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**FLOOD RISK ASSESSMENT AND SURFACE WATER MANAGEMENT STRATEGY
FOR A PROPOSED DEVELOPMENT
AT
HUNSWORTH LANE, EAST BIERLEY**

**Prepared for
ROUSE HOMES**



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4944-FRA01	Location Plan
4944-FRA02	Flood Zone Plan
4944-FRA03	Surface Water Flood Map
4944-FRA04	Reservoir Flood Risk Plan
4944-FRA05	Aerial Photograph
4944-FRA06B	Drainage Strategy Plan

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**FLOOD RISK ASSESSMENT AND
SURFACE WATER MANAGEMENT STRATEGY REPORT
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AT
HUNSWORTH LANE, EAST BIERLEY**

1 INTRODUCTION

1.1 iD Civils Design Ltd (iDC), have been appointed by Rouse homes (RH) to prepare a Flood Risk Assessment (FRA) and surface water drainage management strategy report for the proposed residential development on land off Hunsworth Lane, East Bierley.

1.2 This Flood Risk Assessment and Surface Water Management Strategy Report accompanies a full planning application for the redevelopment of the site to provide 42 dwellings and associated infrastructure.

1.3 The report will be undertaken in accordance with Environment Agency, Kirklees Metropolitan Borough Council (KMBC) and Yorkshire Water (YW) development control policies and will focus on:

Site Use and Current Drainage regime, Flooding History, Ground Conditions and use of SUDS, Impact of development and proposed drainage strategy, pluvial flooding routes and the overall impact of development on the site and surrounds.

1.4 The report is for the sole use of RH and presents comments and conclusions based on information available at the time of writing. iD reserve the right to amend conclusions if further information is made available.

2 BACKGROUND

2.1 RH is seeking planning consent for the construction of 46 new dwellings on the site. The application area is 1.71 ha. The actual developed part of the site is 1.60 Ha.

2.2 The site is currently open greenfield arable land.

2.3 This Flood Risk Assessment has been undertaken with reference to the following reports and documents:

- Environment Agency Flood Zone Maps (EA website)
- Environment Agency Surface Water Flooding Maps (EA website)
- Calderdale Valley Strategic Flood Risk Assessment (JBA 2008)
- Kirklees MBC Development Control Standards
- National Planning Policy Framework (NPPF)
- Technical Guidance to NPPF
- Codes for Adoption
- Public Sewer Records and pre-development enquiry (Yorkshire Water)
- Proposed Site Layout
- SuDS Manual (Ciria C753)
- Topographical Survey
- Site Investigation Report (Lithos Consulting).
- Topographical Survey.

2.4 In addition, iD has reviewed commercially available information including aerial photographs and historic ordnance survey maps of the area during the preparation of the report.

2.5 **Site Walkover:** A site walkover survey was undertaken in April 2019. During the site walkover, overland flood routes onto and from the site were inspected where possible in order to assess the risk of flooding from external sources.

3 REGULATORY GUIDANCE

- 3.1 National Planning Policy Framework (NPPF), along with the Technical Guidance to NPPF provides the regulatory framework and guidance for planning authorities in relation to Flood Issues for new developments. Any application submitted to a local planning authority will be considered in conjunction with this guidance and local development control policies, and dependant on the nature and location of the application, the planning authority may request a Flood Risk Assessment as part of the planning application submission.
- 3.2 The Environment Agency is a statutory consultee to the Planning Authority in relation to flood risk issues. The EA often delegates responsibility for applications which do not affect major rivers to the Lead Local Flood Authority.
- 3.3 KMBC is the Lead Local Flood Authority (LLFA), and has their own internal Flood Management/Drainage Department who advise on drainage issues and work with the EA on strategic issues within the area.
- 3.4 The Environment Agency has, in April 2015, provided guidance for local planning authorities regarding the relevant consultees to the planning process in terms of flood risk. In summary, this advises that the *Lead Local Flood Authority should be consulted for major developments in all flood zones, with the Environment Agency also consulted if the development is within 20 metres of a main river. If the site is more distant to a main river then the Environment Agency should only be consulted for Flood Zone 2 and 3 developments*, with the exception of water compatible developments in Flood Zone 2 where consultation is not needed. As this site is greater than 20m from a main river the EA have not been consulted directly, although EA flood risk and surface water flooding plans have been reviewed.
- 3.5 The Environment Agency have undertaken a national study of flood risk across England and published flood maps covering the country. The maps can be viewed on the agency web site at www.gov.uk/government/organisations/environment-agency. Specific locations can be studied by searching either using postcode or address.
- 3.6 The EA flood maps identify 3 zones.

Flood Zone 1: This zone comprises land with a less than 1 in 1000 annual probability of river or sea flooding in any one year (<0.1%)

Flood Zone 2: This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-0.1%) in any year. This flood zone is denoted by light blue shading on the EA flood zone maps.

Flood Zone 3: The zone comprises land assessed as having a 1 in 100 year or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. This flood zone is denoted by dark blue shading on the EA flood zone maps.

- 3.7 Flood risk should be assessed from the following sources;
- Tidal and river
 - Surface water overland flow
 - Groundwater
 - Sewers (Pluvial Flooding)
 - Artificial sources e.g. canals, reservoirs, water mains.
- 3.8 Flood zone plans reflect the undefended flood scenario for a particular area. Many flood areas are defended with flood defences of varying types and design life. Areas benefiting from flood protection are shown hatched on the EA plans. The EA have also published additional flood risk mapping, the Risk of Flooding from Rivers and the Sea, which shows the defended scenario.
- 3.9 The EA has published a series of Surface Water Flood Maps which demonstrate overland flood routes on the basis of a 100-year storm event assuming that the natural drainage system is blocked or at capacity (pluvial flooding). Whilst this premise may have a low risk of occurrence, the plans assist designers in identifying areas at risk so that the necessary flood mitigation measures can be designed to produce a safe development. The surface water flood maps detail anticipated flood depths and velocity.
- 3.10 The level of detail and complexity of a Flood Risk Assessment can vary considerably, dependant on the scale, nature and location of the planned development. EA guidance sets out the criteria for the level of information which should be included within the FRA.
- 3.11 The development site is shown to lie within Flood Zone 1 on the Environment Agency's Flood Map for Planning and on the Risk of Flooding from Rivers and the Sea plan. A copy of this plan is included as drawing 4944-FRA02.
- 3.12 The Planning Practice Guidance to the NPPF refers to vulnerability classifications, which are based on the sensitivity of different forms of development. In accordance with the guidance (Table 2) the residential end use planned for this development is classed as '*More Vulnerable*'.

- 3.13 Table 3 in the NPPF technical guidance provides information in relation to the appropriate vulnerability classes within each of the flood risk zones. The table is presented below:

Table 4944.1 – Flood Risk Vulnerability and Flood Zone compatibility

Flood Risk Vulnerability Classification (Table 2 NPPF)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test Required	✓	✓
Zone 3a	Exception Test Required	✓	x	Exception Test Required	✓
Zone 3b	Exception Test Required	✓	x	x	x

- 3.14 Based on the above table it can be seen that the intended use of the development is consistent with NPPF guidance and appropriate for its intended use from a flood zone perspective.
- 3.15 **The Sequential Test:** In accordance with NPPF, LPA's allocating land for development should apply the Sequential Test, to demonstrate that there are no available sites in the area with a lower risk of flooding. As the site is in Flood Zone 1 a Sequential Test is not needed.
- 3.16 **The Exception Test:** The exception test is relevant if, following the application of the sequential test; it is not possible for the development to be allocated in zones of lower probability of flooding. The test provides a method of managing flood risk while still allowing necessary development to occur. The development is within Flood Zone 1; thus, the Exception Test will not be required.
- 3.17 Yorkshire Water work within the framework of 'Sewers for Adoption' (SFA), which sets the standard for adoptable surface water and foul water sewers. They also apply development control standards which are consistent with current best practice and Building Regulations. Yorkshire Water is currently working to Code for Adoption (April 2020).

- 3.18 Developers are encouraged to make 'pre-development' enquiries to Yorkshire Water to ensure that there is sufficient time for the company to fully assess the capacity of their network and treatment works. This process also ensures that drainage strategies are acceptable in principle, prior to planning permission and helps avoid any objections from Yorkshire Water during the planning process. iDC submitted a pre-development enquiry to YW with regards to the development, a copy of which is enclosed in appendix E.
- 3.19 KMBC, as Lead Local Flood Authority, is a statutory consultee to the Local Planning Authority regarding SuDS matters on major developments. IDC liaised with the LLFA in February 2019 and a copy of their response is included in appendix C. The LLFA also provided planning consultation response to the original FRA submitted with this application prior to the layout changes. Points raised in that response are addressed in this revised FRA report.
- 3.20 KMBC do not adopt SuDS features. Consideration of the type of SuDS features that can be reasonably incorporated into this site has been undertaken and is covered later in this report.
- 3.21 KMBC have minimum development drainage standards that need to be met as part of development proposals.

