitted to UU.
- Several sewer abandonments and diversions will be required to facilitate the development. Pre-application discussions with United Utilities have confirmed this is acceptable in principle and a S185 Sewer Diversion application will be progressed following Planning Approval
- Further intrusive investigation of the existing public sewer network within the development site is planned to ensure new connections and diversions are achievable.
- Detailed drainage design will be undertaken once Planning Approval has been granted in order to discharge any relevant pre-commencement Planning Conditions relating to drainage.

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13. REFERENCES

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[4] British Geological Survey, 2020. Geoindex. http://mapapps2.bgs.ac.uk/geoindex/home.html

[5] Land Information System (LANDIS)- Soilscapes viewer, Accessed June 2022. http://www.landis.org.uk/soilscapes

[6] Defra Magic Maps, 2022. https://magic.defra.gov.uk/MagicMap.aspx . Accessed June 2022

[7] Copeland Borough Council, Draft Strategic Flood Risk Assessment (SFRA), October 2021

[8] CIRIA, The SuDS Manual, Report C753, 2015.

[9] BS8582:2013, Code of Practice for Surface Water Management, November 2013.

[10] DEFRA/EA, Rainfall Runoff Management for Developments, SC030219, October 2013.

[11] CIRIA, Designing for Exceedance in Urban Drainage – Good Practice, Report C635, London, 2006.

[12] Centre for Ecology and Hydrology, Flood Estimation Handbook, Vols. 1 – 5 & FEH CD-ROM 3, 2009.

[13] Institute of Hydrology, Flood Studies Report, Volume 1, Hydrological Studies, 1993.

[14] Institute of Hydrology, Flood Studies Supplementary Report No 14 – Review of Regional Growth Curves, August 1983.

[15] Marshall & Bayliss, 1994. Flood Estimation for Small Catchments, Report No. 124 (IoH 124), Institute of Hydrology.

[16] Department for Environment, Food and Rural Affairs, Non-Statutory Technical Standards for Sustainable Drainage Systems, March 2015

[17] Water UK, Design and Construction Guidance for Foul & Surface Water Sewers Offered for Adoption Under the Code for Adoption Agreements for Water and Sewage Companies Operating Wholly or Mainly in England, Approved Version 2.0, March 2020

APPENDIX A

DRAWINGS

EXISITNG DRAINAGE PLAN – SHEETS 1 – 4

PROPOSED DRAINAGE PLAN – SHEETS 1 – 4

PROPOSED SEWER DIVERSIONS & ABANDONMENT PLAN – SHEETS 1 – 4

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

Rev	Description	Date	Revised by	Checked by	Approved
A	UU Detailed sewer record info added	20/07/22	CA	TM	TM

Issue Purpose: INFORMATION

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd		
Project:	Windermere Rd & Fell View Ave		
Drawing Title:	Existing Drainage Plan 1 of 4		

Scale @ A1: 1:200	First Issue: 26/05/22	Office of Origin: Kendal	
Drawn by: CA	Checked by: TM	Approved: TM	
Project No: K39225	Drawing No: 100	Rev: A	
BIM No:			

516100

297200

96.2m

WINDERMERE ROAD

Windermere Road

Grid North

UU MH 1026
CL ~97.99
IL ~

MH 8
CL ~97.92
IL ~96.52 (sonde)

225Ø VC

UU MH 1113
CL ~
IL ~

UU MH 1117
CL ~96.27
IL ~

MH O/S No.73
CL ~?
IL ~?

UU MH 2004
CL ~97.77
IL ~97.17

UU MH 2002
CL ~ 97.33
IL ~

MH 9
CL ~97.26
IL ~95.60

150Ø VC

225Ø VC

UU MH 2113
CL ~
IL ~

MH 11 (blocked)
CL ~96.75
IL ~93.99

UU MH 2107
CL ~ 95.81
IL ~ 94.79

MH reached CCTV 87.76m

MH 10
CL ~96.50
IL ~93.80

UU MH 2001
CL ~ 96.54
IL ~ 93.86

225Ø VC

UU MH 2103
CL ~ 95.14
IL ~ 92.87

UU MH 2105
CL ~ 94.44
IL ~ 93.09

No Access

WAS

58 65 72 53 75 73 90 51a 51 20 6 4a 4 2a 2 22

EAVES
RIDGE
MH
FH
CL

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

Rev	Description	Date	Revised by	Checked by	Approved
A	UU Detailed sewer record info added	20/07/22	CA	TM	TM

Issue Purpose: INFORMATION

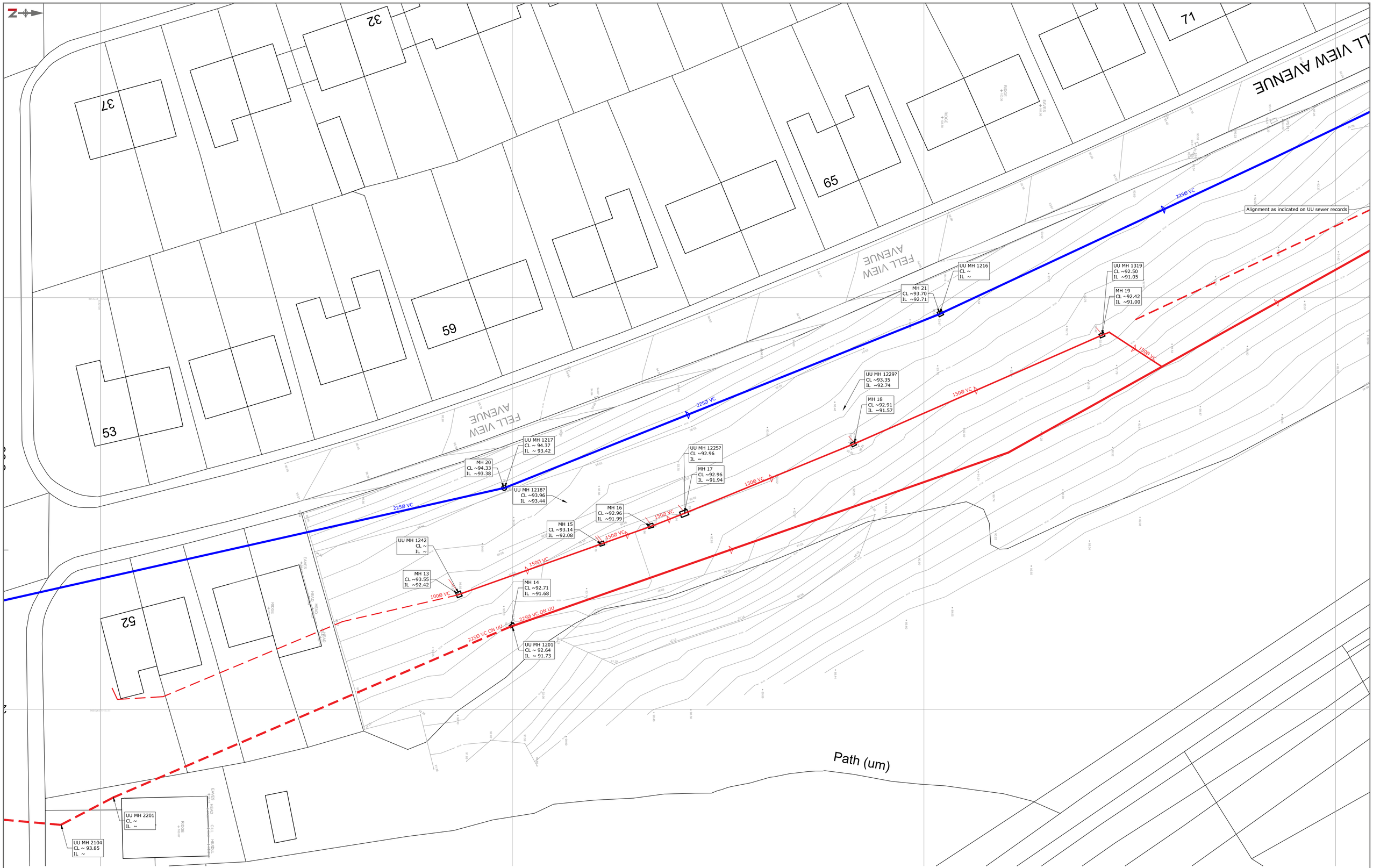
Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd
Project:	Windermere Rd & Fell View Ave
Drawing Title:	Existing Drainage Plan 2 of 4

Scale @ A1: 1:200	First Issue: 26/05/22	Office of Origin: Kendal
Drawn by: CA	Checked by: TM	Approved: TM
Project No: K39225	Drawing No: 101	Rev: A
BIM No:		



EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

Rev	Description	Date	Revised by	Checked by	Approved
A	UU Detailed sewer record info added	20/07/22	CA	TM	TM

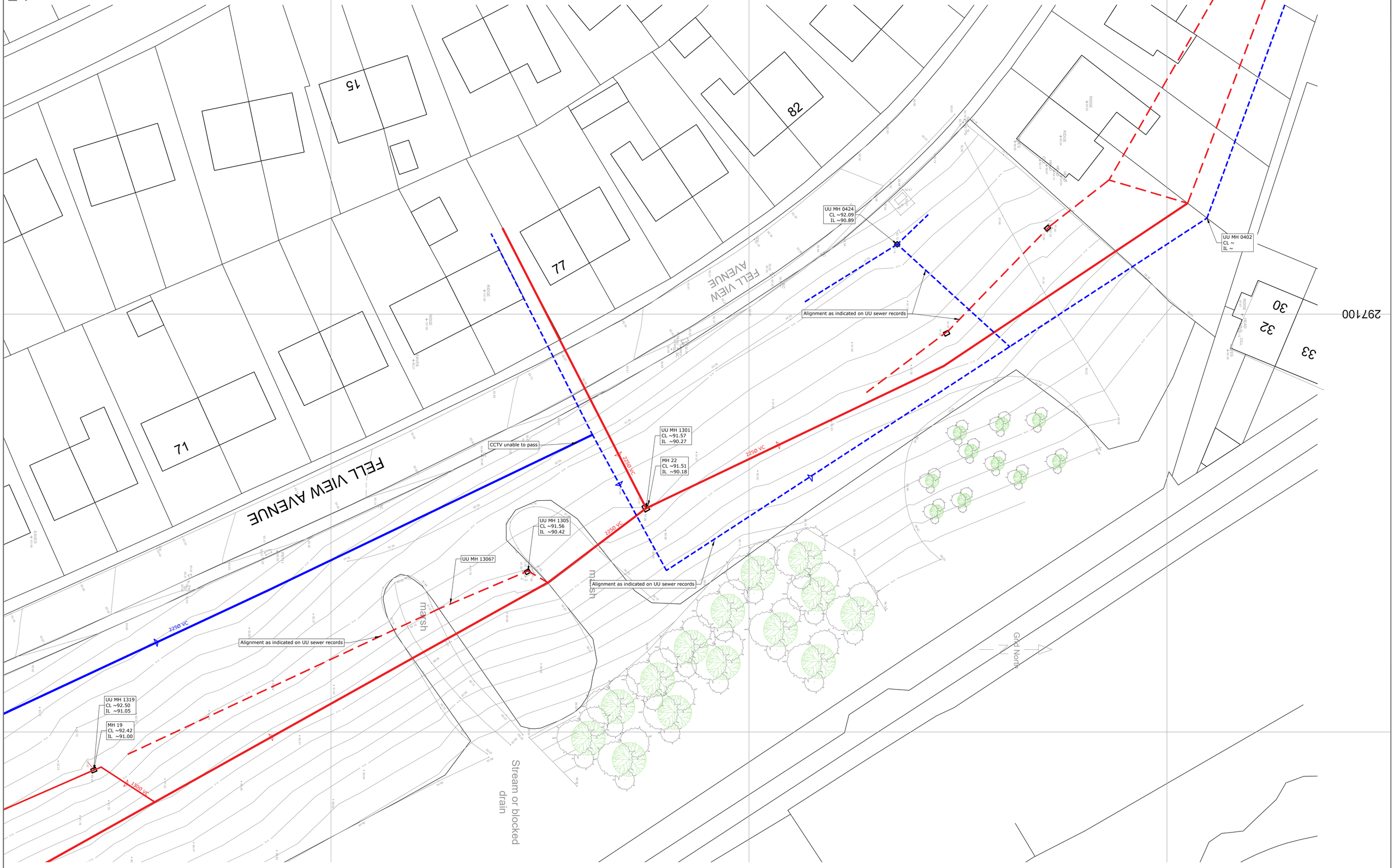
Issue Purpose: INFORMATION

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd		
Project:	Windermere Rd & Fell View Ave		
Drawing Title:	Existing Drainage & Services 3 of 4		
Scale @ A1: 1:200	First Issue: 26/05/22	Office of Origin: Kendal	
Drawn by: CA	Checked by: TM	Approved: TM	
Project No: K39225	Drawing No: 102	Rev: A	
BIM No:			



EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

Rev	Description	Date	Revised by	Checked by	Approved
A	UU Detailed sewer record info added	20/07/22	CA	TM	TM

Issue Purpose: INFORMATION

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd	Scale @ A1: 1:200	First Issue: 26/05/22	Office of Origin: Kendal	
Project:	Windermere Rd & Fell View Ave	Drawn by: CA	Checked by: TM	Approved: TM	
Drawing Title:	Existing Drainage Plan 4 of 4	Project No: K39225	Drawing No: 103	Rev: A	
		BIM No:			

516000

297200

Windermere Road

Windermere Road

UU MH 1906
CL ~98.58
IL ~97.19

Alignment as indicated by UU records
Different flow direction.

15000Ø PCC manhole
c. 1.6m deep

Alignment as indicated by DD

New 23m 225Ø VC pipe

Alignment as indicated by UU records
Different flow direction.

Existing 225Ø sewer
removed c.25m

Existing manhole
removed

12000Ø PCC manhole
c. 1.5m deep

Alignment as indicated on UU sewer records

UU MH 1934?
CL ~ 97.51
IL ~ 96.20

Invert depths of sewers in
this location to be verified.
To determine whether a
connection is feasible.

