

Prepared on behalf of

Stuart Brook

FLOOD RISK ASSESSMENT

**Proposed Residential Development
Land off Redwood Close, Long Lee, Keighley**

**Flood Risk Assessment
&
Drainage Impact Assessment**

Acknowledgements:

Yorkshire Water
Environment Agency

Disclaimer

The methodology adopted and the sources of information used by Sanderson Associates (Consulting Engineers) Ltd in providing its services are outlined within this Report.

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1 Introduction

- 1.1 Sanderson Associates (Consulting Engineers) Ltd have been appointed to undertake a Flood Risk Assessment and Drainage Impact Assessment for a proposed Residential (C3 use) development at a parcel of land off Redwood Close, Long Lee, Keighley.
- 1.2 The assessment discusses the present and future flood risk to the site over the lifetime of the development, using a risk based approach and reference to the Sequential Test and Exception Test where appropriate.
- 1.3 The report also assesses, evaluates and quantifies the existing and proposed drainage mechanisms of the site and considers any drainage requirements to ensure a suitable and acceptable strategy for surface and foul water discharge.
- 1.4 This Flood Risk Assessment has been undertaken in accordance with the National Planning Policy Framework (NPPF) March 2012 and the associated Planning Practice Guidance, 2014 (PPG 2014).
- 1.5 Consultation with Yorkshire Water has taken place to obtain a Pre-Development Enquiry for the site. The Environment Agency online map confirms the site is situated in Flood Zone 1, therefore further formal consultation with the EA has not taken place in regards to flood risk. This Flood Risk Assessment has been undertaken taking into account current EA standing advice for developments in Flood Zone 1 and with reference to the Environment Agency online mapping.

2 Existing Situation

2.1 Existing Site Description

- 2.1.1 The site is located on a piece of land off Redwood Close, Long Lee, Keighley approximately 2.0km southeast of Keighley Town Centre and 12km northwest of Bradford City Centre. Drawing 9704/001 included in Appendix A shows the site location and surroundings.
- 2.1.2 The site comprises of undeveloped Greenfield land which fronts Redwood Close.
- 2.1.3 The site is bound by Redwood Close to the north and by existing residential properties to the east, south and west.
- 2.1.4 The closest main watercourse to the site is the River Worth which is located 890m to the northwest of the site at its closest point. A minor watercourse in the form of Hog Holes Beck is located 170m southwest of the site.
- 2.1.5 The closest area of higher probability Flood Zones (2 and 3) is located 980m to the northwest of the site and relate to the River Worth.

2.2 Existing Site Analysis

- 2.2.1 The existing site layout and makeup have been assessed to establish the estimated surface water runoff rate. Drawing 9704-002 shows the existing permeable and impermeable areas of the site.
- 2.2.2 The total site area is 11,200m² (1.12Ha) with 0m² of building/structure and 0m² of hard standing. 11,200m² is considered to be permeable (naturally drained). Therefore the site is considered to be 0% impermeable and 100% permeable.
- 2.2.3 The Greenfield run off rate has been assessed using Microdrainage (Xp Solutions) source control software, The IH124 Method has been used, which requires calculation to be carried out for an area of 50Ha and reduced to the site area. The

Greenfield runoff rate has been calculated at 6.50l/s for the total area of 1.12Ha or 5.80l/s/Ha. The WinDES output file is contained in Appendix C.

- 2.2.4 The topography of the site slopes from north to south towards the southern boundary of the site at an approximate average gradient of 12% although there are steeper areas. The topographical survey is contained within Appendix A.

3 Consultations

3.1 *Environment Agency (EA)*

- 3.1.1 The site is wholly contained within Flood Zone 1 which means that there is less than a 1 in 1000 chance of flooding in any one year (<0.1%) from fluvial sources.
- 3.1.2 There is no requirement to formally consult with the EA regarding this development. As the site area is greater than 1Ha in area, the Environment Agency standing advice is referred to and followed for development sites in Flood Zone 1 greater than 1 ha. This standing advice directs developers and consultants to look at the control of surface water from the development site so not to increase flood risk elsewhere and improve if possible.
- 3.1.3 The Environment Agency online groundwater mapping confirmed the site is not located within a Groundwater Source Protection Zone.
- 3.1.4 Environment Agency groundwater mapping shows the sites underlying strata consists of a Secondary A bedrock aquifer and a Secondary undifferentiated superficial (drift) aquifer. A secondary A aquifer are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers. Secondary Undifferentiated aquifers are assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. These are generally the water-bearing parts of the former non-aquifers. It should be noted that the area of the site has a superficial strata that is designated as both unproductive and secondary undifferentiated aquifers.

3.2 *Yorkshire Water (YW)*

- 3.2.1 Yorkshire Water have provided a plan showing their drainage apparatus in the area. The plan is contained in Appendix B.
- 3.2.2 Foul water domestic waste should discharge to the 225 mm diameter public combined sewer recorded in Long Lee Lane, at a point to the south of the site.
- 3.2.3 Yorkshire Water have advised that the proposal site is currently undeveloped no surface water is known to have previously discharged to the public sewer network and as such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority with a view to establishing a suitable watercourse (if any nearby for discharge).
- 3.2.4 On the 30th May 2017 Yorkshire Water provided comments on Flood Risk Assessment 9704/DH/001/01 which was issued on December 2016. They stated that the surface water sewer to the North of the site in Redwood Close should be used for the discharge of surface water. From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public surface water sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a surface water pumping station will be required to facilitate connection to the public surface water sewer network. If pumping is required, the peak pumped surface water discharge must not exceed 5 (five) litres per second.