4 SITE DESCRIPTION AND HISTORY

- 4.1 A site location plan is included as Drawing No. 4944-FRA01. Site details are summarised in the Table below.

Table 4944.2 - Site Location Summary

Detail	Remarks
Location	East of Hunsworth Lane and south of Soureby Cross Way, BD4 6PY
NGR	SE 197,288
Area	Application Area – 1.71 ha, Development Area – 1.60 ha.
Current Use	Arable farmland.

- 4.2 **Topography:** The site is rectangular in shape comprising a single field with fenced/hedgerow boundaries. There is an existing public park to the west separating the site from Hunsworth Lane. There is existing housing to the north and south west and open fields to the east with the sports club beyond to the south of the field.
- 4.3 The site generally slopes moderately steeply from north to south. The northern boundary slopes sharply away from Soureby Cross Way. The highest part of the site is in the north at 208.50m AOD. The lowest part of the site is the south eastern corner at 197.90m AOD. Average gradient across the site is 1 in 25
- 4.4 Within the southern edge of the site there is an access track/footpath which provides access to the sports club to the south direct from Hunsworth Lane to the west. The track climbs steeply from Hunsworth Lane to the edge of the site then drops away to the south of the site. This access track is to be upgraded to form the site access with an adoptable standard highway.
- 4.5 **Existing Hardstanding:** There are no areas of hardstanding within the main site. The section of existing access track which is in the south of the site is surfaced and will drain into the culvert via the road gully system in Hunsworth Lane. This area which currently drains to the site is approx. 310m².
- 4.6 **Hydrology:** Ordnance Survey mapping does not show any watercourses through the site. The nearest watercourse is a culverted watercourse which runs along Hunsworth Lane flowing southwards approximately 25m to the west of the site. This watercourse is 225mm diameter, based on information from the LLFA. Lodge Beck is the nearest open watercourse which is c.200m to the south of the site.
- 4.7 The site is not in a source protection zone.
- 4.8 There is a single abstraction borehole within 1km of the site.
- 4.9 **Groundwater:** 12 Trial pits and 7 window sample boreholes were installed across the site. The window sample holes were monitored for gas and groundwater. Trial pits in the north of the site recorded seepage at depths of between 0.5m and 1.5m. Window sample boreholes recorded groundwater table depths of between 0.5m and 1.74m. Based on these results groundwater appears relatively shallow.
- 4.10 **Existing Drainage:** A review of YW records reveals that there are no public sewers through the site. Details of the public sewers in the area are summarised in section 5.
- 4.11 It should be noted that the YW records may not accurately show all drainage in the area, as substantial parts of the system may not be mapped. A copy of the drainage records is attached as appendix B.
- 4.12 **Ground Conditions:** The site ground investigation report by Lithos Geo environmental indicates that the site is overlain by typically 300mm depth of topsoil over cohesive residual strata of clay and gravelly clay to depths of 0.9m to 2.3m. Gravels were recorded in 10 pits below the cohesive soils with weak thinly bedded siltstone below.

4.13 **Site History:** The site is greenfield with no previous substantial development.

5 EXISTING SITE DRAINAGE

5.1 iD has obtained a copy of Yorkshire Water's Sewerage Record plans for the area. A summary of sewers within and adjacent to the site is presented below, and a copy of the sewer record is included within Appendix B:

Table 4944.3 – Existing Drainage

Drainage	Description
Surface Water Sewer	Yorkshire Water records indicate that there are no surface water sewers crossing the site. There is a surface water sewer system to the north which discharges to the culvert in Hunsworth Lane. There is also a surface water system to the west in Hurstville Avenue which discharges to the same culvert.
Foul Water Sewer	There are no foul water sewers crossing the site. The nearest foul water sewer is to the north and this system discharges to the combined sewer in Hunsworth Lane. There is also a short foul system to the west discharging to the same combined sewer.
Combined Water	There are no combined sewers passing through the site. There is a combined sewer running within Hunsworth Lane to the west of the site flowing south. This system is 225mm in diameter.
Highway Drainage	iDC has no records of any highway drainage in the area. It is considered likely that the highway drains to the culverted watercourse along Hunsworth Lane.
Land Drainage	During the walkover, there were no signs of land drainage on site.
Watercourses/Culverts	As described above there is a of culverted watercourse within Hunsworth Lane draining south. This watercourse is 225mm diameter.

- 5.2 The joint Environment Agency and DEFRA R&D Technical Report W5-074/A/TR/1 'Preliminary Rainfall Runoff Management for Developments' reviews the methodologies for the derivation of greenfield runoff from development sites. The report recommends (Table 9.1) that for catchments of less than 50ha the methodology set out in the Institute of Hydrology Report 124 should be followed, with greenfield rates for small sites based on a 50ha area with linear interpolation to the site size.
- 5.3 A review of the greenfield runoff from the site has been undertaken which only considers the actual net developed area i.e. excludes areas to remain open space or tree belts. The net developed area is 1.60 ha. The rate of surface water runoff based on the Institute of Hydrology Report 124 and an area of 1.60 Ha is shown on the table below.

Table 4944.4 – Greenfield Runoff to IOH124

Return Period	Flow Rate (litres/second)
Q _{bar}	8.96
30 years	15.69
100 years	18.65

- 5.4 The existing access track drains to Hunsworth Lane overland and in the Q_{bar} event will generate approximately 4 l/s runoff which will flow to the surface water culvert via the road drainage system. The total Q_{bar} rate of discharge for the site, allowing greenfield and brownfield components is 12.96 l/s.
- 5.5 KMBC land drainage section have been contacted and they have confirmed that they apply a 5 l/s greenfield rate across the whole borough. This rate is very close, but slightly less than the rate derived from IOH124 for the total site.
- 5.6 Due to the small diameter of the culvert in Hunsworth Lane, the LLFA has requested that the site is limited to the lowest discharge rate practical for the adoption of the sewers, ideally 3 l/s for the 1 in 30-year storm and 5 l/s for the 1 in 100-year storm. As flood risk increases with higher storm intensities, the higher allowable rate for the most significant storm is not fully understood, however as part of the strategy we have provided the lowest rate for all storms that would be adoptable under Yorkshire Waters requirements for hydro brake design given a design head of 2.2m. This rate is 3.7 l/s and the reasons for this rate area explained later in this report.

6 PROPOSED DEVELOPMENT

- 6.1 It is proposed that the site is developed to provide 46 dwellings. The site has a single access point from Hunsworth Lane in the south with a cul de sac arrangement serving the site. The proposed access is an upgrade of the existing access to the adjacent sports field.
- 6.2 A detailed assessment of the catchment area is beyond the scope of this report and may well change through the planning process, however a catchment area of 1.0 Ha has been estimated from the layout proposed and has been used for the derivation of storage volumes at this stage.
- 6.3 The new highways within site will be offered for adoption under a section 38 agreement with the highway authority (KMBC).
- 6.4 Foul and surface water sewers within the development, including the tank storage in the south of the site, will be adopted by Yorkshire Water under a section 104 agreement on completion.

7 FLOOD HISTORY, SITE VULNERABILITY AND CLIMATE CHANGE

- 7.1 Flooding can occur from a variety of sources, including tidal, rivers, watercourses, overland run-off, sewers and culverts. NPPF and KMBC guidance requires flood risk from all sources to be evaluated and suitable mitigation provided where required.
- 7.2 Environment Agency mapping shows that the site is located within Flood Zone 1 and the 'risk of flooding from surface water' plans, which map likely overland flow routes, shows that the site has a low risk of surface water flooding. Flood maps are included in this report and the risks associated are discussed in detail below.
- 7.3 The Strategic Flood Risk Assessment does not identify the site as a flood risk area or a critical drainage area.
- 7.4 iDC has liaised with KMBC who are the Lead Local flood Authority to ascertain the historical flood setting of the site. A copy of the initial pre-development information provided by the LLFA is included in appendix C. KMBC have confirmed that they have no record of the site flooding, however that doesn't mean that the site has never flooded as reports tend to concentrate on roads and dwellings.
- 7.5 **Climate Change:** NPPF provides guidance with respect to the implications of climate change and suggests appropriate additional allowances for climate change with respect to rainfall intensities.

- 7.6 Subsequent to the NPPF the Environment Agency have, in February 2016, provided updated guidance on climate change allowance. In terms of peak river flow this guidance varies by river basin district and provides central, higher central and upper end allowances based on the 50th, 70th and 90th percentiles respectively.
- 7.7 Liaison with KMBC confirms that the authority adopts a climate change factor of 30% for new developments of this type where storage is provided below ground. EA guidance in terms of peak river flows is not relevant to this application as it is not adjacent to a main river.

8 FLOOD IMPACT AND MITIGATION MEASURES

- 8.1 NPPF guidance requires the risk from a range of potential sources to be evaluated. The range of flood sources identified in NPPF is reviewed below:

- 8.2 **Flood Risk from Rivers/Watercourses or the Sea – Fluvial Flooding:** Environment Agency mapping shows that the site is located within Flood Zone 1 and there is no known history of fluvial flooding on the site given its remoteness from rivers.

