

**FLOOD RISK ASSESSMENT  
LAND OFF WORKSOP ROAD, MASTIN MOOR  
CHESTERFIELD  
DEVONSHIRE PROPERTY (MM) LIMITED  
FRA-19412-17-31 R8  
JULY 2021**





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Current Document Details

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Document Revisions

Rev	Date	Author	Checked	Approved	Remarks
R0	13/02/17	KN	KN	PRD	First issue.
R1	26/05/17	KN	KN	PRD	Revised to include scheme introduction and updated masterplan.
R2	08/06/17	KN	KN	PRD	Drainage strategy amended to suit updated masterplan.
R3	23/06/17	KN	KN	PRD	Client instructed presentational amendments.
R4	28/11/17	KN	KN	PRD	Appendix 4 updated to clarify areas used for runoff assessment.
R5	08/09/2020	PG	MSB	MSB	Updated for re-submission of outline application & Masterplan
R6	22/09/2020	PG	MSB	MSB	Updated to suit client's comments
R7	06/10/2020	PG	MSB	MSB	Updated to suit client's comments
R8	15/07/21	JR	MSB	MSB	Updates to sections 10.10 and 10.11, and to Appendices 1 (Masterplan), 4 (Drainage Calculations) and 5 (Drainage Strategy Drawings).





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## SCHEME INTRODUCTION & CONTEXT CHAPTERS

### 1.0 Introduction

#### Purpose

- 1.1 The purpose of this report is to explain and support an outline planning application for residential development of land at Mastin Moor (Chesterfield) as submitted to Chesterfield Borough Council (CBC) as the local planning authority (LPA) concerned. It outlines the context within which the application is made and provides a detailed assessment of the main flood risk and drainage considerations, together with a reasoned justification in support of the development.

#### Structure of Report

- 1.2 This report addresses the following:

- Context.
- The site and surrounding area.
- Development proposal.
- Planning policy considerations.
- Key benefits.
- Assessment of flood risk.
- Summary and conclusion.

- 1.2 The report concludes that there are some potential flood risks related to the site. However it is considered that risks and impacts can be managed to an appropriate level with the adoption of mitigation measures employed as part of the proposed development and as highlighted in this report and consequently there are no flood risk and drainage reasons why residential development should not be supported on the site.

#### Other Reports

- 1.4 The proposal has been informed by a range of technical evidence. As such, the planning application resubmission comprises a suite of information which includes:
- Supporting Planning Statement
  - Design and Access Statement
  - Landscape and Visual Appraisal
  - Transport Assessment
  - Flood Risk Assessment
  - Ecology Surveys
  - Archaeological Assessment
  - Geo-Environmental Assessment
  - Noise and Vibration Assessment.
  - Air Quality Assessment
  - Topographical Survey



### **Author**

- 1.5 This report has been prepared by IDOM Merebrook Limited. IDOM Merebrook Limited is an environmental and engineering consultancy with extensive experience of providing high quality, practical and pragmatic advice and solutions across many sectors. Our contact details are as follows:

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## **2.0 Context**

### **Applicant**

- 2.1 The land subject of this application is owned and managed by Devonshire Property (MM) Limited (DPMML). DPMML is part of the Devonshire Group.
- 2.2 The Devonshire Group, known technically as the Chatsworth Settlement Trustees (CST), owns the land and estates of the Dukedom of Devonshire. Its main estates are in the vicinity of Chatsworth in Derbyshire and Bolton Abbey in North Yorkshire. It also runs visitor and other businesses on these estates, including hotels; retail and catering outlets; forestry; livestock and arable farming. It employs over 600 full time employees. It is committed to quality in all its activities and takes a responsible approach to development; as such, it measures performance in social and environmental as well as financial terms.
- 2.3 Together with the Chatsworth House Trust (registered charity no. 1511149), CST's Derbyshire Estate provides over 450 full time equivalent jobs and contributes c.£50m of enabled Gross Value Added to the local economy each year (Source: New Economics Foundation 2014). Its income funds socio-economic facilities (e.g. village shop/post office) and environmental management activities (e.g. architectural conservation) without grant support. CST thereby provides benefits far beyond "just the estate".
- 2.4 CST has a range of interests in the Borough of Chesterfield including: agricultural land supporting modern farming; commercial properties supporting local employment; farmsteads supporting smaller scale rural enterprises; and the majority of the former Staveley Works site (including both the Clocktower Business Centre (leased to CBC and providing flexible term offices and workspaces) and the Devonshire Building (home to a gym and other enterprises)).
- 2.5 Whilst maintaining a long-term perspective, CST manages a diverse range of landholdings to achieve corporate and wider social and environmental objectives. It has thereby identified that the best long-term use for the land subject to this application would be for residential development. This will help deliver its own objective to deliver 1,000 new homes over the next ten years, and also meet the needs and aspirations of the local community and wider Borough, subject to securing a planning permission that is both attractive to the development market and commercially viable.



### **The Site**

- 2.6 This section provides a summary of key features of the site. The site is more fully described within the Design and Access Statement submitted as part of the application.
- 2.7 The site is located at Mastin Moor, to the south of Worksop Road (A619) to both the east and west of Bolsover Road, with part of the site extending southwards to Woodthorpe Road. It encompasses some 46.2 ha of mainly agricultural land. The overall site forms a shallow valley sloping from the ridge lines along Worksop Road and Woodthorpe Road towards a watercourse that runs in a westerly direction through the site. The highest part of the site is around 119 m AOD in the north-east with the lowest part in the south-west at around 56 m AOD.
- 2.8 The site is primarily comprised of undulating arable fields with limited features. The main features of note include:
- An unnamed watercourse which flows in a westerly direction through the site.
  - Bolsover Road which runs through the site on a north-south axis.
  - Pumphouse Farm (dwelling and curtilage) which is surrounded by the development proposal but does not form part of it.
  - Field boundaries which are a mixture of hedgerows, stone walls and woodland.
  - Isolated trees.
- 2.9 The main part of the settlement of Mastin Moor is located to the north of the site, on the northern side of Worksop Road. The settlement of Woodthorpe is located generally to the west of the site. The site abuts a limited number of residential properties, as well as the Mastin Moor Community Garden.

**Photo 1: View over site from South-Eastern corner (adjacent Woodthorpe Road) looking towards Woodthorpe**





**Photo 2: View over site from Bolsover Road (close to Community Garden) looking towards Woodthorpe**



**Photo 3: View over site from Bolsover Road looking North West towards Worksop Road)**



**Photo 4: View over site from near North Eastern boundary adjacent to Worksop Road looking towards Bolsover Road and Woodthorpe**





## Design Process

- 2.10 CST first considered residential development options for its land at Mastin Moor in 2011 when it was identified in the Strategic Housing Land Availability Assessment by Chesterfield Borough Council. This formed part of the evidence base for what was at the time the emerging Local Plan: Core Strategy. CST appointed planning and masterplan specialists to explore these options. Outputs from that process formed part of CST's response to consultation on the Local Plan: Core Strategy.
- 2.11 Following adoption of the Local Plan: Core Strategy in 2013 which confirmed Mastin Moor as a focus for regeneration and growth, CST appointed an expanded team of specialists. Resulting technical surveys and reports contributed to a detailed appreciation of the development opportunity and potential constraints. These informed a masterplan-led approach that fully explored design options. The process had regard to the wider setting of the site and existing development in the locality.
- 2.12 Draft proposals were subject to extensive consultation with Chesterfield Borough Council, Derbyshire County Council and Staveley Town Council. Meetings were held with groups representing local residents and interest groups including Friends of Mastin Moor, the Woodthorpe Village Community Group and Mastin Moor Gardens and Allotments (formerly Mastin Moor Allotments Association). The resulting proposals were presented at two community consultation events in July 2016, held at the Eventide Rest Room (Mastin Moor) and the Albert Inn (Woodthorpe), and were available to view at the same time on a website.
- 2.13 An outline planning application for 650 dwellings and other development was subsequently submitted to Chesterfield Borough Council (ref. CHE/17/00469/OUT) in June 2017. Contrary to the unequivocal recommendation of the Officer's report, and despite no objections being received from any statutory consultees, the application was refused by the Council's Planning Committee in October 2019. An appeal against the refusal was allowed by decision dated 15<sup>th</sup> October 2020. The site therefore benefits from outline planning permission.
- 2.14 Feedback received during the course of the determination of the above application has informed the current proposals. The design process that has led to the proposals for which planning permission is now sought is more fully described within the Design and Access Statement.

## Development Proposal

- 2.15 The proposed development seeks outline planning permission for residential development of up to 650 dwellings, a residential care facility with extra care, a Local Centre (including local retail, health facilities, leisure facilities, other local facilities and services, offices), open space, community garden extension, community building, parking and associated infrastructure and earthworks with all matters reserved except access. Details of scale, layout and landscaping are reserved for future consideration.
- 2.16 For illustrative purposes, an indicative layout has been prepared to show how the site could be developed. Further explanation of the design principles that have been incorporated into the proposals, and how the design has been informed and influenced by the comprehensive suite of technical information and analysis, is set out in the Design and Access Statement.





2.17 Key aspects of the proposal include:

- Up to 650 dwellings located on land to the south of Worksop Road (east and west of Bolsover Road) extending to Woodthorpe Road
- A residential care facility with extra care
- A Local Centre (including local retail, health facilities, leisure facilities, other local facilities and services, offices) located adjacent to Worksop Road
- A new signal-controlled junction on Worksop Road providing access to the new Local Centre and residential areas, incorporating pedestrian and cyclist crossing facilities
- New priority-controlled junctions on Bolsover Road and Woodthorpe Road
- An extension to the Community Garden (approximately doubling its existing size), including provision for a new community building and associated car park
- Significant new areas of parkland, play areas and other open space
- Retention of existing hedgerows and trees wherever possible
- Additional landscape planting and ecological enhancements
- New walking and cycling connections
- New drainage infrastructure including surface water storage ponds
- Financial contributions to allow the expansion of existing local services including Norbriggs Primary School.

2.18 The proposal therefore comprises a high quality development scheme designed to: address multiple deprivation issues at Mastin Moor; help regenerate the area in line with key related Local Plan policy; respect but integrate with the distinct communities of Woodthorpe and Mastin Moor; acknowledge and address the specific physical challenges and constraints of the site (e.g. topography, drainage).

**Planning Policy**

2.19 Section 38 (6) of the Planning and Compulsory Purchase Act 2004 requires that the determination of planning applications is undertaken in accordance with the development plan, unless material considerations indicate otherwise. The relevant document for this application is the Chesterfield Local Plan (2020) (the Local Plan).

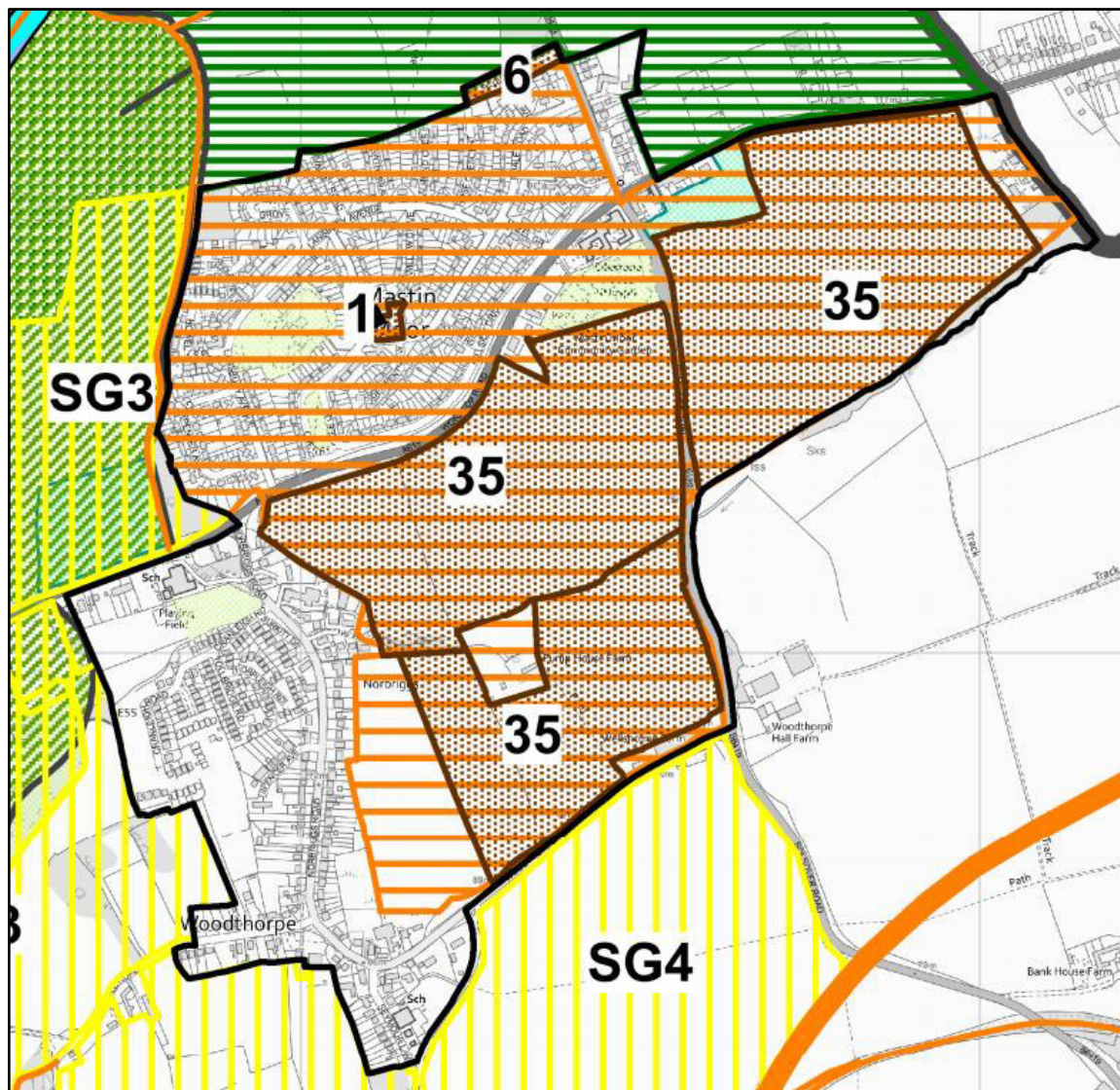
2.20 The Local Plan allocates the site for development by way of Policy CLP3 Flexibility in Delivery of Housing. Table 4 within the Local Plan references the site as H35 (Land South of Worksop Road, and East and West of Bolsover Road, Mastin Moor), having a capacity of 650 dwellings, the extent of which is shown on the Local Plan Policies Map. Policy RP1 Regeneration Priority Areas sets out further specific requirements for any development within site H35.

2.21 Other relevant policies of the Local Plan include: CLP1 Spatial Strategy, CLP2 Principles for Location of Development, CLP4 Range of Housing, CLP6 Economic Growth, CLP8 Vitality and Viability of Centres, CLP9 Retail, CLP10 Social Infrastructure, CLP11 Infrastructure Delivery, CLP13 Managing the Water Cycle, CLP14 A Healthy Environment, CLP15 Green Infrastructure, CLP16 Biodiversity, Geodiversity and the Ecological Network, CLP17 Open Space, Play Provision, Sports Facilities and Allotments, CLP20 Design, CLP21 Historic Environment, CLP22 Influencing the Demand for Travel.





- 2.22 An extract from the Local Plan Policies Map showing the extent of the allocation and the wider Mastin Moor Regeneration Priority Area is shown below.



**Figure 1: Local Plan Policies Map (extract)**

- 2.23 The National Planning Policy Framework (NPPF) 'sets out the Government's planning policies for England and how these are expected to be applied'. Paragraph 10 of the NPPF sets out that 'at the heart of the [NPPF] is a presumption in favour of sustainable development'. Paragraph 11 states that 'For decision-taking this means:

*c) approving development proposals that accord with an up-to-date development plan without delay;  
or*

*d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:*



*i. the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed<sup>6</sup>; or*

*ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.*

- 2.24 The National Planning Policy Framework (NPPF) which was published on 27<sup>th</sup> March 2012 and revised on 24<sup>th</sup> July 2018 (the first revision since the first issue) sets out the expectation that new development is sustainable and requires that LPAs should avoid flood risk to people and property and should manage any residual risk. NPPF was last updated on 19<sup>th</sup> February 2019.
- 2.25 NPPF sets out the government's planning policies for England and how these are expected to be applied. The aims are to ensure that flood risk is considered at all stages of the planning process, to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk. Where new development is exceptionally necessary in such areas, the policy aims to make it safe without increasing flood risk elsewhere.
- 2.26 The NPPF provides guidance in relation to development and flooding. It provides a framework within which risks arising from both river and coastal flooding, and additional runoff from development in any location, can be assessed.
- 2.27 This report has been produced in line with the above guidance together with other associated guidance to reduce flow rates from the site to nearest watercourse and provides SUDS features via attenuated storage.
- 2.28 The NPPF also sets out other key priorities for planning to address including climate change, water quality and biodiversity – all challenges that SuDS help to address. Planning practice guidance supports the use of SuDS. It emphasises that generally the aim should be to discharge surface runoff as high up the hierarchy of drainage options as reasonably practicable, with infiltration to the ground the most preferred and connection to a combined sewer the least.

### **Planning Assessment**

- 2.29 The proposal performs well against relevant Local Plan policies. In particular, it will deliver development in accordance with Policies CLP1 Spatial Strategy, CLP2 Principles for Location of Development, Policies CLP3 Flexibility in Delivery of Housing and Policy RP1 Regeneration Priority Areas.
- 2.30 It is also considered that there are no material considerations that indicate anything other than the fact that the LPA should determine the application in line with the extant plan as outlined above.
- 2.31 In addition, key benefits of the proposal would include:
- Provision of new, high quality housing
  - New development in an area with acknowledged regeneration needs
  - Greater variety of housing type and tenure (including Affordable Housing) to meet the diverse needs of the local community (including housing to buy and rent)



- Extension of the Community Garden (approximately doubling its existing size) including provision for a new community building and parking area
- Improved local services and facilities (including provision for retail, health and other local and community services within a new Local Centre)
- Significant new areas of parkland, play areas and other open greenspace available to existing and new residents
- New housing in a location where future residents will have a realistic choice of walking, cycling or using public transport, in preference to using private motor vehicles
- Additional capacity at local schools
- Opportunities for skills and learning through training programmes during construction and operational phases of the development
- New employment opportunities during construction and operational phases of the development
- Additional landscape planting and ecological enhancements
- New traffic signal-controlled junction on Worksop Road to include pedestrian and cyclist crossing facilities
- On-site water storage to help reduce existing off-site flood risk.

2.23 The proposal will therefore provide opportunities and benefits for all sections of the local community, including existing and future residents. Benefits will accrue in the short and longer term. It will help to overcome issues that can lead to deprivation and will contribute to regeneration in line with Local Plan objectives.



## EXECUTIVE SUMMARY

A Flood Risk Assessment has been produced on behalf the client, Devonshire Property (MM) Limited. The purpose of this report is to present the findings of the assessment, which includes flood risk from all sources both to the Site, and as a result of the development. Where flood risks are present, or where they cannot be clearly established, further actions or mitigations are outlined.

### SITE DETAILS

<b>Approximate Site Area</b>	46.2 ha, gross site area, (from planning layout).
<b>Current/Previous Use</b>	Arable agricultural use.
<b>Proposed Use</b>	650 dwellings, a local centre, community gardens/allotments, public open space, green spaces, and amenity space.

### FLOOD RISK ASSESSMENT

<b>Fluvial Flood Zone</b>	Zone 1.
<b>NPPF Vulnerability</b>	'More Vulnerable'.
<b>Compatibility</b>	Compatible – 'More Vulnerable' development is considered appropriate in Flood Zone 1. Sequential Test considered applied, Exception Test is therefore not required.
<b>Flood Risks to the Site</b>	<b>Low risk</b> of flooding from all sources, except potential for mine drainage infrastructure failure, assessed as a <b>high risk</b> .
<b>Flood Risk as a Result of the Development</b>	Run-off from new impermeable areas resulting in an increased risk of surface water and fluvial flooding, assessed as <b>high risks</b> . The risk of sewer flooding is assessed as <b>moderate</b> (surface water) and <b>high</b> (foul water), since Yorkshire Water has identified that the sewer network has inadequate capacity to serve the development; the waste water treatment works may also have capacity issues. The potential for mine drainage infrastructure failure is also assessed as a <b>high risk</b> .

### ACTIONS AND MITIGATIONS

<b>Off-site Surface Water</b>	Managed by on-site surface water mitigations, see below.
<b>On-site Surface Water and Fluvial</b>	Reduce run-off from impermeable areas to greenfield rates. Attenuate using attenuation ponds. Site drainage designed to 1% (1 in 100) AEP with 40% allowance for climate change.
<b>Sewers and Drains</b>	Significant strategic off-site reinforcements to the sewer network are expected to be required and possibly to the Staveley waste water treatment works.
<b>Groundwater</b>	Not assessed as a risk.
<b>Water Management Infrastructure</b>	There is no existing water management infrastructure on or near the Site. The indicative drainage strategy has highlighted the need for attenuation ponds, however, the mitigations and actions described in this FRA mean that there should be no increased flood risk on site or to adjacent areas off site.
<b>Further Investigation</b>	Modelling investigation of the sewer network by Yorkshire Water and investigation of the mine drainage required.



## SECTION 1 INTRODUCTION

- 1.1 IDOM Merebrook Limited has been instructed by Devonshire Property (MM) Limited (**DPL**) to undertake a Flood Risk Assessment (**FRA**) in support of an anticipated planning application to be submitted to the Local Planning Authority for a site identified as Mastin Moor (the **Site**), located adjacent and to the south of the village of Mastin Moor, in Chesterfield Borough, Derbyshire.
- 1.2 It is anticipated that DPL intends to obtain planning permission for a development of approximately 650 dwellings, a local centre, community gardens/allotments, public open space, green spaces, and amenity space.
- 1.3 The purpose of this report is to present the results of a FRA undertaken on the Site proposals. The information does not purport to be a detailed design and a quantitative assessment cannot be undertaken at this time.
- 1.4 This report has been prepared for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to this report should consult Devonshire Property (MM) Limited and Idom Merebrook Limited as to the extent to which findings may be appropriate for their use.

## SECTION 2 DESCRIPTION OF THE PRE-DEVELOPMENT SITE

### 2.1 GENERAL

- 2.1.1 The Site is located to the south of the A619 Worksop Road and the village of Mastin Moor, between 2 km and 2.5 km to the east of the town of Staveley, at approximate National Grid Reference E 445462, N 375240 (SK 454 752) and post code S43 3BS, site centred. In plan, the Site presents itself as two irregular, broadly rectangular parcels of land either side of the B6419 Bolsover Road, occupying approximately 46.2 ha total area.
- 2.1.2 A topographic survey of the Site by Merebrook dated 29 August 2014, referenced MER00810-002-001 to -007, (seven sheets), indicates that the Site slopes towards an ordinary watercourse, which flows along the southern boundary of the north-eastern parcel of the Site and through the south-western parcel. The north-eastern parcel of the Site slopes from north-east to south-west and topographic survey information indicates that the slope is relatively steep, in the region of approximately 1 in 18 on average, from a level of 118.70 m AOD to 55.9 m AOD over a distance of 1.1 km. The south-western parcel of the Site slopes at a similar gradient, of 1 in 14 from 89.23 m AOD to 55.90 m AOD over 0.5 km. The Site overall therefore forms a fluvial 'V' shaped valley, sloping towards the ordinary watercourse that dissects the Site in a north-east to south-west direction. The topographic survey of the Site is included in **Appendix 1**.
- 2.1.3 The Site is currently in arable agricultural use and comprises undulating fields with little features. Within the Site, the main feature of note is the unnamed tree-lined



ordinary watercourse which flows through the Site to the west of the Bolsover Road and along the southern site boundary to the east of Bolsover Road. The Site is bounded by a mixture of drystone walls, hedges and trees where adjacent to existing highways and the boundaries of residential properties bounding the Site to the west. A property, ('Pumphouse Farm'), which does not form part of the development land, but is surrounded by it, is occupied by a dwelling and outbuildings. This was the location of former coal mining-related structures.

- 2.1.4 A site location plan is included in **Appendix 1**.

## 2.2 SITE AREA

- 2.2.1 The total site area is approximately 46.2 ha, as measured in AutoCAD from the planning layout, and the total development area (excluding any areas of green open space) is approximately 27.7 ha. The development impermeable area was calculated as part of the drainage strategy from drawing 19412-200-002 to -004 (**Appendix 5**) at a total of 16.62 ha. This means a medium density development at 60% impermeable.

## 2.3 HYDROLOGY

- 2.3.1 A study of Ordnance Survey and Environment Agency online mapping indicates that the main surface water feature relevant to the Site is the unnamed ordinary watercourse, which enters the site boundary at its eastern extent, and follows the southern boundary of the Site to Bolsover Road.
- 2.3.2 West of Bolsover Road, the watercourse dissects the northern and southern portions of the Site towards an access track, marked as 'The Paddocks'. Here the watercourse exits the site boundary but remains adjacent to it, before turning north-west towards Norbriggs Road. The Merebrook Phase 1 Geo-environmental Assessment (Phase 1 GEA) referred to in **Section 5** indicates that the channel was noted to be approximately 800 mm wide and 200 mm deep. The unnamed ordinary watercourse ultimately flows into the River Doe Lea, a main river, which is located approximately 700 m to the west of the Site.
- 2.3.3 An additional feature of note was recorded as part of the Phase 1 GEA. To the rear of a property number 50a Worksop Road ('Seven Winds'), there is anecdotal evidence from a local resident indicated that there was a 1 m diameter pipe/conduit which was at full flow. During the survey of the Site, a concrete marker post for a mine water discharge was observed in the footway near this location, as annotated on drawing MER00810-002-001, (Sheet 1), in Appendix 1.
- 2.3.4 Records of historical ground workings (between 1876 and 1947) within and adjacent to the Site indicate that there was a sewage works to the north-east, a small covered distribution reservoir to the north, (this may now be partly occupied by number 50a Worksop Road), a canal to the west (Norbriggs Cutting, arm of the Chesterfield Canal), and a sewage bed to the west of the Site.



- 2.3.5 There are no licenced surface water abstractions indicated within 1 km of the Site.
- 2.3.6 Information on localised flooding has been obtained from local residents and is discussed within this section. The information is anecdotal and further investigations will be required to confirm, or otherwise, the following observations:
- i.* As shown on Drawing 19412-203-001 (**Appendix 1**), Area 'A' is reported by a resident to suffer from localised flooding. It is inferred from the discussions that the area forms a depression within the local terrain, with flooding as a result of overland flow of rainfall runoff. The occupier also reported the presence of a pipe within the rear garden of the property. It is inferred that the pipe discharges into a manhole within the verge at the junction of the A619 Worksop Road and Norbriggs Road. The purpose of the pipe is unknown.
  - ii.* As shown on Drawing 19412-203-001 (**Appendix 1**), Area 'B' illustrates an area where the unnamed watercourse was identified as being in culvert. It is inferred from the anecdotal information that the culverted watercourse progresses from beneath the residential gardens, passes beneath Norbriggs Road before discharging into the River Doe Lea.
  - iii.* As shown on Drawing 19412-203-001 (**Appendix 1**), Area 'C' identifies an area in which the unnamed watercourse is understood to be in culvert. Anecdotal evidence indicates that the watercourse passes beneath Bolsover Road within a 450 mm diameter pipe.

## 2.4 GEOLOGY

- 2.4.1 The inferred geology of the Site, from the British Geological Survey 1:50,000 mapping, (via the Geology of Britain on-line viewer) is summarised as follows:

### **Drift Geology**

The superficial geology is indicated to be absent, meaning that the solid bedrock geology will likely be present immediately beneath topsoil and subsoil.

### **Solid Geology**

Pennine Middle Coal Measures Formation - comprising Mudstone, Siltstone and Sandstone. There may also be Pennine Middle Coal Measures Formation Sandstone present on the extreme southern edge of the Site near the junction of Bolsover Road and on the western boundary between Woodthorpe and Norbriggs.

## 2.5 HYDROGEOLOGY

- 2.5.1 The Environment Agency online groundwater mapping indicates that the Site is located within an area classified as Secondary (A) Aquifer associated with the Pennine Middle Coal Measures Formation. Secondary (A) Aquifers are classified as 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 classed as minor aquifers. The Environment Agency online groundwater vulnerability map indicates that the Site lies within an area which falls within the 'Minor Aquifer Low' groundwater vulnerability zone.

- 2.5.2 The Environment Agency groundwater mapping indicates that the Site is not within a Source Protection Zone (SPZ).
- 2.5.3 There are no licenced groundwater abstractions indicated on the Environment Agency online mapping within 1 km of the Site.
- 2.5.4 The Site is noted to be within 50 m of a British Geological Survey identified area with susceptibility to groundwater flooding, which relates to flood risk from fluctuation in groundwater levels within unconfined aquifers. The British Geological Survey confidence rating in this result is rated as 'Low'. This risk is identified in the Groundsure® Geo Insight and Enviro Insight reports reviewed in **Section 5**.

### **SECTION 3 DESCRIPTION OF THE PROPOSED DEVELOPMENT**

- 3.1 The proposals comprise the development of approximately 650 dwellings, a local centre, community gardens/allotments, public open space, green spaces, and amenity space. The Site will be served by a network of residential roads, off Worksop Road to the north, Bolsover road to the east and Woodthorpe Road to the south.

### **SECTION 4 PLANNING FRAMEWORK**

#### **4.1 GENERAL**

- 4.1.1 Flood Risk Assessment in England is assessed using the National Planning Policy Framework (NPPF), and 'Planning practice Guide – Flood Risk and Coastal Change' produced by Communities and Local Government, in addition to the details set out in BS 8533:2011 'Assessing and managing flood risk in development - Code of practice'.
- 4.1.2 The NPPF provides guidance in relation to development and flooding. It provides a framework within which risks arising from both river and coastal flooding, and additional runoff from development in any location, can be assessed. NPPF outlines that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. This is achieved through applying the Sequential Test to development sites, as described below in **Section 4.2**.

#### **4.2 THE SEQUENTIAL TEST**

- 4.2.1 The Sequential Test is a decision-making tool designed to direct development away from areas at high risk of flooding from rivers and the sea. The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available





sites appropriate for the proposed development in areas with a lower probability of flooding. In Table 1, Paragraph 065 of 'Planning Practice Guide – Flood Risk and Coastal Change', land is divided into three basic zones:

- i.* Zone 1 (Low Probability) - land assessed as having a less than 0.1% (1 in 1000) annual probability of river or sea flooding;
- ii.* Zone 2 (Medium Probability) - land assessed as having between a 1% (1 in 100) and 0.1% (1 in 1000) annual probability of river flooding; or between a 0.5% (1 in 200) and 0.1% (1 in 1,000) annual probability of sea flooding;
- iii.* Zone 3a (High Probability) - land assessed as having a 1% (1 in 100) or greater annual probability of river flooding or a 0.5% (1 in 200) or greater annual probability of flooding from the sea;
- iv.* Zone 3b (The Functional Floodplain) - land where water has to flow or be stored in times of flood.

4.2.2 The Sequential Test is not normally required for developments in Flood Zone 1 (Low Probability) and it is considered to have been 'applied' by virtue of the site being in the zone of lowest probability of flooding, unless there are flooding issues in the area of the development.

4.2.3 The Sequential Test is also not normally required for developments which are proposed on sites which have been 'allocated' by the local planning authority in their local plan and the development proposed is consistent with the land use allocation. For example, proposed residential development on land allocated for residential use. Where sites have been allocated the Sequential Test will have already been carried out by the local planning authority as part of the land allocation process.

4.2.4 However, if the site has not been allocated, it is likely that the Sequential Test will be required even if the site is in Flood Zone 1. It is recommended that checks are made with the local planning authority to establish if the site has been allocated and if so the site allocation reference in the local plan should be obtained and included in the planning application. If the local plan has not been adopted, the draft local plan should be checked.

#### 4.3 **LAND USE AND DEVELOPMENT**

4.3.1 Whilst it may sometimes not be possible to direct developments into low flood risk areas, particular flooding consequences may not be acceptable for certain land use types. Table 2 of 'Planning Practice Guide – Flood Risk and Coastal Change' identifies the vulnerability of land uses to flooding by dividing land use into five distinct categories:

- i.* Essential infrastructure
- ii.* Highly vulnerable



- iii. More vulnerable
- iv. Less vulnerable
- v. Water-compatible development

4.3.2 Table 3, of 'Planning Practice Guide – Flood Risk and Coastal Change' sets out the appropriateness of development, in terms of the compatibility of the Flood Zone classification and the flood risk vulnerability classification of a site, as shown in **Table 4.1**.

Flood risk vulnerability classification	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
Zone 3b	Exception Test required	✓	✗	✗	✗
Key:    ✓ Development is appropriate ✗ Development should not be permitted					

**Table 4.1 Land use and flood risk vulnerability classification compatibility**

#### 4.4 THE EXCEPTION TEST

4.4.1 If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding; the Exception Test can be applied if appropriate. For the Exception Test to be passed:

- i. it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- ii. a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

4.4.2 Both elements of the test will have to be passed for development to be allocated or permitted.



#### 4.5 PLANNING POLICY & THE PROPOSED DEVELOPMENT SITE

- 4.5.1 Based on the Environment Agency fluvial flood map as described further in **Sections 6.1 and 8.1** the Site lies within Flood Zone 1, that is land assessed as having a less than 0.1% (1 in 1000) annual probability of river or sea flooding.
- 4.5.2 With regards to the flood risk vulnerability classification, as described in **Section 4.3**, the proposed land use for the Site, (residential housing), is considered to be '**More Vulnerable**'.
- 4.5.3 Referring to Table 4.1, '**More Vulnerable**' development is considered appropriate in Flood Zone 1.
- 4.5.4 Based upon the Sequential Test criteria, the Site is not considered to be at risk as a result of fluvial means, therefore the application of the Exception Test is not required for the subject site.