3.3 *Strategic Flood Risk Assessment (SFRA)*

- 3.3.1 There was no Strategic Flood Risk Assessment available to review for this area at the time of writing the report.

4 Proposed Development

- 4.1 It is proposed that the site is developed for residential (C3) use with the construction of 38 residential dwellings with associated hard standing and gardens/open green areas.
- 4.2 Access to the site is proposed from Redwood Close in the form of an extension of the existing carriageway in a southerly direction where Redwood Close turns in an easterly direction. This is shown on the Illustrative Masterplan contained in Appendix A of this report.
- 4.3 On assessing the proposed site layout, the overall site area has been calculated to remain at 1,120m² (1.12Ha) this can be divided into 2,402m² of buildings/structures and 3,129m² of hard standing and highways. The proposed permeable area of the site (gardens/public open space) has been calculated as 5,684m². The proposed permeable and impermeable areas of the site are shown on plan 9458/003 contained within Appendix A.
- 4.4 The final drainage layout will be confirmed as part of the detailed drainage design and consultations held with the Local Highway Authority and Yorkshire Water with regards to the final design details and future adoption of the drainage techniques to be utilised.

5 Sequential and Exception Tests

5.1 Sequential Approach

- 5.1.1 The site is considered to lie within Flood Zone 1 as confirmed by the Environment Agency mapping.
- 5.1.2 The site is currently agricultural land, in accordance with Table 2 of (PPG 2014, Planning Practise Guidance 2014) its last use is classed as being 'Less Vulnerable' in terms of flood risk.
- 5.1.3 The proposed residential use of the site, in accordance with Table 2 (PPG 2014, Planning Practise Guidance 2014) is classed as being 'More Vulnerable' in terms of flood risk as the site will contain dwelling houses.
- 5.1.4 In accordance with Table 3 (PPG 2014, Planning Practise Guidance 2014) a 'More Vulnerable' (residential) development in Flood Zone 1 is an appropriate development in terms of flood risk, therefore the Exception Test would not be required as part of a planning application for this development.
- 5.1.5 As the site is located in Flood Zone 1 there can be no other sites in the area with a lower risk from fluvial flooding based upon the Flood Zone classification outlined in Table 1 of PPG 2014, (Planning Practise Guidance 2014).

6 Assessment of Flood Risk

6.1 Surface Water Flooding

- 6.1.1 The main risk of flooding from overland flow comes from the local highway network, impermeable areas within the vicinity of the site and land at a higher elevation.
- 6.1.2 The site has very limited connectivity to the local highway network. Therefore the potential for surface water to be conveyed by road is limited to the immediate, surrounding highways. Local topography shows that the land falls generally from north to south.
- 6.1.3 The online Environment Agency modelled surface water flood map shows that the site is at a very low risk of surface water flooding. A low risk is land classed as having less than 1 in 1000 (0.1%) probability of flooding in any given year.
- 6.1.4 The mitigation measures recommended in Section 7 will to be put in place to deal with any residual risk from this source.

6.2 Flooding from Rivers / Watercourses

- 6.2.1 As discussed in Section 3, the site falls within Flood Zone 1 with a less than a 1 in 1000 (<0.1%) annual probability of flooding from a fluvial Source in any given year.
- 6.2.2 There are no areas of Flood Zones 2 & 3 associated with local watercourses that encroach within the boundary of the site. The closest area of higher probability Flood Zones (2 and 3) is located 980m to the northwest of the site and relate to the River Worth. The flood zones associated with this watercourse are confined to the immediate vicinity of the rivers channel. Due to the elevation difference between the watercourse and the site it is unlikely that the projected effects of climate change would bring the site into a higher probability flood zone.

6.3 *Flooding from Sewers*

- 6.3.1 If any of the sewers/drainage apparatus adjacent to the site were to surcharge and flood, it is likely that any floodwaters would be shallow, relatively slow moving and constrained within the limits of the carriageway.
- 6.3.2 At the time of writing the report there was no evidence available to suggest the site has been directly affected from flooding from overloaded sewers/drainage apparatus in the past; therefore the risk of flooding from sewers would be considered low.
- 6.3.3 The mitigation measures proposed for the development as discussed in section 7 will also protect against any flooding from this source should the risk increase over the lifetime of the development.

6.4 *Flooding from Groundwater*

- 6.4.1 The potential for groundwater flooding has been assessed with the aid of groundwater mapping from the Environment Agency and British Geological Survey geological and borehole records.
- 6.4.2 The Environment Agency groundwater mapping shows the sites underlying strata consists of a Secondary A bedrock aquifer and a Secondary undifferentiated superficial (drift) aquifer. A secondary A aquifer are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers. Secondary Undifferentiated aquifers are assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. These are generally the water-bearing parts of the former non-aquifers. It should be noted that the area of the site has a superficial strata that is designated as both unproductive and secondary undifferentiated aquifers.