Mitigation: None required.

- 8.3 **Flooding from Overland Surface Water:** The Environment Agency's risk of flooding from surface water plans shows no surface water flooding through the site or crossing the boundaries of the site. There is low risk (1 in 100 to 1 in 1000 year) flooding along Hunsworth Lane to the west, however this area is below the site level so will have no effect.

Mitigation: None required.

- 8.4 **Flooding from Sewers:** Yorkshire Water record plans show that there are no sewers crossing the site, therefore there is no risk of flooding within the site. Flooding from combined sewers within Hunsworth Lane is low risk due to the relative levels of Hunsworth Lane to the site.

Mitigation: None required.

- 8.5 **Flooding from Culverts:** The presence of a culvert in Hunsworth Lane does not pose a risk to the site due to the relative levels.

Mitigation: None required.

- 8.6 **Artificial or Other Sources:** Environment Agency mapping shows that the site is not at risk from reservoir flooding. There is a water main across the northern boundary of the site which may pose a risk due to leakage or burst.

Mitigation: Given the main is part of the YW water supply network and is subject to their operational maintenance standards the risk of leakage or burst is considered low, however careful design of the plot to the north is required to ensure that any water from this main is directed away from the northern most dwellings and down a safe exceedance route.

Groundwater: As discussed previously the groundwater table has been located approximately 0.5m to 1.5m below the site. OS plans and the site walkover do not indicate any sign of water issues from the ground so the site should not be at risk of springs appearing.

Mitigation: Modern building regulations precautions which include setting floor levels 150mm above surrounding paths is considered sufficient mitigation. In addition to this factor the site will be covered by an extensive new drainage network which will act to inhibit water rising to ground due to the drainage pathways created.

9 SUDS

- 9.1 Building Regulations (Part H), the National Planning Policy Framework, Yorkshire Water and KMBC development control policies and Environment Agency advice notes, require the consideration of sustainable drainage techniques for new developments.
- 9.2 Surface Water drainage should be considered in accordance with a prescribed hierarchy aimed at minimising the impact of development. Surface Water flows should be designed to discharge to:

1. Infiltration based or sustainable drainage systems
2. Watercourses
3. Surface water Sewers
4. Combined water sewers

Guidance on SUDS techniques can be found in the SUDS Manual (Ciria 2015). There are various forms of technique available as summarised below:

Table 4944.5 – Forms of SuDS Drainage

Technique	Description
Trenches	Shallow excavations filled with rubble or stone that create temporary storage and either filter into the ground or convey water to an outlet. Known as 'French drains'

Technique	Description
Swales	Shallow linear vegetated drain ditches which can either convey flows to an outlet or infiltrate via a granular sub base to the sub strata.
Pervious Pavements	Material which allows water to permeate into underlying sub strata – best utilised on flat sites with permeable sub strata. Permeable paving can be used on clay sub strata but will require a piped drainage outlet from the sub base to a positive system.
Geocellular Systems/Tank systems	Modular plastic geocellular systems which have a high void ratio and allow water to be storage below ground. Large diameter pipework or purpose designed tanks to allow below ground storage.
Infiltration Basins	Vegetated depressions which allow water storage and slow infiltration into the ground.
Detention Basins	Surface water storage basins which remain dry when not in use and allow flood water to collect and discharge to a design flow rate.
Ponds	Ponds can provide both attenuation and treatment, together with landscape and ecology value. Run off from storms is attenuated in an upper level above ambient pond depth.

- 9.3 The use of SUDS techniques is designed to mitigate the impact of development on receiving watercourses or sewers by mimicking pre-development conditions as far as possible. New development should not worsen flooding downstream and should attempt to improve flooding wherever practical.
- 9.4 Sustainable Drainage can take many forms dependant on site use, ground conditions and topography. In terms of the hierarchy of sustainable options, infiltration-based systems should be considered in the first instance i.e. soakaways/infiltration swales/basins etc. The use of infiltration systems will be subject to the infiltration characteristics of the natural ground below the site and any environmental constraints which may apply i.e. sensitivity of the groundwater or risk of increasing water flow through the ground.
- 9.5 In areas with cohesive or mixed sub soils (such as this development), it is unlikely that sufficient percolation can be provided to allow the implementation of infiltration techniques.

- 9.6 Sustainable Drainage in areas of cohesive sub soils can be provided by a range of flow attenuation devices to suit the site constraints, policies of adopting authorities and planning authority requirements. Attenuation ponds and swales can provide ecological benefits by the creation of wetland habitats and also improve the quality of water by adding a treatment element to the drainage process.
- 9.7 Site constraints, both topographical and financial can influence the provision of SUDS, particularly measures to enhance water treatment. The steep topographical and downstream historical record of flooding has been factored into our assessment of the SUDS measures which are able to be included in the final drainage design.
- 9.8 An assessment of the available SUDS source control, pre-treatment and components mentioned in the SUDS Manual has been completed and is summarised in the table below:

Table 4944.6 – Site Specific SuDS Consideration

Source Control Feature	Included Y/N	Comment
Green Roof	N	Not appropriate to the form of development which is traditional steep pitched roofs. Householders or landlords do not have the appropriate specialist knowledge to maintain this form of roof covering.
Soakaways	N	The site investigation has proven the site to be underlain by stiff clays and mudstone bedrock which are unsuitable for infiltration drainage.
Water Butts	Y	Water butts promote the re-use of water for non-potable use, however do not add significantly to volume control in significant storm events where the butt rapidly reaches capacity.
Rainwater Harvesting	N	High capital cost and high maintenance and running costs make this form of SuDS inappropriate for this development. The development can be served by new water mains so there is not restriction to supply in this area. Harvesting tanks need to be on an individual property basis therefore it is unlikely that householders will be sufficiently aware of their ongoing maintenance obligations and it is considered that in the long terms they will be less effective.
Pre-Treatment Feature		
Silt Traps/Sumps	Y	Plot drainage, driveway drainage and adoptable road drainage will feature trapped gullies and sumps which will collect silts and sediments as a pre-treatment feature. Householders will need to maintain the system within their

		property curtilage.
Vortex Separator	N	The form of development is low risk and there is no requirement under EA Pollution Prevention Guidance to install such features on a plot basis. Separators would not be adopted by any of the regulators or water authority.
Filtration System	N	The form of development is low risk and there is no requirement under EA Pollution Prevention Guidance to install such features on a plot basis. Filtration systems would not be adopted by any of the regulators or water authority.
Oil Separators	N	The form of development is low risk and there is no requirement under EA Pollution Prevention Guidance to install such features on a plot basis. Separators would not be adopted by any of the regulators or water authority.
SuDS Component		
Filter Strips	N	Not appropriate to the form of development and layout as these systems deal with sheet runoff and require large areas to accommodate. Mainly used for car parking and large hardstanding areas.
Trenches	N	Not appropriate in a residential setting. Their use would be limited as runoff from driveways tends to be towards the footway or plot and gravel filled trenches could not be accommodated in these locations. Not appropriate for adopted estate roads.
Swales	N	Not appropriate for the housing or roads within the development due to the number of drive crossing points, site gradients and spatial impacts.
Bio retention	N	Unsuitable for this form of residential layout. There are very few opportunities within the layout to create this form of SuDS component.
Permeable Paving	N	Predominantly used where soils can infiltrate to the groundwater. Infiltration systems are not appropriate for use on the site due to ground conditions. In addition, given the topography of the site, a large percentage of driveways will be laid to falls (1:12-1:20). Permeable paving should be used on areas with shallow gradients to allow adequate infiltration down the jointing in the paving. KMBC highways do not adopt permeable paved roads.
Geocellular Systems	N	These types of systems are not adoptable by the water authority or LLFA and are therefore not suitable for use on the adoptable elements of the drainage infrastructure.
Infiltration Basin	N	Ground conditions not suitable for the use of infiltration basins.
Detention Basin	N	Detention basins are features that can be offered for adoption to Yorkshire Water. Basins cannot be efficiently

		used on steeply sloping areas due to the maximum batter slope requirements and the maximum water depths which results in the basins being a significant size with significant earthworks.
Ponds	N	KMBC or YW do not adopt ponds. Ponds cannot be efficiently used on steeply sloping areas due to the maximum batter slope requirements and the maximum depths which results in the ponds being a significant size when draining sites of this size.
Wetlands	N	KMBC do not adopt wetlands. This site is steeply sloping and therefore unsuitable for a wetland area.
Tanks/Oversized Pipes	Y	Can be adopted as part of the Yorkshire Water Section 104 network and Yorkshire Water will therefore maintain in perpetuity. Significant storage volume can be achieved in relatively small areas. Given the sites topography and the space available in the south, storage via an adoptable tank system is considered to be appropriate for the majority of the site.