### SECTION 5 EXISTING REFERENCES AND/OR REPORTS

#### 5.1 GEO-ENVIRONMENTAL ASSESSMENT/SI/DESK STUDY

- 5.1.1 Merebrook obtained Groundsure® Geo Insight and Enviro Insight reports dated 13 June 2016.
- 5.1.2 With respect to this FRA, the following aspects from the Groundsure® Geo Insight and Enviro Insight reports are reproduced and summarised as follows:

##### **Geology & Ground Conditions**

There are no records of any artificial or made ground on site or within 500 m of the study site boundary. (Note; this is in contradiction to known historical opencast coal mining which has been undertaken on site)

There are no superficial drift deposits on site, the nearest drift deposits being the Alluvium associated with the River Doe Lea to the west of the Site, classified as a Secondary (A) Aquifer - permeable layers; and a small area of Head deposits near the junction of Worksop Road and Norbriggs Road, classified as a Secondary Aquifer – undifferentiated layers.

The solid bedrock geology is Pennine Middle Coal Measures Formation - comprising Mudstone, Siltstone and Sandstone; and Pennine Middle Coal Measures Formation Sandstone present on the extreme southern edge of the Site near the junction of Bolsover Road and on the western boundary between Woodthorpe and Norbriggs. The reported permeabilities of the solid bedrock geology range from low to high, with 'fracture' flow type, meaning that groundwater flow will be via rock fractures.



### **Groundwater**

The Pennine Middle Coal Measures Formation bedrock beneath the Site is classed as a Secondary (A) Aquifer - permeable layers.

The Site is not shown to be within a Source Protection Zone (SPZ). There are no groundwater abstraction licences indicated within 1 km of the Site.

The Site is noted to be within 50 m of a British Geological Survey identified 'Clearwater Flooding' susceptibility area in relation to unconfined aquifers. The highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions is rated as 'Limited Potential'. This means that although given the geological conditions there may be a groundwater flooding hazard, unless other relevant information, e.g., records of previous flooding suggests groundwater flooding has occurred before in this area, no further action in relation to groundwater flooding hazard is required. The British Geological Survey confidence rating in this result is rated as 'Low'.

### **Hydrology**

The ordinary watercourse which passes through the Site referred to in paragraph 2.3.1, is classified as a 'Tertiary River', with a section indicated to be in culvert where the watercourse follows the southern boundary of the Site before being crossed by Bolsover Road. Where the watercourse flows through Norbriggs, it is shown to be a 'Secondary River' before being culverted under Worksop Road and a recreation ground and discharging into the River Doe Lea.

The Site lies in Flood Zone 1 where flooding is very unlikely. There is less than a 0.1% (1 in 1000) chance of flooding occurring each year. Flood Zones 2, 3a and 3b are shown to be associated with the River Doe Lea to the west of the Site.

The foregoing summary from the Groundsure® Geo Insight and Enviro Insight reports is consistent with the assessment made in this FRA in **Section 2**.

### **Ground Investigation**

Merebrook has also prepared a Phase 2 Geo-environmental Assessment (Phase 2 GEA) for the Site (report reference GEA-19412-15-256), dated 11 January 2016. A Phase 1 Geo-environmental Assessment/Desk Study (non-intrusive investigation), was prepared in June 2014. Reference should be made to both reports.

The GEAs highlight that the closest surface water feature to the Site is a 'Tertiary River' which runs along the southern boundary of the north-eastern land parcel (culverted in part), and across the south-western land parcel. This is consistent with the Groundsure® Geo Insight and Enviro Insight reports.

Anecdotally, this feature was reported to be susceptible to flooding where it coincides with properties to the west.



The intrusive ground investigation undertaken as part of the Phase 2 GEA confirmed the published geology reviewed in **Section 2**. Made ground was encountered comprising re-worked weathered Pennine Middle Coal Measures consisting of variably gravelly variably sandy often silty clays within the historical opencast mining area within the northern central field area of the Site. Natural ground was found to comprise weathered Pennine Middle Coal Measures consisting of variably gravelly variably sandy often silty clays; rockhead was found to be weak weathered mudstone and siltstone, coal was also encountered.

Groundwater was only encountered in one of the exploratory holes during site works and was subsequently recorded within two exploratory holes, at minimum depths of 2.91 m and 2.71 m below ground level, respectively.

## 5.2 STRATEGIC FLOOD RISK ASSESSMENT LEVEL 1

5.2.1 The Strategic Flood Risk Assessment Level 1 (SFRA-1) is intended to provide sufficient detail for the sequential test to be applied and is produced either by the local planning authority, or is commissioned by them from a flood consultancy to produce the SFRA. The SFRA-1 should have maps which show the entire area that the local planning authority covers, which should include:

- i.* Main rivers. (Environment Agency responsibility).
- ii.* Any other rivers and streams (ordinary watercourses - local planning authority responsibility).
- iii.* Development sites that have been allocated in the local plan and any under consideration for future allocation.
- iv.* Flood zones including the functional floodplain.

5.2.2 The SFRA-1 should include an assessment of the risk of flooding in the local planning authority area from all sources and should detail the following:

- i.* Areas at risk from other sources of flooding.
- ii.* Existing measures in use in the local planning authority area to manage flood risk (e.g., flood gates), including their effectiveness.
- iii.* Areas that are covered by flood warnings.
- iv.* Critical drainage areas as notified by the Environment Agency.
- v.* Areas that may need surface water management plans.
- vi.* Locations that may have an increased flood risk if there is additional development.

5.2.3 The SFRA-1 should contain advice for applicants carrying out site-specific flood risk assessments (such as this FRA) and should identify if there is anything specific they



need to do to manage flood risk, e.g., sustainable urban drainage systems (SuDS). Site-specific flood risk assessments are required for developments which are more than 1 hectare.

- 5.2.4 The foregoing summary has been based on information provided on the DEFRA website.
- 5.2.5 A SFRA-1, dated March 2009, was produced by Faber Maunsell/Aecom (consulting engineers) on behalf of Chesterfield Borough Council, Bolsover and North East Derbyshire District Councils.
- 5.2.6 The SFRA-1 was downloaded from the Chesterfield Borough Council website.
- 5.2.7 The SFRA-1 outlines Draft Policy Recommendations (DPR) that may be of particular relevance to the subject site, as follows:
  - i.* DPR 5: Sustainable Drainage Systems (SuDS) - The LPA should require developers to demonstrate that their surface water drainage proposals, particularly for large sites, are appropriate and adequate for the development and will not increase the flood risk to land and property either upstream or downstream of the development site. The Council considers that Sustainable Drainage Systems (SuDS) are a desirable means of achieving this and encourages their use by developers. Planning permission for a site without SuDS will not usually be granted unless the Developer can provide sufficient justification as to why SuDS are inappropriate, unfeasible or unnecessary at the proposed development site.
  - ii.* DPR 6: Culverting of Open Watercourses - The Environment Agency and Council are in general opposed to the culverting of open watercourses because of the adverse ecological effect, potentially increased flood risk and other consequences that are likely to arise. Where practical in connection with the development proposals, LPAs should seek to have existing culverted watercourses restored to open channels, using planning conditions or S106 legal agreements.
  - iii.* DPR 7: Climate Change - All new developments must take account of climate change both for river flows and surface water run-off. River flows should be assumed to increase by 10% or 20% and peak rainfall intensity by 10%, 20% or 30% depending on the lifetime of the development. Current guidance defines development lifetimes of 30 years for retail, 60 years for commercial/industry and 100 years for residential. (Refer also to **Section 10.14**, in relation to the Environment Agency's more recent guidance 'Flood risk assessments: climate change allowances, dated 19 February 2016', which has increased the climate change allowances since the SFRA-1 was produced.)



- iv. DPR 8: Afforestation - Opportunities for afforestation (outside of the floodplain) should be considered and implemented wherever practical. Deforestation and other significant tree loss should be avoided, especially clear cutting.
- v. DPR 9: Increases in impermeable area requiring planning permission will not normally be permitted unless it can be demonstrated that the run-off from these areas will not be increased. This could be achieved by sustainable drainage techniques such as permeable pavements and infiltration or underground storage and flow control.

5.2.8 The SFRA-1 also includes guidance on runoff rates, which are summarised as follows:

- i. For events with a return-period between 30 to 100 years, surface flooding of open spaces such as landscaped areas or car parks may be acceptable for short periods, but the layout and landscaping of the site must ensure flooding does not affect property finished floor levels, or increase off-site flooding.
- ii. A climate change allowance of 20% must be applied for industrial/commercial developments and 30% for residential developments. (Refer also to **Section 10.14**, in relation to the Environment Agency's more recent guidance 'Flood risk assessments: climate change allowances, dated 19 February 2016', which has increased the climate change allowances since the SFRA-1 was produced.)
- iii. For Greenfield sites, discharge rates must be reduced to 5 litres/second per hectare for the design (30 year) storm.
- iv. For brownfield sites, discharge rates should match Greenfield run-off rates (5 litres/second per hectare). Where it is impractical, it will be the responsibility of the developer to justify why this cannot be achieved.
- v. SuDS should be used on all development sites as a method of achieving the above criteria. Where SuDS are impractical, it will be the responsibility of the developer to justify why. (SFRA-1 page 127)

5.2.9 The River Doe Lea is also described in the SFRA-1, which rises to the north-east of Tibshelf and flows north, parallel to the upper River Rother, through a gently sloping valley to the east of Chesterfield. It indicates that on the either side of the river, the land rises to an altitude of 180 m AOD.

5.2.10 In addition, historical flooding records are included in the SFRA-1. Those that are relevant to the subject site are presented in **Table 5.1**.



Reference	Location	Date	Details
CHE227	Renishaw Road, Mastin Moor	June 2007	Road closure. Source unknown
CHE300	Worksop Road, Mastin Moor	None given	Internal flooding recorded for three properties. Source - sewer flooding. Probability 1 in 30 years.

**Table 5.1 Records of Historical Flooding**

- 5.2.11 Drawing 55328/C/AS/01 Rev C entitled '*Assets – Chesterfield*' featured in Appendix D Part D of the SFRA-1 highlights the watercourse passing through the development site. The drawing indicates two adjacent outfalls at the point where the watercourse meets the River Doe Lee, just south of Worksop Road, having followed a route adjacent to the highway in a south-westerly direction. In addition, the drawing indicates bifurcation of the watercourse, south of Worksop Road close to Norbriggs Primary School, where a branch of the watercourse appears to cross the highway running north-westwards and meet the River Doe Lea and an additional outfall approximately 150 m to the north. Since neither branch is visible in open section to the west of Norbriggs Primary School on online Ordnance Survey mapping, it is assumed that they are in culvert for approximately 200 m.

### 5.3 STRATEGIC FLOOD RISK ASSESSMENT LEVEL 2

- 5.3.1 The Strategic Flood Risk Assessment Level 2 (SFRA-2) is intended to provide sufficient detail for the exception test to be applied and is produced either by the local planning authority, or is commissioned by them from a flood consultancy to produce the SFRA. The SFRA-2 will follow up on any issues raised in the SFRA-1.
- 5.3.2 The SFRA-2 should assess existing flood defence infrastructure (e.g., flood barriers). The assessment should state where the flood defence infrastructure is located and what condition it is in, by reference to the organisations which operate and maintain the flood defence infrastructure, e.g., local authority or Internal Drainage Board (IDB).
- 5.3.3 The SFRA-2 should assess the risk of flood defence infrastructure failing during the lifetime of any developments, and should include an allowance for climate change as well as wave height and direction for assessments in coastal areas. Consideration should be given to the consequences of failed flood defences in the local planning authority area.
- 5.3.4 The SFRA-2 should identify anything specific which planning applicants need to do to meet the requirements of the exception test.





- 5.3.5 The foregoing summary has been based on information provided on the DEFRA website.
- 5.3.6 There was no SFRA-2 available to download from the Chesterfield Borough Council website, either as a result of a search of the website, or as a result of a general internet search for 'Chesterfield Borough Council Strategic Flood Risk Assessment Level 2'.
- 5.4 **PRELIMINARY FLOOD RISK ASSESSMENT**
- 5.4.1 The Preliminary Flood Risk Assessment (PFRA) is produced either by the local planning authority, or is commissioned by them from a flood consultancy to produce the PFRA. PFRAs are intended as a high-level screening exercise to address local sources of flood risk, primarily from surface water runoff, groundwater and ordinary watercourses, which are the responsibility of the local planning authority (the Lead Local Flood Authority – LLFA).
- 5.4.2 A PFRA is an assessment of:
- i.* Floods that have taken place in the past.
  - ii.* Floods that could take place in the future.
- 5.4.3 The PFRA considers flooding from surface water runoff, groundwater and ordinary watercourses and is used to identify areas that are at risk of significant flooding, these areas are called flood risk areas. LLFAs are responsible for and prepare the PFRAs and identify the flood risk areas.
- 5.4.4 The foregoing summary has been based on information provided on the DEFRA website.
- 5.4.5 A PFRA, dated May 2011, was produced by Derbyshire County Council and was downloaded from the Derbyshire County Council website.
- 5.4.6 The PFRA includes mapping, however this is generally at a small scale and covers the entire Derbyshire area, meaning that it is not possible to identify the subject site.
- 5.4.7 An assessment of future flood risk as part of the PFRA suggests that Chesterfield is ranked highest risk in the Derbyshire area, with 84% of 1 km grid squares within the borough being identified as at future risk of flooding. This assessment is based on surface water flood risk using the Environment Agency's 'Flood Map for Surface Water' (FMfSW) and Ordnance Survey MasterMap building outlines in applying the 'Property Count Method'.
- 5.4.8 As discussed in paragraph 5.4.6, however, the mapping featured in the PFRA is at too small a scale to identify whether the Site is located within one of the grid squares identified as being at risk. It should also be noted that the FMfSW was updated by the Environment Agency by the more accurate 'Risk of Flooding from Surface Water' map. Furthermore, surface water flood risk mapping is now provided on the UK



Government Long Term Flood Risk Information website, (for England), rather than on the Environment Agency website. This is reviewed in **Section 8**.

- 5.4.9 The PFRA also highlights the importance of SuDS in adapting to climate change and managing the risk of flooding in the future.



## 5.5 SURFACE WATER MANAGEMENT PLAN

- 5.5.1 A Surface Water Management Plan (SWMP) is defined by DEFRA in its SWMP technical guidance, which has been written for local authorities to assist them co-ordinate and lead local flood risk management activities, as a plan which outlines the preferred surface water management strategy in a given location, (DEFRA, March 2010, Surface Water Management Plan Technical Guidance).
- 5.5.2 The DEFRA technical guidance emphasises that SWMPs may not be required in all locations and that studies should be prioritised in areas considered to be at greatest risk of surface water flooding or where partnership working is essential to both understand and subsequently address surface water flooding issues.
- 5.5.3 There was no SWMP available to download from either the Chesterfield Borough Council or Derbyshire County Council websites, either as a result of a search of the websites, or as a result of a general internet search for 'Chesterfield Borough Council Surface Water Management Plan', or 'Derbyshire County Council Surface Water Management Plan'.

## 5.6 CATCHMENT FLOOD MANAGEMENT PLAN

- 5.6.1 Catchment Flood Management Plans (CFMPs) consider all types of inland flooding, from rivers, groundwater, surface water and tidal flooding. Shoreline management plans consider flooding from the sea.
- 5.6.2 CFMPs also include:
- i.* The likely impacts of climate change.
  - ii.* The effects of how land is used and managed.
  - iii.* How areas could be developed to meet present day needs without compromising the ability of future generations to meet their own needs.
- 5.6.3 CFMPs help the Environment Agency and their partners to understand the scale and extent of flooding now and to plan and agree the most effective way to manage flood risk in the future. This is achieved by setting policies for managing flood risk within the catchment.
- 5.6.4 CFMPs are used to inform planning and decision making by, *inter alia*, the Environment Agency, local authorities, internal drainage boards and transportation planners. CFMPs aim to promote more sustainable approaches to managing flood risk. CFMPs are grouped by river basin district.
- 5.6.5 The foregoing summary has been based on information provided on the DEFRA and Environment Agency websites.



- 5.6.6 A CFMP, dated December 2010, was produced by the Environment Agency for the Don Catchment, which includes the area of the subject site. The CFMP was downloaded from the Environment Agency website.
- 5.6.7 In summary, the CFMP describes the catchment overall and in the area of the subject site as follows:
- 'The Don catchment extends over 1,800 square kilometres. The upper parts of the catchment comprise the steep-sided, well-defined valleys of the Pennine fringe, including Chesterfield, Sheffield and Barnsley. The catchment covers 13 Local Authorities, of which Sheffield, Barnsley, Chesterfield, Doncaster, North East Derbyshire and Rotherham cover the greatest area. Urban land use occupies 18 per cent of the catchment.'*
- 5.6.8 In relation to the subject site and surrounding areas, the CFMP identifies that these fall within the Chesterfield and River Hipper catchment sub-area (Sub-area 1), which is reported to have 1,731 properties at risk of flooding during a 1% probability flood assuming no defences. It is forecasted that this may rise to 1,899 in the future.
- 5.6.9 Identified issues for the CFMP Sub-area 1 are summarised as follows:
- i.* The sub area includes the main watercourses of the Rivers Hipper, Doe Lea, Drone, Whitting and Rother, draining from the south of Chesterfield northwards towards Rotherham.
  - ii.* Flooding comes from the rivers, surface water and sewer systems.
- 5.6.10 The preferred policy for CFMP Sub-area 1 is Policy Option 6, which the Environment Agency describe as 'Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.' The proposed actions to implement the preferred policy in the sub-area which may impact on the subject site include, inter alia, the following:
- i.* As part of future works, ensure that the potential for habitat creation and environmental improvement is fully investigated.
  - ii.* Work in partnership with the Lead Local Flood Authority to reduce the risk of flooding from surface water.
  - iii.* Work with landowners and other organisations to change the way land is managed to slow the rate at which floods are generated.
- 5.6.11 Since the Site is located in fluvial Flood Zone 1, there are no details of historical flooding recorded in relation to the subject site and the immediate vicinity.
- 5.6.12 There are no references to SuDS guidance *per se* in the CFMP.



**5.7 LOCAL FLOOD RISK MANAGEMENT STRATEGY**

5.7.1 A Local Flood Risk Management Strategy (LFRMS) is a requirement for all Lead Local Flood Authorities (LLFAs) to set out:

- i.* How local flood risks will be assessed and;
- ii.* Objectives for managing local flooding.

5.7.2 The LFRMS should also set out the costs and benefits of the measures proposed to meet the objectives, who will deliver them and how they will be funded. Local flooding is defined as flooding that is caused by the following principal sources:

- i.* Surface water.
- ii.* Groundwater.
- iii.* Ordinary Watercourses.

5.7.3 The foregoing summary has been based on information provided on the DEFRA and Environment Agency websites.

5.7.4 A LFRMS, dated July 2015, was produced by Derbyshire County Council and was downloaded from the Derbyshire County Council website.

5.7.5 There are no specific references in the LFRMS in relation to the subject site and Mastin Moor.

5.7.6 In relation to the risk of surface water flooding, the LFRMS reports that Derbyshire County Council has in partnership with a technical consultant produced a modelled representation of surface water flood risk for Derbyshire for several rainfall/storm scenarios. However, the output from the modelling is not included in the LFRMS, other than a sample illustration at Figure 8.

5.7.7 A map showing indicative areas of shallow groundwater in Derbyshire based on the British Geological Survey SuDS dataset is reproduced as Figure 11, however, as with the mapping included in the PFRA, this is at too small a scale to identify whether the Site is impacted.

5.7.8 SuDS guidance included in the LFRMS is essentially generic rather location specific and adds little to that provided in the SFRA-1.

**5.8 SUDS GUIDANCE**

5.8.1 The principal SuDS guidance is provided in the SFRA-1 as detailed in **Section 5.2**.



## SECTION 6 CONSULTATION RESPONSES: SUMMARY

### 6.1 ENVIRONMENT AGENCY

- 6.1.1 The Environment Agency was originally consulted in 2014 regarding the Site and were subsequently re-consulted via an email enquiry dated 6 December 2016, and responded by email on 11 January 2017.
- 6.1.2 A 'Product 4' was obtained as part of the original 2014 consultation. The Product 4 typically provides a detailed flood risk assessment map, including flood zones, defences and storage areas, areas benefiting from defences, statutory main river designations, historic flood event outlines and more detailed information from the Environment Agency's computer river models, including model extent, information on one or more specific points, flood levels, flood flows.
- 6.1.3 Information provided by the Environment Agency detailed that the Site is located wholly within the Flood Zone 1 outline, and is outside of the area of influence of the River Doe Lea. It also confirmed that the Site was not affected by a historical flood event that occurred on the river in 2007.
- 6.1.4 In their email, the Environment Agency provided advice on attenuation, and outlined that surface water discharge from a new development should ideally 'mimic' the pre-development situation using SuDS so that flow in watercourses is not increased and that in normal circumstances surface water discharge from new development should be attenuated to the 'Greenfield' 1 in 1 year flow from site. The Environment Agency also highlight that any attenuation system needs to be designed so there is no flooding to properties on or off site for rainfall events up to 1 in 100 year return period (including an allowance for climate change).
- 6.1.5 The Environment Agency advised that if it is proposed to discharge surface water to a watercourse, then an investigation should be carried out to determine its suitability to receive any additional volume without causing flooding problems elsewhere.
- 6.1.6 In their email of 11 January 2017, the Environment Agency included a Flood Map for Planning in addition to a new Flood History Map as the previous map issued did not include a flood event in 1958. The Environment Agency advised that otherwise the data supplied is currently their best available.
- 6.1.7 The new Flood History Map includes outlines for both the 1958 and 2007 flood events; however, neither the new Flood History Map, nor the new Flood Map for Planning indicate any impact on the Site; which remains in Flood Zone 1.
- 6.1.8 The Environment Agency also noted that the modelling in the area will be updated in the spring of 2017 as part of their Lower and Middle Don model; they also confirmed that there are no planned flood alleviation works in the area, although there is a paleo channel restoration planned downstream of the Site.



- 6.1.9 Copies of the correspondence with the Environment Agency and provided information/attachments are included in **Appendix 2**.

- 6.1.10 Merebrook also consulted the Environment Agency and the UK Government Long Term Flood Risk Information online mapping, which is reported in the following sections:

#### **Fluvial Flood Map**

- 6.1.11 The fluvial flood map consulted online indicates that the Site lies within Flood Zone 1, that is land assessed as having a less than 0.1% (1 in 1000) annual probability of river or sea flooding.

#### **Surface Water Flood Map**

- 6.1.12 The surface water flood map consulted online (extent of flooding) indicates that surface water flood risk to the vast majority of the Site is 'Very Low'. The areas of highest risk are generally limited to and coincident with the ordinary watercourse which passes through the Site, which areas range from 'Low' to 'High' risk.
- 6.1.13 In relation to velocity and overland flow routes, the surface water flood map indicates that velocities are likely to be greater than 0.25 m/s, in the areas of highest risk which are generally limited to and coincident with the ordinary watercourse which passes through the Site. The predominant direction of overland flow is also coincident with that of the ordinary watercourse, i.e., north-east to south-west.

#### **Groundwater**

- 6.1.14 The Environment Agency online groundwater mapping indicates that the Site is located within an area classified as Secondary (A) Aquifer associated with the Pennine Middle Coal Measures Formation. Secondary (A) Aquifers are classified as 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 classed as minor aquifers. The Environment Agency online groundwater vulnerability map indicates that the Site lies within an area which falls within the 'Minor Aquifer Low' groundwater vulnerability zone.
- 6.1.15 The Environment Agency groundwater mapping indicates that the Site is not within a Source Protection Zone (SPZ).
- 6.1.16 There are no licenced groundwater abstractions indicated on the Environment Agency online mapping within 1 km of the Site.

#### **Infrastructure**

- 6.1.17 The Environment Agency online mapping does not indicate that the Site is at risk from flooding from reservoirs.



## 6.2 LEAD LOCAL FLOOD AUTHORITY

- 6.2.1 The Lead Local Flood Authority (LLFA) for the area, Derbyshire County Council was originally consulted in 2014, in relation to the surface water flood risk to the Site and any site specific flood history and were subsequently re-consulted via an email enquiry dated 6 December 2016, and responded by email on 2 February 2017.
- 6.2.2 Their original 2014 response highlighted that surface water model outputs indicate that the Site is unlikely to be subject to surface water flooding during the critical storm duration in the 1% (1 in 100) event. In addition, model outputs for the 0.1% (1 in 1000) event indicate that the Site is unlikely to be subject to surface water flooding.
- 6.2.3 In addition, it was suggested, based on British Geological Survey data, that groundwater is likely to be more than 5 m below the ground surface throughout the year.
- 6.2.4 Derbyshire County Council hold no records on historical instances of flooding within the site boundary, however there are three records of flooding in the vicinity of the Site. These appear to be identical to those stated in the SFRA-1, as detailed in **Section 5.2**.
- 6.2.5 The Derbyshire County Council response to the re-consultation, email dated 2 February 2017, confirmed that no new information has emerged since the information they provided in 2014. In relation to the drainage strategy, Derbyshire County Council highlighted the following key requirements:
- i.* They would require the pre and post development runoff rates.
  - ii.* As the Site is currently Greenfield, the post development rate should be as close as possible to the Greenfield rate.
  - iii.* They would need to know the point of discharge.
  - iv.* SuDS needs to be considered.
  - v.* They would need to know the volume of any surface water storage required.
  - vi.* They would need an indicative drainage layout plan.
- 6.2.6 A copy of the correspondence with Derbyshire County Council is included in **Appendix 2**.
- 6.2.7 The Derbyshire County Council Preliminary Flood Risk Assessment (PFRA), is reviewed in **Section 5.4**.





### 6.3 STATUTORY DRAINAGE UNDERTAKER

- 6.3.1 Yorkshire Water was originally consulted in 2014, in relation to the locations of sewers in the vicinity of the Site and were subsequently re-consulted via a letter enquiry dated 16 December 2016 and responded by letter on 8 January 2017.
- 6.3.2 Public sewer record plans were supplied by Yorkshire Water dated 9 May 2014. The public sewer record plans provided show the following:

#### **Surface Water Sewers**

There are no surface water sewers present on or near the Site. The Site is not located within an area which is serviced by public surface water sewers.

#### **Foul Water Sewers**

There are no foul water sewers present on or near the Site.

#### **Combined Sewers**

The records indicate that there is a combined sewer in Norbriggs Road to the west of the Site, from the junction with Bridle Road, flowing northwards to the junction with Worksop Road. This is the main sewer for the residential area of Woodthorpe. There is also a combined sewer to the north-east of the Site in Worksop Road, from the eastern extent of the site boundary to Rowan Road, where it turns north-westwards and into the Mastin Moor residential area. This flows west, and connects with the Norbriggs Road combined sewer adjacent to the River Doe Lea before discharging into a pumping station.

- 6.3.3 The Merebrook re-consultation letter dated 16 December 2016, provided a completed Pre-Planning Sewerage Enquiry form and sought to establish the drainage constraints for the proposed development of the Site. The Yorkshire Water response letter dated 8 January 2017, provided further copies of the public sewer record plans; these are identical to those provided in 2014. Therefore, the comments and observations made in relation to the 2014 public sewer record plans in paragraph 6.3.2, remain valid.
- 6.3.4 In relation to the Pre-Planning Sewerage Enquiry, the Yorkshire Water response letter highlighted a number of key points, which are reproduced as follows:

#### **Existing Infrastructure**

*'The local Waste Water Treatment Works (WWTW) is Staveley. It is understood that this WWTW may only have limited spare capacity, if any, available. We have contacted the respective treatment team for more information regarding the impact of proposed development and will contact you when an assessment has been made.'*



### **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.'*

*'The public sewer network does not have adequate capacity available to accommodate the anticipated foul water discharge from this proposal site. Further modelling investigation funded by the developer will be required.'*

*'Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens etc. must pass through a fat and grease trap of adequate design before any discharge to the public sewer network.'*

### **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 with a view to establishing a suitable watercourse for discharge.'*

*'It is understood that a watercourse is located through the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable).'*

*'Surface water run-off from communal parking (greater than 800 sq metres or more than 50 car parking spaces) and hardstanding must pass through an oil, petrol and grit interceptor/separator of adequate design before any discharge to the public sewer network. Roof water should not pass through the traditional 'stage' or full retention type of interceptor/separator. It is good drainage practice for any interceptor/separator to be located upstream of any on-site balancing, storage or other means of flow attenuation that may be required.'*

- 6.3.5 The provided Yorkshire Water sewer records and correspondence, including the response to the Pre-Planning Sewerage Enquiry dated 8 January 2017, are included in **Appendix 3**.



## SECTION 7 POTENTIAL SOURCES OF FLOODING

### 7.1 GENERAL

- 7.1.1 BS 8533: 2011 'Assessing and managing flood risk in development – Code of practice' details recommendation and guidance on the appropriate assessment and management of flood risk where development is proposed in the UK. It is intended to provide developers with practical assistance for dealing with flood risk in and around their development.
- 7.1.2 It outlines that an assessment should be made of flood risk both **to** the development site and **as a result of** the development site in relation to the following sources of flooding:
- i.* Tidal and fluvial flooding – flooding from main rivers, ordinary watercourses and the sea.
  - ii.* Surface water flooding – flooding from overland flow due to rainfall.
  - iii.* Flooding from sewers and drains – flooding from surcharging of below ground drainage systems.
  - iv.* Groundwater flooding – flooding related to the water table, where ground water levels rise above surface levels.
  - v.* Flooding caused by the failure of infrastructure – flooding from reservoir, canal or land drainage infrastructure, usually as a result of catastrophic failure.

**Sections 8 and 9** summarise the significant potential sources of flooding identified from a desk based appraisal. These potential sources have been used to inform further actions or mitigations, as described later in **Section 10**.

## SECTION 8 ASSESSMENT OF FLOOD RISK TO THE DEVELOPMENT

### 8.1 FLUVIAL FLOOD RISK TO THE SITE

- 8.1.1 The Site is located in Flood Zone 1, that is land assessed as having a less than 0.1% (1 in 1000) annual probability of river or sea flooding. This was confirmed by a review of the Environment Agency online fluvial flood mapping and the Environment Agency provided flood mapping as discussed in **Section 6.1**.
- 8.1.2 There is an area of Flood Zone 3 to the west of the Site, associated with the River Doe Lea, where flood defences are indicated on the online Environment Agency mapping. Flood Zone 3 extends to an area approximately 600 m from the Site, with the residential area of Woodthorpe between the Site and the fluvial floodplain. As detailed in **Section 6.1**, information provided by the Environment Agency confirmed that the Site is not within the flood outline of the River Doe Lea.



- 8.1.3 An unnamed ordinary watercourse dissects the Site, flowing from north-east to south-west, originating adjacent to the M1 motorway just south of the Worksop Road/M1 crossing. Online Ordnance Survey mapping indicates that the watercourse is mostly in an open channel as it passes through the Site, and adjacent to properties on Norbriggs Road, before entering a culvert beneath the highway. It then reemerges as it passes adjacent to Norbriggs Primary School, before bifurcation of the watercourse appears to occur.
- 8.1.4 The watercourse is highlighted in the SFRA-1, as part of Chesterfield Borough Council's asset register, as described in **Section 5.2**. This indicates bifurcation of the watercourse as it reaches Worksop Road, with one branch flowing south-west to outfall into the River Doe Lea, and the second flowing north-west and into the same main river but further downstream. Both sections are believed to be in culvert, based on review of online Ordnance Survey mapping and satellite imagery.
- 8.1.5 Consultation with Derbyshire County Council, the Lead Local Flood Authority for the area, indicate that they are not aware of any specific fluvial modelling proposed for the Site.
- 8.1.6 Mechanisms related to the ordinary watercourse are perhaps best represented in the Environment Agency online risk of flooding from surface water mapping, due to the natural surface water flow path formed by the watercourse channel in the hydraulic 2D modelling (although in using this interpretive method, caution should be taken not to confuse the overland flow paths indicated on the mapping with fluvial flow). This suggests a relatively deep 'V' shaped valley, where flow is contained within a narrow band along the watercourse channel. This may suggest that out of bank flow is less likely than in flatter sections of watercourse, such as those further downstream close to the River Doe Lea.
- 8.1.7 It should be noted that there is a potential for blockage or capacity issues relating to the culvert where the watercourse passes beneath Norbriggs Road. It is likely however that any flooding as a result of problems with the culvert would affect adjacent, lower properties before it affected land within the Site. It is likely therefore that residents and risk management authorities would be alerted prior to any effect within the Site. There is no known history of flooding to these existing properties adjacent to the culvert.
- 8.1.8 There are no known historical records of flooding associated with this ordinary watercourse. During on-site survey work, anecdotal evidence was provided by a small number of local residents who suggested that the ordinary watercourse was prone to flooding in times of high flow, although it seemed that flooding affected highways and external areas rather than being internal property flooding.
- 8.1.9 The risk to the undeveloped site from fluvial flooding is considered to be **low** and mitigation is not considered to be required.



## 8.2 SURFACE WATER FLOOD RISK TO THE SITE

- 8.2.1 Surface water flooding is generally associated with either sloping land with poor permeability, or land that is topographically low relative to its surroundings, known as a 'low spot'.
- 8.2.2 As described in **Section 2**, the topography of the Site comprises a 'V' shaped valley with relatively steep sided slopes (between 1 in 14 and 1 in 16). It is possible that, where permeability is low and a catchment sufficiently large, such topography can lead to overland surface water flow paths. The Environment Agency and the UK Government Long Term Flood Risk Information online surface water flood risk maps and catchment outline available from Flood Estimation Handbook (FEH) sources suggest that the surface water catchment is relatively confined, and broadly corresponds with the proposed site area.
- 8.2.3 The Environment Agency and the UK Government Long Term Flood Risk Information online surface water flood risk maps suggests a narrow band of 'high risk' area along the route of the ordinary watercourse, as described in paragraph 8.1.6. This suggests that the channel of the watercourse acts as a flow path for runoff from the upstream catchment. The 'high risk' nature of the flow path is likely to be related to the depth/velocity relationship of the surface water here, however the risk is confined to a very narrow area, relative to the Site. There are also two low risk bands of surface water overland flow routes indicated from the north of the Site, originating near the junction of Worksop Road and Bolsover road, joining with the main flow path to the south.
- 8.2.4 A consultation response from Derbyshire County Council suggested that the Site is unlikely to be subject to surface water flooding during the 1% (1 in 100) or 0.1% (1 in 1000) annual event probability storms.
- 8.2.5 The risk to the undeveloped site from surface water flooding is considered to be **low**, however, given the presence of a 'high risk' flow path along the route of the ordinary watercourse which dissects the Site, further action may be required to ensure that this risk does not affect the development area. This is discussed in **Section 10**.