- 6.4.3 The online British Geological Survey geological map of the UK has been reviewed and it confirms a superficial strata of Devensian Diamicton/Till of sands, gravel and clay. The underlying bedrock is of the Pennine Lower Coal Measure Formation, the Millstone Grit Group and Guiseley Grit Group. The British Geological Survey do not hold publically accessible borehole for this area.
- 6.4.4 The British Geological Survey hold records of boreholes previously excavated in Dale View Road and Redwood Close to the north of the site. 3 Boreholes on Dale View Road shows a strata of topsoil underlain by firm brown sandy clay to a depth of 0.5m below ground level. 5 boreholes have been reviewed on Redwood Close which show a strata of topsoil underlain by firm yellow/brown clay to a depth of 3.0m. All reviewed boreholes remained dry during excavation apart from one which notes minor seepage in the bottom of an excavation.
- 6.4.5 Due to the impermeable nature of the sites underlying superficial strata, which is predominantly made up of clay. It is unlikely that groundwater would be an issue at this location. Little groundwater was encountered to 3.00m below ground level in excavated boreholes.
- 6.4.6 The mitigation measures recommended to protect the development from other sources of flooding would also protect against groundwater emergence should the risk increase in the future or should groundwater emerge remote from the site and flow overland.

6.5 *Flooding from Climate Change*

- 6.5.1 It is generally considered that the intensity of rainfall will increase by up to 30% by the year 2085 and that winter months will become proportionately wetter.
- 6.5.2 Peak river flows are anticipated to increase by up to 20% due to climate change. As the site is in Flood Zone 1 the anticipated increase in river flows are not considered to pose any increased risk to the site.

6.5.3 These factors have been considered in the assessment of flood risk from all sources including watercourses.

7 Mitigation of Flood Risk

- 7.1 It is important that any proposed development that has the potential to change the flood mechanisms on a site is designed such that there is no increased flood risk to the site itself, or sites upstream and downstream of the development. Below is a list of possible mitigation measures that will be required to ensure the development.
- 7.2 Footways should be constructed to naturally fall towards and into garden/green areas to encourage the informal percolation of surface water runoff from these areas.
- 7.3 External surfaces should fall away from properties and properties should have a finished floor level higher than development carriageway levels and external levels to prevent potential surface water flooding of the dwellings.
- 7.4 Drains within the limits of the site should be regularly inspected and cleared where necessary to reduce the risk of blockages and flooding.

8 Drainage Design Considerations

8.1 *Foul Drainage*

- 8.1.1 Yorkshire Water have confirmed that foul water domestic waste should discharge to the 225 mm diameter public combined sewer recorded in Long Lee Lane, at a point to the south of the site

8.2 *Methods of Surface Water Treatment*

- 8.2.1 The current building regulations, Part H3, detail the favoured hierarchy of surface water disposal being in order of preference, to ground by infiltration, to watercourse and then to sewer.

1. Infiltration

2. Watercourse

3. Sewer

1. Infiltration Drainage

- 8.2.2 Infiltration methods of drainage such as soakaways and filter drains percolate surface water runoff allowing it to permeate into the subsoil at its natural rate mimicking the natural process of drainage and as such are subject to the local ground conditions. As reviewed records are for the local area they can only give an idea of the sites underlying strata, site specific testing should be carried out to obtain site specific results.

- 8.2.3 The British Geological Survey hold records of boreholes previously excavated in Dale View Road and Redwood Close to the north of the site. 3 Boreholes on Dale View Road shows a strata of topsoil underlain by firm brown sandy clay to a depth of 0.5m below ground level. 5 boreholes have been reviewed on Redwood Close which show a strata of topsoil underlain by firm yellow/brown clay to a depth of

3.0m. All reviewed boreholes remained dry during excavation apart from one which notes minor seepage in the bottom of an excavation.

8.2.4 The soils encountered beneath the area is shown to be predominantly clay which suggests that the underlay strata would have very low permeability characteristics. In light of the above soakaways are deemed an unviable method of surface water treatment, this should be confirmed by onsite testing during a site investigation.

8.2.5 It should also be noted that due to the sites location in an area of sloped topography, drainage via infiltration runs the risk of remerging at a lower elevation.

2. Discharge to Watercourse

8.2.6 The closest watercourse to the site is the Hog Holes Beck which is located 170m southwest of the site.

8.2.7 Due to the location, topography and the fact carriageway and third party land would have to be crossed in order to gain connection into the watercourse this method is unlikely to be viable.

3. Discharge to Sewer

8.2.8 Yorkshire Water have advised that the proposal site is currently undeveloped and no surface water is known to have previously discharged to the public sewer network and as such, the local public sewer network does not have capacity to accept any surface water from the proposed site.

8.2.9 Yorkshire Water have agreed that both infiltration and discharge to a nearby watercourse are deemed unviable methods and therefore the public surface water sewer can be used for discharge.

- 8.2.10 On the 30th May 2017 Yorkshire Water provided comments on Flood Risk Assessment 9704/DH/001/01 which was issued on December 2016. They stated that the surface water sewer to the North of the site in Redwood Close should be used for the discharge of surface water. From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public surface water sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a surface water pumping station will be required to facilitate connection to the public surface water sewer network. If pumping is required, the peak pumped surface water discharge must not exceed 5 (five) litres per second.