10 PROPOSED DRAINAGE STRATEGY

- 10.1 The development will require new drainage system designed to suit the final approved layout, and in compliance with current Building Regulations and Sewers for Adoption.
- 10.2 A predevelopment enquiry was submitted to Yorkshire Water to ascertain suitable points of discharge and rates for foul and surface water drainage. Yorkshire Water made the following comments with regards to the drainage of the site;

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

'Foul domestic waste should discharge to the 225mm diameter public combined sewer recorded in Hunsworth Lane to the west of the site.'

'It is understood that a culverted watercourse is located in Hunsworth lane, at a point to the south west of the site. This appears to be the obvious place for surface water disposal.'

- 10.3 Following a review of the above and available surface water options in line with the SUDS hierarchy we can confirm below:

FOUL WATER

- 10.4 Yorkshire Water has confirmed that foul water flows from the development can be discharged to the combined sewer network in Hunsworth Lane. The site can be designed to connect to this point via a gravity system.

SURFACE WATER

- 10.5 In accordance with the hierarchy contained within Part H of the building regulations, NPPF and the SuDS guidance, the surface water strategy should be considered in order of the sustainable hierarchy. The hierarchy and ability of the site to support the particular elements of the hierarchy are discussed below:
- 10.6 **Discharge to infiltration drainage/soakaway:** The ability of any development to discharge to infiltration drainage is wholly reliant on the ground conditions across the site. The site investigation report confirms that five soakaway tests were undertaken via trial pits within the site. All five tests failed to derive a rate suitable for soakaways to be effective as a means of drainage.
- 10.7 **Discharge to Watercourse:** There is a culverted watercourse in Hunsworth Lane to the south west which is suitable for the disposal of surface water from the site. The principle of connection has been discussed with the LLFA and due to the small size of the culvert they have requested a rate of 3 l/s for the 1 in 30-year storm intensity and 5 l/s for the 1 in 100-year storm intensity.
- 10.8 **Discharge to a Surface Water Sewer:** There are no surface water sewers in the area that could be used for connection of surface water from the development.
- 10.9 **Discharge to Combined Sewer:** As a connection to the culverted watercourse is available, under the SUDS hierarchy a connection to combined sewer is not desirable.

STRATEGY OUTLINE

- 10.10 It is proposed that surface water drainage is connected to the culverted watercourse in Hunsworth Lane to the south west of the site. Given the small diameter of the culvert the discharge rate will be restricted to the lowest possible rate for adoption of the site network, with a design head of 2.2m and an orifice diameter of 75mm. The minimum rate is 3.7 l/s.
- 10.11 **Discharge Rate:** The LLFA have requested a rate of 3.0 l/s for the 1 in 30-year intensity and 5.0 l/s for the 1 in 100-year intensity. Provision of rates for different storm intensities could be provided by a complex arrangement of two hydro brakes where the second hydro brake triggers as water levels exceed the 1 in 30-year storage level, however this is very unusual, and it is normal for a single hydro brake to control flows. Yorkshire Water have a minimum clear orifice dimension requirement of 75mm for adoptable hydro brakes, and the lowest rate that can be achieved with a tank head of 2.2m would be 3.7 l/s.

- 10.12 The LLFA stated that a rate of 5 l/s can be utilised at the 1 in 100-year storm event. By using a single flow control as suggested the rate at that peak event is below that suggested by the LLFA therefore downstream areas are further protected.

Table 4944.7 – Summary

Catchment No	Developed Area (Ha)	Drained Area (Ha)	Discharge Rate (l/s)	Volume Required @1:30 year event (m ³)	Volume Required @1:100-year event + 30% cc (m ³)
site	1.71	1.00	3.7	372	707

- 10.13 **Network Design Parameters:** Yorkshire Water and KMBC require that the sewer network is designed so as not to surcharge in the 1 in 2-year storm event and not to flood in the 30-year event. Surface Water from the 100-year event plus climate change should be retained on site and not pose a flood risk to any existing or new dwellings.
- 10.14 **Form of storage:** Given the site layout and road pattern plus the adoption policy of Kirklees highways who will not allow pipe sizes above 900mm within the carriageway, no significant storage can be provided below the highway. Storage will therefore be provided by a pre-cast concrete tank system below the open space in the southern part of the site. A 900mm pipe storage system can be provided under the access road to a hydro brake at the site entrance. The combined volume of storage in the tank and the pipe will provide sufficient to meet the design criteria.
- 10.15 The design of the tank will require approval from YW as part of the section 104 process. Access to the hydro brake is readily available in the adopted highway.
- 10.16 **Exceedance Route:** A safe exceedance route for flows exceeding the 100-year event should be provided through the site in the event of the system being overwhelmed or blockage of gullies. Exceedance routes provided have been illustrated on the drainage strategy plan attached. These routes can be achieved via careful highway design.
- 10.17 The exceedance flows from the main site will be channelled down the road within the site and down through the access to Hunsworth Lane. Flows in excess of the design capacity of the storage tank will escape from the lowest cover, which is the hydro brake chamber adjacent to Hunsworth Lane.
- 10.18 **Maintenance of the drainage system:** All sewers and the storage tank will be adopted by YW under a section 104 agreement. Prior to adoption the developer will manage and maintain all sewers.

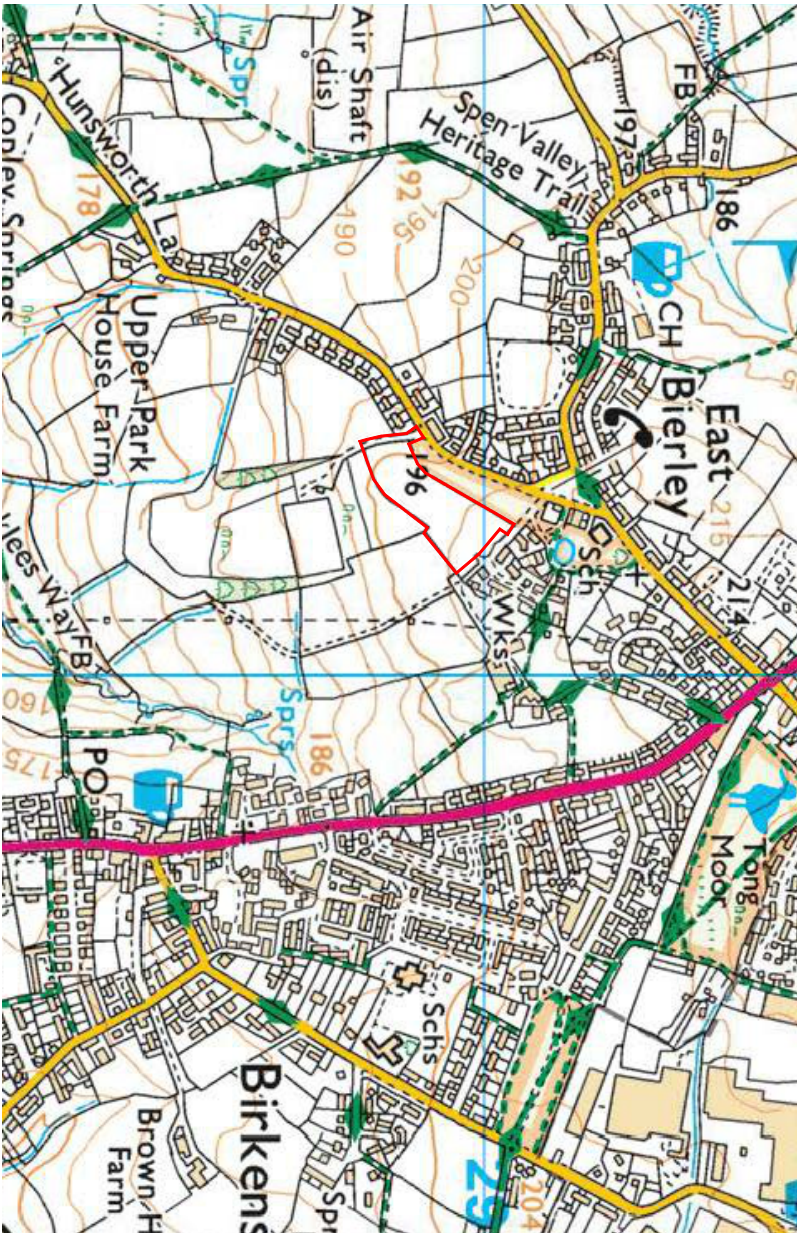
11 IMPACT OF DEVELOPMENT AND RESIDUAL RISK

- 11.1 A detailed Flood Risk Assessment and outline drainage management plan has been undertaken with respect to the planned development on land at Hunsworth Lane, East Bierley.
- 11.2 The FRA has been undertaken in accordance with Environment Agency, Yorkshire Water and Kirklees Metropolitan Borough Council development control guidance, and considers the setting of the development and likely impact on surrounding areas. A surface water and foul water drainage strategy has been outlined in the report.
- 11.3 It has been established that the site is located within fluvial Flood Zone 1 and there is no significant risk of surface water flooding on the site. Flood risks identified have been mitigated and following mitigation the residual risk is considered low.
- 11.4 The assessment has identified the current site drainage characteristics and also established the current level of risk from flooding. A summary of the risks and mitigation identified is presented below:

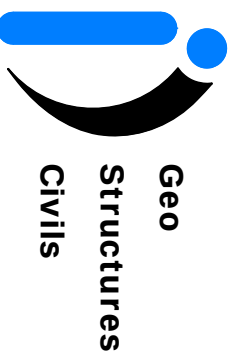
Table 4944.9 - Summary of Main Issues

Issue	Summary	Residual Risk
Flood Zone	The development area of the site is located within Flood Zone 1. The proposed development is compatible to the flood setting.	Low
Fluvial Flooding	The development is not located in an area at risk of fluvial flooding and there is no tidal flood risk.	Low
Pluvial Flooding	Environment Agency mapping shows that there is low risk of surface water flooding on the site.	Low
Artificial Sources	No flood risk from reservoirs. Low risk from existing water main which should be designed out by careful external works design to create flood routing.	Low
Groundwater	Shallow groundwater but no significant risk subject to floor levels being 150mm above surrounding paths.	Low
Surface Water Management	The use of soakaways for this development is considered unfeasible due to the underlying ground conditions. A positive piped system is therefore recommended as the most practical and feasible option. The site will be drained to the adjacent culverted watercourse to the south west. At a maximum rate of 3.7 l/s, as agreed with the LLFA.	Low

Plans



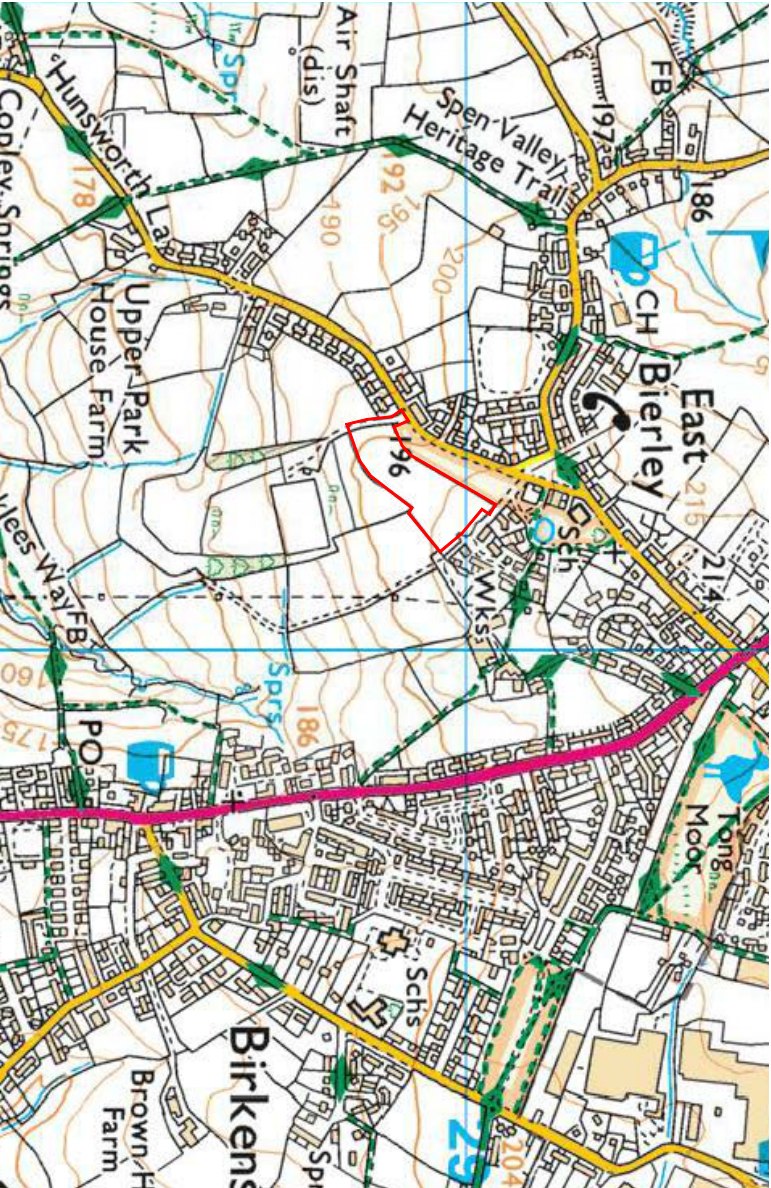
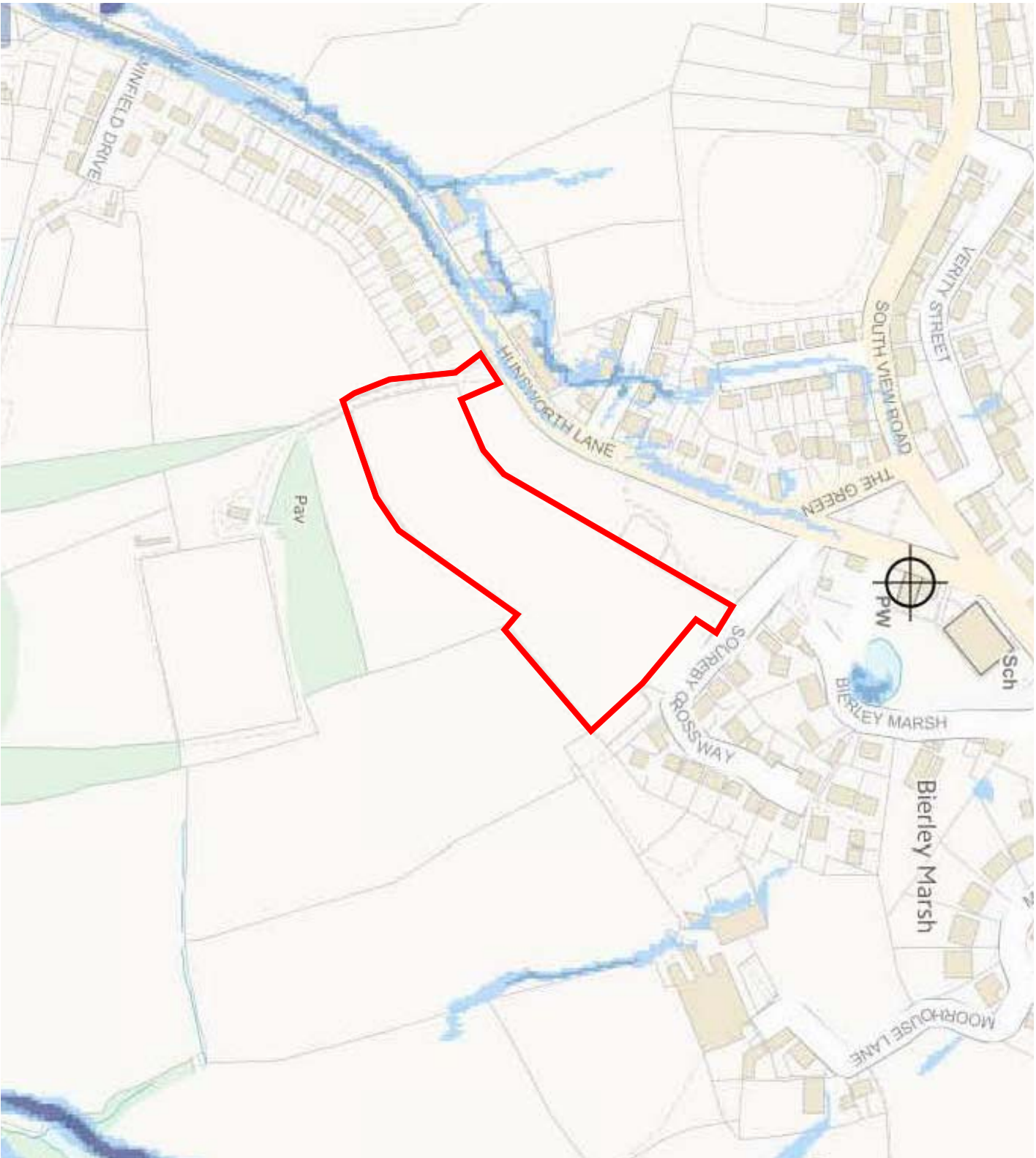
Site Area : 1.71 Ha
Postcode: BD4 6PY
OS Ref: SE 197 288
OS Co Ords: 419718 428890



Geo Structures
Civils
North East & Yorkshire:
Aske Stables, Aske, Richmond,
North Yorkshire, DL10 5HG
T: 01748 889015
F: 01565 740263
North West & Midlands:
Caledonian House,
Tatton Street, Knutsford,
Cheshire, WA16 6AG
T: 01565 755557
F: 01565 740263
ID Civils Design
Consulting Engineers

A	Boundary Update	DL	07.10.20
Rev	Description	By	Date
Scale			
NTS @ A3		Feb 2019	