## 8.3 FLOOD RISK TO THE SITE FROM SEWERS & DRAINS

- 8.3.1 As discussed in **Section 6.3**, there are no foul or surface sewers present on or near the Site and the Yorkshire Water sewer records indicate that the Site is not located within an area which is serviced by public surface water sewers.
- 8.3.2 There is a combined sewer in Norbriggs Road to the west of the Site, from the junction with Bridle Road, flowing northwards to the junction with Worksop Road. This sewer is separated from the Site by a strip of land approximately 10-20 m in width, which includes residential properties to the east of Norbriggs Road. There is no known history of flooding from this sewer. Given the topography of Norbriggs Road and the surrounding area, it is likely that if any surcharging did ever occur on



this sewer, flood water would pond close to the junction with Cranleigh Road, and would not encroach upon the site boundary.

- 8.3.3 There is also a combined sewer to the north-east of the Site in Worksop Road, from the site boundary extent to the east, as far as Rowan Road. There are two known instances of flooding associated with this sewer, as detailed in the SFRA-1 (**Section 5.2**) and Derbyshire County Council's consultation response (**Section 6.2**). The SFRA-1 mapping suggests that these occurred in the area of property numbers 25-53 Worksop Road, on the opposite site of the highway to the north-east of the Site. Records suggest that internal property flooding occurred to two or three dwellings, however the date of the flooding is not known. This appears to have been an isolated incident as opposed to an ongoing problem related to sewer capacity.
- 8.3.4 The relative distance of combined sewers from the Site, and the isolated nature of the historical flood event suggests that the risk of flooding to the Site from existing sewers and drains is low.
- 8.3.5 The risk to the undeveloped site from flooding from existing sewers and drains is therefore considered to be **low** and mitigation is not considered to be required.

#### 8.4 GROUNDWATER FLOOD RISK TO THE SITE

- 8.4.1 Groundwater flooding occurs where groundwater levels rise above the ground surface level. Flooding can also occur due to seepage from higher ground where land is low-lying relative to its surroundings, or in locations where there is superficial clay geology with 'lenses' of sand which fill with water. Groundwater flooding can also occur when the water table elevation in Chalk aquifers rises above ground surface.
- 8.4.2 As described in **Section 2** the hydrogeology of the Site is a Secondary (A) Aquifer. Secondary (A) Aquifers are classified as permeable layers capable of supporting water supplies at a local rather than strategic scale, and are generally aquifers formerly classed as minor aquifers. There are no licenced groundwater abstractions within 1 km of the Site, and the Site does not lie within an Environment Agency designated groundwater source protection zone.
- 8.4.3 Consultation with Derbyshire County Council suggests that groundwater is likely to be more than 5 m below the ground surface throughout the year. The Merebrook Phase 2 Geo-environmental Assessment intrusive ground investigation only encountered groundwater in two of the exploratory holes with recorded minimum depths of 2.91 m and 2.71 m below ground level.
- 8.4.4 The risk to the undeveloped site from groundwater flooding is considered to be **low** and mitigation is not considered to be required.



## 8.5 FLOOD RISK FROM INFRASTRUCTURE FAILURE

- 8.5.1 The Chesterfield Canal is located approximately 2 km to the west of the Site and at a lower elevation. This distance and the topography of the area, indicates that there is no risk to the Site from canal flooding or failure.
- 8.5.2 The Environment Agency mapping consulted online does not indicate that the Site is at risk from reservoir flooding.
- 8.5.3 Online Ordnance Survey and satellite mapping does not indicate any local drainage ditch infrastructure in the vicinity of the Site, and the Site is not in an area managed by an Internal Drainage Board. The risk of flooding from ditches is therefore considered to be low.
- 8.5.4 As outlined in **Section 2.2**, a concrete marker post was identified during the site survey near to the junction of Worksop Road and Bolsover Road, indicating a mine water discharge. Anecdotal evidence from a resident suggested that a 1 m diameter pipe was present within a triangular portion of land to the rear of number 50a Worksop Road, which was associated with mine workings, and often flowed at full bore. It is not known whether this pipe might connect into the ordinary watercourse on site, or the River Doe Lea further downstream. It was also suggested that a 'wet spot' in this land may be due to a fault in the pipe.
- 8.5.5 The location of this mine water discharge, to the north of the Site, means that overland flow from any flooding would follow the topography of the area across the northern portion of the Site towards the ordinary watercourse in the centre, potentially posing a risk to properties in the vicinity and further downstream on the watercourse.
- 8.5.6 The Phase 1 Geo-environmental Assessment/Desk Study completed by Merebrook also highlighted that existing mine drainage was present within the Site, and recommend that a Mine Entry Interpretive Report be obtained from the Coal Authority. Mine records were subsequently obtained from the Coal Authority, which indicated that there are a number of filled and/or capped mineshafts within the Site, although none coincided with the potential mine water discharge referred to in **Section 2.2**. The intrusive ground investigation and reporting undertaken as part of the Phase 2 Geo-environmental Assessment, similarly did not provide any further information in relation to the potential mine water discharge.
- 8.5.7 Consequently, although the risk to the Site from the failure of general infrastructure is considered to be low, the potential risk from mine drainage remains unknown which need to explored at the detail design of the proposed development.
- 8.5.8 The risk to the undeveloped site from the failure of infrastructure is considered to be **low**, however, given that the potential risk from mine drainage remains unknown, further investigation is likely to be required in order to establish the potential level of risk. This is discussed in **Section 10**.



## 8.6 SUMMARY OF FLOOD RISK TO THE DEVELOPMENT

Flood Risk	Summary of risk to the proposed development	Notes	* Further action or mitigation potential
Fluvial	<u>Low</u>	Specific mitigation unlikely.	×
Surface water	<u>Low</u>	Specific mitigation may be required to ensure that the high risk' flow path along the route of the ordinary watercourse does not affect the development area.	✓
Sewers and drains	<u>Low</u>	Specific mitigation unlikely.	×
Groundwater	<u>Low</u>	Specific mitigation unlikely.	×
Failure of infrastructure	Canals, reservoirs and land drainage <u>Low</u>	Specific mitigation unlikely.	×
	Mine drainage <u>High</u>	Specific mitigation required. Further investigation required in order to establish the potential level of risk.	✓

\* For proposed action(s) and/or mitigation refer to **Section 10**.

## SECTION 9 ASSESSMENT OF FLOOD RISK FROM THE DEVELOPMENT

### 9.1 IMPACT ON FLUVIAL FLOODING

#### 9.1.1 Loss of Floodplain

9.1.2 As discussed in **Section 4.5**, the Site is located in Flood Zone 1. The proposed development is not considered to have an impact on the fluvial floodplain of any main rivers.

9.1.3 As discussed in **Section 2.2** an ordinary watercourse dissects the Site, flowing from north-east to south-west. Although the floodplain for this watercourse is not known the topography ('V' shaped valley), and Environment Agency/UK Government Long Term Flood Risk Information online surface water mapping, suggest that flows generally remain within bank.

9.1.4 The impact of the proposed development on the fluvial floodplain is expected to be low and mitigation is not considered to be required.

#### 9.1.5 Increase in Fluvial Flows

9.1.6 The nature of the proposed development means that it is highly likely that an increase in the amount of impermeable area will occur. Based on the development





site area, it is anticipated that the area of impermeable surface created may be in the region of 16.62 ha. This is likely to lead to a significant increase in the amount of runoff from the development site area, compared to the pre-developed situation.

9.1.7 Due the presence of an ordinary watercourse through the centre of the Site, as described in **Section 2.2**, it is likely that any increase in runoff would be directed into this watercourse, thus increasing flood risk immediately downstream and in the wider main river network.

9.1.8 The potential impact of the proposed development on fluvial flows is considered to be **high** and mitigation is considered to be required in order to manage the increased risk of greater fluvial flows. This is discussed in **Section 10**.

## 9.2 **IMPACT ON SURFACE WATER FLOODING**

9.2.1 It is anticipated that the development will increase surface water run-off due to the creation of new impermeable areas on site. If left unmanaged, this run-off is likely to dissipate to areas adjacent to the Site via overland flow routes, increasing the risk of surface water flooding in other areas, particularly in Woodthorpe, which lies adjacent to and at a lower elevation to the Site.

9.2.2 The impact of the proposed development on surface water is considered to be **high** and further action or mitigation is considered to be required in order to manage the increased risk of surface water flooding. This is discussed in **Section 10**.

## 9.3 **IMPACT ON SEWER FLOODING**

### 9.3.1 Surface Water Sewers

9.3.2 As discussed in **Section 6.3**, there are no surface water sewers present on or near the Site; therefore it is considered that there will be no impact on the existing surface water sewer system, where present, as a result of the development.

9.3.3 New surface water sewers will be required to service the proposed development to convey runoff within the Site. Surcharging of these new surface water sewer systems, should it occur could lead to flooding within the proposed development and surrounding areas.

9.3.4 The impact of the proposed development on surface water sewer flooding is considered be **moderate** and further action or mitigation is considered to be required in order to manage the risk of sewer flooding. This is discussed in **Section 10**.

### 9.3.5 Foul Water Sewers

9.3.6 As discussed in **Section 6.3**, there are no foul water sewers present on or near the Site, therefore it is considered that there will be no impact on the existing foul water sewer system, where present, as a result of the development.



- 9.3.7 There are combined sewers present in Norbriggs Road and Worksop Road. Of these the combined sewer in Norbriggs Road to the west of the Site, which is at a lower elevation and down gradient relative to the Site, could potentially be used to receive foul flows from the Site, or a new foul sewer could be provided by means of sewer requisition (pursuant to Section 98 Water Industry Act 1991).
- 9.3.8 However, given the scale and size of the proposed development, significant foul flows are likely to be generated. This is likely to have a correspondingly significant impact on the local combined sewer network, potentially increasing the risk of flooding from this system, and from any new systems within the site area.
- 9.3.9 The Yorkshire Water Pre Planning Sewerage Enquiry response (**Section 6.3**), has highlighted that the public sewer network does not have adequate capacity available to accommodate the anticipated foul water discharge from the proposed development site. Yorkshire Water has also indicated that the local waste water treatment works at Staveley may only have limited spare capacity available, if any. Yorkshire Water has stated in their response that they will revert to Merebrook when an assessment has been made of the waste water treatment works capacity.
- 9.3.10 Given the foregoing, it is likely that further modelling investigation will be required by Yorkshire Water in order to assess the impact of the proposed development. This is likely to result in significant off-site reinforcements of the sewer network, possibly including the Staveley waste water treatment works, and/or new foul sewer requisition(s). This means that until such further assessment and off-site reinforcement works have been undertaken, the proposed development is likely to significantly increase the risk of foul sewer flooding.
- 9.3.11 The impact of the proposed development on foul water sewer flooding is therefore considered to be **high** and further action or mitigation is considered to be required in order to manage the risk of foul sewer flooding. This is discussed in **Section 10**.
- 9.4 **IMPACT ON GROUNDWATER FLOODING**
- 9.4.1 As described in **Section 8.4**, the provided/available information suggests that the Site has a low potential for flooding from groundwater. The hydrogeology of the Site is a Secondary (A) Aquifer. Secondary (A) Aquifers are classified as permeable layers capable of supporting water supplies at a local rather than strategic scale, and are generally aquifers formerly classed as minor aquifers. Consultation with Derbyshire County Council suggests that groundwater is likely to be more than 5 m below the ground surface throughout the year. The Merebrook intrusive ground investigation only encountered groundwater in two of the exploratory holes with recorded minimum depths of 2.91 m and 2.71 m below ground level.
- 9.4.2 An increase in the likelihood of groundwater flooding is generally related to changes in sub-surface flow paths as a result of underground structures, such as basements or sheet piling within the depth range of groundwater levels. Such structures are not expected to be proposed as part of the development.



- 9.4.3 Provided that significant below-ground structures are not proposed as part of the development (such as sheet, or contiguous piles deeper than 5 m below ground level), the impact on the risk of groundwater flooding to the Site and adjacent areas is expected to be **low** and further action or mitigation is not considered to be required.

9.5 **IMPACT ON FLOOD RISK FROM INFRASTRUCTURE FAILURE**

- 9.5.1 As discussed in paragraph 8.5.1 the Chesterfield Canal is located approximately 2 km to the west of the Site, therefore at such a distance, it is not expected to be affected by the proposed development.
- 9.5.2 Impacts on the ordinary watercourse which passes through the Site are considered under the heading of fluvial flood risk, in **Section 9.1**.
- 9.5.3 As discussed in paragraph 8.5.2 the Site is not located within any reservoir flood outlines and so is highly unlikely to impact on reservoir flooding.
- 9.5.4 There are no known land drainage ditches in the vicinity of the Site, so there should be no increased flood risk associated with such infrastructure.
- 9.5.5 As discussed in paragraphs 8.5.4 to 8.5.6, the site survey, the Merebrook Geo-environmental Assessment and anecdotal evidence from local residents suggest that there is existing mine drainage on site, with a discharge to the rear of property number 50a Worksop Road, and potentially a large diameter pipe downstream. Until these mechanisms are better understood, it is not clear whether the proposed development may have an impact on the level of flood risk associated with them.
- 9.5.6 As noted in paragraph 8.5.6, although the Phase 1 Geo-environmental Assessment/Desk Study recommended that a Mine Entry Interpretive Report be obtained from the Coal Authority and mine records were subsequently obtained which indicated a number of filled and/or capped mineshafts within the Site, none coincided with the potential mine water discharge to the rear of property number 50a Worksop Road.
- 9.5.7 Consequently, as noted in paragraph 8.5.7, although the risk to the Site from the failure of general infrastructure is considered to be low, the potential risk from mine drainage remains unknown.
- 9.5.8 The impact of the proposed development on flood risk related to the failure of infrastructure is considered to be **low**, however, given that the potential risk from mine drainage remains unknown, further investigation is likely to be required in order to establish the potential level of risk. This is discussed in **Section 10**.



## 9.6 SUMMARY OF FLOOD RISK FROM THE DEVELOPMENT

Flood Risk	Summary of risk from the proposed development	Notes	* Further action or mitigation potential
Fluvial	Loss of Floodplain - <b>Low</b>	Specific mitigation unlikely.	×
	Increase in fluvial flows - <b>High</b>	Specific mitigation required.	✓
Surface water	<b>High</b>	Specific mitigation required.	✓
Sewers and drains	Surface water <b>Moderate</b>	Specific mitigation required.	✓
	Foul water <b>High</b>	Specific mitigation required.	✓
Groundwater	<b>Low</b>	Specific mitigation unlikely.	× **
Failure of infrastructure	Canals, reservoirs and land drainage <b>Low</b>	Specific mitigation unlikely.	×
	Mine drainage <b>High</b>	Specific mitigation required. Further investigation required in order to establish the potential level of risk.	✓

\* For proposed action(s) and/or mitigation refer to **Section 10**.

\*\* Subject to there being no significant below-ground structures (e.g., basements, sheet piling etc.) proposed as part of the development

## SECTION 10 ACTIONS & MITIGATION

### 10.1 OVERVIEW

10.1.1 As discussed in **Sections 8 and 9**, further action and/or mitigation may be required in order to assess and manage any flood risks as a result of the development.

10.1.2 A sequential, risk-based approach to managing flood risk has been taken, as detailed in BS 8533:2011 'Assessing and managing flood risk in development – Code of practice', with mitigation stages in order of preference as follows:

- i. Assessing and understanding the flood risk – achieving a sound understanding of risk, filling in gaps in understanding where practicable;
- ii. Avoiding the risk – Avoid building in areas of the site that are likely to be affected by flooding;



- iii.* Substitution – allocating land uses within the site so that those most vulnerable to flooding are at lowest risk;
- iv.* Control – incorporating flood risk management infrastructure such as barriers, water storage, surface and/or groundwater management, and safe overland flow pathways;
- v.* Mitigation – where the risk of flooding cannot be avoided, the residual risks should be safely managed, by raising floor levels, or where appropriate, with the use of resistant/resilient building techniques to minimise the damage and disruption caused by flooding;
- vi.* Public safety – public safety should be considered in all aspects of managing flood risk, and includes consideration of safe routes of access and egress, both within and outside of any proposed development, in addition to emergency planning.

## 10.2 FLOOD RISK TO THE PROPOSED DEVELOPMENT

10.2.1 An assessment of flood risk to the Site has indicated the risk from the following sources as:

- i.* Fluvial; Flood Zone 1 – low risk.
- ii.* Surface water – low risk.
- iii.* Sewers and drains – low risk.
- iv.* Groundwater – low risk.
- v.* Infrastructure failure; canals, reservoirs and land drainage – low risk.
- vi.* Infrastructure failure; mine drainage – high risk.

10.2.2 Mitigation is required in order to manage some of these impacts, which are as described below.

## 10.3 SURFACE WATER FLOODING

10.3.1 As discussed in **Section 6.2**, although consultation with Derbyshire County Council suggested a low risk from surface water, the Environment Agency/UK Government Long Term Flood Risk Information online surface water mapping indicates a band of high risk surface water flooding along the route of the ordinary watercourse that dissects the Site, flowing north-east to south-west. Although this risk is contained within a narrow area, the high-risk rating and steepness of the topography suggest that the overland flow route may be deep, or flow at high velocities.



- 10.3.2 There are several possible actions or mitigations to address the potential risk, listed in order of the hierarchical approach detailed in paragraph 10.1.2:
- i.* Assessing and understanding the flood risk – In the first instance a site-based ‘ground-truthing’ exercise could be completed to ascertain whether the Environment Agency/UK Government Long Term Flood Risk Information online surface water mapping is likely to be accurate for this area, and validate the current understanding of the local topography.
  - ii.* Assessing and understanding the flood risk – Where a ground-truthing exercise is inconclusive, it may be possible to complete a 2D direct rainfall model for the catchment. This would utilise the existing topographic survey to enable verification of the Environment Agency/UK Government Long Term Flood Risk Information online surface water mapping, and also allow the derivation of flood volumes, depths and velocities on site, and demonstrate overland flow paths. This understanding should mean that the most appropriate and efficient mitigation and management techniques can be applied, maximising development area whilst reducing the risk of flooding.
  - iii.* Avoidance or substitution - Avoid locating properties in areas at risk of surface water flooding, instead locating lower vulnerability classification uses in the area at risk, such as public open space.
  - iv.* Control - Including surface water management infrastructure as part of the development, for example, designed overland surface water flow routes, SuDS or flood barriers, however such mitigation measures are most appropriately applied where a full understanding of the risk has been established.

#### 10.4 FLOODING FROM INFRASTRUCTURE FAILURE

- 10.4.1 As discussed in **Sections 8 and 9**, the site survey, the Merebrook Geo-environmental Assessment and anecdotal evidence from local residents suggest that there is existing mine drainage on site, with a discharge to the rear of property number 50a Worksop Road and potentially a large diameter pipe downstream. It is not known where this pipe may outfall.
- 10.4.2 The location of this mine water discharge, to the north of the Site, means that overland flow from any flooding would follow the topography of the area across the northern portion of the Site towards the ordinary watercourse in the centre, potentially posing a risk to properties in the vicinity and further downstream on the watercourse.



- 10.4.3 In terms of the hierarchical approach to flood mitigation and management detailed in paragraph 10.1.2, it is suggested that the risk from mine water drainage needs to be further assessed and understood prior to any further stages being applied in mitigating the risk. This may best be completed with a three stage approach:
- i.* Further contact with the Coal Authority to establish any information that they may have on the mine water discharge (this may involve review of their records). It has been noted that mine records obtained thus far indicate a number of filled and/or capped mineshafts within the Site, however, none coincide with the potential mine water discharge to the rear of property number 50a Worksop Road.
  - ii.* A targeted site visit to gain a further understanding of the mine water discharge, such as locations of any access points into the system, the route of the pipe and potential outfall location. This may include, if possible, a visual inspection of the pipe via any access point(s), and dye tracing to establish connectivity.
  - iii.* Where further understanding is required, an intrusive CCTV survey may be required in order to establish the route, size and condition of the mine water discharge infrastructure.
- 10.4.4 Once a better understanding of the location, condition and hydraulic characteristics of the mine water drainage infrastructure has been established, it will be possible to better assess the level of risk.
- 10.5 **FLOOD RISK FROM THE PROPOSED DEVELOPMENT**
- 10.5.1 An assessment of the impact of the development on flood risk elsewhere has indicated that the proposed development has the potential to impact flood risk in the vicinity of the Site, as follows:
- i.* Increase in the risk of fluvial and surface water flooding, due to an increase in impermeable area and surface water run-off volumes.
  - ii.* Increase in the risk of sewer flooding due to the need for a new surface water sewer network to serve the development which may surcharge if surface water runoff is not adequately managed; and lack of capacity in the existing combined sewer network to accommodate the anticipated foul water discharge from the development. There may also be limited spare capacity at the Staveley waste water treatment works.
  - iii.* Infrastructure failure; mine drainage, unknown location, route condition, risk of damage, etc. However, the current level of mitigation identified in relation to this risk is set out in **Section 10.4**. The risk will need to be reviewed when the actions set out in **Section 10.4** have been implemented.



10.5.2 Mitigation is required in order to manage these impacts, as described below.

## 10.6 SURFACE WATER MANAGEMENT

10.6.1 Adequate surface water management is required for the proposed development in order to control the risk of flooding associated with an increase in the amount of surface water runoff which must be managed through collection, and storage in times of high flows.

10.6.2 In order to establish the likely attenuation requirements for the Site, and to demonstrate adequate mitigation for the increase in runoff, the pre-development Greenfield runoff must be assessed.

## 10.7 PRE-DEVELOPMENT GREENFIELD RUNOFF ASSESSMENT

10.7.1 A Greenfield runoff assessment was completed for the 27.7 ha site (**Section 2**) using the ICP SuDS Mean Annual Flood method, the results of which are included in **Table 10.1**. Outputs from Microdrainage Source Control software are included in **Appendix 4**.

Design Event	Runoff (l/s)
Development mean annual peak flow ( $Q_{BAR}$ )	98.8
100% (1 in 1) annual event probability ( $Q_{1yr}$ )	84.9
33.3% annual event probability ( $Q_{30yr}$ )	173.6
1% annual event probability ( $Q_{100yr}$ )	205.5

**Table 10.1 Greenfield Runoff Assessment**

10.7.2 This equates to a mean annual Greenfield runoff rate per hectare at 3.57 litres/second.

## 10.8 METHOD OF DISPOSAL OF SURFACE WATER

10.8.1 Current national guidance including but not limited to Requirement H3 of the Building Regulations Approved Document H 'Drainage and Waste Disposal' (2000) indicates the following surface water management options should be considered (listed in order of preference):

- i. Disposal via on-site infiltration system (source control)
- ii. Disposal to off-site watercourse; or,
- iii. Disposal to off-site sewer.

10.8.2 An assessment of the appropriateness of each of these solutions for the Site is detailed as follows:





## 10.9 DISPOSAL BY INFILTRATION

- 10.9.1 As discussed in **Section 5** the SFRA-1 highlights the requirement for the incorporation of SuDS into surface water drainage and current regulatory thinking/good practice encourages the use of source control techniques, and in particular, infiltration systems. However, in order for these systems to be used successfully the underlying geology needs to be sufficiently permeable to allow surface water to infiltrate, which potential should be assessed by on-site infiltration testing.
- 10.9.2 Infiltration testing has not been undertaken at the Site. However, given nature of the geology as discussed in **Section 2.4**, namely, solid geology comprising predominantly mudstone and siltstone and the presence of predominantly cohesive deposits and localised deep made ground, the Site is highly unlikely to be appropriate for the use of infiltration SuDS. Consequently, infiltration SuDS cannot be used for the disposal of surface water and this currently does not form part of the proposed drainage strategy for the Site.
- 10.9.3 It may be possible to utilise non-infiltration systems, such as Type C (BS 7533-13:2009) permeable pavements, or partial infiltration systems, such as Type B (BS 7533-13:2009) permeable pavements to reduce and/or attenuate flows prior to final discharge from the Site. It is reasonable to expect that the use of partial infiltration systems and/or the use of the void space with pavement sub-base as attenuation (Type C Systems) may assist in managing the risk of surface water flooding.

## 10.10 DISPOSAL TO WATERCOURSE

- 10.10.1 Given the design code hierarchy, the lack of surface water sewer provision, the nature of the site hydrogeology and the presence of an existing ordinary watercourse which passes through the Site, it is preferable to discharge surface water into the watercourse system. This is the premise of the drainage strategy featured in **Appendix 5**.
- 10.10.2 In order to adequately manage risk associated with an increase in the impermeable area on site, the discharge rate into the watercourse must be restricted to the value of the existing greenfield run off. The mean annual peak flow ( $Q_{bar}$ ), at 98.8 litres/second (**Section 10.7**), can be pro-rated over the 27.685 ha to give a run-off rate of 3.6 l/s/ha. This requires attenuation of runoff volumes, as detailed in **Section 10.11**.
- 10.10.3 Consent to discharge will be required from Derbyshire County Council as the LLFA and it is probable that the rate of discharge will be restricted to Greenfield, or pre-development run-off rates.



## 10.11 SURFACE WATER ATTENUATION

- 10.11.1 In order to manage the risk of surface water flooding, the on-site surface water drainage system should be designed to attenuate any volume in excess of the allowable discharge rate for the given storm event.
- 10.11.2 Based upon current guidance documents and information from the Environment Agency as detailed in **Section 6.1** and within this section, the appropriate design event is considered to be the 1% (1 in 100) annual probability event plus 40% additional allowance on peak rainfall intensity for the effects of climate change.
- 10.11.3 An estimate of the required storage volume was completed using the MicroDrainage Source Control Quick Storage Estimate tool for the value of 3.6 l/s/ha.
- 10.11.4 As featured in the drainage strategy illustrated on drawing 19412-200-002 to -004, attenuation is proposed by way of five attenuation ponds.
- 10.11.5 Design calculations for the attenuation storage volume, was completed using the MicroDrainage Source Control Quick Storage Estimate tool, included in **Appendix 4**, demonstrate no flooding occurs up to the 1% (1 in 100) Annual Exceedance Probability with 40% allowance on inflows for climate change (**Section 10.14**). The climate change allowance is based the Environment Agency's guidance '*Flood risk assessments: climate change allowances, dated 19February 2016*'.
- 10.11.6 The base level, top water level, volume and outflow of each pond shown on drawings 19412-200-002 to -004. In each case the flow rate is restricted to 3.6 l/s/ha, in line with the value for Qbar detailed in **Section 10.7**. This demonstrates that the peak discharge rate for all events up to and including the 1% (1 in 100) Annual Exceedance Probability with 40% allowance on inflows for climate change (**Section 10.14**), will not exceed that of the existing site.
- 10.11.7 In relation to water quality, SuDS guidance typically recommends a three stage management treatment train comprising:
- i. **Filtration**, using a variety of filtration media, for example: sands, gravels (e.g. permeable pavements, filter drains), soils (e.g. bio-retention), grasses and other surface vegetation (e.g. swales, detention basins) or aquatic vegetation (e.g. wetlands).
  - ii. **Detention**, by storing surface water runoff volumes in detention basins, by using outflow controls, meets hydraulic criteria but also allows filtering and sedimentation to take place, which contributes to water quality improvement.
  - iii. **Permanent Treatment Ponds**, ponds and wetlands are useful for polishing surface water runoff at the end of a management train and can be used to store large volumes of clean water.



- 10.11.8 It is likely that the final designs for the development will use elements from all three of the foregoing management treatment train. Drawings 19412-200-002 to -004 depict the final two stages (dry basin and reedbed) which are applied holistically.

**10.12 IMPACT ON SEWERS AND DRAINS**

- 10.12.1 Given the absence of surface water sewers in the vicinity of the Site, as discussed in **Section 6.3**, it is not considered that disposal to surface water sewer is a feasible option for the management of surface water. Consequently, disposal to surface water sewer currently does not form part of the proposed drainage strategy for the Site and therefore there will be no impact on the existing surface water sewer system, where present, as a result of the development.
- 10.12.2 In order to reduce the risk of flooding from new surface water sewers as part of the development, consideration should be given to the system incorporating designs in accordance with the criteria detailed in paragraph 10.9.3, (i.e., non-infiltration Type C systems, or similar equivalent). This should be agreed with the relevant risk management authorities, depending on the type of drainage system.
- 10.12.3 The nature of the proposed development means that residential foul flows will be generated from the 650 dwellings. At the stage of an initial consultation with the local water authority, Yorkshire Water indicated that the public sewer network does not have adequate capacity available to accommodate the anticipated foul water discharge from the proposed development. The network capacity issues to be addressed via Section 104 agreement at the detailed design of the proposed development and agreed with Yorkshire Water as the local water authority for this area.
- 10.12.4 In view of the current Chesterfield Borough Council's Local Plan (adopted version) which was published in July 2020 and provides details in Table 4 for housing allocation of 650 dwellings at land south of Worksop Road and East and West of Bolsover Road, Mastin Moor (the development site), it is assumed that Yorkshire Water would have already made provision for accommodating the additional demand of sewers at least that level of development (650 dwellings).
- 10.12.5 Based on 'Sewers for Adoption' (WRC), the design flow for gravity sewers for residential developments should be 4000 litres/unit dwelling/per 24 hours. Based on 650 dwellings, this equates to 30 litres/second. It is considered therefore that flood risk from foul sewers will be increased as a result of the development without significant strategic off-site reinforcements to the public sewer network and possibly the Staveley waste water treatment works, subject to further confirmation from Yorkshire Water following a more detailed assessment. It is considered very likely that a new foul sewer will need to be provided by means of sewer requisition (pursuant to Section 98 Water Industry Act 1991).



- 10.12.6 In order to mitigate the risk of flooding from new foul sewers on the Site, the system should be designed in accordance with BS EN 752:2008. A foul water drainage strategy is illustrated on drawing 19412-200-001.

#### 10.13 MINE WATER DRAINAGE INFRASTRUCTURE

- 10.13.1 As discussed in **Section 9.5**, until the mechanisms associated with mine drainage on site are better understood, it is not clear whether the proposed development may have an impact on the level of flood risk associated with them. Actions for assessing and understanding the risk are listed in **Section 10.4**.
- 10.13.2 A copy of The Coal Authority's plan dated 20/02/2019 showing Creswell to Renshaw Air valves is provided in Appendix 1. This plan also shows an approximate location of the proposed development.

#### 10.14 CLIMATE CHANGE – FEBRUARY 2016 GUIDANCE

- 10.14.1 The frequency and intensity of rainfall is predicted to increase as a result of climate change. Allowance for how this will affect the development proposals will need to be factored into the design.
- 10.14.2 The Environment Agency's guidance 'Flood risk assessments: climate change allowances, 19 February 2016' supersedes the earlier guidance produced in September 2013, which suggested that a 30% precautionary sensitivity range should be added to peak rainfall intensity and 20% added to peak river flows.
- 10.14.3 The 2016 guidance is presented and summarised in this section.

##### **Peak River Flow Allowances**

- 10.14.4 The 2016 guidance provides for peak river flow allowances to be assessed by river basin districts, flood zone and flood risk vulnerability classification (**Section 4.3**). Table 1 of the guidance provides a range of allowances based on percentiles to be applied (added) based on the flood zone and flood risk vulnerability classification for the site location and proposed land use respectively for each river basin district. The percentiles used are as follows:
- i.* Central allowance, based on the 50th percentile.
  - ii.* Higher central allowance, based on the 70th percentile.
  - iii.* Upper end allowance, based on the 90th percentile.
- 10.14.5 Table 1 is reproduced as **Table 10.2** in this FRA. It is noted that the baseline to which the percentages in the table should be added is the 1961 to 1990 baseline.



River basin district	Allowance category	Total potential change anticipated for 2015 to 2039	Total potential change anticipated for 2040 to 2069	Total potential change anticipated for 2070 to 2115
Northumbria	Upper end	20%	30%	50%
	Higher central	15%	20%	25%
	Central	10%	15%	20%
Humber	Upper end	20%	30%	50%
	Higher central	15%	20%	30%
	Central	10%	15%	20%
Anglian	Upper end	25%	35%	65%
	Higher central	15%	20%	35%
	Central	10%	15%	25%
South East	Upper end	25%	50%	105%
	Higher central	15%	30%	45%
	Central	10%	20%	35%
Thames	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%
South West	Upper end	25%	40%	85%
	Higher central	20%	30%	40%
	Central	10%	20%	30%
Severn	Upper end	25%	40%	70%
	Higher central	15%	25%	35%
	Central	10%	20%	25%
Dee	Upper end	20%	30%	45%
	Higher central	15%	20%	25%
	Central	10%	15%	20%
North West	Upper end	20%	35%	70%
	Higher central	20%	30%	35%
	Central	15%	25%	30%
Solway	Upper end	20%	30%	60%
	Higher central	15%	25%	30%
	Central	10%	20%	25%
Tweed	Upper end	20%	25%	45%
	Higher central	15%	20%	25%
	Central	10%	15%	20%

**Table 10.2 Peak River Flow Allowances by River Basin District**

10.14.6 The table should be read in conjunction with the flood zone and flood risk vulnerability classification for the site location within the relevant river basin district in order to determine the appropriate percentage allowance in the table to be added. The guidance is published with a set of river basin district maps in order to assist determining which river basin district a site may be located.



- 10.14.7 The flood zone, flood risk vulnerability classification and allowances to be added are reproduced below.

**Flood Zone 2**

Essential Infrastructure – use the higher central and upper end to assess a range of allowances.

Highly Vulnerable – use the higher central and upper end to assess a range of allowances.

More Vulnerable – use the central and higher central to assess a range of allowances.

Less Vulnerable – use the central allowance.

Water Compatible – use none of the allowances.

**Flood Zone 3a**

Essential Infrastructure – use the upper end allowance.

Highly Vulnerable – development should not be permitted.

More Vulnerable – use the higher central and upper end to assess a range of allowances.

Less Vulnerable – use the central and higher central to assess a range of allowances.

Water compatible – use the central allowance.

**Flood Zone 3b (Functional Floodplain)**

Essential Infrastructure – use the upper end allowance.

Highly Vulnerable – development should not be permitted.

More Vulnerable – development should not be permitted.

Less Vulnerable – development should not be permitted.

Water Compatible – use the central allowance.