Existing sewer
removed c.14m

New 10m 150Ø VC pipe

MH 2
CL ~96.19
IL ~95.22

Existing manhole
removed

Existing sewer
removed c.8m

12000Ø PCC manhole
c. 1.5m deep

Existing manhole
removed

UU MH 2902

Existing sewer
removed c.12.5m

MH 3
CL ~96.25
IL ~94.87

Existing manholes
retained

MH 4
CL ~95.94
IL ~94.54

New 30m 150Ø VC pipe

New 5m 150Ø VC pipe

12000Ø PCC manhole
c. 1.5m deep

New 9m 150Ø VC pipe

15000Ø PCC manhole
c. 2.0m deep

15000Ø PCC manhole
c. 1.6m deep

UU MH 1907
CL ~96.92
IL ~95.62

Flow Control Chamber
Design Flow = 1.8 l/s
Min. IL ~96.125

Geocellular Attenuation Crate
87m x 2.5m x 0.8m deep
TWL Volume = 164.3m³
Min 0.6m Cover
IL ~96.125

MH 6
CL ~97.06
IL ~95.51

Existing 225Ø sewer
removed c.4m

CCTV unable to pass
28m

New 15000Ø PCC manhole at
proposed foul connection point

UU MH 2901
CL ~96.44
IL ~95.18

UU MH 2903
CL ~96.13
IL ~

Existing sewer
removed c.5.5m

MH 5
CL ~96.21
IL ~95.02

Existing manhole
removed

Existing sewer
removed c.63m

New 62m 225Ø VC pipe

Existing sewer
removed c.38m

MH 7
CL ~96.52
IL ~95.82

Existing manhole
removed

New 100m 225Ø VC pipe

CCTV unable to pass 57.54m

Existing 225Ø sewer
removed c.120m

UU MH 2004

Existing (buried?)
manhole removed

UU MH 2009
CL ~97.23
IL ~96.38

Existing (buried?)
manhole removed

15000Ø PCC manhole
c. 2.0m deep

Existing sewer
removed c.16m

Existing sewer
removed c.52m

New 20m 225

49

51

106

40

39

38

3

36

35

34

33

32

31

30

06

05

WAS

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

DRAINAGE KEY - SEWER DIVERSIONS & ABANDONMENTS

- PROPOSED DIVERSION OF EXISTING COMBINED SEWER
- PROPOSED ABANDONMENT OF EXISTING COMBINED SEWER
- PROPOSED DIVERSION OF EXISTING SURFACE WATER SEWER
- PROPOSED ABANDONMENT OF EXISTING SURFACE WATER SEWER

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd
Project:	Windermere Rd & Fell View Ave
Drawing Title:	Proposed Drainage Plan 1 of 4

Scale @ A1: 1:200	First Issue: 02/08/22	Office of Origin: Kendal
Drawn by: CA	Checked by: TM	Approved: TM
Project No: K39225	Drawing No: 105	Rev:
BIM No:		

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

DRAINAGE KEY - SEWER DIVERSIONS & ABANDONMENTS

- PROPOSED DIVERSION OF EXISTING COMBINED SEWER
- PROPOSED ABANDONMENT OF EXISTING COMBINED SEWER
- PROPOSED DIVERSION OF EXISTING SURFACE WATER SEWER
- PROPOSED ABANDONMENT OF EXISTING SURFACE WATER SEWER

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS
Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd	Scale @ A1: 1:200	First Issue: 02/08/22	Office of Origin: Kendal
Project:	Windermere Rd & Fell View Ave	Drawn by: CA	Checked by: TM	Approved: TM
Drawing Title:	Proposed Drainage Plan 2 of 4	Project No: K39225	Drawing No: 106	Rev:
		BIM No:		

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

DRAINAGE KEY - SEWER DIVERSIONS & ABANDONMENTS

- PROPOSED DIVERSION OF EXISTING COMBINED SEWER
- PROPOSED ABANDONMENT OF EXISTING COMBINED SEWER
- PROPOSED DIVERSION OF EXISTING SURFACE WATER SEWER
- PROPOSED ABANDONMENT OF EXISTING SURFACE WATER SEWER

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd		
Project:	Windermere Rd & Fell View Ave		
Drawing Title:	Proposed Drainage 3 of 4	BIM No:	

Scale @ A1:	First Issue:	Office of Origin:
1:200	02/08/22	Kendal
Drawn by: CA	Checked by: TM	Approved: TM
Project No: K39225	Drawing No: 107	Rev:

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

DRAINAGE KEY - SEWER DIVERSIONS & ABANDONMENTS

- PROPOSED DIVERSION OF EXISTING COMBINED SEWER
- PROPOSED ABANDONMENT OF EXISTING COMBINED SEWER
- PROPOSED DIVERSION OF EXISTING SURFACE WATER SEWER
- PROPOSED ABANDONMENT OF EXISTING SURFACE WATER SEWER

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd		
Project:	Windermere Rd & Fell View Ave		
Drawing Title:	Proposed Drainage Plan 4 of 4		

Scale @ A1: 1:200	First Issue: 02/08/22	Office of Origin: Kendal
Drawn by: CA	Checked by: TM	Approved: TM
Project No: K39225	Drawing No: 108	Rev:
BIM No:		

516000

29720

Windermere Road

Windermere Road

15000 PCC manhole c. 1.6m deep

New 23m 225Ø VC pipe

Existing 225Ø sewer removed c.25m

Existing manhole removed

12000 PCC manhole c. 1.5m deep

Existing sewer removed c.14m

New 10m 150Ø VC pipe

12000 PCC manhole c. 1.5m deep

Existing manhole removed

Existing sewer removed c.8m

Existing manhole removed

Existing sewer removed c.12.5m

Existing manholes retained

New 30m 150Ø VC pipe

New 5m 150Ø VC pipe

12000 PCC manhole c. 1.5m deep

New 9m 150Ø VC pipe

15000 PCC manhole c. 2.0m deep

Invert depths of sewers in this location to be verified. To determine whether a connection is feasible.

New 15000 PCC manhole at proposed foul connection point

Existing 225Ø sewer removed c.4m

Existing sewer removed c.5.5m

Existing manhole removed

Existing sewer removed c.38m

Existing manhole removed

Existing 225Ø sewer removed c.63m

New 62m 225Ø VC pipe

New 100m 225Ø VC pipe

Existing 225Ø sewer removed c.120m

Existing (buried?) manhole removed

Existing sewer removed c.16m

Existing sewer removed c.52m

Existing (buried?) manhole removed

15000 PCC manhole c. 2.0m deep

New 20m 225

15000 PC c. 1.6m de

150Ø VC

225Ø VC

44 49 51 106 40 39 38 37 36 35 34 33 32 31 30 06

No Access

WAS

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

DRAINAGE KEY - SEWER DIVERSIONS & ABANDONMENTS

- PROPOSED DIVERSION OF EXISTING COMBINED SEWER
- PROPOSED ABANDONMENT OF EXISTING COMBINED SEWER
- PROPOSED DIVERSION OF EXISTING SURFACE WATER SEWER
- PROPOSED ABANDONMENT OF EXISTING SURFACE WATER SEWER

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd
Project:	Windermere Rd & Fell View Ave
Drawing Title:	Proposed Sewer Diversions & Abandonment Plan 1 of 4

Scale @ A1: 1:200	First Issue: 02/08/22	Office of Origin: Kendal
Drawn by: CA	Checked by: TM	Approved: TM
Project No: K39225	Drawing No: 109	Rev:
	BIM No:	

516100

WINDERMERE ROAD

Windermere Road

Windermere Road

1500Ø PCC manhole c. 1.6m deep

1500Ø PCC manhole c. 1.6m deep

1500Ø PCC manhole c. 1.6m deep

New 67m 225Ø VC pipe

225Ø VC

Existing 225Ø sewer removed c.120m

New 20m 225Ø VC pipe

Existing manhole removed

Existing 225Ø sewer removed c.3m

Existing 225Ø sewer removed c.67m

Invert depths of manhole in this location to be verified. To determine whether a SW connection is feasible.

Invert depths of sewer in this location to be verified. To determine whether a connection is feasible.

225Ø VC

New 1500Ø PCC manhole at proposed foul connection point

Existing (buried?) manhole removed

Existing sewer removed c.16m

150Ø VC

150Ø VC

Existing (buried?) manhole removed

Existing sewer removed c.52m

Existing manhole retained

Existing sewer removed c.30m

Existing manhole and all incoming pipes removed

Existing sewer removed c.5m

Existing (buried?) manhole removed

No Access

225Ø VC

225Ø VC

225Ø VC

1500Ø PCC manhole c. 2.0m deep

Existing manhole retained

Grid North

58

65

72

53

75

73

297200

51a

90

33

32

31

30

29

28

27

26

25

24

23

20

6

4a

4

2a

2

22

WAS

EAVES

RIDGE

HEAD

CILL

FH

MH

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

DRAINAGE KEY - SEWER DIVERSIONS & ABANDONMENTS

- PROPOSED DIVERSION OF EXISTING COMBINED SEWER
- PROPOSED ABANDONMENT OF EXISTING COMBINED SEWER
- PROPOSED DIVERSION OF EXISTING SURFACE WATER SEWER
- PROPOSED ABANDONMENT OF EXISTING SURFACE WATER SEWER

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS
Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd		
Project:	Windermere Rd & Fell View Ave		
Drawing Title:	Proposed Sewer Diversions & Abandonment Plan 2 of 4		

Scale @ A1: 1:200	First Issue: 02/08/22	Office of Origin: Kendal	
Drawn by: CA	Checked by: TM	Approved: TM	
Project No: K39225	Drawing No: 110	Rev:	
BIM No:			

FELL VIEW AVENUE

FELL VIEW AVENUE

FELL VIEW AVENUE

Path (um)

225Ø VC

150Ø VC

100Ø VC

225Ø VC ON UU

Existing sewer removed c.53m

Existing manhole removed

Existing sewer removed c.9m

Existing sewer removed c.33m

New 100m 225Ø VC pipe

Existing manhole removed

Existing sewer removed c.22m

Existing 225Ø sewer removed c.155m

15000Ø PCC manhole c. 2.0m deep

Existing manhole removed

Existing sewer removed c.4.5m

Existing sewer removed c.6.5m

Existing manhole removed

Existing manhole removed

Existing sewer removed c.18.5m

New 43m 225Ø VC pipe

Existing sewer removed c.15m

Existing manhole removed

Existing manhole removed

12000Ø PCC manhole c. 1.5m deep

15000Ø PCC manhole c. 2.0m deep

Existing 225Ø sewer removed c.19m

New 9m 150Ø VC pipe

New 30m 225Ø VC pipe

15000Ø PCC manhole c. 2.0m deep

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

DRAINAGE KEY - SEWER DIVERSIONS & ABANDONMENTS

- PROPOSED DIVERSION OF EXISTING COMBINED SEWER
- PROPOSED ABANDONMENT OF EXISTING COMBINED SEWER
- PROPOSED DIVERSION OF EXISTING SURFACE WATER SEWER
- PROPOSED ABANDONMENT OF EXISTING SURFACE WATER SEWER

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS

Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd
Project:	Windermere Rd & Fell View Ave
Drawing Title:	Proposed Sewer Diversions & Abandonment Plan 3 of 4

Scale @ A1: 1:200	First Issue: 02/08/22	Office of Origin: Kendal
Drawn by: CA	Checked by: TM	Approved: TM
Project No: K39225	Drawing No: 111	Rev:
BIM No:		

297100

UU MH 0424
CL ~92.09
IL ~90.89

UU MH 0402
CL ~
IL ~

Existing sewer removed c.5.0m

Existing manhole removed

Existing manhole removed

Existing sewer removed c.32.5m

15000 PCC manhole c. 2.0m deep

15000 PCC manhole c. 2.0m deep

Existing sewer removed c.13m

Existing sewer removed c.18.2m

Existing manhole removed

New 15.5m 225Ø VC pipe

New 3m 150Ø VC pipe

15000 PCC manhole c. 2.0m deep

New 29m 225Ø VC pipe

New 15.5m 225Ø VC pipe

Invert depths of pipes in these locations to be verified. To determine whether connections/crossovers are feasible.

Existing 225Ø sewer removed c.62.5m

15000 PCC manhole c. 2.0m deep

New 15000 PCC manhole at proposed foul connection point

225Ø VC

Existing 225Ø sewer removed c.65m

15000 PCC manhole c. 2.0m deep

New 35m 225Ø VC pipe

New 8.5m 225Ø VC pipe

New 35m 225Ø VC pipe

Existing sewer removed c.3m

225Ø VC

Existing manhole removed

15000 PCC manhole c. 2.0m deep

New 3.5m 225Ø VC pipe

15000 PCC manhole c. 2.0m deep

Invert depths of pipes in these locations to be verified. To determine whether connections/crossovers are feasible.

225Ø VC

Existing sewer removed c.53m

Existing manhole removed

New 100m 225Ø VC pipe

150Ø VC

Existing sewer removed c.9m

Grid North

EXISTING DRAINAGE KEY

- EXISTING SURFACE WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING SURFACE WATER SEWER (BASED ON UU RECORDS)
- EXISTING COMBINED WATER SEWER (SURVEYED BY DRAIN DOCTOR)
- EXISTING COMBINED WATER SEWER (BASED ON UU RECORDS)

DRAINAGE KEY - SEWER DIVERSIONS & ABANDONMENTS

- PROPOSED DIVERSION OF EXISTING COMBINED SEWER
- PROPOSED ABANDONMENT OF EXISTING COMBINED SEWER
- PROPOSED DIVERSION OF EXISTING SURFACE WATER SEWER
- PROPOSED ABANDONMENT OF EXISTING SURFACE WATER SEWER

Rev	Description	Date	Revised by	Checked by	Approved

Issue Purpose: PLANNING

Do not scale from this drawing

R G PARKINS
Kendal | 01539 729393 Lancaster | 01524 32548

Client:	Thomas Armstrong Ltd	Scale @ A1: 1:200	First Issue: 02/08/22	Office of Origin: Kendal	
Project:	Windermere Rd & Fell View Ave	Drawn by: CA	Checked by: TM	Approved: TM	
Drawing Title:	Proposed Sewer Diversions & Abandonment Plan 4 of 4	Project No: K39225	Drawing No: 112	Rev:	
		BIM No:			

APPENDIX B

UNITED UTILITIES INFORMATION

UU DETAILED SEWER RECORDS & CORRESPONDENCE

United Utilities

Water for the North West

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

RG Parkins & Partners Ltd

RG Parkins & Partners Ltd
RG Parkins & Partners Ltd, Meadowside, Shap Road
Kendal, Cumbria
LA9 6NY

FAO:

Your Ref: K39225 - Windermere Road & Fell View Avenue, Whitehaven
Our Ref: UUPS-ORD-402511
Date: 14/06/2022

Dear Sirs

Location: Windermere Road & Fell View Avenue Woodhouse Whitehaven

I acknowledge with thanks your request dated 09/06/2022 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. http://www.unitedutilities.com/work-near-asset.aspx .

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please contact us .