Client:		Drawing Title:	
Rouse Homes		Location Plan	
Project Title:		Drawing No	
East Bierley		Revision	Status
		4944-FRA-01	A
			Final



Flood risk





Geo

Structures

Civils

North East & Yorkshire:

Aske Stables, Aske, Richmond,

North Yorkshire, DL10 5HG

01748 889015

01565 740263

North West & Midlands:

Caledonian House,

Tatton Street, Knutsford,

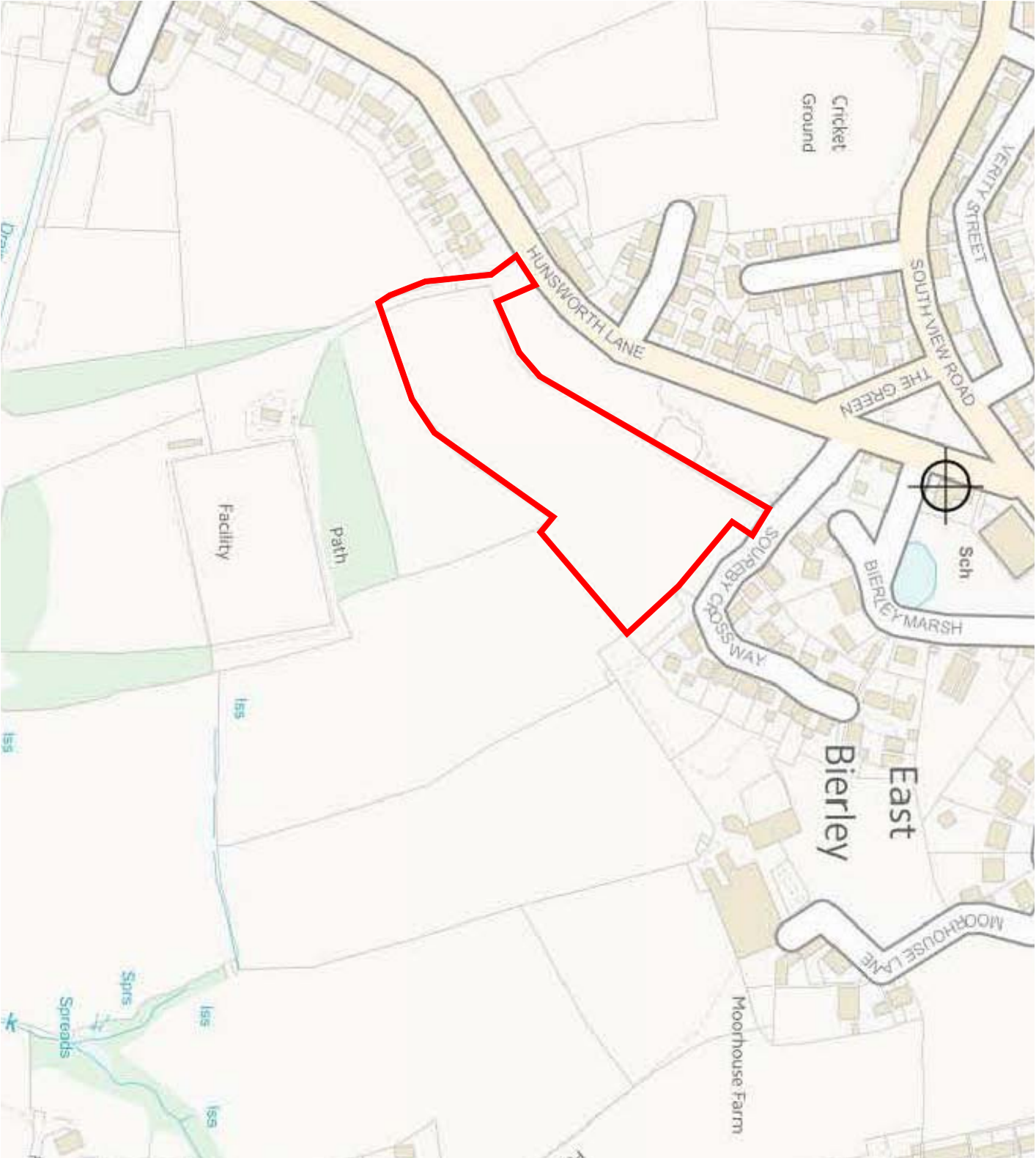
Cheshire, WA16 6AG

01565 755557

01565 740263

A	Boundary Update	DL	07.10.20
Rev	Description	By	Date
Scale			
NTS @ A3		Feb 2019	

Client:		Drawing Title:	
Rouse Homes		Surface Water Flood Risk Plan	
Project Title:		Drawing No	
East Bierley		Revision	Status
		4944-FRA-03	A Final



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A	Boundary Update	DL	07.10.20
Rev	Description	By	Date
Scale			
NTS @ A3		Oct 2018	

Client:

Rouse Homes

Project Title:

East Bierley

Drawing Title:

Reservoir Flood Risk Plan

Drawing No			Revision		Status
4944-FRA04			A		Final



**Geo
Structures
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**iD Civils Design
Consulting Engineers**

A	Boundary Update	DL	07.10.20
Rev	Description	By	Date
Scale			
NTS @ A3		Oct 2018	

Client:

Rouse Homes

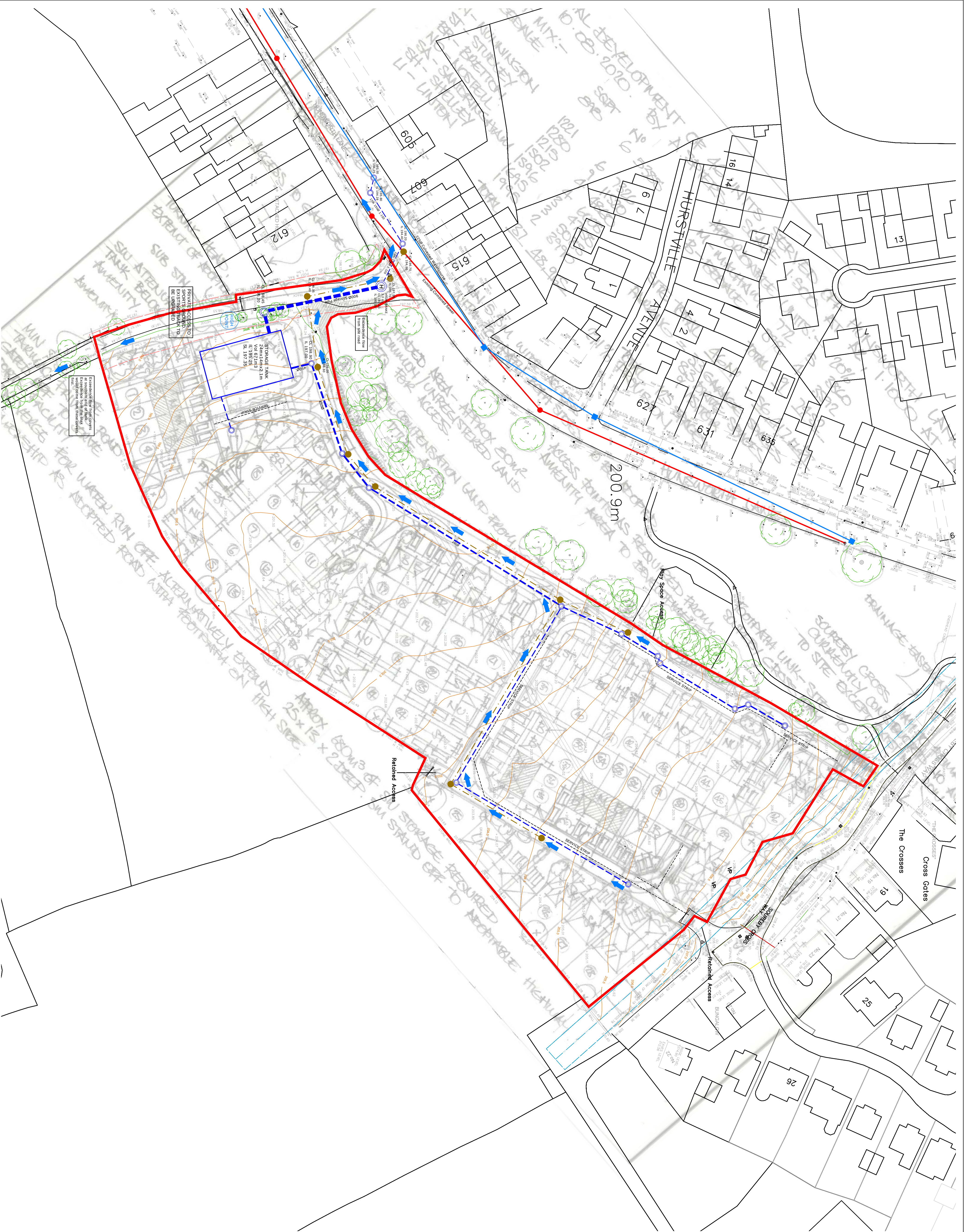
Project Title:

East Bierley

Drawing Title:

Aerial Picture

Drawing No	Revision	Status
4944-FRA05	A	Final



In line with the above regulations we are obliged to inform the Contractor of the part of the design process at the safety health & safety aspects are given full consideration. Although considerable effort is undertaken to eliminate risks, the very nature of the project gives rise to some hazards and risks. Significant risks that cannot be eliminated by design and could not be screened by a competent person are listed in the table below. The Contractor is responsible for the safety of the project.