8.3 Attenuation Options

Attenuation in ponds/basin and open water features

- 8.3.1 As it is proposed that the site will be developed for residential use, having an open water structure to store rainwater within the site poses a risk to the safety of the potential occupants of the site especially children. The residual risk of such a system requires careful thought before implementation.
- 8.3.2 If discharge into the combined public sewer located in Long Lee Lane is deemed viable, it has been calculated that to enable a discharge rate of 5.0l/s between 261m³ and 401m³ of storage would be required for a 1 in 100 storm event including climate change (+30%) in line with the NPPF.
- 8.3.3 Due to the level of storage required for the proposed development and the existing gradient across the site it is considered that attenuation in ponds/basins and open water features is an unviable option for inclusion in a drainage strategy for this site due to the potential land take in accommodating a pond on the site.

Attenuate rainwater by storing in tanks or sealed water features

- 8.3.4 Attenuating the surface water runoff into oversized pre-cast concrete pipes underneath the proposed highways is considered to be an option for the site.

-
- 8.3.5 This form of storage could be in the form of pre cast concrete culverts, oversized pipes or other techniques such as Geo-cellular systems under public open spaces, private drives or car parks to provide some of the storage required to accommodate the 1 in 100 year storm event.
- 8.3.6 In line with current guidance, attenuation should be provided to ensure that the system does not flood during a 1 in 30 year storm event and for a 1 in 100 year storm event + 30% climate change the system can flood but the surcharge must not flood properties and be kept within the site's boundary.
- 8.3.7 Between 261m³ and 401m³ of storage would be required for a 1 in 100 storm event including climate change (+30%) in line with the NPPF. This has been calculated using WinDES software; the results are contained in Appendix C. This is an initial estimate of the likely storage to be required on the site and should be verified as part of any detailed drainage design of the site.

9 Proposed Surface Water Drainage Strategy

- 9.1.1 The application to be submitted is an outline proposal only and as such the purpose of the Surface Water Drainage Strategy is to detail the principle of a sustainable drainage strategy and layout. The final details should be designed and confirmed at the detailed design stage and following consultations with the Local Planning, Highway and Drainage Authority.
- 9.1.2 It is clear that there is an opportunity to provide a level of SuDs techniques appropriate for the new site which will contribute to a sustainable development and improve urban design, by balancing the different issues that influence the development.
- 9.1.3 The existing site is an undeveloped Greenfield site. The site falls towards the sites southern boundary at an approximate average gradient of 12%.
- 9.1.4 The soils encountered beneath the area is shown to be predominantly clay which suggests that the underlay strata would have very low permeability characteristics. In light of the above soakaways are deemed an unviable method of surface water treatment, this should be confirmed by onsite testing during a site investigation.
- 9.1.5 As infiltration and connection into a local watercourse have both been deemed unviable surface water discharge options, the only other means of surface water discharge would be into a Yorkshire Water system. Yorkshire Water have advised that the discharge point should be to the North of the site in Redwood Close. However If the site, or part of it, will not drain by gravity, then it is likely that a surface water pumping station will be required to facilitate connection to the public surface water sewer network. If pumping is required, the peak pumped surface water discharge must not exceed 5 (five) litres per second.
- 9.1.6 Assuming a minimum surface water discharge rate of 5.0l/s is agreed with Yorkshire Water into their system, then between 261m³ and 401m³ of storage

would be required for a 1 in 100 storm event including climate change (+30%) in line with the NPPF.

- 9.1.7 The most viable method of storage due to the extreme gradient of the site would be methods such as pre cast concrete culverts, oversized pipes or other techniques such as Geo-cellular systems under public open spaces, private drives or car parks to provide some of the storage required to accommodate the 1 in 100 year storm event. This should be located to the south of the site due to the natural grade of the land.
- 9.1.8 The final drainage layout will be confirmed as part of the detailed drainage design and consultations held with the Local Highway Authority and Yorkshire Water with regards to the final design details and future adoption of the drainage techniques to be utilised.

10 Conclusion

- 10.1 This report serves to review and assess the sources of potential flooding to the site, the impact of the proposed development on the flood mechanisms of the site and the impact on the surrounding area in accordance with NPPF.
- 10.2 Sequential and Exception Tests have been assessed in accordance with NPPF and it is concluded that the development is suitable for this location.
- 10.3 Suitable mitigation measures have been recommended in Section 7 that will reduce this risk to acceptable levels for the end user should a flood event occur.
- 10.4 This report concludes that the site can be developed without increasing flood risk to the site itself and other sites in the vicinity and also without unacceptable residual risk of flooding, with the implementation of suitable mitigation measures.