Yours Faithfully,

Karen McCormack
Property Searches Manager

United Utilities Water Limited
Registered In England & Wales No. 2366678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

United Utilities Water Limited
Registered In England & Wales No. 2366678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
0408		CO	0	150			VC	13.45362	
9532		FO		100			VC	8.994693	
0209		CO	0	150			VC	4.472136	
0101		CO	0	100			VC	11.40175	
1221		CO		100			VC	37.04213	
1012		CO	0	100			VC	25	
1012		CO	0	100			VC	25	
9535		FO		150			VC	9.26631	
1204		CO	0	150			VC	5	
0933		CO	0	100			VC	10.04988	
0933		CO	0	100			VC	10.04988	
0510		CO		100			PVC	15.43705	
9536		FO		100			VC	8.624202	
1238		SW	0	150			VC	65.55151	
0403		FO	0	150			VC	22.82542	
0326		CO		150			VC	2.269574	
9534		FO		100			VC	4.995634	
9308		SW	0	150			VC	13.23668	
0207		CO	0	150			VC	5.385165	
0507		CO		100			VC	15.87326	
0504		SW		0			VC	7.256277	
9211		SW	0	150			VC	20.09975	
2104	93.85	CO		225			VC	6.676724	
0936		CO	0	100			VC	2.828427	
0936		CO	0	100			VC	2.828427	
1203		CO	0	150			VC	11.18034	
0934		CO	0	100			VC	21.02381	
0934		CO	0	100			VC	21.02381	
1206		CO	0	150			VC	5.385165	
0337	94.41	CO	93.09	225			VC	38.91015	1 in 14
9307		CO	0	100			VC	11.40175	
3101	88.6	CO	86.17	150			VC	33	1 in 19
3104	80.37	SW	78.23	150			VC	34.66987	1 in 8
1007		CO	0	100			VC	5	
1007		CO	0	100			VC	5	
1249		CO	0	150			VC	8.544003	
1919		CO	0	100			VC	16.03122	
1919		CO	0	100			VC	16.03122	
0935		CO	0	100			VC	9.219544	
0935		CO	0	100			VC	9.219544	
0333		CO	0	150			VC	15.13275	
0506		CO		100			VC	16.54161	
9537		FO		100			VC	5.197922	
0409		CO	0	150			VC	10	
0208		CO	0	150			VC	4.123106	
9533		FO		100			VC	10.62114	
3105	86.27	SW	84.78	150			VC	58.18075	1 in 9
0327		CO	0	150			VC	22.2036	
1101		CO	0	100			VC	18.02776	
0204		CO	0	150			VC	12.64911	
0221		CO	0	100			VC	9.486833	
0511		CO		100			PVC	9.251398	
0210		CO	0	150			VC	17.08801	
1313		CO	0	150			VC	10.77033	
0206		CO	0	150			VC	8.246211	
0318		CO	0	150			VC	10.44031	
9032		CO		100			VC	11.32496	
0303		CO	0	150			VC	19.84943	
9308		SW	0	150			VC	34.66925	
0502		FO	0	150			VC	26.40076	
0205		CO	0	150			VC	7.615773	
3102	86.3	CO	84.42	150			VC	57.27129	1 in 10
1301	91.57	CO	90.27	225			VC	76.37391	1 in 100
3103	80.4	CO	78.37	150			VC	72.56032	1 in 8
0404		SW	0	150			VC	48	1 in 38.7096771
0028		CO	0	100			VC	8.944272	
0902	96.91	SW	0	100			VC	15.0333	
0902	96.91	SW	0	100			VC	15.0333	
2902		CO		150			VC	17.70131	
2902		CO		150			VC	17.70131	
1022		CO	0	150			VC	34.10061	
1022		CO	0	150			VC	34.10061	
0402		SW	0	225			VC	153.0663	
2105	94.44	CO	93.09	100			VC	5	
5905	68.99	CO	68.25	150			VC	9.055386	
5905	68.99	CO	68.25	150			VC	9.055386	
1107	101.23	CO	99.81	100			VC	23.02173	1 in 56
0218	99.51	CO	98.3	150			VC	7.28011	
0407	95.12	CO	93.91	100			VC	17.11724	
4914	75.01	CO	74.24	100			VC	17.02939	1 in 29
9109	100.47	CO	98.8	150			VC	6	1 in 86
9922	96.05	CO	0	100			VC	6.38187	
9922	96.05	CO	0	100			VC	6.38187	
4102	70.64	SW	69.19	225			VC	148.3846	1 in 9
1110	100.12	CO	99.51	100			VC	6.708204	1 in 20
4918	73.76	CO	72.53	150			VC	6	1 in 43
4918	73.76	CO	72.53	150			VC	6	1 in 43
1002		CO	0	100			VC	8.602325	
1002		CO	0	100			VC	8.602325	
0912		CO	0	150			VC	8.704571	
0912		CO	0	150			VC	8.704571	
1014	101.18	CO	100.45	100			VC	11.18034	1 in 32
1014	101.18	CO	100.45	100			VC	11.18034	1 in 32
5907	69.8	CO	68.83	150			VC	5.09902	
5907	69.8	CO	68.83	150			VC	5.09902	
2110		CO		150			VC	5.161152	
2009	97.23	CO	96.38	100			VC	21.0238	
2009	97.23	CO	96.38	100			VC	21.0238	
9408	89.98	CO	89.15	100			VC	14.28011	
1202	97.54	CO	96.96	100			VC	6.082763	
0103	100.71	CO	99.67	150			VC	17.18034	
0505		CO		100			VC	10.72434	
0220	100.18	CO	0	100			VC	5.385165	
0412		CO	0	150			VC	4	
4012	71.26	CO	69.83	150			VC	5	1 in 29
4012	71.26	CO	69.83	150			VC	5	1 in 29
4013	71.61	CO	70.15	150			VC	8	1 in 29
4013	71.61	CO	70.15	150			VC	8	1 in 29
0002	98.65	CO	97.55	100			VC	4.123106	
0002	98.65	CO	97.55	100			VC	4.123106	
0202		CO	0	100			VC	21.84033	
1904	100.91	CO	100.09	100			VC	11.04536	1 in 48
1904	100.91	CO	100.09	100			VC	11.04536	1 in 48
1216		SW	0	225			VC	32.31099	
5911	70.69	CO	69.79	150			VC	3	1 in 50
5911	70.69	CO	69.79	150			VC	3	1 in 50
0424	92.09	SW	90.89	150			VC	19.79899	
9350	97.07	CO	96.13	100			VC	4.472136	1 in 4.71048657
5017	67.2	CO	66.76	100			VC	4	1 in 8
5017	67.2	CO	66.76	100			VC	4	1 in 8
9023	97.73	CO	96.44	150			VC	8.944272	1 in 41
9023	97.73	CO	96.44	150			VC	8.944272	1 in 41
0201		SW	0	150			VC	95.07891	
5948	70.81	CO	70.18	100			VC	9.055386	1 in 43
5948	70.81	CO	70.18	100			VC	9.055386	1 in 43
1927	99.44	CO	98.32	150			VC	19.53671	
1927	99.44	CO	98.32	150			VC	19.53671	
4913	74.01	CO	72.84	100			VC	5	1 in 36
4913	74.01	CO	72.84	100			VC	5	1 in 36
4920	74.69	CO	73.63	100			VC	10.04988	1 in 33
4920	74.69	CO	73.63	100			VC	10.04988	1 in 33
1319	92.5	CO	91.05	100			VC	10.44031	
1108	101.13	CO	99.89	100			VC	4.472136	1 in 64
2117		CO		100			VC	9.959115	
1006		CO	0	100			VC	6.324555	
1006		CO	0	100			VC	6.324555	
0025	100.52	CO	99.57	100			VC	4.472136	
0025	100.52	CO	99.57	100			VC	4.472136	
0329	96.05	SW	0	150			VC	51.89412	
4009	70.54	CO	69.26	150			VC	5.09902	1 in 24
4009	70.54	CO	69.26	150			VC	5.09902	1 in 24
9423	95.31	SW	94.04	225			VC	54.74486	1 in 0.59087817
0426		CO	0	100			VC	11.04536	
0931	99.61	CO	98.75	100			VC	13.60147	
0931	99.61	CO	98.75	100			VC	13.60147	
5015	66.33	CO	65.58	150			VC	9	1 in 9
5015	66.33	CO	65.58	150			VC	9	1 in 9
0339		CO		150			VC	8.480206	
9108	100.34	CO	98.73	150			VC	1	1 in 50
4106	72.31	CO	71.44	150			VC	14.21267	
0021	100.68	CO	99.09	150			VC	28	1 in 27
0021	100.68	CO	99.09	150			VC	28	1 in 27
0419	90.82	CO		100			VC	15.85093	
1201	92.64	CO	91.73	225			VC	154.1028	1 in 106
5910	70.6	CO	69.5	150			VC	8.246211	
5910	70.6	CO	69.5	150			VC	8.246211	
0311		CO	0	100			VC	6.708204	
0203		CO	0	100			VC	8.544003	
4001	75.73	CO	74.92	150			VC	39.05125	1 in 21
4001	75.73	CO	74.92	150			VC	39.05125	1 in 21
5019	67.94	CO	67.14	150			VC	9	1 in 21
5019	67.94	CO	67.14	150			VC	9	1 in 21
5908		CO	0	150			VC	10	
5908		CO	0	150			VC	10	
9026	99.12	CO	97.9	150			VC	11.7047	1 in 65
9026	99.12	CO	97.9	150			VC	11.7047	1 in 65
4902		CO	0	150			VC	44	
4902		CO	0	150			VC	44	
4014	74.02	CO	73.04	150			VC	38.0526	1 in 47
9443		CO		100			VC	10.01671	
0920		CO		100			VC	4.685552	
0920		CO		100			VC	4.685552	
0914	97.63	CO	96.83	150			VC	4.123106	
0914	97.63	CO	96.83	150			VC	4.123106	
0910		CO	0	150			VC	38.94868	
0910		CO	0	150			VC	38.94868	
4905	78.21	CO	77.51	100			VC	9	1 in 25
4905	78.21	CO	77.51	100			VC	9	1 in 25
5018	67.22	CO	66.7	150			VC	5	
5018	67.22	CO	66.7	150			VC	5	
0222	98.29	CO	97.93	100			VC	6.403124	
2002	97.33	CO		100			VC	13.15295	
0312		CO	0	100			VC	9.219544	
1217	94.37	SW	93.42	225			VC	25.63201	
9107	100.58	CO	99.01	150			VC	13.15295	1 in 82
4007	69.77	CO	68.69	150			VC	8.246211	
4007	69.77	CO	68.69	150			VC	8.246211	
0027	100.44	CO	99.85	100			VC	7.211102	1 in 72
1224	93.72	CO	92.68	100			VC	14.31782	
5020	68.22	CO	67.56	150			VC	13.0384	1 in 33
5020	68.22	CO	67.56	150			VC	13.0384	1 in 33
0117		CO	0	100			VC	30.8707	
5016	66.3	CO	65.76	150			VC	9	1 in 60
5016	66.3	CO	65.76	150			VC	9	1 in 60
0317		SW	0	150			VC	41.76123	
0940	99.38	CO	98.48	150			VC	19.36066	1 in 22
0940	99.38	CO	98.48	150			VC	19.36066	1 in 22
0909		CO	0	100			VC	4.74843	
0909		CO	0	100			VC	4.74843	
2004	97.77	CO	97.17	100			VC	15.65248	
2004	97.77	CO	97.17	100			VC	15.65248	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
1239	97.12	CO	95.58	150			VC	6	
1907	96.92	SW	95.62	225			VC	93.24998	
1907	96.92	SW	95.62	225			VC	93.24998	
9414	93.5	CO	92.5	100			VC	12.64911	
1011	101.58	CO	99.69	225			VC	25.01999	1 in 17
4011	70.97	CO	69.61	150			VC	5.09902	1 in 30
4011	70.97	CO	69.61	150			VC	5.09902	1 in 30
0901	97.52	CO	96.56	100			VC	7.81025	1 in 34
0901	97.52	CO	96.56	100			VC	7.81025	1 in 34
0219	99.88	CO	98.69	100			VC	10.44031	1 in 58
0418	91.47	CO	90.4	100			VC	22.13594	1 in 37
1103		CO	0	150			VC	19.0263	
9206		CO	0	100			VC	23.34524	
1918	100.66	CO	99.83	100			VC	4	
1918	100.66	CO	99.83	100			VC	4	
0019		CO	0	150			VC	29.01724	
0019		CO	0	150			VC	29.01724	
0421		CO	0	150			VC	11.18034	
9212	98.21	CO	96.81	100			VC	27.89265	
9021		CO	0	225			VC	43.95435	
9021		CO	0	225			VC	43.95435	
1315		CO	0	150			VC	9.848858	
1225	92.96	CO	0	100			VC	12.36932	
4919	74.54	CO	73.33	100			VC	14	1 in 32
4919	74.54	CO	73.33	100			VC	14	1 in 32
9305		CO	0	100			VC	6	
0422	91.54	CO	0	100			VC	9.433981	
0427		CO	0	100			VC	9.219544	
1205	96.94	CO	96.51	100			VC	5.830952	
5013	65.92	CO	64.34	150			VC	2	
2103	95.14	CO	92.87	225			VC	31.14657	1 in 56
1218	93.96	CO	93.44	100			VC	6.708204	
4911	73.39	CO	72.18	150			VC	4	1 in 31
4911	73.39	CO	72.18	150			VC	4	1 in 31
1938	98.71	CO	98.1	100			VC	6.708204	
1938	98.71	CO	98.1	100			VC	6.708204	
2901	96.44	CO	95.18	100			VC	2.236068	
2901	96.44	CO	95.18	100			VC	2.236068	
0328	95.8	CO	95.26	100			VC	15.25221	
4904	77.86	CO	77.11	100			VC	5	
4904	77.86	CO	77.11	100			VC	5	
5949	70.59	CO	69.71	150			VC	9.055386	1 in 70
5949	70.59	CO	69.71	150			VC	9.055386	1 in 70
1213	97.6	CO	96.6	100			VC	8.246211	
1244	99.77	CO	98.65	100			VC	10.44031	
9903	96.2	SW	94.65	225			VC	54.56189	
9903	96.2	SW	94.65	225			VC	54.56189	
0338	94.43	CO	93.23	150			VC	1.973066	
5012		CO	0	150			VC	18.60108	
4008	70.28	CO	69	150			VC	9	1 in 33
4008	70.28	CO	69	150			VC	9	1 in 33
9309		CO	0	100			VC	20.12461	
0014	99.66	CO	98.7	100			VC	6.403124	
0014	99.66	CO	98.7	100			VC	6.403124	
5913	70.88	CO	70.28	100			VC	3.162278	1 in 40
1026	97.99	SW	0	225			VC	104.1729	
1106	100.9	CO	99.37	150			VC	16.12452	
1317	93.71	SW	92.33	225			VC	45.69464	
0503		FO	0	150			VC	39.66106	
4901	72.45	CO	71.49	150			VC	33.01515	1 in 25
4901	72.45	CO	71.49	150			VC	33.01515	1 in 25
0938	98.45	CO	97.55	150			VC	8	1 in 30
0938	98.45	CO	97.55	150			VC	8	1 in 30
0313	97.79	CO	97.3	100			VC	7.81025	
1934	97.51	CO	96.2	150			VC	14.60968	
0310	97.68	CO	96.8	100			VC	7.81025	1 in 60
0904	97.07	SW	95.44	225			VC	92.9017	
0010	100.23	SW	98.22	225			VC	18.35756	1 in 31
0010	100.23	SW	98.22	225			VC	18.35756	1 in 31
4917	73.02	CO	72.02	150			VC	5	1 in 33
4917	73.02	CO	72.02	150			VC	5	1 in 33
1312		SW	0	225			VC	20.12461	
0215	98.88	CO	97.82	150			VC	8.544003	1 in 61
4910	72.88	CO	71.82	150			VC	9	1 in 30
4910	72.88	CO	71.82	150			VC	9	1 in 30
0420	91.74	CO	90.84	100			VC	34.48188	
0315	98.01	CO	96.77	150			VC	6.324555	
1925	99.65	CO	98.49	100			VC	5.830952	
1925	99.65	CO	98.49	100			VC	5.830952	
0118	100.8	CO	100.14	100			VC	15.6205	
0217		CO	0	150			VC	10.29563	
9407	90.23	CO	88.99	100			VC	16.49242	1 in 92
1316		CO	0	150			VC	24.62568	
0022	100.42	CO	100.02	100			VC	2.828427	
0022	100.42	CO	100.02	100			VC	2.828427	
0012	99.41	SW	97.58	225			VC	47.94831	
0012	99.41	SW	97.58	225			VC	47.94831	
4912	73.55	CO	72.34	150			VC	4	1 in 31
4912	73.55	CO	72.34	150			VC	4	1 in 31
2001	96.54	CO	93.86	225			VC	88.20431	1 in 90
0307	98.34	CO	97.37	100			VC	10.19804	1 in 11
1001	100.76	CO	99.82	100			VC	35	1 in 40
1001	100.76	CO	99.82	100			VC	35	1 in 40
0417	91.57	CO	90.82	100			VC	12.08305	1 in 35
0005		CO	0	100			VC	20.80865	
0005		CO	0	100			VC	20.80865	
0401	90.75	CO	89.5	225			VC	150.5482	1 in 114
0332	95.91	SW	95.22	150			VC	24.59675	
0301	99.02	SW	97.95	150			VC	18.43909	
9437		CO		100			VC	11.13753	
9022	97.63	CO	96.21	150			VC	4.472136	
9022	97.63	CO	96.21	150			VC	4.472136	
0023	100.52	CO	99.4	100			VC	4.123106	
0023	100.52	CO	99.4	100			VC	4.123106	
9018	97.22	SW	0	225			VC	15.23155	
9018	97.22	SW	0	225			VC	15.23155	
0018	101.55	CO	100.4	100			VC	5.385165	
0018	101.55	CO	100.4	100			VC	5.385165	
0321	97.01	CO	95.68	150			VC	18.05997	
0026	100.4	CO	99.73	100			VC	10	1 in 71
9310	97.13	CO	95.93	100			VC	14.4222	1 in 0.15227753
1234	99.26	CO	97.8	150			VC	15.81139	
9451	92.91	CO	91.6	150			VC	8.547535	1 in 66
1920	100.16	CO	99.01	150			VC	5	1 in 56
1920	100.16	CO	99.01	150			VC	5	1 in 56
0106	100.96	CO	100.46	100			VC	4.123106	
4101	70.63	CO	68.82	225			VC	135.3864	1 in 9
4010	70.78	CO	69.4	150			VC	4.123106	1 in 41
4010	70.78	CO	69.4	150			VC	4.123106	1 in 41
9130	100.29	CO	98.71	150			VC	28.3196	1 in 20
4107	67.94	CO	66.37	150			VC	13.45362	
1236	99.49	CO	98.98	100			VC	7.28011	
0501		FO	0	150			CO	56.36581	
1228	93.37	CO	92.94	100			VC	8.602325	
1905		CO	0	150			VC	10.04988	
1905		CO	0	150			VC	10.04988	
0105	100.88	CO	100.01	100			VC	4.472136	
0017	101.49	CO	100.6	100			VC	7.071068	1 in 42
0017	101.49	CO	100.6	100			VC	7.071068	1 in 42
2113		CO	0	150			VC	44.04543	
0102	100.82	CO	99.6	100			VC	5.759168	
0216	99.15	CO	97.99	150			VC	9.486833	1 in 63
2107	95.81	CO	94.79	100			VC	3	
0112		CO		100			VC	15.43769	
1117	96.27	SW	0	225			VC	72.03471	
9205	98.56	CO	0	100			VC	6.082763	
9416		CO	0	100			VC	11.18034	1 in 13.1533406
1901	99.77	CO	98.92	100			VC	6	1 in 35
1901	99.77	CO	98.92	100			VC	6	1 in 35
4903		CO	0	100			VC	31.06445	
4903		CO	0	100			VC	31.06445	
5912	70.79	CO	69.97	100			VC	3	1 in 43
5912	70.79	CO	69.97	100			VC	3	1 in 43
1104		CO	0	150			VC	2	
1305	91.56	CO	90.42	100			VC	3.605551	
9904	96.64	SW	0	225			VC	12.16553	
9904	96.64	SW	0	225			VC	12.16553	
1222	94.29	CO	93.38	100			VC	6	
0309	97.74	CO	96.63	100			VC	11.6619	1 in 51
0335	94.18	CO	93.24	100			VC	14.21267	
0107		CO	0	100			VC	6.082763	
1013		CO	0	100			VC	4.123106	
1013		CO	0	100			VC	4.123106	
0411	93.6	CO	91.98	150			VC	13	
9918	96.36	CO	0	100			VC	2.236068	
9918	96.36	CO	0	100			VC	2.236068	
0425	95.23	CO	94.11	100			VC	8.246211	
0906	95.87	CO	94.71	150			VC	38.58874	
0336	94.36	CO	93.79	100			VC	28.01785	1 in 53
2102	90.62	SW	89.41	150			VC	70	1 in 15
0003		CO	0	150			VC	6.708204	
0003		CO	0	150			VC	6.708204	
1029	100.36	CO	99.59	100			VC	17.11724	
1029	100.36	CO	99.59	100			VC	17.11724	
5014	65.4	CO	64.55	150			VC	9.848858	
0322	95.71	CO	94.13	150			VC	5	
0932	99.62	CO	98.73	100			VC	5.385165	
0932	99.62	CO	98.73	100			VC	5.385165	
1209	96.05	SW	95.21	150			VC	21.93171	
1936	99.44	CO	98.56	150			VC	5	1 in 83
1936	99.44	CO	98.56	150			VC	5	1 in 83
9450	92.7	CO	91.45	150			VC	8.544003	
9921	96.22	CO	95.58	100			VC	17.26284	
9921	96.22	CO	95.58	100			VC	17.26284	
2906		CO		225			VC	94.09643	
2906		CO		225			VC	94.09643	
1114	100.47	CO	99.41	150			VC	37	
1306		CO	0	100			VC	10.29563	
1025	99.61	SW	97.68	225			VC	16.12452	
0911	97.46	CO	96.03	150			VC	6.403124	
0911	97.46	CO	96.03	150			VC	6.403124	
4105	73.25	CO	72.17	150			VC	9.899495	1 in 15
0908	97.46	CO	96.32	100			VC	8.944272	
0908	97.46	CO	96.32	100			VC	8.944272	
2116		CO		100			VC	15.84752	
1112		CO	0	100			VC	6.708204	
1211	98.18	CO	97.24	100			VC	21.84033	
0015		CO	0	100			VC	22.56103	
0015		CO	0	100			VC	22.56103	
9919	96.28	CO	95.67	100			VC	13.89244	
9919	96.28	CO	95.67	100			VC	13.89244	
1005	101.39	SW	100.54	100			VC	36.01389	1 in 33
1005	101.39	SW	100.54	100			VC	36.01389	1 in 33
4005	69.06	CO	68.02	150			VC	24.02082	1 in 15
4921	76.76	CO	75.81	150			VC	9.055386	
4921	76.76	CO	75.81	150			VC	9.055386	
4006		CO	0	150			VC	5.09902	
0334		CO	0	100			VC	13.0384	
0410		CO	0	150			VC	31.38471	
0024	100.59	CO	99.55	100			VC	9.899495	1 in 71

LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

All point assets follow the standard colour convention:
red - combined blue - surface water
brown - foul purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

- FO Foul
- SW Surface Water
- CO Combined
- OV Overflow

SEWER SHAPE

- CI Circular
- TR Trapezoidal
- EG Egg
- AR Arch
- OV Oval
- BA Barrel
- FT Flat Top
- HO HorseShoe
- RE Rectangular
- UN Unspecified
- SQ Square

SEWER MATERIAL

- AC Asbestos Cement
- BR Brick
- PE Polyethylene
- RP Reinforced Plastic Matrix
- CO Concrete
- CSB Concrete Segment Bolted
- CSU Concrete Segment Unbolted
- CC Concrete Box Culverted
- PSC Plastic / Steel Composite
- GRC Glass Reinforced Plastic
- DI Ductile Iron
- PVC Polyvinyl Chloride
- CI Cast Iron
- SI Spun Iron
- ST Steel
- VC Vitrified Clay
- PP Polypropylene
- PF Pitch Fibre
- MAC Masonry, Coursed
- MAR Masonry, Random
- U Unspecified

Address or Site Reference:

Windermere Road & Fell View Avenue Woodhouse Whitehaven,

OS sheet Number: NX9716SW
Scale: 1:1250 **Date:** 14/06/2022
Nodes: 401
Sheet: 1 of 2

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
1240	99.23	CO	0	150			VC	5.830952	
1314		CO	0	150			VC	14.31782	
0016	101	CO	100.24	100			VC	6	
0016	101	CO	100.24	100			VC	6	
0104	100.77	CO	100.19	100			VC	6	
0308	97.73	CO		150			VC	12.05388	
0013	99.01	CO	97.69	150			VC	25.80698	
0013	99.01	CO	97.69	150			VC	25.80698	
0330	96.04	CO	0	225			VC	24.59675	
1008	101.69	SW	100.97	150			VC	24	1 in 15
9020	97.57	CO	96.21	100			VC	3.605551	
9020	97.57	CO	96.21	100			VC	3.605551	
9413	93.18	CO	91.75	150			VC	11.61577	1 in 83
0302		CO	0	150			VC	9.848858	
5906		CO	0	150			VC	9.055386	
5906		CO	0	150			VC	9.055386	
0306	98.6	CO	97.76	100			VC	17	1 in 47
0009	99.82	SW	98.43	150			VC	23.34524	1 in 180
0009	99.82	SW	98.43	150			VC	23.34524	1 in 180
0305	98.71	CO	97.95	100			VC	9.486833	1 in 59
0020		CO	0	150			VC	7.615773	
0020		CO	0	150			VC	7.615773	
1214	97.15	CO	96.73	100			VC	6.324555	
2903	96.13	CO	0	100			VC	5	
2903	96.13	CO	0	100			VC	5	
1247	99.84	CO	99.54	100			VC	29.15476	
1906	98.58	SW	97.19	150			VC	9.219544	1 in 14
1906	98.58	SW	97.19	150			VC	9.219544	1 in 14
0008	99.96	CO	97.9	225			VC	32.7026	
0008	99.96	CO	97.9	225			VC	32.7026	
9019	97.52	CO	96.4	100			VC	8.602325	1 in 45
9019	97.52	CO	96.4	100			VC	8.602325	1 in 45
1403	91.26	CO	89.89	100			VC	16.97056	
1111	99.87	CO	99.12	100			VC	18.97367	1 in 42
0316	98.62	CO	97.57	150			VC	34.88553	1 in 48
9411		CO	0	225			VC	38.38783	
0211		CO	0	150			VC	21.26029	
1242		CO		100			VC	1.760389	
9440		CO	89.77	100			VC	8.190701	
0119	100.77	CO	99.89	100			VC	33.24154	
5021		CO	0	150			VC	4.24264	
5021		CO	0	150			VC	4.24264	
9031	99.31	CO	98.6	100			VC	10.81665	
9417	95.33	CO	94.17	100			VC	28.16026	
0325	95.86	CO	95.41	100			VC	7.28011	1 in 6
1921	99.91	CO	0	150			VC	15.56737	
1921	99.91	CO	0	150			VC	15.56737	
9105	99.92	SW	98.36	225			VC	16.03122	1 in 25
9135		CO		150			VC	18.74739	
0007	100.14	CO	98.89	100			VC	9.219544	
0007	100.14	CO	98.89	100			VC	9.219544	
1241		CO	0	150			VC	5.385165	
1229	93.35	CO	92.74	100			VC	7.28011	
9901		CO	0	225			VC	51.10773	
9901		CO	0	225			VC	51.10773	
1113		SW	0	150			VC	13	
1208	97.37	CO	96.09	150			VC	31.62278	
0214	98.84	CO	97.66	150			VC	5.830952	1 in 117
9415	94.83	CO	93.96	100			VC	21.18962	1 in 15
2101	90.61	CO	89.4	150			VC	38.00002	1 in 18
1024	100.35	CO	98.18	225			VC	38.90247	
9917	96.38	CO	0	100			VC	13.60147	
9917	96.38	CO	0	100			VC	13.60147	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad

LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

All point assets follow the standard colour convention:

red - combined **blue - surface water**

brown - foul **purple - overflow**

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Vaive
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CC	Concrete Box Culverted
PSC	Plastic / Steel Composite
GRC	Glass Reinforecd Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Address or Site Reference:

Windermere Road & Fell View Avenue Woodhouse Whitehaven,

OS sheet Number: NX9716SW

Scale: 1:1250 **Date:** 14/06/2022

Nodes: 63

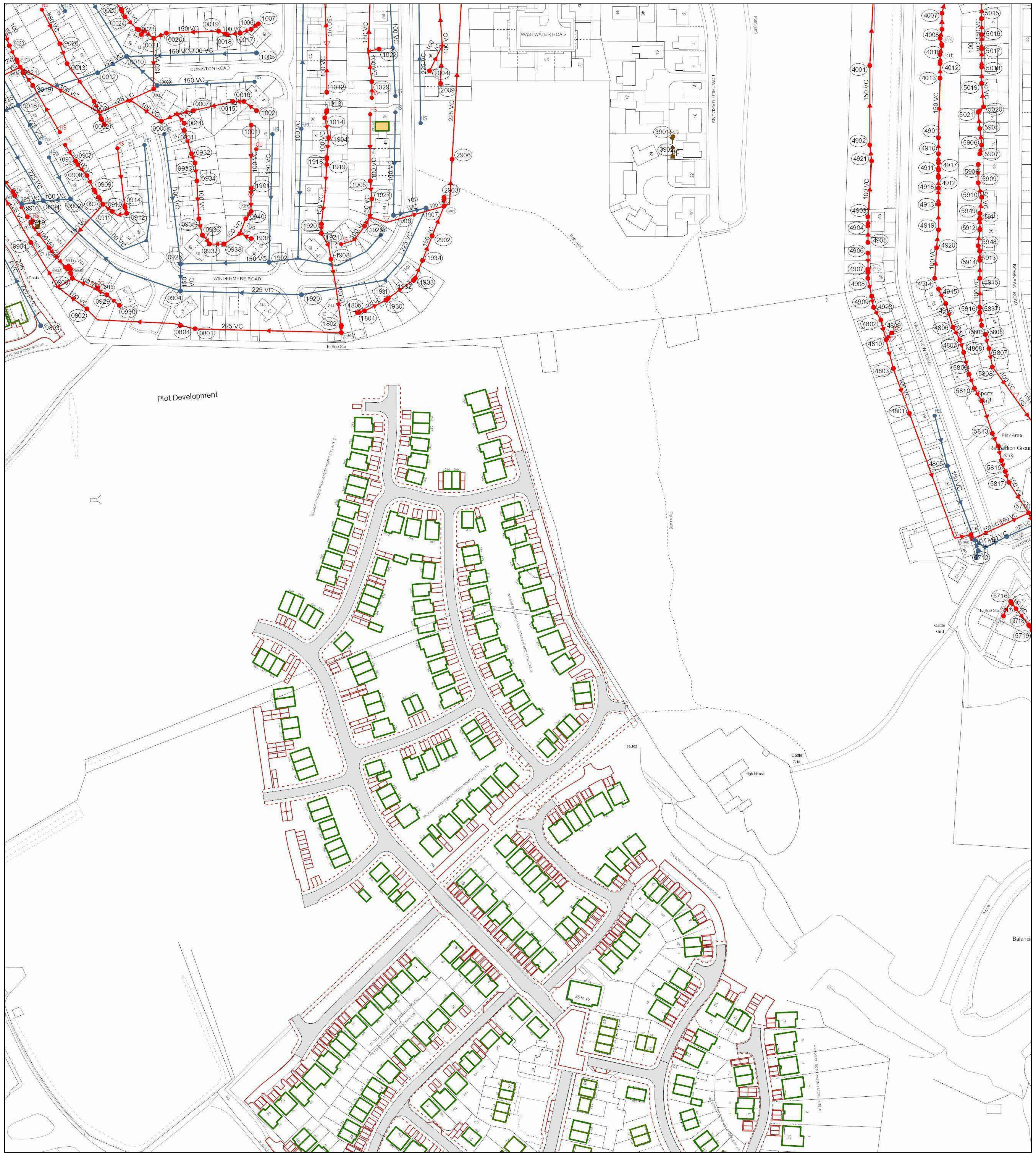
Sheet: 1 of 2

Printed by: Property Searches

SEWER RECORDS

United Utilities

Water for the North West



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
0935		CO	0	100			VC	9.219544	
0935		CO	0	100			VC	9.219544	
1012		CO	0	100			VC	25	
1012		CO	0	100			VC	25	
4802	77.24	CO	76.36	100			VC	11.40175	1 in 60.0092329
0933		CO	0	100			VC	10.04988	
0933		CO	0	100			VC	10.04988	
4803		CO	0	100			VC	73.66112	
0936		CO	0	100			VC	2.828427	
0936		CO	0	100			VC	2.828427	
0934		CO	0	100			VC	21.02381	
0934		CO	0	100			VC	21.02381	
0929	96.07	CO		100			VC	8.944272	
1007		CO	0	100			VC	5	
1007		CO	0	100			VC	5	
0930		CO	0	100			VC	9.219544	
9803	96.26	SW	94.82	225			PVC	57.2152	1 in 155
1908		CO	0	150			VC	14.85556	
1919		CO	0	100			VC	16.03122	
1919		CO	0	100			VC	16.03122	
0010	100.23	SW	98.22	225			VC	18.35756	1 in 31
0010	100.23	SW	98.22	225			VC	18.35756	1 in 31
4917	73.02	CO	72.02	150			VC	5	1 in 33
4917	73.02	CO	72.02	150			VC	5	1 in 33
4910	72.88	CO	71.82	150			VC	9	1 in 30
4910	72.88	CO	71.82	150			VC	9	1 in 30
5716		CO	0	100			VC	5	
1925	99.65	CO	98.49	100			VC	5.830952	
1925	99.65	CO	98.49	100			VC	5.830952	
0902	96.91	SW	0	100			VC	15.0333	
0902	96.91	SW	0	100			VC	15.0333	
4907	78.07	CO	76.95	100			VC	4	1 in 57
4923	77.61	CO	76.52	100			VC	8.062258	1 in 62
2902		CO		150			VC	17.70131	
2902		CO		150			VC	17.70131	
5705	73.32	CO	72.05	150			VC	2.55196	1 in 3.59988718
1022		CO	0	150			VC	34.10061	
1022		CO	0	150			VC	34.10061	
1902		SW	0	150			VC	49.0102	
0022	100.42	CO	100.02	100			VC	2.828427	
0022	100.42	CO	100.02	100			VC	2.828427	
0012	99.41	SW	97.58	225			VC	47.94831	
0012	99.41	SW	97.58	225			VC	47.94831	
5905	68.99	CO	68.25	150			VC	9.055386	
5905	68.99	CO	68.25	150			VC	9.055386	
5817		CO	0	150			VC	20.24846	
5914	71.32	CO	70.38	100			VC	5	1 in 56
4915	74.92	CO	74.11	100			VC	8.944272	1 in 45
4912	73.55	CO	72.34	150			VC	4	1 in 31
4912	73.55	CO	72.34	150			VC	4	1 in 31
4914	75.01	CO	74.24	100			VC	17.02939	1 in 29
1001	100.76	CO	99.82	100			VC	35	1 in 40
1001	100.76	CO	99.82	100			VC	35	1 in 40
9922	96.05	CO	0	100			VC	6.38187	
9922	96.05	CO	0	100			VC	6.38187	
4916	74.69	CO	73.87	100			VC	13.60147	1 in 47
5812		CO	0	150			VC	18.97367	
0005		CO	0	100			VC	20.80865	
0005		CO	0	100			VC	20.80865	
4808		CO	0	150			VC	12.36932	
4918	73.76	CO	72.53	150			VC	6	1 in 43
4918	73.76	CO	72.53	150			VC	6	1 in 43
5719		CO	0	100			VC	12.64911	
1002		CO	0	100			VC	8.602325	
1002		CO	0	100			VC	8.602325	
1933	97.22	CO	96.4	100			VC	10.77033	1 in 67
9022	97.63	CO	96.21	150			VC	4.472136	
9022	97.63	CO	96.21	150			VC	4.472136	
0023	100.52	CO	99.4	100			VC	4.123106	
0023	100.52	CO	99.4	100			VC	4.123106	
0912		CO	0	150			VC	8.704571	
0912		CO	0	150			VC	8.704571	
1014	101.18	CO	100.45	100			VC	11.18034	1 in 32
1014	101.18	CO	100.45	100			VC	11.18034	1 in 32
5806		CO	0	100			VC	8.246211	
9018	97.22	SW	0	225			VC	15.23155	
9018	97.22	SW	0	225			VC	15.23155	
0018	101.55	CO	100.4	100			VC	5.385165	
0018	101.55	CO	100.4	100			VC	5.385165	
4909	77.64	CO	76.63	100			VC	6.082763	1 in 68
0913		CO		100			VC	1.604676	
5907	69.8	CO	68.83	150			VC	5.09902	
5907	69.8	CO	68.83	150			VC	5.09902	
0026	100.4	CO	99.73	100			VC	10	1 in 71
2009	97.23	CO	96.38	100			VC	21.0238	
2009	97.23	CO	96.38	100			VC	21.0238	
1920	100.16	CO	99.01	150			VC	5	1 in 56
1920	100.16	CO	99.01	150			VC	5	1 in 56
5715		CO	0	100			VC	8.944272	
4012	71.26	CO	69.83	150			VC	5	1 in 29
4012	71.26	CO	69.83	150			VC	5	1 in 29
4010	70.78	CO	69.4	150			VC	4.123106	1 in 41
4010	70.78	CO	69.4	150			VC	4.123106	1 in 41
4013	71.61	CO	70.15	150			VC	8	1 in 29
4013	71.61	CO	70.15	150			VC	8	1 in 29
0002	98.65	CO	97.55	100			VC	4.123106	
0002	98.65	CO	97.55	100			VC	4.123106	
1904	100.91	CO	100.09	100			VC	11.04536	1 in 48
1904	100.91	CO	100.09	100			VC	11.04536	1 in 48
5714		SW	0	150			VC	7.211102	
5911	70.69	CO	69.79	150			VC	3	1 in 50
5911	70.69	CO	69.79	150			VC	3	1 in 50
1930		CO	0	100			VC	1.414214	
5017	67.2	CO	66.76	100			VC	4	1 in 8
5017	67.2	CO	66.76	100			VC	4	1 in 8
1905		CO	0	150			VC	10.04988	
1905		CO	0	150			VC	10.04988	
9023	97.73	CO	96.44	150			VC	8.944272	1 in 41
9023	97.73	CO	96.44	150			VC	8.944272	1 in 41
0017	101.49	CO	100.6	100			VC	7.071068	1 in 42
0017	101.49	CO	100.6	100			VC	7.071068	1 in 42
5948	70.81	CO	70.18	100			VC	9.055386	1 in 43
5948	70.81	CO	70.18	100			VC	9.055386	1 in 43
1927	99.44	CO	98.32	150			VC	19.53671	
1927	99.44	CO	98.32	150			VC	19.53671	
5809	73.79	CO	72.79	150			VC	8.544003	1 in 7
4913	74.01	CO	72.84	100			VC	5	1 in 36
4913	74.01	CO	72.84	100			VC	5	1 in 36
4920	74.69	CO	73.63	100			VC	10.04988	1 in 33
4920	74.69	CO	73.63	100			VC	10.04988	1 in 33
5712	72.66	SW	71.17	150			VC	6.324555	
1901	99.77	CO	98.92	100			VC	6	1 in 35
1901	99.77	CO	98.92	100			VC	6	1 in 35
0801	96.96	CO	95.67	225			VC	62.90219	1 in 42
5807		CO	0	100			VC	10.19804	
4903		CO	0	100			VC	31.06445	
4903		CO	0	100			VC	31.06445	
1006		CO	0	100			VC	6.324555	
1006		CO	0	100			VC	6.324555	
5912	70.79	CO	69.97	100			VC	3	1 in 43
5912	70.79	CO	69.97	100			VC	3	1 in 43
0025	100.52	CO	99.57	100			VC	4.472136	
0025	100.52	CO	99.57	100			VC	4.472136	
9904	96.64	SW	0	225			VC	12.16553	
9904	96.64	SW	0	225			VC	12.16553	
4009	70.54	CO	69.26	150			VC	5.09902	1 in 24
4009	70.54	CO	69.26	150			VC	5.09902	1 in 24
1801		CO	0	225			VC	81.02469	
5710	71.37	SW	69.98	225			VC	77.47257	1 in 15
0802	95.66	CO	0	100			VC	20	
1013		CO	0	100			VC	4.123106	
1013		CO	0	100			VC	4.123106	
0931	99.61	CO	98.75	100			VC	13.60147	
0931	99.61	CO	98.75	100			VC	13.60147	
4805	75.1	SW	0	150			VC	43.65776	1 in 18.4209966
5810	72.34	CO	71.61	150			VC	8.062258	
5015	66.33	CO	65.58	150			VC	9	1 in 9
5015	66.33	CO	65.58	150			VC	9	1 in 9
9918	96.36	CO	0	100			VC	2.236068	
9918	96.36	CO	0	100			VC	2.236068	
0906	95.87	CO	94.71	150			VC	38.58874	
4922	78.07	CO	76.99	100			VC	1	1 in 33
0021	100.68	CO	99.09	150			VC	28	1 in 27
0021	100.68	CO	99.09	150			VC	28	1 in 27
5816		CO	0	150			VC	6.324555	
0003		CO	0	150			VC	6.708204	
0003		CO	0	150			VC	6.708204	
5910	70.6	CO	69.5	150			VC	8.246211	
5910	70.6	CO	69.5	150			VC	8.246211	
1029	100.36	CO	99.59	100			VC	17.11724	
1029	100.36	CO	99.59	100			VC	17.11724	
1805		CO	0	100			VC	13.41641	
4001	75.73	CO	74.92	150			VC	39.05125	1 in 21
4001	75.73	CO	74.92	150			VC	39.05125	1 in 21
5019	67.94	CO	67.14	150			VC	9	1 in 21
5019	67.94	CO	67.14	150			VC	9	1 in 21
0945	95.91	CO	95.35	100			VC	2	
0932	99.62	CO	98.73	100			VC	5.385165	
0932	99.62	CO	98.73	100			VC	5.385165	
5908		CO	0	150			VC	10	
5908		CO	0	150			VC	10	
9026	99.12	CO	97.9	150			VC	11.7047	1 in 65
9026	99.12	CO	97.9	150			VC	11.7047	1 in 65
4902		CO	0	150			VC	44	
4902		CO	0	150			VC	44	
0926	97.29	SW	95.99	150			VC	15	1 in 31
1936	99.44	CO	98.56	150			VC	5	1 in 83
1936	99.44	CO	98.56	150			VC	5	1 in 83
1804	98.79	CO	98.1	100			VC	4.123106	
0920		CO		100			VC	4.685552	
0920		CO		100			VC	4.685552	
9921	96.22	CO	95.58	100			VC	17.26284	
9921	96.22	CO	95.58	100			VC	17.26284	
2906		CO		225			VC	94.09643	
2906		CO		225			VC	94.09643	
5706	73.09	CO	71.92	150			VC	17.80934	1 in 0.25200703
4906	78.23	CO	77.53	100			VC	9	1 in 17
4807		CO	0	100			VC	7.28011	
0911	97.46	CO	96.03	150			VC	6.403124	
0911	97.46	CO	96.03	150			VC	6.403124	
4908	78.04	CO	76.85	100			VC	10.19804	1 in 49
0914	97.63	CO	96.83	150			VC	4.123106	
0914	97.63	CO	96.83	150			VC	4.123106	
0910		CO	0	150			VC	38.94868	
0910		CO	0	150			VC	38.94868	
0908	97.46	CO	96.32	100			VC	8.944272	
0908	97.46	CO	96.32	100			VC	8.944272	
4905	78.21	CO	77.51	100			VC	9	1 in 25
4905	78.21	CO	77.51	100			VC	9	1 in 25
5018	67.22	CO	66.7	150			VC	5	
5018	67.22	CO	66.7	150			VC	5	