- 10.14.8 The 2016 guidance notes that:

*'If (exceptionally) development is considered appropriate when not in accordance with flood zone vulnerability categories, then it would be appropriate to use the upper end allowance.'*



### Peak Rainfall Intensity Allowances

- 10.14.9 The 2016 guidance provides for peak rainfall intensity allowances for central and upper end allowances only, which apply across all of England. These are set out in Table 2 of the guidance which is reproduced as **Table 10.3** in this FRA. It is noted that the baseline to which the percentages in the table should be added is the 1961 to 1990 baseline.

Applies Across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

**Table 10.3 Peak Rainfall Intensity Allowances in Small & Urban Catchments**

- 10.14.10 The guidance notes that flood risk assessments and strategic flood risk assessments should assess both the central and upper end allowances to understand the range of impact.

### Sea Level Allowances

- 10.14.11 The 2016 guidance provides for a single regional allowance for each epoch or time frame for sea level rise in Table 3. Sea level rise is driven in part by climate change and in part by glacial isostatic re-adjustment resulting from the release of pressure after ice that covered large parts of northern Britain melted at the end of the last ice age. The northern part of the country is slowly rising and the southern part is slowly sinking. For this reason net sea level rise is less for the north-west and north-east than the rest of the country.
- 10.14.12 The Table 3 allowances are reproduced as **Table 10.4** in this FRA. It is noted that the baseline to which the percentages in the table should be added is the 1990 baseline.
- 10.14.13 The boundaries between the three regions used in Table 3 of the 2016 guidance is shown on the river basin district maps; these are as follows:
- The north-west and north east of England is north of Flamborough Head.
  - The east, East Midlands, London and the south-east is south of Flamborough Head.
  - The south-west of England is defined as the parts of the country to the west of a boundary between the Isle of Wight in the south to Weston-super-Mare in the north.



Area of England	1990 to 2025 (mm)	2026 to 2050 (mm)	2051 to 2080 (mm)	2081 to 2115 (mm)	Cumulative Rise 1990 to 2115
East, East Midlands, London, South-East	4 (140)	8.5 (212.5)	12 (360)	15 (525)	1.24 metres
South-West	3.5 (122.5)	8 (200)	11.5 (345)	14.5 (507.5)	1.18 metres
North-West, North-East	2.5 (87.5)	7 (175)	10 (300)	13 (455)	1.02 metres

**Table 10.4 Sea Level Allowances for Each Epoch**

(millimetres per year with cumulative sea level rise for each epoch in brackets)

10.14.14 The sea level is calculated by selecting an allowance for the appropriate geographical area for the location of the site and adding to the 1990 base sea level year. Either the cumulative total(s) for the relevant epoch(s) or parts thereof (if less than a full epoch) are added to the 1990 base sea level year. However, residential development with a life expectancy of 100 years will mean that the cumulative rise for the period 1990 to 2115 will be applied.

#### Offshore Wind Speed & Extreme Wave Height Allowances

10.14.15 Offshore wind speed and extreme wave height allowance is provided for in the 2016 guidance by means of percentage allowances to be added to the 1990 baseline as detailed in Table 4. Table 4 of the guidance is reproduced as **Table 10.5** in this FRA.

Applies Around all the English Coast	1990 to 2050	2051 to 2115
Offshore wind speed allowance	+5%	+10%
Offshore wind speed sensitivity test	+10%	+10%
Extreme wave height allowance	+5%	+10%
Extreme wave height sensitivity test	+10%	+10%

**Table 10.5 Offshore Wind Speed & Extreme Wave Height Allowances**

10.14.16 The guidance notes that wave heights are predicted to change because of increased water depths resulting from climate change, as will the frequency, duration and severity of storms. Flood risk assessments should use the single allowance for each epoch for wind speed and wave height in Table 4 and the 10% sensitivity allowance to understand the range of impacts.

#### High++ Allowances for Peak River Flood Flow & Mean Sea Level

10.14.17 The guidance refers to 'high++ allowances', and that these will only apply to assessments for developments that are very sensitive to flood risk and with lifetimes beyond the end of the century. For example, infrastructure projects or developments that significantly change existing settlement patterns, including urban extensions and new settlements. The high++ allowances are provided in Table 3 of the Environment Agency document 'Adapting to Climate Change: Advice for Flood and Coastal





Erosion Risk Management Authorities', reference LIT\_5707. The PDF document is undated, however, the document metadata indicates a 'create date' of 1 March 2016.

### **Application**

10.14.18 The application of the climate change allowances in the assessment of flood risk as part of this FRA is undertaken as follows:

#### **Inland Sites/No Coastal Exposure**

- i.* Peak River Flow Allowances, and/or,
- ii.* Peak Rainfall Intensity Allowances, and in very sensitive flood risk areas,
- iii.* High++ Allowances for Peak River Flood Flow.

#### **Sites With Coastal Exposure**

- i.* Peak River Flow Allowances, and/or,
- ii.* Peak Rainfall Intensity Allowances, and
- iii.* Sea Level Allowances, and
- iv.* Offshore Wind Speed & Extreme Wave Height Allowances, and in very sensitive flood risk areas,
- v.* High++ Allowances for Peak River Flood Flow & Mean Sea Level.

10.14.19 The allowances used from this sub-section are referenced in the preceding sub-sections of **Section 10 – Actions & Mitigation**.

### **10.15 SCOPE**

10.15.1 Given the outline nature of the development, the actions and mitigations detailed in the preceding sections are intended as guidance for the next stages of the development in relation to flood risk, and not as a definitive list of the requirements. These actions and mitigations should be developed as additional information becomes available.



10.16 **SUMMARY**

- 10.16.1 This FRA is intended as a qualitative study based upon a desk-based assessment, readily available information, and where applicable, responses from consultees.
- 10.16.2 The proposals comprise the construction of a residential development of 650 dwellings, a local centre, community gardens, public open space, green spaces, and amenity space.
- 10.16.3 The Site is located in Environment Agency Flood Zone 1, namely, areas with a low probability of flooding from main rivers.
- 10.16.4 The majority of the Site is classed as having 'More Vulnerability' to flooding, based on a proposed residential end use, as outlined in 'Planning practice Guide – Flood Risk and Coastal Change'.
- 10.16.5 Development of 'more vulnerable' uses is compatible with Flood Zone 1, and it is considered that the Sequential Test has been applied. The Exception Test is therefore not required.
- 10.16.6 A review of relevant planning documents outlines that the SFRA details Draft Planning Policy Recommendations that are relevant to the Site, and also highlights guidance relating to Greenfield run-off and climate change. The PFRA includes flood risk mapping for Derbyshire, however this is at too small a scale to identify specific risk on a site by site basis.
- 10.16.7 An assessment of flood risk to the development site highlighted that there is potentially a high risk of surface water flooding, where overland runoff forms a potentially deep and/or high velocity flow path along the route of the ordinary watercourse.
- 10.16.8 In addition, there appears to be a mine water discharge point on site, based on anecdotal evidence, that may pose a risk, however this must be further investigated before the level of risk can be fully understood and the likely impact to be assessed at the detailed stage of the proposed development.
- 10.16.9 The location of marker post for Mine water discharge is shown in north west corner of Topographic Survey drawing no. 002/001 Revision A and copy of The Coal Authority's plan dated 20/02/2019 showing Creswell to Renshaw Air valves are provided in Appendix 1. This plan also shows an approximate location of the proposed development.
- 10.16.10 An assessment of flood risk as a result of the development suggests that a significant increase in impermeable area could impact on fluvial flows in the ordinary watercourse which passes through the Site, and is also likely to lead to an increased risk of surface water flooding in areas adjacent to the Site. In addition, it was highlighted that the development is likely to increase the risk of flooding to sewers.



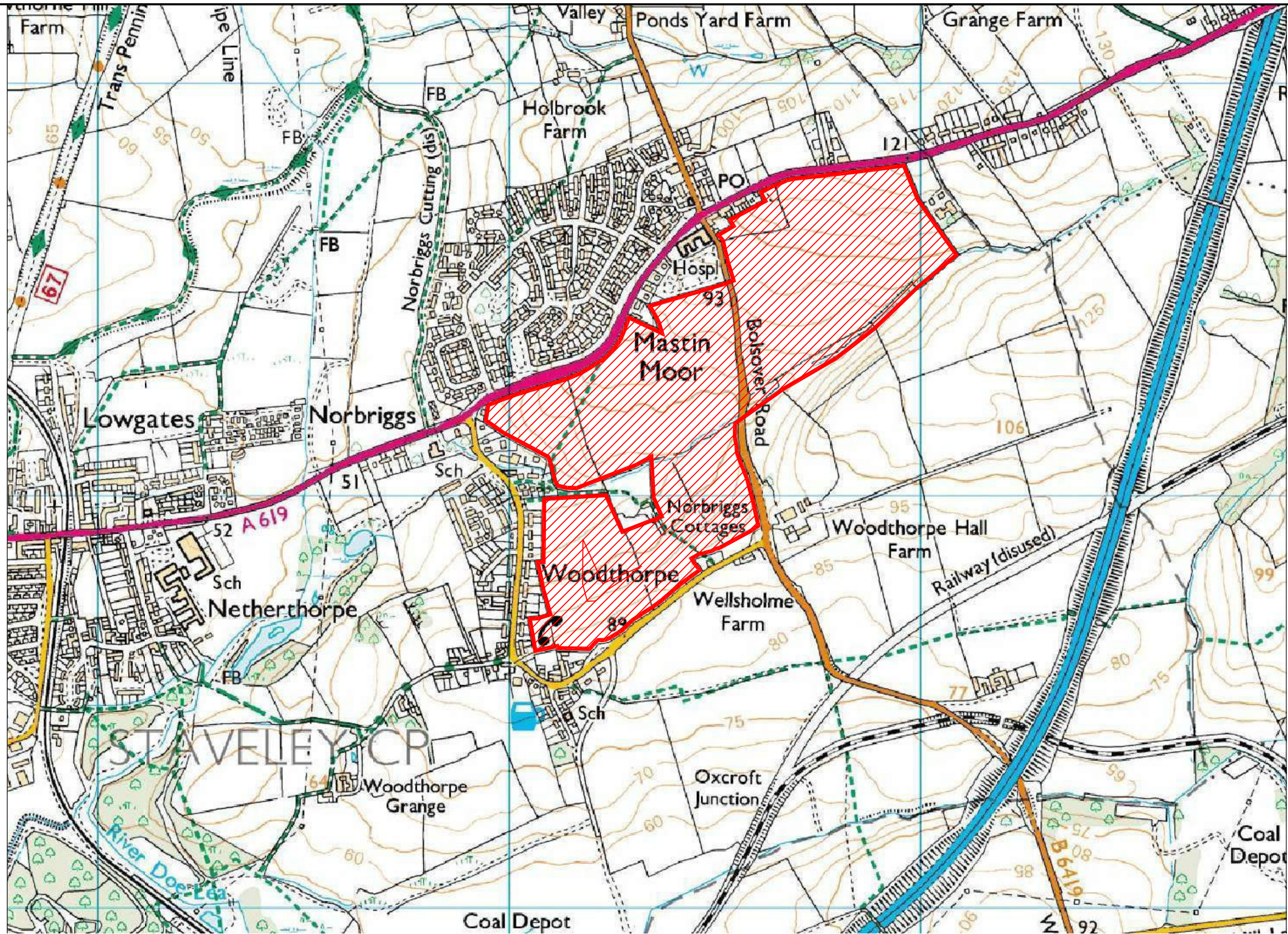
- 10.16.11 Mitigations to flood risk have been assessed based on the sequential, risk-based approach outlined in BS 8533:2011, and include further studies or investigations, considerations for master planning and advice on detailed design criteria.
- 10.16.12 Mitigations are proposed to manage runoff from the Site to pre-development (Greenfield) rates, meaning that there will be no increase in volumes up to and including the 1% (1 in 100) annual exceedance probability event.
- 10.16.13 In addition, Yorkshire Water has confirmed that the public sewer network does not have adequate capacity available to accommodate the anticipated foul water discharge from the proposed development site; and that the local waste water treatment works at Staveley may only have limited spare capacity available, if any.
- 10.16.14 Significant strategic off-site reinforcements to the public sewer network and possibly the Staveley wastewater treatment works are expected to be required to serve the proposed development. Yorkshire Water has also identified that further developer funded modelling investigation will be required to assess the impact of the proposed development and in order to determine the scale and scope of the reinforcement works required.
- 10.17 **CONCLUSION**
- 10.17.1 The flood risk assessment highlights that there are some potential flood risks related to the Site. However, it is considered likely that risks and impacts can be managed to an appropriate level with the adoption of mitigation measures employed as part of the proposed development.



## **APPENDIX 1**

- Site Location Plan
- Existing Site Plan/Topographic Survey
- Proposed Layout Plan
- Mine Water Discharge Marker Post (on Topographic Survey)
- The Coal Authority's plan for Creswell to Renishaw Air Valves
- Flooding Information Obtained from Local Knowledge





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Merebrook Consulting Limited AL 100015912

Based on OS		06-05-2014		-
		PDT	-	-
Issue Details		Dwn	Chd	App'd
Job No.	MER00810	Dwg No.	001-001	
Scale	1:10000	Date	April 2014	
Drawn	PDT	Checked	-	
		Approved	-	
		Revision	-	
		Frame Dimensions mm	(A3) 400 x 280	

London  
Kent  
Derby  
Cardiff  
Manchester



East Mill, Bridgefoot, Belper, Derbyshire, England. DE56 2UA  
tel +44(0)1773 829988 fax +44(0)1773 829393 email info@merebrook.co.uk

Client/Project

Mastin Moor

Dwg Title

Site Location Plan





- Legend
- |                           |          |
|---------------------------|----------|
| Air Valve                 | Av       |
| Beeline Beacon            | Bb       |
| Borehole                  | Bh       |
| Bulford                   | Bd       |
| Bus Stop                  | Bs       |
| British Telecom box       | Bt       |
| Control Box               | Cb       |
| Cable Covers              | Cc       |
| Down Pipe                 | Dp       |
| Electric Post             | Ep       |
| Earth Road                | Er       |
| Fire Hydrant              | Fh       |
| Floor Light               | Fl       |
| Flag Staff                | Fs       |
| Gas Meter                 | Gm       |
| Gate Post                 | Gp       |
| Gas Valve                 | Gv       |
| Gully                     | Gu       |
| Illuminated Bollard       | Il       |
| Invert Level              | IL       |
| Post Level                | PL       |
| Letter Box                | Lb       |
| Lamp post                 | Lp       |
| Manhole                   | Mh       |
| Marker Post               | Mp       |
| Parking Motor             | Pm       |
| Post                      | Ps       |
| Rubbish Bin               | Rb       |
| Road Name Board           | Rn       |
| Roading Eye               | Re       |
| Soft Level                | Sl       |
| Sign Post                 | Sp       |
| Site                      | St       |
| Tree Stump                | St       |
| Stop Tap                  | St       |
| Stop Valve                | St       |
| Cable Stay                | St       |
| Trial Pit                 | TP       |
| Traffic Light             | TL       |
| Telegraph Post            | TP       |
| Unstable to LF            | UL       |
| Valve                     | Va       |
| Vent Pipe                 | Vp       |
| Video Camera              | Vc       |
| Water Level               | WL       |
| Water Meter               | Wm       |
| Wash Out                  | Wo       |
| Window Sample             | WS       |
| Survey Station with Level | △ 10,000 |