- LEGEND**
- Existing Combined Sewer
 - Proposed foul water sewer
 - Proposed surface water sewer
 - Existing Curved Watercourse
 - Exceedance Route

NOTES

Surface Water
Discharge rate to be restricted to lowest practical rate given design head of 2.3m - 3.71/s
Storage to be designed for the 100 year plus 30% climate change event and to be stored on site in tank below open space.

Hydrant to be located in access road to allow as much road statement as possible to be captured in the storage.

Foul Water
Foul to be drained by gravity to public sewer in Hunsworth Lane.

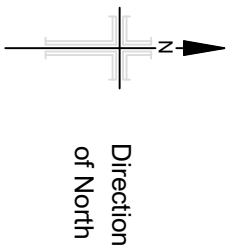
B	Layout updated	DL	07.10.20
A	Layout updated	DL	04.03.20
Rev	Description	By	Date
Client:			

Rouse Homes	
Project Title:	
East Bierley	
Drawing Title:	
Drainage Strategy Plan	
Scale	Date
1:500 @ A1	Oct 2019
Drawing No	Revision
4944-FRA06	A
Status	Draft

Appendix A

Notes

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Grid : OS National Grid

Using the OS GPS Network and applying OSTN15 transformation and then removing the scale factor for true distances with a one-step transformation centred on SZ.

Datum : OS Level Datum

Using the OS GPS Network and applying OSGM15 National Geoid Model to obtain local area corrections.

Station Listing			
Station	Easting	Northing	Level
S1	419700.449	429048.394	209.176
S2	419833.061	428994.222	207.796
S3	419642.266	428904.650	197.190

KEY	
AIR VALVE	AV
BECH MARK	BM
BLN	BLN
BOULAND	BO
BONE HOLE	BOH
BRITISH TELECOM COVER	BT
BUS STOP	BS
CABLE TV COVER	CTV
CABLE TV SHUT-UP	CTV
COLUMN	CL
PREPARED FERN	PF
LEARNING POINT	LP
ELECTRICITY COVER	EC
ELECTRICITY POLE	EP
FIRE HYDRANT	FD
GAS VALVE	GV
GATE	GT
INSPECTION COVER (CIRCULAR)	IC
INSPECTION COVER (RECTANGULAR)	IR
COVER LEVEL	CL
INVERT LEVEL	IL
UNABLE TO MEASURE	UM
DIAMETER OF TREE TRUNK	D
HEIGHT TO TOP OF TREE CANOPY	H
MULTI BOLT TREE	MB

Rev	Date	Drawn	Description	Check
-	-	-	-	-



Soutrgate House
Porterford Road
Stourton
Leeds
West Yorkshire
LS10 1SW

T: +44 (0) 1132 008 900
F: +44 (0) 1132 008 901
E: admin@metgeoenvironmental.com
W: www.metgeoenvironmental.com

Client

SAVILLS (UK) LIMITED

Site

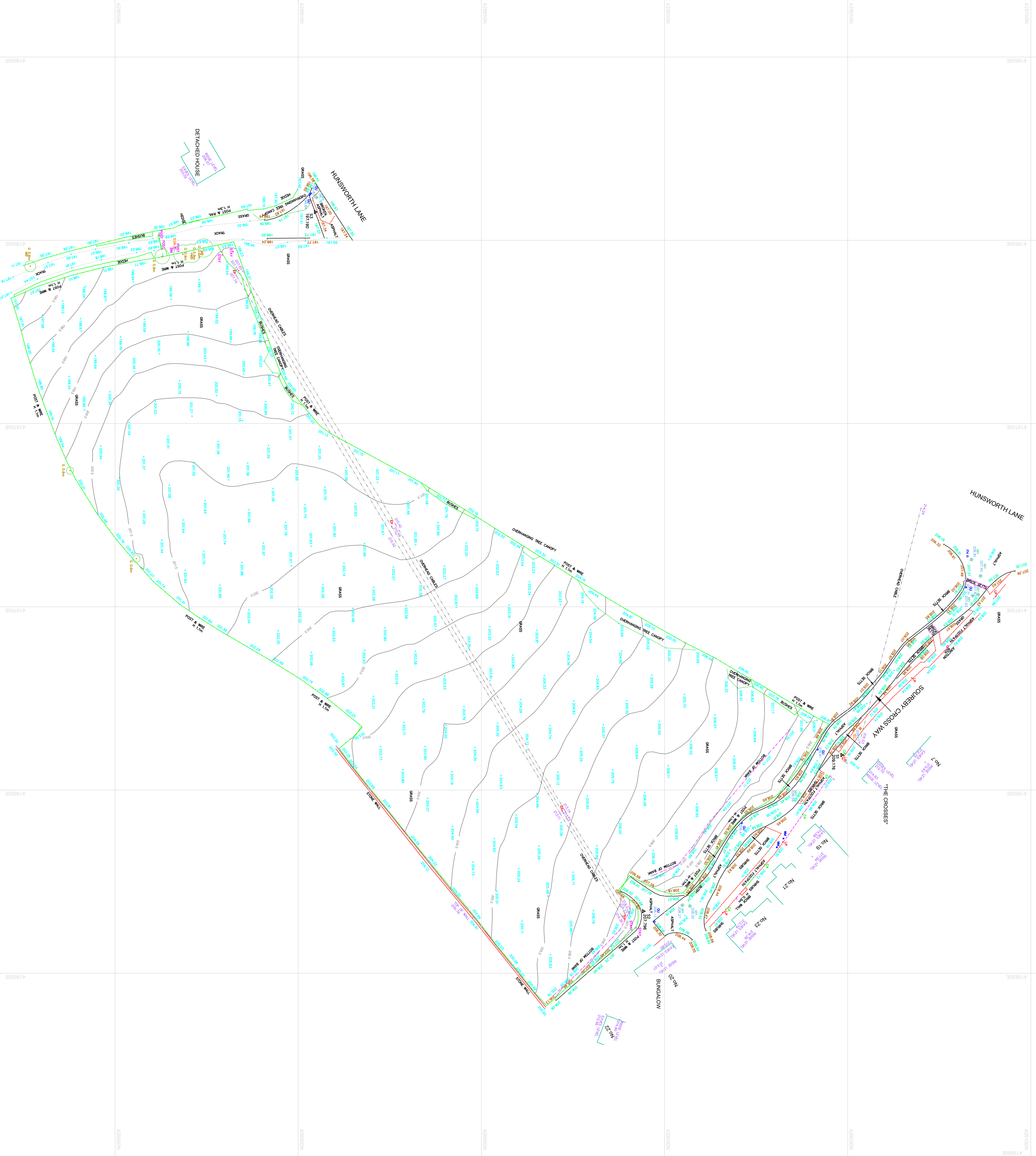
SOURCEBY CROSS WAY, EAST BRIERLY
BIRKENSHAW, BD 4 6PZ

Title

TOPOGRAPHICAL
SURVEY

Surveyed	SA, MC	Drawn	MC
CHK	DA	Date	14/08/2018
Scale	1:500	Job No	P18-01218
		Sheet Size	A1
		Rev	01

DWG Ref	Project Number	Origin	Zone	Level	Desc	Type	Role	Sheet
P1801218	METEXT	XX	TOP	M2	G	001		



Appendix B



419536 : 428821



Map Name : SE1928NW

Yorkshire Water,
PO Box 500,
Halifax Road,
Bradford BD6 2LZ
Contact Name :
YorMap Advisor C ROBERTS
Contact Tel : 87 2582

Title

Notes

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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.

Date Req : 06/03/2019, 11:13:45

Date Gen : 06/03/2019, 11:14:46

Source : Sewer Network Enquiry

Appendix C

Darren Linklater

From: Paul Farndale <Paul.Farndale@kirklees.gov.uk>
Sent: 21 February 2019 08:13
To: Darren Linklater
Subject: RE: East Bierley
Attachments: Hunsworth Lane.pdf

Hello Darren,

No reports of surface water flooding into the Council. However we are more likely to receive phone calls from the public when housing or highway is affected. This comment should therefore not be taken to mean the site has never flooded.

Incidents have been reported in the past just north of the junction of Hunsworth Lane and Soureby Cross Way. It is not clear whether this is blocked or surcharging gullies. I would be mindful just to examine the road contours in that area and check if this is, or will be a flood route from this area into site that has to be accommodated. Although no depth is recorded, one of the incidents described water running across the full road (Hunsworth Lane).