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
0015		CO	0	100			VC	22.56103	
0015		CO	0	100			VC	22.56103	
9919	96.28	CO	95.67	100			VC	13.89244	
9919	96.28	CO	95.67	100			VC	13.89244	
5808	72.63	CO	71.83	100			VC	22.2036	1 in 27
1005	101.39	SW	100.54	100			VC	36.01389	1 in 33
1005	101.39	SW	100.54	100			VC	36.01389	1 in 33
4921	76.76	CO	75.81	150			VC	9.055386	
4921	76.76	CO	75.81	150			VC	9.055386	
4007	69.77	CO	68.69	150			VC	8.246211	
4007	69.77	CO	68.69	150			VC	8.246211	
1931	98.04	CO	97.08	100			VC	17.20465	1 in 32
0024	100.59	CO	99.55	100			VC	9.899495	1 in 71
0024	100.59	CO	99.55	100			VC	9.899495	1 in 71
0016	101	CO	100.24	100			VC	6	
0016	101	CO	100.24	100			VC	6	
5020	68.22	CO	67.56	150			VC	13.0384	1 in 33
5020	68.22	CO	67.56	150			VC	13.0384	1 in 33
5016	66.3	CO	65.76	150			VC	9	1 in 60
5016	66.3	CO	65.76	150			VC	9	1 in 60
1932	97.57	CO	96.52	100			VC	1.414214	1 in 16
1802	98.92	CO	97.42	100			VC	4	
0940	99.38	CO	98.48	150			VC	19.36066	1 in 22
0940	99.38	CO	98.48	150			VC	19.36066	1 in 22
0909		CO	0	100			VC	4.74843	
0909		CO	0	100			VC	4.74843	
2004	97.77	CO	97.17	100			VC	15.65248	
2004	97.77	CO	97.17	100			VC	15.65248	
0013	99.01	CO	97.69	150			VC	25.80698	
0013	99.01	CO	97.69	150			VC	25.80698	
1907	96.92	SW	95.62	225			VC	93.24998	
1907	96.92	SW	95.62	225			VC	93.24998	
4810	77.1	CO	76.17	100			VC	16.49242	
9020	97.57	CO	96.21	100			VC	3.605551	
9020	97.57	CO	96.21	100			VC	3.605551	
5906		CO	0	150			VC	9.055386	
5906		CO	0	150			VC	9.055386	
4011	70.97	CO	69.61	150			VC	5.09902	1 in 30
4011	70.97	CO	69.61	150			VC	5.09902	1 in 30
0901	97.52	CO	96.56	100			VC	7.81025	1 in 34
0901	97.52	CO	96.56	100			VC	7.81025	1 in 34
0009	99.82	SW	98.43	150			VC	23.34524	1 in 180
0009	99.82	SW	98.43	150			VC	23.34524	1 in 180
0020		CO	0	150			VC	7.615773	
0020		CO	0	150			VC	7.615773	
2903	96.13	CO	0	100			VC	5	
2903	96.13	CO	0	100			VC	5	
1918	100.66	CO	99.83	100			VC	4	
1918	100.66	CO	99.83	100			VC	4	
1906	98.58	SW	97.19	150			VC	9.219544	1 in 14
1906	98.58	SW	97.19	150			VC	9.219544	1 in 14
0019		CO	0	150			VC	29.01724	
0019		CO	0	150			VC	29.01724	
5814		CO	0	150			VC	8.246211	
5718	69.23	CO	67.93	100			VC	3.605551	
0008	99.96	CO	97.9	225			VC	32.7026	
0008	99.96	CO	97.9	225			VC	32.7026	
9019	97.52	CO	96.4	100			VC	8.602325	1 in 45
9019	97.52	CO	96.4	100			VC	8.602325	1 in 45
9021		CO	0	225			VC	43.95435	
9021		CO	0	225			VC	43.95435	
4919	74.54	CO	73.33	100			VC	14	1 in 32
4919	74.54	CO	73.33	100			VC	14	1 in 32
4806	74.63	CO	73.52	100			VC	8.062258	
5813		CO	0	150			VC	7.615773	
5717		CO	0	100			VC	11.40175	
4911	73.39	CO	72.18	150			VC	4	1 in 31
4911	73.39	CO	72.18	150			VC	4	1 in 31
1938	98.71	CO	98.1	100			VC	6.708204	
1938	98.71	CO	98.1	100			VC	6.708204	
2901	96.44	CO	95.18	100			VC	2.236068	
2901	96.44	CO	95.18	100			VC	2.236068	
4904	77.86	CO	77.11	100			VC	5	
4904	77.86	CO	77.11	100			VC	5	
5949	70.59	CO	69.71	150			VC	9.055386	1 in 70
5949	70.59	CO	69.71	150			VC	9.055386	1 in 70
5021		CO	0	150			VC	4.24264	
5021		CO	0	150			VC	4.24264	
9903	96.2	SW	94.65	225			VC	54.56189	
9903	96.2	SW	94.65	225			VC	54.56189	
5915	71.38	CO	70.62	100			VC	10	1 in 48
1921	99.91	CO	0	150			VC	15.56737	
1921	99.91	CO	0	150			VC	15.56737	
5916	72.2	CO	71.27	100			VC	16	1 in 25
4008	70.28	CO	69	150			VC	9	1 in 33
4008	70.28	CO	69	150			VC	9	1 in 33
0007	100.14	CO	98.89	100			VC	9.219544	
0007	100.14	CO	98.89	100			VC	9.219544	
0014	99.66	CO	98.7	100			VC	6.403124	
0014	99.66	CO	98.7	100			VC	6.403124	
5913	70.88	CO	70.28	100			VC	3.162278	1 in 40
1929	98.96	SW	0	225			VC	67.02985	
5815		CO	0	150			VC	6.324555	
9901		CO	0	225			VC	51.10773	
9901		CO	0	225			VC	51.10773	
5837	72.2	CO	0	100			VC	3	
5734	70.88	CO	69.44	150			VC	7.615773	
4901	72.45	CO	71.49	150			VC	33.01515	1 in 25
4901	72.45	CO	71.49	150			VC	33.01515	1 in 25
0938	98.45	CO	97.55	150			VC	8	1 in 30
0938	98.45	CO	97.55	150			VC	8	1 in 30
5805	73.08	CO	71.66	100			VC	7.071068	
1934	97.51	CO	96.2	150			VC	14.60968	
9917	96.38	CO	0	100			VC	13.60147	
9917	96.38	CO	0	100			VC	13.60147	
0904	97.07	SW	95.44	225			VC	92.9017	

LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

All point assets follow the standard colour convention:
red - combined | blue - surface water
brown - foul | purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement
BR	Brick
PE	Polyethylene
RP	Reinforced Plastic Matrix
CO	Concrete
CSB	Concrete Segment Bolted
CSU	Concrete Segment Unbolted
CC	Concrete Box Culverted
PSC	Plastic / Steel Composite
GRC	Glass Reinforced Plastic
DI	Ductile Iron
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Pitch Fibre
MAC	Masonry, Coursed
MAR	Masonry, Random
U	Unspecified

Address or Site Reference:

Windermere Road & Fell View Avenue Woodhouse Whitehaven,

OS sheet Number: NX9715NW
Scale: 1:1250 **Date:** 14/06/2022
Nodes: 307
Sheet: 2 of 2

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West

Troy Melhuish

From: Chris Abram
Sent: 04 August 2022 15:27
To: Troy Melhuish
Subject: FW: Our reference - 02489509 Windermere Road & Fell View Avenue, Woodhouse, Whitehaven, Cumbria, CA28 9LL

Follow Up Flag: Follow up
Flag Status: Flagged

FYI

Chris Abram BEng(Hons) GMICE
Engineer

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From: wastewaterdeveloperservices@uuplc.co.uk <wastewaterdeveloperservices@uuplc.co.uk>
Sent: 04 August 2022 12:20
To: Chris Abram <chris.abram@rgparkins.com>
Subject: RE: Our reference - 02489509 Windermere Road & Fell View Avenue, Woodhouse, Whitehaven, Cumbria, CA28 9LL

Good Morning Chris,

Pre Development Enquiry for: Windermere Road & Fell View Avenue, Whitehaven CA28 9NZ – UU ref 02489509

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 6723 723 or refer to the link below:

https://www.unitedutilities.com/builders-developers/working-near-our-assets/

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Southern site: It is noted the proposed connection point is to two new manholes, upstream of UUMM2901 and UUMH6002. Our only concern would be if these connection points have cover levels that are similar or higher than the proposed private manhole cover levels and FFL'S – if this is the case please connect foul flows to the rear of the plots, which is at a lower level.

Northern site: For the same reasons as above, please can the foul flows be connected to the rear of the plots which is lower.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.
This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**
2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The **North West SuDS Pro-Forma** provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible. It is noted you are awaiting the Ground Investigation report, for information:

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

https://www.gov.uk/government/publications/groundwater-protection-position-statements

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

Our records appear to show a surface water body to the east of the northern site. If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the watercourse, particularly for the Northern site.

We would encourage you to identify and engage with any third party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider connections to the surface water sewers as follows:

Southern site: It is noted the proposed connection point is to a new manhole upstream of UUMH1301. It is unclear what the existing and proposed situation is for the flow direction from this manhole, and our modelling data suggests this manhole is at an increased risk of surcharge than others. Therefore, we would request the southern site is routed to connect further northwards (to the manholes proposed at roughly opposite 68 Windermere Road). **We would require all private cover levels and FFL's to be higher than the cover level of the connection point to the public sewer.** United Utilities would have no objection to the proposed flow rates of 1.8 and 1.1 l/s, although the orifice size required to achieve these flows would be susceptible to blocking – can the two connections be converged into one single connection with a larger orifice size?

Northern Site: Noted the proposed connection point is to the bend on the diversion roughly opposite number 77. This would be acceptable to United Utilities **providing all private cover levels and FFL's are above the cover level of this connection point.** The proposed rate of 2.9 l/s is acceptable to United Utilities, although if the orifice size required to achieve these flows would be susceptible to blocking, we would accept a slightly increased flow rate. This should also be discussed/agreed with the LLFA.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the pubic sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

As identified within the provided drawings, there are a large number of public sewers within the site boundary. Some initial comments on the proposals are as follows (please note a full review would be required once the S185 applications are submitted):

- We would need multiple S185 applications – one for each site should be sufficient
- The normal minimum gradient and cover requirements for adoptable sewers would apply
- We will likely need to have the diversion proposals modelled which can take up to 6 months (following the formal S185 applications) in order to confirm the diversion proposals are acceptable. This is because the diversions appear to be reducing the amount of cover on the public sewers, and also because the northern site appears to be joining two runs into one.
- The S185 applications will need to include evidence (e.g. cross sections) confirming no loading from any structures/retaining walls will be placed onto the public sewers – where retaining walls are close to the sewers, the wall foundation should go below the public sewer.
- The very first combined manholes on the diversion routes for both sites appear to be squeezed between two retaining walls? The easement widths do not appear to be achieved here. Can the layout be amended to ensure easement is achieved between retaining walls – UU must be able to access and carry out maintenance activities on the manholes
- Please provide confirmation/demonstration within the future S185 applications of how UU will access all manholes along the diversion routes and maintain the assets
- Regarding the southern sections of surface water sewers within the southern site – it is unclear what is occurring for both the existing and proposed arrangements (appears to be two opposite directions of flows from the same point?)
- We would need full clarity/evidence of what the existing lines to be abandoned/diverted are serving.

Please refer to the links below to obtain full details of the processes involved with sewer diversions and abandonments:

https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-diversions/
https://www.unitedutilities.com/builders-developers/wastewater-services/close-a-sewer/sewer-closures/

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address: DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Sewer Adoptions

You have indicated on your application form that you intend to put the sewers forward for adoption, however we would not be willing to adopt the proposed assets as these are all within private land.

Many thanks and kind regards,

Tom

Thomas Bethell
Developer Engineer
Developer Services & Metering
Customer Services
M: 07880 339 195
unitedutilities.com

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Good Morning,

We have been asked to undertake some feasibility studies for a foul and surface water drainage strategy for a proposed development at Windermere Road and Fell View Avenue, in the Woodhouse area of Whitehaven, Cumbria.

This pre-development enquiry follows on from a pre-development Teams meeting with your Developer Services Engineer Tom Bethell held on the 27/06/22 for reference.

Ground Investigation has been conducted at the site and we are still awaiting the finalised report which can be forwarded in due course. In summary, the investigations found the site to be underlain with firm to stiff clays, with falling head permeability testing proving an infiltration-based strategy is not viable at this location.

This proposed development is expected to comprise of 40 dwellings, and it is anticipated the development drainage will remain private.

An assumed foul flow rate of 1.85 l/s has been calculated for the proposed development on this basis using the latest Design and Construction Guidance for Foul and Surface Water Sewers.
Due to space constraints, it is proposed to attenuate surface water runoff using a series of SuDs features with controlled discharge to the existing public surface water sewers restricted to match existing greenfield runoff rates.

Indicative Foul and Surface water connection locations are shown on the attached Draft Proposed Drainage Plans Nos. 105 - 108.

The site is in the location of long since demolished terraced housing and is now considered greenfield for planning

purposes, however a number of public combined and surface water sewers are still present in the area, which will require either abandonment or diversion to facilitate the new development.

We have therefore included Draft Sewer Diversion and Abandonment plans for information (Drawing Nos. 109 - 112).

Please could you advise whether the above proposals are acceptable in principle to UU?

Best regards,

Chris Abram BEng(Hons) GMICE
Engineer

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APPENDIX C

CALCULATIONS

PRE-DEVELOPMENT RUNOFF CALCULATIONS

MICRODRAINAGE SOURCE CONTROL RESULTS

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Wallingford Runoff Estimation	Job Number K39443	Page Number 1 of 6
	Calc by JB	Check by RH
Windermere Road Whitehaven	Date 10/06/2022	Revised -

DESIGN BASIS MEMORANDUM - PEAK RATE OF RUN-OFF CALCULATION

Design Brief

The following peak rate of run-off calculations have been undertaken to determine changes in peak flow resulting from the development of a greenfield or brownfield site. These calculations are for the **Peak Rate of Run-Off** requirements only.

Background Information & References

The site area **is less than** 200ha and the Greenfield (pre-development) calculation has been undertaken in accordance with methodology described by Marshall & Bayliss, Institute of Hydrology, Report No. 124, Flood Estimation for Small Catchments, 1994 (IoH 124).

In addition, the following references have been used in the preparation of these calculations:

- Interim Code of Practice for Sustainable Drainage Systems (SUDS), CIRIA, 2004
- CIRIA, The SUDS Manual, Report C753, 2015
- Designing for Exceedance in Urban Drainage - good practice, CIRIA Report C635, 2006
- Flood Estimation Handbook (FEH)
- Flood Studies Report (FSR), Volume 1, Hydrological Studies, 1993
- Flood Studies Supplementary Report No 2 (FSSR2), The Estimation of Low Return Period Floods
- Flood Studies Supplementary Report No 14 (FSSR14), Review of Regional Growth Curves, 1983
- Planning Practice guidance of the National Planning Policy Framework, Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights.