— 0.50 — Terrain contours shown at 0.50m intervals

~~~~~ Hawthorn hedge (row width drawn approximately)

- Survey notes:
1. Survey orientated to Ordnance Survey National Grid by the use of GPS coordinates transformed using UKOSGB 1936/British National Grid OSTN02. Scale factor of 0.999601271698 applied to all calculations.
  2. Level datum taken GPS observations and transformed using The National Geoid Model OSGM02
  3. All feature shown were current at the time of the survey. There may be features missed during the survey due to obstructions or lack of access.
  4. Drainage: Invert levels, pipe sizes and pipe connections have been surveyed by visual inspection only, and therefore the complete accuracy of this information cannot be guaranteed.
  5. Trees: sizes and species are indicative only, with the mean spread drawn to scale.
  6. The contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts.

| Survey Control Table |             |             |          |
|----------------------|-------------|-------------|----------|
| Station              | Easting     | Northing    | Level    |
| M101                 | 445626.5520 | 374892.5180 | 90.5560  |
| M102                 | 445658.1470 | 374612.9250 | 88.1960  |
| M103                 | 445633.7909 | 374608.4992 | 88.7991  |
| M104                 | 445568.5130 | 374854.7030 | 90.5230  |
| M105                 | 445478.8200 | 374612.9690 | 86.2020  |
| M106                 | 445338.8990 | 374709.2830 | 86.0940  |
| M107                 | 445281.0469 | 374658.1345 | 87.0693  |
| M202                 | 445262.7470 | 375193.3460 | 74.0660  |
| M301                 | 445440.3220 | 375676.1370 | 96.5950  |
| M302                 | 445492.1300 | 375644.1090 | 96.4040  |
| M303                 | 445524.7761 | 375564.4459 | 93.1311  |
| M304                 | 445392.5020 | 375619.4470 | 91.6820  |
| M305                 | 445366.1350 | 375591.2820 | 90.2890  |
| M306                 | 445512.9710 | 375705.3750 | 99.3150  |
| M307                 | 445640.2000 | 375768.8720 | 109.8310 |
| M308                 | 445741.9050 | 375793.1070 | 112.9090 |
| M309                 | 445654.5540 | 375696.3620 | 116.0290 |
| M310                 | 445954.2880 | 375817.8500 | 119.2830 |
| M401                 | 445256.2220 | 375400.2760 | 84.8710  |
| M402                 | 445206.5580 | 375321.8460 | 79.2640  |
| M403                 | 445024.0910 | 375271.0100 | 62.9700  |
| M404                 | 444907.8460 | 375215.3940 | 56.4230  |
| M405                 | 444898.6470 | 375178.9930 | 55.0310  |
| M406                 | 444921.0480 | 375099.7960 | 54.3260  |
| M407                 | 445022.1883 | 375003.5143 | 55.9290  |
| M305A                | 445317.7220 | 375529.3950 | 88.3420  |

|                              |            |      |
|------------------------------|------------|------|
| Survey completed and updated | 28/09/14   | A    |
| Based on a LSS output        | 24/07/2014 | -    |
| Issue Details                | RM         | MB   |
| Drawn                        | RM         | MB   |
| Client                       | Chd        | Appr |

Chatsworth Settlement Trustees

Project

Mastin Moor  
Staveley,  
Derbyshire

Dwg Title

Topographic Survey  
June 2014  
Sheet 1

| Job No.   | Dwg No.     | Revision            |
|-----------|-------------|---------------------|
| June 2014 | 002/001     | A                   |
| Scale     | Date        | Frame Dimensions mm |
| 1:500     | August 2014 | (A0) 1139 x 791     |
| Drawn     | Checked     | Approved            |
| RM        | RM          | MB                  |

London

Kent

Derby

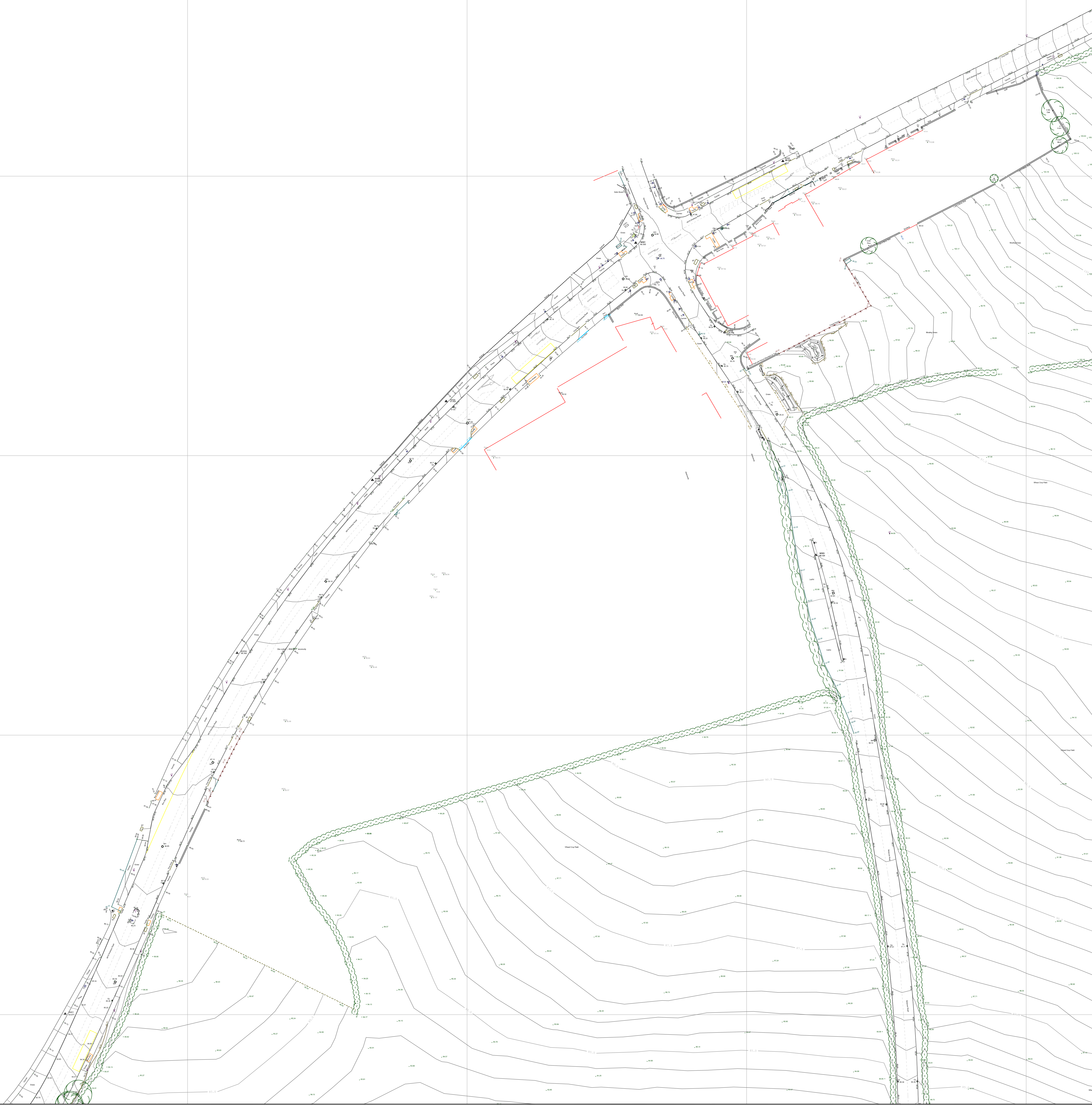
Cardiff

Manchester

idm merebrook

East MB, Topographic Survey, Derbyshire, England, OSGB 1936  
Tel: +44(0)1773 620000 Fax: +44(0)1773 620001 email: info@idm-merebrook.co.uk





- Legend**
- |                           |          |
|---------------------------|----------|
| Air Valve                 | Av       |
| Bellman Beacon            | Bb       |
| Borehole                  | Bh       |
| Bus Stop                  | Bs       |
| British Telecom box       | Bt       |
| Control Box               | Cb       |
| Cable Covers              | Cc       |
| Down Pipe                 | Dp       |
| Electric Post             | Ep       |
| Earth Rod                 | Er       |
| Fire Hydrant              | Fh       |
| Floor Light               | Fl       |
| Flag Staff                | Fs       |
| Gas Meter                 | Gm       |
| Gate Post                 | Gp       |
| Gas Valve                 | Gv       |
| Gully                     | Gy       |
| Illuminated Bollard       | Ib       |
| Invert Level              | IL       |
| Post Level                | PL       |
| Letter Box                | Lb       |
| Lamp post                 | Lp       |
| Manhole                   | Mh       |
| Marker Post               | Mp       |
| Parking Meter             | Pm       |
| Post                      | Ps       |
| Rubbish Bin               | Rb       |
| Road Name Board           | Rn       |
| Roading Eye               | Re       |
| Soft Level                | Sl       |
| Sign Post                 | Sp       |
| Site                      | St       |
| Tree Stump                | St       |
| Stop Tap                  | St       |
| Stop Valve                | St       |
| Cable Stay                | St       |
| Traffic Light             | Tl       |
| Trial Pit                 | Tp       |
| Uddle to LF               | U/L      |
| Valve                     | Va       |
| Vent Pipe                 | Vp       |
| Video Camera              | Vc       |
| Water Level               | Wl       |
| Water Meter               | Wm       |
| Wash Out                  | Wo       |
| Window Sample             | Ws       |
| Survey Station with Level | △ 10.000 |

— 0.50 — Terrain contours shown at 0.50m intervals

— — — Hawthorn hedge (row width drawn approximately)

- Survey notes:**
1. Survey orientated to Ordnance Survey National Grid by the use of GPS coordinates transformed using UKOSGB 1936/British National Grid OSTN02. Scale factor of 0.999601271698 applied to all calculations.
  2. Level datum taken GPS observations and transformed using The National Geoid Model OSGM02
  3. All features shown were current at the time of the survey. There may be features missed during the survey due to obstructions or lack of access.
  4. Drainage: Invert levels, pipe sizes and pipe connections have been surveyed by visual inspection only, and therefore the complete accuracy of this information cannot be guaranteed.
  5. Trees: sizes and species are indicative only, with the mean spread drawn to scale.
  6. The contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts.

| Survey Control Table |             |             |          |
|----------------------|-------------|-------------|----------|
| Station              | Easting     | Northing    | Level    |
| M101                 | 445626.5520 | 374882.5180 | 90.5560  |
| M102                 | 445658.1470 | 374812.9250 | 88.1960  |
| M103                 | 445633.7920 | 374858.4992 | 88.7991  |
| M104                 | 445568.5130 | 374854.7030 | 90.5230  |
| M105                 | 445478.8200 | 374812.9690 | 86.2020  |
| M106                 | 445338.8990 | 374709.2830 | 86.0940  |
| M107                 | 445281.0469 | 374658.1345 | 87.0693  |
| M202                 | 445662.7470 | 375193.3460 | 74.0660  |
| M301                 | 445460.3220 | 375676.1370 | 96.5950  |
| M302                 | 445492.1300 | 375644.1090 | 96.4040  |
| M303                 | 445524.7761 | 375564.4459 | 93.1311  |
| M304                 | 445392.5020 | 375619.4470 | 91.6820  |
| M305                 | 445366.1350 | 375591.2820 | 90.2890  |
| M306                 | 445512.9710 | 375705.3750 | 99.3150  |
| M307                 | 445640.2000 | 375768.8720 | 109.8310 |
| M308                 | 445741.9050 | 375793.1070 | 112.9090 |
| M309                 | 445954.5540 | 375906.3620 | 116.0290 |
| M310                 | 445954.2880 | 375817.8500 | 119.2830 |
| M401                 | 445256.2220 | 375400.2760 | 84.8710  |
| M402                 | 445206.5580 | 375321.8460 | 79.2640  |
| M403                 | 445024.0910 | 375271.0100 | 62.9700  |
| M404                 | 444907.8460 | 375215.3940 | 56.4230  |
| M405                 | 444886.6470 | 375178.9930 | 55.0310  |
| M406                 | 444921.0480 | 375099.7960 | 54.3260  |
| M407                 | 445022.1883 | 375003.5143 | 55.9290  |
| M306A                | 445317.7220 | 375529.3950 | 88.3420  |

|                              |            |     |
|------------------------------|------------|-----|
| Survey completed and updated | 29/09/14   | A   |
| Based on a LSS output        | 24/07/2014 | -   |
| Issue Details                | Rev        | Rev |
| Drawn                        | Rev        | Rev |

|                                            |             |                     |   |
|--------------------------------------------|-------------|---------------------|---|
| Chatsworth Settlement Trustees             |             |                     |   |
| Project                                    |             |                     |   |
| Mastin Moor<br>Staveley,<br>Derbyshire     |             |                     |   |
| Dwg Title                                  |             |                     |   |
| Topographic Survey<br>June 2014<br>Sheet 2 |             |                     |   |
| Site No.                                   | Dwg No.     | Revision            | A |
| June 2014                                  | 002/002     |                     |   |
| Scale                                      | Date        | Frame Dimensions mm |   |
| 1:500                                      | August 2014 | (A0) 1139 x 791     |   |
| Drawn                                      | Checked     | Approved            |   |
| RM                                         | RM          | MB                  |   |
| London                                     |             |                     |   |
| Kent                                       |             |                     |   |
| Derby                                      |             |                     |   |
| Cardiff                                    |             |                     |   |
| Manchester                                 |             |                     |   |







Legend

Air Valve  
Barbed Beacon  
Borehole  
Bus Stop  
British Telecom box  
Control Box  
Cable Covers  
Down Pipe  
Electric Post  
Earth Rod  
Fire Hydrant  
Flag Staff  
Gas Meter  
Gate Post  
Gas Valve  
Gully  
Illuminated Bollard  
Invert Level  
Post Level  
Letter Box  
Lamp post  
Marker Post  
Parking Meter  
Post  
Rubbish Bin  
Road Name Board  
Roof Level  
Roofing Eye  
Sign Post  
Site  
Tree Stump  
Stop Tap  
Stop Valve  
Cable Stay  
Traffic Light  
Traffic Light  
Telegraph Post  
Unstable to LF  
Valve  
Vent Pipe  
Video Camera  
Water Level  
Water Meter  
Wash Out  
Window Sample  
Survey Station with Level

BB  
BH  
BS  
BT  
BX  
CB  
CC  
CP  
EP  
ER  
FH  
FS  
GM  
GP  
GV  
IB  
IL  
IP  
LB  
LP  
MP  
PM  
PS  
RB  
RNB  
RS  
RE  
SP  
ST  
SV  
SY  
TL  
TL  
TP  
UL  
V  
VP  
VC  
WL  
WM  
WO  
WS

0.50  
0.50m intervals  
Hatched hedge row width  
drawn approximately

Survey notes:

1. Survey orientated to Ordnance Survey National Grid by the use of GPS coordinates transformed using UKOSGB 1936/British National Grid OSTN02. Scale factor of 0.99961271698 applied to all calculations.

2. Level datum taken GPS observations and transformed using The National Geoid Model OSGM02

3. All features shown were current at the time of the survey. There may be features missed during the survey due to obstructions or lack of access.

4. Drainage: Invert levels, pipe sizes and pipe connections have been surveyed by visual inspection only, and therefore the complete accuracy of this information cannot be guaranteed.

5. Trees: sizes and species are indicative only, with the mean spread drawn to scale.

6. The contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts.

Survey Control Table

| Station | Easting     | Northing    | Level    |
|---------|-------------|-------------|----------|
| M101    | 445626.5520 | 374892.5180 | 90.5560  |
| M102    | 445658.1470 | 374812.9250 | 88.1960  |
| M103    | 445633.7929 | 374658.4992 | 88.7991  |
| M104    | 445568.5130 | 374854.7030 | 90.5230  |
| M105    | 445478.8200 | 374812.9690 | 86.2020  |
| M106    | 445338.8990 | 374705.2830 | 86.0940  |
| M107    | 445281.0469 | 374658.1345 | 87.0693  |
| M202    | 445262.7470 | 375193.3460 | 74.0660  |
| M301    | 445460.3220 | 375676.1370 | 96.5950  |
| M302    | 445492.1300 | 375644.1090 | 96.4040  |
| M303    | 445524.7761 | 375564.4459 | 93.1311  |
| M304    | 445392.5020 | 375619.4470 | 91.6820  |
| M305    | 445366.1350 | 375591.2820 | 90.2890  |
| M306    | 445512.9710 | 375705.3750 | 99.3150  |
| M307    | 445640.2000 | 375768.8720 | 109.8310 |
| M308    | 445741.9050 | 375793.1070 | 112.9090 |
| M309    | 445954.5540 | 375906.3620 | 116.0290 |
| M310    | 445954.2880 | 375817.8500 | 119.2830 |
| M401    | 445256.2220 | 375400.2760 | 84.8710  |
| M402    | 445206.5580 | 375321.8460 | 79.2640  |
| M403    | 445024.0910 | 375271.0100 | 62.9700  |
| M404    | 444907.8460 | 375215.3940 | 56.4230  |
| M405    | 444886.6470 | 375178.9930 | 55.0310  |
| M406    | 444921.0480 | 375099.7960 | 54.3260  |
| M407    | 445022.1883 | 375003.5143 | 55.9290  |
| M305A   | 445317.7220 | 375529.3950 | 88.3420  |

Survey completed and updated

28/09/14

A

Based on a LSS output

24/07/2014

-

Issue Details

RM

RM

MB

Client

Chatsworth Settlement Trustees

Project

Mastin Moor  
Staveley,  
Derbyshire

Dwg Title

Topographic Survey  
June 2014  
Sheet 3

Job No.

June 2014

Dwg No.

002/003

Revision

A

Scale

1:500

Date

August 2014

Frame Dimensions mm

(A0) 1139 x 791

Drawn

RM

Checked

RM

Approved

MB

London

Kent

Derby

Cardiff

Manchester

dm  
merebrook

East MB, Highgate, Derby, Derbyshire, England, DE24 3JA  
tel +44(0)1773 620088 fax +44(0)1773 620090 email dm@dmerebrook.co.uk





| Legend                    |          |
|---------------------------|----------|
| Air Valve                 | Av       |
| Beeline Beacon            | Bb       |
| Borehole                  | Bh       |
| Bus Stop                  | Bs       |
| British Telecom box       | Bt       |
| Covered Box               | Cb       |
| Cable Covers              | Cc       |
| Down Pipe                 | Dp       |
| Electric Post             | Ep       |
| Earth Rod                 | Er       |
| Fire Hydrant              | Fh       |
| Floor Light               | Fl       |
| Flag Staff                | Fs       |
| Gas Meter                 | Gm       |
| Gate Post                 | Gp       |
| Gas Valve                 | Gv       |
| Gully                     | Gy       |
| Illuminated Bollard       | Il       |
| Invert Level              | IL       |
| Post Level                | PL       |
| Letter Box                | Lb       |
| Lamp post                 | Lp       |
| Manhole                   | Mh       |
| Marker Post               | Mp       |
| Parking Motor             | Pm       |
| Post                      | Ps       |
| Rubbish Bin               | Rb       |
| Road Name Board           | Rn       |
| Road Sign                 | Rd       |
| Roading Eye               | Re       |
| Soft Level                | Sl       |
| Sign Post                 | Sp       |
| Site                      | S        |
| Tree Stump                | St       |
| Stop Tap                  | Stp      |
| Stop Valve                | Sv       |
| Cable Stay                | Sc       |
| Traffic Light             | Tl       |
| Traffic Post              | Tp       |
| Uddle to LF               | U/LF     |
| Valve                     | Va       |
| Vent Pipe                 | Vp       |
| Video Camera              | Vc       |
| Water Level               | WL       |
| Water Meter               | Wm       |
| Wash Out                  | Wo       |
| Window Sample             | WS       |
| Survey Station with Level | △ 10,000 |

— 0.50 — Terrain contours shown at 0.50m intervals  
Hawthorn hedge (row width drawn approximately)

- Survey notes:
- Survey orientated to Ordnance Survey National Grid by the use of GPS coordinates transformed using UKOSGB 1936/British National Grid OSTN02. Scale factor of 0.99961217698 applied to all calculations.
  - Level datum taken GPS observations and transformed using The National Geoid Model OSGM02
  - All features shown were current at the time of the survey. There may be features missed during the survey due to obstructions or lack of access.
  - Drainage: Invert levels, pipe sizes and pipe connections have been surveyed by visual inspection only, and therefore the complete accuracy of this information cannot be guaranteed.
  - Trees: sizes and species are indicative only, with the mean spread drawn to scale.
  - The contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts.

| Survey Control Table |             |             |          |
|----------------------|-------------|-------------|----------|
| Station              | Easting     | Northing    | Level    |
| M101                 | 445626.5520 | 374892.5180 | 90.5560  |
| M102                 | 445658.1470 | 374812.9250 | 88.1960  |
| M103                 | 445633.7920 | 374858.4992 | 88.7991  |
| M104                 | 445568.5130 | 374854.7030 | 90.5230  |
| M105                 | 445478.8200 | 374812.9690 | 86.2020  |
| M106                 | 445338.8990 | 374709.2830 | 86.0940  |
| M107                 | 445281.0469 | 374658.1345 | 87.0693  |
| M202                 | 445662.7470 | 375193.3460 | 74.0660  |
| M301                 | 445440.3220 | 375676.1370 | 96.5950  |
| M302                 | 445492.1300 | 375644.1090 | 96.4040  |
| M303                 | 445524.7761 | 375564.4459 | 93.1311  |
| M304                 | 445392.5020 | 375619.4470 | 91.6820  |
| M305                 | 445366.1350 | 375591.2820 | 90.2890  |
| M306                 | 445512.9710 | 375705.3750 | 99.3150  |
| M307                 | 445640.2000 | 375768.8720 | 109.8310 |
| M308                 | 445741.9050 | 375793.1070 | 112.9090 |
| M309                 | 445654.5540 | 375806.3620 | 116.0290 |
| M310                 | 445954.2880 | 375817.8500 | 119.2830 |
| M401                 | 445256.2220 | 375400.2760 | 84.8710  |
| M402                 | 445206.5580 | 375321.8460 | 79.2640  |
| M403                 | 445024.0910 | 375271.0100 | 62.9700  |
| M404                 | 444907.8460 | 375215.3940 | 56.4230  |
| M405                 | 444886.6470 | 375178.9930 | 55.0310  |
| M406                 | 444921.0480 | 375099.7960 | 54.3260  |
| M407                 | 445022.1883 | 375003.5143 | 55.9290  |
| M305A                | 445317.7220 | 375529.3950 | 88.3420  |

|                              |            |       |
|------------------------------|------------|-------|
| Survey completed and updated | 28/09/14   | A     |
| Based on a LSS output        | 24/07/2014 | -     |
| Drawn Details                | RM         | RM MB |
| Drawn                        | RM         | RM MB |

Chatsworth Settlement Trustees

Project  
Mastin Moor  
Staveley,  
Derbyshire

Dwg Title  
Topographic Survey  
Sheet 4

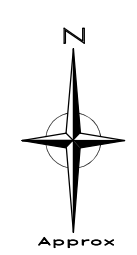
| Site No.  | Dwg No.     | Revision            |
|-----------|-------------|---------------------|
| June 2014 | 002/004     | A                   |
| Scale     | Date        | Frame Dimensions mm |
| 1:500     | August 2014 | (A0) 1139 x 791     |
| Drawn     | Checked     | Approved            |
| RM        | RM          | MB                  |

London  
Kent  
Dorset  
Cambridge  
Manchester

idm  
merebrook

East MB, Highgate, Derby, Derbyshire, England, DE21 3JA  
Tel: +44(0)1773 620088 Fax: +44(0)1773 620090 email: idm@idm.co.uk





| Legend                    |          |
|---------------------------|----------|
| Air Valve                 | Av       |
| Bellman Beacon            | BB       |
| Borehole                  | BH       |
| Bus Stop                  | BS       |
| British Telecom box       | BT       |
| Control Box               | CB       |
| Cable Covers              | CC       |
| Down Pipe                 | DP       |
| Electric Post             | EP       |
| Earth Rod                 | ER       |
| Fire Hydrant              | FH       |
| Floor Light               | FL       |
| Flag Staff                | FS       |
| Gas Meter                 | GM       |
| Gate Post                 | GP       |
| Gas Valve                 | GV       |
| Gully                     | GU       |
| Illuminated Bollard       | IB       |
| Invert Level              | IL       |
| Post Level                | PL       |
| Letter Box                | LB       |
| Lamp post                 | LP       |
| Manhole                   | MH       |
| Marker Post               | MP       |
| Parking Motor             | PM       |
| Post                      | PO       |
| Rubbish Bin               | RB       |
| Road Name Board           | RNB      |
| Rodding Eye               | RE       |
| Soft Level                | SL       |
| Sign Post                 | SP       |
| Site                      | SI       |
| Tree Stump                | ST       |
| Stop Tap                  | STP      |
| Stop Valve                | SV       |
| Cable Stay                | CS       |
| Trial Pit                 | TP       |
| Traffic Light             | TL       |
| Telegraph Post            | TP       |
| Unstable to L/R           | UL       |
| Valve                     | VA       |
| Vent Pipe                 | VP       |
| Vision Camera             | VC       |
| Water Level               | WL       |
| Water Meter               | WM       |
| Wash Out                  | WO       |
| Window Sample             | WS       |
| Survey Station with Level | △ 10,000 |

— 0.50 — Terrain contours shown at 0.50m intervals  
Hawthorn hedge (row width drawn approximately)

- Survey notes:
1. Survey orientated to Ordnance Survey National Grid by the use of GPS coordinates transformed using UKOSGB 1936/British National Grid OSTN02. Scale factor of 0.999601271698 applied to all calculations.
  2. Level datum taken GPS observations and transformed using The National Geoid Model OSGM02
  3. All features shown were current at the time of the survey. There may be features missed during the survey due to obstructions or lack of access.
  4. Drainage: Invert levels, pipe sizes and pipe connections have been surveyed by visual inspection only, and therefore the complete accuracy of this information cannot be guaranteed.
  5. Trees: sizes and species are indicative only, with the mean spread drawn to scale.
  6. The contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts.

| Survey Control Table |             |             |          |
|----------------------|-------------|-------------|----------|
| Station              | Easting     | Northing    | Level    |
| M101                 | 445626.5520 | 374882.5180 | 90.5560  |
| M102                 | 445658.1470 | 374812.9250 | 88.1960  |
| M103                 | 445633.7820 | 374858.4992 | 88.7991  |
| M104                 | 445568.5130 | 374854.7030 | 90.5230  |
| M105                 | 445478.8200 | 374812.9690 | 86.2020  |
| M106                 | 445338.8990 | 374709.2830 | 86.0940  |
| M107                 | 445281.0469 | 374658.1345 | 87.0693  |
| M202                 | 445562.7470 | 375193.3460 | 74.0660  |
| M301                 | 445440.3220 | 375676.1370 | 86.5950  |
| M302                 | 445492.1300 | 375644.1090 | 96.4040  |
| M303                 | 445524.7761 | 375564.4459 | 83.1311  |
| M304                 | 445392.5020 | 375619.4470 | 91.6820  |
| M305                 | 445366.1350 | 375591.2820 | 90.2890  |
| M306                 | 445512.9710 | 375705.3750 | 99.3150  |
| M307                 | 445640.2000 | 375768.8720 | 109.8310 |
| M308                 | 445741.9050 | 375793.1070 | 112.9090 |
| M309                 | 445954.5540 | 375906.3620 | 116.0290 |
| M310                 | 445954.2880 | 375817.8500 | 119.2830 |
| M401                 | 445256.2220 | 375400.2760 | 84.8710  |
| M402                 | 445206.5580 | 375321.8460 | 79.2640  |
| M403                 | 445024.0910 | 375271.0100 | 62.9700  |
| M404                 | 444907.8460 | 375215.3940 | 56.4230  |
| M405                 | 444886.6470 | 375178.9930 | 55.0310  |
| M406                 | 444921.0480 | 375099.7960 | 54.3260  |
| M407                 | 445022.1883 | 375003.5143 | 55.9290  |
| M305A                | 445317.7220 | 375529.3950 | 88.3420  |

|                              |            |           |
|------------------------------|------------|-----------|
| Survey completed and updated | 29/09/14   | A         |
|                              | RM         | RM MB     |
| Based on a LSS output        | 24-07-2014 | -         |
|                              | RM         | RM MB     |
| Issue Details                | Des        | Chd App'd |
| Drawn                        |            |           |

Chatsworth Settlement Trustees

Project

Mastin Moor  
Staveley,  
Derbyshire

Dwg Title

Topographic Survey  
June 2014  
Sheet 5

|          |           |         |             |                     |                 |
|----------|-----------|---------|-------------|---------------------|-----------------|
| Site No. | June 2014 | Dwg No. | 002/005     | Revision            | A               |
| Scale    | 1:500     | Date    | August 2014 | Frame Dimensions mm | (A0) 1139 x 791 |
| Drawn    | RM        | Checked | RM          | Approved            | MB              |

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Derby

Cardiff

Manchester

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tel +44(0)1773 620088 fax +44(0)1773 620090 email info@idm-merebrook.co.uk









|                           |          |
|---------------------------|----------|
| Legend                    |          |
| Air Valve                 | Av       |
| Beeline Beacon            | Bb       |
| Bench                     | Bt       |
| Bus Stop                  | Bs       |
| British Telecom box       | Bt       |
| Control Box               | Cb       |
| Cable Covers              | Cc       |
| Down Pipe                 | Dp       |
| Electric Post             | Ep       |
| Earth Rod                 | Er       |
| Fire Hydrant              | Fh       |
| Floor Light               | Fl       |
| Flag Staff                | Fs       |
| Gas Meter                 | Gm       |
| Gas Post                  | Gp       |
| Gas Valve                 | Gv       |
| Gully                     | Gy       |
| Illuminated Bollard       | Ib       |
| Invert Level              | IL       |
| Post Level                | PL       |
| Letter Box                | Lb       |
| Lamp post                 | Lp       |
| Manhole                   | Mh       |
| Marker Post               | Mp       |
| Parking Meter             | Pm       |
| Post                      | Ps       |
| Rubbish Bin               | Rb       |
| Road Name Board           | Rn       |
| Rodding Eye               | Re       |
| Soft Level                | Sl       |
| Sign Post                 | Sp       |
| Site                      | St       |
| Tree Stump                | St       |
| Stop Tap                  | St       |
| Stop Valve                | Sv       |
| Cable Stay                | Sc       |
| Traffic Light             | Tl       |
| Telegraph Post            | Tp       |
| Unstable to Lift          | UL       |
| Valve                     | Va       |
| Vent Pipe                 | Vp       |
| Video Camera              | Vc       |
| Water Level               | WL       |
| Water Meter               | Wm       |
| Wash Out                  | Wo       |
| Window Sample             | WS       |
| Survey Station with Level | △ 10.000 |

— 0.50 — Terrain contours shown at 0.50m intervals

— Hawthorn hedge row width drawn approximately

- Survey notes:
1. Survey orientated to Ordnance Survey National Grid by the use of GPS coordinates transformed using UK/OSGB 1936/ British National Grid OSTN02. Scale factor of 0.999601271698 applied to all calculations.
  2. Level datum taken GPS observations and transformed using The National Geoid Model OSGM02
  3. All feature shown were current at the time of the survey. There may be features missed during the survey due to obstructions or lack of access.
  4. Drainage: Invert levels, pipe sizes and pipe connections have been surveyed by visual inspection only, and therefore the complete accuracy of this information cannot be guaranteed.
  5. Trees: sizes and species are indicative only, with the mean spread drawn to scale.
  6. The contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts.

| Survey Control Table |             |             |          |
|----------------------|-------------|-------------|----------|
| Station              | Easting     | Northing    | Level    |
| M101                 | 445626.5520 | 374892.5180 | 90.5560  |
| M102                 | 445658.1470 | 374812.9250 | 88.1960  |
| M103                 | 445633.7920 | 374858.4992 | 88.7991  |
| M104                 | 445568.5130 | 374854.7030 | 90.5230  |
| M105                 | 445478.8200 | 374812.9690 | 86.2020  |
| M106                 | 445338.8990 | 374705.2830 | 86.0940  |
| M107                 | 445281.0469 | 374658.1345 | 87.0693  |
| M202                 | 445562.7470 | 375193.3460 | 74.0660  |
| M301                 | 445460.3220 | 375676.1370 | 96.5950  |
| M302                 | 445492.1300 | 375644.1090 | 96.4040  |
| M303                 | 445524.7761 | 375564.4459 | 93.1311  |
| M304                 | 445392.5020 | 375619.4470 | 91.6820  |
| M305                 | 445366.1350 | 375591.2820 | 90.2890  |
| M306                 | 445512.9710 | 375705.3750 | 99.3150  |
| M307                 | 445640.2000 | 375768.8720 | 109.8310 |
| M308                 | 445741.9050 | 375793.1070 | 112.9090 |
| M309                 | 445954.5540 | 375906.3620 | 116.0290 |
| M310                 | 445954.2880 | 375817.8500 | 119.2830 |
| M401                 | 445256.2220 | 375400.2760 | 84.8710  |
| M402                 | 445206.5580 | 375321.8460 | 79.2640  |
| M403                 | 445024.0910 | 375271.0100 | 62.9700  |
| M404                 | 444907.8460 | 375215.3940 | 56.4230  |
| M405                 | 444886.6470 | 375178.9930 | 55.0310  |
| M406                 | 444921.0480 | 375099.7960 | 54.3260  |
| M407                 | 445022.1883 | 375003.5143 | 55.9290  |
| M305A                | 445317.7220 | 375529.3950 | 88.3420  |

|                       |            |           |
|-----------------------|------------|-----------|
| Based on a LSS output | 24-07-2014 | -         |
| Draw Details          | RM         | RM MB     |
| Draw                  | Dim        | Chd App'd |

Chatsworth Settlement Trustees

Project  
Mastin Moor  
Staveley,  
Derbyshire

Dwg Title  
Topographic Survey  
June 2014  
Sheet 7

| Site No.  | Dwg No.     | Revision            |
|-----------|-------------|---------------------|
| June 2014 | 002/007     | -                   |
| Scale     | Date        | Frame Dimensions mm |
| 1:500     | August 2014 | (A0) 1139 x 791     |
| Drawn     | Checked     | Approved            |
| RM        | RM          | MB                  |





KEY

Planning Boundary

Residential

Local Centre

Elderly Care

Community Garden Building

Public Open Space

LEAP (Local Equipped Play Area)

Community Garden

Community Orchard

Rose Gardens

Naturalistic Parkland

Attenuation Basin

Road

Segregated Cycle Lane

Existing PRoW (retained / improved)

Multi-user Path

Recreational Path

Garden Footpath

| rev | details     | by | date     |
|-----|-------------|----|----------|
| 00  | Draft Issue | LY | 25.06.21 |
|     |             |    |          |
|     |             |    |          |
|     |             |    |          |
|     |             |    |          |
|     |             |    |          |

| rev | details | by | date |
|-----|---------|----|------|
|     |         |    |      |
|     |         |    |      |
|     |         |    |      |
|     |         |    |      |
|     |         |    |      |

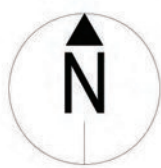
- Notes
1.

Do not scale from drawing, use figured dimensions only.
2.

All dimensions to be checked onsite.
3.

This drawing to be read in conjunction with all other Gillespies drawings and specifications.

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Project title

MASTIN MOOR

Drawing title

INDICATIVE MASTERPLAN

|                |             |                        |         |
|----------------|-------------|------------------------|---------|
| Drawing number |             | P20181-00-001-GIL-0101 |         |
| Drawing Status |             | Revision               |         |
| PLANNING       |             | 00                     |         |
| Date           | Scale       | Drawn                  | Checked |
| 25.06.21       | 1:2500 @ A1 | LY                     | MC      |

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CST

GILLESPIES

Milton Chambers, 12 Healds Court, Leeds LS1 4LJ  
P: 0113 247 0550 F: 0113 247 0650 E: design.team@gillespies.co.uk

Client

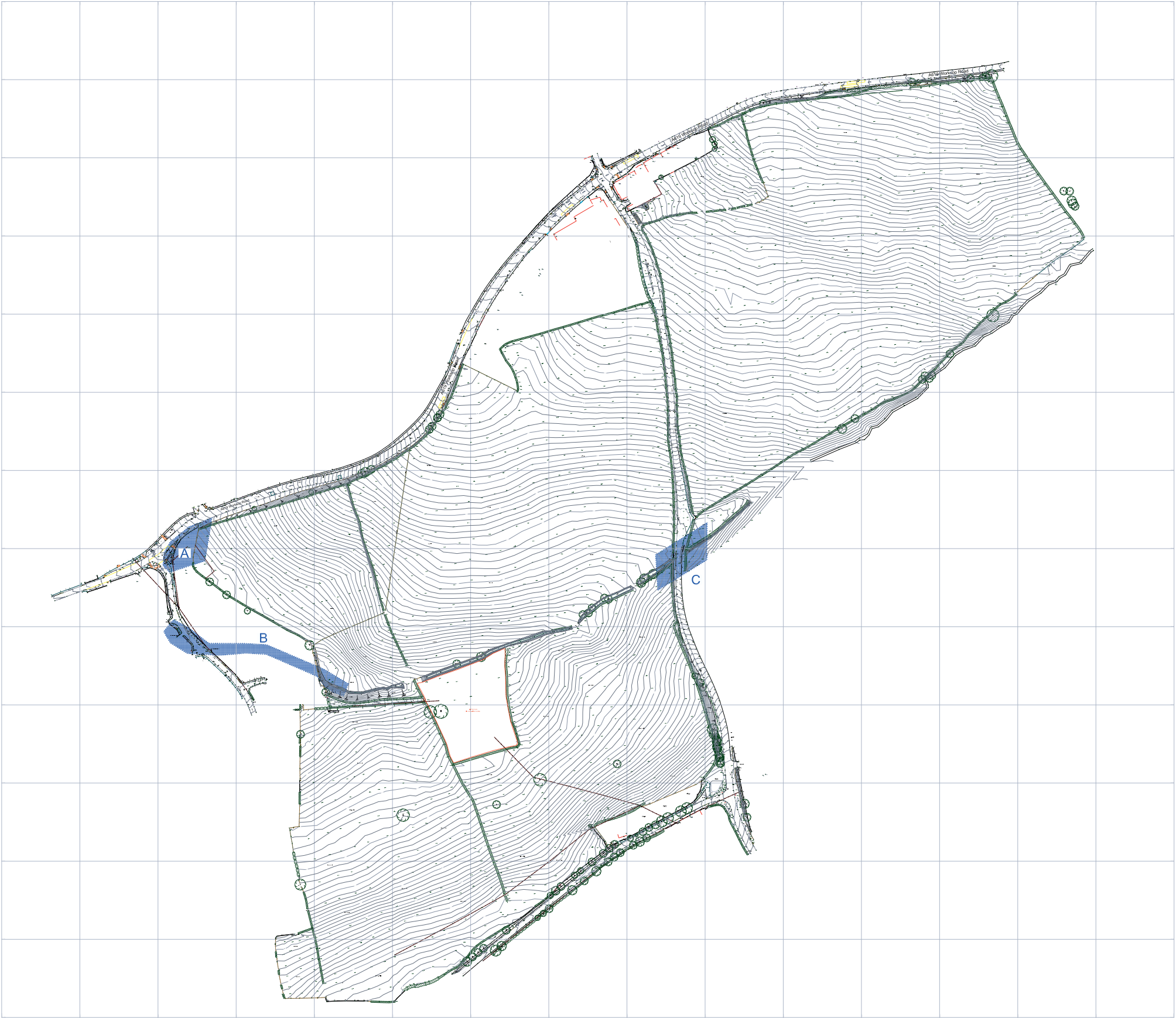






## Creswell to Renishaw Air valves





Legend  
Potential flooding area  
based on local knowledge  
of the area

|                       |            |       |
|-----------------------|------------|-------|
| Based on a LSS output | 05-10-2015 | -     |
| RM                    | GJ         | GJ    |
| Drawn                 | Chd        | App'd |

Chatsworth Settlement Trustees

Project  
Maslin Moor  
Staveley,  
Derbyshire

Drawn Title  
Flooding Information Obtained  
From Local Knowledge  
- For Information Only -

|                   |                      |                                        |
|-------------------|----------------------|----------------------------------------|
| Site No.<br>19412 | Drawn No.<br>203/001 | Revision<br>-                          |
| Scale<br>1:2000   | Date<br>October 2015 | Frame Dimensions mm<br>(A0) 1139 x 791 |
| Drawn<br>RM       | Checked<br>GJ        | Approved<br>GJ                         |

London  
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## **APPENDIX 2**

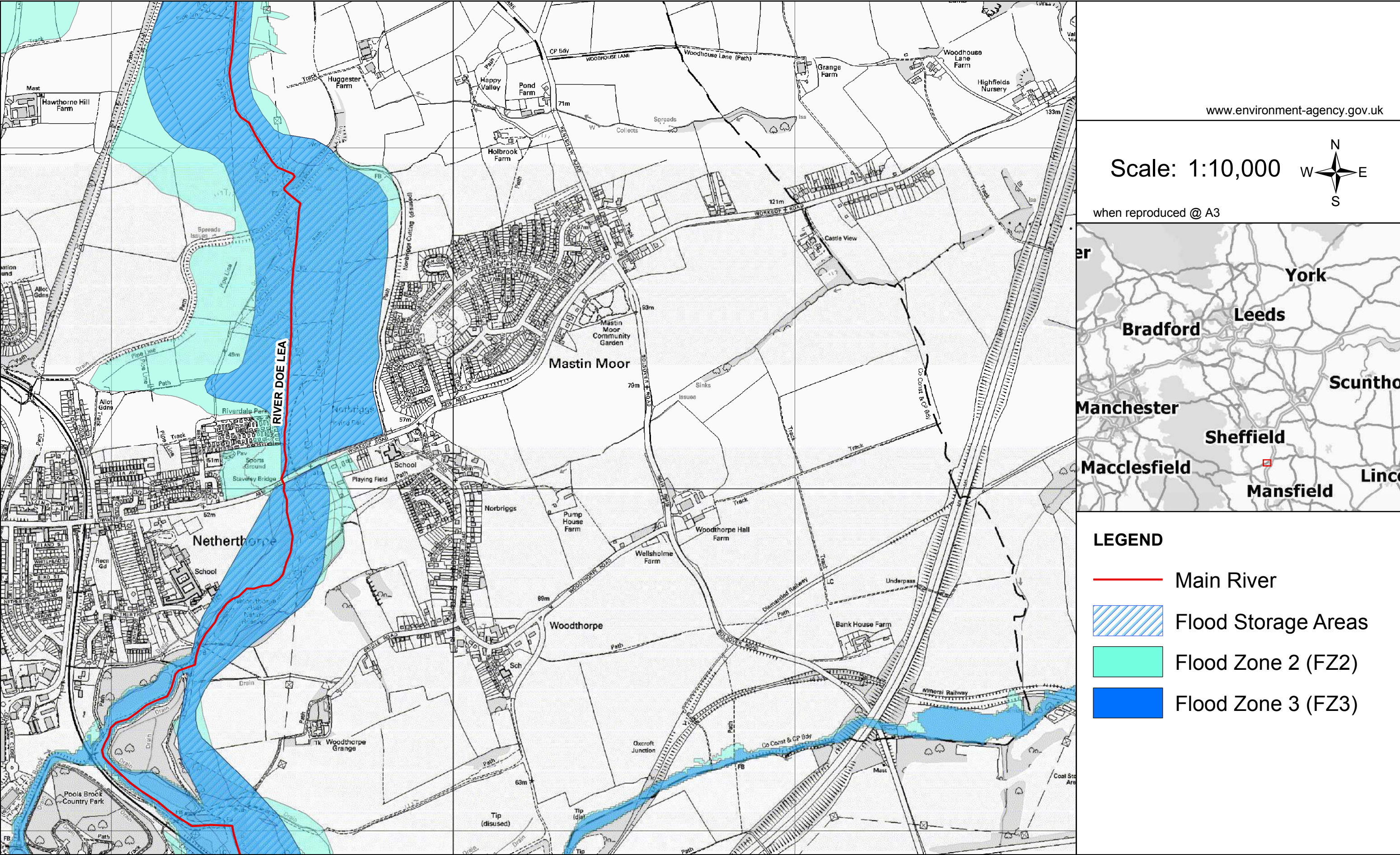
- Environment Agency Consultation
- Lead Local Flood Authority Consultation



## **Environment Agency 2014 Correspondence & Provided Documents**

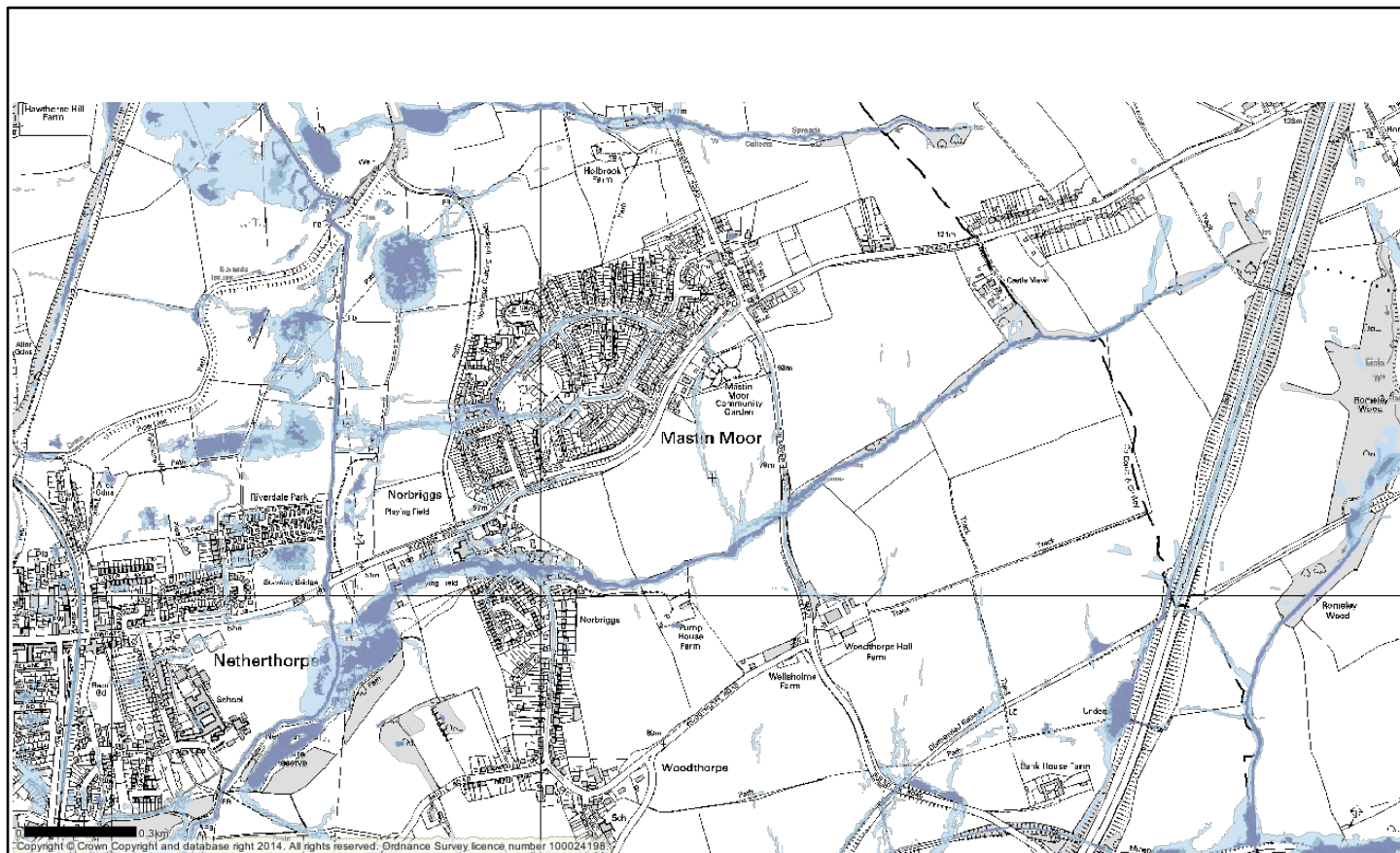


# Flood Map for Mastin Moor, Chesterfield - Date Created: 02/07/2014





# Risk of flooding from Surface Water – Mastin Moor, Chesterfield- RFI no: 29733 – Date 02/07/14



## Likelihood of Flooding from Surface Water

- High
- Medium
- Low
- Very Low

## Likelihood of Flooding from Surface Water

- High:** Greater than or equal to 1 in 30 (3.3%) chance in any given year
- Medium:** Less than 1 in 30 (3.3%) but greater than or equal to 1 in 100 (1%) chance in any given year
- Low:** Less than 1 in 100 (1%) but greater than or equal to 1 in 1,000 (0.1%) chance in any given year
- Very Low:** Less than 1 in 1,000 (0.1%) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on our website.

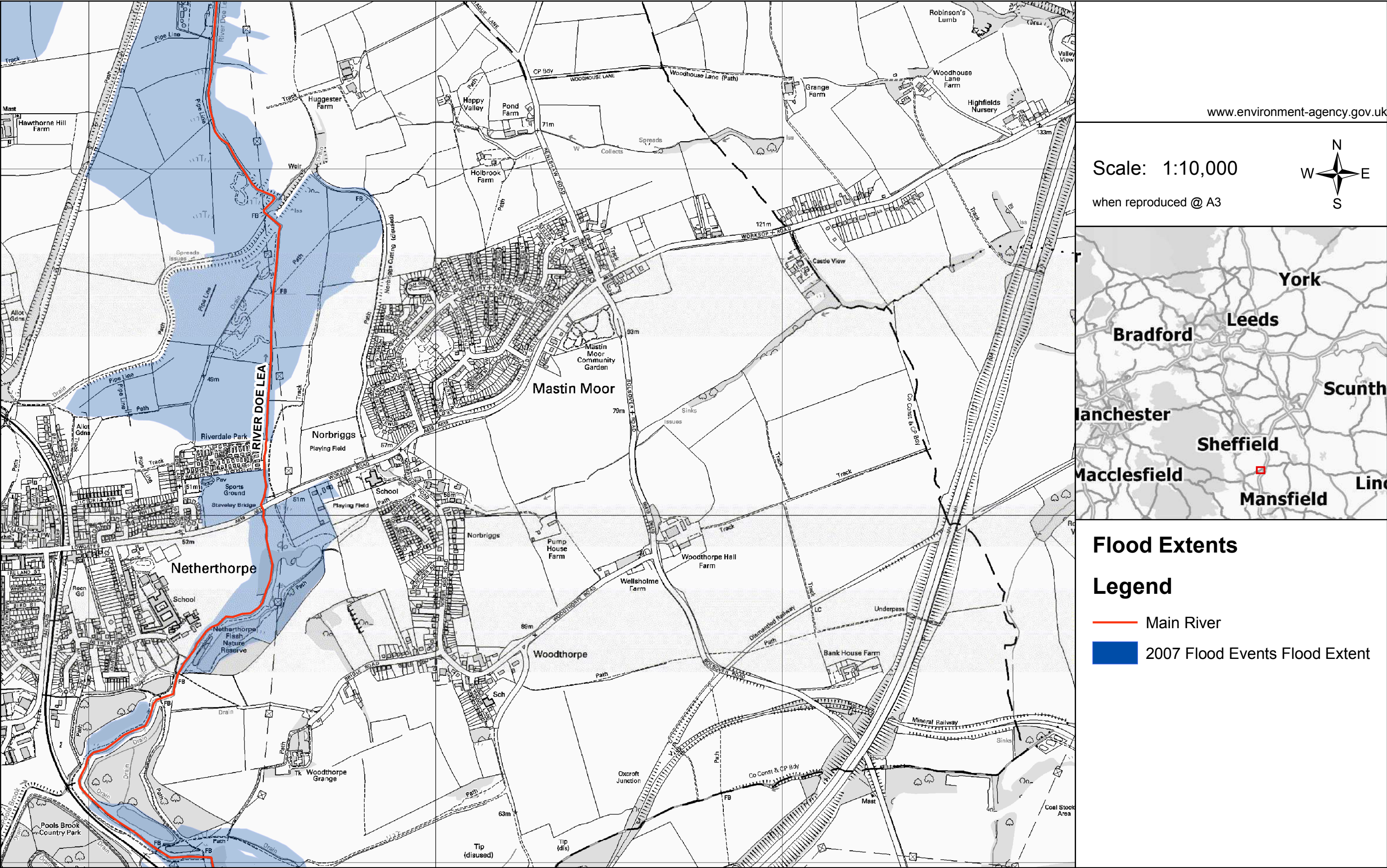
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**Contact Us:** National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)



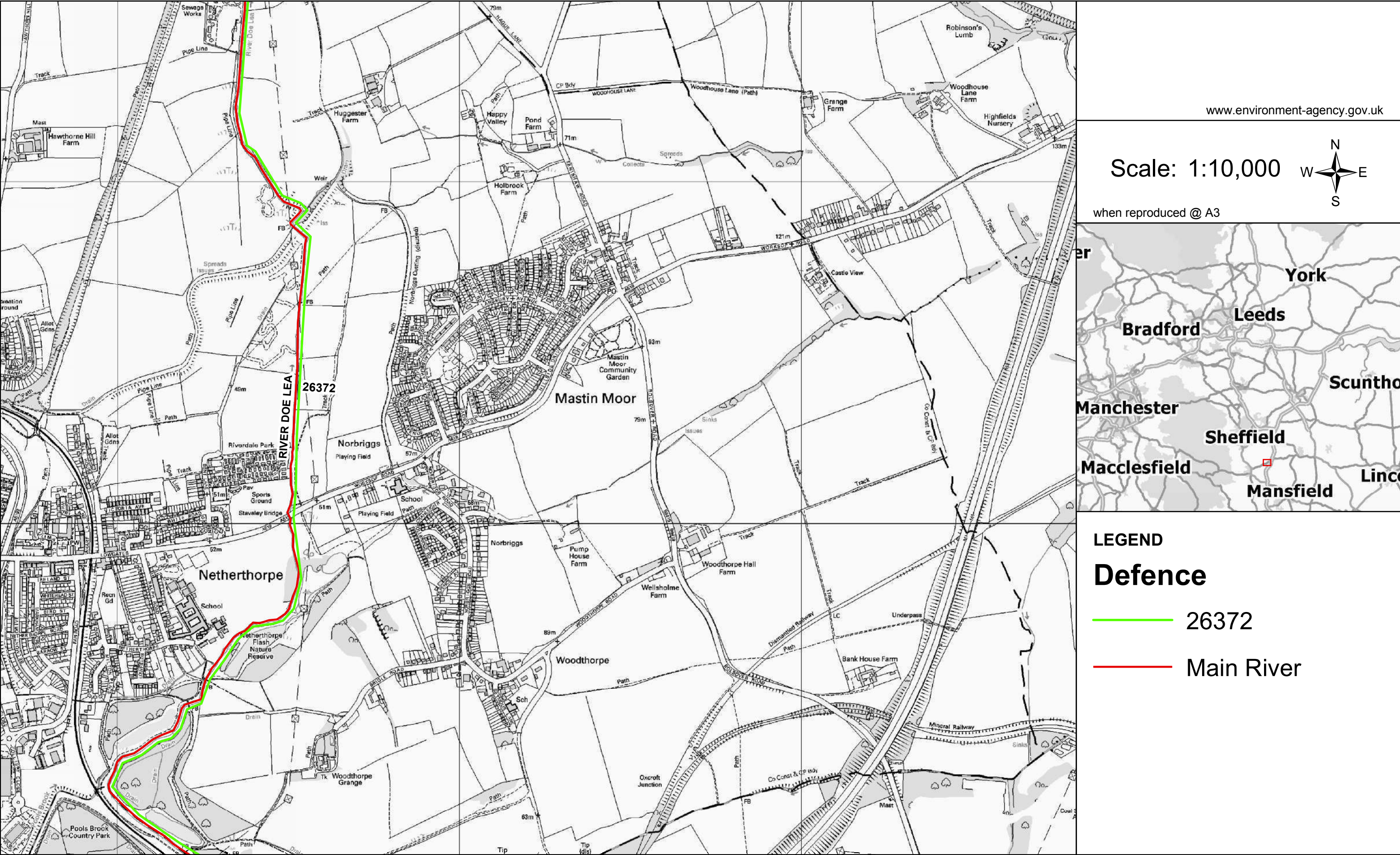
Flood History Map for Mastin Moor, Chesterfield - dated: 02/07/2014

[Ref: 29733]





# Asset Location for Mastin Moor, Chesterfield - Date Created: 02/07/2014

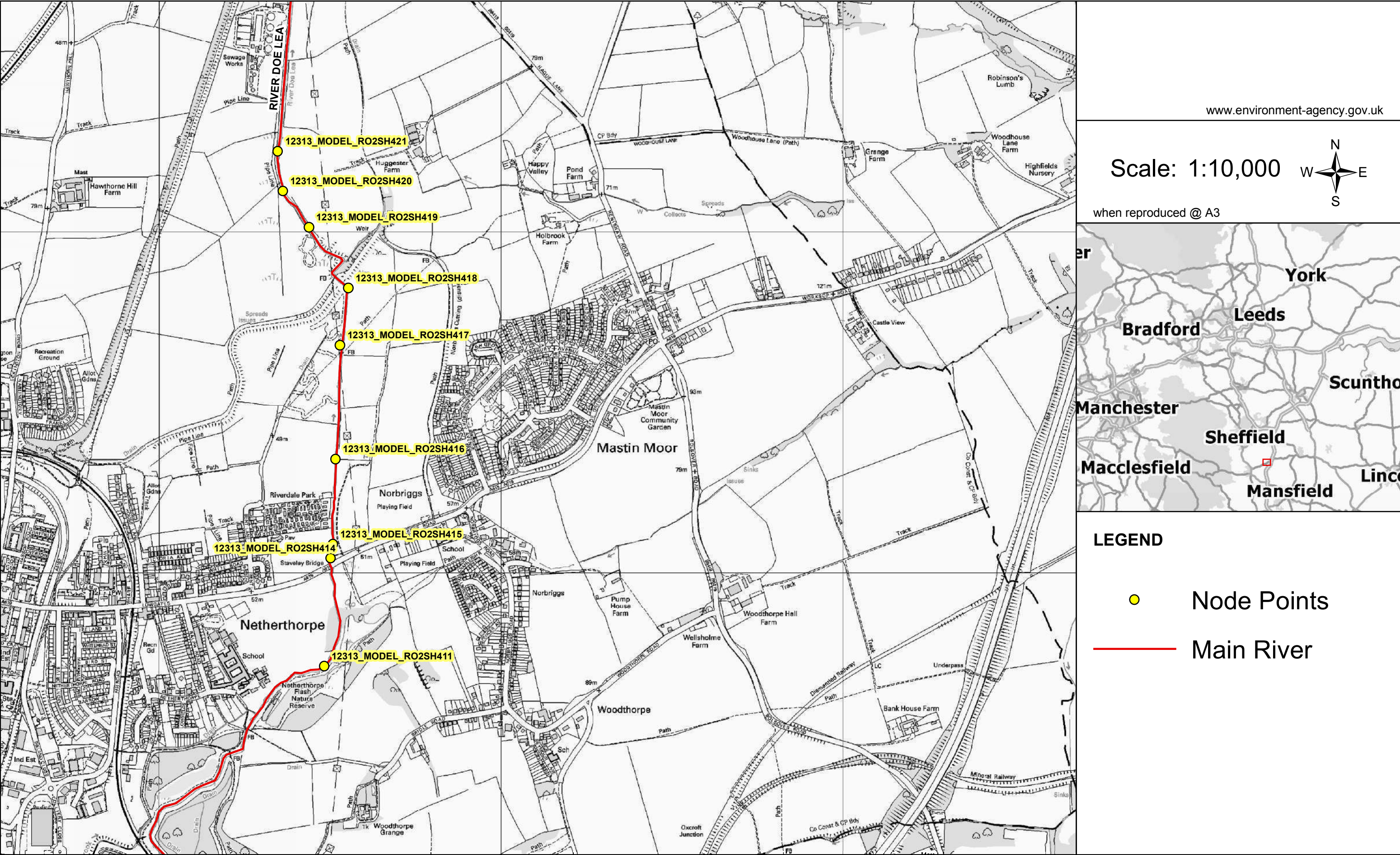




| RFI No: 29733 Asset Information |            |               |            |              |                               |                               |                             |                         |
|---------------------------------|------------|---------------|------------|--------------|-------------------------------|-------------------------------|-----------------------------|-------------------------|
| Asset ID                        | Asset Type | Asset Subtype | Maintainer | Description  | Design Standard of Protection | Actual Downstream Crest Level | Actual Upstream Crest Level | Actual Condition Rating |
| 26372                           | Defence    | High Ground   | Private    | Open Channel | 30                            | No Data                       | No Data                     | 3                       |



# Node Point Location for Mastin Moor, Chesterfield - Date Created: 02/07/2014





## Model Levels (Defended) for Mastin Moor, Chesterfield (Flow level mAOD, Flow m<sup>3</sup>/s)

### Stage - mAOD

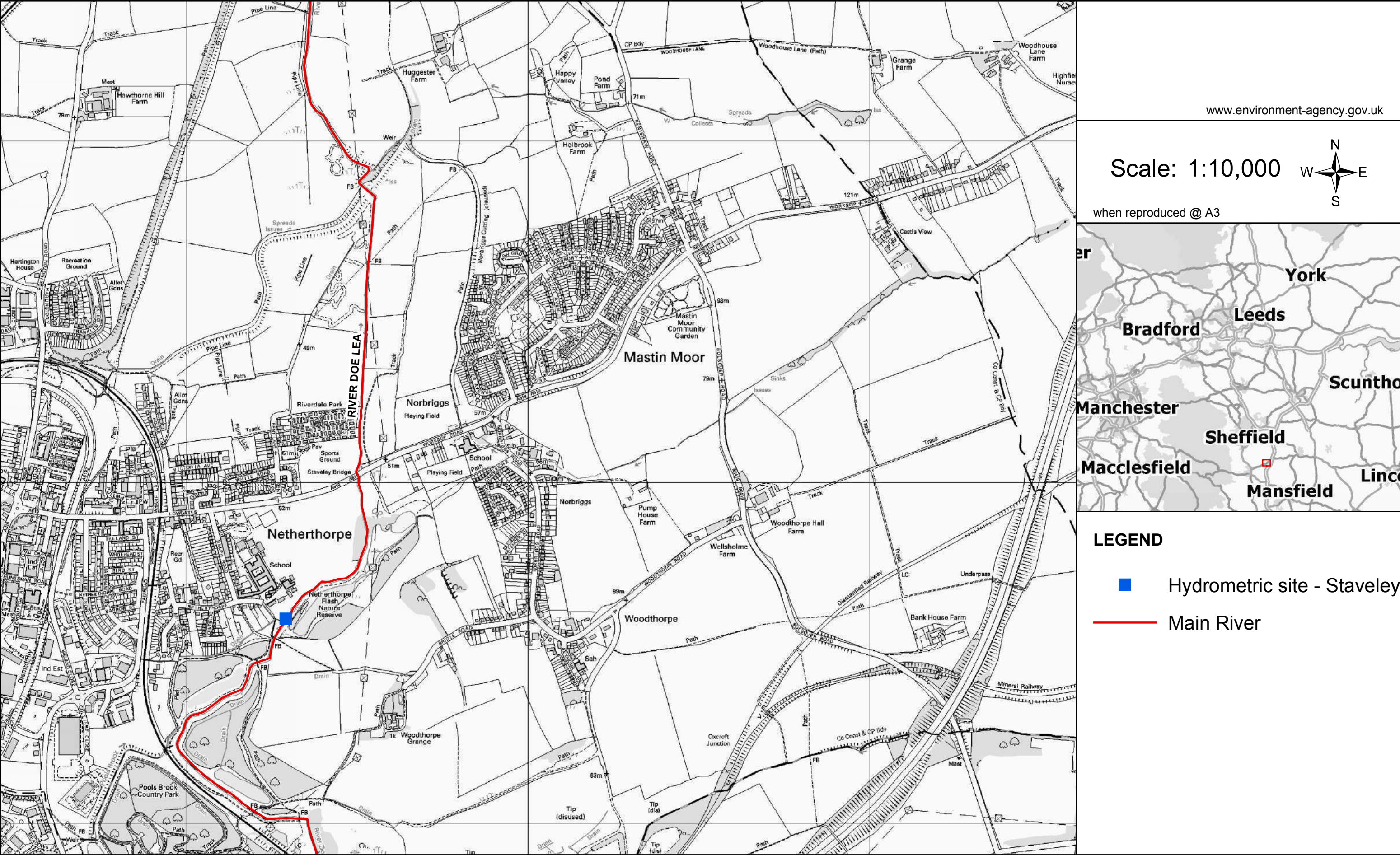
| Node Point Name      | Return Period |        |        |        |        |        |
|----------------------|---------------|--------|--------|--------|--------|--------|
|                      | 25            | 50     | 75     | 100    | 150    | 200    |
| 12313_Model_RO2SH411 | 48.275        | 48.457 | 48.475 | 48.531 | 48.640 | 48.702 |
| 12313_Model_RO2SH414 | 48.078        | 48.257 | 48.279 | 48.331 | 48.450 | 48.512 |
| 12313_Model_RO2SH415 | 47.983        | 48.153 | 48.179 | 48.223 | 48.343 | 48.404 |
| 12313_Model_RO2SH416 | 47.703        | 47.820 | 47.868 | 47.896 | 48.055 | 48.116 |
| 12313_Model_RO2SH417 | 47.586        | 47.689 | 47.744 | 47.784 | 47.961 | 48.029 |
| 12313_Model_RO2SH418 | 47.482        | 47.598 | 47.692 | 47.768 | 47.971 | 48.043 |
| 12313_Model_RO2SH419 | 47.413        | 47.525 | 47.606 | 47.696 | 47.904 | 47.977 |
| 12313_Model_RO2SH420 | 47.387        | 47.531 | 47.615 | 47.705 | 47.913 | 47.985 |
| 12313_Model_RO2SH421 | 47.355        | 47.520 | 47.605 | 47.696 | 47.904 | 47.977 |

### Flow - m<sup>3</sup>/s

| Node Point Name      | Return Period |      |      |      |      |      |
|----------------------|---------------|------|------|------|------|------|
|                      | 25            | 50   | 75   | 100  | 150  | 200  |
| 12313_Model_RO2SH411 | 16.9          | 19.0 | 19.2 | 19.7 | 20.6 | 21.1 |
| 12313_Model_RO2SH414 | 17.0          | 20.6 | 21.0 | 22.0 | 24.3 | 25.5 |
| 12313_Model_RO2SH415 | 17.0          | 20.6 | 21.0 | 22.0 | 24.3 | 25.5 |
| 12313_Model_RO2SH416 | 17.0          | 20.6 | 21.0 | 22.0 | 24.3 | 25.5 |
| 12313_Model_RO2SH417 | 17.0          | 20.5 | 21.0 | 22.0 | 24.2 | 24.9 |
| 12313_Model_RO2SH418 | 15.1          | 15.7 | 15.8 | 15.8 | 15.8 | 15.9 |
| 12313_Model_RO2SH419 | 17.2          | 20.5 | 21.1 | 21.9 | 23.7 | 25.2 |
| 12313_Model_RO2SH420 | 17.2          | 18.6 | 18.9 | 19.0 | 19.2 | 19.3 |
| 12313_Model_RO2SH421 | 17.2          | 18.6 | 18.9 | 19.1 | 19.2 | 19.4 |



# Hydrometric Site Location close to Mastin Moor, Chesterfield- Date Created: 04/07/2014





## **Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments**

### **Important**

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

<http://www.environment-agency.gov.uk/research/planning/33580.aspx>

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

<http://www.environment-agency.gov.uk/research/planning/82587.aspx>

<http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance>

<http://www.communities.gov.uk/publications/planningandbuilding/pps25guideupdate>

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

In **Wales**, you should refer to TAN15 for information about what flood consequence assessment is needed for new development in the different flood zones

<http://new.wales.gov.uk/splash.jsessionid=8yIGTfGZthmB0t2vhp6hS1GcB1LXvZzB3Ylczf20Xn7LK3zK0nMk!981825250?orig=/topics/planning/policy/tans/tan15/>

You should also consult the Strategic Flood Consequence Assessment if one has been produced by your local planning authority.

In both **England and Wales** you should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk / Consequence Assessment (FRA / FCA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.
4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

## Taking climate change into account

11. Global sea level will continue to rise, depending on greenhouse gas emissions and the sensitivity of the climate system. The relative sea level rise in England also depends on the local vertical movement of the land, which is generally falling in the south-east and rising in the north and west. In preparing a Strategic Flood Risk Assessment or a site-specific flood risk assessment, the allowances for the rates of relative sea level rise shown in table 4 should be used as a starting point for considering flooding from the sea, along with the sensitivity ranges for wave height and wind speed in table 5.

**Table 4: Recommended contingency allowances for net sea level rises**

|                                                                                              | Net sea level rise (mm per year)<br>relative to 1990 |                 |                 |                 |
|----------------------------------------------------------------------------------------------|------------------------------------------------------|-----------------|-----------------|-----------------|
|                                                                                              | 1990 to<br>2025                                      | 2025 to<br>2055 | 2055 to<br>2085 | 2085 to<br>2115 |
| East of England, east midlands,<br>London, south-east England<br>(south of Flamborough Head) | 4.0                                                  | 8.5             | 12.0            | 15.0            |
| South-west England                                                                           | 3.5                                                  | 8.0             | 11.5            | 14.5            |
| North-west England, north-east<br>England (north of Flamborough<br>Head)                     | 2.5                                                  | 7.0             | 10.0            | 13.0            |

**Notes to table 4:**

- a. For deriving sea levels up to 2025, the 4mm per year, 3mm per year and 2.5mm per year rates (covering the three geographical groups respectively), should be applied back to the 1990 base sea level year. From 2026 to 2055, the increase in sea level in this period is derived by adding the number of years on from 2025 (to 2055), multiplied by the respective rate shown in the table. Subsequent time periods 2056 to 2085 and 2086 to 2115 are treated similarly.
- b. Refer to Department for Environment, Food and Rural Affairs *FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts*, October 2006, for details of the derivation of this table. In particular, Annex A1 of this Note shows examples of how to calculate sea level rise.
- c. Vertical movement of the land is incorporated in the table and does not need to be calculated separately.

12. The rise in sea level will change the frequency of occurrence of high water levels relative to today's sea levels, assuming no change in storminess. There may also be secondary impacts such as changes in wave heights due to increased water depths, as well as possible changes in the frequency, duration and severity of storm events. A 10 per cent sensitivity allowance should be added to offshore wind speeds and wave heights by the 2080s.
13. In making an assessment of the impacts of climate change on flooding from the land, rivers and sea as part of a flood risk assessment, the sensitivity ranges in table 5 may provide an appropriate precautionary response to the uncertainty about climate change impacts on rainfall intensities, river flow, wave height and wind speed.

**Table 5: Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights**

| Parameter               | 1990 to 2025 | 2025 to 2055 | 2055 to 2085 | 2085 to 2115 |
|-------------------------|--------------|--------------|--------------|--------------|
| Peak rainfall intensity | +5%          | +10%         | +20%         | +30%         |
| Peak river flow         | +10%         | +20%         |              |              |
| Offshore wind speed     | +5%          |              | +10%         |              |
| Extreme wave height     | +5%          |              | +10%         |              |

**Notes to table 5:**

- a. Refer to Department for Environment, Food and Rural Affairs *FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts*, October 2006, for details of the derivation of this table.