APPENDIX A - Drawings

Site Location: 9704/001

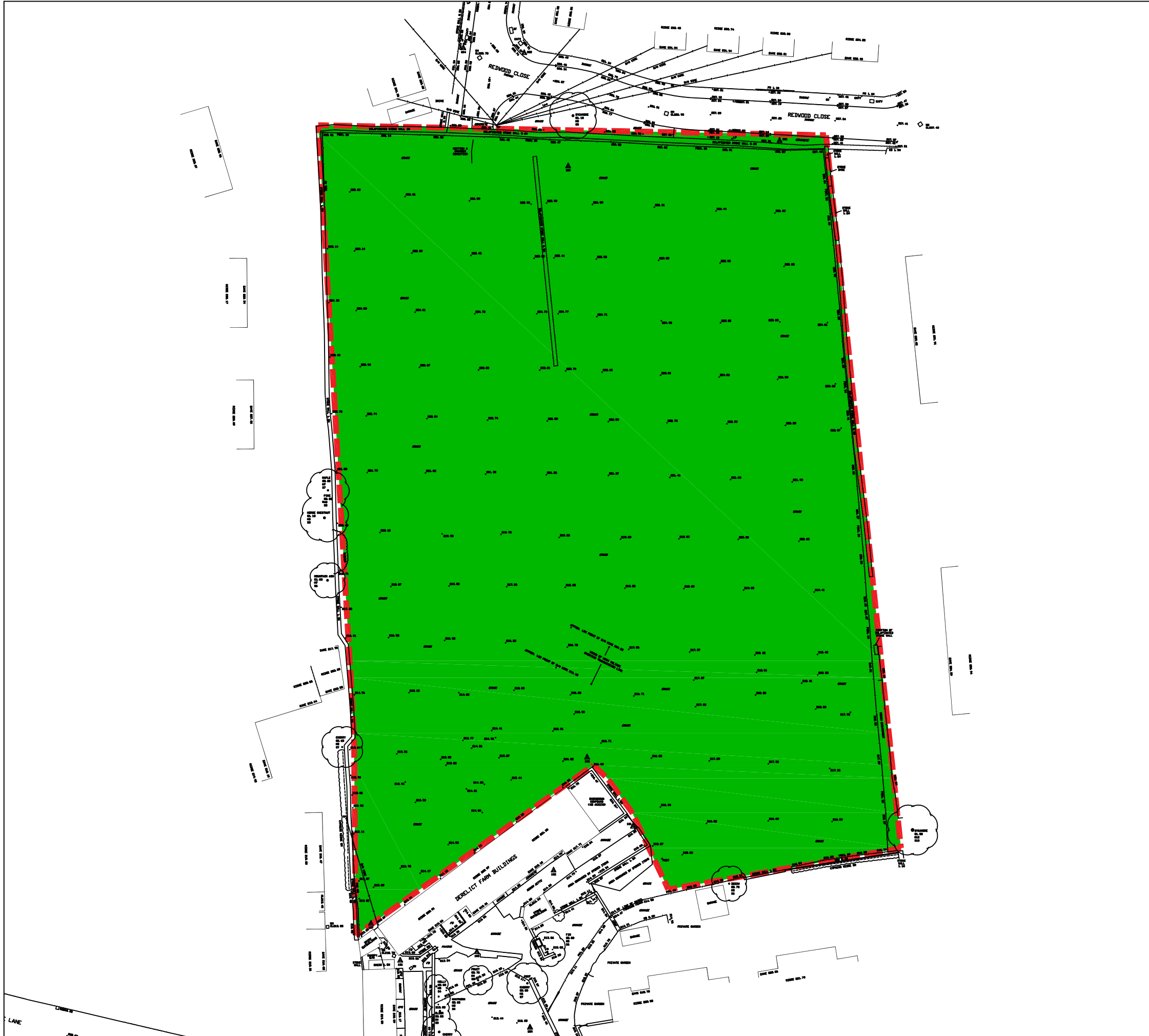
Existing Permeable and Impermeable Areas: 9704/002

Proposed Permeable and Impermeable Areas: 9704/003

Topographical Survey

Illustrative Masterplan





Notes

Impermeable Areas

<div></div>	Hardstanding	0m ²	(0%)
<div></div>	Buildings	0m ²	(0%)
	Total	0m ²	(0%)

Permeable Areas

<div></div>	Area	11,215m ²	(100%)
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Total Area 11,215m² (100%)

Rev	Amendment	Drawn	Date	Checked

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Project Name
Proposed Residential Development
Land off Redwood Close
Long Lee, Keighley

Drawing Title
Existing
Impermeable and Permeable
Areas



Scale 1:500	Drawn By DH
Drawing Size A3	Checked By TW
Date Dec 16	Approved By TW

<div><div>✓</div><div>QMS</div><div>ISO 9001</div><div>REGISTERED FIRM</div></div>	Drawing Number 9704-002	Rev
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Notes

Impermeable Areas

	Hardstanding	3,129m ²	(28%)
	Buildings	2,402m ²	(21%)
	Total	5,531m ²	(49%)

Permeable Areas

	Area	5,684m ²	(51%)
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Total Area 11,215m² (100%)

Rev	Amendment	Drawn	Date	Checked
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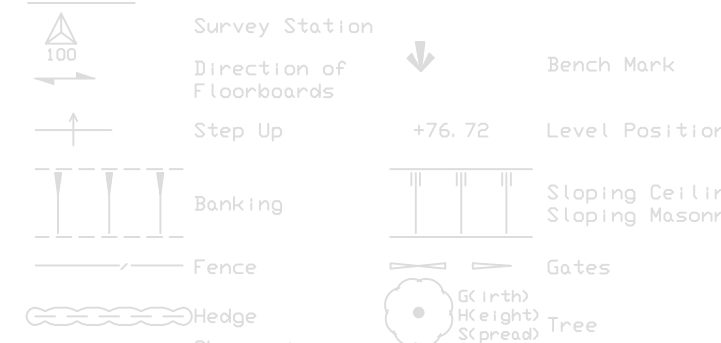
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Project Name
Proposed Residential Development
Land off Redwood Close
Long Lee, Keighley