Proposed Land Use Changes

Changes to the existing site are as follows:

Greenfield Site to Brownfield Site

Results Summary

Rate of Run-Off (l/s)		
Event	**Greenfield**	[redacted]
Q1	2.5	
QBAR	2.9	
Q10	4.0	
Q30	4.9	
Q100	6.0	
Q100 + 40% CC	8.4	

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SITE AREAS (LAND COVER AREAS)

Existing Impermeable & Permeable Land Cover

Total Site Area: **0.71494** ha **7149.4** m²

Existing Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	0.0	0.000	0%
Remaining permeable area	7149.4	0.715	100%

Proposed Land Cover Areas

Land Cover	Area		Percentage of total site area
	m²	ha	
Total roof area	1432.0	0.143	20%
Total parking area	1033.5	0.103	14%
Total road area	0.0	0.000	0%
Total hardstanding area	1055.1	0.106	15%
Garden & landscaped areas	3628.8	0.363	51%

Proposed Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	3520.6	0.352	49%
Remaining permeable area	3628.8	0.363	51%

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ESTIMATION OF QBAR (RURAL) (GREENFIELD RUNOFF RATE)

IoH 124 based on research on small catchments < 25 km2

Method is based on regression analysis of response times
using catchments from 0.9 to 22.9 km^2

$QBAR_{rural}$ is mean annual flood on rural catchment
$QBAR_{rural}$ depends on SOIL, SAAR and AREA most significantly

$QBAR_{rural} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

For SOIL refer to FSR Vol 1, Section 4.2.3 and 4.2.6 and IoH 124

Contributing watershed area

Area, A	=	500000	m^2	insert 50 ha for EA
	=	0.500	km^2	small catchment method
	=	50.000	ha	

SAAR = **1102** mm — From FEH Web Service (point data)

Soil index based on soil type, SOIL

$$= \frac{(0.1S1+0.3S2+0.37S3+0.47S4+0.53S5)}{(S1+S2+S3+S4+S5)}$$

Where: S1	=		%
S2	=		%
S3	=		%
S4	=	**100**	%
S5	=		%
		100	%

UK Suds website provides a value of 4 based on the equivalent Host value. This seems reasonable based on ground investigation.

So, SOIL = **0.47**

Note: for very small catchments it is far better to rely on local site investigation information.

$QBAR_{rural}$	=	0.410	m^3/s
	=	410.5	l/s

Small rural catchments less than 50 ha
The Environment Agency recommends that this method should be used for development sizes from 0 to 50 ha and should linearly interpolate the formula to 50 ha.

So, catchment size	=	**3521**	m^2
	=	0.004	km^2
	=	0.352	ha
$QBAR_{rural\ site}$	=	0.00289	m^3/s
	=	**2.89**	l/s

Excluding significant open space which would remain disconnected from the positive drainage system during flood events.

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GREENFIELD RETURN PERIOD ORDINATES

QBAR can be factored by the UK FSR regional growth curves for return periods <2 years and for all other return periods to obtain peak flow estimates for required return periods.

These regional growth curves are constant throughout a region, whatever the catchment type and size.

See Table 2.39 for region curve ordinates
Use FSSR2 Growth Curves to estimate Qbar

Reference- Pg 173-FSR V.1, ch 2.6.2

Region = **10**

Use Figure A1.1 to determine region

GREENFIELD RETURN PERIOD FLOW RATES

Return Period	Ordinate	Q (l/s)
1	0.87	2.51
2	0.93	2.69
5	1.19	3.44
10	1.38	3.99
25	1.64	4.74
30	1.7	4.91
50	1.85	5.35
100	2.08	6.01
200	2.32	6.71
500	2.73	7.89
1000	3.04	8.79

Ordinate from FSSR2

Interpolation taken from Figure 24.2 (pg 515) SuDS Manual

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ESTIMATE OF BROWNFIELD RUNOFF

Total site impermeable area, A = **3521** m²

M5-60 rainfall depth = **20** mm
Ratio M5-60/M5-2Day, r = **0.30**

[Flood Studies Report (NERC, 1975)]
[The Wallingford Proceedure - V4 Modified Rational Method, Fig A.2 (Hydraulics Research, 1983)]

Storm Duration = 15 mins

Anticipated critical duration for the site - usually 15 minutes

Duration factor, Z1 = 0.59

[The Wallingford Proceedure - V4 Modified Rational Method, Fig A.3b (Hydraulics Research, 1983)]

M5-15 rainfall depth = 11.8 mm

Return period ratio, Z2

M1-15	0.61
M10-15	1.23
M30-15	1.50
M100-15	1.94

[The Wallingford Proceedure - V4 Modified Rational Method, Table A1 (Hydraulics Research, 1983)]

Rainfall

	Depth (mm)	Intensity, i (mm/hr)
M1-15	7.2	29
M10-15	14.5	58
M30-15	17.8	71
M100-15	22.9	92

Peak discharge, Qp = Cv Cr i A

Where:

Cv = Volumetric Runoff Coefficient
Cr = Routing Coefficient
i = Rainfall intensity (mm/hour)

Cv = **0.95**
Cr = **1.3**

Peak Runoff

	l/s
Q1	35.0
Q10	70.0
Q30	85.8
Q100	110.7

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ESTIMATION OF QBAR (BROWNFIELD RUNOFF RATE)

See Table 2.39 for region curve ordinates
Use FSSR2 Growth Curves to estimate Qbar

Reference- Pg 173-FSR V.1, ch 2.6.2

Region = **10**

Use Figure A1.1 to determine region

Return Period	Ordinate
1	0.87
2	0.93
5	1.19
10	1.38
25	1.64
30	1.70
50	1.85
100	2.08
200	2.32
500	2.73
1000	3.04

Ordinate from FSSR2

Interpolation taken from Figure 24.2 (pg 515) SuDS Manual

Qbar

Ordinate used	l/s
10 year	50.7
30 year	50.5
100 year	53.2

Proposed Brownfield Runoff, Qbar = 51.47 l/s

Using the average Qbar derived from three ordinates.

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DESIGN BASIS MEMORANDUM - PEAK RATE OF RUN-OFF CALCULATION

Design Brief

The following peak rate of run-off calculations have been undertaken to determine changes in peak flow resulting from the development of a greenfield or brownfield site. These calculations are for the **Peak Rate of Run-Off** requirements only.

Background Information & References

The site area **is less than** 200ha and the Greenfield (pre-development) calculation has been undertaken in accordance with methodology described by Marshall & Bayliss, Institute of Hydrology, Report No. 124, Flood Estimation for Small Catchments, 1994 (IoH 124).

In addition, the following references have been used in the preparation of these calculations:

- Interim Code of Practice for Sustainable Drainage Systems (SUDS), CIRIA, 2004
- CIRIA, The SUDS Manual, Report C753, 2015
- Designing for Exceedance in Urban Drainage - good practice, CIRIA Report C635, 2006
- Flood Estimation Handbook (FEH)
- Flood Studies Report (FSR), Volume 1, Hydrological Studies, 1993
- Flood Studies Supplementary Report No 2 (FSSR2), The Estimation of Low Return Period Floods
- Flood Studies Supplementary Report No 14 (FSSR14), Review of Regional Growth Curves, 1983
- Planning Practice guidance of the National Planning Policy Framework, Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights.

Proposed Land Use Changes

Changes to the existing site are as follows:

Greenfield Site to Brownfield Site

Results Summary

Rate of Run-Off (l/s)		
Event	**Greenfield**	[redacted]
Q1	2.5	
QBAR	2.9	
Q10	4.0	
Q30	4.9	
Q100	6.0	
Q100 + 40% CC	8.4	

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SITE AREAS (LAND COVER AREAS)

Existing Impermeable & Permeable Land Cover

Total Site Area: **0.58489** ha **5848.9** m²

Existing Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	0.0	0.000	0%
Remaining permeable area	5848.9	0.585	100%

Proposed Land Cover Areas

Land Cover	Area		Percentage of total site area
	m²	ha	
Total roof area	1248.4	0.125	21%
Total parking area	1083.4	0.108	19%
Total road area (Existing)	0.0	0.000	0%
Total hardstanding area	1177.7	0.118	20%
Garden & landscaped areas	2339.4	0.234	40%

Proposed Impermeable & Permeable Land Cover

Land Cover	Area		Percentage of total site area
	m²	ha	
Total impermeable area	3509.5	0.351	60%
Remaining permeable area	2339.4	0.234	40%

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ESTIMATION OF QBAR (RURAL) (GREENFIELD RUNOFF RATE)

IoH 124 based on research on small catchments < 25 km2

Method is based on regression analysis of response times
using catchments from 0.9 to 22.9 km^2

$QBAR_{rural}$ is mean annual flood on rural catchment
$QBAR_{rural}$ depends on SOIL, SAAR and AREA most significantly

$QBAR_{rural} = 0.00108 \times AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$

For SOIL refer to FSR Vol 1, Section 4.2.3 and 4.2.6 and IoH 124

Contributing watershed area

Area, A	=	500000	m^2	insert 50 ha for EA
	=	0.500	km^2	small catchment method
	=	50.000	ha	

SAAR = **1102** mm — From FEH Web Service (point data)

Soil index based on soil type, SOIL

$$= \frac{(0.1S1+0.3S2+0.37S3+0.47S4+0.53S5)}{(S1+S2+S3+S4+S5)}$$

Where: S1	=		%
S2	=		%
S3	=		%
S4	=	**100**	%
S5	=		%
		100	%

UK Suds website provides a value of 4 based on the equivalent Host value. This seems reasonable based on ground investigation.

So, SOIL = **0.47**

Note: for very small catchments it is far better to rely on local site investigation information.

$QBAR_{rural}$	=	0.410	m^3/s
	=	410.5	l/s

Small rural catchments less than 50 ha
The Environment Agency recommends that this method should be used for development sizes from 0 to 50 ha and should linearly interpolate the formula to 50 ha.

So, catchment size	=	**3510**	m^2
	=	0.004	km^2
	=	0.351	ha
$QBAR_{rural\ site}$	=	0.00288	m^3/s
	=	**2.88**	l/s

Excluding significant open space which would remain disconnected from the positive drainage system during flood events.

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GREENFIELD RETURN PERIOD ORDINATES

QBAR can be factored by the UK FSR regional growth curves for return periods <2 years and for all other return periods to obtain peak flow estimates for required return periods.

These regional growth curves are constant throughout a region, whatever the catchment type and size.

See Table 2.39 for region curve ordinates
Use FSSR2 Growth Curves to estimate Qbar

Reference- Pg 173-FSR V.1, ch 2.6.2

Region = **10**

Use Figure A1.1 to determine region

GREENFIELD RETURN PERIOD FLOW RATES

Return Period	Ordinate	Q (l/s)
1	0.87	2.51
2	0.93	2.68
5	1.19	3.43
10	1.38	3.98
25	1.64	4.73
30	1.7	4.90
50	1.85	5.33
100	2.08	5.99
200	2.32	6.68
500	2.73	7.87
1000	3.04	8.76

Ordinate from FSSR2

Interpolation taken from Figure 24.2 (pg 515) SuDS Manual

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ESTIMATE OF BROWNFIELD RUNOFF

Total site impermeable area, A = **3510** m²

M5-60 rainfall depth = **17** mm
Ratio M5-60/M5-2Day, r = **0.30**

[Flood Studies Report (NERC, 1975)]
[The Wallingford Proceedure - V4 Modified Rational Method, Fig A.2 (Hydraulics Research, 1983)]

Storm Duration = 15 mins

Anticipated critical duration for the site - usually 15 minutes

Duration factor, Z1 = 0.59

[The Wallingford Proceedure - V4 Modified Rational Method, Fig A.3b (Hydraulics Research, 1983)]

M5-15 rainfall depth = 10.0 mm

Return period ratio, Z2

M1-15	0.61
M10-15	1.22
M30-15	1.49
M100-15	1.91

[The Wallingford Proceedure - V4 Modified Rational Method, Table A1 (Hydraulics Research, 1983)]

Rainfall

	Depth (mm)	Intensity, i (mm/hr)
M1-15	6.1	24
M10-15	12.2	49
M30-15	14.9	60
M100-15	19.2	77

Peak discharge, Qp = Cv Cr i A

Where:

Cv = Volumetric Runoff Coefficient
Cr = Routing Coefficient
i = Rainfall intensity (mm/hour)

Cv = **0.95**
Cr = **1.3**

Peak Runoff

	l/s
Q1	29.5
Q10	58.9
Q30	72.0
Q100	92.3

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ESTIMATION OF QBAR (BROWNFIELD RUNOFF RATE)

See Table 2.39 for region curve ordinates

Use FSSR2 Growth Curves to estimate Qbar

Reference- Pg 173-FSR V.1, ch 2.6.2

Region = **10**

Use Figure A1.1 to determine region

Return Period	Ordinate
1	0.87
2	0.93
5	1.19
10	1.38
25	1.64
30	1.70
50	1.85
100	2.08
200	2.32
500	2.73
1000	3.04

Ordinate from FSSR2

Interpolation taken from Figure 24.2 (pg 515) SuDS Manual

Qbar

Ordinate used	l/s
10 year	42.7
30 year	42.3
100 year	44.4

Proposed Brownfield Runoff, Qbar = 43.13 l/s

Using the average Qbar derived from three ordinates.