  - b. For deriving peak rainfall, for example, between 2025 and 2055 multiply the rainfall measurement (in mm per hour) by 10 per cent and between 2055 and 2085 multiply the rainfall measurement by 20 per cent. So, if there is a 10mm per hour event, for the 2025 to 2055 period this would equate to 11mm per hour; and for the 2055 to 2085 period, this would equate to 12mm per hour. Other parameters in table 5 are treated similarly.
14. Sensitivity testing of the flood map produced by the Environment Agency, using the 20 per cent from 2025 to 2115 allowance for peak flows, suggests that changes in the extent of inundation are negligible in well-defined floodplains, but can be dramatic in very flat areas. However, changes in the depth of flooding under the same allowance will reduce the return period of a given flood. This

means that a site currently located within a lower risk zone (e.g. Zone 2 in table 1) could in future be re-classified as lying within a higher risk zone (e.g. Zone 3a in table 1). This in turn could have implications for the type of development that is appropriate according to its vulnerability to flooding (see table 2). It will therefore be important that developers, their advisors and local authorities refer to the current flood map and the Strategic Flood Risk Assessment when preparing and considering proposals.

15. Flooding in estuaries may result from the combined effects of high river flows and high sea surges. When taking account of impacts of climate change in flood risk assessments covering tidal estuaries, it will be necessary for the allowances for sea level rise in table 4 and the allowances for peak flow, wave height and wind speed in table 5 to be combined.<sup>11</sup>

---

<sup>11</sup> Refer to Defra *FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts*, October 2006. Annex A2 gives details of joint probability analysis. [www.defra.gov.uk/enviro/fcd/pubs/pagn/climatechangeupdate.pdf](http://www.defra.gov.uk/enviro/fcd/pubs/pagn/climatechangeupdate.pdf)

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## **Environment Agency 2017 Correspondence & Provided Documents**

---

**From:** Robert Hopkinson  
**Sent:** 06 December 2016 16:43  
**To:** 'enquiries@environment-agency.gov.uk'  
**Subject:** 19412: Mastin Moor, Pre-Development Enquiry  
**Attachments:** Node Locations - Mastin Moor.pdf; Asset Information - Mastin Moor.pdf; Flood History Map - Mastin Moor.pdf; M5328-100-P01-INDICATIVE MASTERPLAN 4-7-16.pdf; MER00810-001-001.pdf

**PROPOSED DEVELOPMENT: MASTIN MOOR  
FLOOD RISK ASSESSMENT: PRE PLANNING ENQUIRY**

Our client Chatsworth Settlement Trustees is currently updating a planning application for approximately 650 dwellings within a proposed site at approximate NGR E445500, N375500, post code S43 3DN. (see attached masterplan).

We have received information from yourselves in 2014 but given the time that has elapsed, we would request an update to the original consultation request. Extracts of the original requested information are attached to this email for your information.

We would be grateful if you could advise whether this is considered appropriate for planning purposes by yourselves, and also whether there is any specific information or any issues related to the site, such as historical flooding events, IDB management areas, relevant catchment or flood management plans.

If you have any queries or if this site is known to you and you would like to discuss things on either a formal or informal basis please do not hesitate to telephone me on 01773 829988.

Kind Regards

**Rob Hopkinson** EngTech MICE  
Junior Civil Engineer

E: [rhopkinson@merebrook.co.uk](mailto:rhopkinson@merebrook.co.uk)



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t +44 (0)1773 829 988 f +44 (0)1773 829 393 e [consulting@merebrook.co.uk](mailto:consulting@merebrook.co.uk)  
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**Subject:**

FW: 33051 Mastin Moor, Pre-Development Enquiry

**From:** Wait, Tom [<mailto:Tom.Wait@environment-agency.gov.uk>]**Sent:** 11 January 2017 16:06**To:** Robert Hopkinson <[rhopkinson@merebrook.co.uk](mailto:rhopkinson@merebrook.co.uk)>**Cc:** NE Yorkshire, Customer Contact <[neyorkshire@environment-agency.gov.uk](mailto:neyorkshire@environment-agency.gov.uk)>**Subject:** RFI: 33051 Mastin Moor, Pre-Development Enquiry

Dear Rob,

Firstly please accept my apologies for the delay in getting a response back to you.

I have included a Flood Map for Planning in addition to a new Flood History Map as the previous map issued did not include the 1958 event, otherwise the data supplied is currently our best available. Although please note that the modelling in this area will be updated in the spring of this year as part of our Lower and Middle Don model.

There are no planned flood alleviation works in the area, though there is a paleo channel restoration planned downstream of the site that we're undertaking in partnership with Chesterfield Borough Council. Please let me know if you wish for further information on the project and I'll contact the relevant team.

For further pre-application advice please [contact](#) our Sustainable Places team, there will be a charge associated with any consultation beyond preliminary advice.

Yours warmly,

**Tom Wait**  
**FCRM Officer*****Flood & Coastal Risk Management - Partnerships and Strategic Overview - Yorkshire***✉ **Environment Agency, Lateral, 8 City Walk, Leeds. LS11 9AT**☎ **Direct 020 8474 8062 (internal 48062)**📧 **[tom.wait@environment-agency.gov.uk](mailto:tom.wait@environment-agency.gov.uk)**

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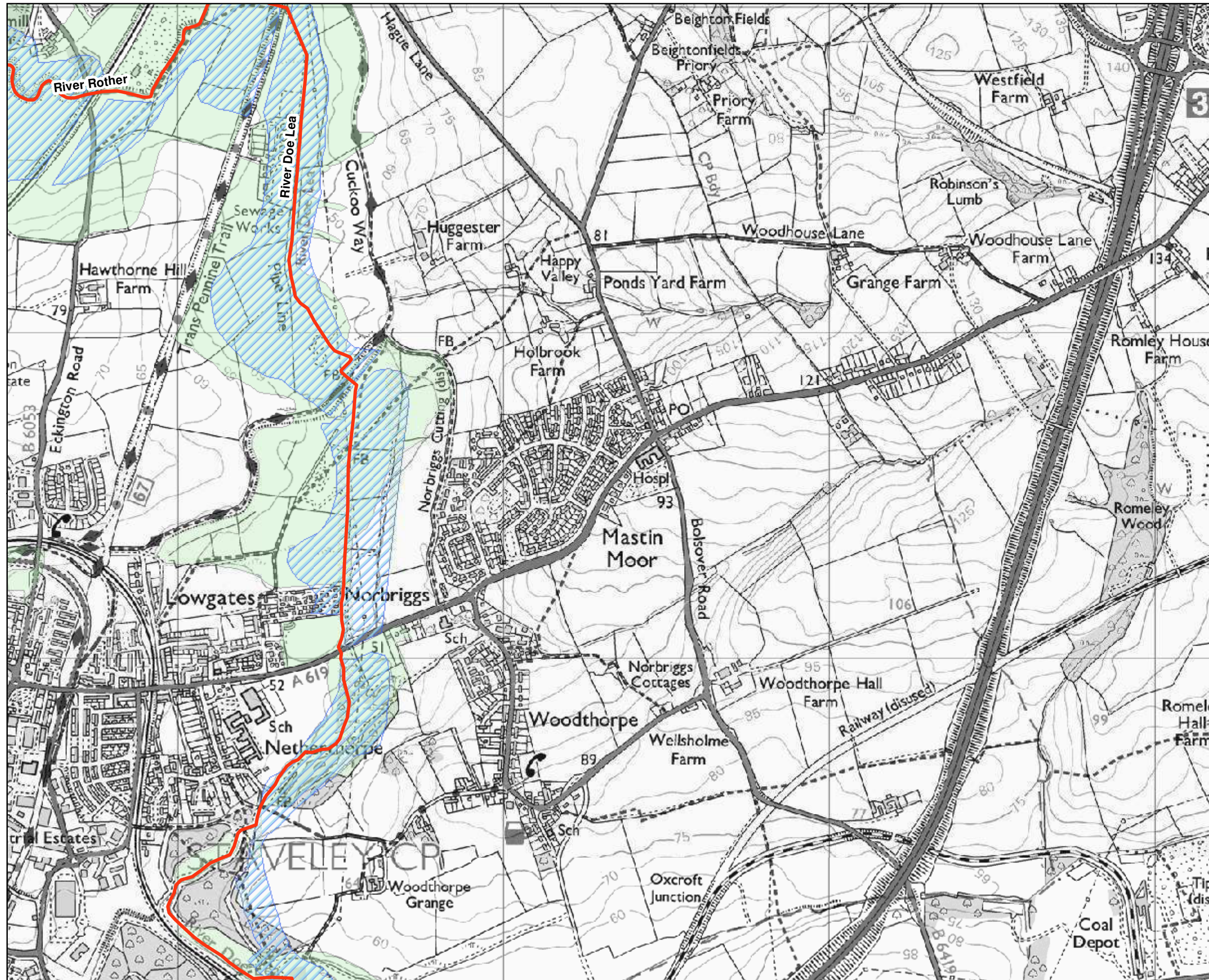
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## LEGEND

- Main River
- River Rother 1958 Flood Extent
- 2007 Flood Events Flood Extent





## **Derbyshire County Council 2014 Correspondence & Provided Documents**

## Environment Information Request - Response Form

|                            |                                                                      |                  |            |
|----------------------------|----------------------------------------------------------------------|------------------|------------|
| <b>DCC REFERENCE:</b>      | 2014/26 – Mastin Moor, Chesterfield.                                 |                  |            |
| <b>DCC CONTACT:</b>        | Lauren Christopher                                                   |                  |            |
| <b>CONTACT NAME:</b>       | Paul Turner                                                          |                  |            |
| <b>CONTACT COMPANY:</b>    | Merebrook                                                            |                  |            |
| <b>CONTACT TEL NUMBER:</b> | <a href="mailto:pturner@merebrook.co.uk">pturner@merebrook.co.uk</a> |                  |            |
| <b>ADDRESS OF SITE:</b>    | Mastin Moor, Chesterfield.                                           |                  |            |
| <b>DATE RECEIVED:</b>      | 18/06/2014                                                           | <b>DATE DUE:</b> | 16/07/2014 |

### **SURFACE WATER DATA:**

A review of the Derbyshire County Council (DCC) surface water model outputs indicate that the proposed site is unlikely to be subject to surface water flooding during the critical storm duration in the 1 in 100 year return period event in its current land use.

When considering designing drainage systems for exceedence, the developer should consider rainfall events in the excess of the 1 in 100 year return period to allow for extreme events.

An analysis of the DCC surface water model outputs for the 1 in 1000 year critical storm duration rainfall event indicate that the site is unlikely to be subject to surface water flooding.

### **FLUVIAL DATA (ORDINARY WATERCOURSE AND MAIN RIVER WHERE APPLICABLE):**

DCC are not aware of any specific fluvial modelling for the proposed site.

### **GROUNDWATER DATA:**

An analysis of the British Geological Survey (BGS) data is summarised below:

- Groundwater is likely to be more than 5 m below the ground surface throughout the year.
- Ground instability problems may be present or anticipated. Increased infiltration is unlikely to result in ground instability.
- The groundwater may be vulnerable to contamination. Infiltrating water should be free of contaminants.

It is recommended that a site specific ground investigation is undertaken for the site based on the review of the BGS data.

**HISTORICAL DATA:**

DCC has received no reported historical incidences of flooding within the proposed site boundary. There has however been one reported incident of sewer flooding on the northern boundary of the site on Worksop Road; internal flooding was recorded in two properties for more information contact the water company. There are two other incidents of flooding outside the boundary of the site (200m and 50m approximately) but there are no details held about these incidents.

**WATER FRAMEWORK DIRECTIVE/WATER ENVIRONMENT DATA:**

The unnamed watercourse intersecting the site is not currently assessed under the WFD (Water Framework Directive, 2000). However, no activities or works should deteriorate the status of this watercourse as the main objectives for the WFD is to prevent deterioration in 'status' for all waterbodies. All waterbodies should reach 'good ecological status' by 2015 according to the directive.

A brief review of the county ecological information shows that there have been reported ecological records within close proximity of the site. Grass snakes have been sighted south of Woodthorpe Road in 2009 and common lizards have been identified north of Worksop Road in 2002 both of which are a protected species under the Wildlife and Countryside Act 1981. It is recommended that an appropriate ecological report is carried out for further information.

**OTHER RELEVANT INFORMATION AND COMMENTS:**

DCC do not hold any DG5 records. Please contact the local water company.

The Flood and Water Management Act (FWMA) came into force in 2010 and designated DCC as a Lead Local Flood Authority (LLFA). As of the 6<sup>th</sup> April 2012 the FWMA transposed consenting powers under the Land Drainage Act (LDA) to DCC (the LLFA), therefore any works in or nearby to an Ordinary Watercourse require consent from DCC (the consent authoriser). Upon receipt of any application (including the legislative fee) DCC has an eight week legislative period at which to make a decision and either consent or object the proposals. If you wish to make an application for works to an Ordinary Watercourse please contact the Flood Team directly.

DCC strongly promote Sustainable Drainage Systems (SuDS) to be incorporated within the design of a drainage strategy for any proposed development, applying the SuDS management train. The applicant is advised to contact the DCC Flood Team should any guidance on the drainage strategy for the proposed development be required. DCC encourages that site surface water drainage is designed in line with the current draft National SuDS Standards, including restricting developed discharge of surface water to greenfield runoff rates making suitable allowances for climate change and urban creep, managing surface water as close to the surface as possible and prioritising infiltration as a means of surface water disposal where possible. Regardless of the site's status as greenfield or brownfield land, DCC encourages that surface water discharge from the developed site should be as close to the greenfield runoff rate as is reasonably practicable.



Derbyshire County Council holds a suite of information that can inform site development across Derbyshire. The information within this document has been interpreted and provided by an officer from the flood risk management team.

- Historical data has been collated from a range of sources and is anecdotal. The provision of this data is suggested to act as a guide only.
- Fluvial data has been provided by the EA however the applicant is advised to contact the EA for further information should the site lie within the floodplain of a Main River.
- Derbyshire County Council hold BGS data under a licenced agreement and therefore are not licenced to reproduce this information into the public domain.
- Derbyshire County Council have modelled surface water flooding for the whole of Derbyshire. The model output gives an indication of the broad areas likely to be at risk of surface water flooding and is intended to act as a guide only and cannot be used to identify specific properties at risk.
- Further information regarding the Water Framework Directive (WFD), ecology and biodiversity should be obtained from the EA and Natural England.

|                      |                    |                   |                   |
|----------------------|--------------------|-------------------|-------------------|
| <b>COMPLETED BY:</b> | Lauren Christopher | <b>DATE:</b>      | 30/06/2014        |
| <b>CHECKED BY:</b>   | Victoria Raiment   | <b>JOB TITLE:</b> | Senior Technician |
| <b>SIGNATURE:</b>    |                    | <b>DATE:</b>      |                   |



## **Environment Agency 2017 Correspondence & Provided Documents**

---

**From:** Robert Hopkinson  
**Sent:** 06 December 2016 16:44  
**To:** 'contact.centre@derbyshire.gov.uk'  
**Subject:** FW: 19412: Mastin Moor  
**Attachments:** M5328-100-P01-INDICATIVE MASTERPLAN 4-7-16.pdf; 20140630 EIR Response Mastin Moor chesterfield.docx; MER00810-001-001.pdf

Including site location plan.

**FAO Lauren Christopher/ Victoria Raiment**

Our client Chatsworth Estates is currently updating a planning application for approximately 650 dwellings within a proposed site at approximate NGR E445500, N375500, post code S43 3DN.

We have received information from yourselves in 2014 but given the time that has elapsed, we would request an update to the original consultation request. Copies of the original requested are attached to this email for your information.

We are commissioned with preparing a Flood Risk Assessment and Drainage Strategy. We would be grateful if you could provide any relevant information (advising on any charges where appropriate) as follows:

- Section 19 Flood Investigation Reports relevant to the site;
- Known ordinary watercourses in proximity to the site;
- Known surface water or groundwater flooding issues relevant to the site (with mapping where available);
- Guidance or advice documents on SuDS Policies (we note from your website that you are due to publish additional documents soon, we would be grateful if you could advise on timescales for this);
- Information on specific documents (other than PFRA and SFRA) that may be relevant to the site, such as SWMPs, CMPs;
- LLFA standing advice on flood risk or SuDS.
- Please can you confirm whether the site has been allocated in the local plan, or if the local plan has not yet been adopted, whether allocated the draft local plan?
- If the site has been allocated please provide the site allocation reference.

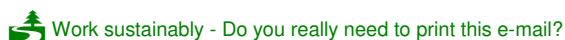
With regards the proposed drainage strategy, we would be grateful if you could advise on the level of detail of information required in the supporting documents, for example the format of any drainage calculations and drawings (required scales etc).

Do not hesitate to contact me if you require any further information in order to process my request.

Kind Regards

**Rob Hopkinson** EngTech MICE  
Junior Civil Engineer

E: [rhopkinson@merebrook.co.uk](mailto:rhopkinson@merebrook.co.uk)



---

**From:** Robert Hopkinson  
**Sent:** 06 December 2016 16:36  
**To:** 'contact.centre@derbyshire.gov.uk' <contact.centre@derbyshire.gov.uk>  
**Subject:** 19412: Mastin Moor

**FAO Lauren Christopher/ Victoria Raiment**

Our client Chatsworth Estates is currently updating a planning application for approximately 650 dwellings within a proposed site at approximate NGR E445500, N375500, post code S43 3DN.

We have received information from yourselves in 2014 but given the time that has elapsed, we would request an update to the original consultation request. Copies of the original requested are attached to this email for your information.

We are commissioned with preparing a Flood Risk Assessment and Drainage Strategy. We would be grateful if you could provide any relevant information (advising on any charges where appropriate) as follows:

- Section 19 Flood Investigation Reports relevant to the site;
- Known ordinary watercourses in proximity to the site;
- Known surface water or groundwater flooding issues relevant to the site (with mapping where available);
- Guidance or advice documents on SuDS Policies (we note from your website that you are due to publish additional documents soon, we would be grateful if you could advise on timescales for this);
- Information on specific documents (other than PFRA and SFRA) that may be relevant to the site, such as SWMPs, CMPs;
- LLFA standing advice on flood risk or SuDS.
- Please can you confirm whether the site has been allocated in the local plan, or if the local plan has not yet been adopted, whether allocated the draft local plan?
- If the site has been allocated please provide the site allocation reference.

With regards the proposed drainage strategy, we would be grateful if you could advise on the level of detail of information required in the supporting documents, for example the format of any drainage calculations and drawings (required scales etc).

Do not hesitate to contact me if you require any further information in order to process my request.

Kind Regards


**Rob Hopkinson**  
Junior Civil Engineer

E: [rhopkinson@merebrook.co.uk](mailto:rhopkinson@merebrook.co.uk)



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**Subject:**

FW: Information re: Mastin Moor

**From:** Coleman, Martin (Economy Transport and Communities) [<mailto:Martin.Coleman@derbyshire.gov.uk>]**Sent:** 02 February 2017 07:29**To:** Robert Hopkinson <[rhopkinson@merebrook.co.uk](mailto:rhopkinson@merebrook.co.uk)>**Subject:** Information re: Mastin Moor

Hi Rob

I've checked the information we currently hold relating to the site at Mastin Moor and can confirm no new information has come to light since the information we provided in 2014.

As regards the details of a drainage strategy, we would require the pre and post development runoff rates. The site is currently greenfield and we would ask that the post development rate is as close as possible to the greenfield rate. We would need to know the point of discharge, e.g. watercourse or sewer. Obviously, you'd need to consider SuDS first and justify why SuDS would not be suitable on the site if you intend not utilise them. We would need to know the volume of any surface water storage required, e.g. attenuation pond or basin. We would also need a indicative drainage layout plan.

I hope that helps.

Best wishes

**Martin Coleman | Flood Risk Technician**

**Flood Risk Management Team**

Economy, Transport and Communities | Derbyshire County Council

County Hall, Matlock, Derbyshire, DE4 3AG

T 01629 538571

E [martin.coleman@derbyshire.gov.uk](mailto:martin.coleman@derbyshire.gov.uk)



[www.derbyshire.gov.uk/environment/flooding/strategy](http://www.derbyshire.gov.uk/environment/flooding/strategy)

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**APPENDIX 3**

- Sewer Records
- Capacity Assessment















## **Yorkshire Water 2014 Correspondence & Provided Documents**













## Sewer Legend

|                                                                                     |                               |                                                                                      |                             |
|-------------------------------------------------------------------------------------|-------------------------------|--------------------------------------------------------------------------------------|-----------------------------|
|    | Combined Sewer                |    | S24 Combined Sewer          |
|    | Surface Water Sewer           |    | S24 Surface Water Sewer     |
|    | Foul Sewer                    |    | S24 Foul Sewer              |
|    | Section 104 Sewer             |    | Public Rising Main          |
|    | Pumping Station               |    | Abandoned Sewer             |
|  | Public Sewage Treatment Works |  | Syphon Sewer & Vacuum Sewer |
|                                                                                     |                               | +                                                                                    | Property Identifier         |

## Water Legend

|                                                                                     |                         |
|-------------------------------------------------------------------------------------|-------------------------|
|  | Water Main 4" and below |
|  | Water Main 4" and above |
|  | Raw Water Main          |
|  | Private Water Main      |
|  | Fire Hydrant            |
|  | Pumping Station         |



## **Yorkshire Water 2017 Correspondence & Provided Documents**



16 December 2016

Developer Services  
Yorkshire Water Services Ltd  
PO Box 52  
Bradford  
BD3 7YD

**By Post Only**

Dear Sirs

**RESIDENTIAL AND COMERCIAL DEVELOPMENT AT MASTIN MOOR  
PRE-PLANNING PUBLIC SEWER ENQUIRY**

Please find enclosed a Pre Planning Sewerage Enquiry form completed with the information which we currently hold.

The site is currently greenfield and it is proposed to develop it with a mix of residential and commercial property.

The proposals for the site are conceptual and in order to progress these further we must establish the drainage constraints. No specific drainage routes are currently available; these will be developed to accommodate site constraints.

If you have any queries please do not hesitate to contact me by telephone on 01773 829988 or by email on [pdaykin@merebrook.co.uk](mailto:pdaykin@merebrook.co.uk)

Yours sincerely

A handwritten signature in black ink, appearing to read 'P. Daykin', enclosed in a rectangular box.

P Daykin  
For Idom Merebrook Ltd