Drawing Title
Proposed
Impermeable and Permeable
Areas

Scale 1:500	Drawn By DH
Drawing Size A3	Checked By TW
Date Dec 16	Approved By TW

	Drawing Number 9704-003	Rev
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FENCE TYPES
BW Barbed Wire
CB Close Boarded
CI Corrugated Iron
CLK Chain Link
CPG Chestnut Paling
IR Iron Railings
PR Post & Rail
PV Post & Wire
OB Open Boarded
WM Wire Mesh

ABBREVIATIONS (Where Applicable)
AGL Above Ground Level
ASL Arch Spring Level
AHL Arch Head Level
AV Air Valve
BDL Bollard
BRW Brick Wall
BRWR Brick Ret Wall
BSL Beam Soffit Level
BT British Telecom IC
CATV Cable TV
CBSL Clad Beam Soffit Lvl
CD Cable Duct
CE Clearing Eye
CIH Change in Height
CL Cover Level
CM Cable Marker
CP Catch Pit
CPS Concrete Paving Slabs
CSL Ceiling Soffit Level
D Door
DP Down Pipe
DHL Door Head Level
DSL Duct Soffit Level
ECP Elec Cable Pit
EJB Elec Junc. Box
EP Electricity Pole
ERP Earthing Point
FB Flower Bed
FCSL False Ceiling
Soffit Level
FH Fire Hydrant
FIG Feeds into Ground
FL Floor Level
G Gully
GM Gas Meter
GSC Gas Stop Cock
GV Gas Valve
H High/Height

IC Inspection Cover
IL Invert Level
KD Kerb Outlet
LL Landing Level
LP Lamp Post
MC Mercury
MH Manhole
MKR Marker
MR Metal Railings
NB Notice Board
NFI No Further Info.
D/H Overhead
FR From Records
RG Road Gully
RL Roof Level
RNB Road Name Board
RS Road Sign
RSJ Rolled Steel Joist
RW Retaining Wall
RWP Rainwater Pipe
SA Soakaway
SC Stop Cock
ST Stone
SV Stop Valve
T Trunking
TL Threshold Level
TLT Traffic Light
TP Telephone Pole
TPS Tactile Paving
UG Underground
UTL Unable To Lift
V Vent
VP Vent Pipe
W Window
WHB Wash Hand Basin
WHL Window Head Level
WSC Water Stop Cock
WSL Window Sill Level
WV Water Valve

NOTES

LEVEL DATUM OS GPS

THE ORIGIN AND ORIENTATION OF THE SURVEY GRID
ARE THOSE OF THE NATIONAL GRID.

UNDERGROUND SERVICES INFORMATION

DRAINAGE	N/A
ELECTRICITY	N/A
GAS	N/A
TELECOM	N/A
WATER	N/A

While all reasonable care has been taken in locating the underground services shown on this plan the completeness or accuracy of the information cannot be guaranteed. Users are advised to satisfy themselves before connections are made.

REV	DATE	PREV JOB NO.	REVISION DETAILS

PLANET ARCHITECTURE LTD
MILL COTTAGE
ICKORNshaw
COWLING
BD22 0BD

JOB TITLE

LAND OFF LONG LEE LANE
LONG LEE
KEIGHLEY

DRAWING TITLE

SITE SURVEY

DRAWING 2 OF 2	AUTOCAD DRAWING FILE NAME
CLIENT JOB No.	SITE.DWG
SCALE 1/200	REVISION SUFFIX
SHEET SIZE A1-841x594mm	DATE MAY 2016
SURVEYOR AL	DRAWN JM
CHECKED PHK	



STN	EASTING	NORTHING	LEVEL	DESCRIPTION
101	407206.750	440332.812	216.091	HILTI NAIL IN PEG
102	407193.109	440325.269	214.556	HILTI NAIL IN SETTS
103	407179.914	440311.247	213.671	HILTI NAIL IN PAVING
104	407189.061	440298.268	212.285	HILTI NAIL IN PEG
105	407168.632	440277.929	209.829	HILTI NAIL IN TARMAC
106	407166.737	440309.772	212.839	HILTI NAIL IN CONCRETE
107	407161.702	440316.131	212.996	HILTI NAIL IN PEG
108	407198.880	440344.707	216.706	HILTI NAIL IN PEG
109	407195.613	440446.335	226.427	HILTI NAIL IN PEG



APPENDIX B – Consultation

Yorkshire Water

Borehole Logs



YorkshireWater

Mr T Walker
Sanderson Associates (Consulting Engineers)
Ltd
Sanderson House
Jubilee Way
Grange Moor
Wakefield
West Yorkshire
WF4 4TD

Yorkshire Water Services
Developer Services
Sewerage Technical Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax: (01274) 372 834

Email:
Technical.Sewerage@yorkshirewater.co.uk

Your Ref: SAL001878N
Our Ref: S017953

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

6th December 2016

Dear Mr Walker,

Land off Redwood Close, Long Lee, Keighley - Pre-planning sewerage enquiry on R381388 - Residential

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months.

Existing Infrastructure

Please note:- due to the change in legislation on 01/10/2011 there may be public sewers within the site boundary which are not recorded on the Statutory Sewer Map the presence of which should be taken into account in the design of the scheme.

Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul water domestic waste should discharge to the 225 mm diameter public combined sewer recorded in Long Lee Lane, at a point to the south of the site.

Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

As the proposal site is currently undeveloped no surface water is known to have previously discharged to the public sewer network



YorkshireWater

As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority with a view to establishing a suitable watercourse (if any nearby for discharge).

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the WRc publication "Sewers for Adoption - a design and construction guide for developers" 6th Edition as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991. An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Developer Services Team (telephone 0345 120 84 82) for further information.


The public sewer network is for domestic sewage purposes. This generally means foul water for domestic purposes and, where a suitable surface water or combined sewer is available, surface water from the roofs of buildings together with surface water from paved areas of land appurtenant to those buildings. Land and highway drainage have no right of connection to the public sewer network. No land drainage to be connected/discharged to public sewer.

As a last resort, highway drainage may be accepted under certain circumstances. If it can be demonstrated, through satisfactory evidence, that SUDS are not a viable option, there are no watercourses or highway drains available and if capacity is available within the public sewer network, highway drainage discharges to the public sewer network may be permitted. In this event, the developer may be required to enter into a formal agreement with Yorkshire Water Services under Section 115 Water Industry Act 1991 to discharge non-domestic flows into the public sewer network.

All the above comments are based upon the information and records available at the present time. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

Chris Roberts
Sewerage Technician
Developer Services

407096 : 440227	Map Name : SE0740SW	Title	
 <p>Yorkshire Water</p>	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : YorMap Advisor C ROBERTS Contact Tel : 87 2582	Notes	
		Partial Key Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.
	(Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432	Date Req : 06/12/2016, 10:37:30 Source : Sewer Network Enquiry	Date Gen : 06/12/2016, 10:37:47



YorkshireWater

Head of Service
City of Bradford Metropolitan District Council
Planning, Transportation and Highways
Development Services
4th Floor
Britannia House
Hall Ings
Bradford
BD1 1HX

Yorkshire Water Services
Developer Services
Sewerage Technical Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
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Email:
Technical.Sewerage@yorkshirewater.co.uk

For telephone enquiries ring :
John Wellham on 0345 120 8482

Your Ref: 17/02809/MAO
Our Ref: T007040

30th May 2017

Dear Sir/Madam,

Land At Redwood Close Long Lee Keighley - Outline planning application for up to 45 dwellings and associated works with all matters reserved except for access to the site (access within site is reserved)

Thank you for consulting Yorkshire Water regarding the above proposed development. We have the following comments:

Waste Water

If planning permission is to be granted, the following conditions should be attached in order to protect the local aquatic environment and YW infrastructure:

**The site shall be developed with separate systems of drainage for foul and surface water on and off site.
(In the interest of satisfactory and sustainable drainage)**

**No development shall take place until details of the proposed means of disposal of surface water drainage, including details of any balancing works and off -site works, have been submitted to and approved by the local planning authority . The rate of discharge of surface water to surface water sewer shall not exceed 5 (five) litres per second, the point of connection to be agreed by the statutory sewerage undertaker . Furthermore, unless otherwise approved in writing by the local planning authority, there shall be no piped discharge of surface water from the development prior to the completion of the approved surface water drainage works .
(To ensure that no surface water discharges take place until proper provision has been made for its disposal)**

The Flood Risk Assessment and Drainage Impact Assessment (prepared by Sanderson Associates - Report 9704/DH/001/01 dated December 2016) is not acceptable.

Yorkshire Water accept that soakaways will not be appropriate at this site and there are no watercourses nearby. However, there is a Combined Sewer Overflow (CSO) immediately downstream of the proposed connection point, which controls the flow within the sewer. As such, the combined sewer cannot be used as the outfall point for surface water from this site as this would impact on our permitted discharge to watercourse agreed with the Environment Agency.

The surface water sewer to the North in Redwood Close should be used for the discharge of surface water. From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public surface water sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a surface water pumping station will be required to facilitate connection to the public surface water sewer network. If pumping is required, the peak pumped surface water discharge must not exceed 5 (five) litres per second.

The public sewer network is for domestic sewage purposes. This generally means foul water for domestic purposes and, where a suitable surface water or combined sewer is available, surface water from the roofs of buildings together with surface water from paved areas of land appurtenant to those buildings. Land and highway drainage have no right of connection to the public sewer network.

The developer should contact the Highway Authority with regard to acceptability of highway drainage proposals. Highway drainage, may however be accepted under certain circumstances. In this event, a formal agreement for highway drainage discharge to public sewer, in accordance with Section 115 of the Water Industry Act 1991, will be required.