In terms of a watercourse present, we do have records of a small diameter pipe 225mm labelled watercourse in Hunsworth Lane, we believe this is fed from a pond in Bradley Marsh. Surface water public sewers from Soureby Cross Way are shown to connect in at the same point.

Although we have some Kirklees defined critical drainage areas the local policy relating to them has not yet come into being and at the moment Kirklees chooses to not impose stricter discharge policies which would be likely to relate to Brownfield sites anyway.

Climate change factors remain at 30% housing development where the 1 in 100 + cc event is stored underground. If for any reason above ground storage is used we would expect an examination of the 40% upper limit and a 10% for urban creep to be factored into below ground attenuation. Urban creep is eliminated if we are storing 1 in 100 + 30% climate change.

Storage tanks under the highway can only be 1500mm span or larger if the road is to remain private. If a road is to be put forward for adoption then particular whole life inspection criteria is required to protect the Council's and public interest. At this moment in time the statutory undertaker will not commit to this criteria which would result in non-adoption of the road network. Careful thought on layout design that makes space for water is therefore of paramount importance.

We will not accept Greenfield discharges (either out 5l/s/ha or IOH124) to such a small diameter pipe with a base flow in it. This is because it is an enclosed system. On this occasion an analysis of capacity to find an appropriate figure is not required. We would allow an absolute maximum of 5l/s from this developer for the 1 in 100+cc event, also hitting the target of 3l/s for the 1 in 30. If adjacent sites are to come forward in the local plan then a discussion on facilitating this development is required in the FRA and with the planning officer concerned. An adjacent allocation cannot become landlocked and part of this decision.

The site is in main river flood zone 1 – No Sequential test or exceptions test will therefore be required.

An FRA is required that should be limited to surface water specifics listed below.

BGS data appears to state that soakaways should be explored further at the local level.

In terms of surface water flood risk, risk maps do not show a catchment flood route entering and leaving site. In any FRA a blockage scenario to the pond to the north would require an assessment as to where water may go in addition

to water produced by known flooding incidents from gully in Hunsworth Lane just to the north of its junction with Soureby.

The positioning of the attenuation tank needs a blockage and exceedance event scenario to avoid property and curtilage on site.

As assessment of exceedance high intensity storm that causes water to bypass gullies must be included in the compulsory FRA that should concentrate on surface water only. Effectively this is an assessment of water using the highway as a conduit with the addition of open space avoiding property curtilage. In short can flood water escape the site without risk to property.

We are concerned that a plan has already been produced and none of these factors have been taken into account. We will not accept of flood route designed around houses when houses should be designed around a drainage and flood route. The former introduces risk and provides poor mitigation strategies.

A temporary drainage plan to protect land and property from increased run off post soil and vegetation strip is expected by can be conditioned.

Kind regards,

Paul Farndale
Kirklees LLFA

From: Darren Linklater [mailto:darren.linklater@id-gsc.co.uk]
Sent: 18 February 2019 17:47
To: Paul Farndale <Paul.Farndale@kirklees.gov.uk>
Subject: East Bierley

Hi Paul,

We are working for a developer on the above site which comprises a single parcel of land north of the Rugby Club and south of the play area. We are looking to develop a drainage strategy and FRA report for a planning application.

In order to assist I would be grateful if you could reply to the queries below;

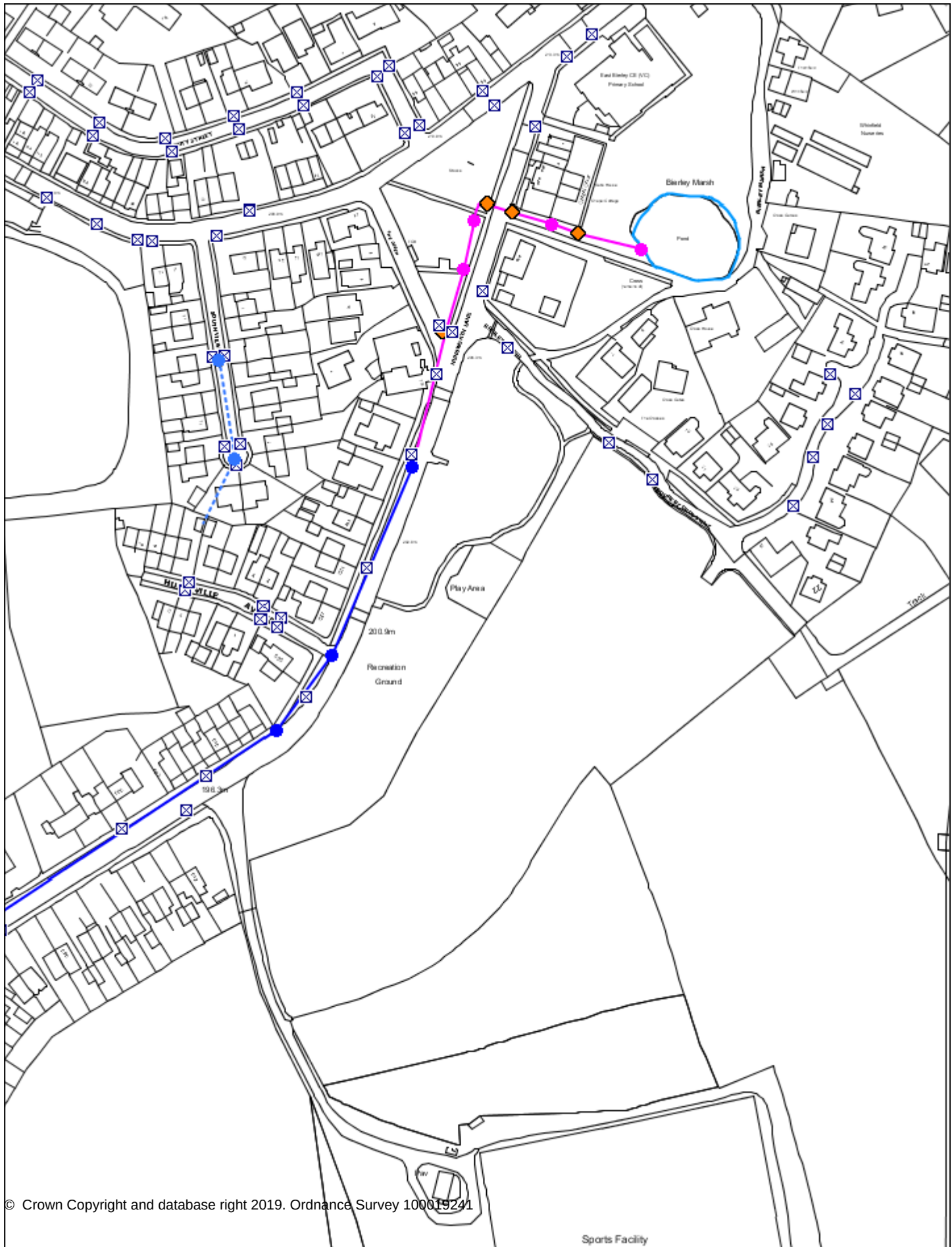
1. Has the authority any record of the site flooding historically.
2. If the authority has a record, can you provide details of the extent of flooding, frequency, source and depth?
3. Has the authority any records of culverts across or adjacent to the site? We are aware of a culvert crossing the cricket pitch and possibly running down Hunsworth Road.
4. Is the site in a critical drainage area or an area subject to specific discharge restrictions over and above normal development policy?
5. What climate change factor do the authority apply to new developments?
6. Do the authority apply urban creep factor to new developments?
7. Do the authority apply a generic greenfield rate across the area or do you accept IOH124 greenfield assessments?
8. Do the authority know of any restriction to development due to flooding?

Thanks for your assistance.

Kind Regards

Darren Linklater
Director
For and on behalf of
iD Civils Design Ltd

Appendix D



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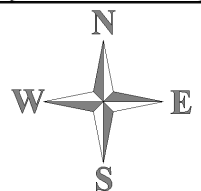
Kirklees
COUNCIL

Kompass
Kirklees Mapping Service

Tel: 01484 221757 (Internal 860
1757) E-Mail: maps@kirklees.gov.uk

100m

Scale = 1 :
1905 120



Appendix E

Mr D Linklater
ID Civils Design
The Stables
8 Aske Hall
DL10 5HG

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

Your Ref: MMI096
Our Ref: V002963

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

Email:
technical.sewerage@yorkshirewater.co.uk

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

6th March 2019

Dear Mr Linklater,

Hunsworth Road, East Bierley, Bradford, BD4 6PY - Pre-Planning Sewerage-Enquiry-Residential T322349

Thank you for your recent enquiry. Our charge of £158.93 (plus VAT) will be added to your account with us, reference MMI096. You will receive an invoice for your account in due course.

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.

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

Foul water domestic waste should discharge to the 225 mm diameter public combined sewer recorded in Hunsworth Lane, at a point to the south west 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

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/Internal Drainage Board with a view to establishing a suitable watercourse for discharge.

It is understood that a culverted watercourse is located in Hunsworth Lane, at a point to the south west of the site of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable).

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or 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.

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