cc File

enc Pre-planning Enquiry Form  
Check: £182.40  
Markup of sewer record plans indicating notional connection location  
Layout: M5328-100  
Topographic survey: MER00810-002-001 rev-, MER00810-002-002 rev-, MER00810-002-003 rev-,  
MER00810-002-004 rev- & MER00810-002-005 rev-

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**Idom Merebrook Ltd** Cromford Mills, Mill Lane, Matlock, Derbyshire, DE4 3RQ  
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**offices** London Kent Derbyshire Cardiff Manchester Stirling

Mr R Hopkins  
Idom Merebrook Ltd  
Cromford Mills  
Mill Lane  
Matlock  
Derbyshire  
DE4 3RQ

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

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

Your Ref: L-19412-2.4.2-16-C172-PRD  
Our Ref: S019485

Email:  
Technical.Sewerage@yorkshirewater.co.uk

For telephone enquiries ring:  
Chris Roberts on 0345 120 8482

8th January 2017

Dear Mr Hopkins,

**Mastin Moor, Derbyshire, S43 3DN - Pre-planning sewerage enquiry on R414913 - Mixed residential and commercial**

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.

The local Waste Water Treatment Works (WWTW) is Staveley. It is understood that this WWTW may only have limited spare capacity, if any, available. We have contacted the respective treatment team for more information regarding the impact of proposed development and will contact you when an assessment has been made.

**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.

The public sewer network does not have adequate capacity available to accommodate the anticipated foul water discharge from this proposal site. Further modelling investigation funded by the developer will be required.

Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens etc. must pass through a fat and grease trap of adequate design before any discharge to the public sewer network.



### **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 with a view to establishing a suitable watercourse for discharge.

It is understood that a watercourse is located through 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, with regard to surface water disposal from the site.

Surface water run-off from communal parking (greater than 800 sq metres or more than 50 car parking spaces) and hardstanding must pass through an oil, petrol and grit interceptor/separator of adequate design before any discharge to the public sewer network. Roof water should not pass through the traditional 'stage' or full retention type of interceptor/separator. It is good drainage practice for any interceptor/separator to be located upstream of any on-site balancing, storage or other means of flow attenuation that may be required.

### **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](http://www.yorkshirewater.com)) or by telephoning 0345 120 84 82.

Under the provisions of section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes fat, oil, nappies, bandages, syringes, medicines, sanitary towels and incontinence pants. Contravention of the provisions of section 111 is a criminal offence.

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.



YorkshireWater

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.

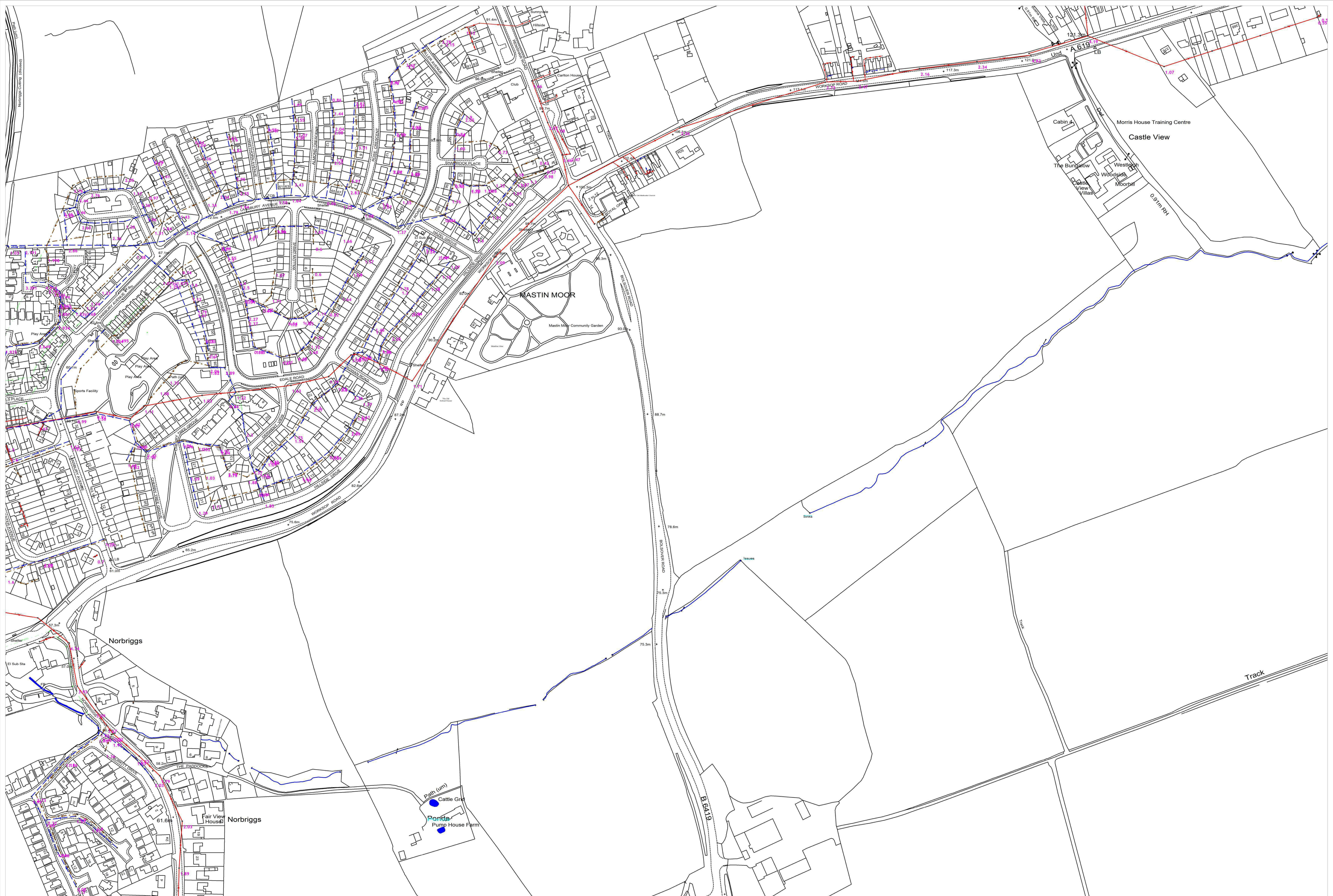
As a last resort, highway drainage may be accepted under certain circumstances. If it can be demonstrated, through satisfactory evidence, that SUDS are not a viable option, there are no watercourses or highway drains available and if capacity is available within the public sewer network, highway drainage 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.

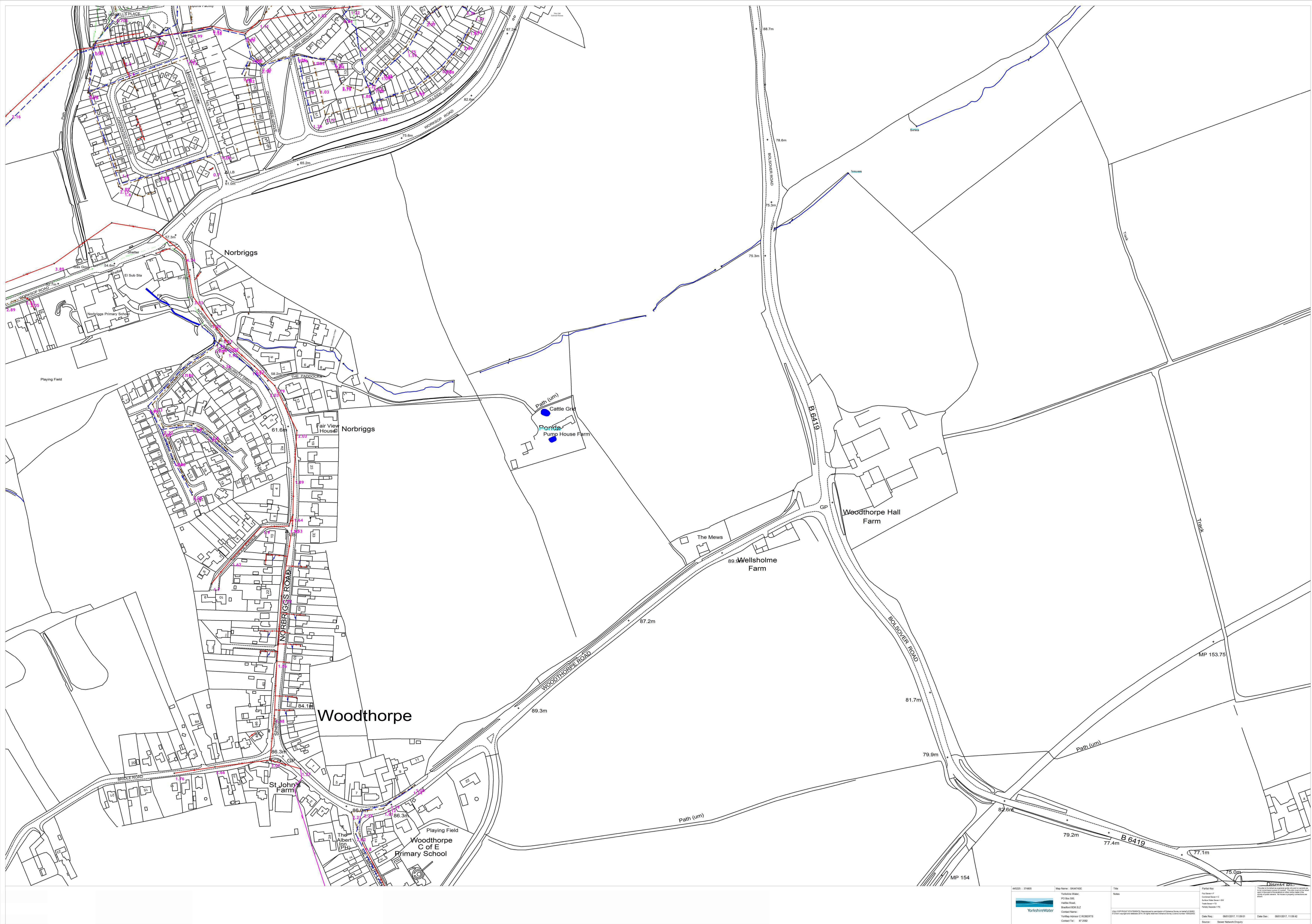
Yours sincerely

**Chris Roberts**  
**Sewerage Technician**  
**Developer Services**














## **APPENDIX 4    ▪    MicroDrainage Outputs**



|                                                     |                                      |                                                                                     |
|-----------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------|
| Idom Merebrook Ltd                                  |                                      | Page 1                                                                              |
| Suite 2B East Mill<br>Belper Derbyshire<br>DE56 2UA |                                      |  |
| Date 23/01/2017 12:24<br>File mastin moor.srcx      | Designed by rhopkinson<br>Checked by |                                                                                     |
| XP Solutions Source Control 2016.1.1                |                                      |                                                                                     |

ICP SUDS Mean Annual Flood

Input

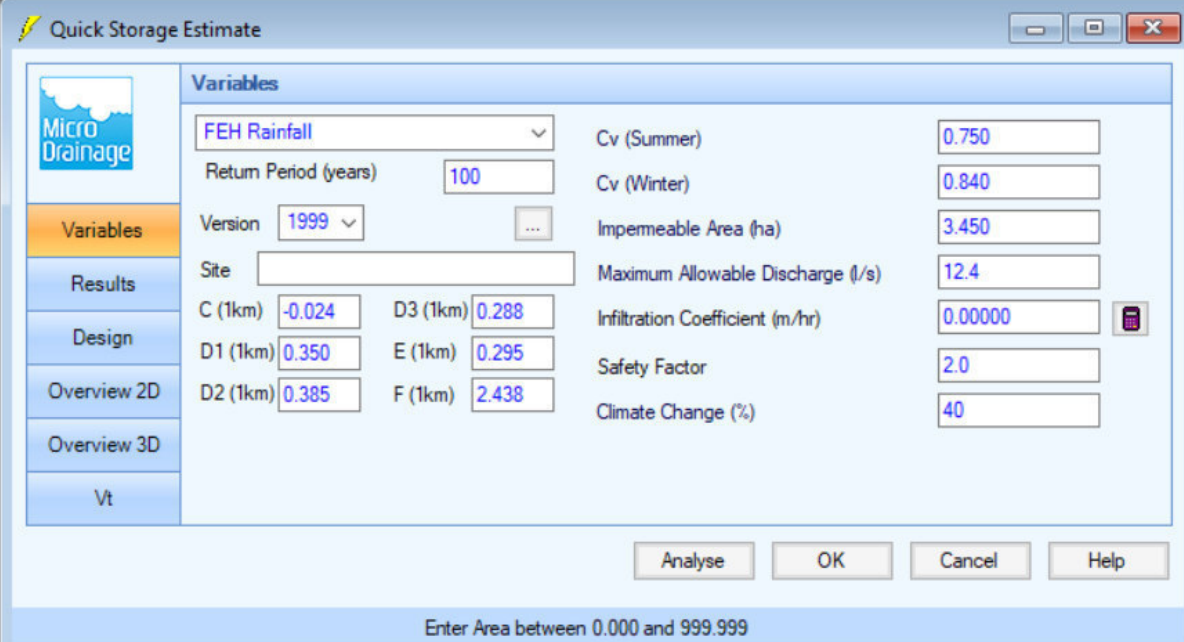
|                       |        |               |          |
|-----------------------|--------|---------------|----------|
| Return Period (years) | 100    | Soil          | 0.400    |
| Area (ha)             | 27.685 | Urban         | 0.000    |
| SAAR (mm)             | 729    | Region Number | Region 3 |

**Results    l/s**

|            |       |
|------------|-------|
| QBAR Rural | 98.8  |
| QBAR Urban | 98.8  |
| Q100 years | 205.5 |
| Q1 year    | 84.9  |
| Q30 years  | 173.6 |
| Q100 years | 205.5 |

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## Phase 1



Micro Drainage

**Variables**

FEH Rainfall

Return Period (years) 100

Version 1999

Site

Cv (Summer) 0.750

Cv (Winter) 0.840

Impemeable Area (ha) 3.450

Maximum Allowable Discharge (l/s) 12.4

Infiltration Coefficient (m/hr) 0.00000

Safety Factor 2.0

Climate Change (%) 40

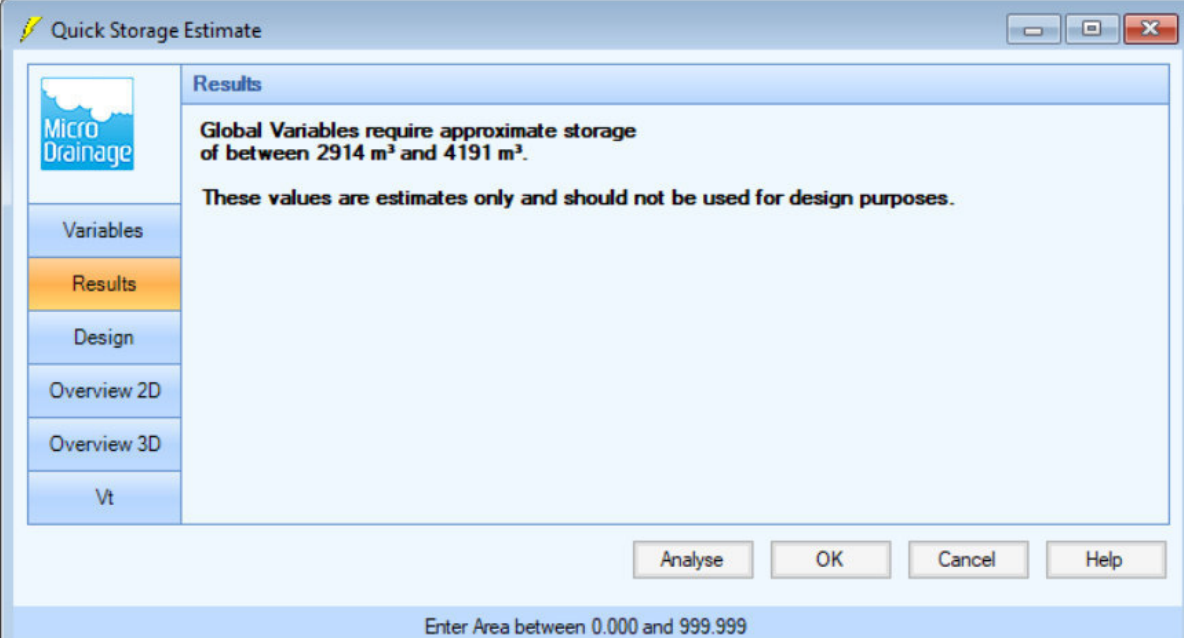
C (1km) -0.024 D3 (1km) 0.288

D1 (1km) 0.350 E (1km) 0.295

D2 (1km) 0.385 F (1km) 2.438

Analyse OK Cancel Help

Enter Area between 0.000 and 999.999



Micro Drainage

**Results**

Global Variables require approximate storage of between 2914 m<sup>3</sup> and 4191 m<sup>3</sup>.

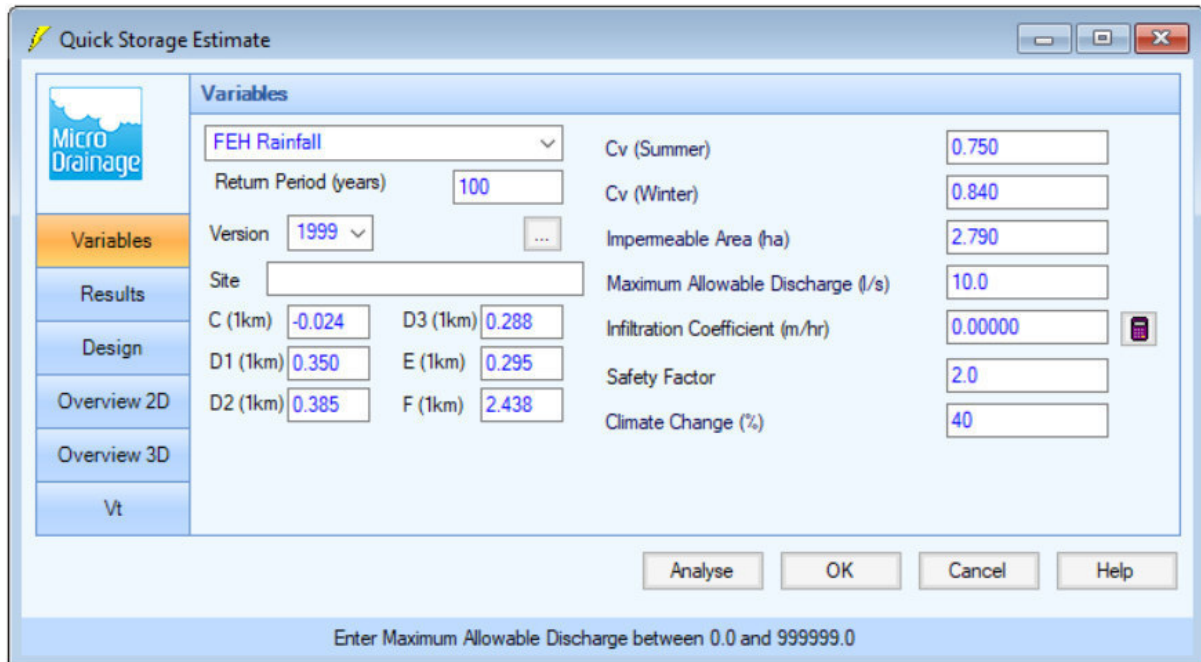
These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Area between 0.000 and 999.999



## Phase 2



**Quick Storage Estimate**

**Variables**

FEH Rainfall

Return Period (years) 100

Version 1999

Site

C (1km) -0.024 D3 (1km) 0.288

D1 (1km) 0.350 E (1km) 0.295

D2 (1km) 0.385 F (1km) 2.438

Cv (Summer) 0.750

Cv (Winter) 0.840

Impervious Area (ha) 2.790

Maximum Allowable Discharge (l/s) 10.0

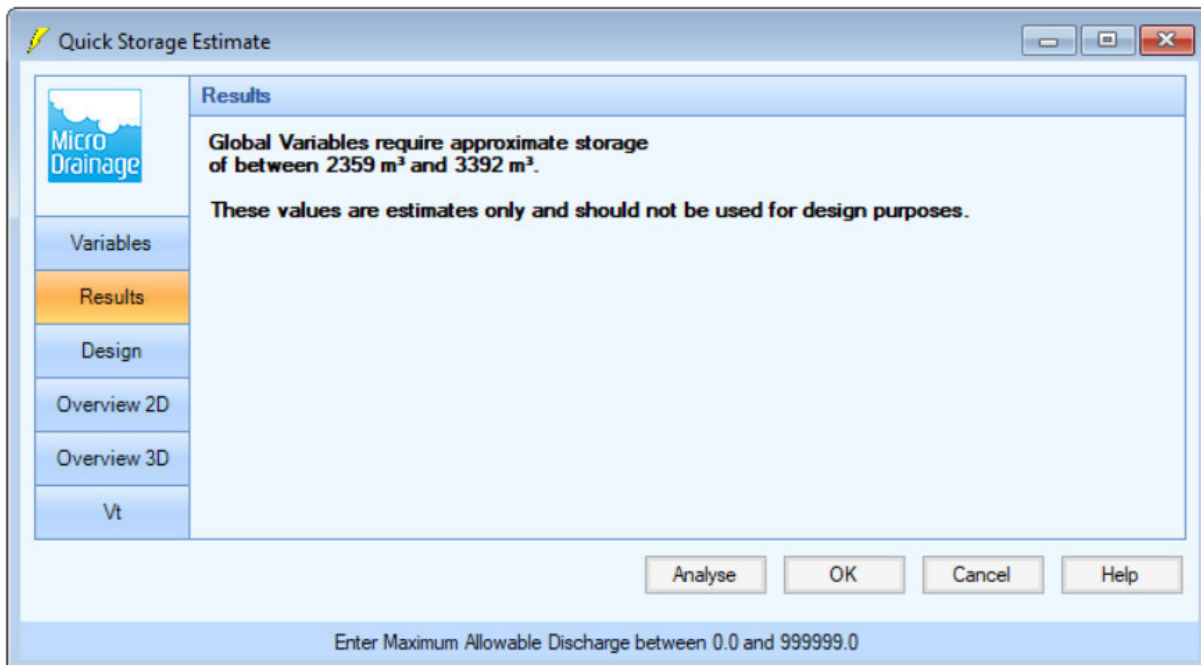
Infiltration Coefficient (m/hr) 0.00000

Safety Factor 2.0

Climate Change (%) 40

Analyse OK Cancel Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0



**Quick Storage Estimate**

**Results**

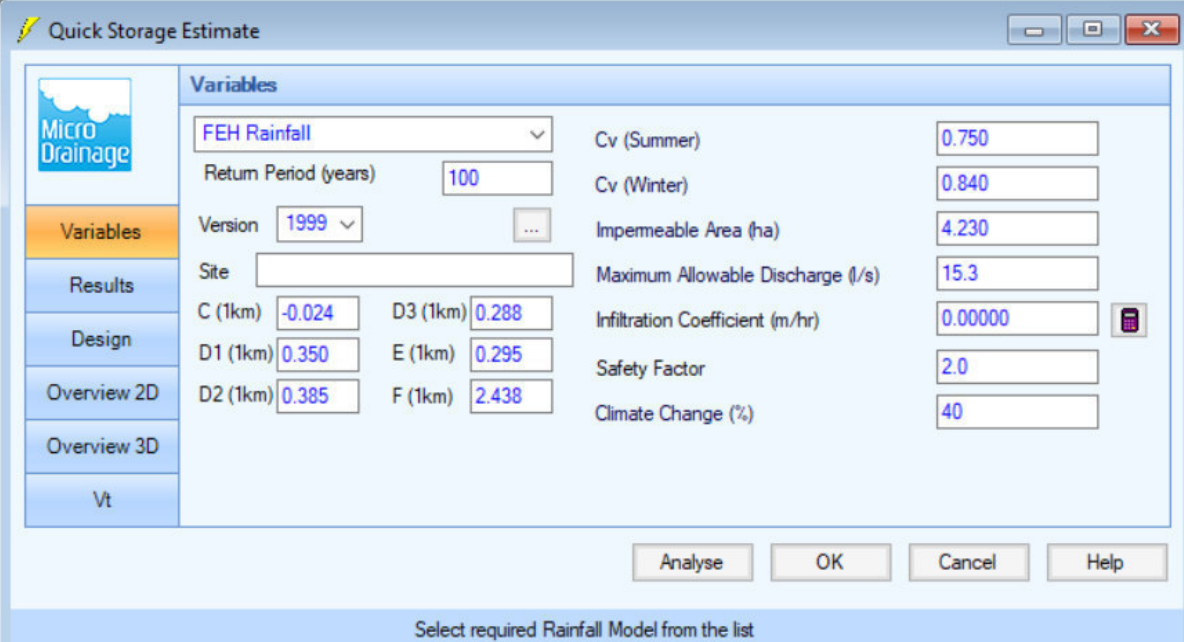
Global Variables require approximate storage of between 2359 m<sup>3</sup> and 3392 m<sup>3</sup>.

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

### Phase 3

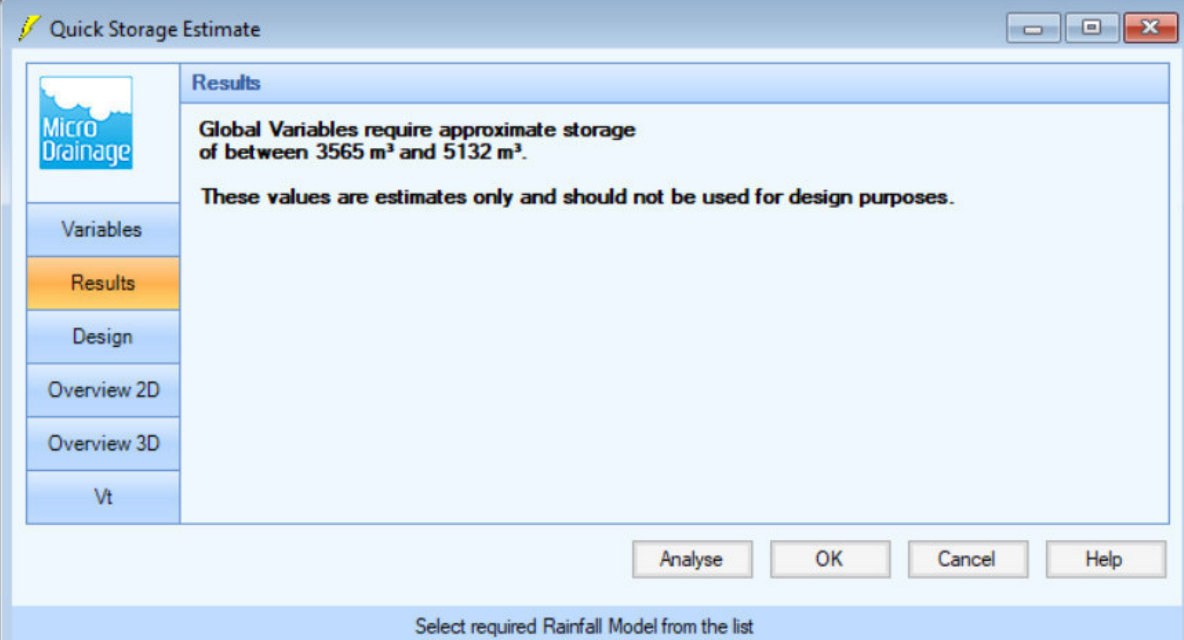


The image shows the 'Variables' tab of the 'Quick Storage Estimate' window. The left sidebar contains buttons for 'Variables', 'Results', 'Design', 'Overview 2D', 'Overview 3D', and 'Vt'. The main area is titled 'Variables' and contains the following fields:

| Field                             | Value        |
|-----------------------------------|--------------|
| Rainfall Model                    | FEH Rainfall |
| Return Period (years)             | 100          |
| Version                           | 1999         |
| Site                              |              |
| C (1km)                           | -0.024       |
| D3 (1km)                          | 0.288        |
| D1 (1km)                          | 0.350        |
| E (1km)                           | 0.295        |
| D2 (1km)                          | 0.385        |
| F (1km)                           | 2.438        |
| Cv (Summer)                       | 0.750        |
| Cv (Winter)                       | 0.840        |
| Impervious Area (ha)              | 4.230        |
| Maximum Allowable Discharge (l/s) | 15.3         |
| Infiltration Coefficient (m/hr)   | 0.00000      |
| Safety Factor                     | 2.0          |
| Climate Change (%)                | 40           |

Buttons at the bottom: Analyse, OK, Cancel, Help.

Footer: Select required Rainfall Model from the list



The image shows the 'Results' tab of the 'Quick Storage Estimate' window. The left sidebar contains buttons for 'Variables', 'Results', 'Design', 'Overview 2D', 'Overview 3D', and 'Vt'. The main area is titled 'Results' and contains the following text:

**Global Variables require approximate storage of between 3565 m<sup>3</sup> and 5132 m<sup>3</sup>.**

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

Buttons at the bottom: Analyse, OK, Cancel, Help.

Footer: Select required Rainfall Model from the list



## Phase 4A

**Quick Storage Estimate**

**Micro Drainage**

**Variables**

FEH Rainfall

Return Period (years) 100

Version 1999

Site

Cv (Summer) 0.750

Cv (Winter) 0.840

Impervious Area (ha) 2.612

Maximum Allowable Discharge (l/s) 9.4

Infiltration Coefficient (m/hr) 0.00000

Safety Factor 2.0

Climate Change (%) 40

C (1km) -0.024 D3 (1km) 0.288

D1 (1km) 0.350 E (1km) 0.295

D2 (1km) 0.385 F (1km) 2.438

Analyse OK Cancel Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

**Quick Storage Estimate**

**Micro Drainage**

**Results**

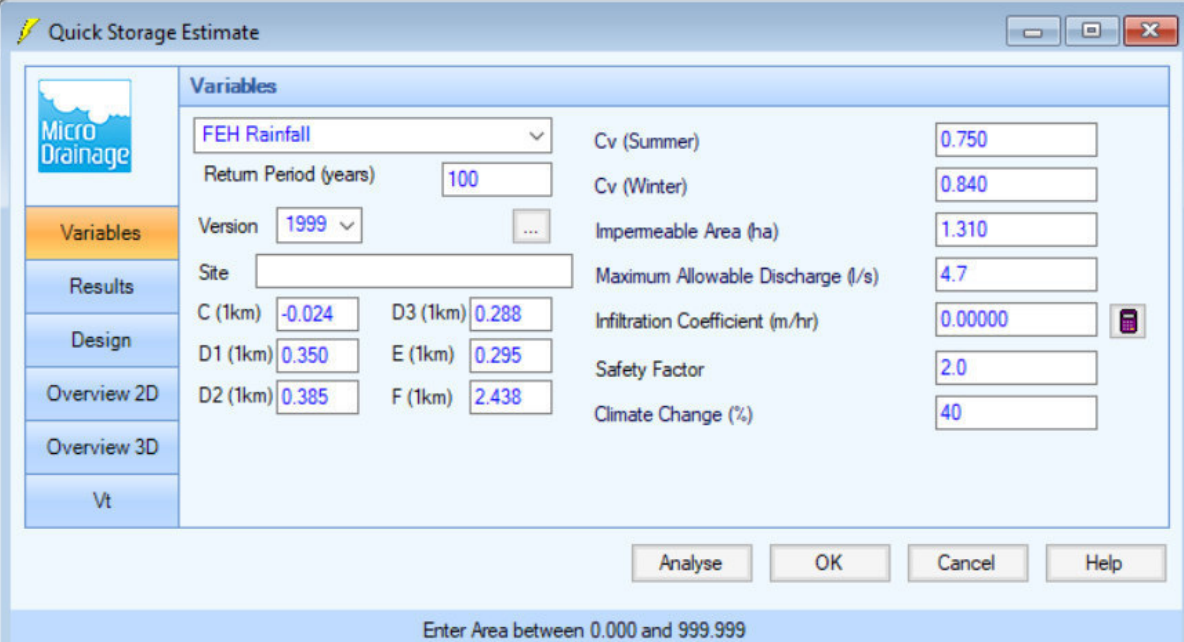
**Global Variables require approximate storage of between 2205 m<sup>3</sup> and 3172 m<sup>3</sup>.**

**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

## Phase 4B



**Quick Storage Estimate**

**Micro Drainage**

**Variables**

FEH Rainfall

Return Period (years) 100

Version 1999

Site

Cv (Summer) 0.750

Cv (Winter) 0.840

Impervious Area (ha) 1.310

Maximum Allowable Discharge (l/s) 4.7

Infiltration Coefficient (m/hr) 0.00000

Safety Factor 2.0

Climate Change (%) 40

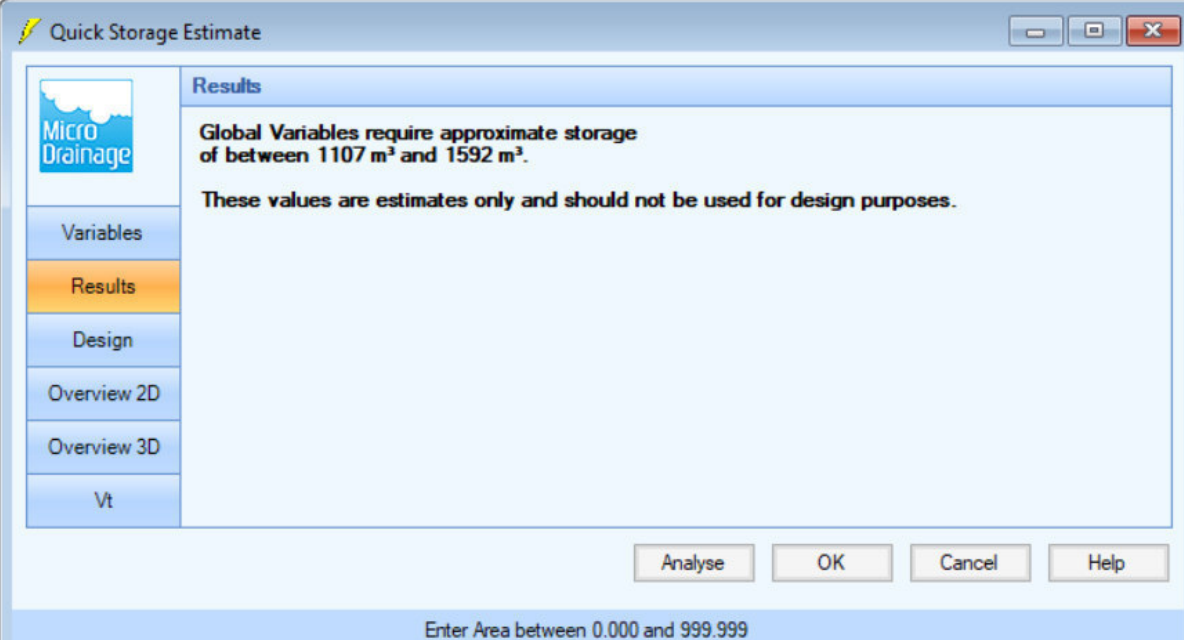
C (1km) -0.024 D3 (1km) 0.288

D1 (1km) 0.350 E (1km) 0.295

D2 (1km) 0.385 F (1km) 2.438

Analyse OK Cancel Help

Enter Area between 0.000 and 999.999



**Quick Storage Estimate**

**Micro Drainage**

**Results**

**Global Variables require approximate storage of between 1107 m<sup>3</sup> and 1592 m<sup>3</sup>.**

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

Analyse OK Cancel Help

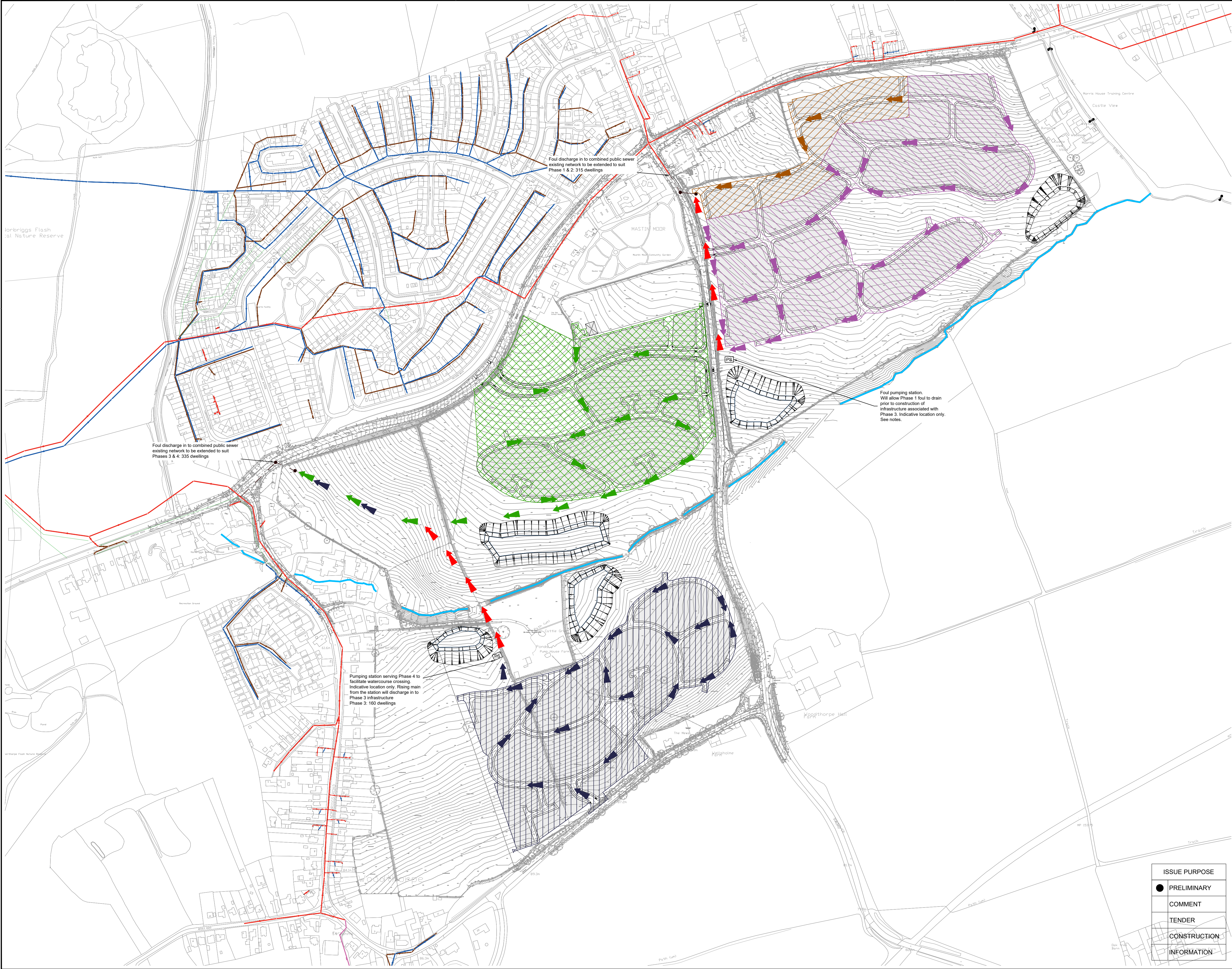
Enter Area between 0.000 and 999.999





## **APPENDIX 5**   ■   Indicative Drainage Strategy





Legend

Existing Combined Sewer

Existing Surface Water Sewer

Existing Foul Water Sewer

Existing Ordinary Watercourse

Proposed Foul Sewer

Inferred development Phase 1 and 2

Inferred development Phase 1 and 2

Inferred development Phase 3

Inferred development Phase 4

Indicative direction of flow  
Various colours  
Colour typically correlates to development parcel

- Notes
1. Do not scale.

2. Proposed development of approximately 650 dwellings on the site.

3. Yorkshire Water has confirmed that there is currently insufficient capacity within the public sewer network. consultation is currently on-going.

4. The outfalls shown are indicative only and are subject to confirmation by Yorkshire Water.

5. This strategy is based on the Indicative Masterplan reference P20181-00-001-GIL-0101-00, Topographic Survey completed by Idom Merebrook and featured on drawings MER-00810-002-001 to 007.

6. The foul water drainage strategy is summarised as follows:  
Discharge via gravity is not possible for all phases. phase 1 pumping station and offsite gravity connection must be operation to facilitate phase 2, the offsite gravity connection for phase 3 must be operational to facilitate phase 4.

|                                                          |            |     |
|----------------------------------------------------------|------------|-----|
| Updated to new masterplan and drainage strategy revised. | 02-07-2021 | F   |
|                                                          | JB         | JR  |
| Legend corrected                                         | 23-06-2017 | E   |
|                                                          | RH         | KN  |
| Issue Details                                            | Dwn        | Chd |
| Client                                                   | App'd      |     |

Chatsworth Settlement Trustees

Project

Mastin Moor

Dwg Title

Foul Drainage Strategy

|         |        |         |           |                     |                |
|---------|--------|---------|-----------|---------------------|----------------|
| Job No. | 19412  | Dwg No. | 200-001   | Revision            | F              |
| Scale   | 1:2500 | Date    | Sept 2014 | Frame Dimensions mm | (A1) 791 x 544 |
| Drawn   | LJB    | Checked | MB        | Approved            | MB             |

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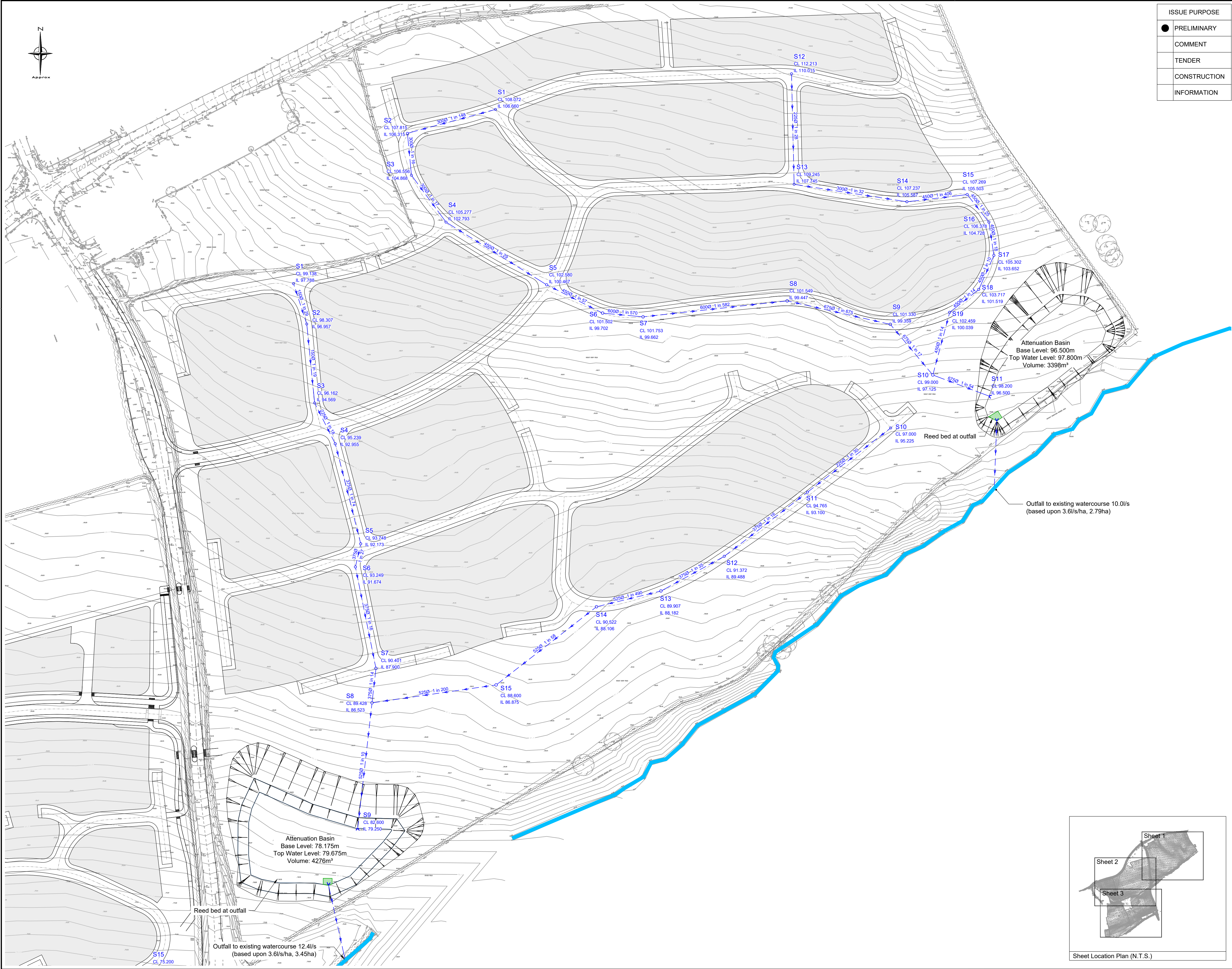
dom

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| ISSUE PURPOSE |
|---------------|
| ● PRELIMINARY |
| COMMENT       |
| TENDER        |
| CONSTRUCTION  |
| INFORMATION   |





| ISSUE PURPOSE |              |
|---------------|--------------|
| ●             | PRELIMINARY  |
|               | COMMENT      |
|               | TENDER       |
|               | CONSTRUCTION |
|               | INFORMATION  |

Legend

Existing generally shown in GREY

Site boundary

Proposed surface water drainage, shown with cover and invert level, pipe diameter

Notes

- Do not scale.
- The outfalls shown are indicative only.
- This strategy is based on the Indicative Masterplan reference P20181-00-001-GIL-0101-00, Topographic Survey completed by Idom Merebrook and featured on drawings MER-00810-002-001 to 007.
- Surface water from the site will be discharged into an existing watercourse.
- Dry basins are used to attenuate flows from the site, reed beds will be provided at each outlet.
- Drainage calculations summarised below:
  - It is assumed that 60% of the development parcels are hard/positively drained.
  - Multiple ponds/outfalls are used. Discharge is restricted to the equivalent Greenfield runoff rate.
  - Greenfield runoff has been calculated at 3.6l/s/ha.
  - Attenuation basins are sized to accommodate 1 in 100 year storm events, plus 40% allowance for climate change, derived using FEH inputs.
- The basins are typically shown with 1 in 4 side slopes. The extents of the basins should be considered as indicative only and will be dependant upon detailed design.

|                                                                                            |            |     |
|--------------------------------------------------------------------------------------------|------------|-----|
| Updated to new masterplan and drainage strategy revised.                                   | 02-07-2021 | B   |
|                                                                                            | JB         | JR  |
| Drainage strategy updated to reflect planning layout reference: Masterplan 6 revB May 2017 | 07-06-2017 | A   |
|                                                                                            | RH         | KN  |
| First issue                                                                                | 13-02-2017 | -   |
| Issue Details                                                                              | RH         | PRD |
| Client                                                                                     | Dwn        | Chd |

Chatsworth Settlement Trustees

Project

Mastin Moor

Dwg Title

Surface Water Drainage Strategy

Sheet 1

|         |               |                     |
|---------|---------------|---------------------|
| Job No. | Dwg No.       | Revision            |
| 19412   | 200-002       | B                   |
| Scale   | Date          | Frame Dimensions mm |
| 1:1000  | February 2017 | (A1) 791 x 544      |
| Drawn   | Checked       | Approved            |
| RH      | PRD           | KN                  |

London

Kent

Derbyshire

Cardiff

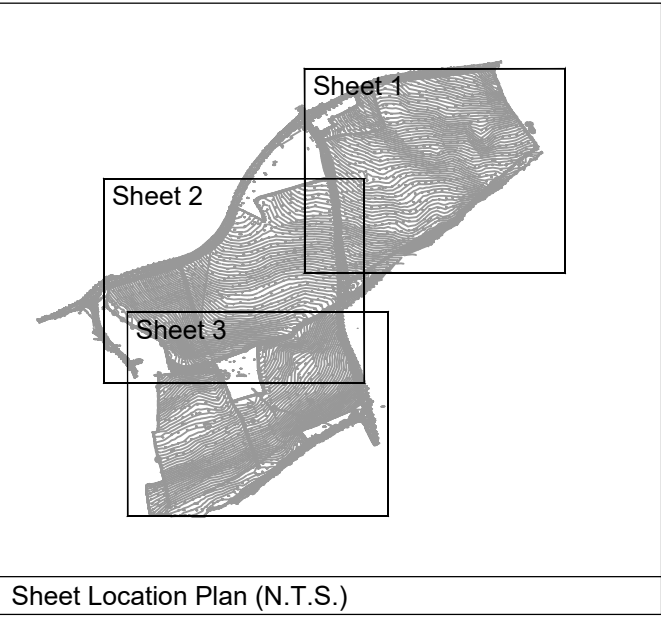
Manchester

Stirling

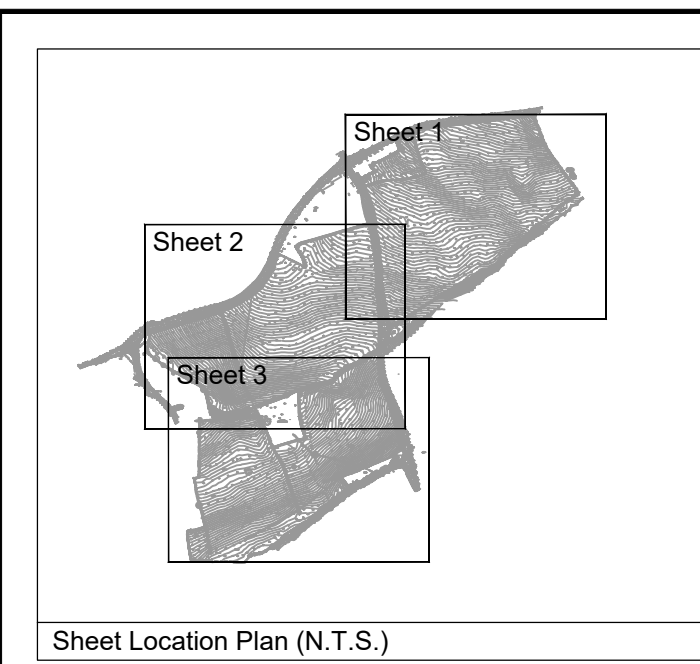
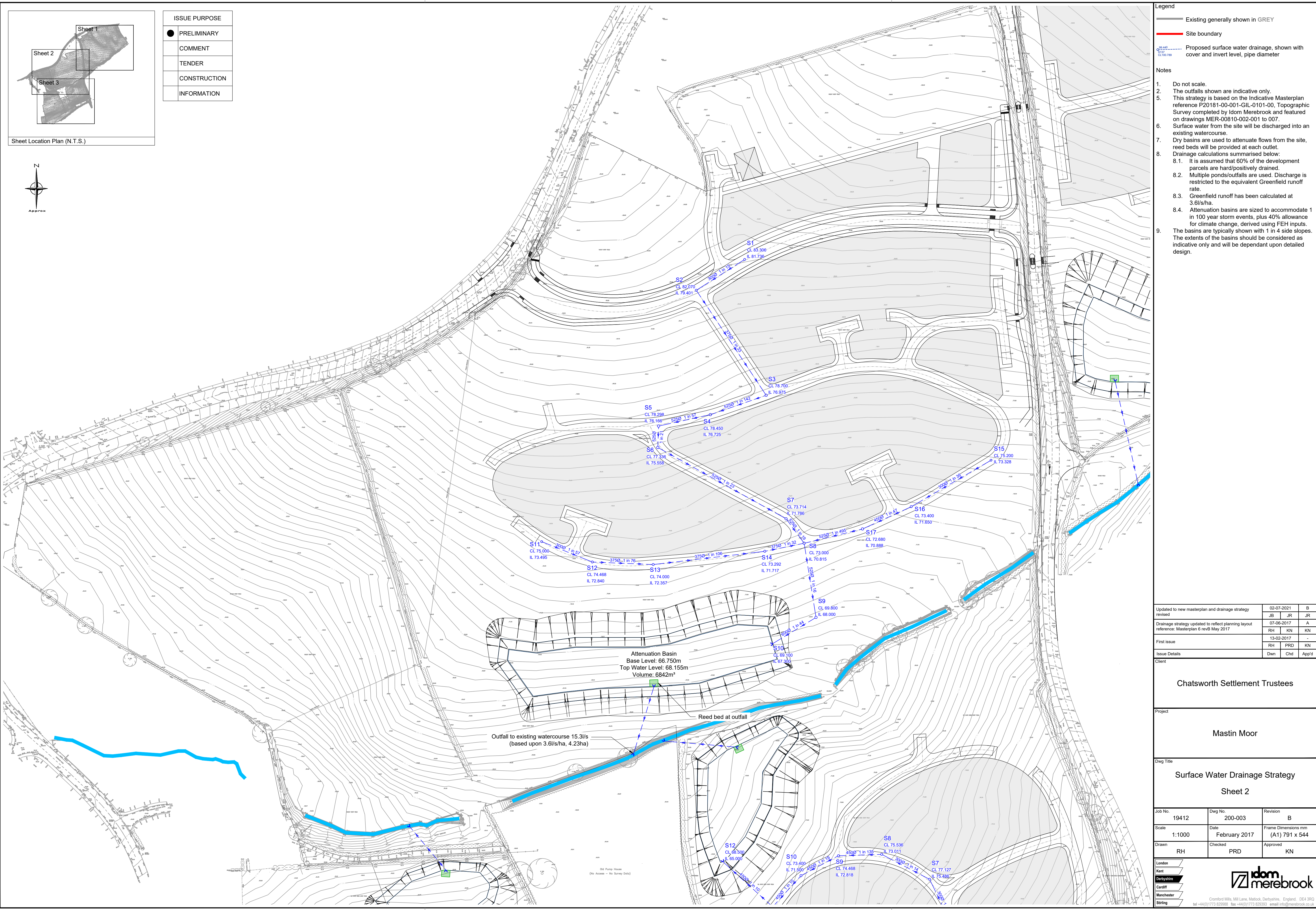
dom merebrook

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tel +44(0)1773 82988 fax +44(0)1773 82993 email info@dommerebrook.co.uk







| ISSUE PURPOSE |              |
|---------------|--------------|
| ●             | PRELIMINARY  |
|               | COMMENT      |
|               | TENDER       |
|               | CONSTRUCTION |
|               | INFORMATION  |

|  |                                                                                   |
|--|-----------------------------------------------------------------------------------|
|  | Existing generally shown in GREY                                                  |
|  | Site boundary                                                                     |
|  | Proposed surface water drainage, shown with cover and invert level, pipe diameter |

- Notes
- Do not scale.
  - The outfalls shown are indicative only.
  - This strategy is based on the Indicative Masterplan reference P20181-00-001-GIL-0101-00, Topographic Survey completed by Idom Merebrook and featured on drawings MER-00810-002-001 to 007.
  - Surface water from the site will be discharged into an existing watercourse.
  - Dry basins are used to attenuate flows from the site, reed beds will be provided at each outfall.
  - Drainage calculations summarised below:
    - It is assumed that 60% of the development parcels are hard/positively drained.
    - Multiple ponds/outfalls are used. Discharge is restricted to the equivalent Greenfield runoff rate.
    - Greenfield runoff has been calculated at 3.6l/s/ha.
    - Attenuation basins are sized to accommodate 1 in 100 year storm events, plus 40% allowance for climate change, derived using FEH inputs.
  - The basins are typically shown with 1 in 4 side slopes. The extents of the basins should be considered as indicative only and will be dependant upon detailed design.

|                                                                                            |            |           |
|--------------------------------------------------------------------------------------------|------------|-----------|
| Updated to new masterplan and drainage strategy                                            | 02-07-2021 | B         |
| revised                                                                                    | JB JR      | JR        |
| Drainage strategy updated to reflect planning layout reference: Masterplan 6 revB May 2017 | 07-06-2017 | A         |
|                                                                                            | RH KN      | KN        |
| First issue                                                                                | 13-02-2017 | -         |
|                                                                                            | RH PRD     | KN        |
| Issue Details                                                                              | Dwn        | Chd App'd |
| Client                                                                                     |            |           |

Chatsworth Settlement Trustees

Project

Mastin Moor

Dwg Title

Surface Water Drainage Strategy

Sheet 2

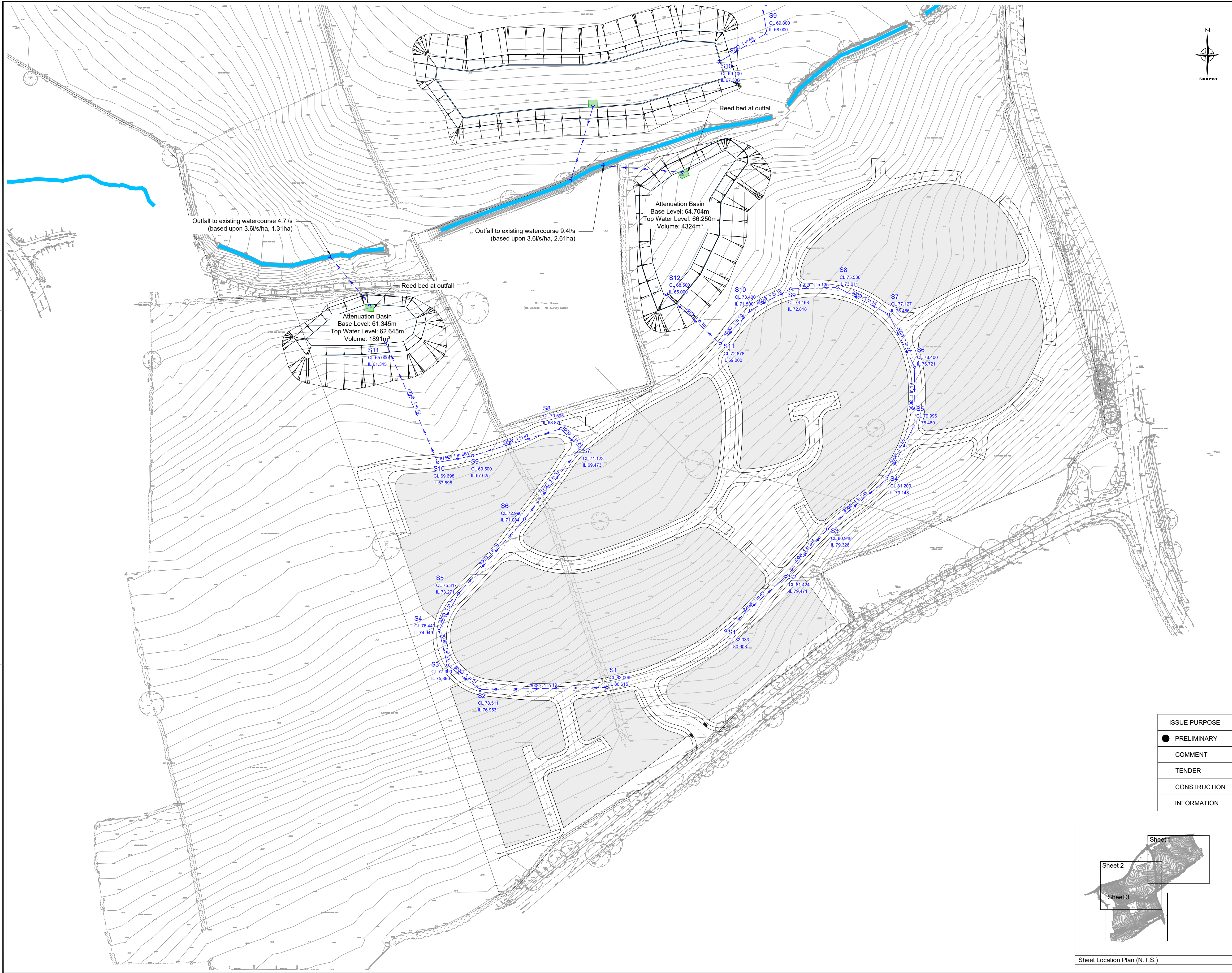
|         |               |                     |
|---------|---------------|---------------------|
| Job No. | Dwg No.       | Revision            |
| 19412   | 200-003       | B                   |
| Scale   | Date          | Frame Dimensions mm |
| 1:1000  | February 2017 | (A1) 791 x 544      |
| Drawn   | Checked       | Approved            |
| RH      | PRD           | KN                  |

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Legend

Existing generally shown in GREY

Site boundary

Proposed surface water drainage, shown with cover and invert level, pipe diameter

Notes

- Do not scale.
- The outfalls shown are indicative only.
- This strategy is based on the Indicative Masterplan reference P20181-00-001-GIL-0101-00, Topographic Survey completed by Idom Merebrook and featured on drawings MER-00810-002-001 to 007.
- Surface water from the site will be discharged into an existing watercourse.
- Dry basins are used to attenuate flows from the site, reed beds will be provided at each outlet.
- Drainage calculations summarised below:
  - It is assumed that 60% of the development parcels are hard/positively drained.
  - Multiple ponds/outfalls are used. Discharge is restricted to the equivalent Greenfield runoff rate.
  - Greenfield runoff has been calculated at 3.6l/s/ha.
  - Attenuation basins are sized to accommodate 1 in 100 year storm events, plus 40% allowance for climate change, derived using FEH inputs.
- The basins are typically shown with 1 in 4 side slopes. The extents of the basins should be considered as indicative only and will be dependant upon detailed design.

|                                                                                            |            |     |
|--------------------------------------------------------------------------------------------|------------|-----|
| Updated to new masterplan and drainage strategy revised                                    | 02-07-2021 | B   |
| Drainage strategy updated to reflect planning layout reference: Masterplan 6 revB May 2017 | 07-06-2017 | A   |
| First issue                                                                                | 13-02-2017 | -   |
| Issue Details                                                                              | RH         | PRD |
| Client                                                                                     | Dwn        | Chd |

Chatsworth Settlement Trustees

Project

Mastin Moor

Dwg Title

Surface Water Drainage Strategy

Sheet 3

|         |               |                     |
|---------|---------------|---------------------|
| Job No. | Dwg No.       | Revision            |
| 19412   | 200-004       | B                   |
| Scale   | Date          | Frame Dimensions mm |
| 1:1000  | February 2017 | (A1) 791 x 544      |
| Drawn   | Checked       | Approved            |
| RH      | PRD           | KN                  |

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