Yours faithfully

Developer Services Team

LOCATION: LONG LEE LANE, KEIGHLEY

TRIAL PITS 1, 2 and 3

Method HAND EXCAVATION

British Geological Survey

Date 27.10.78

Casing

Sheet 1 of 2

R.L. m A.O.D.	DEPTH m	SOIL DESCRIPTION	SAMPLING		TEST
			No.	Depth	
		Trial pits were excavated from proposed formation level.			
		<u>TRIAL PIT 1</u> 0725 4054			SE04SE
	F.L.	F.L. 0.3m below general ground level.			
	0.3	Firm brown sandy CLAY with gravel size sandstone fragments.	B1	0-0.3	CBR R 10 BD R 1 m 2 LL 1/4 PL 1/4
		End of Trial Pit. Trial Pit dry.			
		<u>TRIAL PIT 2</u> 0718 4051			SE04SE
	F.L.	F.L. 0.1m below general ground level.			
	0.3	Firm brown sandy CLAY with gravel size sandstone fragments.	B1	0-0.3	CBR R 8 BD R 1 m 26
		End of Trial Pit. Trial Pit dry.			
		<u>TRIAL PIT 3</u> 0710 4050			SE04SE
	F.L.	F.L. 0.1m to below general ground level.			
	0.3	Firm brown very sandy CLAY with gravel size sandstone fragments.	B1	0-0.3	CBR R 13 BD R 2 m 15
		End of Trial Pit. Trial Pit dry.			

British Geological Survey

British Geological Survey

British Geological Survey

Hole No.	Date	Grd. Water	Depth	K.L.	Description of Strata
4.	6.11.73				0730 4051 SED4SE-192
			350		TOPSOIL
			1000		FIRM. YELLOW CLAY
		HOLE DRY	1450		WEATHERED GRITSTONE
5.	6.11.75				0733 4051 SED4SE-193
			150		TOPSOIL
			2340		FIRM YELLOW CLAY
		HOLE DRY	3450		FIRM DARK BLUE CLAY
					WEATHERED GRITSTONE
6.	7.11.75				0732 4050 SED4SE-194
			350		TOPSOIL
			1000		FIRM YELLOW CLAY
		HOLE DRY	1400		FIRM BROWN CLAY WITH GRITSTONE FRAGMENTS

RECORD OF TRIAL HOLES

BRADFORD METROPOLITAN DISTRICT COUNCIL
DIRECTORATE OF DEVELOPMENT SERVICES
ENGINEERING DIVISION

DRG.No. 2002/47/2

Scale

1:50

ROYD HOUSE FARM, LONG LEE, KEIGHLEY.

Prepared

D.W.F.

REV 02/10/72

British Geological Survey

British Geological Survey

British Geological Survey

Hole No.	Date	Grd. Water	Depth	R.L.	Description of Strata
7	7.11.75				0731 4048 SED4SE-195
			350		TOPSOIL AND RGN
			450		FIRM YELLOW CLAY
		HOLE DRY	1650		FIRM BROWN CLAY
8	7.11.75				0734 4048 SED4SE-196
			1350		TOPSOIL
			1600		FIRM YELLOW CLAY
		HOLE DRY	1400		FIRM YELLOW-BROWN CLAY
			1600		WEATHERED GRITSTONE
9	7.11.75				0733 4047 SED4SE-197
			300		TOPSOIL
			550		FIRM YELLOW CLAY
					FIRM GREY CLAY
		WATER IN BOTTOM	1600		WEATHERED GRITSTONE
			1800		
10	7.11.75				0731 4046 SED4SE-198
			150		TOPSOIL
					SOFT YELLOW CLAY
			900		
		HOLE DRY			FIRM YELLOW CLAY
			2200		

RECORD OF TRIAL HOLES

BRADFORD METROPOLITAN DISTRICT COUNCIL
DIRECTORATE OF DEVELOPMENT SERVICES
ENGINEERING DIVISION

DRG.No. 2002/47/3

Scale 1:50

ROYD HOUSE FARM, LONG LEE, KEIGHLEY


Prepared D.W.F.

SAP 01/10/75

APPENDIX C – WinDES Calculations

Existing Greenfield Run Off Estimate

Proposed Storage Calculations

Sanderson Associates		Page 1
Sanderson House Jubilee Way Huddersfield, WF4 4TD		
Date 15/12/2016 14:30 File	Designed by darren.hawkyard Checked by	
Micro Drainage Source Control 2016.1		

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	50.000	Urban	0.000
SAAR (mm)	1000	Region Number	Region 10

Results	l/s
QBAR Rural	333.4
QBAR Urban	333.4
Q1 year	290.1
Q1 year	290.1
Q2 years	310.5
Q5 years	396.8
Q10 years	460.1
Q20 years	524.2
Q25 years	546.8
Q30 years	565.3
Q50 years	616.8
Q100 years	693.5
Q200 years	786.8
Q250 years	816.9
Q1000 years	1013.6

Existing Greenfield Run-off

$290.1 / 50\text{ha} = 5.80\text{l/s / ha}$

$5.80 / 1.12\text{ha} = \underline{6.50\text{l/s}}$

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Variables

Results

Design

Overview 2D

Overview 3D

Vt

Quick Storage Estimate

FSR Rainfall

Return Period (years)

Region

Map

M5-60 (mm)

Ratio R

Cv (Summer)

Cv (Winter)

Impermeable Area (ha)

Maximum Allowable Discharge (l/s)

Infiltration Coefficient (m/hr)

Safety Factor

Climate Change (%)

0.750

0.840

0.550

5.0

0.00000

2.0

30

Analyse

OK

Cancel

Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Variables

Results

Design

Overview 2D

Overview 3D

Vt

Quick Storage Estimate

Results

Global Variables require approximate storage of between 261 m³ and 401 m³.

These values are estimates only and should not be used for design purposes.

Analyse

OK

Cancel

Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0