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 933 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	90.490	0.240	0.0	1.5	1.5	79.4	O K
30 min Summer	90.587	0.337	0.0	1.8	1.8	111.5	O K
60 min Summer	90.700	0.450	0.0	2.1	2.1	148.9	O K
120 min Summer	90.782	0.532	0.0	2.3	2.3	176.0	O K
180 min Summer	90.831	0.581	0.0	2.4	2.4	192.0	O K
240 min Summer	90.864	0.614	0.0	2.4	2.4	202.8	O K
360 min Summer	90.903	0.653	0.0	2.5	2.5	215.9	O K
480 min Summer	90.924	0.674	0.0	2.6	2.6	222.8	O K
600 min Summer	90.934	0.684	0.0	2.6	2.6	226.1	O K
720 min Summer	90.940	0.690	0.0	2.6	2.6	228.0	O K
960 min Summer	90.946	0.696	0.0	2.6	2.6	230.2	O K
1440 min Summer	90.948	0.698	0.0	2.6	2.6	230.8	O K
2160 min Summer	90.939	0.689	0.0	2.6	2.6	227.7	O K
2880 min Summer	90.922	0.672	0.0	2.6	2.6	222.2	O K
4320 min Summer	90.881	0.631	0.0	2.5	2.5	208.7	O K
5760 min Summer	90.844	0.594	0.0	2.4	2.4	196.3	O K
7200 min Summer	90.812	0.562	0.0	2.3	2.3	185.8	O K
8640 min Summer	90.785	0.535	0.0	2.3	2.3	176.9	O K
10080 min Summer	90.762	0.512	0.0	2.2	2.2	169.3	O K
15 min Winter	90.519	0.269	0.0	1.6	1.6	88.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.942	0.0	71.6	23
30 min Summer	83.377	0.0	98.7	37
60 min Summer	56.324	0.0	149.4	66
120 min Summer	34.110	0.0	180.9	126
180 min Summer	25.392	0.0	201.8	184
240 min Summer	20.570	0.0	217.5	244
360 min Summer	15.250	0.0	240.5	362
480 min Summer	12.319	0.0	257.2	482
600 min Summer	10.432	0.0	269.8	596
720 min Summer	9.104	0.0	279.2	644
960 min Summer	7.338	0.0	291.8	762
1440 min Summer	5.413	0.0	302.8	1022
2160 min Summer	4.012	0.0	391.1	1432
2880 min Summer	3.254	0.0	422.2	1848
4320 min Summer	2.430	0.0	466.4	2676
5760 min Summer	1.987	0.0	519.7	3464
7200 min Summer	1.711	0.0	559.2	4248
8640 min Summer	1.522	0.0	596.2	5016
10080 min Summer	1.383	0.0	631.0	5752
15 min Winter	117.942	0.0	79.9	22

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	90.628	0.378	0.0	1.9	1.9	125.1	O K
60 min Winter	90.755	0.505	0.0	2.2	2.2	167.1	O K
120 min Winter	90.849	0.599	0.0	2.4	2.4	197.9	O K
180 min Winter	90.904	0.654	0.0	2.5	2.5	216.3	O K
240 min Winter	90.942	0.692	0.0	2.6	2.6	228.8	O K
360 min Winter	90.989	0.739	0.0	2.7	2.7	244.4	O K
480 min Winter	91.016	0.766	0.0	2.7	2.7	253.1	O K
600 min Winter	91.030	0.780	0.0	2.8	2.8	258.0	O K
720 min Winter	91.038	0.788	0.0	2.8	2.8	260.5	O K
960 min Winter	91.040	0.790	0.0	2.8	2.8	261.1	O K
1440 min Winter	91.038	0.788	0.0	2.8	2.8	260.5	O K
2160 min Winter	91.016	0.766	0.0	2.7	2.7	253.4	O K
2880 min Winter	90.986	0.736	0.0	2.7	2.7	243.3	O K
4320 min Winter	90.918	0.668	0.0	2.6	2.6	221.0	O K
5760 min Winter	90.858	0.608	0.0	2.4	2.4	201.0	O K
7200 min Winter	90.807	0.557	0.0	2.3	2.3	184.3	O K
8640 min Winter	90.765	0.515	0.0	2.2	2.2	170.4	O K
10080 min Winter	90.730	0.480	0.0	2.2	2.2	158.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	83.377	0.0	108.5	37
60 min Winter	56.324	0.0	167.4	66
120 min Winter	34.110	0.0	202.5	124
180 min Winter	25.392	0.0	225.5	182
240 min Winter	20.570	0.0	242.7	240
360 min Winter	15.250	0.0	267.7	354
480 min Winter	12.319	0.0	285.1	468
600 min Winter	10.432	0.0	297.5	578
720 min Winter	9.104	0.0	306.9	684
960 min Winter	7.338	0.0	319.5	806
1440 min Winter	5.413	0.0	329.8	1088
2160 min Winter	4.012	0.0	438.1	1556
2880 min Winter	3.254	0.0	472.7	1992
4320 min Winter	2.430	0.0	518.9	2856
5760 min Winter	1.987	0.0	582.2	3688
7200 min Winter	1.711	0.0	626.4	4472
8640 min Winter	1.522	0.0	667.9	5272
10080 min Winter	1.383	0.0	707.1	6048

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 297201 516096 NX 97201 16096
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.364

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.182	4	8	0.182

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Model Details

Storage is Online Cover Level (m) 91.650

Cellular Storage Structure

Invert Level (m) 90.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	348.0	0.0	0.801	0.0	0.0
0.800	348.0	0.0			

Orifice Outflow Control

Diameter (m) 0.039 Discharge Coefficient 0.600 Invert Level (m) 90.250

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 899 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	95.730	0.240	0.0	0.6	0.6	29.6	O K
30 min Summer	95.827	0.337	0.0	0.7	0.7	41.6	O K
60 min Summer	95.940	0.450	0.0	0.8	0.8	55.5	O K
120 min Summer	96.021	0.531	0.0	0.9	0.9	65.6	O K
180 min Summer	96.069	0.579	0.0	0.9	0.9	71.5	O K
240 min Summer	96.101	0.611	0.0	0.9	0.9	75.5	O K
360 min Summer	96.140	0.650	0.0	1.0	1.0	80.2	O K
480 min Summer	96.160	0.670	0.0	1.0	1.0	82.7	O K
600 min Summer	96.169	0.679	0.0	1.0	1.0	83.8	O K
720 min Summer	96.174	0.684	0.0	1.0	1.0	84.5	O K
960 min Summer	96.180	0.690	0.0	1.0	1.0	85.2	O K
1440 min Summer	96.180	0.690	0.0	1.0	1.0	85.2	O K
2160 min Summer	96.169	0.679	0.0	1.0	1.0	83.8	O K
2880 min Summer	96.151	0.661	0.0	1.0	1.0	81.6	O K
4320 min Summer	96.109	0.619	0.0	0.9	0.9	76.4	O K
5760 min Summer	96.071	0.581	0.0	0.9	0.9	71.7	O K
7200 min Summer	96.039	0.549	0.0	0.9	0.9	67.8	O K
8640 min Summer	96.012	0.522	0.0	0.9	0.9	64.4	O K
10080 min Summer	95.989	0.499	0.0	0.8	0.8	61.6	O K
15 min Winter	95.759	0.269	0.0	0.6	0.6	33.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.942	0.0	27.8	23
30 min Summer	83.377	0.0	37.9	37
60 min Summer	56.324	0.0	56.6	66
120 min Summer	34.110	0.0	68.5	126
180 min Summer	25.392	0.0	76.3	184
240 min Summer	20.570	0.0	82.3	244
360 min Summer	15.250	0.0	91.1	362
480 min Summer	12.319	0.0	97.4	482
600 min Summer	10.432	0.0	102.1	588
720 min Summer	9.104	0.0	105.6	632
960 min Summer	7.338	0.0	110.4	760
1440 min Summer	5.413	0.0	114.7	1014
2160 min Summer	4.012	0.0	146.7	1432
2880 min Summer	3.254	0.0	158.5	1848
4320 min Summer	2.430	0.0	175.7	2644
5760 min Summer	1.987	0.0	194.4	3456
7200 min Summer	1.711	0.0	209.2	4248
8640 min Summer	1.522	0.0	223.1	5016
10080 min Summer	1.383	0.0	236.4	5752
15 min Winter	117.942	0.0	31.0	22

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	95.868	0.378	0.0	0.7	0.7	46.7	O K
60 min Winter	95.995	0.505	0.0	0.8	0.8	62.3	O K
120 min Winter	96.087	0.597	0.0	0.9	0.9	73.8	O K
180 min Winter	96.143	0.653	0.0	1.0	1.0	80.6	O K
240 min Winter	96.180	0.690	0.0	1.0	1.0	85.2	O K
360 min Winter	96.226	0.736	0.0	1.0	1.0	90.9	O K
480 min Winter	96.252	0.762	0.0	1.0	1.0	94.1	O K
600 min Winter	96.266	0.776	0.0	1.1	1.1	95.8	O K
720 min Winter	96.272	0.782	0.0	1.1	1.1	96.6	O K
960 min Winter	96.273	0.783	0.0	1.1	1.1	96.7	O K
1440 min Winter	96.270	0.780	0.0	1.1	1.1	96.3	O K
2160 min Winter	96.246	0.756	0.0	1.0	1.0	93.4	O K
2880 min Winter	96.214	0.724	0.0	1.0	1.0	89.5	O K
4320 min Winter	96.145	0.655	0.0	1.0	1.0	80.9	O K
5760 min Winter	96.084	0.594	0.0	0.9	0.9	73.3	O K
7200 min Winter	96.033	0.543	0.0	0.9	0.9	67.1	O K
8640 min Winter	95.991	0.501	0.0	0.8	0.8	61.9	O K
10080 min Winter	95.955	0.465	0.0	0.8	0.8	57.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	83.377	0.0	41.4	37
60 min Winter	56.324	0.0	63.3	66
120 min Winter	34.110	0.0	76.6	124
180 min Winter	25.392	0.0	85.3	182
240 min Winter	20.570	0.0	91.9	240
360 min Winter	15.250	0.0	101.3	354
480 min Winter	12.319	0.0	107.8	468
600 min Winter	10.432	0.0	112.5	578
720 min Winter	9.104	0.0	116.1	684
960 min Winter	7.338	0.0	120.9	794
1440 min Winter	5.413	0.0	124.9	1086
2160 min Winter	4.012	0.0	164.3	1544
2880 min Winter	3.254	0.0	177.4	1992
4320 min Winter	2.430	0.0	195.4	2856
5760 min Winter	1.987	0.0	217.7	3688
7200 min Winter	1.711	0.0	234.3	4472
8640 min Winter	1.522	0.0	249.9	5272
10080 min Winter	1.383	0.0	264.8	6048

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 297201 516096 NX 97201 16096
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.136

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.068	4	8	0.068

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Model Details

Storage is Online Cover Level (m) 96.890

Cellular Storage Structure

Invert Level (m) 95.490 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	130.0	0.0	0.801	0.0	0.0
0.800	130.0	0.0			

Orifice Outflow Control

Diameter (m) 0.024 Discharge Coefficient 0.600 Invert Level (m) 95.490

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 910 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	95.733	0.243	0.0	1.0	1.0	50.1	O K
30 min Summer	95.831	0.341	0.0	1.1	1.1	70.4	O K
60 min Summer	95.945	0.455	0.0	1.3	1.3	94.0	O K
120 min Summer	96.028	0.538	0.0	1.4	1.4	111.1	O K
180 min Summer	96.076	0.586	0.0	1.5	1.5	121.2	O K
240 min Summer	96.109	0.619	0.0	1.6	1.6	127.9	O K
360 min Summer	96.149	0.659	0.0	1.6	1.6	136.1	O K
480 min Summer	96.169	0.679	0.0	1.6	1.6	140.3	O K
600 min Summer	96.179	0.689	0.0	1.6	1.6	142.3	O K
720 min Summer	96.184	0.694	0.0	1.7	1.7	143.5	O K
960 min Summer	96.191	0.701	0.0	1.7	1.7	144.8	O K
1440 min Summer	96.192	0.702	0.0	1.7	1.7	145.0	O K
2160 min Summer	96.181	0.691	0.0	1.6	1.6	142.8	O K
2880 min Summer	96.164	0.674	0.0	1.6	1.6	139.3	O K
4320 min Summer	96.122	0.632	0.0	1.6	1.6	130.6	O K
5760 min Summer	96.084	0.594	0.0	1.5	1.5	122.7	O K
7200 min Summer	96.051	0.561	0.0	1.5	1.5	116.0	O K
8640 min Summer	96.024	0.534	0.0	1.4	1.4	110.4	O K
10080 min Summer	96.001	0.511	0.0	1.4	1.4	105.6	O K
15 min Winter	95.762	0.272	0.0	1.0	1.0	56.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.942	0.0	46.2	23
30 min Summer	83.377	0.0	63.3	37
60 min Summer	56.324	0.0	95.1	66
120 min Summer	34.110	0.0	115.1	126
180 min Summer	25.392	0.0	128.4	184
240 min Summer	20.570	0.0	138.4	244
360 min Summer	15.250	0.0	153.1	362
480 min Summer	12.319	0.0	163.7	482
600 min Summer	10.432	0.0	171.6	594
720 min Summer	9.104	0.0	177.5	642
960 min Summer	7.338	0.0	185.6	762
1440 min Summer	5.413	0.0	192.6	1016
2160 min Summer	4.012	0.0	247.7	1432
2880 min Summer	3.254	0.0	267.5	1848
4320 min Summer	2.430	0.0	296.0	2676
5760 min Summer	1.987	0.0	328.6	3464
7200 min Summer	1.711	0.0	353.6	4248
8640 min Summer	1.522	0.0	377.1	5016
10080 min Summer	1.383	0.0	399.3	5752
15 min Winter	117.942	0.0	51.5	22

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	95.872	0.382	0.0	1.2	1.2	79.0	O K
60 min Winter	96.001	0.511	0.0	1.4	1.4	105.5	O K
120 min Winter	96.095	0.605	0.0	1.5	1.5	124.9	O K
180 min Winter	96.151	0.661	0.0	1.6	1.6	136.5	O K
240 min Winter	96.189	0.699	0.0	1.7	1.7	144.3	O K
360 min Winter	96.236	0.746	0.0	1.7	1.7	154.1	O K
480 min Winter	96.262	0.772	0.0	1.7	1.7	159.5	O K
600 min Winter	96.277	0.787	0.0	1.8	1.8	162.5	O K
720 min Winter	96.284	0.794	0.0	1.8	1.8	164.0	O K
960 min Winter	96.285	0.795	0.0	1.8	1.8	164.3	O K
1440 min Winter	96.282	0.792	0.0	1.8	1.8	163.7	O K
2160 min Winter	96.260	0.770	0.0	1.7	1.7	159.1	O K
2880 min Winter	96.228	0.738	0.0	1.7	1.7	152.6	O K
4320 min Winter	96.159	0.669	0.0	1.6	1.6	138.3	O K
5760 min Winter	96.098	0.608	0.0	1.5	1.5	125.6	O K
7200 min Winter	96.047	0.557	0.0	1.5	1.5	115.0	O K
8640 min Winter	96.004	0.514	0.0	1.4	1.4	106.2	O K
10080 min Winter	95.968	0.478	0.0	1.4	1.4	98.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	83.377	0.0	69.3	37
60 min Winter	56.324	0.0	106.5	66
120 min Winter	34.110	0.0	128.8	124
180 min Winter	25.392	0.0	143.5	182
240 min Winter	20.570	0.0	154.5	240
360 min Winter	15.250	0.0	170.3	354
480 min Winter	12.319	0.0	181.3	468
600 min Winter	10.432	0.0	189.1	578
720 min Winter	9.104	0.0	195.1	684
960 min Winter	7.338	0.0	203.1	800
1440 min Winter	5.413	0.0	209.7	1088
2160 min Winter	4.012	0.0	277.4	1556
2880 min Winter	3.254	0.0	299.5	1992
4320 min Winter	2.430	0.0	329.2	2856
5760 min Winter	1.987	0.0	368.1	3688
7200 min Winter	1.711	0.0	396.1	4472
8640 min Winter	1.522	0.0	422.4	5272
10080 min Winter	1.383	0.0	447.4	6048

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 297201 516096 NX 97201 16096
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.230

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.115	4	8	0.115

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Model Details

Storage is Online Cover Level (m) 96.890

Cellular Storage Structure

Invert Level (m) 95.490 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	217.5	0.0	0.801	0.0	0.0
0.800	217.5	0.0			

Orifice Outflow Control

Diameter (m) 0.031 Discharge Coefficient 0.600 Invert Level (m) 95.490

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